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

February 27, 2025

Justin Jenson
Tehama County Flood Control and Water Conservation District Groundwater Sustainability Agency
9380 San Benito Avenue
Gerber, CA 96035
jjenson@tcpw.ca.gov

RE: Approved Determination of the 2022 Groundwater Sustainability Plan Submitted for the Redding Area – Bowman Subbasin

Dear Justin Jenson

The Department of Water Resources (Department) has evaluated the groundwater sustainability plan (GSP) submitted for the Redding Area – Bowman Subbasin and has determined the GSP is approved. The approval is based on recommendations from the Staff Report, included as an exhibit of the attached Statement of Findings, which describes that the Bowman GSP 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 believe will enhance the GSP and facilitate future evaluation by the Department. The Department strongly encourages the recommended corrective actions to be given due consideration and suggests incorporating all resulting changes to the GSP in future updates.

Recognizing SGMA sets a long-term horizon for groundwater sustainability agencies (GSAs) to achieve their basin sustainability goals, monitoring progress is fundamental for successful implementation. GSAs are required to evaluate their GSPs at least every five years and whenever the Plan is amended, and to provide a written assessment to the Department. Accordingly, the Department will evaluate approved GSPs and issue an assessment at least every five years. The GSAs are required to submit their periodic evaluation of the Redding Area – Bowman Subbasin GSP no later than January 31, 2027.

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

Thank You,

Paul Gosselin

Paul Gosselin
Deputy Director
Sustainable Groundwater Management

Attachment:

1. Statement of Findings Regarding the Approval of the Redding Area – Bowman Subbasin 2022 Groundwater Sustainability Plan

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

STATEMENT OF FINDINGS REGARDING THE APPROVAL OF THE REDDING AREA – BOWMAN 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.) Although basins designated by the Department as low and very low priority are not required to be managed under a GSP, SGMA encourages and authorizes them to be managed under a GSP. (Water Code § 10720.7.) This Statement of Findings explains the Department's decision regarding the Plan submitted by the Tehama County Flood Control and Water Conservation District Groundwater Sustainability Agency (GSA or Agency) for the Redding Area Basin – Bowman Subbasin (Basin No. 5-006.01).

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

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

    1. Because the Subbasin is prioritized as very low, there is no statutory deadline for Plan submittal. (Water Code § 10720.7(2)(b); 23 CCR § 355.4(a)(1).)

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

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

B. The general standards the Department applied in its evaluation and assessment of the Plan are: (1) "conformance" with the specified statutory requirements, (2) "substantial compliance" with the GSP Regulations, (3) whether the Plan is likely to achieve the sustainability goal for the Subbasin within 20 years of the implementation of the Plan, and (4) whether the Plan adversely affects the ability of an adjacent basin to implement its GSP or impedes achievement of sustainability goals in an adjacent basin. (Water Code § 10733.) Application of these standards requires exercise of the Department's expertise, judgment, and discretion when making its determination regarding the status of a Plan In the event that a low or very low Basin is determined to be "incomplete," the Department will provide the GSAs with recommended corrective actions for the GSAs to consider addressing in future GSP updates.

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

C. In making these findings and Plan determination, the Department also recognized that: (1) the Department maintains continuing oversight and jurisdiction to ensure the Plan is adequately implemented; (2) the Legislature intended SGMA to be implemented over many years; (3) SGMA provides Plans 20 years of implementation to achieve the sustainability goal in a 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.)

D. The Plan conforms with Water Code §§ 10727.2 and 10727.4, substantially complies with 23 CCR § 355.4, and appears likely to achieve the sustainability goal for the Subbasin. It does not appear at this time that the Plan will adversely affect the ability of adjacent basins to implement their GSPs or impede achievement of sustainability goals.

1. The Plan sets the minimum thresholds for groundwater levels selected based on a level that would indicate a depletion of supply for 10-20% domestic wells in the Subbasin. While recommended corrective actions identified, the Plan indicates that the groundwater levels have been stable historically in the Subbasin and plan to maintain stable in the future with the same level of pumping. Overall, the 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 Plan has identified reasonable measures and schedules to eliminate data gaps in order to refine the sustainable management criteria and monitoring network and to improve hydrogeologic model and the numerical groundwater model. (23 CCR § 355.4(b)(2).)

3. The projects and management actions proposed are designed to increase local water supply availability and reduce groundwater pumping. 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 GSA with greater versatility to adapt and respond to changing conditions and future challenges during GSP implementation. (23 CCR § 355.4(b)(3).)

4. The Plan considers varied interests of groundwater uses and users in the Subbasin in developing the sustainable management criteria and how those interests would be impacted by the chosen minimum thresholds. (23 CCR § 355.4(b)(4).)

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

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

7. At this time, it does not appear that the Plan will adversely affect the ability of an adjacent basin to implement its GSP or impede achievement of sustainability goals in an adjacent basin. (23 CCR § 355.4(b)(7).)

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

9. At this time, it appears the GSA has the legal authority and financial resources necessary to implement the Plan. (23 CCR § 355.4(b)(9).)

10. Through review of the Plan and consideration of public comments, the Department determines that the GSA 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 address certain technical or policy issues that were raised and, if not addressed before future, subsequent plan evaluations, may preclude approval of the Plan in those future evaluations. (23 CCR § 355.4(b)(10).)

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

1. The Department developed its GSP Regulations consistent with and intending to further the State's human right to water policy through implementation of SGMA and the Regulations, primarily by achieving sustainable groundwater management in a basin. By ensuring substantial compliance with the GSP Regulations, the Department has considered the state policy regarding the human right to water in its evaluation of the Plan. (Water Code § 106.3; 23 CCR § 350.4(g).)

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

sustainable management criteria as more information and improved methodology become available.

3. The basin is not currently in a state of long-term overdraft and projections of future basin extractions are likely to stay within current and historic ranges, at least until the next periodic evaluation by the GSA and the Department. Projections of future basin extractions appear likely to stay within current and historic ranges, at least until the next periodic evaluation by the GSA and the Department. Subbasin groundwater levels and other SGMA sustainability indicators appear unlikely to substantially deteriorate while the GSA implements the Department's recommended corrective actions.

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

Accordingly, the GSP submitted by the Agency for the Redding Area – Bowman 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 Agency address them in the next Periodic Evaluation, which is set to be submitted by January 31, 2027, as required by Water Code § 10733.8. Failure to address the Department's recommended corrective actions before future, subsequent plan evaluations, may lead to a Plan being determined incomplete or inadequate.

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Signed:

Karla Nemeth

Karla Nemeth, Director
Date: February 27, 2025

Exhibit A: Groundwater Sustainability Plan Assessment Staff Report – Redding Area - Bowman Subbasin

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

Groundwater Basin Name:	Redding Area – Bowman Subbasin (No. 5-006.01)
Submitting Agency:	Tehama County Flood Control and Water Conservation District Groundwater Sustainability Agency - Bowman
Submittal Type:	Initial Groundwater Sustainability Plan Submission
Submittal Date:	January 31, 2022
Recommendation:	Approve
Date:	February 27, 2025

The Tehama County Flood Control and Water Conservation District (FCWCD), acting as the exclusive Groundwater Sustainability Agency (GSA or Agency) for the Redding Area – Bowman Subbasin (Subbasin), submitted the Redding Area – Bowman Subbasin Groundwater Sustainability Plan (GSP or Plan) to the Department of Water Resources (Department) on January 31, 2022, for evaluation and assessment. The Subbasin is designated by the Department as very low-priority and therefore, is not required to be managed under a GSP and is not subject to state intervention under Chapter 11 of the Sustainable Groundwater Management Act (SGMA). However, SGMA encourages and authorizes basins designated as low- and very low-priority to be managed under a GSP.[1] The Tehama County FCWCD elected to submit a GSP for the Bowman Subbasin. The GSP covers the entire Subbasin for the implementation of SGMA.

After evaluation and assessment, Department staff conclude that the Plan includes the required components of a GSP and the GSA has developed sustainable management criteria and monitoring network for all applicable sustainability indicators.[2] However, Department staff have also identified areas in need of improvement with recommended corrective actions. Given the groundwater levels in this Subbasin are stable and no appreciable increase in annual pumping is currently projected, Department staff do not recommend that these recommended corrective actions preclude approval of the Plan at this time. Department staff will continue to monitor and evaluate the Subbasin's conditions and progress toward achieving the sustainability goal through annual reporting and future periodic evaluations of the GSP and its implementation.

[1] Water Code 10720(b).
[2] 23 CCR § 350 *et seq*.

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

This assessment includes five sections:

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

1 SUMMARY

Department staff recommend approval of the Bowman Subbasin GSP. The Plan includes the required components of a GSP, and the GSA has developed sustainable management criteria for chronic lowering of groundwater levels, reduction of groundwater storage, degradation of groundwater quality, land subsidence, and depletions of interconnected surface water. Accordingly, the GSA has developed monitoring networks and proposed projects and management actions so that at this time the Subbasin is likely to achieve the sustainability goal within the Plan implementation period. However, there are areas in the Plan that need improvement. The GSA has identified some areas for improvement of its Plan (e.g., identification of GDEs and interconnected surface water). Department staff have also identified additional recommended corrective actions within this assessment that the GSA should consider addressing by the first periodic evaluation of the Plan. Given the number and nature of some of the deficiencies Department staff identified, Department staff considered an "incomplete" recommendation but ultimately concluded that these deficiencies should not preclude a recommendation to approve the plan. The Subbasin is a very-low priority basin, and although Department staff reviews all GSPs against the same standards, several factors that resulted in the Subbasin being assigned a very-low priority also support approving this plan at this time and allowing the GSA ample time to consider and address the recommended corrective actions identified by Department staff rather than the alternative of providing only a maximum of 180 days to address these issues or find the plan inadequate. In this Subbasin, there is no immediate urgency to address the deficiencies or risk from affording the GSA further time to improve its plan while implementing and assessing the GSP and Subbasin progress in the next periodic evaluation and review. Specifically, groundwater levels in this Subbasin are stable and no increased annual pumping is currently projected. Similarly, land-uses in the Subbasin have generally remained the same and no increased development or other land-use changes or trends that would affect groundwater demand or management are expected within the next five years. Accordingly, these recommended corrective actions should not preclude approval of the Plan at this time. The recommended corrective actions include:

1. Explain the inconsistency between the depicted west-east groundwater flow direction and a significant north-south subsurface flow from the Bowman Subbasin to the Red Bluff Subbasin, given the two subbasins are separated by the Red Bluff Arch. Explain how this magnitude of subsurface flow, if truly present, corresponds to the selected minimum thresholds of groundwater levels not causing undesirable results in the adjacent subbasins or not affecting their ability to achieve sustainability.
2. Revise the sustainable management criteria for groundwater levels consistent with the GSP Regulations, including clearly defining the undesirable results, sufficiently considering domestic well users and other beneficial users, and discussing the relationship between other sustainability indicators.

3. Revise the definition of undesirable results for groundwater quality such that groundwater conditions, whether due to action or inaction of the GSA with respect to Subbasin management, should be considered.
4. Identify critical infrastructure as well as other land uses or property interests that are likely to be affected by land subsidence if it occurs in the Subbasin. Expand land subsidence monitoring coverage to include locations near the identified critical infrastructure.
5. Consider utilizing the interconnected surface water guidance issued by the Department to evaluate the rate, timing, and volume of depletions of interconnected surface water caused by groundwater extractions. And establish sustainable management criteria and management actions based on the quantified rate, timing, and volume of depletions caused by groundwater extractions.

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

2 EVALUATION CRITERIA

The GSA submitted a single GSP to the Department to evaluate whether the Plan conforms to specified SGMA requirements[3] and is likely to achieve the sustainability goal for the Bowman Subbasin.[4] To achieve the sustainability goal for the Subbasin, the GSP must demonstrate that implementation of the Plan will lead to sustainable groundwater management, which means the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.[5] Undesirable results must be defined quantitatively by the GSAs.[6] The Department is also required to evaluate whether the GSP will adversely affect the ability of an adjacent basin to implement its GSP or achieve its sustainability goal.[7]

For the GSP to be evaluated by the Department, it must first be determined that the Plan was submitted by the statutory deadline, as applicable,[8] and that it is complete and covers the entire Subbasin.[9] If these conditions are satisfied, the Department evaluates the Plan to determine whether it complies with specific SGMA requirements and substantially complies with the GSP Regulations.[10] Substantial compliance means that the supporting information is sufficiently detailed and the analyses sufficiently thorough and reasonable, in the judgment of the Department, to evaluate the Plan, and the Department determines that any discrepancy would not materially affect the ability of the Agency to achieve the sustainability goal for the Subbasin, or the ability of the Department to evaluate the likelihood of the Plan to attain that goal.[11]

When evaluating whether the Plan is likely to achieve the sustainability goal for the Subbasin, Department staff reviewed the information provided and relied upon in the GSP for sufficiency, credibility, and consistency with scientific and engineering professional standards of practice.[12] The Department's review considers whether there is a reasonable relationship between the information provided and the assumptions and conclusions made by the GSA, including whether the interests of the beneficial uses and users of groundwater in the Subbasin have been considered; whether sustainable management criteria and projects and management actions described in the Plan are commensurate with the level of understanding of the basin setting; and whether those projects and management actions are feasible and likely to prevent undesirable results.[13]

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

The Department also considers whether the GSA has the legal authority and financial resources necessary to implement the Plan.[14]

To the extent overdraft is present in a basin, the Department evaluates whether the Plan provides a reasonable assessment of the overdraft and includes reasonable means to mitigate the overdraft.[15] The Department also considers whether the Plan provides reasonable measures and schedules to eliminate identified data gaps.[16] Lastly, the Department's review considers the comments submitted on the Plan and evaluates whether the GSA adequately responded to the comments that raise credible technical or policy issues with the Plan.[17]

The Department is required to evaluate the Plan within two years of its submittal date and issue a written assessment of the Plan.[18] The written assessment is required to include a determination of the Plan's status.[19] The GSP Regulations define the three options for determining the status of a Plan: Approved,[20] Incomplete,[21] or Inadequate.[22] Within two years of submission, the Department notified the GSA that its review was in progress but was not yet complete.

Even when review indicates that the GSP satisfies the requirements of SGMA and is in substantial compliance with the GSP Regulations, the Department may recommend corrective actions.[23] Recommended corrective actions are intended to facilitate progress in achieving the sustainability goal within the Subbasin and the Department's future evaluations, and to allow the Department to better evaluate whether the Plan adversely affects adjacent basins. While the issues addressed by the recommended corrective actions do not, at this time, preclude approval of the Plan, the Department recommends that the issues be addressed to ensure the Plan's implementation continues to be consistent with SGMA and the Department is able to assess progress in achieving the sustainability goal within the Subbasin.[24] Unless otherwise noted, the Department proposes that recommended corrective actions be addressed by the submission date for the first periodic evaluation.[25]

The Department staff's assessment of the GSP involves the review of information presented by the GSA, including models and assumptions, and an evaluation of that information based on scientific reasonableness, including standard or accepted

[14] 23 CCR § 355.4(b)(9).
[15] 23 CCR § 355.4(b)(6).
[16] 23 CCR § 355.4(b)(2).
[17] 23 CCR § 355.4(b)(10).
[18] Water Code § 10733.4(d); 23 CCR § 355.2(e).
[19] Water Code § 10733.4(d); 23 CCR § 355.2(e).
[20] 23 CCR § 355.2(e)(1).
[21] 23 CCR § 355.2(e)(2).
[22] 23 CCR § 355.2(e)(3).
[23] Water Code § 10733.4(d).
[24] Water Code § 10733.8.
[25] 23 CCR § 356.4 *et seq*.

professional and scientific methods and practices. The assessment does not require Department staff to recalculate or reevaluate technical information provided in the Plan or to perform its own geologic or engineering analysis of that information. The staff recommendation to approve a Plan does not signify that Department staff, were they to exercise the professional judgment required to develop a GSP for the basin, would make the same assumptions and interpretations as those contained in the Plan, but simply that Department staff have determined that the assumptions and interpretations relied upon by the submitting GSA are supported by adequate, credible evidence, and are scientifically reasonable.

Lastly, the Department's review and approval of the Plan is a continual process. Both SGMA and the GSP Regulations provide the Department with the ongoing authority and duty to review the implementation of the Plan.[26] Also, GSAs have an ongoing duty to provide reports to the Department, periodically reassess their plans, and, when necessary, update or amend their plans.[27] The passage of time or new information may make what is reasonable and feasible at the time of this review to not be so in the future. The emphasis of the Department's periodic reviews will be to assess the progress toward achieving the sustainability goal for the basin and whether Plan implementation adversely affects the ability of adjacent basins to achieve their sustainability goals.

[26] Water Code § 10733.8; 23 CCR § 355.6.
[27] Water Code §§ 10728 *et seq.*, 10728.2.

3 REQUIRED CONDITIONS

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

3.1 SUBMISSION DEADLINE

Basins categorized as low- or very low- priority are not subject to a statutory deadline to submit a GSP.[28]

The Plan notes that the Subbasin was initially designated as medium priority and was awarded a grant funding under the Proposition 1 grant. Subsequently, the Subbasin has been re-prioritized as a very low- priority Subbasin. The GSA elected to lead the Plan development for the Subbasin, which had started before the basin re-prioritization.[29] The GSA submitted its Plan for the Subbasin on January 31, 2022.[30]

3.2 COMPLETENESS

GSP Regulations specify that the Department shall evaluate a GSP if that GSP is complete and includes the information required by SGMA and the GSP Regulations.[31]

The GSA submitted an adopted GSP for the entire Subbasin. After an initial, preliminary review, Department staff found the GSP to be complete and include the required information, sufficient to warrant a thorough evaluation by the Department.[32] The Department posted the GSP to its website on February 14, 2022.[33]

3.3 BASIN COVERAGE

A GSP, either on its own or in coordination with other GSPs, must cover the entire basin.[34] A GSP that is intended to cover the entire basin may be presumed to do so if the basin is fully contained within the jurisdictional boundaries of the submitting GSAs.

[28] Water Code § 10720.7(b).
[29] Bowman GSP (January 2022), Section 1.1, p. 45.
[30] https://sgma.water.ca.gov/portal/gsp/preview/137
[31] 23 CCR § 355.4(a)(2).
[32] The Department undertakes a preliminary completeness review of a submitted Plan under section 355.4(a) of the GSP Regulations to determine whether the elements of a Plan required by SGMA and the Regulations have been provided, which is different from a determination, upon review, that a Plan is "incomplete" for purposes of section 355.2(e)(2) of the Regulations.
[33] https://sgma.water.ca.gov/portal/gsp/preview/137.
[34] Water Code § 10727(b); 23 CCR § 355.4(a)(3).

The GSP intends to manage the entire Bowman Subbasin and the jurisdictional boundary of the submitting GSA fully contains the Subbasin and serves as the exclusive GSA for the Subbasin.[35]

[35] Bowman GSP (January 2022), Section 1.1, p. 43, Figure 1-1, p. 44.

4 PLAN EVALUATION

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

4.1 ADMINISTRATIVE INFORMATION

The GSP Regulations require each Plan to include administrative information identifying the submitting Agency, its decision-making process, and its legal authority;[36] a description of the Plan area and identification of beneficial uses and users in the Plan area;[37] and a description of the ability of the submitting Agency to develop and implement a Plan for that area.[38]

The Plan provides the administrative information for the submitting agency[39] and its decision-making process.[40] The Plan identifies the Tehama County FCWCD as the exclusive GSA for the Subbasin and the GSA's governing body is the Tehama County FCWCD Board of Directors consisting of five members, which are the same five members of the Tehama County Board of Supervisors. The Plan describes that the Tehama County FCWCD has the final decision-making authority for the Subbasin with the inputs and recommendations provided by the Tehama County Groundwater Commission, AB3030 Technical Advisory Committee, and ad hoc committees. The Plan notes that there are seven subbasins within Tehama County, and that the Tehama County FCWCD is the exclusive GSA for six subbasins including Bowman, Antelope, Bend, Los Molinos, Red Bluff, and South Battle Creek. The seventh – the Corning Subbasin, partially located in Tehama County and partially in Glenn County, is jointly managed by the Tehama County FCWCD GSA and the Corning Subbasin GSA.[41]

The Plan describes that the Tehama County Groundwater Commission was established in 2016 to serve as an advisory commission to the Tehama County FCWCD Board of

[36] 23 CCR § 354.6 *et seq*.
[37] 23 CCR § 354.8 *et seq*.
[38] 23 CCR § 354.6(e).
[39] Bowman GSP (January 2022), Section 1.3.1, pp. 49-50.
[40] Bowman GSP (January 2022), Section 2.1.5.4, p. 113.
[41] Bowman GSP (January 2022), Section 1.1, p. 45.

Directors for GSA related matters.[42] The Groundwater Commission consists of 11 members with one member from the following entities: the Cities of Corning, Red Bluff, Tehama, El Camino Irrigation District, Los Molino's Community Service District, Rio Alto Water District, and five at-large members appointed by the Tehama County Board of Directors. The Plan also describes that the AB3030 Technical Advisory Committee consists of three agricultural pumpers, three water district representatives, one natural resource representative, and one representative each from the Cities of Corning, Red Bluff, and Tehama.[43] The Plan describes major responsibilities, regular meeting schedule, and websites to access meeting agendas and minutes for the Board of Directors and the Groundwater Commission, respectively. Lastly, the Plan describes ad hoc committees consisting of a smaller group of Groundwater Commission members formed and met throughout the GSP development to address specific topics, make recommendations, and report information back to the full Groundwater Commission.[44]

The Plan describes the legal authority of the GSA. The Plan states that the Tehama County FCWCD was formed in 1957 by the Tehama County Flood Control and Water Conservation Act and is responsible for disseminating drought information, levee system management, providing emergency flood information, water resource management, and sustainable groundwater management.[45] The Tehama County FCWCD meets the requirements of becoming a GSA and draws its legal authority from SMGA by adopting a GSP for the Subbasin. The Plan provides a table showing the timeline from GSA formation to Plan adoption.[46]

The Plan describes that the Bowman Subbasin covers 122,500 acres located in the Redding Area Groundwater Basin bounded by the Anderson Subbasin on the north, the Red Bluff on the south, the South Battle Creek Subbasin on the east, and Norther Coast Mountain Ranges on the west.[47] The location map of the Subbasin is shown in Figure 1 below.

[42] Bowman GSP (January 2022), Section 1.3.1, p. 49.
[43] Bowman GSP (January 2022), Section 1.3.1, pp. 50.
[44] Bowman GSP (January 2022), Section 2.1.5.4, p. 113.
[45] Bowman GSP (January 2022), Section 1.3, p. 48.
[46] Bowman GSP (January 2022), Table 1-2, p.51.
[47] Bowman GSP (January 2022), Section 2.1, p. 63.

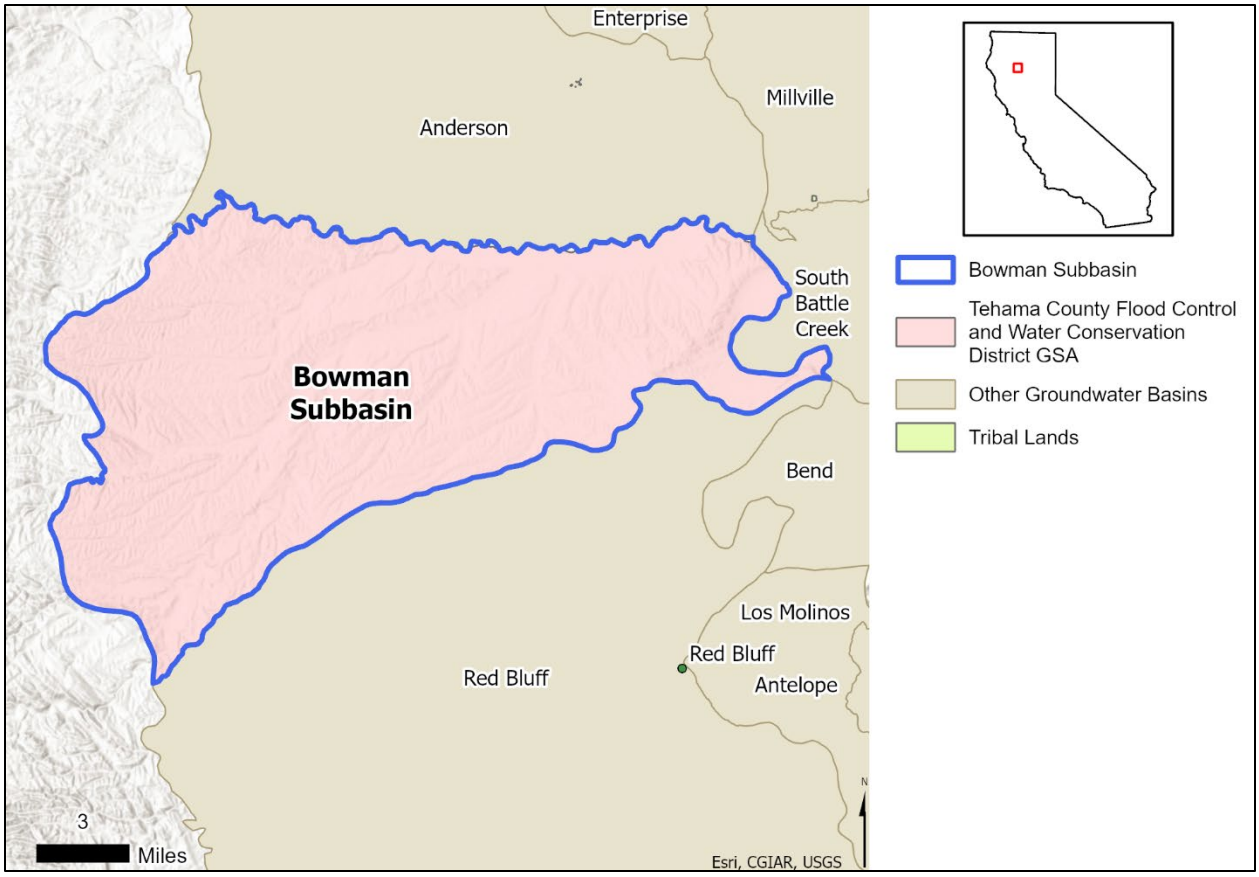

Figure 1: Bowman Subbasin Location Map.

The Plan identifies beneficial uses and users of groundwater in the Subbasin, which are grouped into the following categories: general public, land use agencies, urban and agricultural users, commercial/municipal users, environmental and ecosystems, surface water users, economic development, human right to water, tribes, and integrated water management stakeholders.[48] The GSA has developed a stakeholder communications and engagement for the Subbasin.[49]

The Plan describes the existing monitoring, management, and regulatory programs in the Subbasin. The Plan incorporated data from these programs and associated projects including, for instance, California Statewide Groundwater Elevation Monitoring (CASGEM), Groundwater Ambient Monitoring and Assessment (GAMA), Land Subsidence Monitoring, Surface Water Monitoring, Tehama County AB3030 Groundwater Management Plan (GMP), Northern Sacramento Valley Integrated Regional Water Management Plan (IRWMP), Irrigated Lands Regulatory Program (IRLP), Central Valley – Salinity Alternatives for Long-Term Sustainability (CV-SALTS).[50]

[48] Bowman GSP (January 2022), Table 2-6, pp. 99-100.
[49] Bowman GSP (January 2022), Appendix 2-B, pp. 557-589.
[50] Bowman GSP (January 2022), Section 2.1.2, pp.75-88.

The Plan estimates the total implementation cost to be approximately $19.8 million.[51] The Plan also provides a table detailing the annual implementation cost estimate from 2022 through 2042. The estimated implementation total cost for the first five years is approximately $3.5 million by adding up the numbers from 2022 to 2026 in the table.[52] The GSA plans to fund the plan implementation through fees or charges/assessments through the authority granted by SGMA. Additionally, the GSA will also seek grants and funding sources to assist with the implementation costs.[53]

Overall, Department staff conclude that the administrative information included in the Plan substantially complies with the requirements outlined in the GSP Regulations. Department staff are aware of no significant inconsistencies or contrary information to that presented in the Plan.

4.2 Basin Setting

GSP Regulations require information about the physical setting and characteristics of the basin and current conditions of the basin, including a hydrogeologic conceptual model; a description of historical and current groundwater conditions; and a water budget accounting for total annual volume of groundwater and surface water entering and leaving the basin, including historical, current, and projected water budget conditions.[54]

4.2.1 Hydrogeologic Conceptual Model

The hydrogeologic conceptual model is a non-numerical model of the physical setting, characteristics, and processes that govern groundwater occurrence within a basin, and represents a local agency's understanding of the geology and hydrology of the basin that support the geologic assumptions used in developing mathematical models, such as those that allow for quantification of the water budget.[55] The GSP Regulations require a descriptive hydrogeologic conceptual model that includes a written description of geologic conditions, supported by cross sections and maps,[56] and includes a description of basin boundaries and the bottom of the basin,[57] principal aquifers and aquitards,[58] and data gaps.[59]

The Plan describes that the Subbasin is bordered to the north by Cotton Creek, and to the east by the Sacramento River, to the south by the Red Bluff Arch separating the

[51] Bowman GSP (January 2022), Section 5.1.5, p. 417.
[52] Bowman GSP (January 2022), Table 5-4, p. 418.
[53] Bowman GSP (January 2022), Section 5.1.6, p. 419.
[54] 23 CCR § 354.12.
[55] 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.
[56] 23 CCR §§ 354.14 (a), 354.14 (c).
[57] 23 CCR §§ 354.14 (b)(2-3).
[58] 23 CCR § 354.14 (b)(4) *et seq.*
[59] 23 CCR § 354.14 (b)(5).

Subbasin from the Red Bluff Subbasin, and to the west by the Coastal Ranges.[60] The Plan provides a topography map showing that groundwater elevations generally slope from the southwest to northeast so water generally flows northeast to Cottonwood Creek before it enters into the Sacramento River in the east.[61]

The Plan defines the bottom of the Subbasin at the base of the post-Eocene continental deposits where the deepest fresh water may exist. The Plan states that fresh water is defined as having a maximum electrical conductivity (EC) of 3,000 micromhos per centimeter. The Plan indicates that the base of fresh water in the Subbasin is shallowest in the west at -400 feet and deepest in the east at -1,200 feet, relative to the mean sea level.[62]

The Plan describes the geologic setting for the Subbasin including regional geology,[63] geologic formations,[64] geologic structures,[65] soil characteristics,[66] surface water features and areas of recharges,[67] and principal aquifers.[68] The Plan supports the description of geologic setting with a series of maps and reference cross-sections.[69]

The Plan identifies two principal aquifers in the Subbasin: Upper Aquifer and Lower Aquifer.[70] The Plan states that the depositional environment for the northern Sacramento Valley resulted in a complex and varied series of water bearing sedimentary deposits and the Tuscan/Tehama Formations, which collectively form a two-aquifer system in the Subbasin and beyond. The Plan also states that "[t]he complexity of the geologic materials and similarly [sic] among the formations makes it difficult to define a singular widespread aquitard or distinctive change in geologic materials separating an upper and lower aquifer." The delineation between the Upper and Lower Aquifer are attempted by the GSA based on well construction data throughout the Subbasin, and such delineation is presented in reference cross-sections provided in the Plan.[71] The Upper Aquifer is identified as the freshwater bearing geologic units approximately 350-450 feet in thickness below ground surface, consisting of the Quaternary formations and the upper portions of the Tehama and Tuscan Formations with unconfined to semi-confined water conditions. The Plan states that wells screened in the Upper Aquifer are largely for domestic purposes.[72] The Lower Aquifer is defined as the freshwater geologic bearing units underlying the Upper Aquifer to the bottom of the Subbasin, consisting of the lower

[60] Bowman GSP (January 2022), Section 2.2.1.1, p. 123, Figure 2-15, p. 124.
[61] Bowman GSP (January 2022), Figure 2-19, p. 129.
[62] Bowman GSP (January 2022), Section 2.2.1.6, pp. 159-160, Figure 2-16, p. 125.
[63] Bowman GSP (January 2022), Section 2.2.1.3.1, pp. 130-133.
[64] Bowman GSP (January 2022), Section 2.2.1.3.1, pp. 133-145.
[65] Bowman GSP (January 2022), Section 2.2.1.3.1, pp. 146-147.
[66] Bowman GSP (January 2022), Section 2.2.1.3.1, pp. 147-156.
[67] Bowman GSP (January 2022), Section 2.2.1.3.1, pp. 159-162.
[68] Bowman GSP (January 2022), Section 2.2.1.3.1, pp. 157-158.
[69] Bowman GSP (January 2022), Figures 2-20 to 2-34, pp. 131-164.
[70] Bowman GSP (January 2022), Section 2.2.1.5, p. 157.
[71] Bowman GSP (January 2022), Figures 2-23 and 2-24, pp. 138-139.
[72] Bowman GSP (January 2022), Section 2.2.1.5, p. 157.

portions of the Tehama and Tuscan Formations also with unconfined to semi-confined water conditions.[73]

The GSP identifies two principal aquifers in the Subbasin: The Upper and Lower Aquifers. The two principal aquifers are not separated by an aquitard layer. It appears that the stratigraphy of the principal aquifers is not correlated with the geologic formations or consistent with the stratigraphy depicted in the lithologic logs.[74] The Plan identifies data gaps associated with the hydrogeologic conceptual model for the Subbasin, primarily in the areas of stratigraphy, hydrogeologic parameters, and surface water and groundwater interconnectivity.[75] The GSA proposes to fill the data gaps related to surface water and groundwater interconnectivity in the first periodic evaluation period.[76] Department staff recommend that the GSA verify the presence of two distinct principal aquifers with the data gaps filled or explain how the subdivision of the principal aquifer helps the Subbasin management.

Overall, Department staff conclude that the hydrogeologic conceptual model depicted in the Plan generally complies with the requirements outlined in the GSP Regulations, but there are areas that still need improvement as described in the recommended corrective actions. These recommended corrective actions do not preclude the approval of the Plan at this time and Department staff expect the GSA to address the recommended corrective actions by the next periodic evaluation.

4.2.2 Groundwater Conditions

The GSP Regulations require a written description of historical and current groundwater conditions for each of the applicable sustainability indicators that includes the following: groundwater elevation contour maps and hydrographs,[77] a graph depicting change in groundwater storage,[78] maps and cross-sections of the seawater intrusion front,[79] maps of groundwater contamination sites and plumes,[80] maps depicting total subsidence,[81] identification of interconnected surface water systems and an estimate of the quantity and timing of depletions of those systems,[82] and identification of groundwater dependent ecosystems.[83]

[73] Bowman GSP (January 2022), Section 2.2.1.5, p. 158.
[74] Bowman GSP (January 2022), Figures 2-23 and 2-24, pp. 138-139.
[75] Bowman GSP (January 2022), Section 2.2.1.8, pp. 162 and 165.
[76] Bowman GSP (January 2022), Section 3.7.8.8, p. 324.
[77] 23 CCR §§ 354.16 (a)(1-2).
[78] 23 CCR § 354.16 (b).
[79] 23 CCR § 354.16 (c).
[80] 23 CCR § 354.16 (d).
[81] 23 CCR § 354.16 (e).
[82] 23 CCR § 354.16 (f).
[83] 23 CCR § 354.16 (g).

The Plan describes that the groundwater level conditions have been historically stable in the Subbasin,[84] supported by groundwater elevation hydrographs[85] and contour maps.[86] The hydrographs show that not only groundwater levels have been stable, but also the seasonal fluctuations are less than five feet in the Upper Aquifer and ten feet in the Lower Aquifer.[87] The Plan also notes a weak hydraulic separation between the Upper Aquifer and Lower Aquifer with a consistent downward gradients (0.01 to 0.06), as indicated by water level hydrographs of nested/clustered wells.[88] The Plan uses groundwater elevation contour maps to evaluate general groundwater flow directions, concluding that groundwater generally flows from west to east with a lateral hydraulic gradient between 16 to 18 feet per mile. In some areas, such as the southwest portion of the Subbasin, the groundwater flows in a northeast direction.[89]

Department staff note that there appears to be some inconsistency between the predominant west-east direction of groundwater flow depicted by groundwater elevation contour maps and the predominant north-south direction based on the Subbasin's water budgets. The water budgets provided in the Plan indicate a significant amount of subsurface flow in north-south direction from the Subbasin to the Red Bluff Subbasin (approximately 120,000 acre-feet per year),[90] contradicting the west-east groundwater flow direction based on the groundwater elevation contour maps.[91] Furthermore, the Red Bluff Arch that separates the two Subbasins may present a hydraulic barrier to groundwater subsurface flow[92] so that presumably only a small amount of subsurface flow is expected flowing from the Subbasin out to the Red Bluff Subbasin, as opposed to a significant subsurface flow of 120,000 acre-feet per year. Should groundwater levels in either of the basins drop to the minimum threshold level, there could be impacts to the subsurface flow between the subbasins that are not understood. Department staff recommend the GSA explain why such inconsistency exists and why there is a significant subsurface flow between the Subbasin and the Red Bluff Subbasin given the presence of the Red Bluff Arch (see Recommended Corrective Action 1).

In describing groundwater conditions related to groundwater storage, the Plan provides a groundwater elevation change map to demonstrate the change in groundwater storage conditions for the Upper Aquifer between spring 1990 and spring 2018.[93] The Plan notes that the groundwater elevation change map covers only a northern portion of the Subbasin due to insufficient groundwater level data. The Plan concludes that the groundwater storage in this area did not change considerably. Department staff concur

[84] Bowman GSP (January 2022), Section 2.2.2.1, pp. 165-168.
[85] Bowman GSP (January 2022), Figure 2-35, p. 169, Appendix 2-F, pp. 654-672.
[86] Bowman GSP (January 2022), Figures 2-37 to 2-44, pp. 171-178.
[87] Bowman GSP (January 2022), Section 2.2.2.1.1, p. 167.
[88] Bowman GSP (January 2022), Section 2.2.2.1.2, p. 179, Appendix 2-F, pp. 664-666.
[89] Bowman GSP (January 2022), Section 2.2.2.1.2, p. 179.
[90] Bowman GSP (January 2022), Figure 2-61, p. 233, Figures 2-64 and 2-69, pp. 245 and 257.
[91] Bowman GSP (January 2022), Figures 2-37 to 2-44, pp. 171-178.
[92] Bowman GSP (January 2022), Section 2.2.1.3, p. 147.
[93] Bowman GSP (January 2022), Figure 2-45, p. 180.

with the assessment and note that the map in fact indicates a slight increase in groundwater storage during this period.

The Plan describes that the Subbasin has no known issues with groundwater quality. The Plan reports that concentrations are below the respective maximum contamination level for total dissolved solids (TDS), nitrate, and arsenic.[94]

The Plan states that seawater intrusion is not an applicable sustainability indicator for the Subbasin because it is located about 90 miles away from the Pacific Ocean.[95]

The Plan reports that the Subbasin has little to no reported evidence of subsidence. The measured groundwater surface changes ranged from -0.073 to -0.129 feet between 2008 and 2017 based on the Department's GPS survey study report.[96] Similarly, the Department's InSAR surveys show that vertical displacement was -0.09 to 0.05 feet from July 2015 to June 2019.[97]

The Plan describes that the Sacramento River and Cottonwood Creek flow throughout the year and the other creeks flow seasonally including the South Fork of Cottonwood Creek, Pine Creek, Hooker Creek, and Little Dry Creek. The Plan notes that one active stream gage is located within the Subbasin four miles away from the closest shallow groundwater monitoring well, and that characterizing the connectivity between surface water and groundwater is challenging due to the limited data.[98] The Plan provides a map showing likely interconnected, likely disconnected, and interconnectivity uncertain for stream reaches based on a dataset developed by The Nature Conservancy.[99] The Plan also relies on the calibrated Tehama Integrated Hydrologic Model to identify losing and gaining reaches. The Plan states that the modeling results for such characterization are provided in "Sub-appendix G of Appendix 2-J".[100] By using the modeling, the Plan identifies the presence of interconnectivity of the streams within the Subbasin. However, the Plan does not provide an estimate of quantity and timing of depletions of interconnected surface water systems due to groundwater pumping required by GSP Regulations.[101] More discussion is provided in Section 4.3.2.6. related to sustainable management criteria for depletions of interconnected surface water.

The Plan identifies and prioritizes potential groundwater dependent ecosystems (GDEs) within the Subbasin.[102] First, the Plan uses the dataset of Natural Communities Commonly Associated with Groundwater (NCCAG), recent land cover data, and recent seasonal high groundwater levels data to identify potential GDEs. Second, the Plan uses

[94] Bowman GSP (January 2022), Section 2.2.2.3, pp. 179-181.
[95] Bowman GSP (January 2022), Section 2.2.2.4, p. 181.
[96] Bowman GSP (January 2022), Section 2.2.2.5, p. 186, Figure 2-50, p. 187.
[97] Bowman GSP (January 2022), Section 2.2.2.5, p. 186, Figure 2-51, p. 188.
[98] Bowman GSP (January 2022), Section 2.2.2.6, p. 186.
[99] Bowman GSP (January 2022), Figure 2-52, p. 192.
[100] Bowman GSP (January 2022), Section 2.2.2.6, p. 189.
[101] 23 CCR 354.16 (f).
[102] Bowman GSP (January 2022), Section 2.2.2.7, pp. 190-191, Appendix 2-I, pp. 693-709.

vegetation metrics such as Normalized Derived Vegetation Index (NDVI) and Normalized Derived Moisture Index (NDMI) to classify the GDEs into two categories: high priority GDEs[103] and low priority GDEs. Third, the Plan evaluates the high priority GDEs to determine if temporal changes of vegetation metrics and local groundwater levels were correlated. However, the Plan notes that limited data are available for groundwater level monitoring near high priority GDEs to establish any correlations at present. Thus, the Plan proposes to install additional shallow groundwater monitoring wells near or within high priority GDEs.

While Department staff have provided a couple recommended corrective actions, overall, Department staff conclude that the description of groundwater conditions in the Plan substantially complies with the requirements outlined in the GSP Regulations and appears to use the best available information and science. Department staff are aware of no significant inconsistencies or contrary technical information to that presented in the Plan.

4.2.3 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,[104] and the sustainable yield.[105]

The Plan describes and quantifies the historical, current, and projected water budgets of the Subbasin using the Tehama Integrated Hydrologic Model.[106]

The Plan uses the modeling period from 1990 to 2018 to develop the historical water budget. The Plan provides a historical surface water system budget[107] and groundwater system budget[108] in both graphic and tabular format. The Plan also presents a graph showing the cumulative change in groundwater storage over the historical water budget period.[109] The average historical groundwater pumping in the Subbasin is 6.1 thousand acre-feet (TAF), which is a small fraction of the Subbasin's water budget. For instance, the water budget shows on average 290 TAF of precipitation, 160 TAF of evapotranspiration, 53 TAF of deep percolation, 43 TAF of seepage of surface water, and 88 TAF of net subsurface flows leaving the Subbasin. The cumulative change in groundwater storage shows a reduction of 50 TAF in storage, or 1.7 TAF per year. Groundwater pumping is fairly stable with a variance of approximately +/- 1.0 TAF depending on the hydrologic conditions, while deep percolation shows a variance of

[103] Bowman GSP (January 2022), Figure 2-53, p. 193.
[104] 23 CCR §§ 354.18 (a), 354.18 (c) *et seq*.
[105] 23 CCR § 354.18 (b)(7).
[106] Bowman GSP (January 2022), Section 2.3, pp. 207-268.
[107] Bowman GSP (January 2022), Figure 2-60, p. 229, Table 2-21, pp. 230-231.
[108] Bowman GSP (January 2022), Figure 2-61, p. 233, Table 2-22, pp. 235-236.
[109] Bowman GSP (January 2022), Figure 2-62, p. 234.

approximately +/- 20 TAF and net subsurface flows approximately +/- 10 TAF.[110] The Plan concludes that the Subbasin is not in overdraft based on its small amount of storage reduction.[111] Department staff recognize that historically the pumping in the Subbasin has been stable and limited to a small fraction of the natural recharge, and that the groundwater levels in the Subbasin have generally been stable. Department staff have no material concerns or disagreements with the GSA's assessment.

The Plan uses the recent three-year period between 2016 and 2018 to develop the current water budget.[112] The Plan provides the current surface water system budget[113] and groundwater system budget[114] in tabular format. The average current groundwater pumping in the Subbasin is 6.6 TAF, precipitation 310 TAF, evapotranspiration 160 TAF, deep percolation 51 TAF, seepage of surface water 51 TAF, and net subsurface flows 84 TAF leaving the Subbasin. The cumulative change in groundwater storage shows an increase of 9.8 TAF in storage, or 3.3 TAF per year.

The Plan develops the Subbasin's projected water budget using the projected model runs evaluating the effects of anticipated future hydrologic conditions, water supply availability, and water demand over a 50-year GSP planning period (2022-2072).[115] The Plan provides projected surface water system budget[116] and groundwater system budget[117] in both graphic and tabular format. The average projected groundwater pumping is 6.4 TAF, precipitation 300 TAF, evapotranspiration 160 TAF, deep percolation 53 TAF, seepage of surface water 47 TAF, and net subsurface flows 91 TAF leaving the Subbasin. The cumulative change of groundwater storage shows a slight decrease of 15 TAF (or 0.30 TAF per year).[118]

The Plan also evaluates the effects of climate change on projected water budgets.[119] The Plan concludes that climate change does not appear to change the overall Subbasin groundwater system water budget in a considerable way.[120]

The Plan estimates that the subsurface flow to the adjacent Red Bluff Subbasin is 120 TAF historically in the projected water budget. As discussed previously, the GSA should explain why the subsurface flow of such magnitude exists given the presence of the Red Bluff Arch.

[110] Bowman GSP (January 2022), Table 2-22, p. 236.
[111] Bowman GSP (January 2022), Section 2.3.5.3, p. 232.
[112] Bowman GSP (January 2022), Section 2.3.6, pp. 236-238.
[113] Bowman GSP (January 2022), Table 2-23, p. 237.
[114] Bowman GSP (January 2022), Table 2-24, p. 238.
[115] Bowman GSP (January 2022), Section 2.3.7, pp. 239-260.
[116] Bowman GSP (January 2022), Figure 2-68, p. 252, Table 2-29, pp. 253-254.
[117] Bowman GSP (January 2022), Figure 2-70, p. 258, Table 2-30, pp. 259-260.
[118] Bowman GSP (January 2022), Section 2.3.8.1, p. 256.
[119] Bowman GSP (January 2022), Section 2.3.9, pp. 261-264.
[120] Bowman GSP (January 2022), Section 2.3.9.2, p. 261, Table 2-32, p. 262.

The Plan estimates the sustainable yield of the Subbasin is approximately 10,000 acre-feet per year, which includes groundwater pumping and groundwater uptake by the plants/vegetation.[121] While groundwater pumping and groundwater uptake are two different processes, both are considered by the GSA in estimating the sustainable yield of the Subbasin. It is important to keep in mind that the GSA must provide groundwater withdrawals of both elements in its annual reporting and the Plan's periodic evaluations, in order to evaluate if the Subbasin is operating within its sustainable yield.

Overall, based on the information presented in the Plan, Department staff conclude that the information included in the Plan related to the Plan related to the water budget complies with the requirements outlined in the GSP Regulations and appears to use the best available information and science. Department staff have identified a recommended corrective action asking the GSA to address the inconsistency between the subsurface flow to the Red Bluff Subbasin and the presence of the Red Bluff Arch. However, the recommended corrective action does not preclude the approval of the Plan at this time, and the GSA is expected to provide additional information to address the recommended corrective action by the next periodic evaluation of the Plan.

4.2.4 Management Areas

The GSP Regulations provide the option for one or more management areas to be defined within a basin if the GSA has determined that the creation of the management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives, provided that undesirable results are defined consistently throughout the basin.[122]

The Plan does not establish management areas within the Subbasin.

4.3 Sustainable Management Criteria

GSP Regulations require each Plan to include a sustainability goal for the basin and to characterize and establish undesirable results, minimum thresholds, and measurable objectives for each applicable sustainability indicator, as appropriate. The GSP Regulations require each Plan to define conditions that constitute sustainable groundwater management for the basin including the process by which the GSA characterizes undesirable results and establishes minimum thresholds and measurable objectives for each applicable sustainability indicator.[123]

4.3.1 Sustainability Goal

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

[121] Bowman GSP (January 2022), Section 2.3.12, p. 268.
[122] 23 CCR § 354.20.
[123] 23 CCR § 354.22 *et seq*.

and should include an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation.[124]

The Plan states that the sustainability goal for the Subbasin is "to ensure that by 2042, and thereafter within the planning and implementation horizon of this GSP (50 years to 2072), the Subbasin is operated within its sustainable yield and does not exhibit undesirable results considered significant and unreasonable."[125] The GSA plans to achieve the sustainability goal through the proposed projects and management actions proposed in Chapter 4 of the Plan.[126]

Overall, the Subbasin's sustainability goal will maintain the groundwater pumping at the same level that the Subbasin has experienced, and the GSA intends to maintain the water levels and avoid undesirable results.

4.3.2 Sustainability Indicators

Sustainability indicators are defined as any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results.[127] 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[128] – but refer to groundwater conditions that are not, in and of themselves, significant and unreasonable. Rather, sustainability indicators refer to the effects caused by changing groundwater conditions that are monitored, and for which criteria in the form of minimum thresholds are established by the agency to define when the effect becomes significant and unreasonable, producing an undesirable result.

GSP Regulations require that GSAs provide descriptions of undesirable results including defining what are significant and unreasonable potential effects to beneficial uses and users for each sustainability indicator.[129] GSP Regulations also require GSPs provide the criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based

[124] 23 CCR § 354.24.
[125] Bowman GSP (January 2022), Section 3.1.1, p. 278.
[126] Bowman GSP (January 2022), Section 3.1.3, p. 279.
[127] 23 CCR § 351(ah).
[128] Water Code § 10721(x).
[129] 23 CCR §§ 354.26 (a), 354.26 (b)(c).

on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the Subbasin.[130]

GSP Regulations require that the description of minimum thresholds include the information and criteria relied upon to establish and justify the minimum threshold for each sustainability indicator.[131] GSAs are required to describe how conditions at minimum thresholds may affect beneficial uses and users,[132] and the relationship between the minimum thresholds for each sustainability indicator, including an explanation for how the GSA has determined conditions at each minimum threshold will avoid causing undesirable results for other sustainability indicators.[133]

GSP Regulations require that GSPs include a description of the criteria used to select measurable objectives, including interim milestones, to achieve the sustainability goal within 20 years.[134] GSP Regulations also require that the measurable objectives be established based on the same metrics and monitoring sites as those used to define minimum thresholds.[135]

The following subsections thus consolidate three facets of sustainable management criteria: undesirable results, minimum thresholds, and measurable objectives. Information, as presented in the Plan, pertaining to the processes and criteria relied upon to define undesirable results applicable to the Subbasin, as quantified through the establishment of minimum thresholds, are addressed for each applicable sustainability indicator. A submitting agency is not required to establish criteria for undesirable results that the agency can demonstrate are not present and are not likely to occur in a basin.[136]

4.3.2.1 Chronic Lowering of Groundwater Levels

In addition to components identified in 23 CCR §§ 354.28 (a-b), for the chronic lowering of groundwater, the GSP Regulations require the minimum threshold for chronic lowering of groundwater levels to be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results that is supported by information about groundwater elevation conditions and potential effects on other sustainability indicators.[137]

The Plan quantitatively defines undesirable results for chronic lowering of groundwater levels as "25% or more of the RMS wells are below the MTs [minimum thresholds] for two (2) consecutive annual spring measurements."[138] The Plan describes significant and unreasonable effects for chronic lowering of groundwater levels as "…lower the rate of

[130] 23 CCR § 354.26 (b)(2).
[131] 23 CCR § 354.28 (b)(1).
[132] 23 CCR § 354.28 (b)(4).
[133] 23 CCR § 354.28 (b)(2).
[134] 23 CCR § 354.30 (a).
[135] 23 CCR § 354.30 (b).
[136] 23 CCR § 354.26 (d).
[137] 23 CCR § 354.28(c)(1) *et seq*.
[138] Bowman GSP (January 2022), Section 3.3.1.4, p. 294.

production of pre-existing groundwater wells below that necessary to meet the minimum required to support overlying beneficial use(s) where alternative means of obtaining sufficient water resources are not technically or financially feasible."[139] This description is vague as it does not quantify what is the minimum to support each individual beneficial use and objectively determine what is technically or financially feasible. As currently described, it's unclear what rate of production is required for the overlying beneficial users and uses. Department staff recommend the GSA further quantify the effects of the groundwater conditions the Subbasin is wanting to avoid. The Department staff also take issue with the use of spring measurements to alert the GSA of undesirable results. The use of spring levels in the definition of undesirable results for chronic lowering of groundwater levels appears inconsistent with SGMA because it could potentially disregard the impacts to beneficial users and uses at other parts of the year, including at seasonal lows, which generally occur in the late-summer or fall periods for most basins. Based on the hydrographs provided in the GSP, groundwater levels in the Subbasin follow this pattern with lower levels in fall than in spring.[140] Accordingly, without a convincing explanation for how managing using only spring groundwater levels will account for and consider all uses and users of groundwater throughout the year, Department staff recommend that the GSA not use only spring measurements to establish undesirable results. The GSA should be monitoring for undesirable results throughout the entire year. Department staff recommend the GSA clearly describe the significant and unreasonable conditions the GSA is managing the Subbasin to avoid; and sufficiently discuss the process and rationale for how the criteria of undesirable results are determined, including impacts to beneficial users and uses when revising the undesirable result, such as number and location of wells that may go dry. Department staff also recommend the undesirable result be redefined to not include a seasonal component (see Recommended Corrective Action 2a).

The GSA establishes minimum thresholds at four monitoring wells in the upper aquifer and three in the lower aquifer. For monitoring wells in the Upper Aquifer, the minimum thresholds are set at the spring groundwater elevation where less than 10 – 20% (on average) of domestic wells could potentially be impacted.[141] The Plan estimates that there are a total of 2,428 domestic wells located in the Subbasin, which would mean the minimum thresholds in the upper aquifer could result in 243 to 486 wells that could go dry.[142] It is unclear where these dry wells would be located in the Subbasin. For the Lower Aquifer, the minimum thresholds are set at spring groundwater elevation minus 20 to 120 feet.[143] The GSP also states that the minimum thresholds are established by projecting water levels to 2042, which in turn establishes the minimum thresholds to levels which the Subbasin has never experienced. The use of the approach in projecting water levels

[139] Bowman GSP (January 2022), Section 3.3.1.1, p. 292.
[140] Bowman GSP (January 2022), Appendix 2-F, pp. 654-672.
[141] Bowman GSP (January 2022), Section 3.3.1.1, p. 292, Table 3-7, p. 293.
[142] Bowman GSP (January 2022), Table 2-3, p. 71.
[143] Bowman GSP (January 2022), Section 3.3.1.1, p. 292, Table 3-8, p. 293.

is not consistent with SGMA and the GSP Regulations. Minimum thresholds should be defined as "the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results."[144] When examining the hydrographs provided in Appendix 3B for each of the monitoring wells with established minimum thresholds, the historical and current water levels fairly consistently stay above the defined measurable objectives and the trends don't appear to align with the projected 2042 values.[145] The Plan also does not describe increased future groundwater usage; therefore, it's unclear how these projections make sense. Department staff recommend the minimum thresholds be revised to be consistent with the GSP Regulations, including being informed by a depletion of supply that may lead to undesirable results, supported by clear consistent information, and clearly describing potential impacts to beneficial users and uses. Should impacts be present, also describe how those are not considered undesirable results (see Recommended Corrective Action 2b).

GSP Regulations require that the GSA describe the relationship between the minimum thresholds for each sustainability indicator, including an explanation for how the GSA has determined conditions at each minimum threshold will avoid causing undesirable results for other sustainability indicators.[146] However, the Plan does not provide that analysis or discussion. While the GSP states that minimum thresholds are established to "protect against significant and unreasonable levels of chronic groundwater storage declines, water quality degradation, subsidence in areas where critical infrastructure is located," Department staff do not believe the establishment of the minimum thresholds to levels that the Subbasin has never experienced supports this statement. Department staff recommend that the GSA provide analysis and discussion to demonstrate that the minimum thresholds for groundwater levels will not interfere with other sustainability indicators causing undesirable results (see Recommended Corrective Action 2c).

Given that water levels in the Subbasin have historically fluctuated only five to 10 feet and no increased groundwater demand is projected, the Department believe the lack of information and deficiencies identified should not preclude approval at this time; however, Department staff believe the GSA should address the recommended corrective actions prior to the next periodic evaluation. Failure to adequately respond to the recommended corrective actions to establish sustainable management criteria in accordance with the GSP Regulations may limit the ability of the Department to determine that the Plan is likely to achieve the sustainability goal for the Subbasin.

4.3.2.2 Reduction of Groundwater Storage

In addition to components identified in 23 CCR §§ 354.28 (a-b), for the reduction of groundwater storage, the GSP Regulations require the minimum threshold for the reduction of groundwater storage to be a total volume of groundwater that can be

[144] 23 CCR § 354.28(c)(1).
[145] Bowman GSP (January 2022) (January 2022), Appendix 3B, pp. 1074 – 1081.
[146] 23 CCR §§ 354.28 (b)(2); 354.28(c)(1).

withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.[147]

The GSP uses groundwater levels as a proxy for groundwater storage. The sustainable management criteria for the reduction of groundwater storage are identical to those for the chronic lowering of groundwater levels.[148] The GSP states that the GSA intends to use changes in groundwater elevations to estimate changes in groundwater storage. [149] Using groundwater levels as a proxy can be a reasonable approach as long as the GSA can prove that there is a strong correlation between groundwater levels and storage. Department staff recommend that the GSA provide such analysis in the next periodic evaluation of the Plan.

4.3.2.3 Seawater Intrusion

In addition to components identified in 23 CCR §§ 354.28 (a-b), for seawater intrusion, the GSP Regulations require the minimum threshold for seawater intrusion to be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results.[150]

The GSP does not establish sustainable management criteria for seawater intrusion because the GSA determines that seawater intrusion is not a sustainability indicator applicable to the Subbasin. The GSA based its conclusion on the fact that the Subbasin is 90 miles inland from the Pacific Ocean.[151]

Department staff are satisfied with the rationale for not setting sustainable management criteria for seawater intrusion for the Subbasin.

4.3.2.4 Degraded Water Quality

In addition to components identified in 23 CCR §§ 354.28 (a-b), for degraded water quality, the GSP Regulations require the minimum threshold for degraded water quality to be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.[152]

[147] 23 CCR § 354.28(c)(2).
[148] Bowman GSP (January 2022), Section 3.3.2.1, p. 294, Section 3.4.1.2, p. 303, Section 3.2.2, p. 284.
[149] Bowman GSP (January 2022), Section 3.3.2.2, p. 295.
[150] 23 CCR § 354.28(c)(3).
[151] Bowman GSP (January 2022), Section 2.2.2.4, p. 181.
[152] 23 CCR § 354.28(c)(4).

The Plan describes that significant and unreasonable effect related to water quality occur if "it causes reduction in the long-term viability of domestic, agriculture, municipal wells, or environmental uses over the planning and implementation of the GSP."[153] The Plan quantitatively defines undesirable results for water quality degradation as "at least 25% RMS wells exceed the MTs for two (2) consecutive years at each well it can be established that GSP implementation is the cause of the exceedance."[154]

The GSP's definition of undesirable results for degraded water quality is not fully consistent with SGMA because the Plan solely focuses on water quality impacts caused directly by the GSP implementation. Under SGMA, significant and unreasonable degraded water quality caused by groundwater conditions occurring through the Subbasin can also include conditions caused by a lack of groundwater management. In other words, SGMA specifies that undesirable results are significant and unreasonable effects caused by groundwater conditions occurring throughout the Subbasin, which are not limited to impacts directly caused by GSP implementation in the Subbasin. 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, whether the GSA has implemented projects and management actions or not, should be considered in the assessment of undesirable results in the Subbasin. Department staff recommend the GSA revise the definition of undesirable results for groundwater quality such that groundwater conditions, whether due to action or inaction of the GSA with respect to Subbasin management, should be considered and included in the undesirable result definition (see Recommended Corrective Action 3).

The Plan identifies TDS as the sole constituent of concern within the Subbasin.[155] The GSP set the minimum threshold for TDS at 750 milligrams per liter (gm/L) and the measurable objective at 500 mg/L.[156] The Plan states that the minimum threshold is lower than the California State Water Resources Control Board (SWRCB) upper secondary maximum contaminant level of 1,000 mg/L.[157] Department staff are satisfied with the GSA's sustainable management criteria for TDS.

Overall, the description of the Subbasin's sustainable management criteria for groundwater quality included in the Plan generally complies with the requirements outlined in the GSP Regulations but with recommended corrective actions identified. Department staff conclude that the recommended corrective action does not preclude the approval of the Plan at this time, but Department staff expect the GSA to address them in the next periodic evaluation of the Plan. In the future, should other constituents of concern degrade water quality due to groundwater management, the Department staff

[153] Bowman GSP (January 2022), Section 3.4.1.4, p. 303.
[154] Bowman GSP (January 2022), Section 3.4.1.4, p. 303.
[155] Bowman GSP (January 2022), Section 3.3.4.1, p. 297.
[156] Bowman GSP (January 2022), Section 3.3.4.1, p. 297, Table 3-10, p. 298.
[157] Bowman GSP (January 2022), Section 3.3.4.1, p. 297.

will expect the GSA to establish sustainable groundwater management criteria for those constituents.

4.3.2.5 Land Subsidence

In addition to components identified in 23 CCR §§ 354.28 (a-b), the GSP Regulations require the minimum threshold for land subsidence to be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results.[158] Minimum thresholds for land subsidence shall be supported by identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects and maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum thresholds and measurable objectives.[159]

The Plan reports that the Subbasin has experienced little or no land subsidence.[160] The GSA used InSAR data to develop the sustainable management criteria and will rely on InSAR data to monitor potential subsidence in the future as well. The Plan defines the undesirable results as 50% of representative monitoring sites with subsidence exceeding the minimum thresholds.[161] The GSA set the minimum thresholds at InSAR pixel locations near water level monitoring network wells at two feet cumulative subsidence over 20 years or 0.5 feet over a five (5)-year period.[162] The GSA set the measurable objectives at one foot of cumulative subsidence over 20 years or 0.25 feet over a five (5)-year period.[163] The Plan explains that the minimum threshold was established by doubling the measured land vertical displacement in InSAR from June 2015 to September 2019.[164] Because the Subbasin has experienced minimal or no subsidence historically, Department staff are generally satisfied with the Plan's description of sustainable management criteria. However, Department staff recommend that the GSA add monitoring locations near critical infrastructure for land subsidence. To do that, the GSA needs to first identify critical infrastructure (e.g., water conveyance or flood control facilities) that are likely to be affected by land subsidence. The Plan describes generic effects of land subsidence as "unchecked subsidence can impact critical water conveyance and flood control infrastructure",[165] but it does not identify any specific water conveyance and flood control infrastructure in the Subbasin. Second, the GSA needs to expand the land subsidence monitoring coverage to include locations near the identified critical infrastructures rather than limited to the groundwater level monitoring well sites.

[158] 23 CCR § 354.28(c)(5).
[159] 23 CCR §§ 354.28(c)(5)(A-B).
[160] Bowman GSP (January 2022), Section 2.2.2.5, p. 182.
[161] Bowman GSP (January 2022), Section 3.1.1.3, p. 303.
[162] Bowman GSP (January 2022), Section 3.3.3.1, p. 296, Table 3-9, p. 296.
[163] Bowman GSP (January 2022), Section 3.2.3.1, p. 285, Table 3-4, p. 285.
[164] Bowman GSP (January 2022), Section 3.3.3.1, p. 296.
[165] Bowman GSP (January 2022), Section 3.3.3.5, p. 297.

InSAR data is available to assist the GSA in expanding the monitoring coverage (see Recommended Corrective Action 4).

Based on the discussion above, Department staff are generally satisfied with the Plan's description of the sustainable management criteria developed for subsidence. However, a recommended corrective action has been identified. However, Department staff conclude that the recommended corrective action does not preclude the Plan's approval at this time but expect the GSA to address it in the next periodic evaluation of the Plan.

4.3.2.6 Depletions of Interconnected Surface Water

SGMA defines undesirable results for the depletion of interconnected surface water as those that have significant and unreasonable adverse impacts on beneficial uses of surface water and are caused by groundwater conditions occurring throughout the basin.[166] 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.[167] 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.[168]

The Plan acknowledges the presence of interconnected surface waters in the Subbasin and identifies their location by using the calibrated groundwater model due to significant data gaps in surface water and shallow groundwater monitoring data.[169]

The GSP does not quantify the rate or volume of surface water depletions due to groundwater pumping as the sustainable management criteria as required by the GSP Regulations.[170] Instead, the GSP proposes to use groundwater levels at four representative monitoring wells screened in the Upper Aquifer as a proxy to set sustainable management criteria for interconnected surface water.[171] Specifically, the Plan sets the minimum thresholds for interconnected surface water at the same levels set for chronic lowering of groundwater levels.[172] Similarly, the measurable objectives and interim milestones for interconnected surface water are set at the same levels as those set for chronic lowering of groundwater levels.[173] The Plan defines undesirable results as "25% of groundwater elevations measured at RMS wells drop below the associated threshold during two (2) consecutive years in the Upper Aquifer."[174]

[166] Water Code § 10721(x)(6).
[167] 23 CCR § 354.16 (f).
[168] 23 CCR § 354.28 (c)(6).
[169] Bowman GSP (January 2022), Section 2.2.2.6.1, p. 189, Figure 2-52, p. 192.
[170] 23 CCR § 354.28 (c)(6).
[171] Bowman GSP (January 2022), Section 3.2.5.1, p. 289, Section 3.3.5.1, p. 299.
[172] Bowman GSP (January 2022), Section 3.3.5.1, p. 299, Table 3-11, p. 299.
[173] Bowman GSP (January 2022), Section 3.2.5.1, p. 289, Table 3-6, p. 289.
[174] Bowman GSP (January 2022), Section 3.4.5.1, p. 303.

Department staff understand that quantifying depletions of surface water from groundwater extractions is a complex task that likely requires developing new, specialized tools, models, and methods to understand local hydrogeologic conditions, interactions, and responses. The Department has developed a set of papers[175] discussing the technical aspects of interconnected surface water and plans to release the guidance document for complying with GSP Regulations requiring GSAs to evaluate the rate, timing, and volume of depletions of interconnected surface water caused by groundwater extractions. The GSA should consider incorporating appropriate guidance approaches into their future periodic evaluations to the GSP and establishing sustainable management criteria based on the quantified rate, timing, and volume of depletions caused by groundwater extractions (see Recommended Corrective Action 5).

4.4 Monitoring Network

The GSP Regulations describe the monitoring network that must be developed for each sustainability indicator including monitoring objectives, monitoring protocols, and data reporting requirements. Collecting monitoring data of 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.[176] Specifically, a monitoring network must be able to monitor impacts to beneficial uses and users,[177] monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds,[178] capture seasonal low and high conditions,[179] include required information such as location and well construction and include maps and tables clearly showing the monitoring site type, location, and frequency.[180] Department staff encourage GSAs to collect monitoring data as specified in the GSP, follow SGMA data and reporting standards,[181] fill data gaps identified in the GSP prior to the first periodic evaluation,[182] update monitoring network information as needed, follow monitoring best management practices,[183] 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.

The Plan proposes seven (7) representative monitoring wells for groundwater levels including four (4) wells in the Upper Aquifer and three (3) wells in the Lower Aquifer. The

[175] https://catalog.data.gov/dataset/sgma-depletions-of-interconnected-surface-water-8a400
[176] 23 CCR § 354.32.
[177] 23 CCR § 354.34(b)(2).
[178] 23 CCR § 354.34(b)(3).
[179] 23 CCR § 354.34(c)(1)(B).
[180] 23 CCR §§ 354.34(g-h).
[181] 23 CCR § 352.4 *et seq*.
[182] 23 CCR § 354.38(d).
[183] Department of Water Resources, 2016, Best Management Practices and Guidance Documents.

Plan provides maps illustrating the locations of the wells.[184] The well identification, latitude and longitude, monitoring frequency, well construction data (i.e., well depth, well screen interval, groundwater surface elevation, measurement years, and number of measurements) are included in tables.[185] The Plan also notes that the representative monitoring wells are part of either the California State Groundwater Elevation Monitoring (CASGEM) or Tehama County Monitoring Network.[186]

The Plan uses groundwater levels as a proxy for groundwater storage, so the groundwater levels monitoring network will be used for monitoring groundwater storage.[187]

The Plan selects six (6) InSAR data pixels near groundwater level monitoring wells to monitor land subsidence in the Subbasin.[188] As discussed previously in this report, Department question whether the monitoring locations are relevant and sufficient for the water conveyance and flood control infrastructure (and other land uses or property interests) in the Subbasin that are likely to be affected by land subsidence. Department staff recommend that the GSA expand the coverage of land subsidence monitoring locations (see Recommended Corrective Action 4).

The Plan describes that the groundwater quality monitoring network consists of four (4) monitoring wells screened in the Upper Aquifer, coinciding with the four monitoring wells in the Upper Aquifer for groundwater level monitoring network.[189] Annual monitoring of groundwater quality will include sampling and laboratory analysis of TDS.[190] The Plan notes that TDS is a not concern for the Lower Aquifer of the Subbasin.[191]

The Plan notes extensive data gaps in the availability of monitoring sites for interconnected surface water. In the interim, the Plan uses the groundwater level monitoring wells in the Upper Aquifer as a proxy to monitor interconnected surface water.[192] As GSP Regulations require the GSA to quantify the rate or volume of surface water depletions due to groundwater pumping as the sustainable management criteria,[193] the GSA needs to revisit and modify the monitoring network in the future if a different approach is used.

Overall, Department staff conclude that the description of the Subbasin's monitoring networks generally complies with the requirements outlined in the GSP Regulations. Department staff have also identified a couple of recommended corrective actions related

[184] Bowman GSP (January 2022), Figures 3-2 and 3-3, pp. 282 and 283.
[185] Bowman GSP (January 2022), Tables 3-14 and 3-15, p. 309.
[186] Bowman GSP (January 2022), Section 3.6.2, p. 308, Table 3-16, p. 309.
[187] Bowman GSP (January 2022), Section 3.6.3, p. 310.
[188] Bowman GSP (January 2022), Section 3.6.4, p.312, Tables 3-20 and 3-21, p. 313.
[189] Bowman GSP (January 2022), Section 3.6.5, p. 314, Figure 3-5, p. 288.
[190] Bowman GSP (January 2022), Section 3.7.4, p. 320, Table 3-26, p. 321.
[191] Bowman GSP (January 2022), Section 3.2.4.1, p. 287.
[192] Bowman GSP (January 2022), Section 3.6.6, p. 316.
[193] 23 CCR § 354.28 (c)(6).

to the monitoring networks for land subsidence and interconnected surface water. These recommended corrective actions do not preclude approval of the Plan at this time, but Department staff expect the GSA to address them in the next periodic evaluation.

4.5 PROJECTS AND MANAGEMENT ACTIONS

The GSP Regulations require a description of the projects and management actions the submitting Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.[194] Each Plan's description of projects and management actions must include details such as: how projects and management actions in the GSP will achieve sustainability, the implementation process and expected benefits, and prioritization and criteria used to initiate projects and management actions. [195]

The Plan proposes two projects and one management action that are expected to be completed prior to 2042.[196] The projects include: 1) Multi-Benefit Recharge that involves direct groundwater recharge through normal farming operations; and 2) Cottonwood Creek Invasive Control Follow Up & Riparian Habitat Restoration that aims for groundwater demand reduction by removing invasive weeds (e.g., Arundo, salt cedar, etc.) in Cottonwood Creek. The proposed management action is grower education that will provide growers with educational resources on supporting groundwater sustainability and maintain/improve agricultural productivity.

The Plan provides an overview of the projects and management action, and describes the implementation circumstances, schedule, notice to public and other agencies, legal authority and permitting, and expected benefits and costs.[197] The Plan estimates that the expected benefit for the Multi-Benefit Recharge project is 105 acre-feet per year.[198] The expected benefit for other project and management action is not quantified.

The Plan also describes a list of 10 potential projects and 15 management actions on as needed basis and of conceptual nature.[199] The Plan provides additional details to some extent for these projects and management actions.[200]

Overall, Department staff conclude that the description of the Subbasin's projects and management actions complies with the requirements outlined in the GSP Regulations.

[194] 23 CCR § 354.44 (a).
[195] 23 CCR § 354.44 (b) *et seq.*
[196] Bowman GSP (January 2022), Table 4-2, p. 336.
[197] Bowman GSP (January 2022), Section 4.4, pp. 350-365.
[198] Bowman GSP (January 2022), Table 4-6, p. 356.
[199] Bowman GSP (January 2022), Table 4-2, p. 336.
[200] Bowman GSP (January 2022), Section 4.5, pp. 365-403.

4.6 Consideration of Adjacent Basins/Subbasins

SGMA requires the Department to "…evaluate whether a groundwater sustainability plan adversely affects the ability of an adjacent basin to implement their groundwater sustainability plan or impedes achievement of sustainability goals in an adjacent basin."[201] Furthermore, the GSP Regulations state that minimum thresholds defined in each GSP be designed to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.[202]

The Bowman Subbasin is adjacent to Anderson Subbasin to the north, Red Bluff Subbasin to the south, and South Battle Creek Subbasin to the east. According to the historical water budgets presented in the Plan, the subsurface flows between Bowman and Anderson, Red Bluff Subbasins are significantly greater than the pumping within the Bowman Subbasin. The Plan estimates that 22 TAF flowing from Anderson into Bowman, and 120 TAF from Bowman to Red Bluff, compared to 6.1 TAF groundwater pumping in Bowman.[203]

However, the Plan does not provide any discussion on how the selected minimum thresholds would affect the adjacent subbasins, particularly, the minimum thresholds for groundwater levels are selected 20-70 feet below the 2015 level. At minimum thresholds, the outflow from Anderson Subbasin will increase significantly as a result of a greater groundwater flow gradient. The inflow to the Red Bluff Subbasin is not clearly understood because of the presence of the Red Bluff Arch. As the GSA addresses Recommended Corrective Actions 1 and 2, consideration of adjacent basins should also be discussed. Department staff encourage the GSA to coordinate with the adjacent subbasins to address the recommended corrective action by the next periodic evaluation of the Plan.

4.7 Consideration of Climate Change and Future Conditions

The GSP Regulations require a GSA to consider future conditions and project how future water use may change due to multiple factors including climate change.[204]

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

[201] Water Code § 10733(c).
[202] 23 CCR § 354.28(b)(3).
[203] Bowman GSP (January 2022), Figure 2-61, p. 233.
[204] 23 CCR § 354.18.

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

5 STAFF RECOMMENDATION

Department staff recommend approval of the GSP with the recommended corrective actions listed below. The Subbasin GSP conforms with Water Code Sections 10727.2 and 10727.4 of SGMA and substantially complies with the GSP Regulations. At this time, it appears the GSP is likely to achieve the sustainability goal for the Bowman Subbasin with appropriate implementation and periodic improvements and refinements. The GSA has identified several areas for improvement of its Plan and Department staff concur that those items are important and should be addressed as soon as possible. Department staff have also identified additional recommended corrective actions that should be considered by the GSA for the first periodic evaluation of its GSP. Addressing these recommended corrective actions will be important to demonstrate that implementation of the Plan is likely to achieve the sustainability goal.

The recommended corrective actions include:

RECOMMENDED CORRECTIVE ACTION 1

Explain the inconsistency between the depicted west-east groundwater flow direction based on groundwater elevation contours and the north-south flow direction based on the water budgets. Explain why there is a significant amount of subsurface flow from the Bowman to the Red Bluff Subbasins given the two Subbasins are separated by the Red Bluff Arch. If this magnitude of subsurface flow is truly present, the GSA should consider how the subsurface flow will be impacted at the minimum thresholds and discuss whether the selected minimum thresholds will avoid causing undesirable results in the adjacent Subbasins due to change in the subsurface flow from Bowman and not affecting their ability to achieve sustainability.

RECOMMENDED CORRECTIVE ACTION 2

Revise the sustainable management criteria for groundwater levels as follows:

a. Refine the description of undesirable results to clearly describe the significant and unreasonable conditions the GSA is managing the Subbasin to avoid. The GSA should sufficiently discuss the process and rationale for how the criteria of undesirable results are determined, including impacts to beneficial users and uses the GSA intends to avoid. The description of undesirable results may include but should not be limited to only one season or part of the year unless compelling support for excluding other times of year and are thoroughly discussed and explained in the GSP.

b. Department staff recommend the minimum thresholds be revised to be consistent with the GSP Regulations, including being informed by a depletion of supply that may lead to undesirable results, supported by clear consistent information, and clearly describing potential impacts to beneficial users and uses. The GSA should clearly

articulate the number of wells (domestic, agricultural, etc.) that may be impacted rather than provide a range. Should impacts be present which are not considered significant and undesirable, describe why those are not considered undesirable results.

c. Provide analysis and discussion to demonstrate that the minimum thresholds for groundwater levels will not interfere with other sustainability indicators causing undesirable results.

RECOMMENDED CORRECTIVE ACTION 3

Revise the definition of undesirable results of groundwater quality such that groundwater conditions, whether due to action or inaction of the GSA with respect to Subbasin management, should be considered.

RECOMMENDED CORRECTIVE ACTION 4

Identify critical infrastructure as well as other land uses or property interests that are likely to be affected by land subsidence in the Subbasin. Expand the land subsidence monitoring coverage to include locations near the identified critical infrastructure.

RECOMMENDED CORRECTIVE ACTION 5

Consider utilizing the interconnected surface water guidance issued by the Department to evaluate the rate, timing, and volume of depletions of interconnected surface water caused by groundwater extractions. And establish sustainable management criteria and management actions based on the quantified rate, timing, and volume of depletions caused by groundwater extractions.