

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

Groundwater Basin Name: Sacramento Valley - South American (5-021.65)
Submitting Agency: Sacramento Central Groundwater Authority
Recommendation: Do Not Approve
Date Issued: July 17, 2019

I. Summary

The Sacramento Central Groundwater Authority (SCGA) submitted an alternative (South American Subbasin Alternative *or* Alternative) to the Department of Water Resources (Department) for evaluation and assessment as provided by the Sustainable Groundwater Management Act (SGMA).¹ The South American Subbasin Alternative is based on an analysis of basin conditions that demonstrates the basin has operated within its sustainable yield over a period of at least 10 years.² Based on evaluation of the South American Subbasin Alternative and consideration of public comments, Department staff believe the Alternative has not satisfied the objectives of SGMA and recommend that the Alternative not be approved.

SCGA is a Joint Powers Authority composed of the County of Sacramento and the cities of Elk Grove, Folsom, Rancho Cordova and Sacramento, and is responsible for groundwater management in the locally-defined Sacramento Central Groundwater Basin (Central Basin). The Central Basin overlaps considerably with the South American Subbasin, as defined by the Department's Bulletin 118 (see Basin Coverage below). SCGA was created in 2006 following the recommendations of the Central Sacramento County Groundwater Forum to implement the Central Sacramento County Groundwater Management Plan (Groundwater Management Plan), which was prepared in 2006 for the Central Basin and was one of the outcomes of the Sacramento Area Water Forum Successor Effort (Water Forum). The Water Forum was created in 1993 by stakeholders in the Sacramento Region with goals to provide safe and reliable water supply for the Sacramento Region and preserve the environmental values of the Lower American River.

¹ Water Code § 10720 *et seq.*

² Water Code § 10733.6(b)(3)

A major outcome of the Water Forum was the negotiation of the Water Forum Agreement signed in 2000.

To demonstrate sustainable groundwater management for the South American Subbasin, SCGA relies upon a negotiated volume of groundwater production referred to in the Water Forum documents as the “sustainable yield” for the area managed by the SCGA, the Central Basin, and presents that volume of groundwater production for the Subbasin as equivalent to the sustainable yield defined in SGMA.³ SCGA also provides pumping estimates for urban, agricultural, and rural uses for the 11 years prior to 2015 to show that the Subbasin has operated within that yield.

After reviewing the Alternative, Department staff did not find evidence that the sustainable yield provided for the Central Basin through the Water Forum Agreement was developed to avoid undesirable results for all applicable sustainability indicators, specifically depletions of interconnected surface water. Staff were also unable to determine how the trigger points provided for Basin Management Objective (BMO) No. 4, as presented in the 2006 Groundwater Management Plan prepared for the Central Basin, are intended to avoid undesirable results related to surface water depletions in the South American Subbasin, or find evidence that SCGA monitored streamflow to determine whether the trigger points were exceeded.

It is also unclear as to what constitutes an undesirable result with regard to lowering groundwater levels. BMO No. 2 from the 2006 Groundwater Management Plan provides a monitoring methodology to meet specific objectives to manage groundwater levels in the Central Basin. Information provided in the Alternative demonstrates that there are several areas/wells in the South American Subbasin that have experienced declining groundwater levels during the 10-year period analyzed. In some cases, the groundwater levels exceeded (i.e., were lower than) the lower threshold identified in the Alternative. SCGA states that these groundwater levels were acceptable, but does not provide any scientific rationale as to why exceeding the thresholds was not an undesirable result.

Also, SCGA does not include regulatory pumping in determining if the Subbasin is operating within its sustainable yield on the assumption that SCGA has no control over those extractions. The volume of water at issue is not insignificant, and could conceivably determine whether the Subbasin is being managed sustainably, or not. All pumping that may have a significant effect on groundwater conditions in the Subbasin is relevant and must be accounted for, even if its use is not within the direct control of the managing agency.

For the reasons identified above, Department staff are unable to determine that the South American Subbasin has operated within its sustainable yield for a period of 10 years.

³ Water Code § 10721(w)

Department staff are unable to assume that undesirable results have not occurred in the Subbasin in the absence of a compelling argument and adequate supporting data. The information and data provided in the Alternative indicate that the sustainable yield negotiated for the Central Basin was not necessarily intended to avoid undesirable results with regard to depletions of interconnected surface waters, may have been exceeded, and exceedances of other management thresholds identified in the Groundwater Management Plan's BMOs have not led to any of the identified management actions. Therefore, Department staff recommend that the Alternative not be approved.

Importantly, in making this recommendation, Department staff are not stating that the sustainable yield developed for the Central Basin through the Water Forum is an unreasonable value for the South American Subbasin. Supported by further analysis and monitoring, that value may prove to be sufficient to avoid all undesirable results in the Subbasin. Department staff do find that additional analysis and monitoring will be necessary to demonstrate that operating to the negotiated sustainable yield will not cause undesirable results for all sustainability indicators, once these have been defined.

The remainder of this assessment is organized as follows:

- **Section II. Review Principles** describes legal and other considerations regarding Department staff's assessment and evaluation of alternatives.
- **Section III. Alternative Materials** describes materials (i.e., plans, reports, data, and other information) submitted by the SCGA that, collectively, the Department staff considered as the Alternative.
- **Section IV. Required Conditions** describes whether the Alternative satisfies each of the four conditions required for the Department to review an alternative.
- **Section V. Alternative Contents** describes the information contained in the Alternative submittal.
- **Section VI. Assessment** describes Department staff's evaluation of the Alternative, whether it satisfies the objectives of SGMA, and, if applicable, describes recommended actions proposed for the first five-year update.

II. Review Principles

SCGA submitted an alternative based on an analysis of basin conditions to the Department for evaluation and assessment to determine whether it satisfies the objectives of SGMA for the South American Subbasin. To satisfy the objectives of SGMA, an alternative based on an analysis of basin conditions must demonstrate that the basin has been operated within its sustainable yield for a period of at least 10 years.⁴ The SGMA

⁴ Water Code § 10733.6(b)(3)

definition of sustainable yield requires the avoidance of undesirable results.⁵ As a result, an alternative based on an analysis of basin conditions must demonstrate that the submitting agency has an understanding of groundwater conditions that would cause undesirable results, as well as analysis in the alternative demonstrating the absence of undesirable results over a 10-year period.

An alternative, to be evaluated by the Department, must be submitted by the statutory deadline and be within a basin that complies with Part 2.11 of Division 6 of the Water Code.⁶ The submitted alternative must also be complete and must cover the entire basin.⁷ The GSP Regulations⁸ require the Department to evaluate an Alternative “in accordance with Sections 355.2, 355.4(b), and Section 355.6, *as applicable*, to determine whether the Alternative complies with the objectives of the Act”.⁹ The elements of the cited sections are not all applicable to alternatives. Some provisions apply to GSPs and alternatives alike, to alternatives only prospectively, or do not apply to alternatives at all.¹⁰ Ultimately, the purpose of the evaluation is to determine whether an alternative satisfies the objectives of SGMA.¹¹ The agency must explain how the elements of an alternative are “functionally equivalent” to the elements of a GSP required by Articles 5 and 7 of the GSP Regulations and are sufficient to demonstrate the ability of an alternative to achieve the objectives of SGMA.¹² The explanation by the agency that elements of an alternative are functionally equivalent to elements of a GSP furthers the objective of demonstrating that an alternative satisfies the objectives of SGMA. Alternatives based on groundwater management plans or historical basin management practices that predate the passage of SGMA or adoption of GSP Regulations, although required to satisfy the objectives of SGMA, are not necessarily expected to conform to the precise format and content of a

⁵ Water Code § 10721(u)

⁶ Water Code § 10733.6(c)-(d)

⁷ 23 CCR § 358.4(a)

⁸ 23 CCR § 350 *et seq.*

⁹ 23 CCR § 358.4(b) (emphasis added)

¹⁰ Procedural requirements, including submissions by the agency, posting by the Department, and the public comment period, apply equally to plans and alternatives (23 CCR § 355.2(a)-(c)). The periodic review of Plans (23 CCR § 355.6(a)) applies to alternatives prospectively but does not apply to initial submissions. Other regulatory provisions are inapplicable to alternatives, including the two-year review period (23 CCR § 355.2(e)), which is based on the statutory time-frame that applies to Plans but not alternatives (Water Code § 10733.4(d)); the “incomplete” status that allows the agency to address “one or more deficiencies that preclude approval, but which may be capable of being corrected by the Agency in a timely manner” (23 CCR § 355.2(e)(2)), which applies to plans undergoing development, but not alternatives that purportedly satisfy the objectives of SGMA at the time of their submission (Water Code § 10733.6(a)); and, for the same reason, corrective actions to address deficiencies in plans (23 CCR § 355.4(a)(4)), which applies to plans developed after the adoption of SGMA, but is inapplicable to alternatives that predate SGMA.

¹¹ Water Code § 10733.6(a). The Department considers the regulatory language in 23 CCR § 358.2(d) (“complies with the objectives of [SGMA]”) to be equivalent to the statutory threshold upon which it is based.

¹² 23 CCR § 358.2(d)

GSP. The Department's assessment is thus focused on the ability of an alternative to satisfy the objectives of SGMA as demonstrated by information provided by the agency; it is not a determination of the degree to which an alternative matched the specific requirements of the GSP Regulations.

When evaluating whether an alternative satisfies the objectives of SGMA and thus is likely to achieve the sustainability goal for the basin, staff review the information provided by and relied upon by the agency for sufficiency, credibility, and consistency with scientific and engineering professional standards of practice.¹³ The Department's review considers whether there is a reasonable relationship between the information provided and the assumptions and conclusions made by the agency, whether sustainable management criteria and projects and management actions described in an alternative are commensurate with the level of understanding of the basin setting, and whether those projects and management actions are feasible and likely to prevent undesirable results.¹⁴ Staff will recommend that an alternative be approved if staff believe, in light of these factors, that alternative has achieved or is likely to achieve the sustainability goal for the basin.¹⁵

An alternative based on a demonstration that the basin has operated within its sustainable yield over a period of at least 10 years may be approved based on information that demonstrates that objective criteria defining operating standards that governed groundwater management for the basin were established and consistently achieved. Even when staff review indicates that an alternative will satisfy the objective of SGMA, the Department may recommend actions to facilitate future evaluation of that alternative and to allow the Department to better evaluate whether an alternative adversely affects adjacent basins. DWR proposes that recommended actions be addressed by the submission date for the first periodic evaluation.

Staff assessment of an alternative involves the review of information presented by the agency, including models and assumptions, and an evaluation of that information based on scientific reasonableness. The assessment does not require Department staff to recalculate or reevaluate technical information provided in an alternative or to perform its own geologic or engineering analysis of that information. The staff recommendation to approve an alternative does not signify that Department staff, were they to exercise the professional judgment required to develop a plan for the basin, would make the same assumptions and interpretations as those contained in an alternative, but simply that Department staff have determined that the assumptions and interpretations relied upon

¹³ 23 CCR § 351(h).

¹⁴ 23 CCR § 355.4(b)(1), (3), and (5).

¹⁵ 23 CCR § 355.4(b).

by the submitting agency are supported by adequate, credible evidence, and are scientifically reasonable.

III. Alternative Materials

SCGA submitted an alternative based on an analysis demonstrating the South American Subbasin has operated within its sustainable yield over a period of at least 10 years, pursuant to Water Code Section 10733.6(b)(3). The South American Subbasin Alternative includes the following documents:

- *South American Subbasin Alternative Submittal* – SCGA and GEI Consultants, Inc., December 14, 2014, 707 pages¹⁶ (Analysis of Basin Conditions). The Analysis of Basin Conditions was prepared by SCGA to provide information about the South American Subbasin and demonstrate that the Subbasin has not experienced undesirable results in the past 10 years.

SCGA submitted the following additional plans, reports, and other documents prepared prior to the implementation of SGMA that the Department has determined to be sufficiently related to the Alternative to warrant their consideration as part of the Alternative:

- *Central Sacramento County Groundwater Management Plan*, February 2006 (Groundwater Management Plan)
- *SCGA Basin Management Report, 2011-2012*
- *SCGA Basin Management Report, 2009-2010*
- *SCGA Basin Management Report, 2007-2008*
- *Water Forum Agreement Groundwater Management Element*, January 2000
- *Baseline Conditions for Groundwater Yield Analysis, Final Report*, May 1997 (Baseline Yield Analysis)
- *Water Forum Agreement Environmental Impact Report*, January 2000

SCGA also submitted an Alternative Elements Guide and Annual Reports.¹⁷ Other material submitted by the SCGA, public comments, documents submitted by third parties, correspondence, and other information provided to the Department have been posted on the Department's website.¹⁸

¹⁶ Identified as document "Alt_Sub_Final_SCGA_S_American_Subbasin_Chapters_20161214_wApp" on the Department's Alternatives Portal.

¹⁷ The Annual Reports are not part of the Alternative and were not reviewed by the Department for the purpose of assessing the Alternative.

¹⁸ <https://sgma.water.ca.gov/portal/alternative/print/15>

IV. Required Conditions

An alternative, to be evaluated by the Department, must be submitted by the statutory deadline and be within a basin that complies with Part 2.11 of Division 6 of the Water Code.¹⁹ The submitted alternative must also be complete and must cover the entire basin.²⁰

A. Submission Deadline

SGMA requires that an alternative for a basin categorized as high- or medium-priority as of January 31, 2015, be submitted no later than January 1, 2017.²¹

SCGA submitted its Alternative on December 30, 2016, before the submission deadline.

B. Part 2.11 (CASGEM) Compliance

SGMA requires that the Department assess whether an alternative is within a basin that is in compliance with Part 2.11 of Division 6 of the Water Code,²² which requires that groundwater elevations in all groundwater basins be regularly and systematically monitored and that groundwater elevation reports be submitted to the Department.²³ To manage its obligations under this law, the Department established the California Statewide Groundwater Elevation Monitoring (CASGEM) Program. The acronym CASGEM is used in this document to denote both the program and the groundwater monitoring law.²⁴

SGMA specifies that an alternative does not satisfy the objectives of SGMA if the basin is not in compliance with the requirements of CASGEM.²⁵ The Department confirmed that the South American Subbasin was in compliance with the requirements of CASGEM prior to evaluating this Alternative and confirmed that the Subbasin remained in compliance with CASGEM prior to issuing this assessment.

C. Completeness

GSP Regulations specify that the Department shall evaluate an alternative if that alternative is complete and includes the information required by SGMA and the GSP

¹⁹ Water Code § 10733.6

²⁰ 23 CCR § 358.6

²¹ Water Code § 10733.6(c). Pursuant to Water Code § 10722.4(d), a different deadline applies to a basin that has been elevated from low- or very low-priority to high- or medium-priority after January 31, 2015.

²² Water Code § 10733.6(d)

²³ Water Code § 10920 *et seq.*

²⁴ Stats.2009-2010, 7th Ex.Sess., c. 1 (S.B.6), § 1

²⁵ Water Code § 10733.6(d)

Regulations.²⁶ An alternative submitted pursuant to Water Code Section 10733.6(b)(3) must include an analysis demonstrating the basin has operated within its sustainable yield over a period of at least 10 years. That analysis must include a report prepared by a registered professional engineer or geologist who is licensed by the state, and that report must be submitted under that engineer's or geologist's seal. The alternative must include an explanation of how the elements of the alternative are functionally equivalent to the elements of a GSP required by Articles 5 and 7 of the GSP Regulations and are sufficient to demonstrate the ability of the alternative to achieve the objectives of SGMA.²⁷

SCGA submitted an analysis of basin conditions under the seal of a licensed Professional Geologist and a licensed Professional Engineer, as well as several complementary documents and other required materials. The submission was deemed complete and was evaluated by the Department.

D. Basin Coverage

An alternative is required to cover the entire basin.²⁸ An alternative 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 agency. However, an alternative submitted by an agency whose jurisdictional boundaries do not include all areas of the basin may be found to effectively cover the entire basin. Because the intent of SGMA is to provide for the sustainable management of groundwater basins,²⁹ with sustainability defined as the management and use of groundwater that does not cause undesirable results,³⁰ an alternative effectively covers the entire basin if it results in groundwater management that avoids undesirable results for that basin. An alternative that cannot avoid undesirable results is not sustainably managing the basin even if the entire basin is within the jurisdiction of the managing agency, but an alternative that avoids undesirable results throughout the basin is sustainably managing that basin even if some part of the basin lies outside the jurisdiction of that agency.

SCGA recognizes that the GSP Regulations require an alternative to apply to the entire basin, as delineated by the Department in Bulletin 118,³¹ and contains statements in the Analysis of Basin Conditions indicating the intent of the Analysis of Basin Conditions is to demonstrate sustainable groundwater management for the entire South American Subbasin. However, SCGA's jurisdiction covers an area referred to in Water Forum

²⁶ 23 CCR § 358.4(a)(3)

²⁷ 23 CCR § 358.2(c)-(d)

²⁸ 23 CCR § 358.4(a)(4)

²⁹ Water Code § 10720.1(a)

³⁰ Water Code § 10721(v)

³¹ Analysis of Basin Conditions, Chapter 1, Section 1.5.2, p. 1-15

documents as the Central Basin (outlined in yellow on Figure 1).³² The boundaries of the Central Basin overlap, but do not entirely cover the South American Subbasin (shown in teal on Figure 1) as defined in Bulletin 118. The Central Basin does not include the southwestern corner of the South American Subbasin, which lies in the Sacramento-San Joaquin Delta,³³ and extends south into the adjacent Cosumnes Subbasin (shown in lavender on Figure 1), as well as exhibiting other minor boundary deviations. To demonstrate that the SCGA groundwater management effectively covers the entire basin, SCGA presents an analysis to relate the sustainable yield defined for the Central Basin to the South American Subbasin.³⁴

The Analysis of Basin Conditions presents a comparison of the Delta area (located outside of the Central Basin but within the South American Subbasin) and the Cosumnes Subbasin area (located within the Central Basin but outside of the South American Subbasin) to demonstrate that the two areas are similar enough in size and land use that sustainable yield estimates and management practices presented in the GMP can be applied to the entire South American Subbasin.³⁵ The comparison suggests that the Alternative effectively covers the entire South American Subbasin because the groundwater management assumptions for the Central Basin directly apply to the South American Subbasin.³⁶ SCGA also states that it will enter into a memorandum of understanding (MOU) with local agencies in the Sacramento Delta to conduct the required monitoring and annual reporting requirements for this area as part of future SGMA compliance for the Alternative.³⁷ The signed MOU was not found in the Alternative.

³² Map of "Sacramento County Groundwater Subbasins" from Figure 1-2, South American Subbasin and Sacramento Central Groundwater Authority, Analysis of Basin Conditions, Section 1.1.3 (South American Subbasin Location) p. 1-6.

³³ Department of Water Resources, Sacramento-San Joaquin Delta Atlas (reprinted 1995), p. 4.

³⁴ Analysis of Basin Conditions, Chapters 2.2.2 and 2.2.3, pgs. 2-6 to 2-10

³⁵ Analysis of Basin Conditions, Section 2.2.2

³⁶ Analysis of Basin Conditions, Section 2.2.3

³⁷ Analysis of Basin Conditions, Section 1.5.2

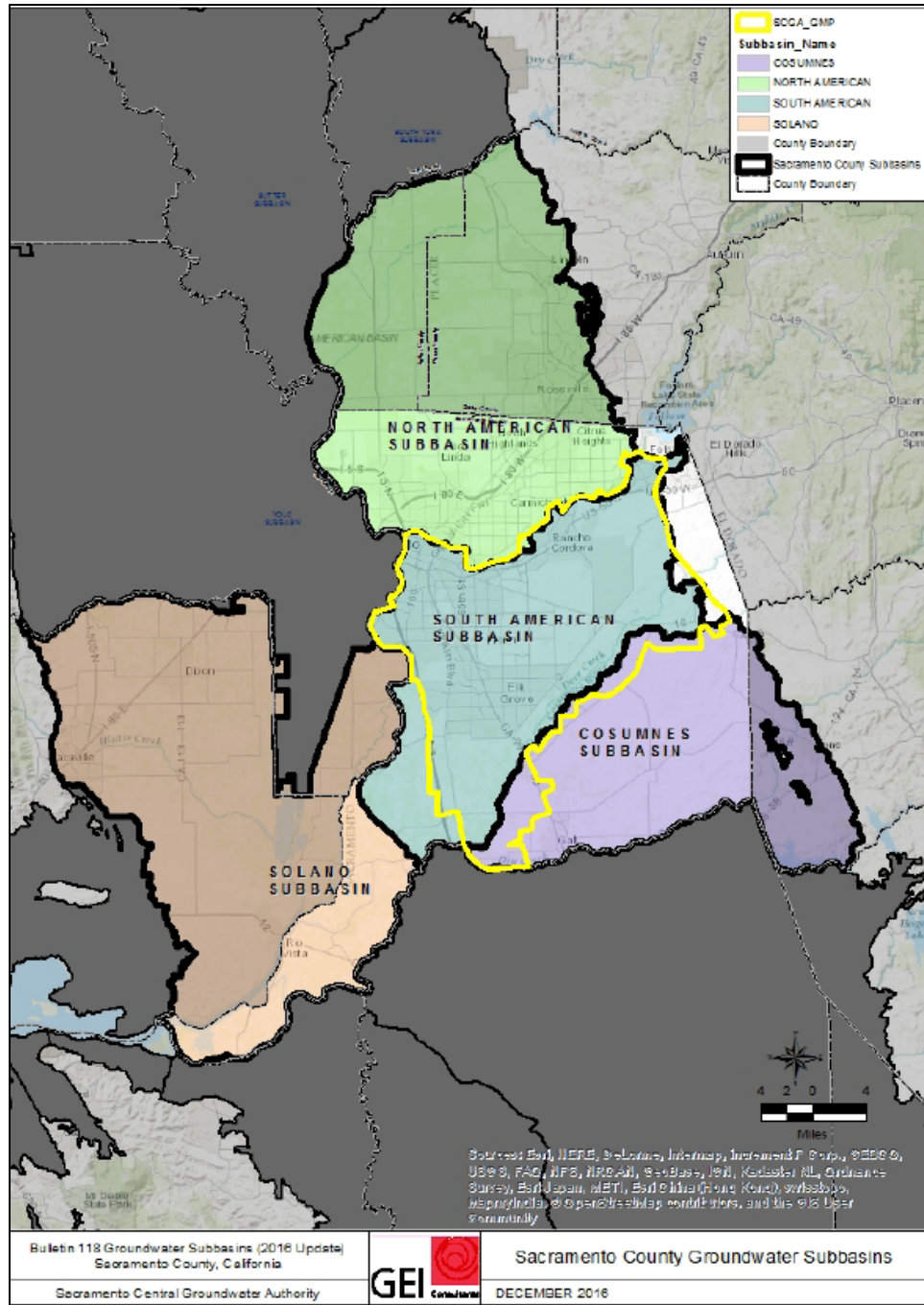


Figure 1 – Sacramento County Groundwater Basins – Central Basin Boundary Compared with South American Subbasin Boundary

To determine whether the Alternative effectively covers the entire Subbasin, Department staff are required to determine whether groundwater management pursuant to the Alternative has avoided undesirable results in the entire Subbasin for at least 10 years. Because Department staff have determined that the Analysis of Basin Conditions does not demonstrate that undesirable results have been absent for at least 10 years, even

within the locally-defined Central Basin, the Department staff are unable to determine the South American Subbasin has been managed sustainably. As a result, Department staff cannot conclude that the Alternative effectively covers the entire Subbasin. Although the failure to cover the entire Subbasin precludes the Alternative from approval, Department staff note that the failure to effectively cover the entire Subbasin is a consequence of the Alternative not demonstrating sustainability in the area within SCGA's jurisdiction. Department staff do not express an opinion as to whether the area managed by SCGA would be sufficient to effectively manage the entire South American Subbasin if sustainable groundwater management had been sufficiently demonstrated.

V. Alternative Contents

GSP Regulations require the submitting agency to explain how the elements of an alternative are functionally equivalent to the elements of a GSP as required by Article 5 of the GSP regulations³⁸ and are sufficient to demonstrate the ability of an alternative to achieve the objectives of SGMA.³⁹

As stated previously, alternatives based on historical basin management practices that predate the passage of SGMA or adoption of GSP Regulations, although required to satisfy the objectives of SGMA, are not necessarily expected to conform to the precise format and content of a GSP, and the criteria for adequacy of an alternative is whether the Department is able to determine that an alternative satisfies the objectives of SGMA. Department staff rely on the submitting agency's determination of functional equivalence of alternative elements to facilitate its evaluation and assessment of an alternative (see Assessment, below). Although the exact components of a GSP are not required for an alternative, for organizational purposes the discussion of information contained in the Analysis of Basin Conditions and related documents provided by SCGA generally follows the elements of a GSP provided in Article 5 of the GSP Regulations. The reference to requirements of the GSP Regulations at the beginning of each section is to provide context regarding the nature of the element discussed but is not meant to define a strict standard applicable to alternatives.

³⁸ 23 CCR § 354-354.44

³⁹ 23 CCR § 358.2(d). The requirements pertaining to Article 7 of the GSP Regulations (23 CCR § 356-356.4) relate to annual reports and periodic evaluation and are not applicable to review of the initial alternative.

A. Administrative Information

GSP Regulations require information identifying the submitting agency, describing the plan area, and demonstrating the legal authority and ability of the submitting agency to develop and implement a plan for that area.⁴⁰

Information about SCGA and its authority to manage groundwater in the South American Subbasin is provided in the Analysis of Basin Conditions and in the SCGA Joint Powers Agreement. SCGA is a Joint Powers Authority formed based on recommendations of the Central Sacramento County Groundwater Forum to manage the Central Basin and implement the 2006 Groundwater Management Plan for the Central Basin.⁴¹ SCGA is composed of the County of Sacramento and the cities of Elk Grove, Folsom, Rancho Cordova, and Sacramento.⁴² SCGA also describes the Water Forum and the Water Forum Agreement as the basis for many of the recent groundwater management activities in the Central Basin and the definition of the sustainable yield. SCGA explains its jurisdictional boundaries do not completely coincide with the South American Subbasin (see Basin Coverage, above). The area outside of the jurisdictional boundary of SCGA is located in the southwestern portion of the Subbasin in the Legal Delta. To account for this, SCGA indicates that a MOU is being created between SCGA and the local agencies to account for the area outside of the jurisdictional boundary.⁴³ However, the signed MOU was not provided as part of the submittal.

B. 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 an assessment of the water budget.⁴⁴

1. Hydrogeologic Conceptual Model

The GSP Regulations require a descriptive hydrogeologic conceptual model of the basin that includes a written description supported by cross sections and maps.⁴⁵

A hydrogeologic conceptual model of the Central Basin is provided in the Groundwater Management Plan.⁴⁶ In addition, the Analysis of Basin Conditions indicates the

⁴⁰ 23 CCR § 354.2 et seq.

⁴¹ Sacramento Central Joint Powers Authority, p. 2

⁴² Analysis of Basin Conditions, Chapter 1.1.1, p. 1-4

⁴³ Analysis of Basin Conditions, Chapter 1.5.2, p. 1-15

⁴⁴ 23 CCR § 354.12 et seq.

⁴⁵ 23 CCR § 354.14(a)

⁴⁶ Groundwater Management Plan, Chapter 2.3, p. 2-24

Sacramento Integrated Groundwater Surface Water Model (SaciGSM) is used as the hydrogeologic conceptual model for the South American Subbasin (see Water Budget, below).⁴⁷ As defined in the model, the South American Subbasin is conceptualized as having three aquifers. The upper two contain fresh water and the lowest one contains non-fresh water. At the surface, there is an aquitard, and another aquitard separates the two freshwater aquifers. The geologic description is based on work by the Department from 1974, United States Geological Survey (USGS) reports, and well logs. A generalized geologic cross section is provided to show the bedrock contact, as well as the geologic formations and their relative thicknesses.⁴⁸ SCGA also describes recharge areas in the Subbasin as primarily related to the perennial streams bounding the Subbasin, the American River, Sacramento River, and Cosumnes River.⁴⁹

2. Groundwater Conditions

The GSP Regulations require a description of historical and current groundwater conditions in the basin that includes information related to groundwater elevations, groundwater storage, seawater intrusion, groundwater quality, subsidence, and interconnected surface water, as applicable. The GSP Regulations also require an identification of groundwater dependent ecosystems.⁵⁰

Groundwater elevations are discussed in the Analysis of Basin Conditions, the Groundwater Management Plan, and the Basin Management Reports. In the Analysis of Basin Conditions, SCGA uses contour maps developed using data from CASGEM wells for fall 2005 and fall 2015 to show groundwater elevations over the 10-year period. The Analysis of Basin Conditions uses groundwater elevation data to describe trends. The trends indicate that water levels are rising in the vicinity of Elk Grove where a cone of depression has been present for several decades.⁵¹ The groundwater elevation trends also indicate falling groundwater elevations in the northeastern portion of the Subbasin and associates them with remediation pumping activities.⁵² Groundwater elevation declines are also noted near the Cosumnes River and are attributed to remediation pumping and lower surface water discharges to Deer Creek.⁵³ In the Groundwater Management Plan, historical groundwater elevation trends indicate declining groundwater levels of 20 to 30 feet across the Subbasin prior to 1980. Then, between 1980 and 1987, groundwater levels recovered approximately 10 feet. During the 1987 to

⁴⁷ Analysis of Basin Conditions, Chapter 2.4, p. 2-22

⁴⁸ Groundwater Management Plan, Figure 2-15

⁴⁹ Analysis of Basin Conditions, Chapter 2.4.1.1, p. 2-26

⁵⁰ 23 CCR § 354.16

⁵¹ Analysis of Basin Conditions, Chapter 2.6.1.6.1, p. 2-50

⁵² Analysis of Basin Conditions, Chapter 2.6.1.6.2, p. 2-50

⁵³ Analysis of Basin Conditions, Chapter 2.6.1.6.2, p. 2-50 to 2-51

1992 drought water levels declined another 15 feet.⁵⁴ The Basin Management Reports provide essentially the same description of historical groundwater elevation trends as the Groundwater Management Plan.⁵⁵ Contour maps are provided for spring and fall ten years apart (e.g. 2002 and 2012 for the 2011-2012 Basin Management Report). In addition, hydrographs of groundwater levels at 47 wells in the South American Subbasin are provided with 28 indicating declining trends between 2005 and 2015.

Changes in groundwater storage are discussed in the Analysis of Basin Conditions. SCGA provides a depiction of change in storage based on changes in water elevation contours between fall 2005 and fall 2015.⁵⁶ This is used to estimate a change in storage by assuming a specific yield value which is consistent with USGS studies. In addition, change in storage is also calculated using the groundwater model (SaciGSM) and the Department's Coarse Grid C2VSim (C2VSimCG) model. The change in storage calculations show a decrease in storage for the Subbasin of between 4,000 acre-feet per year to 19,000 acre-feet per year. SCGA explains that this decrease in storage is small, less than one percent, when compared to the overall storage of the Subbasin, but it is unclear how that percentage was established.⁵⁷

Seawater intrusion is discussed in the Analysis of Basin Conditions. SCGA indicates that the Sacramento River does experience tidal fluctuations, but the water in the Sacramento River remains fresh. Data indicate seawater intrusion has not been an issue since prior to the construction of Shasta Dam. SCGA uses this information to indicate that seawater intrusion is not a concern in the South American Subbasin.

Groundwater quality issues are discussed in the Analysis of Basin Conditions, the Groundwater Management Plan, the Basin Management Reports, and the Baseline Yield Analysis. In the Analysis of Basin Conditions and Groundwater Management Plan, SCGA provides a map of the known extent of contaminant plumes from 2006.⁵⁸ Each of the reports identify water quality issues related to iron, manganese, arsenic, nitrate, and total dissolved solids (TDS). In the Analysis of Basin Conditions, SCGA indicates that, overall, water quality is acceptable for most uses.⁵⁹ The Groundwater Management Plan identifies nitrate, volatile organic compounds (VOCs), and TDS as the primary concerns in the Central Basin. Nitrate is primarily associated with agricultural fertilizer and sewage disposal activities. TDS is associated with upwelling of poor quality water from greater than 2,000 ft. VOCs are related to landfills, wrecking yards, military installations, and

⁵⁴ Groundwater Management Plan, Chapter 2.3.4, p. 2-27

⁵⁵ Basin Management Report, 2011-2012, p. 13

⁵⁶ Analysis of Basin Conditions, Figure 2-26

⁵⁷ Analysis of Basin Conditions, Chapter 2, Section 2.6.2.1, p. 2-56

⁵⁸ Analysis of Basin Conditions, Chapter 2, Figure 2-8; Groundwater Management Plan, Figure ES-7

⁵⁹ Analysis of Basin Conditions, Chapter 2, Section 2.6.3, p. 2-56

research facilities.⁶⁰ The 2011-2012 Basin Management Report also identifies hexavalent chromium as a water quality concern and includes a map of concentrations measured at wells.⁶¹ The Baseline Yield Analysis indicates that water quality is generally better in the shallower aquifer.⁶²

Land subsidence is discussed in the Analysis of Basin Conditions, the Groundwater Management Plan, and the Baseline Yield Analysis. Monitoring activities related to land subsidence are discussed in the Basin Management Reports (see Monitoring Networks, below). The Baseline Yield Analysis used water level measurements from the Department and historical benchmark data from the National Geodetic Survey to correlate changes in water levels with subsidence. The benchmark data indicates that subsidence in Sacramento County was typically less than 0.4 feet and occurred between the 1940s and 1960s.⁶³ In the Analysis of Basin Conditions, SCGA provides a summary of the analysis done in the Baseline Yield Analysis and indicates that subsidence occurred between 1947 and 1966.⁶⁴ In addition, the South American Subbasin is described as being less susceptible to land subsidence on the eastern side than on the western side due to the geologic conditions.⁶⁵ In the Groundwater Management Plan, SCGA indicates that land subsidence between 1981 and 1991 was negligible and it could not be determined if the subsidence that occurred was elastic or inelastic.⁶⁶ The Groundwater Management Plan uses the correlation between declining groundwater levels and subsidence to establish a Basin Management Objective (see Land Subsidence, below).

Surface water-groundwater interaction is discussed in the Analysis of Basin Conditions and the Groundwater Management Plan. In the Analysis of Basin Conditions, SCGA mentions using the SacIGSM groundwater model to assess impacts to the rivers bounding the South American Subbasin, and those impacts were used to establish BMOs and trigger points in the Groundwater Management Plan (see Depletions of Interconnected Surface Water, below).⁶⁷ SCGA does not identify interconnected reaches or the quantity and timing of depletions of interconnected surface water. Instead, SCGA mentions that the middle reach of the Cosumnes River is known to be disconnected, and the extent of this reach and the duration of disconnection are not identified. SCGA also indicates that the deeper aquifer along portions of the American River is disconnected based on evidence that the Aerojet contamination plume has migrated under the river, and levees and cut-off walls along the American and Sacramento rivers limit the

⁶⁰ Groundwater Management Plan Chapter 3.1.5, p. 3-7

⁶¹ Basin Management Report, 2011-2012, p. 27

⁶² Baseline Conditions for Groundwater Yield Analysis, Section 2.5, p. 11

⁶³ Baseline Conditions for Groundwater Yield Analysis, Section 5.3, p. 63

⁶⁴ Analysis of Basin Conditions, Chapter 2, Section 2.5.4.2, p. 2-36

⁶⁵ Analysis of Basin Conditions, Chapter 2, Section 2.5.4.2, p. 2-36

⁶⁶ Groundwater Management Plan, Chapter 3, Section 3.2.2.3, p. 3-13

⁶⁷ Analysis of Basin Conditions, Chapter 2, Section 2.6.5, p. 2-62

interconnection to groundwater by reducing the floodplain.⁶⁸ However, the Water Forum's sustainable yield negotiations assumed that the rivers surrounding the South American Subbasin are connected and remain connected, with the exception of portions of the Cosumnes River, under all of the planning scenarios.⁶⁹

SCGA states in the Functional Equivalency chapter of the Analysis of Basin Conditions that groundwater dependent ecosystems (GDEs) are not fully understood in the context of groundwater management statewide and the relationship between management of groundwater and GDEs will be better understood in the coming years as scientific studies are conducted for statewide implementation.⁷⁰ No GDE maps or other equivalent method of identification are provided in the Analysis of Basin Conditions.

3. Water Budget

GSP Regulations require a water budget that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored, as applicable.⁷¹

A water budget for the South American Subbasin was provided in the Analysis of Basin Conditions. SCGA uses its numerical model (SaciGSM) and the Department's C2VSimCG model to calculate the water budget and compare water budget estimates.⁷² SaciGSM simulates conditions through 2011 and C2VSimCG simulates conditions through 2009. For purposes of comparing the two models, the Analysis of Basin Conditions provides groundwater budget estimates as an average between 2000 and 2009.⁷³ The C2VSimCG 10-year average groundwater budget accounts for total pumping, lakes and streams, boundary recharge, subsurface flows, diversion recoverable gains, and losses and gains to groundwater due to land subsidence. No annual water budget was provided in tabular form. SCGA provides a graphical water budget for 2000 through 2011 from SaciGSM. Both SaciGSM and C2VSimCG indicate an average decline in storage. SCGA indicates the decline in storage is small compared to overall Subbasin storage but makes no mention of model uncertainty or appropriateness. SCGA does not use the water budget to estimate sustainable yield. However, a sustainable yield of

⁶⁸ Analysis of Basin Conditions, Chapter 2, Section 2.6.5.1, p. 2-63

⁶⁹ Groundwater Management Plan, Appendix A, p. A-2

⁷⁰ Analysis of Basin Conditions, Chapter 4, Section 2.2.8, p. FE-21

⁷¹ 23 CCR § 354.18

⁷² Analysis of Basin Conditions, Chapter 2, Section 2.4.3

⁷³ Analysis of Basin Conditions, Chapter 2, Table 2-5, 2-6; Basin Management Report 2011-2012

273,000 acre-feet per year was negotiated for the locally-defined Central Basin through the Water Forum using modeling projections and an impacts analysis.⁷⁴

Groundwater extractions between 2005 and 2015 for the Central Basin are presented in tabular form for urban, agricultural, and rural water use sectors to show that groundwater production has not exceeded the sustainable yield during that time.⁷⁵ These extraction estimates are calculated using the Water Forum land use assumptions prior to 2010. For 2010 to 2014, extraction estimates are based on land use assumptions from satellite imagery. For 2015, groundwater extractions are estimated using an average of extraction estimates from the previous three years.⁷⁶ SCGA states that the sustainable yield of 273,000 acre-feet per year negotiated for the Central Basin does not account for remediation efforts within the South American Subbasin, which can account for up to 31,400 acre-feet per year.⁷⁷

4. Management Areas

GSP Regulations authorize, but do not require, an agency to define one or more management areas within a basin if the agency has determined that creation of management areas will facilitate implementation of the GSP.⁷⁸

SCGA states that management areas are not used in the South American Subbasin. However, SCGA indicates management areas may be established in the future if it is warranted. Specific reference is given to the portion of the South American Subbasin outside of SCGA's jurisdictional authority (see Basin Coverage).⁷⁹

C. Sustainable Management Criteria

GSP Regulations require a sustainability goal that defines conditions that constitute sustainable groundwater management for the basin, the characterization of undesirable results, and establishment of minimum thresholds and measurable objectives for each applicable sustainability indicator, as appropriate.⁸⁰

1. Sustainability Goal

GSP Regulations require that sustainable management criteria include a sustainability goal that culminates in the absence of undesirable results within the appropriate timeframe, and includes a description of the sustainability goal, describes information

⁷⁴ Analysis of Basin Conditions, Chapter 2, Page 2-10

⁷⁵ Analysis of Basin Conditions, Chapter 2, Table 2-2

⁷⁶ Analysis of Basin Conditions, Chapter 2, Table 2-2, footnote 2

⁷⁷ Analysis of Basin Conditions, Chapter 2, Section 2.3.3

⁷⁸ 23 CCR § 354.20

⁷⁹ Analysis of Basin Conditions, Chapter 4, Section 2.4

⁸⁰ 23 CCR § 354.22

used to establish the goal for the basin, describes measures that will be implemented to ensure the basin operates within its sustainable yield, and contains an explanation of how the sustainability goal will be met.⁸¹ The sustainability goal for an alternative based on an analysis of basin conditions represents the criteria that allowed the basin to be operated within its sustainable yield for a period of at least 10 years, which includes the avoidance of undesirable results.⁸²

The Water Forum's coequal objectives are to provide safe and reliable water supply and preserve the environmental and recreational values of the Lower American River.⁸³ The Groundwater Management Plan further defines the goal for the Central Basin of ensuring viable groundwater resources for beneficial uses that support the Water Forum's coequal objectives.⁸⁴

In addition, the Groundwater Management Plan defines Basin Management Objectives (BMOs) to benefit groundwater users in the Central Basin.

- **BMO No. 1:** Maintain the long-term average groundwater extraction rate at or below 273,000 AF/year.
- **BMO No. 2:** Maintain specific groundwater elevations within all areas of the Basin consistent with the Water Forum "solution."
- **BMO No. 3:** Protect against any potential inelastic land surface subsidence by limiting subsidence to no more than 0.007 feet per 1 foot of drawdown in the groundwater Basin.
- **BMO No. 4:** Protect against any adverse impacts to surface water flows in the American, Cosumnes, and Sacramento rivers.
- **BMO No. 5:** Water quality objectives.

2. Sustainability Indicators

The GSP Regulations specify that an agency define conditions that constitute sustainable groundwater management for a basin, including the characterization of undesirable results and the establishment of minimum thresholds and measurable objectives for each applicable sustainability indicator.⁸⁵

Sustainability indicators are defined as any of the effects caused by groundwater conditions occurring throughout the basin that, *when significant and unreasonable, cause*

⁸¹ 23 CCR § 354.24. For an alternative based on a demonstration of 10 years of sustainable management, the sustainability goal, or its functional equivalent, would have been developed at some previous time during basin management, and its goals met by the time the Alternative was submitted to the Department.

⁸² Water Code Section 10721(w)

⁸³ Analysis of Basin Conditions, Chapter 1, Section 1.3, pg. 1-11

⁸⁴ Groundwater Management Plan, pg. ES-8

⁸⁵ 23 CCR § 354.22

undesirable results.⁸⁶ Sustainability indicators thus correspond with the six undesirable results – chronic lowering of groundwater levels indicating a depletion of supply if continued over the planning and implementation horizon, reduction of groundwater storage, seawater intrusion, 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 adverse impacts on beneficial uses of the surface water⁸⁷ – but refer to groundwater conditions that are not, in and of themselves, significant and unreasonable. Rather, sustainability indicators refer to the effects caused by changing groundwater conditions that are monitored, and for which criteria in the form of minimum thresholds are established by the agency to define when the effect becomes significant and unreasonable, producing an undesirable result.

The sustainability indicators section thus conflates three requirements of the sustainable management criteria set out in the GSP Regulations: undesirable results, minimum thresholds, and measurable objectives. Information pertaining to the processes and criteria relied upon to define undesirable results applicable to the basin as quantified through the establishment of minimum thresholds are discussed for each sustainability indicator. However, a submitting agency is not required to establish criteria for an undesirable result when the agency can demonstrate that an undesirable result for that sustainability indicator is not present and is not likely to occur in the basin.⁸⁸

As discussed above (see Sustainability Goal), the five BMOs established for the Central Basin in the Groundwater Management Plan were developed to protect and enhance groundwater. Each of the BMOs identify numerical trigger points and corresponding recommended actions.⁸⁹ According to information in the Groundwater Management Plan, a trigger point is defined as a condition in which a BMO has been breached at a defined level. Each trigger point has a corresponding recommended action that is linked to each level. The recommended action is dependent on the measurement taken and the BMO in question. Individual trigger points are tied to monitoring actions, such as groundwater level measurements, groundwater extraction calculations, and water quality determinations.⁹⁰

⁸⁶ 23 CCR § 351(ah)

⁸⁷ Water Code § 10721(x)

⁸⁸ 23 CCR § 354.26(d)

⁸⁹ Groundwater Management Plan, Table 4-1

⁹⁰ Groundwater Management Plan, Section 4.2

a. Chronic Lowering of Groundwater Levels

GSP Regulations specify that the minimum threshold for chronic lowering of groundwater levels be based on groundwater elevations indicating a depletion of supply that may lead to undesirable results.⁹¹

Management criteria for groundwater levels are discussed in the Analysis of Basin Conditions, the Groundwater Management Plan, and the Baseline Yield Analysis. The Baseline Yield Analysis indicates that potential undesirable effects related to lowering of groundwater levels include degraded water quality and increased migration of known contaminant plumes (see Degraded Water Quality), land subsidence (see Land Subsidence), and reduced efficiency on existing supply wells or the need to deepen wells.⁹² These undesirable effects were the basis for negotiations leading to the sustainable yield established in the Water Forum Agreement.⁹³

In the Groundwater Management Plan, BMO No. 2 sets criteria for groundwater elevations in the upper unconfined aquifer consistent with the Water Forum Solution,⁹⁴ a model simulation for 2030 projected conditions from the 1993 Sacramento County General Plan with an assumed 25.6 percent level of conservation.⁹⁵ No criteria are defined for groundwater levels in the Subbasin's deeper aquifers. BMO No. 2 uses the Water Forum Solution model results to establish a range of water levels, or bandwidth,⁹⁶ for defined hexagonal polygons across the Central Basin.⁹⁷ Four trigger points are specified for BMO No. 2 related to the water levels in a particular polygon and the percent encroachment relative to the bandwidth, i.e., zero percent encroachment for water levels at the upper threshold and 100 percent for water levels at the lower threshold.⁹⁸ These trigger points reflect a 25 to 50 percent, 50 to 75 percent, 75 to 100 percent, and over 100 percent encroachment into the designated bandwidth of the polygons. Each trigger point has a recommended action defined. In the Analysis of Basin Conditions, SCGA states that, although the trigger points have been exceeded, none of the corrective actions identified in the Groundwater Management Plan have been exercised for BMO No. 2 because stakeholders have not reported any undesirable results resulting from non-regulatory pumping practices.⁹⁹ Of the 28 wells with declining groundwater level trends

⁹¹ 23 CCR § 354.28(c)(1)

⁹² Baseline Conditions for Groundwater Yield Analysis, Technical Memorandum No. 2 p. 2

⁹³ Groundwater Management Plan, Chapter 2.3.5, p. 2-29

⁹⁴ Groundwater Management Plan, Chapter 3.1.2, p. 3-2

⁹⁵ Baseline Conditions for Groundwater Yield Analysis, Appendix E, p. 1

⁹⁶ "bandwidth" is a term used by SCGA to refer to the range between high and low water levels as simulated in the Water Forum Solution model. This bandwidth is used in the Groundwater Management Plan to define trigger points and recommended actions based on encroaching into the bandwidth.

⁹⁷ Groundwater Management Plan, Figure 3-3

⁹⁸ Groundwater Management Plan, Table 4-1

⁹⁹ Analysis of Basin Conditions, Chapter 2.6.1.5, p. 2-49

(see Groundwater Conditions, above), four wells are above the bandwidth defined in BMO No. 2. Another 14 of the 28 are below the bandwidth, and 10 are within the bandwidth. An additional three wells are below the bandwidth with either stable or increasing water levels.¹⁰⁰ SCGA does not provide an explanation of how managing to these criteria avoid undesirable results for the Subbasin. In addition, SCGA does not provide information indicating what conditions would occur in the Subbasin when actual water levels reach the trigger points.

b. Reduction of Groundwater in Storage

GSP Regulations specify that the minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results.¹⁰¹

Sustainable management criteria for reductions in groundwater storage are discussed in the Analysis of Basin Conditions and the Groundwater Management Plan. In the Groundwater Management Plan, BMO No. 1 sets criteria for groundwater storage using the sustainable yield of 273,000 acre-feet per year.¹⁰² Trigger points and recommended actions are defined and associated with the number of years in a row the Central Basin has exceeded the sustainable yield.¹⁰³ In the Analysis of Basin Conditions, SCGA also indicates the sustainable yield is the threshold to prevent the South American Subbasin's loss of storage due to over-pumping by its non-regulatory water use sectors, i.e., urban, agricultural, and rural use categories.¹⁰⁴ SCGA does not describe the physical effects constituting an undesirable result for the Subbasin related to reductions in groundwater storage or in combination with other sustainability indicators. In addition, SCGA does not explain the basis for the trigger points.

c. Seawater Intrusion

GSP Regulations specify that the minimum threshold for seawater intrusion be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results.¹⁰⁵

Seawater intrusion is discussed in the Analysis of Basin Conditions. As described previously (see Groundwater Conditions), SCGA explains that seawater intrusion is unlikely to occur in the South American Subbasin. In the Analysis of Basin Conditions, SCGA references an Atlas prepared by the Department for the Sacramento-San Joaquin

¹⁰⁰ Analysis of Basin Conditions, Figure 2-25

¹⁰¹ 23 CCR § 354.28(c)(2)

¹⁰² Groundwater Management Plan, Table 4-1

¹⁰³ Groundwater Management Plan, Table 4-1

¹⁰⁴ Analysis of Basin Conditions, Section 2.6.2

¹⁰⁵ 23 CCR § 354.28(c)(3)

Delta showing that furthest inland encroachment of 1000 parts chloride per million parts water, have not advanced beyond Brannan Island, 14 miles downstream of the southwestern boundary of the South American Subbasin, between 1944 through 1990.¹⁰⁶ The Alternative additionally states that more recent work indicates that salinity intrusions are unlikely to reach the western limit of the South American Subbasin, based on unreferenced measurement data showing low electrical conductivity values (less than 200 micromhos per centimeter or 140 milligrams per Liter of TDS) during August 1992, December 1999, July 2004, and June 2005. As a result, sustainable management criteria for seawater intrusion were not provided in the Alternative submittal.

d. Degraded Water Quality

GSP Regulations specify that the minimum threshold for degraded water quality shall 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.¹⁰⁷

Sustainable management criteria for degraded water quality is discussed in the Analysis of Basin Conditions, the Groundwater Management Plan, and the Baseline Yield Analysis. In the Baseline Yield Analysis, upwelling of poor quality water and migration of contaminant plumes are included in the impact analysis used to negotiate the sustainable yield for the Central Basin.¹⁰⁸ In the Groundwater Management Plan, BMO No. 5 provides criteria for degradation of water quality. The water quality objectives include TDS, VOCs, and nitrates. Two trigger points are identified for each water quality objective, with the first trigger point for each defined using either the primary or secondary maximum contaminant levels for drinking water.¹⁰⁹ Recommended actions are also provided for each trigger point (see Projects and Management Actions).

e. Land Subsidence

GSP Regulations specify that the minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results.¹¹⁰

¹⁰⁶ Analysis of Basin Conditions, Chapter 2.6.6, Page 2-64. See also Department of Water Resources, Sacramento-San Joaquin Delta Atlas (reprinted 1995), p. 23. The Department's 1000 parts chloride per million parts water isocontour is equivalent to 1,000 mg/L, which is the upper limit of dissolved solid concentrations in "fresh" water (see DeSimone, L.A., McMahon, P.B., and Rosen, M.R., 2014, The quality of our Nation's waters—Water quality in Principal Aquifers of the United States, 1991–2010: U.S. Geological Survey Circular 1360, 151 p.).

¹⁰⁷ 23 CCR § 354.28(c)(4)

¹⁰⁸ Baseline Conditions for Groundwater Yield Analysis, Technical Memorandum No. 2, Section 4 and 6

¹⁰⁹ Groundwater Management Plan, Table 4-1

¹¹⁰ 23 CCR § 354.28(c)(5)

Sustainable management criteria for land subsidence is discussed in the Baseline Yield Analysis, Groundwater Management Plan, and the Analysis of Basin Conditions. In the Baseline Yield Analysis, land subsidence is mentioned in the impact analysis used to negotiate the sustainable yield for the Central Basin; however, land subsidence impacts are minor.¹¹¹ In the Groundwater Management Plan, BMO No. 3 provides criteria to manage the Central Basin for land subsidence. The criteria defined is to limit inelastic land subsidence to less than 0.007 feet per one foot of drawdown in the Central Basin. Three trigger points are defined, each with recommended actions if any of the trigger points are encountered (see Projects and Management Actions).¹¹² In the Analysis of Basin Conditions, SCGA indicates that land subsidence is unlikely to occur under current management and pumping practices because wells with lower water levels are located on the east side of the Subbasin in coarser grained materials (see Groundwater Conditions).¹¹³

f. Depletions of Interconnected Surface Water

GSP Regulations specify that the minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results.¹¹⁴

Two trigger points for management actions are identified in the Groundwater Management Plan as thresholds for depletions of interconnected surface waters.¹¹⁵ The two triggers points identified in BMO No. 4 are associated with the percent increase, 5 percent and 25 percent, over a modeled loss-rate of river water to groundwater.¹¹⁶ No information was provided as to whether adverse impacts to interconnected surface waters result from the base loss rate. When conducting an analysis on the impacts of operating to the negotiated sustainable yield, depletions of interconnected surface water were not included in the impacts analysis.¹¹⁷ There is also no explanation as to what happens in the Sacramento, American and Cosumnes rivers should the trigger points be exceeded.

D. Monitoring Networks

GSP Regulations require that each basin be monitored, and that a monitoring network include monitoring objectives, monitoring protocols, and data reporting requirements be

¹¹¹ Baseline Conditions for Groundwater Yield Analysis, Technical Memorandum No. 2, p. 66

¹¹² Groundwater Management Plan, Table 4-1

¹¹³ Analysis of Basin Conditions, Chapter 2, Section 2.6.4

¹¹⁴ 23 CCR § 354.28(c)(6)

¹¹⁵ See Analysis of Basin Conditions, Chapter 2.6.5

¹¹⁶ Analysis of Basin Conditions, Chapter 2.6.5, p. 2-62

¹¹⁷ See Baseline Conditions for Groundwater Yield Analysis, Technical Memorandum No. 2, p. 2

developed that shall promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions.¹¹⁸

The monitoring network for the South American Subbasin is described in the Analysis of Basin Conditions, the Groundwater Management Plan, and the Basin Management Reports. Monitoring protocols are described in the CASGEM monitoring plan. In the Groundwater Management Plan, the monitoring discussion includes groundwater elevation monitoring, water quality monitoring, land surface elevation monitoring, and surface water-groundwater interaction monitoring.¹¹⁹ Groundwater elevation monitoring takes place at about 150 locations across Sacramento County, but the number within the Central Basin is not provided. Water quality monitoring is performed to meet Title 22 water quality reporting requirements at drinking water production wells. The number of wells where water quality is monitored is not provided. Land subsidence is monitored irregularly using historical benchmarks and there does not appear to be any recent data. No dedicated subsidence monitoring is discussed in the Groundwater Management Plan. Surface water-groundwater interaction monitoring indicates that Sacramento State University installed several monitoring wells adjacent to the American River. No other monitoring for surface water-groundwater interaction is provided. In the Analysis of Basin Conditions, SCGA indicates groundwater levels are monitored for the South American Subbasin at 30 CASGEM wells and over 100 voluntary wells.¹²⁰ The CASGEM wells were used to develop the groundwater level contour maps mentioned above (see Groundwater Conditions). Additional groundwater elevation monitoring protocols and reporting information is presented in SCGA's Groundwater Elevation Monitoring Plan (February 2012), which was prepared for the Department's CASGEM Program. No information was provided to indicate where trigger points were monitored for land subsidence or surface water-groundwater interaction. In the Basin Management Reports, there is no indication that monitoring is occurring for surface water-groundwater interactions in the Subbasin. SCGA states that, because it believes undesirable results are not occurring in the Subbasin, a discussion of the monitoring network for the six sustainability indicators is not required.¹²¹

E. Projects and Management Actions

GSP Regulations require a description of the projects and management actions the submitting agency has determined will achieve the sustainability goal for the basin,

¹¹⁸ 23 CCR § 354.32

¹¹⁹ Groundwater Management Plan, Chapter 3.2.2,

¹²⁰ Analysis of Basin Conditions, Chapter 2.6.1, p. 2-38

¹²¹ Functional Equivalency Resources, Section 4.1

including projects and management actions to respond to changing conditions in the basin.¹²²

Projects and Management Actions are described in the Groundwater Management Plan and the Basin Management Reports. In the Groundwater Management Plan, multiple recommended actions are provided for each of the BMOs. When monitoring for a BMO shows that a trigger point has been exceeded, a recommended action identifies steps for management. For example, the first trigger point for BMO No. 1 has recommended actions that include evaluation and confirmation of data and looking for opportunities to reduce pumping through conservation or education. However, as mentioned previously (see Chronic Lowering of Groundwater Levels), no trigger points have been exercised since the Groundwater Management Plan was implemented. An implementation schedule is also included in the Groundwater Management Plan. The implementation schedule calls for annual reporting and for the Groundwater Management Plan to be re-evaluated every five years. The implementation schedule also sets a timeline for surface water-groundwater interaction studies, collection of subsidence data from benchmarks, and updates to the groundwater model. Evidence that these activities have been completed were not provided.

In the Basin Management Reports, groundwater level data, contour maps, and water quality data are provided. In addition, a section on current management activities in the Central Basin is included, as well as recommendations for the next reporting period. The 2012 Basin Management Report (the most recent Basin Management Report available at the time the Alternative was submitted) indicates the need to update the 2006 Groundwater Management Plan and the surface water-groundwater model. In the Analysis of Basin Conditions, SCGA indicates it intended to update the Groundwater Management Plan and the groundwater model in 2014, and the process would result in real-world thresholds for groundwater elevations to fluctuate within or above through time.¹²³ However, SGMA was enacted and these efforts were delayed.

IV. Assessment

The following describes the evaluation and assessment of the Alternative for the South American Subbasin as determined by Department staff. In undertaking this assessment, Department staff did not conduct geologic or engineering studies, although Department staff may have relied on publicly available geologic or engineering or other technical information to verify claims or assumptions presented in the Alternative.¹²⁴ As discussed

¹²² 23 CCR § 354.44

¹²³ Analysis of Basin Conditions, Chapter 2.6.1.4, p. 2-49

¹²⁴ Instances where the Department review relied upon publicly available data that was not part of the Alternative are specifically noted in the assessment.

above, Department staff have determined that the South American Subbasin Alternative was submitted within the statutory period, the Subbasin was found to be in compliance with the reporting requirements of CASGEM, and staff find the Alternative to be complete.¹²⁵ Based on its evaluation and assessment of the South American Subbasin Alternative, as discussed below, Department staff find that SCGA was not able to demonstrate that the Subbasin has operated within its sustainable yield over a period of at least 10 years as required for an alternative. Staff thus recommend that the South American Subbasin Alternative not be approved.

A. Evaluation of Alternative Contents

As discussed below, Department staff are not able to determine from the information presented whether the 273,000 acre-feet per year sustainable yield, as negotiated through the Water Forum for the Central Basin, is equivalent to the sustainable yield defined in SGMA and is sufficient to avoid all undesirable results as defined in SGMA. Even if the 273,000 acre-feet per year value could be shown to correspond to the sustainable yield for the South American Subbasin within the SGMA meaning of that term, it is not clear that the methods SCGA used to document historical pumping were sufficiently reliable to establish that the Subbasin has operated within its acceptable range.

Regarding whether the sustainable yield determined in the Water Forum Agreement is equivalent to the sustainable yield defined in SGMA, Department staff found insufficient supporting evidence to show that the Water Forum Agreement's sustainable yield is sufficient to avoid undesirable results for depletions of interconnected surface water. An assumption underlying the modeling analysis used to negotiate the sustainable yield for the Central Basin is that rivers will maintain a sufficient hydraulic connection to groundwater such that the Central Basin can be recharged by the rivers to make up for additional extractions under projected development.¹²⁶ However, undesirable effects to the American, Sacramento, and Cosumnes rivers resulting from that additional induced recharge were not considered in the impacts analysis used to negotiate the sustainable yield. Additionally, the discussion of depletions of interconnected surface water in the Analysis of Basin Conditions appears to call this assumption into question because of the assertion that deeper groundwater is not readily connected to surface water along portions of the American River as well as the discussion of levee cut-off walls.¹²⁷ No supporting evidence is provided to justify if, or where, levee cut-off walls limit interconnections between surface water and groundwater. This lack of justification is important because cut-off walls are typically designed to elongate the flow path between

¹²⁵ 23 CCR § 358.4(a)

¹²⁶ Groundwater Management Plan, Appendix A, p. A-3; Analysis of Basin Conditions, Chapter 2.5.1.1 p. 2-33

¹²⁷ Analysis of Basin Conditions, Chapter 2.6.5.1, p. 2-63

surface water and shallow groundwater during high-water events and not prevent it from occurring. Regardless, Department staff did not find any attempt to provide information related to the quantity and timing of depletions of surface water at any location within the South American Subbasin, or to explain how the Water Forum sustainable yield would avoid depletions of surface waters that would cause significant and unreasonable adverse impacts to the beneficial uses of the surface water.

Department staff have also identified two issues regarding SCGA's claim that pumping in the South American Subbasin has not exceeded 273,000 acre-feet per year between 2005 and 2015. The first issue relates to SCGA's estimation of agricultural pumping estimates between 2005 and 2011. Without metered pumping, it is often standard practice to use water demands to calculate an estimate of groundwater pumping. This requires understanding of numerous factors including, but not limited to, land use, unit water demand for that land use, annual hydrology, and other water supplies (e.g., surface water deliveries) if applicable. The agricultural pumping estimates between 2005 and 2010 provided by SCGA do not follow this practice. Instead, the agricultural pumping estimates are based on two model simulations that are both based on forecasts of land use developed in the 1990s. The first model simulation assumes fixed water demands projected at year 2000 levels, and the second assumes fixed demands projected at 2030 levels. The two models were utilized to obtain projected pumping for the 2000 and 2030 conditions, and pumping for individual years between 2005 and 2010 were linearly interpolated between those points. The pumping estimates using this methodology are, therefore, not based on actual conditions but instead rely on the assumptions built into the forecasts. The degree to which the estimated forecasted pumping quantities match actual pumping is dependent on how closely the forecasts match reality. Yet, the Alternative does not contain an analysis of whether the 2000 forecasted conditions, comprising one end-member of the linear interpolation, matched actual conditions and, of course, there is no way to know whether the 2030 forecasted condition will match with reality. Ultimately, neither the 2005 through 2010 pumping quantities nor the 2015 pumping quantity, noted above to be the average of the prior three years (see Water Budget), are informed by actual conditions for the given year. Department staff believe this to be a significant issue for an alternative demonstrating operation within a sustainable yield.

The second issue identified by Department staff regarding SCGA's claim that pumping in the South American Subbasin has not exceeded the 273,000 acre-feet per year sustainable yield between 2005 and 2015 is that pumping volumes cited do not appear to account for regulatory pumping associated with various groundwater remediation activities in the Subbasin. The Analysis of Basin Conditions explains that regulatory pumping was not included as part of the Water Forum efforts because, at the time of the Water Forum studies, the treated effluent was returned to the Subbasin either through

injection or discharge to tailings piles to allow infiltration.¹²⁸ However, the Analysis of Basin Conditions indicates those operations have since changed and much of the treated water is now discharged to the American River or Morrison Creek. The Agency indicates that regulatory pumping for remediation is outside of its control and, while that may be true, Department staff do not agree that it can be neglected when determining if the Subbasin is being operated within its sustainable yield.

Department staff also reviewed whether SCGA uses defined management standards or operational criteria for groundwater conditions consistent with undesirable results defined in SGMA. Since operating within a sustainable yield requires the avoidance of undesirable results, an agency submitting an alternative needs to understand undesirable results for its basin and demonstrate management to avoid those conditions. SCGA uses the BMOs from the Central Basin's Groundwater Management Plan, with the associated trigger points and recommended actions, to explain how the South American Subbasin is sustainably managed. However, Department staff have identified several issues related to the BMOs, including their applicability to avoiding undesirable results for the South American Subbasin, and the lack of supporting evidence to show the Subbasin is being managed using the Groundwater Management Plan's BMO trigger points.

Department staff found inconsistencies with how groundwater levels are used to define the Water Forum sustainable yield and trigger points associated with BMO No. 2, and no discussion of when exceedances of those trigger points would indicate that undesirable results were present in the Subbasin. BMO 2 is to maintain specific groundwater elevations for all areas of the Central Basin within a defined bandwidth. The bandwidth is defined based on minimum and maximum groundwater levels from a model simulation corresponding to the Water Forum solution. As described previously (see Chronic Lowering of Groundwater Levels), the Water Forum solution is a model simulation developed using a projection of 2030 conditions using land use data from the late 1980s and early 1990s with an estimated 25.6 percent water conservation. Separate from the Water Forum solution, the Water Forum sustainable yield is also negotiated based on model simulations of projected conditions. However, the Water Forum sustainable yield uses an average of the 2000 projected model simulation and 2010 projected model simulation, not the 2030 projected model simulation with conservation used for the Water Forum solution. Department staff believe additional discussion would be necessary to describe how maintaining groundwater elevations defined using one set of assumptions (i.e., the Water Forum solution simulation) are consistent with avoiding adverse conditions that may have been considered when establishing the Water Forum sustainable yield, which used its own set of modeling assumptions.

¹²⁸ Analysis of Basin Conditions, Chapter 2.3.3, p. 2-19

More important than the apparent inconsistency between the Water Forum sustainable yield and the triggers for BMO 2 is the fact that the Alternative does not demonstrate that SCGA actively managed the Central Basin in response to exceedances of those defined triggers. As indicated previously, SCGA states in the Analysis of Basin Conditions that no recommended actions associated with the trigger points have been exercised because stakeholders have not reported undesirable results related to non-regulatory pumping. This, in combination with the groundwater level hydrographs provided in Appendix 2C of the Analysis of Basin Conditions, indicates that SCGA is aware that trigger points have been exceeded, but has chosen not to take action as defined by the BMOs. In the Basin Management Reports, SCGA shows that it monitors for groundwater levels. Hydrographs are included at 21 wells, 19 wells, and 19 wells in the 2007-2008, 2009-2010, and 2011-2012 Basin Management Reports, respectively. However, the Basin Management Reports do not compare these levels against the trigger points for water levels under BMO No. 2. It was not until the Analysis of Basin Conditions was developed that the analysis appears to have been completed, showing numerous wells that are exceeding trigger points for water levels (see Monitoring Networks, above). The Analysis of Basin Conditions describes the reasons why SCGA believes the triggers have been exceeded (e.g., regulatory pumping, lower surface water discharges to Deer Creek), however, SCGA has not initiated any of the recommended actions described in the Groundwater Management Plan. Recommended actions associated with the trigger points include a process to adapt the bandwidth but that process was, apparently, not followed. Instead SCGA took no action, stating essentially that no stakeholders had complained about the lowered groundwater levels. Department staff believe that the lack of response to exceeding trigger points and thresholds, even if that response had been to adapt the thresholds based on an increased understanding of what, in fact, constituted an adverse condition or undesirable result, is not consistent with the standards of groundwater management described in SGMA.

With regard to BMO No. 4, which is to protect against adverse impacts to surface water flows in the American, Cosumnes, and Sacramento rivers, the Alternative contained no analysis or explanation to relate the two identified trigger points (a 5 and 25 percent increase in streamflow loss rates relative to current conditions) to adverse impacts to surface water flows in the American, Sacramento, and Cosumnes rivers. Department staff are not able to assume that the trigger points are reasonable without supporting evidence or a description of how management to these trigger points will avoid significant and unreasonable depletions of interconnected surface water. In addition, loss-rates from the rivers were not included in the impacts analysis used to negotiate the Water Forum sustainable yield. Department staff also found no evidence of monitoring or management with regard to BMO No. 4 subsequent to adoption of the Groundwater Management Plan. The biennial Basin Management Reports do not compare updated streamflow loss rates to determine whether increases occurred relative to conditions at the time of adoption,

and whether any trigger points had been activated. Instead, all that is provided in the biennial Basin Management Reports is a list of coordination activities and action items that do not appear to change between each report.

The BMO for land subsidence is provided as a rate of subsidence per unit drawdown. However, nowhere in the Basin Management Reports is there information to suggest that SCGA evaluates the rate of subsidence per unit drawdown on an ongoing basis. The first trigger point is reached if any subsidence is detected in the Subbasin and the recommended action is to initiate further study. There is one location provided in Appendix 2D of the Analysis of Basin Conditions with monitoring data for a location near Snodgrass Slough that appears to show some land subsidence. However, this plot has no description or explanation and the Basin Management Reports indicate for 2009 through 2012 that no land subsidence studies were performed in the Subbasin.

For BMO No. 5, water quality objectives related to nitrate, VOCs, and TDS are provided. However, the sustainable yield was developed using impacts related to arsenic, iron, and manganese.¹²⁹ In addition, the metric used in the Water Forum negotiation was the area within the Central Basin impacted by upwelling of poor quality water due to pumping. As a result, Department staff were unable to find a relationship between the impacts included in the Water Forum sustainable yield negotiations with the trigger points established for BMOs in the Groundwater Management Plan. As a result, it is unclear how management using BMO No. 5 would avoid undesirable results for the Subbasin as they were defined in the Water Forum sustainable yield.

In summary, based on the information provided in the South American Subbasin Alternative, Department staff are unable to determine if historical operation to the negotiated sustainable yield for the Central Basin has not caused undesirable results in the South American Subbasin related to all applicable sustainability indicators. Without a sustainable yield that is demonstrated to avoid all undesirable results, Department staff are unable to assess, based solely on whether groundwater extractions were less than 273,000 acre-feet per year, if the South American Subbasin has been operated within its sustainable yield (as defined by SGMA) for at least 10 years. Even if that quantity was shown to consider all undesirable results identified in SGMA, it is not clear whether methods used to calculate historical groundwater pumping during the last 10 years, which for some periods rely on earlier forecasts of land use conditions or averages of prior years and do not appear to include pumping associated with groundwater remediation, are sufficient to conclude that pumping remained below 273,000 acre-feet per year in the Subbasin. In addition, the apparent lack of management to defined standards (i.e., the trigger points and thresholds identified in the Groundwater Management Plan) over the last 10 years do not support SCGA's conclusion of sustainable groundwater

¹²⁹ Baseline Conditions for Groundwater Yield Analysis, Section 3.3, p. 21

management. Department staff are unable to determine if the South American Subbasin operated within an equivalent to the sustainable yield defined in SGMA and, therefore, are unable to determine that the Alternative satisfies the objectives of SGMA. As a result, staff recommend that the Alternative not be approved.