Mound Basin
Groundwater Sustainability Plan

MoundBasin
GROUNDWATER SUSTAINABILITY AGENCY

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Mound Basin Groundwater Sustainability Plan

Prepared for

MoundBasin
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Executive Summary [§354.4(a)]

§354.4 General Information. *Each Plan shall include the following general information:*

(a) *An executive summary written in plain language that provides an overview of the Plan and description of groundwater conditions in the basin.*

Introduction

The State of California enacted the Sustainable Groundwater Management Act (SGMA), effective January 1, 2015, to mandate comprehensive sustainable groundwater resources management. SGMA provides a statewide framework for groundwater management by locally formed Groundwater Sustainability Agencies (GSAs). The Mound Basin Groundwater Sustainability Agency (MBGSA) was formed in 2017 to satisfy the requirement for a GSA to fully cover the Mound Basin (DWR Basin 4-004.03) (Basin).

MBGSA was formed pursuant to a joint exercise of powers agreement (JPA) between three local public agencies overlying the Basin: the City of San Buenaventura (more commonly known as the City of Ventura), the County of Ventura, and the United Water Conservation District (United) (Figure 2.1-01). The City of San Buenaventura is a local municipality that exercises water supply, water management, and land use authority within the city's boundaries. The County of Ventura exercises water management and land use authority on a portion of the land overlying the Mound Basin. See Figure 2.1-03 for land use information. United was formed in 1950 under the State of California's Water Conservation District Law of 1931 and is organized as a governmental special district. United does not produce water from the Basin but is authorized to engage in groundwater replenishment of the Basin.

MBGSA is governed by a five-member board comprising one director appointed by each member public agency (City of San Buenaventura, the County of Ventura, and United) and two stakeholder directors representing agricultural and environmental interests. Except for the two industrial well owners, all groundwater users in the Basin have direct representation in the SGMA process by virtue of a director on the MBGSA Board of Directors. MBGSA was designated as the exclusive GSA for the Basin by the State on September 30, 2017. Following submittal of an initial notification on September 17, 2018, MBGSA developed this Groundwater Sustainability Plan (GSP) to comply with SGMA's statutory and regulatory requirements and initiated planning by engaging with stakeholders and holding public meetings pursuant to an adopted Stakeholder Engagement Plan.

The goal of this GSP is to sustainably manage the groundwater resources of the Mound Basin for the benefit of current and anticipated future beneficial users of groundwater and the welfare of the general public who rely directly or indirectly on groundwater. This GSP describes the approach to achieve and maintain a sustainable groundwater resource free of undesirable results pursuant to the SGMA, while establishing long-term reliability no later than 20 years from GSP adoption through implementation.

The content of this GSP includes administrative information, description of the Basin setting, development of quantitative sustainable management criteria (SMC) that consider the interests of all beneficial uses and users of groundwater, identification of projects and management actions and monitoring networks that will ensure the Basin is demonstrably managed in a sustainable manner no later than the 20-year sustainability timeframe (2042) and for the duration of the entire 50-year planning and implementation horizon (2072).

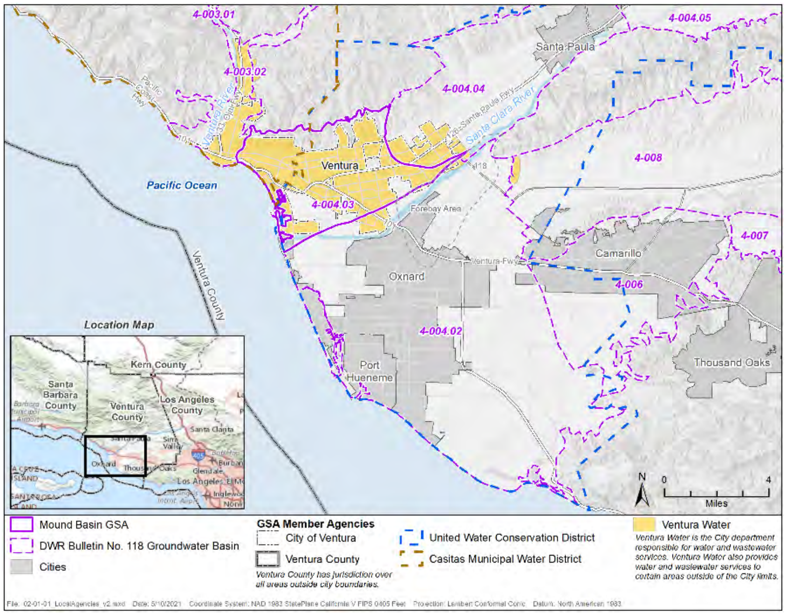
This GSP is generally organized following California Department of Water Resources (DWR) guidance documents (DWR, 2016a):

- Section 1 - Introduction to Plan Contents
- Section 2 - Administrative Information
- Section 3 - Basin Setting
- Section 4 - Sustainable Management Criteria
- Section 5 - Monitoring Networks
- Section 6 - Projects and Management Actions
- Section 7 - GSP Implementation
- Section 8 - References and Technical Studies

ES-1. Plan Area, Land Use, and Water Sources.

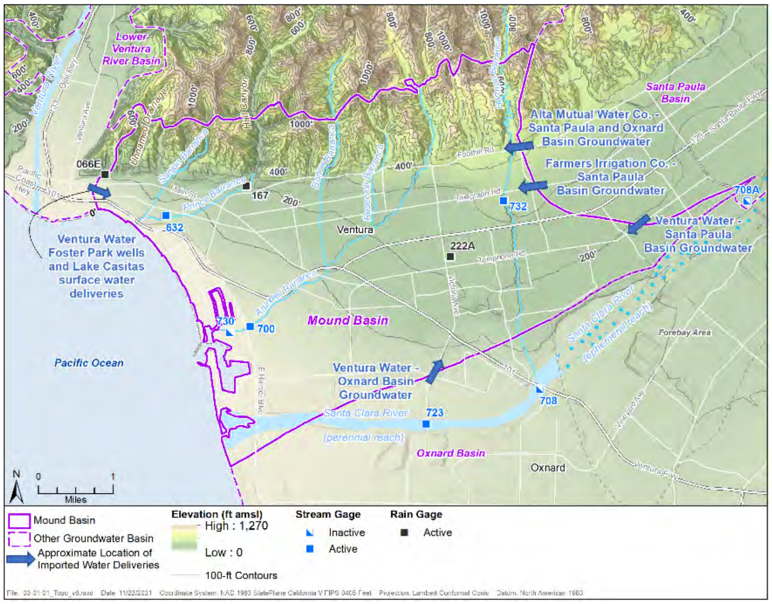
The Mound Basin is in western Ventura County along the Pacific coastline, including the City of Ventura (officially San Buenaventura). The Basin is within the Santa Clara River Valley watershed and includes the Santa Clara River estuary and floodplain at the southwestern corner, where the river discharges into the Pacific Ocean.

The geographic area covered by this GSP and managed by MBGSA includes the entire Mound Basin (DWR Basin No. 4-004.03), as defined by DWR Bulletin No. 118, "California's Groundwater," Update 2020 (DWR, 2021a). Adjacent basins are Oxnard Subbasin (No. 4-004.02) to the south, Santa Paula Subbasin (No. 4-004.04) to the east, and Lower Ventura River Subbasin (4-003.02) to the west.



Land use in the Basin is dominated by developed areas of the City of Ventura, including low-density residential, commercial, public/ institutional, and industrial land use designations. Agricultural land use occupies three separate areas of farmland in the eastern and southwestern portions of the Basin, and open space covers the remaining upland areas in the northern portion of the Basin. The principal land use planning agencies in the Basin include the City of Ventura (within the City limits) and County of Ventura (unincorporated areas outside of the City limits).

The beneficial uses of groundwater extracted from the principal aquifers of Mound Basin include municipal, industrial, and agricultural water supply corresponding to the land use categories above. There are no active or recently active domestic wells in the Basin. Beneficial uses for the shallow, non-principal groundwater include the groundwater-dependent ecosystem (GDE) associated with groundwater in the Shallow Alluvial Deposits and instream flow uses in interconnected reaches of the Santa Clara River and estuary (interconnected with groundwater in the Shallow Alluvial Deposits). However, these beneficial uses are not impacted by groundwater extraction because there is no groundwater extraction from the Shallow Alluvial Deposits and groundwater extraction from principal aquifers (Mugu and Hueneme aquifers) does not materially influence shallow groundwater levels or surface water flows (see Appendix G for explanation).



The beneficial users for the principal aquifers of Mound Basin include the City of Ventura, industrial users (two as of 2021), and agricultural users (22 active wells as of 2021). There are currently no active domestic well users within the Basin or private water companies; drinking water supply within the Basin is provided exclusively by the City of Ventura.

Other sources of water supply for the Basin include groundwater extracted from City of Ventura wells located in the adjacent Santa Paula and Oxnard Basins and from the Upper Ventura River Basin (not an immediately adjacent basin), and surface water imported from the Ventura River Watershed, which is purchased from Casitas Municipal Water District (MWD). Although Mound Basin groundwater is an important source of water supply for the communities located within the Basin, the communities are not considered to be exclusively dependent on Mound Basin groundwater because it is only one component of the City's water supply portfolio. In contrast, agricultural beneficial users are heavily dependent on groundwater extracted from the Mound Basin as they currently do not have an alternative water supply.

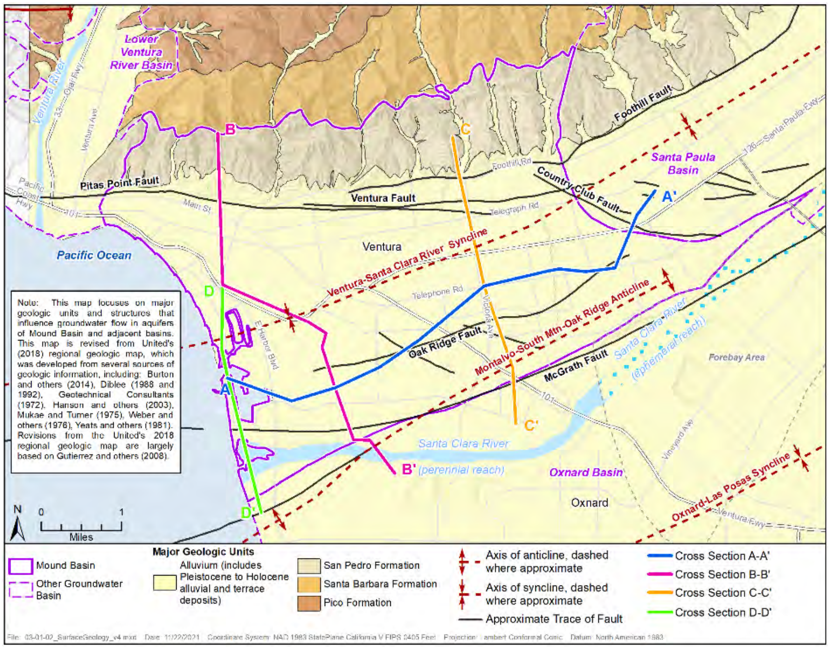
ES-2. Basin Setting and Groundwater Conditions

The topography of Mound Basin consists largely of gently south-sloping coastal plain, coastal and alluvial terraces, and alluvial fans. Hills rising to approximately 1,000 feet above mean sea level (ft msl) are present along the northern margin of the Basin in which one of the principal aquifers of the Basin outcrops and is recharged. Several small perennial stream channels originate in the canyons above the Basin and trend south and southwest within the Basin, either discharging into the Santa Clara River to the south or the Pacific Ocean to the west.

The Mound Basin is within the tectonically active Transverse Ranges geomorphic province of California, characterized by mountain ranges and valleys with an east-west orientation. Structurally, Mound Basin occurs within an elongate, complex syncline referred to as the Ventura structural basin, which trends east to west (Yeats et al., 1981). Near the coast, sediments were deposited on a wide delta complex that formed at the terminus of the Santa Clara River, with a total stratigraphic thickness reportedly exceeding 55,000 ft (Sylvester and Brown, 1988).

The geologic units (strata) in the Basin which contain groundwater include (from youngest/shallowest to oldest/deepest):

- Recent (active) stream-channel deposits along the present course of the Santa Clara River and its tributaries;
- Holocene-age alluvial fan deposits, which cover most of the Mound Basin surface;
- Stream terrace deposits adjacent to the Santa Clara River;
- Undifferentiated older alluvium of Pleistocene age; and
- Semi-consolidated sand, gravel, and clay deposits of the San Pedro Formation of late Pleistocene age.



Note: This map focuses on major geologic units and structures that influence groundwater flow in aquifers of Mound Basin and adjacent basins. This map is revised from United's (2018) regional geologic map, which was developed from several sources of geologic information, including: Burton and others (2014), Diblee (1988 and 1992), Geotechnical Consultants (1972), Hanson and others (2003), Mukae and Turner (1975), Weber and others (1976), Yeats and others (1981). Revisions from the United's 2018 regional geologic map are largely based on Gutierrez and others (2008).

File: 03-01-02_SurfaceGeology_v4.mxd Date: 11/22/2021 Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet Projection: Lambert Conformal Conic Datum: North American 1983

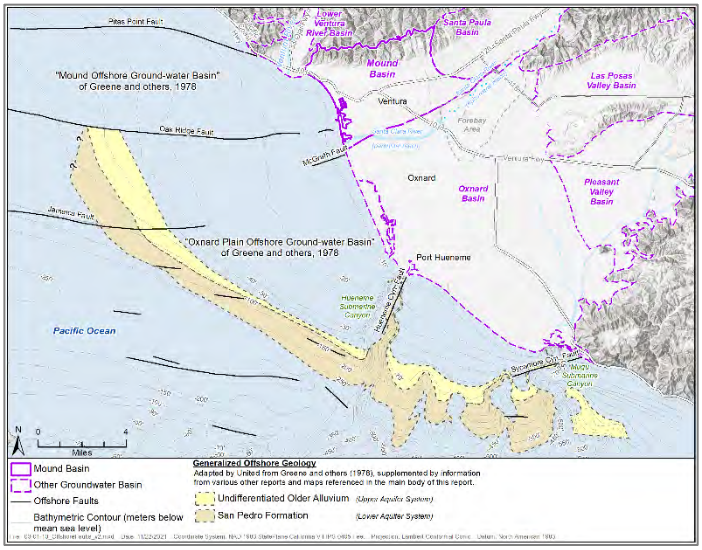
Structurally, the Mound Basin is generally bounded on the east by the Country Club Fault system, which offsets the aquifers and impedes groundwater flow from the Santa Paula Basin into the Mound Basin. To the northwest, the Basin boundary is the hydraulic divide between Mound Basin and Lower Ventura River Subbasin.

The western boundary is the Pacific Ocean shoreline; however, the primary aquifers crop out on the continental shelf approximately 10 miles offshore. The northern boundary is defined by the contact of the San Pedro Formation (the deepest freshwater-bearing formation in the Basin) with the underlying Santa Barbara Formation. The southern boundary is approximately aligned with the axis of the Montalvo-South Mountain-Oak Ridge Anticline and the McGrath Fault. The bottom of the Basin is defined by the base of fresh water, corresponding with the base of the San Pedro Formation.

The aquifers in Mound Basin consist of layers and lenses of relatively coarse-grained, permeable sediments (primarily sand and gravel) deposited within unconsolidated alluvium and the underlying, semi-consolidated San Pedro Formation (Figure 3.1-04). Aquitards present between the aquifers in Mound Basin consist of layers of poorly permeable fine-grained sediments (primarily silt and clay, Figure 3.1-04). Distinct hydrostratigraphic units (HSUs) were identified using geophysical methods by United (2018), and consist of the Shallow Alluvial Deposits, fine-grained Pleistocene deposits, Mugu, Hueneme, and Fox Canyon aquifers (and the aquitards between these aquifers). The Mugu and Hueneme aquifers are considered principal aquifers and are managed by this GSP. The Shallow Alluvial Deposits and fine-grained Pleistocene deposits do not meet the SGMA definition of a principal aquifer to "store, transmit, and yield significant or economic quantities of groundwater…", and the Fox Canyon Aquifer does not have material groundwater extractions; therefore, they are not considered principal aquifers in the GSP and will not be managed at this time.

Importantly, the principal aquifers extend approximately 10 miles offshore to the edge of the continental shelf, where they crop out and are exposed to seawater. The principal aquifers are believed to be protected from seawater between the shoreline and the continental shelf outcrops by the fine-grained stratigraphic units that overlie them. Modeling performed for this GSP indicates that seawater will not migrate from the aquifer outcrops to the shoreline within the 50-year SGMA period. However, there is a risk that seawater could enter the aquifers though nearshore short circuit pathways along faults or stratigraphic windows in the fine-grained stratigraphic units. This risk is considered in the GSP.

Groundwater flow directions within Mound Basin are generally from the east to west and are generally parallel with the Santa Clara River within the eastern portion of the Basin, and toward the Oxnard Basin in the southwestern portion of the Basin. A small groundwater flow component from the uplands to the north flows to the south and is driven by recharge in the hills.



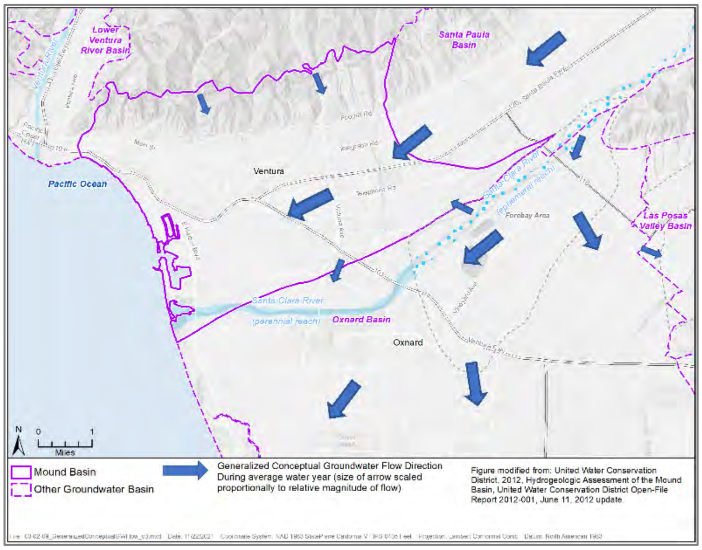
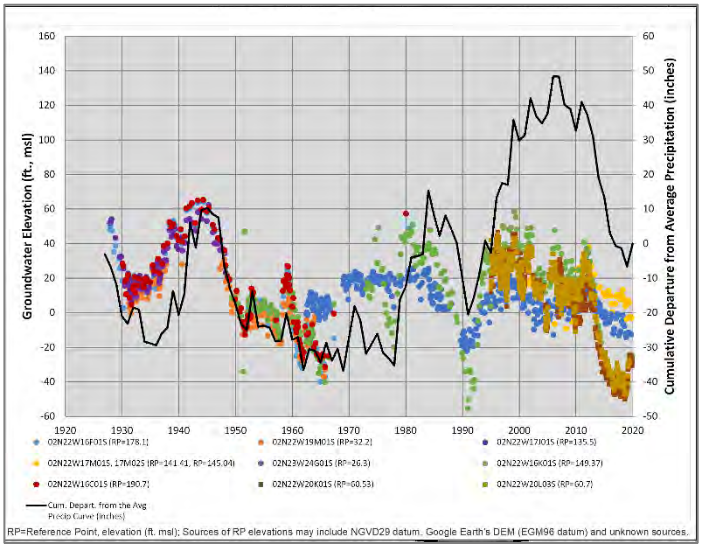


Figure modified from: United Water Conservation District, 2012, Hydrogeologic Assessment of the Mound Basin, United Water Conservation District Open-File Report 2012-001, June 11, 2012 update.



RP=Reference Point, elevation (ft. msl); Sources of RP elevations may include NGVD29 datum, Google Earth's DEM (EGM96 datum) and unknown sources.

Measured groundwater levels in the Mound Basin have historically risen and fallen consistent with the rainfall patterns and have not exhibited evidence of chronic lowering. Groundwater storage has fluctuated similarly, with no long-term reduction and no reports of land subsidence effects or seawater intrusion historically.

The natural groundwater quality in the principal aquifers is not ideal but is beneficially used by municipal and agricultural users across the Basin. Regional Water Quality Control Board (RWQCB) Water Quality Objectives (WQOs) exist for sulfate, boron, chloride, and total dissolved solids (TDS) and are generally met, although some exceptions exist. The natural groundwater quality is generally better in the Mugu Aquifer as compared to the Hueneme Aquifer, which has more frequent exceedances of RWQCB WQOs. These constituents appear to be relatively stable at most Mound Basin wells having long-term groundwater quality records. The dissolved constituents are derived from natural sources, and groundwater extraction does not appear to be correlated with common ion chemistry concentrations; however, there is a risk that lower groundwater levels could locally induce migration of poor-quality groundwater from shallow water-bearing units into the Mugu Aquifer. Nitrate concentrations in groundwater are generally low. It is noted that several wells exhibit anomalously high nitrate concentrations that are believed to be the result of well construction or well deterioration issues that have created conduits for poor-quality water to enter the well from shallow water-bearing units. Lastly, migration of contaminant plumes is not an issue because there are none identified in the Basin at present.

Surface bodies in the Mound Basin include the Santa Clara River and its estuary and several smaller, ephemeral streams (barrancas). The Santa Clara River has perennial baseflow within its reach that spans the Mound Basin. The perennial baseflow is fed by shallow groundwater and tile drain discharges from the Mound and Oxnard basins. The barrancas are ephemeral and flow in response to storm events and, hence, may only be transiently interconnected with shallow groundwater. Despite the interconnection with shallow groundwater occurring within the Shallow Alluvial Deposits, there is no depletion of interconnected surface water in the Basin because there are no groundwater extractions from the Shallow Alluvial Deposits, and groundwater in the principal aquifers is physically separated from the surface water bodies by several hundred feet of fine-grained materials. In addition, numerical modeling simulations that varied extraction rates in the principal aquifers did not show any significant impact to shallow groundwater levels or Santa Clara River flows (Appendix G). No GDEs have been identified in the Basin that rely on groundwater from a principal aquifer.

ES-3. Water Budget

The groundwater flow model was used to quantify and evaluate the water budgets for the historical, current, and projected conditions, including the evaluation of uncertainty due to climate change (United, 2021a).

Surface water enters and leaves Mound Basin via the Santa Clara River and several smaller barrancas where they cross the Basin’s boundaries primarily as storm flows. Surface water is also imported into the Basin via pipeline from Casitas MWD (Ventura Water, 2020b).

The primary sources of recharge to the Mound Basin groundwater system are underflow from the Santa Paula Basin, areal recharge (the sum of infiltration of precipitation, Municipal and Industrial (M&I) return flows, and agricultural irrigation return flows), and mountain-front recharge. Stream channel recharge is a minor component. Depending on groundwater level conditions, groundwater can flow into the Mound

Basin from the Oxnard Basin; however, there has historically been a net outflow from the Mound Basin to the Oxnard Basin. The primary groundwater outflow is groundwater extraction for beneficial use, although underflow to the Oxnard Basin can be a significant outflow at times. Discharge from the Shallow Alluvial Deposits (not a principal aquifer) along the lower, gaining reach of the Santa Clara River; via tile drains installed under farmland adjacent to the river; and via evapotranspiration are minor components. The change in storage for the Basin is a function of imbalances between inflows and outflows. In years when inflow (recharge) exceeds outflow (discharge) the volume of groundwater in storage increases, and vice versa. The average reduction in groundwater storage during the historical period (water years 1985-2015), current period (water years 2016-2019), and the baseline future projection for the implementation period (2022-2041), are 469 acre-feet per year (AF/yr), 147 AF/yr, and 13 AF/yr, respectively. A summary of average water budget components for each period is shown on Table ES-1. Climate change and potential land use and population changes were evaluated and are not expected to materially impact the future water budget.

Modeling results for the future projection periods indicate that the projected inflow and outflows will be approximately balanced during the 20-year GSP implementation period and that the minimum thresholds for the sustainability indicators will not be exceeded. Therefore, an estimate of the sustainable yield is approximately equal to the projected extraction rates (approximately averaging 7,900 to 8,200 AF/yr), depending on climate change assumptions. It is recognized that increasing extraction rates above these amounts could increase underflow from adjacent basins, thereby increasing the sustainable yield of the Mound Basin. However, this could impact sustainable management of the adjacent Santa Paula and/or Oxnard basins and is, therefore, not included in the sustainable yield estimate at this time.

Table ES-1. Summary of Average Water Budget Components (acre-feet/year).

	Mugu	**Hueneme**	**Entire Basin**
Historical (1986-2015)			
Total in	3,287	7,612	20,291
Total out	-3,462	-7,758	-20,768
Change in Storage[1]	175	138	469
Current (2016-2019)			
Total in	4,050	7,029	19,303
Total out	-4,057	-7,252	-19,450
Change in Storage[1]	7	224	147
Projected (Implementation Period 2022-2041)			
Total in	4,579	5,847	19,342
Total out	-4,592	-5,727	-19,355
Change in Storage[1]	13	-120	13

1 – Storage term is average volume of groundwater released from storage per water-year (Oct. 1 – Sept.30). Positive values represent inflows to the basin/aquifer. Change in storage term may not match difference between total in and total out due to rounding.

ES-4. Sustainable Management Criteria

The SMC were developed using the best available science and information for the Basin. MBGSA characterized undesirable results and established minimum thresholds, measurable objectives, and interim milestones for each applicable sustainability indicator:

1. Chronic lowering of groundwater levels (Section 4.4)
2. Reduction in groundwater storage (Section 4.5)
3. Seawater intrusion (Section 4.6)
4. Degraded water quality (Section 4.7)
5. Land subsidence (Section 4.8)

The sixth sustainable management criterion, depletion of interconnected surface water, is not applicable in the Basin because surface water is not interconnected with groundwater in the principal aquifers.

The process for developing SMC for this GSP began with a deliberate process that was reviewed by the MBGSA Board of Directors in June 2020, followed by adoption of a sustainability goal in September 2020. These actions were performed intentionally up front to guide SMC development. SMC development then consisted of the MBGSA Board of Directors and stakeholders reviewing SMC proposals prepared by staff. Written proposals were provided in the form of staff reports and presentations at numerous Board of Directors meetings, which included information on SGMA requirements, relevant information from the Basin Setting section, and results of additional analyses completed to support SMC development. Meeting summaries (minutes) were posted on the MBGSA website and two GSP workshops were held to address the SMC. Outreach was performed throughout the SMC development process to encourage input on the proposed SMC, including GSP newsletters, e-mails to the interested parties list, social media posts, telephone communications with stakeholders, updates at the Santa Clara River Watershed Committee, public notices, and a bilingual bill stuffer in the City of Ventura's consumer water bills.

A key part of the SMC development process is defining undesirable results (GSP Emergency Regulations §354.26(a)). The process for defining undesirable results consisted of multiple steps:

1. First, potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other effects were evaluated and described qualitatively.
2. The qualitative statement on potential effects was then translated and quantified into minimum thresholds at specific monitoring network sites (existing and proposed).
3. Lastly, a combination of minimum threshold exceedances representing undesirable results (when significant and unreasonable effects occur on any of the sustainability indicators) in the Basin was established.

For this GSP and pursuant to GSP Emergency Regulations §354.28(d), groundwater elevations are used as a proxy for the depletion of groundwater storage and land subsidence sustainability indicators.

Chronic Lowering of Groundwater Levels: Historically, measured and modeled future groundwater levels indicate no chronic lowering of groundwater levels has or will occur in the Basin. The qualitative description of undesirable results is chronic lowering of groundwater levels that causes a significant number of wells in the Basin to no longer be capable of being operated as designed for the confined aquifers of the Mound Basin. The results of analyzing groundwater levels, well data, and the groundwater model results indicate that groundwater levels could decline by a considerable amount below historical low levels in many areas of the Basin before a significant and unreasonable depletion of supply would occur. The analysis results for the groundwater supply depletion water level thresholds are supported by the lack of reported pumping problems during historical periods of lowered groundwater levels. However, the groundwater supply depletion water level thresholds can be hundreds of feet lower in elevation than historical low groundwater levels (especially for the Hueneme Aquifer), while for others they can be similar in elevation. Groundwater levels cannot decline significantly below historical low levels without creating risk for subsidence undesirable results. For these reasons, the minimum threshold for the chronic lowering of groundwater levels is set at the historical low levels. The combination of minimum threshold exceedances that is deemed to cause significant and unreasonable effects in the Basin for chronic lowering of groundwater levels is minimum threshold exceedances in 50% of the groundwater level monitoring sites in either principal aquifer. This combination is intended to indicate significant and unreasonable effects are widespread in either principal aquifer. The measurable objective was set based on the reasonable margin of operational flexibility and was determined to be groundwater levels following wet phases that are sufficiently high to prevent groundwater levels from dropping below the minimum thresholds during a subsequent drought phase.

Reduction in Groundwater Storage**:** The reduction in groundwater storage sustainability indicator is measured as the “total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results” (GSP Emergency Regulations §354.28 (c)(2)). The minimum threshold is set for the extraction rate not to exceed the sustainable yield (i.e., 8,200 AF/yr) for the Basin, which is the rate that is anticipated to cause water levels to go below the historical low. The reduction of groundwater storage measurable objective is 90% of the sustainable yield (i.e., 7,400 AF/yr), based on professional judgement and to account for uncertainty in the sustainable yield estimate.

Seawater Intrusion**:** Available data indicate that seawater has not been present in the onshore portions of the principal aquifers to date. In addition, the Mound Basin principal aquifers may only be exposed to seawater where they crop out on the continental shelf edge, approximately 10 miles offshore, greatly reducing the likelihood that seawater can find a near-shore path for intrusion into the principal aquifers. Groundwater model particle tracking results suggest that the most seawater has moved is in the Hueneme Aquifer, an average of approximately 0.5 miles from the offshore subcrop (approximately 10 miles from the shoreline) toward the shoreline during the past 100 years. The criteria used to define when and where the effects of the groundwater conditions cause undesirable results is based on the qualitative description of undesirable result, which is seawater intrusion extending east of Harbor Boulevard into areas with current or anticipated future beneficial uses. This means that the chloride concentrations should be maintained below a concentration indicative of seawater intrusion impacts at monitoring sites along Harbor Boulevard. Therefore, the minimum threshold of 150 milligrams per liter (mg/L) is used at monitoring sites along Harbor Boulevard, which is consistent with the degraded water quality sustainability indicator minimum threshold for chloride. The measurable objectives are also set consistent with the degraded water quality sustainability indicator measurable objectives for chloride.

Degraded Water Quality**:** Groundwater quality in the Mound Basin is marginal due to natural geochemical processes, and groundwater extraction does not appear to have exacerbated these natural processes historically. Occurrences of elevated sulfate, TDS, and nitrate concentrations appear to be related to well construction/condition issues that facilitate intrusion of very poor-quality water from the shallow groundwater system into these wells, as opposed to being an indicator of regional water quality degradation in the principal aquifers. Potential future increases in Mugu Aquifer extraction rates could locally induce downward migration of very poor-quality water from the shallow groundwater system into the Mugu Aquifer, which could lead to undesirable results. The effects of groundwater conditions deemed to cause undesirable results is considered to occur when all representative monitoring wells in a principal aquifer exceed the minimum threshold concentration for a constituent for two consecutive years. The minimum thresholds and measurable objectives for degraded water quality were developed by considering existing water quality standards (drinking water regulations and RWQCB Basin Plan WQOs, and historically measured concentrations). The minimum thresholds are based on RWQCB WQOs except in cases where concentrations have historically exceeded the WQO. The measurable objectives are based on preserving existing water quality consistent with upper consumer acceptance levels for drinking water (which trigger treatment requirements) or toxicity levels for crops, in cases where concentrations have historically exceeded these levels.

Land Subsidence**:** No land subsidence due to groundwater extraction has been documented historically in the Mound Basin, which is considered to have a low estimated potential for inelastic land subsidence. Numerical modeling for the water budget suggests that future groundwater levels will remain above historical low levels, which would prevent inelastic subsidence due to groundwater extraction; however, groundwater levels could decline below historical levels and trigger inelastic land subsidence if actual future conditions differ significantly from those assumed in the projected water budget analysis. Undesirable results are any inelastic land subsidence caused by groundwater extraction in the Coastal Area of the Basin (i.e., areas located west of Harbor Boulevard). The minimum threshold is important in the Coastal Area because land subsidence here would exacerbate coastal hazards associated with sea level rise and/or impacts to the City of Ventura’s sewer mains along Harbor Boulevard. Undesirable results could also occur outside of the Coastal Area if enough subsidence occurred to substantially interfere with surface land uses. Due to data coverage gaps and other factors, interferometric synthetic aperture radar (InSAR[1]) monitoring was not considered a reliable method for measuring land subsidence in the western half of the Mound Basin; therefore, groundwater levels were chosen as a proxy minimum threshold, and were set at the historical low groundwater levels to prevent measurable inelastic land subsidence due to groundwater extraction. Any combination of minimum threshold exceedances that include >50% of wells in the western half of the Basin would be considered as potentially leading to undesirable results. This combination is intended to indicate significant and unreasonable effects are widespread in the western half of the Basin. For the eastern half of the Basin, InSAR data are considered adequate to monitor for land subsidence when coupled with continuous global positioning system (GPS) data to filter out tectonic downwarping. Therefore, any exceedances of minimum thresholds in the eastern area will prompt the review of InSAR data to evaluate indications of subsidence rates (due to groundwater extraction) of ≥0.1 ft/yr that leads to cumulative subsidence of 0.6 ft or more. The less conservative minimum threshold for the eastern area was selected based on literature review of subsidence case studies. The measurable objectives for the western half of the Basin are identical to the chronic lowering of groundwater levels measurable objective, and for the eastern half they are equal to the minimum threshold.

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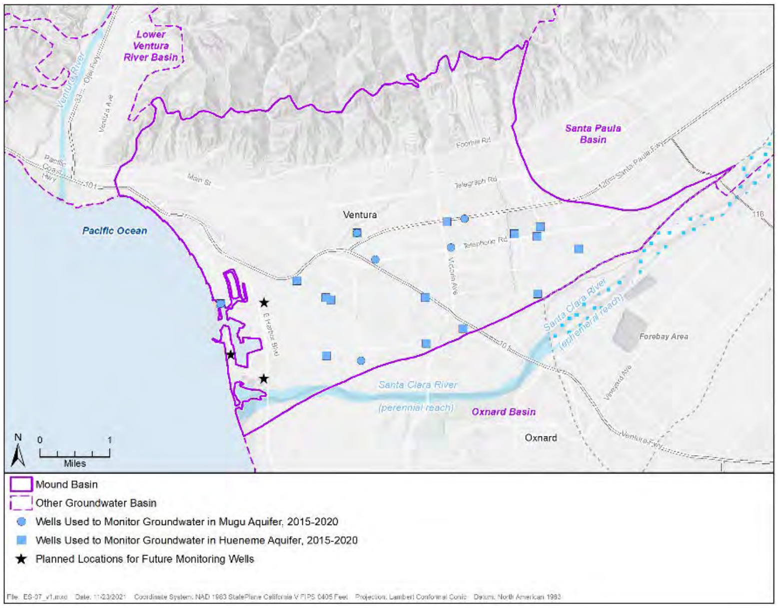
[1] Interferometric Synthetic Aperture Radar (InSAR) measures the spatial extent and magnitude of changes in the land surface associated with fluid extraction and natural hazards (e.g., earthquakes).

ES-5. Monitoring Networks

The GSP Emergency Regulations require monitoring networks be developed to collect data of sufficient quality, frequency, and spatial distribution to characterize groundwater and related surface water conditions (if applicable) in the Basin; evaluate changing conditions that occur during implementation of the GSP; and for implementation of the SMC for the Basin. Monitoring networks should accomplish the following (§354.34(b)):

- **Demonstrate Progress toward Achieving Measurable Objectives Described in the GSP**: The five sustainability indicators discussed above are applicable but have already met the corresponding measurable objectives historically and are expected to meet them going forward. Therefore, the focus of this objective for the Mound Basin is to demonstrate continued compliance with the measurable objectives as opposed to progress toward meeting the measurable objectives.
- **Monitor Impacts to the Beneficial Uses and Users of Groundwater**: The uses and users described in the introduction could be impacted by degradation of water quality, seawater intrusion, and declining groundwater levels and storage (which are an important causative factor in land subsidence). Monitoring groundwater levels and quality can indicate trends that could precede land subsidence or seawater intrusion, as well as trends that could affect operation and associated costs of production wells. Under this guidance, appropriate monitoring sites in Mound Basin are in the southern portion where all the Basin's active water supply wells are located and groundwater levels are known to fluctuate. Monitoring in the northern part of the Basin is low priority due to the lack of beneficial uses.
- **Monitor Changes in Groundwater Conditions Relative to Measurable Objectives and Minimum Thresholds**: This will be accomplished using groundwater level and groundwater quality monitoring. Quarterly groundwater level monitoring and annual groundwater quality sampling frequencies are considered adequate for the Basin, due to the relatively slow rate of groundwater movement.
- **Quantify Annual Changes in Water Budget Components**: The available monitoring data for the Basin will be input to United's flow model for calculating future annual changes in subsurface water budget components and change in storage. Surface flows in the Santa Clara River are measured daily by the Ventura County Watershed Protection District (VCWPD) at flow-gaging station "723 - Santa Clara River at Victoria Ave" located outside of the Basin. Data from this station are available online and can be downloaded annually to update this surface water component of the Mound Basin water budget (VCWPD, 2021). MBGSA intends to continue using data from these existing sources as input to United's model, which will in turn be used periodically to quantify changes in water budget components. At present, this GSP does not contemplate development of a new monitoring network or modification of existing monitoring networks to obtain data regarding groundwater extraction, imported water, or recharge quantities because it is MBGSA's opinion that these water budget components are currently adequate for sustainable management of the Basin.

Groundwater levels and water quality are monitored in approximately 20 wells across the Basin by United; Ventura Water (i.e. the City of Ventura's water and wastewater department) monitors two active water supply wells in the Basin, and VCWPD monitors three wells (currently or formerly used for agricultural and industrial water supply) in the Basin. VCWPD is the California Statewide Groundwater Elevation Monitoring (CASGEM) monitoring entity for the Basin.



Consistent with GSP Emergency Regulations §354.34(e), the groundwater level and quality monitoring networks that will be utilized are based primarily on existing monitoring sites that are monitored by United and VCWPD. The existing monitoring networks in the Basin have been used for several decades to collect information to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface water conditions. The monitoring networks include features for the collection of data to monitor the groundwater sustainability indicators applicable to the Basin. Additional monitoring sites will be added to implement the SMC for seawater intrusion (two new monitoring wells located near Harbor Boulevard). The additional monitoring sites will also help refine the hydrogeologic conceptual model (HCM) and improve the numerical model. A third monitoring site is proposed along the shoreline to provide a second site for early detection of seawater intrusion. A final decision whether to construct this third well will be made during GSP implementation, based on available funding and monitoring results from new Harbor Boulevard monitoring wells. Lastly, MBGSA will seek opportunities to enhance the monitoring networks by instrumenting and sampling additional existing wells in the Basin if and when opportunities to do so arise.

InSAR is the best available method for measuring the rate and extent of land subsidence over large areas, such as a groundwater basin. As described above, InSAR is unreliable for the western half of the Basin, so groundwater elevations will be used as a proxy to detect and monitor the potential onset of inelastic land subsidence that may result from future groundwater extractions in the Basin (i.e., if groundwater elevations decline below historical low levels). To ensure the best available data is used for monitoring land subsidence, InSAR data will be utilized when groundwater levels are below historical lows in the eastern half of the Basin. If InSAR coverage and other data issues are resolved in the future, MBGSA will update the GSP to utilize InSAR measurements for the western half of the Basin.

Pursuant to section §352.6, monitoring data will be stored in MBGSA's Data Management System (DMS). Data will be transmitted to DWR with the GSP, annual reports, and GSP updates electronically on the forms provided by DWR.

ES-6. Projects and Management Actions

The 50-year future modeling projections developed for the projected water budget suggest that the measurable objectives for the applicable sustainability indicators will be met without the need for projects or management actions. However, several management actions are included to help prevent problems from developing and to respond to potential changing conditions in the Basin. The management actions include:

- Coordinate with the County of Ventura to identify and address improperly constructed or abandoned wells that create conduits for migration of poor-quality water from shallow water-bearing units into the principal aquifers. Grant funding will be pursued to address any improperly constructed or abandoned wells that are identified.
- Coordinate with County of Ventura to review the County well permit ordinance and modify, if necessary, to ensure the future wells are properly sealed to prevent migration of poor-quality water from shallow water-bearing units into the principal aquifers.
- Develop a contingency plan to address unexpected land subsidence.
- Develop a contingency plan to address unexpected seawater intrusion.
- Partner with the City of Ventura and United to collect interim shallow groundwater data to further assess the hydraulic connection between the Santa Clara River flows and groundwater in Shallow Alluvial Deposits with groundwater extraction from the deeper principal aquifers.

ES-7. Plan Implementation

The estimated costs for the GSP implementation include annual costs for ongoing activities and estimated costs for one-time activities that are scheduled to occur within the first 5-year GSP assessment period. The estimated total cost of the GSP Implementation over the 20-year planning horizon is [$7,002,188]. The total estimated cost through the first 5-year assessment is [$1,937,618]. The cost is based on the best available information at the time of Plan preparation and submittal. It represents the MBGSA's current understanding of Basin conditions and the current roles and responsibilities of the MBGSA under SGMA.

Funding for GSP implementation will be obtained from groundwater extraction fees charged to groundwater users in the Basin, and grants. This funding approach has been used since the MBGSA's formation and will be reevaluated over time as the GSP implementation progresses. The Site A monitoring well planned is being funded by DWR's Technical Support Services (TSS) grant program. MBGSA will continue to pursue funding from state and federal sources to support GSP planning and implementation.

Implementation of the GSP requires robust administrative and financial structures, with adequate human resources to ensure compliance with SGMA. The activities associated with the GSP implementation are:

1. Agency administration,
2. Preparing annual reports,
3. Monitoring groundwater levels and quality and land subsidence,
4. Maintaining the Basin DMS,
5. Updating the groundwater model,
6. Constructing new monitoring wells,
7. Developing contingency plans,
8. Performing ongoing stakeholder outreach and engagement, and

9. Assessing/updating the GSP every 5 years.

MBGSA will likely continue to address its human resources needs through contracts with consultants and United.

GSP reporting will occur on an annual basis, with reports for the preceding water year due to DWR by April 1. Periodic evaluations (every 5 years) and GSP amendments (if needed) will be submitted to DWR by at least every 5 years (2027, 2032, 2037, and 2042). The proposed monitoring wells are scheduled for construction in 2021, 2026, and 2032, but it is noted that site identification, access agreements, and permitting will take place in the years immediately preceding construction.

Table of Contents

List of Figures

List of Tables

List of Appendices

Definitions of Key SGMA Terms

California Water Code

Sec. 10721

Unless the context otherwise requires, the following definitions govern the construction of this part:

(a) Adjudication action means an action filed in the superior or federal district court to determine the rights to extract groundwater from a basin or store water within a basin, including, but not limited to, actions to quiet title respecting rights to extract or store groundwater or an action brought to impose a physical solution on a basin.

(b) Basin means a groundwater basin or subbasin identified and defined in Bulletin 118 or as modified pursuant to Chapter 3 (commencing with Section 10722).

(c) Bulletin 118 means the department's report entitled California's Groundwater: Bulletin 118 updated in 2003, as it may be subsequently updated or revised in accordance with Section 12924.

(d) Coordination agreement means a legal agreement adopted between two or more groundwater sustainability agencies that provides the basis for coordinating multiple agencies or groundwater sustainability plans within a basin pursuant to this part.

(e) De minimis extractor means a person who extracts, for domestic purposes, two acrefeet or less per year.

(f) Governing body means the legislative body of a groundwater sustainability agency.

(g) Groundwater means water beneath the surface of the earth within the zone below the water table in which the soil is completely saturated with water, but does not include water that flows in known and definite channels.

(h) Groundwater extraction facility means a device or method for extracting groundwater from within a basin.

(i) Groundwater recharge or recharge means the augmentation of groundwater, by natural or artificial means.

(j) Groundwater sustainability agency means one or more local agencies that implement the provisions of this part. For purposes of imposing fees pursuant to Chapter 8 (commencing with Section 10730) or taking action to enforce a groundwater sustainability plan, groundwater sustainability agency also means each local agency comprising the groundwater sustainability agency if the plan authorizes separate agency action.

(k) Groundwater sustainability plan or plan means a plan of a groundwater sustainability agency proposed or adopted pursuant to this part.

(l) Groundwater sustainability program means a coordinated and ongoing activity undertaken to benefit a basin, pursuant to a groundwater sustainability plan.

(m) In-lieu use means the use of surface water by persons that could otherwise extract groundwater in order to leave groundwater in the basin.

(n) Local agency means a local public agency that has water supply, water management, or land use responsibilities within a groundwater basin.

(o) Operator means a person operating a groundwater extraction facility. The owner of a groundwater extraction facility shall be conclusively presumed to be the operator unless a satisfactory showing is made to the governing body of the groundwater sustainability agency that the groundwater extraction facility actually is operated by some other person.

(p) Owner means a person owning a groundwater extraction facility or an interest in a groundwater extraction facility other than a lien to secure the payment of a debt or other obligation.

(q) Personal information has the same meaning as defined in Section 1798.3 of the Civil Code.

(r) Planning and implementation horizon means a 50-year time period over which a groundwater sustainability agency determines that plans and measures will be implemented in a basin to ensure that the basin is operated within its sustainable yield.

(s) Public water system has the same meaning as defined in Section 116275 of the Health and Safety Code.

(t) Recharge area means the area that supplies water to an aquifer in a groundwater basin.

(u) Sustainability goal means the existence and implementation of one or more groundwater sustainability plans that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the applicable basin is operated within its sustainable yield.

(v) Sustainable groundwater management means the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.

(w) Sustainable yield means the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus that can be withdrawn annually from a groundwater supply without causing an undesirable result.

(x) Undesirable result means one or more of the following effects caused by groundwater conditions occurring throughout the basin:

> (1) Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon. Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.
>
> (2) Significant and unreasonable reduction of groundwater storage.
>
> (3) Significant and unreasonable seawater intrusion.
>
> (4) Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.
>
> (5) Significant and unreasonable land subsidence that substantially interferes with surface land uses.

(6) Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

(y) Water budget means an accounting of the total groundwater and surface water entering and leaving a basin including the changes in the amount of water stored.

(z) Watermaster means a watermaster appointed by a court or pursuant to other law.

(aa) Water year means the period from October 1 through the following September 30,

inclusive.

(ab) Wellhead protection area means the surface and subsurface area surrounding a water well or well field that supplies a public water system through which contaminants are reasonably likely to migrate toward the water well or well field.

Official California Code of Regulations

Title 23. Waters

Division 2. Department of Water Resources

Chapter 1.5. Groundwater Management

Subchapter 2. Groundwater Sustainability Plans

Article 2. Definitions

23 CCR § 351

§ 351. Definitions.

The definitions in the Sustainable Groundwater Management Act, Bulletin 118, and Subchapter 1 of this Chapter, shall apply to these regulations. In the event of conflicting definitions, the definitions in the Act govern the meanings in this Subchapter. In addition, the following terms used in this Subchapter have the following meanings:

(a) “Agency” refers to a groundwater sustainability agency as defined in the Act.

(b) “Agricultural water management plan” refers to a plan adopted pursuant to the Agricultural Water Management Planning Act as described in Part 2.8 of Division 6 of the Water Code, commencing with Section 10800 et seq.

(c) “Alternative” refers to an alternative to a Plan described in Water Code Section 10733.6.

(d) “Annual report” refers to the report required by Water Code Section 10728.

(e) “Baseline” or “baseline conditions” refer to historical information used to project future conditions for hydrology, water demand, and availability of surface water and to evaluate potential sustainable management practices of a basin.

(f) “Basin” means a groundwater basin or subbasin identified and defined in Bulletin 118 or as modified pursuant to Water Code 10722 et seq.

(g) “Basin setting” refers to the information about the physical setting, characteristics, and current conditions of the basin as described by the Agency in the hydrogeologic conceptual model, the groundwater conditions, and the water budget, pursuant to Subarticle 2 of Article 5.

(h) “Best available science” refers to the use of sufficient and credible information and data, specific to the decision being made and the time frame available for making that decision, that is consistent with scientific and engineering professional standards of practice.

(i) “Best management practice” refers to a practice, or combination of practices, that are designed to achieve sustainable groundwater management and have been determined to be technologically and economically effective, practicable, and based on best available science.

(j) “Board” refers to the State Water Resources Control Board.

(k) “CASGEM” refers to the California Statewide Groundwater Elevation Monitoring Program developed by the Department pursuant to Water Code Section 10920 et seq., or as amended.

(l) “Data gap” refers to a lack of information that significantly affects the understanding of the basin setting or evaluation of the efficacy of Plan implementation, and could limit the ability to assess whether a basin is being sustainably managed.

(m) “Groundwater dependent ecosystem” refers to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface.

(n) “Groundwater flow” refers to the volume and direction of groundwater movement into, out of, or throughout a basin.

(o) “Interconnected surface water” refers to surface water that is hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted.

(p) “Interested parties” refers to persons and entities on the list of interested persons established by the Agency pursuant to Water Code Section 10723.4.

(q) “Interim milestone” refers to a target value representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan.

(r) “Management area” refers to an area within a basin for which the Plan may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors.

(s) “Measurable objectives” refer to specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the basin.

(t) “Minimum threshold” refers to a numeric value for each sustainability indicator used to define undesirable results.

(u) “NAD83” refers to the North American Datum of 1983 computed by the National Geodetic Survey, or as modified.

(v) “NAVD88” refers to the North American Vertical Datum of 1988 computed by the National Geodetic Survey, or as modified.

(w) “Plain language” means language that the intended audience can readily understand and use because that language is concise, well-organized, uses simple vocabulary, avoids excessive acronyms and technical language, and follows other best practices of plain language writing.

(x) “Plan” refers to a groundwater sustainability plan as defined in the Act.

(y) “Plan implementation” refers to an Agency's exercise of the powers and authorities described in the Act, which commences after an Agency adopts and submits a Plan or Alternative to the Department and begins exercising such powers and authorities.

(z) “Plan manager” is an employee or authorized representative of an Agency, or Agencies, appointed through a coordination agreement or other agreement, who has been delegated management authority for submitting the Plan and serving as the point of contact between the Agency and the Department.

(aa) “Principal aquifers” refer to aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems.

(ab) “Reference point” refers to a permanent, stationary and readily identifiable mark or point on a well, such as the top of casing, from which groundwater level measurements are taken, or other monitoring site.

(ac) “Representative monitoring” refers to a monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin.

(ad) “Seasonal high” refers to the highest annual static groundwater elevation that is typically measured in the Spring and associated with stable aquifer conditions following a period of lowest annual groundwater demand.

(ae) “Seasonal low” refers to the lowest annual static groundwater elevation that is typically measured in the Summer or Fall, and associated with a period of stable aquifer conditions following a period of highest annual groundwater demand.

(af) “Seawater intrusion” refers to the advancement of seawater into a groundwater supply that results in degradation of water quality in the basin, and includes seawater from any source.

(ag) “Statutory deadline” refers to the date by which an Agency must be managing a basin pursuant to an adopted Plan, as described in Water Code Sections 10720.7 or 10722.4.

(ah) “Sustainability indicator” refers to any of the effects caused by groundwater conditions occurring throughout the basin that, when significant and unreasonable, cause undesirable results, as described in Water Code Section 10721(x).

(ai) “Uncertainty” refers to a lack of understanding of the basin setting that significantly affects an Agency's ability to develop sustainable management criteria and appropriate projects and management actions in a Plan, or to evaluate the efficacy of Plan implementation, and therefore may limit the ability to assess whether a basin is being sustainably managed.

(aj) “Urban water management plan” refers to a plan adopted pursuant to the Urban Water Management Planning Act as described in Part 2.6 of Division 6 of the Water Code, commencing with Section 10610 et seq.

(ak) “Water source type” represents the source from which water is derived to meet the applied beneficial uses, including groundwater, recycled water, reused water, and surface water sources identified as Central Valley Project, the State Water Project, the Colorado River Project, local supplies, and local imported supplies.

(al) “Water use sector” refers to categories of water demand based on the general land uses to which the water is applied, including urban, industrial, agricultural, managed wetlands, managed recharge, and native vegetation.

(am) “Water year” refers to the period from October 1 through the following September 30, inclusive, as defined in the Act.

(an) “Water year type” refers to the classification provided by the Department to assess the amount of annual precipitation in a basin.

Acronyms and Abbreviations

AF	acre-foot/acre-feet
AF/yr	acre-feet per year
Alta MWC	Alta Mutual Water Company
Association	Santa Clara River Protection Association
Basin	Mound Basin
bgs	below ground surface
BMP	best management practices
CALVEG	Classification and Assessment with Landsat of Visible Ecological Groupings
CASGEM	California Statewide Groundwater Elevation Monitoring
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
cfs	cubic feet per second
County	County of Ventura
DAC	Disadvantaged Community
DDW	Department of Drinking Water, State of California
DMS	Data Management System
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources, State of California
ENSO	El Nino/Southern Oscillation
ET	evapotranspiration
FCGMA	Fox Canyon Groundwater Management Agency
FICO	Farmers Irrigation Company
ft	foot/feet
ft/d	feet per day
ft/yr	feet per year
GDE	groundwater-dependent ecosystem
GIS	geographic information system
GPS	Ground Positioning System
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HCM	hydrogeologic conceptual model
Hopkins	Hopkins Groundwater Consultants
HSU	hydrostratigraphic unit
HVPAA	Hillside Voter Participation Area Act, City of Ventura

iGDE	indicators of groundwater-dependent ecosystem
InSAR	interferometric synthetic aperture radar
IRWMP	Integrated Regional Water Management Plan
JPA	joint exercise of powers agreement
LAS	Lower Aquifer System
LUST	Leaking Underground Storage Tank
M&I	Municipal and Industrial
MBAWG	Mound Basin Agricultural Water Group
MBGSA	Mound Basin Groundwater Sustainability Agency
MCL	maximum contaminant level
MCLR	maximum contaminant level range
mg/L	milligrams per liter
mi^2	square miles
mm	millimeter/millimeters
msl	above mean sea level
MWD	Municipal Water District
NAVD88	North American Vertical Datum of 1988
NC	Natural Communities
NCCAG	Natural Communities Commonly Associated with Groundwater
NRCS	Natural Resources Conservation Service
PDO	Pacific Decadal Oscillation
RMSE	root mean square error
RWQCB	Regional Water Quality Control Board
RWQCB-LA	Regional Water Quality Control Board, Los Angeles region
SCAG	Southern California Association of Governments
SDAC	Severely Disadvantaged Communities
SEP	Stakeholder Engagement Plan
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
SOAR	Save Open Space and Agricultural Resources
SSP&A	S.S. Papadopulos & Associates, Inc.
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDEM	time domain electromagnetic
TDS	total dissolved solids
TNC	The Nature Conservancy
TSS	Technical Support Services

UAS	Upper Aquifer System
United	United Water Conservation District
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VCWPD	Ventura County Watershed Protection District
Ventura Water	The City of Ventura’s water and wastewater department
VWRF	Ventura Water Reclamation Facility
WQO	Water Quality Objective
WRF	Water Reclamation Facility
WWTP	Wastewater Treatment Plant

1.0 Introduction to Plan Contents [Article 5 §354]

> **§354 Introduction to Plan Contents.** *This Article describes the required contents of Plans submitted to the Department for evaluation, including administrative information, a description of the basin setting, sustainable management criteria, description of the monitoring network, and projects and management actions.*

In 2014, the State of California enacted the Sustainable Groundwater Management Act (SGMA). This law requires groundwater basins in California that are designated as medium or high priority be managed sustainably. Satisfying the requirements of SGMA generally requires five basic activities:

1. Form one or multiple Groundwater Sustainability Agency(s) (GSAs) to fully cover the basin;
2. Develop one or more Groundwater Sustainability Plan(s) (GSPs) that fully cover the basin;
3. Implement the GSP to achieve sustainable groundwater management;
4. Annual reporting to the California Department of Water Resources (DWR); and
5. Prepare and submit a written assessment of the GSP at least every 5 years to DWR and amend the GSP as necessary.

Mound Basin Groundwater Sustainability Agency (MBGSA) was formed in 2017 to satisfy the requirement for a GSA to fully cover the Mound Basin (DWR Basin 4-004.03) (Basin). MBGSA was designated as the exclusive GSA for the Basin by the State on September 30, 2017. MBGSA developed this document to fulfill the GSP requirements for the Basin. This GSP provides administrative information, describes the Basin setting, develops quantitative sustainable management criteria (SMC) that consider the interests of all beneficial uses and users of groundwater, and identifies projects and management actions and monitoring networks that will ensure the Basin is demonstrably managed in a sustainable manner within the 20-year sustainability timeframe (2042) and for the duration of the entire 50-year planning and implementation horizon (2072).

Following submittal of an initial notification on September 17, 2018 (Appendix A), MBGSA developed this GSP to comply with SGMA's statutory and regulatory requirements. As such, the GSP uses the terminology set forth in these requirements (see e.g. Water Code §10721 and 23 CCR §351) which is oftentimes different from the terminology utilized in other contexts (e.g. past reports or studies, past analyses, judicial rules or findings). The definitions from the relevant statutes and regulations are provided in the section titled "Definitions of Key SGMA Terms."

The GSP includes all of the required elements of the GSP Emergency Regulation organized into eight sections plus appendices as follows:

- **Section 1 - Introduction to Plan Contents** provides an overview of SGMA and the plan contents.
- **Section 2 - Administrative Information** provides information about the GSA, a description of the Plan area, and a summary of information relating to notification and communication by the Agency with other agencies and interested parties.
- **Section 3 - Basin Setting** describes the hydrogeologic conceptual model (HCM) of the Basin, current and historical groundwater conditions, the Basin water budget, and designated management areas within the Basin.

- **Section 4 - Sustainable Management Criteria** describes the Basin sustainability goal and the SMC developed for each of the applicable SGMA sustainability indicators. The applicable sustainability indicators for the Basin are Chronic Lowering of Groundwater Levels, Reduction of Groundwater Storage, Seawater Intrusion, Degraded Water Quality, and Land Subsidence. The Depletions of Interconnected Surface Water sustainability indicator is not applicable to the Basin.
- **Section 5 - Monitoring Networks** describes the monitoring networks that will be utilized to characterize groundwater and surface water conditions in the Basin, evaluate changing conditions that occur through implementation of the Plan, and demonstrate sustainable management.
- **Section 6 - Projects and Management Actions** describes projects and management actions included in the GSP to meet the sustainability goal for the Basin in a manner that can be maintained over the planning and implementation horizon.
- **Section 7 - GSP Implementation** describes steps to implementation, plan implementation costs, and plan funding.
- **Section 8 - References and Technical Studies**: provides a list of references and technical studies relied upon by the GSA in developing the Plan.

Appendices provide supporting information referred to in the GSP:

- MBGSA’s Initial Notification to DWR for the GSP is provided in Appendix A.
- This GSP meets regulatory requirements established by the DWR as shown in Appendix B, the Elements of the Plan table.
- The formation of MBGSA Pursuant to Water Code §10723.8 is provided in Appendix C.
- The plan for MBGSA’s engagement with stakeholders is provided in Appendix D.
- A list of public meetings held with MBGSA pursuant to §354.10 is provided in Appendix E.
- Comments and responses regarding the GSP pursuant to §354.10 are provided in Appendix F.
- Appendix G provides supplemental information regarding the Shallow Alluvial Deposits and the Santa Clara River in relation to the principal aquifers of the Basin.
- Areas Containing Indicators of Potential Groundwater-Dependent Ecosystems (iGDEs) are mapped in Appendix H.
- Minimum Thresholds and Measurable Objectives associated with time-series plots of modeled versus observed groundwater level are provided in Appendix I.
- Minimum Thresholds and Measurable Objectives associated with time-series plots of water quality data are provided in Appendix J.
- The approach to estimating annual change in storage for the Basin in provided in Appendix K.
- The Data Management System (DMS) documentation is provided in Appendix L.

2.0 Administrative Information [Article 5, SubArticle 1]

§354.2 Introduction to Administrative Information. *This Subarticle describes information in the Plan relating to administrative and other general information about the Agency that has adopted the Plan and the area covered by the Plan.*

Section 2 describes information relating to administration and other general information about MBGSA and the area covered by the GSP.

2.1 Agency Information [§354.6]

This section describes the MBGSA and its authority in relation to the SGMA. MBGSA is the exclusive GSA for Mound Basin (Department of Water Resources Basin 4-004.03), located in western Ventura County (Figures 2.1-01 and 2.1-02)

MBGSA was formed in 2017, pursuant to a joint exercise of powers agreement (JPA) between three local public agencies overlying the Basin: the City of San Buenaventura, the County of Ventura, and the United Water Conservation District (United) (Figure 2.1-01). The City of San Buenaventura is a local municipality that exercises water supply, water management, and land use authority within the city's boundaries. The County of Ventura exercises water management and land use authority on a portion of the land overlying the Mound Basin. See Figure 2.1-03 for land use information. United was formed in 1950 under the State of California's Water Conservation District Law of 1931 and is organized as a governmental special district. United does not produce water from the Basin, but is authorized to engage in groundwater replenishment of the Basin.

Per §10723.8(a) of the California Water Code, MBGSA gave notice to DWR of its decision to form a GSA for the Basin on June 28, 2017. Copies of the information required pursuant to Water Code §10723.8 for GSA Formation, updated as appropriate, is provided in Appendix C. MBGSA was designated as the exclusive GSA for the Basin by the State on September 30, 2017.

2.1.1 Name and Mailing Address [§354.6(a)]

§354.6 Agency Information. *When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:*

(a) *The name and mailing address of the Agency.*

- GSA Name: Mound Basin Groundwater Sustainability Agency
- GSA Mailing Address: P.O. Box 3544, Ventura, CA 93006-3544

2.1.2 Organization and Management Structure [§354.6(b)]

§354.6 Agency Information. *When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:*

(b) *The organization and management structure of the Agency, identifying persons with management authority for implementation of the Plan.*

MBGSA is governed by a five-member board comprised of one director appointed by each member public agency (City of San Buenaventura, the County of Ventura, and United) and two stakeholder directors representing agricultural and environmental interests. MBGSA contracts with Bondy Groundwater Consulting, Inc. (Bryan Bondy), who serves as the Agency's Executive Director and GSP Plan Manager. MBGSA contracts with member agency United for financial and administrative support. The Executive Director manages day-to-day operations of the Agency, while Board Members vote on actions of the MBGSA. The Board of Directors is MBGSA's decision-making body. Further information about MBGSA's organization and management structure can be found in the MBGSA JPA and MBGSA Bylaws, which are included in Appendix C.

2.1.3 Plan Manager and Contact Information [§354.6(c)]

§354.6 Agency Information. *When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:*

(c) *The name and contact information, including the phone number, mailing address and electronic mail address, of the plan manager.*

- Mound Basin GSA Executive Director: Bryan Bondy, PG, CHG
- Phone Number: (805) 212-0484
- Email: bryan@moundbasingsa.org
- Mailing Address: P.O. Box 3544, Ventura, CA 93006-3544
- Website: www.moundbasingsa.org

2.1.4 Legal Authority [§354.6(d)]

§354.6 Agency Information. *When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:*

(d) *The legal authority of the Agency, with specific reference to citations setting forth the duties, powers, and responsibilities of the Agency, demonstrating that the Agency has the legal authority to implement the Plan.*

MBGSA has legal authority to perform duties, exercise powers, and accept responsibility for managing groundwater sustainably within the Mound Basin. MBGSA's legal authority comes from the SGMA, the JPA signed by MBGSA member agencies, and the MBGSA Bylaws. The JPA and bylaws are included in Appendix C. These laws and agreements, taken together, provide the necessary legal authority for the MBGSA Board to carry out the preparation and implementation of the Basin's GSP. Figures 2.1-01 and 2.1-02 show the extent of the GSP plan area, along with the jurisdictional boundary of each of the Member

Agencies of MBGSA's JPA. Figure 2.1-01 demonstrates that the entire Basin is covered by MBGSA. Therefore, MBGSA has the legal authority to implement this GSP throughout the entire plan area.

Additionally, the City is currently in the planning and design phases for the proposed VenturaWaterPure Program, which includes diversion of tertiary treated effluent to a new Advanced Water Purification Facility for potable reuse. Construction of these Projects is expected to begin in 2023.

City of San Buenaventura

The City of San Buenaventura (usually referred to as Ventura), located on the shore of the Pacific Ocean in western Ventura County, was founded as a Spanish mission in 1782 and incorporated as a town in 1866 and is the county seat of Ventura County. The City administers land use within its municipal boundaries and is the largest land use jurisdiction within the Basin. Ventura Water (the City of Ventura's water and wastewater department) provides retail potable water service within the City limits and portions of unincorporated Ventura County that meet the City's policy for water connections outside City limits (Municipal Code Section 22.110.055). The City's potable water supply is derived from a variety of sources, including Mound Basin groundwater. Sources located outside of the Mound Basin include groundwater pumped from the adjacent Santa Paula and Oxnard Basins, subsurface water from the Ventura River (Upper Ventura River Valley Basin), and Lake Casitas (Casitas Municipal Water District [Casitas MWD]). The City also provides recycled water from the Ventura Water Reclamation Facility (VWRF). The City operates its water supply system by utilizing a conjunctive use operating procedure. The City relies more heavily on surface water sources (such as the Ventura River and Lake Casitas) during wet years while letting groundwater sources rest. During dry years, when the surface water sources are reduced, the City relies more heavily on groundwater sources to meet demands. Conjunctive use of groundwater sources is limited by the requirement to maintain long-term production from the groundwater basins within their safe or operational yield. Conjunctive use also requires treatment and blending ratios to meet water quality goals. The City also has an entitlement from the California State Water Project (SWP) of 10,000 acre-feet per year (AF/yr). To date the City has not received any of this water because there are no existing facilities to get the water directly into the City's distribution system. However, the City is currently working on the design of the State Water Interconnection Project that will enable the City to receive its State Water allocation through a connection to Calleguas Municipal Water District. Additionally, the City is currently in the planning and design phases for the proposed VenturaWaterPure Program, which includes diversion of tertiary treated effluent to a new Advanced Water Purification Facility for potable reuse. Construction of these Projects is expected to begin in 2023.

United Water Conservation District

In 1925, the founding organization of today's United Water Conservation District, the Santa Clara River Protection Association (Association), was formed to protect the runoff of the Santa Clara River from being exported outside the watershed. This effort was successful, and in 1927, the Association was reorganized into the Santa Clara Water Conservation District by vote of the county residents. In 1950, the voters approved the formation of the District under the State Water Conservation Act of 1931, as the United Water Conservation District, to recognize the projected population growth within the District and the need for a reliable water source. The Santa Clara Water Conservation District was then dissolved and the assets transferred to the District. This allowed the District to issue bonds in order to raise funding for construction of the Santa Felicia Dam, creating Lake Piru and other conservation facilities. The District is divided into seven divisions and is governed by an elected seven-member Board of Directors, serving four-year staggered terms.

The District covers approximately 214,000 acres in central Ventura County, California. The District's mission is to manage, protect, conserve, and enhance the water resources of the District and produce a reliable and sustainable supply of groundwater for the reasonable and beneficial use of all users. The District accomplished its mission by constructing, maintaining, and operating facilities along the Santa Clara River and its tributaries to replenishment to groundwater basins within its service area, including the Mound Basin.

Ventura County

The County of Ventura (County) was founded in 1873 and has a total area of 2,208 square miles. The County does not provide water service but does permit and regulate groundwater wells and staffs the Ventura County Watershed Protection District (VCWPD), which participates in countywide planning and management efforts on a variety of water resource programs, including water quality, storm water management, and flood control.

2.2 Description of Plan Area [§354.8]

This section provides a description of the Plan area, including a summary of jurisdictional areas and existing water-resources monitoring and management programs in Mound Basin.

2.2.1 Summary of Jurisdictional Areas and Other Features [§354.8(a)(1),(a)(2),(a)(3),(a)(4),(a)(5), and (b)]

> **§354.8 Description of Plan Area.** *Each Plan shall include a description of the geographic areas covered, including the following information:*
>
> ***(a)*** *One or more maps of the basin that depict the following, as applicable:*
>
> - ***(1)*** *The area covered by the Plan, delineating areas managed by the Agency as an exclusive Agency and any areas for which the Agency is not an exclusive Agency, and the name and location of any adjacent basins.*
> - ***(2)*** *Adjudicated areas, other Agencies within the basin, and areas covered by an Alternative.*
> - ***(3)*** *Jurisdictional boundaries of federal or state land (including the identity of the agency with jurisdiction over that land), tribal land, cities, counties, agencies with water management responsibilities, and areas covered by relevant general plans.*
> - ***(4)*** *Existing land use designations and the identification of water use sector and water source type.*
> - ***(5)*** *The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the Department, as specified in Section 353.2, or the best available information.*
>
> ***(b)*** *A written description of the Plan area, including a summary of the jurisdictional areas and other features depicted on the map.*

The geographic area covered by this GSP and managed by MBGSA includes the entire Mound Basin (DWR Basin No. 4-004.03), as defined by DWR Bulletin No. 118, “California’s Groundwater,” Update 2020 (DWR, 2021a). The extent of Mound Basin is shown on Figures 2.1-01 and 2.1-02. The Mound Basin is bordered by the Oxnard Subbasin (DWR Basin No. 4-004.02) to the south and the Santa Paula Subbasin (DWR Basin No. 4-004.04) to the east. The Oxnard Subbasin is managed by the Fox Canyon Groundwater Management Agency (FCGMA) pursuant to pre-SGMA legislation and SGMA. The Santa Paula Subbasin is adjudicated.

Figure 2.1-01 also delineates the jurisdictional boundaries of Ventura County, the City of San Buenaventura (Ventura), and other agencies with water management responsibilities in Mound Basin (specifically, United and Casitas MWD). Three of the four overlying agencies (Ventura County, City of Ventura, and United) are Member Agencies of the MBGSA JPA, as detailed in Section 2.1. More information about the water resource management roles of these agencies is provided in Section 2.2.2. There are no adjudicated areas located within the Mound Basin. State and Federal Land within the Mound Basin includes two State Beaches (San Buenaventura State Beach and McGrath State Beach [California Department of Parks and Recreation]) and The Channel Islands National Park Visitors Center (Department of Interior) (Figure2.1-03). The Mound Basin lies within the traditional tribal territory of the Chumash; however, there are no tribal trust lands located within the Basin.

Land use planning agencies in the Basin include the City of Ventura (within the City limits) and County of Ventura (unincorporated areas outside of the City limits) (Figure 2.1-03). The City of Oxnard overlies a very small area in the southwestern corner of the Basin and has land use planning jurisdiction there, although most of this area overlaps with McGrath State Beach (Figure 2.1-03). The Basin is covered by the general plans of the above-listed entities. Further details concerning land use are provided in Section 2.2.3.

The City of Ventura occupies much of the land area in Mound Basin and the single largest existing land use in the Basin (in terms of area) is low-density residential, as shown on Figure 2.1-03. Inspection of Figure 2.1-03 indicates that commercial, public/institutional, industrial, and related municipal land use designations also occupy much of Mound Basin. The water use sector for these land use designations is collectively referred to in this GSP as “municipal and industrial” (M&I). Sources of water for the M&I sector in Mound Basin include local groundwater pumped from City of Ventura wells in the Basin, groundwater pumped by the City of Ventura from the adjacent Santa Paula and Oxnard Basins, subsurface water pumped by the City from the Ventura River / the Upper Ventura River Basin (not an immediately adjacent basin), and surface water purchased from Casitas MWD. Details regarding sources and volumes of water used by the M&I and other sectors in Mound Basin is provided in Section 3.1.4.4.

Another water use sector and land use designation in Mound Basin is agricultural, which occupies three separate areas of farmland in the eastern and southwestern portions of Mound Basin (Figure 2.1-03). Sources of water for the agricultural sector in Mound Basin include local groundwater extracted from wells in the Basin and groundwater extracted from the adjacent Santa Paula and Oxnard basins.

The third major land use designation in Mound Basin is open space, consisting largely of undeveloped land in the Hillside Protection Area (Figure 2.1-03) in the foothills of the northern part of the Basin. Very little water is applied to land designated as open space in Mound Basin, although small quantities of water from the M&I sector may be applied to orchards, residential landscaping, and parks along the margins and within the open space-designated area.

Figure 2.2-04 shows the density of wells per square mile and locations of known agricultural and M&I water supply wells in the Basin. There are no known de minimis extractors in the Mound Basin. The communities within the Basin are partially dependent upon groundwater from the Mound Basin. The City of Ventura supplies water to the communities within the Basin and has a diverse water supply portfolio that includes groundwater and surface water supplies from outside of the Basin. Although Mound Basin groundwater is an important source of water supply for the communities located within the Basin, the communities are not considered to be exclusively dependent on Mound Basin groundwater because it is only one component of the City's water supply portfolio.

2.2.2 Water Resources Monitoring and Management Programs [§354.8(c) and (d)]

2.2.2.1 Existing Water Resource Monitoring Programs [§354.8(c) and (d)]

§354.8 Description of Plan Area. *Each Plan shall include a description of the geographic areas covered, including the following information:*

- ***(c)*** *Identification of existing water resource* ***monitoring*** *and management programs, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan.*
- ***(d)*** *A description of how existing water resource* ***monitoring*** *or management programs may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits.*

Existing water resources monitoring programs are listed in Table 2.2-01.

The water resources monitoring programs that have significant relevance to this GSP are the United, Ventura Water, and VCWPD groundwater resource monitoring programs. Details regarding groundwater monitoring locations (i.e., wells) and parameters monitored by these agencies/programs are provided in Section 5. In summary, United monitors groundwater quality and/or elevations in 20 wells across Mound Basin, while Ventura Water monitors their two active M&I water supply wells in the Basin, and VCWPD variably monitors two to four wells (currently or formerly used for agricultural and industrial water supply) in the Basin. VCWPD is the California Statewide Groundwater Elevation Monitoring (CASGEM) monitoring entity for the Basin. VCWPD compiles the groundwater level data gathered by Ventura County staff with that gathered by other agencies and uploads the data to the CASGEM website in accordance with CASGEM program requirements. VCWPD will continue in this role and provide data consistent with the CASGEM program. The MBGSA plans to continue coordinating with these other programs/agencies to obtain groundwater elevation and quality data to support GSP development, monitoring, and annual reporting, as detailed in Section 5.

As described in more detail in Sections 3.1 and 3.3, surface water is not diverted for beneficial uses from surface water bodies located within the Mound Basin. VCWPD monitors rainfall and surface water flow in selected streams (barrancas) in Mound Basin, as described in more detail in Sections 3.1, 3.2, and 3.3. VCWPD also monitors surface water flow in the Santa Clara River in the Oxnard Basin approximately 1.5 miles upstream from Mound Basin, as described in Sections 3.2 and 3.3. The City of Ventura monitors surface water quality in the Santa Clara River Estuary, pursuant to the discharge permit for the VWRF.

The existing water resource monitoring programs do not limit operational flexibility in the Basin.

2.2.2.2 Existing Water Resource Management Programs [§354.8(c) and (d)]

> ***§354.8 Description of Plan Area.*** *Each Plan shall include a description of the geographic areas covered, including the following information:*
>
> ***(c)*** *Identification of existing water resource monitoring and **management programs**, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan.*
>
> ***(d)*** *A description of how existing water resource monitoring or **management programs** may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits.*

Existing water resources management programs within the Basin are listed in Table 2.2-02. The key existing water resource management programs are described below.

City of Ventura Urban Water Management Plan and Related Planning Programs

The City's Urban Water Management Plan (Kennedy/Jenks Consultants, 2021a) describes their existing and planned sources of water supply and demand, as well as their water management programs. The City's 2020 Comprehensive Water Resources Report (Ventura Water, 2020b) provides updated information and projections on impacts of the City's water resources management program. Another related planning document is the City's Water Shortage Event Contingency Plan (Kennedy/Jenks Consultants, 2021b), which identifies actions to be taken during the various stages of a water shortage. The City's Urban Water Management Plan and related documents contain certain elements that reduce the likelihood of exceedances of the City's Mound Basin groundwater extraction projections used in the development of this GSP:

- **Demand Management Measures**: Existing and planned water conservation measures within the City of Ventura have resulted in reductions in M&I water use in Mound Basin, as described in Section 3.3. This reduced demand has been incorporated into the projections for future water use in Mound Basin in this GSP.

- **Recycled Water Reuse**: The City currently distributes approximately 564 AF/yr of treated recycled water for landscape and golf course irrigation (Kennedy/Jenks Consultants, 2021a). The City is currently in the planning phases for the proposed VenturaWaterPure Project, which includes additional diversion of tertiary treated effluent to a new Advanced Water Purification Facility for potable reuse. The future water supply that will be provided by the VenturaWaterPure Project is projected to be 2,800 AF/yr after 2025 and 4,000 AF/yr after 2030 (Ventura Water, 2020b; Kennedy/Jenks Consultants 2021a).

- **State Water Interconnection Project**: The City has a 10,000 AF/yr allocation from the California SWP. To date, the City has not constructed the improvements necessary to receive direct delivery of its allocation. Ventura Water is pursuing the State Water Interconnection Project with Calleguas MWD, Casitas MWD, and United. The projected available water supply for SWP water delivered by the State Water Interconnection Project is estimated to be 2,075-10,000 AF in 2025 and 0-10,000 AF in 2030 (Ventura Water, 2020b).

- **Water Shortage Event Contingency Plan (Kennedy/Jenks Consultants, 2021b)**: This plan provides criteria for when and how voluntary and mandatory water use restrictions are implemented during droughts or other emergency occurred that limited availability of water supply within the City's service area. The project will reduce the potential for increased City demand for Mound Basin groundwater.

The City of Ventura's Urban Water Management Plan (Kennedy/Jenks, 2021b) and related planning programs do not limit operational flexibility in the Basin.

Casitas MWD Urban Water Management and Agricultural Water Management Plan

Casitas MWD's 2020 update to its Urban Water Management and Agricultural Water Management Plan (Casitas MWD, 2021) describes their existing and planned sources of water supply and demand, as well as their water management programs. Casitas MWD provides surface water to the City of Ventura, some of which is imported to Mound Basin. Similar to the City of Ventura's Urban Water Management Plan, the Casitas MWD plan includes descriptions of their water-resource management programs, including:

- Water shortage contingency planning.
- Demand management measures.
- Planned expansion of their portfolio of water supplies (including imports from the California SWP).

Elements of Casitas MWD's Urban Water Management and Agricultural Water Management Plan were used to inform development of the City of Ventura's 2020 Comprehensive Water Resources Report (Ventura Water, 2020b), which in turn was used to project future water use in Mound Basin in this GSP.

Watersheds Coalition of Ventura County Integrated Regional Water Management Plan

The Integrated Regional Water Management Plan (IRWMP) prepared by the Watersheds Coalition of Ventura County (2019) includes several "resource management strategies" that have the potential to directly or indirectly affect water resources management in Ventura County, including the Santa Clara River Watershed and Mound Basin. Some of the management strategies listed in the IRWMP that could potentially affect water-resources management by the MBGSA include the following:

- **Reduce Water Demand**: Includes a list of agricultural water efficiency best-management practices (BMPs) for agriculture and notes that urban water use efficiency practices and standards are implemented by urban water suppliers in Urban Water Management Plans.
- **Improve Operational Efficiency and Transfers**: Summarizes the effects of conveyance projects (for importing water from other areas or within Mound Basin), system reoperation, and water transfers.
- **Increase Water Supply**: Describes the benefits of conjunctive-use projects, desalination of seawater or brackish water, precipitation enhancement, municipal recycled water use, surface storage.
- **Increase Water Supply**: Describes several actions or policies that can improve water quality, including drinking water treatment and distribution, groundwater and aquifer remediation, matching water quality to use, pollution prevention, salt and salinity management, and urban storm water runoff management.

- **Practice Resources Stewardship**: Provides definitions for, and summarizes benefits of, the following activities: agricultural lands stewardship, ecosystem restoration, forest management, land use planning and management, sediment management, and watershed management.
- **People and Water**: Describes approaches for engaging the public in water-resources management, including economic incentives, outreach and engagement, "water and culture," and water-dependent recreation.
- **Other Strategies**: Summarizes potential future sources of supply or strategies for improving water-resources management, including crop idling for water transfers, "dewvaporation" for atmospheric pressure desalination, fog collection, irrigated land retirement, "rainfed agriculture," snow fences (at higher elevations in the Santa Clara River watershed), and "waterbag" transport/storage technology (towing water by ship from other coastal regions in inflatable bladders).

These IRWMP management strategies are not anticipated to limit operational flexibility.

2.2.2.3 Conjunctive-Use Programs [§354.8(e)]

§354.8 Description of Plan Area. *Each Plan shall include a description of the geographic areas covered, including the following information:*
(e) *A description of conjunctive use programs in the basin.*

The City of Ventura's surface water imports to Mound Basin from Casitas MWD comprise a conjunctive-use program, as described in the Ventura Water (2020b) Comprehensive Water Resources Report:

> *"The City (of Ventura) operates its water supply system by utilizing a conjunctive use operating procedure. The City relies more heavily on surface water sources (such as the Ventura River and Lake Casitas) during wet years while letting groundwater sources rest. During dry years, when the surface water sources are reduced, the City relies more heavily on groundwater sources to meet demands. Conjunctive use of groundwater sources is limited by the requirement to maintain long-term production from the groundwater basins within their safe or operational yield. Conjunctive use also requires treatment and blending ratios to meet water quality goals."*

More detail regarding quantities and sources of Ventura Water's surface water use in Mound Basin is provided in Section 3.1 and 3.3. According to the Ventura Water (2020b) Comprehensive Water Resources Report, the City intends to continue their conjunctive use of surface water and groundwater into the foreseeable future. This conjunctive-use program has been incorporated into the projections for future water supply and demand in Mound Basin in this GSP.

United operates a conjunctive-use program in the Forebay area of the Oxnard Basin, adjacent to Mound Basin (Figure 2.1-02) consisting of artificial recharge of 60,000 to 70,000 AF/yr of surface water diverted from the Santa Clara River, followed by groundwater extraction by United and other groundwater users (United, 2018). As described in Section 3.3, artificial recharge by United during high-rainfall years raises groundwater levels in Oxnard Basin sufficiently to induce substantial volumes of groundwater underflow from Oxnard Basin to Mound Basin. This conjunctive-use program has been incorporated into the projected water budget for Mound Basin in this GSP (Section 3.3).

2.2.3 Land Use/General Plans

The Basin is dominated by residential, commercial, and industrial land uses located within incorporated areas of the City of Ventura and collectively accounts for approximately 58% of Basin land acreage (Figure 2.1-03). Residential uses vary between large rural parcels with few impervious surfaces to suburban and urban residential parcels associated with higher development densities and surrounded by more impervious surfaces, wider roads, and more sidewalks. Open space accounts for approximately 13% of Basin land acreage. The key area open space that is relevant to this GSP is the hillsides along the northern part of the Basin where the principal aquifers receive recharge (Figure 3.1-11). Agricultural land accounts for approximately 1,972 acres of the Basin (approximately 14% of the Basin land area) (Figure 2.1-03). Agricultural land is not located in any key Basin recharge areas.

2.2.3.1 Land Use and General Plans Summary [§354.8(f)(1),(f)(2),(f)(3), and (f)(5)]

> **§354.8 Description of Plan Area.** *Each Plan shall include a description of the geographic areas covered, including the following information:*
>
> ***(f)*** *A plain language description of the land use elements or topic categories of applicable general plans that includes the following:*
>
> - ***(1)*** *A summary of general plans and other land use plans governing the basin.*
> - ***(2)*** *A general description of how implementation of existing land use plans may change water demands within the basin or affect the ability of the Agency to achieve sustainable groundwater management over the planning and implementation horizon, and how the Plan addresses those potential effects.*
> - ***(3)*** *A general description of how implementation of the Plan may affect the water supply assumptions of relevant land use plans over the planning and implementation horizon.*
> - ***(5)*** *To the extent known, the Agency may include information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management.*

California state law requires that cities and counties prepare and adopt a “comprehensive long-term general plan for the physical development of the county or city” and that “elements and parts [of the plan] comprise an integrated, internally consistent and compatible statement of policies for the adopting agency” (California Government Code, §65300 and §65300.5). Among the required elements of the plan is the conservation, development, and utilization of water developed in coordination with groundwater agencies such as MBGSA (California Government Code, §65302[d][1]).

All existing general plans and future updates undergo an analysis of environmental impacts under the California Environmental Quality Act (CEQA). In addition, all discretionary projects proposed within the Mound Basin under municipal, County, and/or state jurisdiction are required to comply with CEQA. In 2019, the Governor’s Office of Planning and Research released an update to the CEQA Guidelines that included a new requirement to analyze projects for their compliance with adopted GSPs. Specifically, the applicable significance criteria include the following:

- Would the program or project substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?
- Would the program or project conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

Therefore, to the extent general plans allow growth that could have an impact on groundwater supply, such projects would be evaluated for their consistency with adopted GSPs and for whether they adversely impact the sustainable management of the Basin. Under CEQA, potentially significant impacts identified must be avoided or substantially minimized unless significant impacts are unavoidable, in which case the lead agency must adopt a statement of overriding considerations.

The following sections contain a description of the land use plans that are applicable to sustainable groundwater management planning within the Mound Basin, a discussion of the consideration given to the land use plans, and an assessment of how the GSP may affect those plans. The plans included were selected as the plans with the most salient information relating to sustainable management. General plans are considered applicable to the GSP to the extent that they may change water demands within the Mound Basin or affect the ability of the GSA to achieve sustainable groundwater management over the planning and implementation horizon.

General Plans applicable to the Mound Basin are the City of Ventura General Plan (City of Ventura, 2005) and the Ventura County General Plan (County of Ventura, 2020). Most of the Basin falls within incorporated areas of the City of Ventura (Figure 2.1-01). The unincorporated areas within the Basin include mostly agricultural land use and open space that fall under the County of Ventura's General Plan, although the agricultural areas also fall within the planning area addressed in the City of Ventura's General Plan. A small area (0.5 square miles) of the Basin falls within the City of Oxnard's planning area, but implementation of this general plan (City of Oxnard, 2014) is expected to have a negligible effect on GSP implementation in the Mound Basin.

In addition to the General Plans, it is important to understand that the agricultural land and open space in the Basin lies is subject to the City of Ventura and County of Ventura Save Open Space and Agricultural Resources (SOAR) voter initiatives currently approved through 2050 (SOAR, 2015). The SOAR initiatives require a majority vote of the people to rezone unincorporated open space, agricultural, or rural land for development. In addition to the SOAR initiatives, the City of Ventura Hillside Voter Participation Area Act (HVPAA), also approved through 2050, requires voter approvals for development or the extension of City urban services into the hillsides. The existence of the SOAR and HVPPA make it very unlikely that a material change in land use will occur during the foreseeable future. Because agricultural land and open space is not expected to convert to other uses, it is assumed that there is little potential for new development that could impact basin recharge or water demands. These assumptions will be revisited during each 5-year GSP assessment.

2005 Ventura General Plan

The current version of the City of Ventura's General Plan was adopted in 2005 (City of Ventura, 2005), which has a planning horizon of 2025. The City of Ventura launched the first phase to update its General Plan in November 2020.

Most of the Basin falls within the incorporated limits of the City of Ventura, which consists of predominantly residential, commercial, and industrial land uses (Figure 2.1-03). Present City policy does not include specific growth targets and instead promotes a “Smart Growth” approach that emphasizes creating a “well-planned and designed community” and preserving open space and farmland. The plan calls for measured and appropriate growth in Ventura by prioritizing areas appropriate for additional development based on community values and infrastructure potential. Importantly, the plan emphasizes an “Infill First” strategy to help avoid sacrificing farmland and sensitive areas in hillsides, which lie predominantly at the edges of the City. Most growth is anticipated to occur within the existing City limits in the “Infill” areas. The development potential within the remainder of the City is very limited. Growth in open space and agricultural areas is unlikely to occur given the City’s General Plan policies and the involvement of groups such as SOAR and HVPPA.

As of December 2019, there are 47 infill development projects that are either approved or under construction. The estimated water demand for these projects is 921 AF/yr, and these demands are included into City’s forecasts cited elsewhere in this GSP. Going forward, development is not expected to impact water demand for groundwater in the Mound Basin because the City’s Water Rights Dedication and Water Resource Net Zero Fee Ordinance and Resolution (“Net Zero Policy”) adopted June 6, 2016, requires all new and intensified development to offset the demand associated with its impact on the City’s potable water system.

Offsets can take the form of water rights dedication (i.e. transfer existing rights to extract groundwater from the Mound Basin or the adjacent Oxnard or Santa Paula basins) or payment of a fee that funds development of new City water supplies. Future water supplies include VenturaWaterPure (potable reuse of advanced treated tertiary treated effluent from the VWRF and an interconnection with Calleguas MWD that will allow the City to access its 10,000 AF/yr Table A entitlement from the California SWP. Infill development is expected to have a very small impact on groundwater because the total area with infill potential is small, infill areas are not located in the principal recharge area of the Basin, and because the General Plan includes a policy to helps maintain groundwater recharge:

- Action 5.16: Require new developments to incorporate storm water treatment practices that allow percolation to the underlying aquifer and minimize offsite surface runoff utilizing methods such as pervious paving material for parking and other paved areas to facilitate rainwater percolation and retention/detention basins that limit runoff to pre-development levels.

Approximately 556 acres of agricultural lands within the Basin is located within the City’s sphere of influence in the eastern part of the Basin (approximately 4% of the Basin land area) (Figure 2.1-01). Another 1,267 acres of agricultural land within the Basin is located outside of the City’s sphere of influence in the western part of the Basin (approximately 9% of the Basin land area) (Figure 2.1-01).

The City of Ventura’s General Plan (City of Ventura, 2005) includes numerous elements that discourage development of agricultural land:

- **Policy 3C**: Maximize use of land in the city before considering expansion
- **Action 3.14**: Utilize infill, to the extent possible
- **Policy 3D**: Continue to preserve agricultural and other open space lands within the City’s Planning Area

- **Action 3.20**: Pursuant to SOAR, adopt development code provisions to “preserve agricultural and open space lands as a desirable means of shaping the City’s internal and external form and size, and of serving the needs of the residents.

The key area open space that is relevant to this GSP is the hillsides along the northern part of the Basin where the principal aquifers receive recharge (Figure 3.1-11). The hillsides open space lies predominantly outside of the incorporated limits of the City and the City’s sphere of influence (Figure 2.1-01). Nonetheless, the City’s General Plan includes numerous elements that discourage development in this area:

- **Policy 1B**: Increase the area of open space protected from development impacts.
- **Action 1.12**: Update the provisions of the Hillside Management Program as necessary to ensure protection of open space lands.
- **Action 1.13**: Recommend that the City’s Sphere of Influence boundary be coterminous with the existing City limits in the hillsides in order to preserve the hillsides as open space.
- **Action 1.14**: Work with established land conservation organizations toward establishing a Ventura hillsides preserve.
- **Action 1.15**: Actively seek local, State, and federal funding sources to achieve preservation of the hillsides.

As mentioned earlier, the existence of the SOAR and HVPPA make it very unlikely that a material amount of open space or agricultural land will be developed during the foreseeable future. Because agricultural land and open space is not expected to convert to other uses, it is assumed that there is little potential for new development in these areas that could impact basin recharge or water demands. These assumptions will be revisited during each 5-year GSP assessment.

County of Ventura 2040 General Plan

The Ventura County 2040 General Plan (County of Ventura, 2020) applies to the County as a whole and includes area-specific plans for distinct unincorporated areas.

The key recharge area that is relevant to this GSP is the open space on the hillsides along the northern part of the Basin where the principal aquifers receive recharge (Figure 3.1-11). The hillsides open space lies predominantly outside of the incorporated limits of the City and the City’s sphere of influence and is included in the Ventura County 2040 General Plan (Figure 2.1-01).

The Ventura County 2040 General Plan also applies to the approximate 1,267 acres of agricultural land located outside of the City and its sphere of influence in the western part of the Basin (Figure 2.1-01). Although these open space and agricultural areas are located outside of the City’s sphere of includes, any future development would very likely involve annexation to the City. The County’s General Plan includes numerous elements that discourage development in the open space and agricultural areas and/or continued viability of agricultural activities on agricultural land.

Guiding Principle - Land Use and Community Character: Direct urban growth away from agricultural, rural, and open space lands, in favor of locating it in cities and unincorporated communities where public facilities, services, and infrastructure are available or can be provided.

Guiding Principle - Conservation and Open Space: Conserve and manage the County's open spaces and natural resources, including soils, water, air quality, minerals, biological resources, scenic resources, as well as historic and cultural resources.

Guiding Principle - Agriculture: Promote the economic vitality and environmental sustainability of Ventura County's agricultural economy by conserving soils/land while supporting a diverse and globally competitive agricultural industry that depends on the availability of water, land, and farmworker housing.

WR-6: To sustain the agricultural sector by ensuring an adequate water supply through water efficiency and conservation.

WR-6.1 - Water for Agricultural Uses: The County should support the appropriate agencies in their efforts to effectively manage and enhance water quantity and quality to ensure long-term, adequate availability of high quality and economically viable water for agricultural uses, consistent with water use efficiency programs.

WR-6.2 Agricultural Water Efficiency: The County should support programs designed to increase agricultural water use efficiency and secure long-term water supplies for agriculture.

WR-6.3 Reclaimed Water Use: The County should encourage the use of reclaimed irrigation water and treated urban wastewater for agricultural irrigation in accordance with federal and state requirements in order to conserve untreated groundwater and potable water supplies.

from the Ventura County 2040 General Plan

The Ventura County 2040 General Plan includes a Saticoy Area Plan for the unincorporated community of Saticoy located at the southeastern “tip” of the Basin (Figure 2.1-03). Saticoy is already largely developed (residential and industrial); thus, the Saticoy Area Plan focuses on redevelopment aspects. Saticoy’s water service is provided by the City of Ventura. Thus, City of Ventura water supply policies apply in Saticoy, meaning that any new or intensified development would be required to be water neutral. The Saticoy Area overlaps with a very small area of the Basin and is not located in a key recharge area. Based on the foregoing, land use planning in the Saticoy Area will not have a significant impact in this GSP.

The Ventura County 2040 General Plan (County of Ventura, 2020) includes numerous elements designed to facilitate coordinated planning with MBGSA, maintain groundwater recharge, protect groundwater quality, and conserve groundwater resources.

WR-1: To effectively manage water supply by adequately planning for the development, conservation, and protection of water resources for present and future generations.

WR-1.1 - Sustainable Water Supply: The County should encourage water suppliers, groundwater management agencies, and groundwater sustainability agencies to inventory and monitor the quantity and quality of the county’s water resources, and to identify and implement measures to ensure a sustainable water supply to serve all existing and future residents, businesses, agriculture, government, and the environment.

WR-1.2 - Watershed Planning: The County shall consider the location of a discretionary project within a watershed to determine whether or not it could negatively impact a water source. As part of discretionary project review, the County shall also consider local watershed management plans when considering land use development.

WR-1.3 - Portfolio of Water Sources: The County shall support the use of, conveyance of, and seek to secure water from varied sources that contribute to a diverse water supply portfolio. The water supply portfolio may include, but is not limited to, imported water, surface water, groundwater, treated brackish groundwater, desalinated seawater, recycled water, and storm water where economically feasible and protective of the environmental and public health.

WR-1.4 - State Water Sources: The County shall continue to support the conveyance of, and seek to secure water from, state sources.

WR-1.5 - Agency Collaboration: The County shall participate in regional committees to coordinate planning efforts for water and land use that is consistent with the Urban Water Management Planning Act, Sustainable Groundwater Management Act, the local Integrated Regional Water Management Plan, and the Countywide National Pollutant Discharge Elimination System Permit (storm water and runoff management and reuse).

WR-1.6 - Water Supplier Cooperation: The County shall encourage the continued cooperation among water suppliers in the county, through entities such as the Association of Water Agencies of Ventura County and the Watersheds Coalition of Ventura County, to ensure immediate and long-term water needs are met efficiently.

WR-1.7 - Water Supply Inter-Ties: The County shall encourage the continued cooperation among water suppliers in the county, through entities such as Association of Water Agencies of Ventura County and the Watersheds Coalition of Ventura County, to establish and maintain emergency inter-tie projects among water suppliers.

WR-1.9 - Groundwater Basin Use for Water Storage: Where technically feasible, the County shall support the use of groundwater basins for water storage.

WR-1.10 - Integrated Regional Water Management Plan: The County shall continue to support and participate with the Watersheds Coalition of Ventura County in implementing and regularly updating the Integrated Regional Water Management Plan.

WR-1.11 - Adequate Water for Discretionary Development: The County shall require all discretionary development to demonstrate an adequate long-term supply of water.

WR-1.12 - Water Quality Protection for Discretionary Development: The County shall evaluate the potential for discretionary development to cause deposition and discharge of sediment, debris, waste and other pollutants into surface runoff, drainage systems, surface water bodies, and groundwater. The County shall require discretionary development to minimize potential deposition and discharge through point source controls, storm water treatment, runoff reduction measures, best management practices, and low impact development.

WR-1.14 - Discretionary Development and Conditions of Approval: Golf Course Irrigation: The County shall require that discretionary development for new golf courses shall be subject to conditions of approval that prohibit landscape irrigation with water from groundwater basins or inland surface waters identified as Municipal and Domestic Supply or Agricultural Supply in the California Regional Water Quality Control Board's Water Quality Control Plan unless:

1. The existing and planned water supplies for a Hydrologic Area, including interrelated Hydrologic Areas and Subareas, are shown to be adequate to meet the projected demands for existing uses as well as reasonably foreseeable probable future uses within the area; and
2. It is demonstrated that the total groundwater extraction/recharge for the golf course will be equal to or less than the historic groundwater extraction/recharge for the site as defined in the County Initial Study Assessment Guidelines.

Further, where feasible, reclaimed water shall be utilized for new golf courses.

WR-2: To implement practices and designs that improve and protect water resources.

WR-2.1 - Identify and Eliminate of Sources of Water Pollution: The County shall cooperate with Federal, State and local agencies in identifying and eliminating or minimizing all sources of existing and potential point and non-point sources of pollution to ground and surface waters, including leaking fuel tanks, discharges from storm drains, dump sites, sanitary waste systems, parking lots, roadways, and mining operations.

WR-2.2 - Water Quality Protection for Discretionary Development: The County shall evaluate the potential for discretionary development to cause deposition and discharge of sediment, debris, waste, and other contaminants into surface runoff, drainage systems, surface water bodies, and groundwater. In addition, the County shall evaluate the potential for discretionary development to limit or otherwise impair later reuse or reclamation of wastewater or storm water. The County shall require discretionary development to minimize potential deposition and discharge through point source controls, storm water treatment, runoff reduction measures, best management practices, and low impact development.

WR-2.3 - Discretionary Development Subject to CEQA Statement of Overriding Considerations – Water Quality and Quantity: The County shall require that discretionary development not significantly impact the quality or quantity of water resources within watersheds, groundwater recharge areas or groundwater basins.

WR-3: To promote efficient use of water resources through water conservation, protection, and restoration.

WR-3.1 - Non-Potable Water Use: The County shall encourage the use of non-potable water, such as tertiary treated wastewater and household graywater, for industrial, agricultural, environmental, and landscaping needs consistent with appropriate regulations.

WR-3.2 - Water Use Efficiency for Discretionary Development: The County shall require the use of water conservation techniques for discretionary development, as appropriate. Such techniques include low-flow plumbing fixtures in new construction that meet or exceed the California Plumbing Code, use of graywater or reclaimed water for landscaping, retention of storm water runoff for direct use and/or groundwater recharge, and landscape water efficiency standards that meet or exceed the standards in the California Model Water Efficiency Landscape Ordinance.

WR-3.3 - Low-Impact Development: The County shall require discretionary development to incorporate low impact development design features and best management practices, including integration of storm water capture facilities, consistent with County's Storm water Permit.

WR-3.4 - Reduce Potable Water Use: The County shall strive for efficient use of potable water in County buildings and facilities through conservation measures, and technological advancements.

WR-4: To maintain and restore the chemical, physical, and biological integrity and quantity of groundwater resources.

WR-4.1 - Groundwater Management: The County shall work with water suppliers, water users, groundwater management agencies, and groundwater sustainability agencies to implement the Sustainable Groundwater Management Act (SGMA) and manage groundwater resources within the sustainable yield of each basin to ensure that county residents, businesses, agriculture, government, and the environment have reliable, high-quality groundwater to serve existing and planned land uses during prolonged drought years.

WR-4.2 - Important Groundwater Recharge Area Protection: In areas identified as important recharge areas by the County or the applicable Groundwater Sustainability Agency, the County shall condition discretionary development to limit impervious surfaces where feasible and shall require mitigation in cases where there is the potential for discharge of harmful pollutants within important groundwater recharge areas.

WR-4.3 - Groundwater Recharge Projects: The County shall support groundwater recharge and multi-benefit projects consistent with the Sustainable Groundwater Management Act and the Integrated Regional Water Management Plan to ensure the long-term sustainability of groundwater.

WR-4.4 - In-Stream and Recycled Water Use for Groundwater Recharge: The County shall encourage the use of in-stream water flow and recycled water for groundwater recharge while balancing the needs of urban and agricultural uses, and healthy ecosystems, including in-stream waterflows needed for endangered species protection.

WR-4.5 - Discretionary Development Subject to CEQA Statement of Overriding Considerations – Water Quantity and Quality: The County shall require that discretionary development shall not significantly impact the quantity or quality of water resources within watersheds, groundwater recharge areas or groundwater basins.

WR-4.7 - Discretionary Development and Conditions of Approval – Oil, Gas, and Water Wells: The County shall require that discretionary development be subject to conditions of approval requiring proper drilling and construction of new oil, gas, and water wells and removal and plugging of all abandoned wells on-site.

WR-4.8 - New Water Wells: The County shall require all new water wells located within Groundwater Sustainability Agency (GSA) boundaries to be compliant with GSAs and adopted Groundwater Sustainability Plans (GSPs).

WR-5: To protect and, where feasible, enhance watersheds and aquifer recharge areas through integration of multiple facets of watershed-based approaches.

WR-5.1 - Integrated Watershed Management: The County shall work with water suppliers, Groundwater Sustainability Agencies (GSAs), wastewater utilities, and storm water management entities to manage and enhance the shift toward integrated management of surface and groundwater, storm water treatment and use, recycled water and conservation, and desalination.

WR-5.2 - Watershed Management Funding: The County shall continue to seek funding and support coordination of watershed planning and watershed-level project implementation to protect and enhance local watersheds.

WR-7.1 - Water for the Environment: The County shall encourage the appropriate agencies to effectively manage water quantity and quality to address long-term adequate availability of water for environmental purposes, including maintenance of existing groundwater-dependent habitats and in-stream flows needed for riparian habitats and species protection.

from the Ventura County 2040 General Plan

City of Oxnard 2030 General Plan

A small area (0.5 square miles) in the southwestern corner the Basin lies within the City of Oxnard's planning boundary (Figure 2.1-01) (City of Oxnard, 2014). This area consists of the last approximately 1 mile of the Santa Clara River, including its estuary. This area is designated "Resource Protection" and "Recreation" (a small area lies within the McGrath State Beach). Due to the very small area and the land use designations, it is very unlikely that the land use in this area will change or that groundwater wells would be drilled. Based on the foregoing, it appears this area will not have a material impact on this GSP; and, for this reason, the City of Oxnard's General Plan is not discussed further in this GSP.

2.2.3.1.1 How Land Use Plans May Impact Water Demands and Sustainable Groundwater Management [§354.8(f)(2)]

§354.8 Description of Plan Area. *Each Plan shall include a description of the geographic areas covered, including the following information:*

- ***(f)*** *A plain language description of the land use elements or topic categories of applicable general plans that includes the following:*
  - ***(2)*** *A general description of how implementation of existing land use plans may change water demands within the basin or affect the ability of the Agency to achieve sustainable groundwater management over the planning and implementation horizon, and how the Plan addresses those potential effects.*

This GSP is not anticipated to be impacted by the City of Ventura or County of Ventura land use plans. The general plans already include policies that protect the key recharge area in the Basin (open space in the hillsides along the northern part of the Basin). Open space in the key recharge area is further protected from development by SOAR and HVPPA. Development allowed pursuant to the general plans will not create new demands for Mound Basin groundwater because growth will likely occur within the City of Ventura (within incorporated area or through annexation), making it subject to the City's Net Zero Policy. The Net Zero Policy requires that new water demands for development projects be met by a dedication of an existing water right (i.e. transfer existing rights to extract groundwater from the Mound Basin or the adjacent Oxnard or Santa Clara basins) or payment of a fee that funds development of new City water supplies. Future City of Ventura water supplies under development include VenturaWaterPure (potable reuse of advanced treated tertiary treated effluent from the VWRF) and an interconnection with Calleguas MWD that will allow the City to access its 10,000 AF/yr Table A entitlement from the California SWP.

2.2.3.1.2 How Sustainable Groundwater Management May Affect Water Supply Assumptions of Land Use Plans [§354.8(f)(3)]

> **§354.8 Description of Plan Area.** *Each Plan shall include a description of the geographic areas covered, including the following information:*
>
> ***(f)*** *A plain language description of the land use elements or topic categories of applicable general plans that includes the following:*
>
> ***(3)*** *A general description of how implementation of the Plan may affect the water supply assumptions of relevant land use plans over the planning and implementation horizon.*

This GSP is not anticipated to impact land use plans by the City or County of Ventura because the estimated sustainable yield of the Basin is sufficient to supply planned groundwater extraction in the Basin, and any new water demands resulting from development will be offset pursuant to the City of Ventura's Net Zero Policy by dedication of an existing water right (i.e. transfer existing rights to extract groundwater from the Mound Basin or the adjacent Oxnard or Santa Clara basins) or payment of a fee that funds development of new City water supplies. In short, land use planning for the Mound Basin is not constrained by the Mound Basin sustainable yield.

The GSP will not impact land use plans elements that address recharge areas because the key recharge area is open space in the hillsides along the northern part of the Basin that is already protected from development by City of Ventura and County of Ventura General Plan policies, SOAR, and HVPPA.

2.2.3.1.3 Impact of Land Use Plans Outside of Basin on Sustainable Groundwater Management [§354.8(f)(5)]

> **§354.8 Description of Plan Area.** *Each Plan shall include a description of the geographic areas covered, including the following information:*
>
> ***(f)*** *A plain language description of the land use elements or topic categories of applicable general plans that includes the following:*
>
> ***(5)*** *To the extent known, the Agency may include information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management.*

Land use planning for the areas immediately surrounding Mound Basin is addressed in the Ventura County 2040 General Plan (County of Ventura, 2020), described in Section 2.2.3.1. This GSP is not anticipated to be impacted by the County of Ventura 2040 General Plan for the same reasons described in Section 2.2.3.1.1.

2.2.3.2 Well Permitting [§354.8(f)(4)]

> **§354.8 Description of Plan Area.** *Each Plan shall include a description of the geographic areas covered, including the following information:*
>
> ***(f)*** *A plain language description of the land use elements or topic categories of applicable general plans that includes the following:*
>
> ***(4)*** *A summary of the process for permitting new or replacement wells in the basin, including adopted standards in local well ordinances, zoning codes, and policies contained in adopted land use plans.*

Water well permits are obtained from the Ventura County Groundwater Section, a division of Ventura County Public Works Department. Water well permits are issued pursuant to the requirements of Ventura County Water Well Ordinance No. 4468. The Ventura County Groundwater Section oversees compliance with County Water Well Ordinance No. 4468 which is inclusive of California's Water Well Standards Bulletins 74-9, 74-81, and 74-90. Additionally, groundwater production wells within the City limits of the City of Ventura require a water well agreement with the City of Ventura pursuant to Chapter 8.150 of the San Buenaventura Municipal Code. The Ventura County Groundwater Section monitors and enforces these standards by requiring drilling contractors with a valid C-57 license to submit permit applications for the construction, modification, reconstruction (i.e., deepening), or destruction of any well within their jurisdiction and through inspections. Pursuant to the County of Ventura 2040 General Plan (County of Ventura, 2020), Ventura County Groundwater Section will review the MBGSA's GSP and related resolutions and ordinances to ensure the compliance with MBSGA requirements prior to issuing a water well permit within the boundary of the Mound Basin.

In addition to County Water Well Ordinance 4468, the County of Ventura 2040 General Plan includes the following policies on well permitting:

- **WR-4.7 - Discretionary Development and Conditions of Approval – Oil, Gas, and Water Wells**: The County shall require that discretionary development be subject to conditions of approval requiring proper drilling and construction of new oil, gas, and water wells and removal and plugging of all abandoned wells on-site.
- **WR-4.8 - New Water Wells**: The County shall require all new water wells located within Groundwater Sustainability Agency (GSA) boundaries to be compliant with GSAs and adopted Groundwater Sustainability Plans (GSPs).

2.2.4 Additional Plan Elements [§354.8(g)]

> **§354.8 Description of Plan Area.** *Each Plan shall include a description of the geographic areas covered, including the following information:*
>
> ***(g)*** *A description of any of the additional Plan elements included in Water Code Section 10727.4 that the Agency determines to be appropriate.*

GSP Emergency Regulations [§354.8(g) allows GSAs to include certain "additional plan elements" in the GSP, including:

(a) Control of saline water intrusion.

(b) Wellhead protection areas and recharge areas

(c) Migration of contaminated groundwater.

(d) A well abandonment and well destruction program.

(e) Replenishment of groundwater extractions.

(f) Activities implementing, opportunities for, and removing impediments to, conjunctive use or underground storage.

(g) Well construction policies.

(h) Measures addressing groundwater contamination cleanup, groundwater recharge, in-lieu use, diversions to storage, conservation, water recycling, conveyance, and extraction projects.

(i) Efficient water management practices, as defined in §10902 , for the delivery of water and water conservation methods to improve the efficiency of water use.

(j) Efforts to develop relationships with state and federal regulatory agencies.

(k) Processes to review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity.

(l) Impacts on groundwater-dependent ecosystems (GDEs).

MBGSA determined that the following additional plan elements are appropriate to include in this GSP:

- (d) Well Destruction Program: MBGSA will seek to destroy improperly abandoned or constructed wells that act as conduits for migration of poor-quality water from shallow water-bearing units into the principal aquifers. This additional plan element is included in the groundwater quality protection measures management action, which is described in Section 6.5.
- (g) Well Construction Policies: MBGSA will coordinate with the County of Ventura to ensure new wells are properly constructed to prevent migration of poor-quality water from shallow water-bearing units into the principal aquifers. This additional plan element is included in the groundwater quality protection measures management action, which is described in Section 6.5.
- (j) Efficient water management practices, as defined in §10902 , for the delivery of water and water conservation methods to improve the efficiency of water use: MBGSA will seek opportunities to encourage, promote, and support efforts to increase agricultural water use efficiency.
- (k) Processes to review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity: MBGSA will coordinate with the City of Ventura concerning its General Plan update initiated in November 2020. MBGSA will participate in future general plan updates by the County of Ventura and City of Ventura.

2.3 Notice and Communication [§354.10]

Mound Basin is a relatively small basin with only 26 active wells extracting an average of approximately 6,300 AF/yr. Twenty-two wells supply agricultural beneficial users who formed the Mound Basin Agricultural Water Group (MBAWG) to provide organized input on the GSP. MBAWG selects the Agricultural Stakeholder Director on the MBGSA Board of Directors and the Agency's Stakeholder Engagement Plan (SEP) (Appendix D) specifically charges the Agricultural Stakeholder Director with engaging the Basin's agricultural users of groundwater and representing their interests before the Agency. The remaining wells supply municipal and industrial uses, chiefly the City of Ventura, which has a Director seat on the MBGSA Board of Directors. Thus, all the groundwater users in the Basin except the two industrial well owners have direct representation in the SGMA process by virtue of a director on the MBGSA Board of Directors. There are no active or recently active domestic wells in the Basin. All potable water in the Basin, including that used by disadvantaged communities (DACs) is supplied by the City of Ventura.

In addition to the high degree of direct stakeholder representation on the MBGSA Board of Directors, the MBGSA found it important to develop and implement a SEP to seek, encourage, and consider as much public input on the GSP as possible and to ensure compliance with SGMA requirements (Appendix D). The SEP is tailored to the specific stakeholder landscape of the Basin. The SEP encourages the active involvement of individual stakeholders and stakeholder organizations and other interested parties in the development and implementation of the GSP for the Mound Basin (Appendix D). The SEP was designed and developed to ensure compliance with Water Code §10723.2, which requires GSA to "consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing groundwater sustainability plans." The SEP identifies stakeholders, stakeholder outreach and engagement methodologies, opportunities for integration with other overlapping local programs and planning processes, and the public meeting process used by the GSA. The SEP guides notice and communication activities during GSP development and will continue to serve as a guide during GSP implementation. The following subsections provide a summary of information relating to notification and communication by MBGSA with other agencies and interested parties, as required by the GSP Emergency Regulations.

2.3.1 Beneficial Uses and Users [§354.10(a)]

§354.10 Notice and Communication. *Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:*

(a) A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.

Water Code §10723.2 requires MBGSA to consider the interests of all beneficial uses and users of groundwater within the Basin. These interests are listed below with a description of the nature of MBGSA's consultation with them.

- **Holders of Overlying Groundwater Rights:**
  - **Agricultural Users**: There are agricultural users of groundwater operating on land overlying the Basin. To account for these users' interests, the Agency designated a seat on its five-member governing board to be filled by an Agricultural Stakeholder Director. The Agricultural Stakeholder Director is appointed from nominations received by MBAWG or the Ventura County Farm Bureau. The Agricultural Stakeholder Director is responsible for engaging the Basin's agricultural users of groundwater and representing their interests before the Agency.
  - **Domestic Well Owners**: No domestic wells were identified during development of the GSP, as confirmed by the County of Ventura, the local well permitting agency. The lack of domestic wells is likely due to the availability of potable water from Ventura Water (City of Ventura) and the significant expense required to drill a domestic water supply well to the depth required to reach a principal aquifer in Mound Basin. Available data suggest that shallow groundwater above the principal aquifers is not suitable for potable use (Figures

3.1-21 and -22). For these reasons, it is not anticipated that domestic wells will be drilled in the future.

- **Industrial Users**: Two industrial wells have been identified in the Basin: Saticoy Lemon Association (lemon-packing facility cooperative) and Ivy Lawn Cemetery Association. Given Saticoy Lemon Association's ties to agriculture, the Agricultural Stakeholder Director is responsible for engaging this stakeholder. The Executive Director is responsible for engaging Ivy Lawn Memorial Park and met with its Board on February 19, 2020.
- **Other Users**: The County of Ventura operates a well for landscape irrigation at the County Government Center. The County is represented on the Agency's Board of Directors.

- **Municipal Well Operators:** The Agency is a JPA created by three local public agencies. One of the Agency's signatory members, the City of San Buenaventura, operates municipal wells within the Basin and is represented on the Agency's Board of Directors.
- **Public Water Systems:**
    - Ventura Water (City of San Buenaventura) operates a public water system serving residents and business within and surrounding the City. The City of San Buenaventura is a signatory member to the JPA Agreement forming the Agency and is represented on the Agency's Board of Directors.
    - Casitas MWD is a wholesale water agency that provides a portion of the potable water supplied by Ventura Water within the Basin. Casitas MWD's service area overlaps with a western portion of the Basin. However, Casitas MWD does not operate any facilities in the Basin because Ventura Water's connection to Casitas MWD is located several miles north of the Basin.
- **Local Land Use Planning Agencies:**
    - The County of Ventura has land use planning authority on unincorporated land overlying the Basin (Figure 2.1-01). The County is a signatory member to the MBGSA JPA Agreement and is represented on the Agency's Board of Directors.
    - The City of Ventura has land use planning authority on incorporated land overlying the Basin (Figure 2.1-01). The City is a signatory member to the MBGSA JPA Agreement and is represented on the Agency's Board of Directors.
    - The City of Oxnard has land use planning authority over a small (0.5 square miles) area in the southwestern corner the Basin (Figure 2.1-01). This area consists of the last approximately 1 mile of the Santa Clara River, including its estuary. This area is designated "Resource Protection" and "Recreation" (a small area lies within the McGrath State Beach). Due to the very small area and the land use designations, it is very unlikely that the land use in this area will change or that groundwater wells would be drilled. Thus, MBGSA concluded that the land use planning by the City of Oxnard will not have a material impact on this GSP.
- **Environmental Users of Groundwater:** There are several environmental organizations dedicated to preserving and maintaining environmental values operating within the boundaries of the Basin. To account for these users' interests, the Agency designated a seat on its five-

member governing board to be filled by an Environmental Stakeholder Director. The Environmental Stakeholder Director is appointed from nominations received from local environmental nonprofit organizations supportive of the Basin's groundwater sustainability. The Environmental Stakeholder Director is responsible for engaging stakeholders within the Basin and representing environmental interests before the Agency.

  - Environmental beneficial uses in the Basin include instream flow uses in interconnected reaches of the lower Santa Clara River and its Estuary and the associated GDE identified as GDE Area 11. However, these beneficial uses are not impacted by groundwater extraction because there is no groundwater extraction from the shallow groundwater units (a.k.a. Shallow Alluvial Deposits) and groundwater extraction from principal aquifers (Mugu and Hueneme aquifers) does not materially influence shallow groundwater levels or surface water flows (see Appendix G for explanation).

- **Surface Water Users:** There are no permitted or licensed surface water diversions in the Basin. Instream beneficial uses are described in the preceding bullet.
- **The Federal Government:** Not applicable because there is no federal land within the Basin.
- **California Native American Tribes:** The Mound Basin lies within the traditional tribal territory of the Chumash; however, there are no tribal trust lands located within the Basin. The Agency ensured that a representative of overlying California Native American tribes was on the Agency's interested parties list, in order to receive notices of all Agency meetings and other stakeholder involvement opportunities.
- **Disadvantaged Communities:** There are no domestic wells, community water supply wells, or mutual water companies serving water to DACs or Severely Disadvantaged Communities (SDACs) in the Basin. The City of Ventura (Ventura Water) serves the areas indicated by DWR as DACs and SDACs. As the water supplier for DACs/SDACs in the Basin, the City represented DAC/SDAC interests through its participate on the MBGSA Board of Directors. In addition, direct outreach to DACs/SDACs was accomplished via Ventura Water bill stuffers and newsletters, including materials provided in Spanish.
- **Entities listed in §10927 that Monitor and Report Groundwater Elevations:**
  - The County of Ventura is the designated CASGEM entity for the Basin. The County is a signatory member to the JPA Agreement forming the Agency and represented on the Agency's Board of Directors.
  - United performs monitoring in the Basin and shares the data it collects with the County and MBGSA. United is a signatory member to the JPA Agreement forming the Agency and is represented on the Agency's Board of Directors.

2.3.2 Public Meetings [§354.10(b)]

§354.10 Notice and Communication. *Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:*
(b) *A list of public meetings at which the Plan was discussed or considered by the Agency.*

A list of public meetings is included as Appendix E.

2.3.3 Public Comments [§354.10(c)]

§354.10 Notice and Communication. *Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:*
(c) *Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.*

Public comments and responses are included as Appendix F.

2.3.4 Communication [§354.10(d)]

2.3.4.1 Decision-Making Process [§354.10(d)(1)]

§354.10 Notice and Communication. *Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:*
(d) *A communication section of the Plan that includes the following:*
  (1) *An explanation of the Agency's decision-making process.*

The JPA that created MBGSA requires the GSA to hold public meetings at least quarterly that are noticed and meet all of the requirements of the Ralph M. Brown Act for transparency in California government. To hold a valid meeting the MBGSA must have a quorum of the Board of Directors, which consists of an absolute majority of directors plus one director. With these requirements in mind, the MBGSA:

- Holds board meetings on a regular schedule (no less frequently that quarterly);
- Provides written notice of meetings with meeting agenda and meeting material available at least 72 hours prior to regular meetings;
- Sends email meeting reminders to MBGSA's interested parties list; and
- Posts meeting agendas on https://www.moundbasingsa.org/ and at the meeting location prior to the meeting, as required by law.

MBGSA agendas include general public comments at the beginning of each board meeting. General comments allow community members to raise any groundwater-related issue that is not on the agenda. Public comment time is also given prior to a vote on all agenda items to ensure public opinion can be incorporated into MBGSA Board of Director decisions.

The MBGSA Board directs the Executive Director to fulfill the various requirements of SGMA. To do this, the Executive Director, with support from consultants and United staff, provides the Board with research and recommendation memos, work plans, technical summaries, budgets, and other work products as required to carry out board decisions. Most MBGSA decisions require an affirmative vote of a minimum of three Directors. There are certain matters that come before the MBGSA Board of Directors that require a unanimous vote of all Directors on first reading. If unanimity is not obtained on the first reading of the matter, the Board shall continue a final vote on the matter during a second reading approved by an affirmative vote of a minimum of three (3) Directors, and only if at least one (1) of the affirmative votes is by the City of San Buenaventura's Director or the Agricultural Stakeholder Director. Matters requiring the special voting provisions include of any of the following:

- Annual budget and amendments thereto;
- GSP for the Basin or any amendments thereto;
- Adoption of groundwater extraction fees or charges;
- Adoption of any taxes, fees, or assessments subject to Proposition 218; or
- Any stipulation to resolve litigation concerning groundwater rights within, or groundwater management for, the Basin.

2.3.4.2 Public Engagement [§354.10(d)(2) and (d)(3)]

§354.10 Notice and Communication. *Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:*

(d) *A communication section of the Plan that includes the following:*

(2) *Identification of opportunities for public engagement and a discussion of how public input and response will be used.*

(3) *A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.*

MBGSA uses a variety of methods create opportunities for public engagement and obtain public input for consideration in GSP development and implementation. These methods are presented in the MBGSA SEP (Appendix D) and include:

- **Stakeholder Directors:** The MBGSA Board of Directors includes two stakeholder directors, one each for environmental and agricultural interests. Pursuant to the SEP, the stakeholder directors are responsible for actively obtaining input from their respective stakeholder constituencies and communicating that input to the MBGSA Board and Executive Director for consideration.
- **Direct Engagement by MBGSA Staff:** The Executive Director met or spoke directly with stakeholders during the GSP process, including Ivy Lawn Memorial Park (industrial well operator), City of Ventura, United, and members of MBAWG.
- **MBGSA Board Meetings:** Regular and Special meetings of the MBGSA Board of Directors provided opportunities for the public to engage with the Board, Executive Director, and consultants and provide direct input. The public is welcomed to comment at each meeting and the MBGSA Board regularly incorporates public suggestions into its deliberations and the decisions it makes during Board meetings. Meeting notes are kept by the Clerk of the Board and submitted to the MBGSA Board for approval. All meeting minutes and notes are collected on the MBGSA Website along with supporting agendas, packets, and presentation materials.
- **GSP Workshops:** MBGSA has held several public workshops to provide in depth discussion of the GSP and obtain stakeholder feedback. The workshops include polls to help facilitate public input on key issues and identify which outreach methods are most effective. Public input received during the GSP Workshops is reviewed with MBGSA Board of Directors during subsequent Board meetings prior to making decisions.

- **Online Comment Form:** MBGSA's website includes a comment submission form. The on-line form provides a convenient method for anyone to provide input on the GSP. All comments received via the website were compiled into a table and considered prior to GSP adoption. All comments submitted on-line were responded to in writing (Appendix F).
- **Contact with Staff:** The public is welcomed to contact MBGSA Executive Director or Clerk of the Boards and may do so via telephone, e-mail, or website inquiry (https://www.moundbasingsa.org/contact-us/).

MBGSA uses a variety of methods to inform stakeholders and encourage the active involvement of diverse social, cultural, and economic elements of the population within the groundwater pursuant to Water Code §10727.8(a). These methods are presented in the MBGSA SEP (Appendix D) and include:

- **Statement Describing the Manner in which Interested Parties May Participate in the Development and Implementation of the Groundwater Sustainability Plan (Water Code §10727.8(a)):** The statement was prepared and posted to DWW's SGMA Portal as part of filing a notice of intent to DWR of the MBGSA decision to develop a GSP for the Basin on September 17, 2018. The statement is included, provided in Appendix A, and was developed into the MBGSA SEP (Appendix D).
- **Development and Maintenance of an Interest Parties List:** MBGA developed an interest parties list prior to electing to become a GSA pursuant to Water Code §10723.8(a)(4) and maintained that list after becoming as GSA pursuant after to Water Code §10723.4. The interested parties list is used it to send e-mail meeting notices, agendas, newsletters, and updates.
- **Public Notices:** In accordance with Water Code §10723(b), §10730(b)(1), and §10728.4, MBGSA published public notices in accordance with Government Code §6066 prior to electing to be a GSA, before imposing or increasing groundwater extraction fees, and before adopting the GSP.
- **MBGSA Website:** The MBGSA website provides SGMA and agency information, includes meeting information, meeting materials, and links to meeting agendas and packets. The website provides links to agency resource materials, maps, newsletters, presentation materials, and meeting recordings.
- **Facebook:** The MBGSA Facebook page is used to push meeting notices and other information.
- **Periodic Newsletters:** MBGSA issues periodic newsletters concerning MBGSA status and activities.
- **Existing Outreach Venues:** MBGSA uses the Member Agencies existing outreach networks to provide regular updates about the GSP Development and, going forward, GSP implementation. This includes information via email newsletters, websites, bill inserts, and social media.
- **Santa Clara River Watershed Committee:** The Executive Director provides MBGSA updates during Santa Clara River Watershed Committee meetings and requests publication of MBGSA workshop notices via the Committee's email network.
- **Direct outreach to Public, including DACs/SDACs**: Ventura Water bill stuffers and newsletters about the MBGSA and GSP process were sent to every potable water user in the Basin, including materials provided in Spanish.

Public input was used to help shape the GSP development. The input was also used to develop content for MBGSA meetings, newsletters, and website content. MBGSA public meetings were designed to encourage input, discussion, and questions. Because the Basin and number of stakeholders is small, the meetings provided ample opportunity for everyone to provide comments and ask questions.

Examples of how public input helped shape the GSP include:

- During the development of the GSP water budget, outreach to the City of Ventura was performed to learn about the City's planned well replacements and planned future groundwater extraction rates. The City's planning estimated were incorporated into the planning process.
- During the development of the GSP water budget, outreach to MBAWG was performed to develop estimates of anticipated future agricultural cropping and groundwater extraction rates. MBAWG's estimates were incorporated into the planning process.
- During the analysis of potential land use change, outreach to MBAWG was performed to obtain input about the potential for development of agricultural land in the Basin. MBAWG's input on this topic was incorporated into the planning process.
- During development of SMC for the land subsidence sustainability indicator, outreach to the City of Ventura was performed to obtain input on critical infrastructure that could be potential impacted by land subsidence. The City provided information about the susceptibility of its sewer main that became a key factor in establishing the SMC for the land subsidence sustainability indicator.
- In addition to the above-described examples, input received from MBAWG and Ivy Lawn Memorial Park about costs helped focus the agency on ensuring the GSP is fit-for-purpose for the Basin and only includes aspects absolutely necessary to maintain sustainable conditions in the Basin.

2.3.4.3 Progress Updates [§354.10(d)(4)]

> **§354.10 Notice and Communication.** *Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:*
> ***(d)*** *A communication section of the Plan that includes the following:*
> ***(4)*** *The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.*

MBGSA will continue to follow its adopted SEP to inform the public about progress implementing the GSP, including the status of projects and actions.

3.0 Basin Setting [Article 5, SubArticle 2]

§354.12 Introduction to Basin Setting. *This Subarticle describes the information about the physical setting and characteristics of the basin and current conditions of the basin that shall be part of each Plan, including the identification of data gaps and levels of uncertainty, which comprise the basin setting that serves as the basis for defining and assessing reasonable sustainable management criteria and projects and management actions. Information provided pursuant to this Subarticle shall be prepared by or under the direction of a professional geologist or professional engineer.*

This section describes the information about the characteristics and current conditions of Mound Basin that provide the basis for defining and assessing reasonable SMC, projects, and management actions. As required under §10733.2 of the California Water Code, this section was prepared by a professional geologist and includes subsections that describe the HCM, current and historical groundwater conditions, a water balance, and management areas within Mound Basin based on best available data and information available for Mound Basin at the time of preparation of this GSP.

Most of the information presented in this section is derived from the following sources, which synthesize and summarize and add to historical scientific studies and information:

- "Hydrogeologic Assessment of Mound Basin—United Water Conservation District Open-File Report 2012-01" (United, 2012);
- "Ventura Regional Groundwater Flow Model and Updated Hydrogeologic Conceptual Model: Oxnard Plain, Oxnard Forebay, Pleasant Valley, West Las Posas, and Mound Groundwater Basins—Open-File Report 2018-02" (United, 2018); and
- "Preliminary Hydrogeological Study—Mound Basin Groundwater Conditions and Perennial Yield Study" (Hopkins, 2020).

In addition to the above-listed studies, well construction, groundwater elevation, and groundwater quality data collected by United, VCWPD, and others were relied upon and have been compiled into the MBGSA DMS.

3.1 Hydrogeologic Conceptual Model [§354.14]

§354.14 Hydrogeological Conceptual Model.

(a) Each Plan shall include a descriptive hydrogeologic conceptual model of the basin based on technical studies and qualified maps that characterize the physical components and interaction of the surface water and groundwater systems in the basin.

This section provides a descriptive HCM of the Basin based on technical studies and qualified maps that characterize the physical components and interaction of the surface water and groundwater systems in Mound Basin, to the extent such characterization is possible based on existing best available data and information.

3.1.1 Regional Hydrology

Topography, surface water bodies, and imported water sources and points of delivery in Mound Basin are described below.

3.1.1.1 Topography [§354.14(d)(1)]

§354.14 Hydrogeological Conceptual Model.
(d) Physical characteristics of the basin shall be represented on one or more maps that depict the following:
(1) Topographic information derived from the U.S. Geological Survey or another reliable source.

Topography of Mound Basin is shown on Figure 3.1-01. The topography of Mound Basin consists largely of gently south-sloping coastal plain, coastal and alluvial terraces, and alluvial fans. The Santa Clara River floodplain and estuary occupies the southwest corner of the Basin, and moderately sloping hills rising to 1,000 feet above mean sea level (ft msl) are present along the northern margin of the Basin. Several small stream channels originate in the canyons above the Basin and trend south and southwest within the Basin, forming incised drainage features labeled “barrancas” (Spanish for “gullies”) on United States Geological Survey (USGS) topographic maps of the region. The barrancas typically have a vertical relief in the range of 10 to 30 ft.

3.1.1.2 Surface Water Bodies [§354.14(d)(5)]

§354.14 Hydrogeological Conceptual Model.
(d) Physical characteristics of the basin shall be represented on one or more maps that depict the following:
(5) Surface water bodies that are significant to the management of the basin.

Surface water bodies within the Mound Basin include the Santa Clara River, its estuary, and the Pacific Ocean (Figure 3.1-01). In addition, three barrancas (Sanjon, Arundell, and Harmon) tributary to the Santa Clara River in Mound Basin are shown on Figure 3.1-01. The barrancas typically only flow in response to precipitation events. No springs or seeps are shown on USGS topographic maps within or adjacent to the boundaries of Mound Basin.

3.1.1.3 Imported Water [§354.14(d)(6)]

§354.14 Hydrogeological Conceptual Model.
(d) Physical characteristics of the basin shall be represented on one or more maps that depict the following:
(6) The source and point of delivery for imported water supplies.

Sources and approximate points of delivery of imported water supplies used in Mound Basin are shown on Figure 3.1-01. Three water purveyors import water into Mound Basin: Alta Mutual Water Company (Alta MWC), Farmers Irrigation Company (FICO), and the City of Ventura (Ventura Water), as follows:

- Alta MWC conveys approximately 200 AF/yr on average of groundwater extracted from its wells located in the Santa Paula and Oxnard Basins to farms in the eastern Mound Basin (personal communication, John Lindquist of United and Bryan Bondy of Alta Mutual Water Company, April 2020).

- FICO conveys approximately 1,000 AF/yr on average of groundwater extracted from its Santa Paula Basin wells to farms in the eastern Mound Basin (United, 2017a).
- Ventura Water imports water for municipal supply from several sources outside of Mound Basin, as follows (quantities of water reported below are averages for the period from 2015 to 2020 [Ventura Water, 2020a]):
    - Ventura Water extracts approximately 2,700 AF/yr of groundwater from its Saticoy wells in the Santa Paula Basin and supplies that water to portions of the City overlying both the Mound and Santa Paula Basins. Ventura Water has stated that the specific quantity of imported water from this source distributed to each basin is variable and cannot be precisely determined. However, estimating based on the area occupied by the City of Ventura in Santa Paula Basin and typical water use per acre for developed land in the region, it appears that most of the groundwater extracted from Santa Paula Basin by Ventura Water may be used within Santa Paula Basin, and the quantity of groundwater imported by the City of Ventura to Mound Basin is a relatively small portion of the 2,700 AF/yr total extracted.
    - Ventura Water extracts approximately 3,500 AF/yr of groundwater from its “Golf Course” well field in the Oxnard Basin for blending and distribution throughout its service area.
    - Ventura Water obtains approximately 5,000 AF/yr of water from the Ventura River watershed (sources include water from Casitas MWD and Ventura Water’s facilities at Foster Park) for blending and distribution throughout its service area.
- Jam Mutual Water Company (agricultural) and several ranches straddle the basin boundary shared with the Oxnard Basin. It is assumed that small quantities of groundwater move across the basin boundary within these entities/parcels. The details of water movement across the basin boundary within these entities/parcels is not known.

3.1.2 Regional Geology [§354.14(b)(1) and (d)(2)]

§354.14 Hydrogeological Conceptual Model.

(b) *The hydrogeologic conceptual model shall be summarized in a written description that includes the following:*

(1) The regional geologic and structural setting of the basin including the immediate surrounding area, as necessary for geologic consistency.

(d) *Physical characteristics of the basin shall be represented on one or more maps that depict the following:*

(2) Surficial geology derived from a qualified map including the locations of cross-sections required by this Section.

This subsection describes the regional geologic and structural setting of Mound Basin. The groundwater basins of the Santa Clara River Valley, including Mound Basin, are within the Transverse Ranges geomorphic province of California, characterized by mountain ranges and valleys (basins) that are oriented east-west rather than the typical northwest-southeast trend common in the adjacent Peninsular and Coastal Ranges geomorphic provinces. Structurally, Mound Basin occurs within an elongate, complex syncline referred to as the Ventura structural basin, which trends east to west (Yeats et al., 1981). The province is tectonically active today as a result of transpressional stress related to right-lateral movement along the San Andreas Fault, where the North American tectonic plate contacts the Pacific plate. This transpressional stress occurring in the Transverse Ranges results in ongoing uplift of the adjacent mountains while the basins continue to flex downward (deepen).

The Ventura structural basin is filled with sediments that were deposited in both marine and terrestrial settings (Yeats et al., 1981). Near the coast, sediments were deposited on a wide delta complex that formed at the terminus of the Santa Clara River. The total stratigraphic thickness of these marine and terrestrial deposits in the Ventura structural basin reportedly exceeds 55,000 ft (Sylvester and Brown, 1988). Surface exposures of the major rock units and structural features in the vicinity of Mound Basin are shown in a simplified manner on Figure 3.1-02 and are discussed below. A geologic map that shows more details of the shallow surficial sediments (including landslides, stream terraces, alluvium in active stream channels, artificial fill, alluvial fans, and other near-surface deposits) prepared by the California Geological Survey (Gutierrez et al., 2008) is provided on Figure 3.1-03.

Geologic units (strata) in Mound Basin that may contain freshwater aquifers or aquitards are classified from youngest (top) to oldest (bottom as follows):

- Recent (active) stream-channel deposits along the present course of the Santa Clara River and its tributaries;
- Holocene -age alluvial fan deposits, which cover most of the Mound Basin;
- Stream terrace deposits adjacent to the Santa Clara River;
- Undifferentiated older alluvium of Pleistocene age; and
- Semi-consolidated sand, gravel, and clay deposits of the San Pedro Formation (also referred to as the Saugus Formation and/or Las Posas Formation by some researchers, most recently by Gutierrez et al., 2008), of late Pleistocene age.

Stratigraphic relationships are shown conceptually on Figure 3.1-04. The classification approach shown on Figure 3.1-04 is based largely on hydrogeologic characteristics (United, 2018). Other researchers have divided these deposits in other, equally valid ways, based on geomorphological or other characteristics (e.g., Mukae and Turner, 1975; Dibblee, 1992; USGS, 2003a; Hopkins, 2020). For example, Hopkins Groundwater Consultants, Inc. (Hopkins), mapped the subsurface geologic formations through Mound Basin based upon 10 cross-sections. Cross-sections showing the subsurface geometry of these units are shown on Figures 3.1-05 through 3.1-08.

Older (and typically deeper) strata than those listed above typically are poorly permeable or contain water that is too brackish or saline for municipal or agricultural uses. These strata include (following the descriptions of Burton et al., 2011):

- Sandstone, siltstone, and shale of the Santa Barbara Formation (Yerkes, 1987), of early Pleistocene age. This unit was mapped as the “Mudpit Claystone Member of the Pico formation” by Dibblee (1988, 1992), but several more recent investigations, including those by Burton et al. (2011), the USGS (2003a), and United (2012, 2018), refer to this unit as the Santa Barbara Formation.
- Marine siltstones, sandstones, and conglomerates of the Pico Formation, of Pliocene or early Pleistocene age.

- Marine shales of the Sisquoc and the Monterey Formation, both of Miocene age, which underlie the Pico Formation at depth.

Within the Ventura structural basin, the trend of many (but not all) geologic structures is east-northeast to west-southwest, consistent with regional structural trends (Figure 3.1-02). The Country Club, Oak Ridge, and McGrath (sometimes referred to as Montalvo) faults have previously been identified as significantly limiting or diverting groundwater flow (John F. Mann Jr. & Associates, 1959; Mukae and Turner, 1975; Weber et al., 1975). In general, the older (deeper) geologic units show greater displacement across these faults than the younger (shallower) units. Therefore, groundwater flow in the deeper aquifers can typically be expected to be more disrupted across faults than groundwater flow in shallow aquifers.

Similar to faults in the Ventura structural basin, the axes of major folds (anticlines and synclines) in the sedimentary strata tend to be oriented approximately east-northeast to west-southwest (Figure 3.1-02). The axis of the Ventura-Santa Clara River syncline trends through Mound Basin in an east-west direction, plunging gradually to the west. The Montalvo-South Mountain-Oak Ridge Anticline is approximately parallel to the Ventura-Santa Clara River Syncline and is located near the southern boundary of Mound Basin (Geotechnical Consultants, 1972). Some workers also place a parallel fault at the location of the Montalvo-South Mountain-Oak Ridge Anticline (John F. Mann Jr. & Associates, 1959; Fugro West, 1996). Folding in the Ventura structural basin is ongoing, with older strata (including those that comprise deep aquifers) being more deformed than younger strata (including shallow aquifers). The limbs of these folds are gently dipping within most of the freshwater-bearing strata in Mound Basin and adjacent Oxnard Basin (United, 2018). Therefore, it is unlikely that the folds themselves have a notable direct impact on groundwater flow. However, changes in strata thickness (which affects transmissivity), outcrop area (which affects where recharge occurs), and other hydraulic properties of strata can potentially be indirectly influenced by fold geometry.

3.1.3 Soil Characteristics [§354.14 (d)(3)]

§354.14 Hydrogeological Conceptual Model.

(d) *Physical characteristics of the basin shall be represented on one or more maps that depict the following:*

(3) Soil characteristics as described by the appropriate Natural Resources Conservation Service soil survey or other applicable studies.

The hydrologic characteristics of soils in Mound Basin were downloaded from the Natural Resources Conservation Service (NRCS) online database (NRCS, 2020). Relevant soil information available from the NRCS for groundwater sustainability planning purposes includes soil infiltration capacity, which is shown on Figure 3.1-09. Most of the soils in Mound Basin are reported to have low to very low infiltration rates (Groups C and D, respectively). However, moderate-infiltration-rate soils are reportedly present in an approximately 1-mile-wide band oriented east-to-west along the axis of the Basin (Figure 3.1-09). Smaller areas of high-infiltration-rate soils are reportedly present near the Santa Clara River, Harmon Barranca, and in some of the canyons in the foothills in the north part of Mound Basin.

Some clay-rich soils within the Holocene and Pleistocene alluvial deposits present in Mound Basin may be of sufficiently low vertical permeability to allow the formation of thin, discontinuous lenses or layers of shallow, “perched” groundwater above the primary saturated zone of the Shallow Alluvial Deposits (described in the next subsection of this GSP), which is supported by the presence of tile drainage systems.

Municipal and agricultural return flows contribute substantial quantities of infiltrating water at land surface in Mound Basin, supplementing natural recharge of precipitation (discussed in more detail in Sections 3.1.4.2 and 3.3). When the rate of infiltration exceeds the ability of silt and clay lenses and layers to allow the water to pass through them, small saturated zones can develop in the soil. Groundwater in perched zones typically moves laterally to better-draining soils, where it can then resume its downward infiltration, or it may migrate laterally to nearby depressions in the topography, where it seeps out at land surface, evaporates, or is transpired by vegetation.

3.1.4 Principal Aquifers and Aquitards [§354.14(b)(4)(A)]

§354.14 Hydrogeological Conceptual Model.

(b) *The hydrogeologic conceptual model shall be summarized in a written description that includes the following:*

(4) Principal aquifers and aquitards, including the following information:

(A) Formation names, if defined.

Strata with distinct hydrogeologic characteristics are referred to as hydrostratigraphic units (HSUs). Aquifers have traditionally been defined as those HSUs that are capable of yielding appreciable quantities of groundwater to wells or springs. The SGMA defines "principal aquifers" as "aquifers or aquifer systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems." Aquitards, on the other hand, are poorly permeable HSUs that impede groundwater movement (typically in the vertical direction) and generally do not yield appreciable quantities of groundwater to wells or springs.

The aquifers in Mound Basin consist of layers and lenses of relatively coarse-grained, permeable sediments (primarily sand and gravel) deposited within unconsolidated alluvium and the underlying, semi-consolidated San Pedro Formation (Figure 3.1-04). Aquitards present between the aquifers in Mound Basin consist of layers of poorly permeable fine-grained sediments (primarily silt and clay, Figure 3.1-04).

In Mound Basin, distinct HSUs were identified by United (2018) during their recent update of the HCM for the region. United (2018) observed that electrical-log "signatures" of the Mugu, Hueneme, and Fox Canyon aquifers (and the aquitards between these aquifers) observed in wells in the Oxnard Basin are often recognizable north of the McGrath Fault (Figure 3.1-02). The HSUs are generally grouped into three major "aquifer systems" as follows (from shallow to deep): the Shallow Alluvial Deposits, the Upper Aquifer System (UAS), and the Lower Aquifer System (LAS). Figure 3.1-04 shows the names and relationships between HSUs in Mound Basin, together with their corresponding geologic formations and ages. Details regarding the aquifers and aquitards within each aquifer system are provided below.

3.1.4.1 Physical Properties of Aquifers and Aquitards

3.1.4.1.1 Basin Boundary (Vertical and Lateral Extent of Basin) [§354.14(b)(2),(b)(3), and (c)]

> **§ 354.14 Hydrogeological Conceptual Model.**
> ***(b)*** *The hydrogeologic conceptual model shall be summarized in a written description that includes the following:*
> ***(2) Lateral basin boundaries, including major geologic features that significantly affect groundwater flow.***
> ***(3) The definable bottom of the basin.***
> ***(c) The hydrogeologic conceptual model shall be represented graphically by at least two scaled cross-sections that display the information required by this section and are sufficient to depict major stratigraphic and structural features in the basin.***

The lateral boundaries of Mound Basin determined by DWR (2020a) are defined as follows:

- **East:** The eastern boundary is defined by the western jurisdictional boundary of the Santa Paula Basin stipulated judgment (adjudication), as approved by DWR (2020a) pursuant to a formal Basin Boundary Modification. This jurisdictional boundary is approximately aligned with the Country Club Fault system (Figure 3.1-02). The Country Club Fault system offsets the aquifers (see cross-section A-A’, Figure 3.1-05) and impedes groundwater flow from the Santa Paula Basin into the Mound Basin.

- **Northwest:** The northwestern boundary is defined by the hydraulic divide between Mound Basin, Lower Ventura River Subbasin (Figure 3.1-01).

- **West:** The western boundary is the Pacific Ocean shoreline. However, it should be noted that the UAS and LAS in Mound Basin extend approximately 10 miles offshore under the Pacific Ocean west of the shoreline, where they are mapped as cropping out on the continental shelf, as shown on Figure 3.1-10. The submarine outcrops may be covered with fine-grained marine sediments, such as silt and clay (Greene et al., 1978) that would tend to impede interaction of seawater with fresh water from the aquifers. Although DWR has delineated the western boundary of Mound Basin at the shoreline, the offshore portions of the principal aquifers of Mound Basin are in all likelihood capable of storing and transmitting significant quantities of fresh groundwater that has migrated westward from inland recharge areas. Because DWR (2020a) does not include this offshore area within the boundaries of Mound Basin, it is not included in calculations of area of Mound Basin or volumes of groundwater in storage in each aquifer. However, it must be emphasized that fresh groundwater can flow within the aquifers of Mound Basin either to or from the offshore areas without impediment, and groundwater flowing eastward (landward) across this boundary should not be assumed to consist of seawater.

- **North:** The northern boundary is defined by the contact of the San Pedro Formation (the deepest freshwater-bearing formation in the Basin) with the underlying Santa Barbara Formation (Figure 3.1-02; the Santa Barbara Formation is mapped as the “Mudpit Claystone Member of the Pico formation” by Dibblee [1988, 1992]). The northern boundary of Mound Basin is at the northern edge of cross-section B-B’, where the Fox Canyon Aquifer basal aquitard is in contact with the Santa Barbara Formation (Figure 3.1-06).

- **South:** The southern boundary is defined by the northern jurisdictional boundary of the FCGMA, which also serves as boundary between the Mound and Oxnard basins, as approved by DWR (2020a) pursuant to a formal Basin Boundary Modification. This jurisdictional boundary is approximately aligned with the axis of the Montalvo-South Mountain-Oak Ridge Anticline and the McGrath Fault (Figure 3.1-02), which were understood at the time of formation of the FCGMA (early 1980s) to be the approximate northern limit of the Oxnard Basin.

The "bottom" of the Basin is defined by the effective base of fresh water as described by Mukae and Turner (1975), which they mapped as the base of the San Pedro Formation. The lowermost strata of the San Pedro Formation have also been referred to as the Las Posas Sand (Dibblee, 1988, 1992). In Mound Basin, the San Pedro Formation overlies poorly permeable siltstone and shale of the Santa Barbara Formation (where present) and the Pico Formation (note: some investigators, including Dibblee [1988, 1992]) include portions of the Santa Barbara Formation in the Pico Formation). The depth to these units varies from as little as 0 ft below ground surface (bgs) along the northern basin boundary to approximately 2,400 ft bgs along the axis of the Ventura-Santa Clara River syncline, as shown on cross-sections A-A' through D-D' (Figures 3.1-05 through 3.1-08).

3.1.4.1.2 Groundwater Flow Barriers [§354.14(b)(4)(C)]

§354.14 Hydrogeological Conceptual Model.
(b) *The hydrogeologic conceptual model shall be summarized in a written description that includes the following:*
(4) *Principal aquifers and aquitards, including the following information:*
(C) Structural properties of the basin that restrict groundwater flow within the principal aquifers, including information regarding stratigraphic changes, truncation of units, or other features.

Geologic structures in Mound Basin affect groundwater flow within the aquifers to varying degrees. The most common example is where upward or downward apparent displacement (throw) of aquifer materials across a fault plane disrupts an aquifer's lateral continuity. Such an offset can impede groundwater flow through the aquifer along the fault plane. In Mound Basin, faulting has caused greater displacement (and correspondingly greater potential to impede groundwater flow) in the aquifers of the LAS, which are older (and thus have undergone more faulting and folding) than the aquifers of the UAS. The following subsections describe the primary structures that are believed to impact groundwater flow.

Country Club Fault

The trace of the Country Club Fault forms a northwest-trending arc approximately corresponding with the eastern boundary of Mound Basin adjacent to Santa Paula Basin (Figure 3.1-02). It is a steeply dipping (almost vertical) reverse fault with some left-lateral displacement (Turner, 1975). United's (2012, 2018) inspection of electrical logs for oil wells in the area indicate a displacement of 1,600 to 1,800 ft, with the southwest wall displaced upward relative to the northeast wall (Figure 3.1-05), consistent with the offset reported by previous investigators (Fugro West, 1996; Geotechnical Consultants, 1972). Review of electrical logs for wells in the area suggests that only a portion of the low-permeability Santa Barbara Formation has been uplifted against the San Pedro Formation (which contains the Hueneme and Fox Canyon aquifers). With aquifers of the San Pedro Formation present on both sides of the Country Club Fault above the displaced Santa Barbara Formation, the Country Club Fault is not considered to be a complete barrier to groundwater flow. The fault is not believed to extend upward through the undifferentiated younger alluvium (Geotechnical Consultants, 1972). Consistent with the above geologic information, previous investigators, including USGS (2003a) and United (2018), have noted a consistently steeper hydraulic gradient along the fault at the boundary between Mound Basin and Santa Paula Basin, compared with more gentle hydraulic gradients elsewhere within these basins. Such a steepening of hydraulic gradients is common along faults that impede groundwater flow. To calibrate its groundwater flow model for this area, United (2018) applied a conductance of 0.00001 square ft per day to the Country Club Fault, indicating it is a significant impedance to groundwater flow.

Oak Ridge and McGrath Faults

The Oak Ridge and McGrath Faults trend east-northeast to west-southwest in the southern Mound Basin (Figure 3.1-02). As noted by Yerkes et al. (1987), these faults are buried and known only from subsurface data in this area. Yerkes et al. (1987) describe two pressure ridges in Mound Basin as isolated, elongate northwest-trending structural uplifts. These ridges are described as compressional features and are compatible with left-lateral slip along the adjacent Oak Ridge Fault. Their existence suggests a significant strike-slip component along the Oak Ridge Fault as well as a reverse fault uplift on the south side.

Based on review of electrical logs, United (2012) determined that vertical displacement of approximately 700 ft of vertical displacement occurs along the McGrath Fault, with the up-thrown side on the south. This offset has juxtaposed the low-permeability Santa Barbara Formation against the lower section of the San Pedro Formation (Figures 3.1-06). Another notable feature is the significant difference in San Pedro Formation thickness across the McGrath Fault shown on cross-section B-B’ (Figure 3.1-06). The younger deposits overlying the San Pedro Formation (Mugu Aquifer and Shallow Alluvial Deposits), do not appear to have been offset to the same degree as the LAS by either the McGrath or Oak Ridge faults (Figures 3.1-06 and 3.1-07). Calibration of groundwater flow models for the area (USGS, 2003a; United, 2018) required incorporating the Oak Ridge and McGrath faults as horizontal flow barriers, consistent with the concept that these faults restrict flow to some degree. In its regional groundwater flow model, United (2018) found that assigning a conductance to these faults of 0.0001 square ft per day resulted in an acceptable calibration.

Ventura, Pitas Point, and Foothill Faults

The Ventura and Foothill faults trend east to west in the northern part of Mound Basin (Figure 3.1-02). The Pitas Point Fault is the westerly, offshore (mostly) extension of the Ventura Fault (Greene et al., 1978). The Ventura and Pitas Point Faults are reverse faults that dip to the north at a high angle; upward movement of the north side of the fault likely contributed to formation of the foothills in the north part of Mound Basin (Yerkes at al., 1987). The Foothill Fault is included in a USGS database of Quaternary faults (Burton et al., 2011), and an inferred fault is shown in approximately the same location by Yerkes et al. (1987). It is also shown on the geologic map included in the Hopkins (2020) report for Mound Basin. United (2012) hypothesized that the Foothill Fault is a reverse fault that dips to the north, similar to the Ventura and Pitas Point Faults.

As a result of vertical offset of the San Pedro Formation along the Ventura, Pitas Point, and Foothill Faults ranging from tens to hundreds of feet (Figures 3.1-06 and 3.1-07), it is inferred that these faults impede groundwater flow in the aquifers to some degree because, as shown on cross-section B-B’ (Figure 3.1-06) the faulting disrupts the lateral continuity of the aquifers and juxtaposes different HSUs across the fault plane. However, no groundwater monitoring wells are located north and south of these faults to detect groundwater elevation changes across them that would allow estimation of conductance across the faults. Neither the USGS (2003a) nor United (2018) modeled these faults as horizontal flow barriers due to lack of data to support calibration of the barrier effect of these faults.

3.1.4.1.3 Hydraulic Properties [§354.14(b)(4)(B)]

§354.14 Hydrogeological Conceptual Model.
(b) *The hydrogeologic conceptual model shall be summarized in a written description that includes the following:*
(4) *Principal aquifers and aquitards, including the following information:*
(B) Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information.

This subsection provides a written description of the physical properties of the aquifers and aquitards within Mound Basin, including estimates of their lateral extent, thickness, hydraulic conductivity, and storativity. The lateral and vertical extents of the aquifers and aquitards are depicted on cross-sections A-A' through D-D' (Figures 3.1-05 through 3.1-08). At the time of writing of this GSP, no aquifer test results for hydraulic conductivity or storativity were found in available references. However, well information collected over the past several decades by United (now included in the MBGSA's DMS) from well completion reports includes 10 specific-capacity measurements obtained at water supply and monitoring wells in Mound Basin, which were considered when United (2018) calibrated its numerical groundwater flow model of the region.

For basin-wide estimates of hydraulic conductivity and storativity for each aquifer in Mound Basin, this GSP relies on United's calibrated flow model for the region, which was constructed in 2018 (United, 2018), then expanded and recalibrated in 2020 (United, 2021a). The United model is considered the best available information concerning aquifer and aquitard properties. These estimates are summarized in Table 3.1-01. However, it is recognized that on a local scale, hydraulic conductivity can vary by orders of magnitude over short distances, and there may be areas in Mound Basin where hydraulic conductivity is higher or lower than the values shown on Table 3.1-01.

Shallow Alluvial Deposits

The Shallow Alluvial Deposits in Mound Basin primarily consist of Holocene alluvial fan deposits (USGS, 2003b, 2003c, 2004) deposited by streams emanating from mountain canyons to the north. These deposits are composed of moderately to poorly sorted interbedded sandy clay with some gravel (USGS, 2003b, 2003c, 2004). The Shallow Alluvial Deposits are present in most areas of Mound Basin, except on the hillsides along the northern flank of the Basin (United, 2018). The alluvial fan deposits that comprise the Shallow Alluvial Deposits consist of stream terrace deposits and active wash deposits along the Santa Clara River where the alluvial fan deposits are absent (Figure 3.1-03). The stream terrace deposits include point bar and overbank deposits that consist of poorly sorted clayey sand and sandy clay with gravel (USGS 2003b). The HCM indicates thickness of the Shallow Alluvial Deposits range from less than 50 ft along the margins of Mound Basin to more than 100 ft in the central portion of the Basin (Figures 3.1-05 through 3.1-08) (United, 2018). The Shallow Alluvial Deposits are unconfined across Mound Basin (United, 2012, 2018).

Since 1979, when reporting of groundwater extraction from wells was mandated within United's service area, no extraction has been reported from the Shallow Alluvial Deposits for water supply in Mound Basin (pumping data for water supply wells are included in the Mound Basin DMS), likely due to insufficient saturated thickness and/or poor water quality. The Shallow Alluvial Deposits are not considered a "principal aquifer" at this time for the purpose of groundwater sustainability planning. The analysis and justification for not considering the Shallow Alluvial Deposits as a principal aquifer under SGMA for this GSP is presented in Appendix G.

Based on calibration of its regional groundwater flow model, United (2021a) estimated the horizontal hydraulic conductivity of the Shallow Alluvial Deposits to be 200 feet per day (ft/d) in Mound Basin, and the vertical hydraulic conductivity to be 20 ft/d. The specific yield of the Shallow Alluvial Deposits in the groundwater flow model is 15% (United, 2021a). These values do not apply to localized stream terrace deposits along the Santa Clara River where shallow groundwater interconnects with the Santa Clara River and GDEs are present (i.e. GDE Area No. 11). The presence of tile drains on agricultural lands situated on the stream terrace deposits (Figures 2.1-03 and 3.1-09) suggests that the stream terrace deposits are poorly permeable and, therefore, are not considered to be an aquifer, but may contain perched groundwater zones.

Hydrostratigraphic data, groundwater level data, groundwater quality data, and numerical modeling results demonstrate that shallow groundwater levels within the Shallow Alluvial Deposits and interconnected surface water of the Santa Clara River and its estuary are not materially influenced by extraction from the principal aquifers (please see Appendix G for details).

Upper Aquifer System

The UAS in Mound Basin consists of fine-grained Pleistocene deposits (which behaves as an aquitard) and the Mugu Aquifer. Each of these HSUs is described in more detail below.

Fine-Grained Pleistocene Deposits

United (2018) reports the presence of fine-grained Pleistocene deposits in Mound Basin, consisting primarily of a thick sequence of clays and silts, with sparse interbeds or lenses of sand and gravel. These deposits are stratigraphically equivalent to the Oxnard Aquifer of the Oxnard Basin, but do not yield significant quantities of groundwater in Mound Basin. This HSU has been logged to depths of 350 to 600 ft (typically 100 to 400 ft thick) in a number of wells in Mound Basin (Figures 3.1-05 through 3.1-08). Along the Oxnard Basin boundary these deposits abut or interfinger with the Oxnard Aquifer. Because of its fine-grained nature, this HSU generally is poorly permeable and is rarely targeted for groundwater production; therefore, few data are available regarding its hydraulic parameters. It is possible that sand and gravel layers or lenses in this HSU could contain modest volumes of fresh groundwater.

Based on calibration of its regional groundwater flow model, United (2021a) estimated the horizontal hydraulic conductivity of the fine-grained Pleistocene deposits to be 0.01 ft/d, typical of an aquitard rather than an aquifer, and vertical hydraulic conductivity to be 0.001 ft/d. The specific yield and storage coefficient for this unit were estimated by United (2021a) to be approximately 5% and 0.001 (dimensionless), respectively. This HSU acts as a confining unit for the Mugu Aquifer in Mound Basin, except along the northern margin of the Basin where the San Pedro Formation (which includes the Hueneme and Fox Canyon aquifers) is exposed at land surface and, therefore, is unconfined.

Mugu Aquifer

The Mugu Aquifer consists of marine and non-marine sands and gravels with interbedded silt and clay that lie below the fine-grained Pleistocene deposits and unconformably overlie the San Pedro Formation (Figures 3.1-05 through 3.1-08). Thickness of the Mugu Aquifer in Mound Basin is variable, ranging from approximately 100 to 425 ft, based on borehole geophysical logs reviewed by United (2018). The Mugu Aquifer is generally thickest along the northeast-southwest axis of the Basin, and thins to the north, where it pinches out south of the northern basin boundary. The Mugu Aquifer also thins (to approximately 200 ft) in the south toward the boundary with the Oxnard Basin. Several water supply wells in Mound Basin are screened in the Mugu Aquifer, as it is generally the first aquifer encountered when drilling that yields significant quantities of acceptable-quality groundwater.

Based on calibration of its regional groundwater flow model, United (2021a) estimated the horizontal hydraulic conductivity of the Mugu Aquifer to be 100 ft/d in Mound Basin, and vertical hydraulic conductivity to be 10 ft/d. The specific yield and storage coefficient used in the model (United, 2021a) were approximately 15% where unconfined (along the northern basin margin) and 0.001 (dimensionless) where confined (throughout most of the Basin), respectively.

As described in more detail in Section 3.1.4.4, the Mugu Aquifer stores, transmits, and yields significant or economic quantities of groundwater to wells; therefore, it is considered a “principal aquifer” of Mound Basin.

Lower Aquifer System

The LAS in Mound Basin includes the Hueneme and Fox Canyon aquifers, as well as the aquitards present between each aquifer. These aquifers and aquitards consist of relatively coarse- and fine-grained strata, respectively, of the San Pedro Formation, which is Pleistocene in age. The LAS, being older than the UAS, has undergone more faulting and folding. It has also been eroded, creating an unconformity that separates the UAS from the LAS (Turner, 1975). Except near the northern margin of Mound Basin, the LAS is overlain unconformably by the UAS. The San Pedro Formation crops out in the foothills near the northern boundary of the Basin, attaining a maximum thickness of 2,300 ft in this region (Geotechnical Consultants, 1972). In this area, the aquifers of the San Pedro Formation are not overlain by confining units, and, therefore, are unconfined. The aquifers of the LAS are isolated from each other vertically by relatively low-permeability silt and clay layers called the “Hueneme-Fox Canyon Aquitard.” The base of the LAS is considered to be the base of fresh water (Mukae and Turner, 1975). Beneath the LAS lie older sedimentary rocks that are generally considered to contain brackish to saline water or to be poorly transmissive (Mukae and Turner, 1975) and are not used for water supply in Mound Basin. More details regarding each aquifer and aquitard comprised by the LAS are provided below.

Mugu-Hueneme Aquitard

The upper portion of the LAS in Mound Basin (immediately below the Mugu Formation) consists of poorly permeable sediments with relatively high silt and clay content. This unit is referred to by United (2018) as the Mugu-Hueneme Aquitard. Electrical logs for oil and water wells in the region show that this aquitard is present throughout most of Mound Basin between the Mugu and Hueneme aquifers, except along the northern margin of the Basin where this unit has been uplifted by the Ventura-Pitas Point Fault and eroded away. Thickness of this aquitard ranges from approximately 100 ft at the northern margins of the Basin to 200 ft near the center of the Basin (Figures 3.1-05 through 3.1-08).

Based on calibration of its regional groundwater flow model, United (2021a) estimated the horizontal hydraulic conductivity of the Mugu-Hueneme Aquitard to be approximately 0.01 ft/d in Mound Basin, and vertical hydraulic conductivity to be 0.001 ft/d. The specific yield for the Mugu-Hueneme Aquitard in Mound Basin in the model is 5% where unconfined (along the northern basin margin), and the storage coefficient is 0.0005 (dimensionless) where confined (throughout most of the Basin).

Hueneme Aquifer

A series of interbedded, water-bearing sands in the upper approximately two-thirds of the San Pedro Formation comprise the Hueneme Aquifer (United, 2018). Structural complexities have resulted in thinning of these beds in the southern part of Mound Basin (south of the Oak Ridge and McGrath faults), compared to the central axis of Mound Basin (Figures 3.1-06 and 3.1-07). In the central and northern parts of the Basin, resistivity-log signatures indicate some lithologic differences in this unit compared to its lithology in the Oxnard Basin; specifically, some of the coarse-grained strata of the Hueneme Aquifer thin or become increasingly lenticular in the northward direction (United, 2012). However, thick (up to 1,000 ft) sections of the Hueneme Aquifer (or time-equivalent strata) do occur in Mound Basin, as oil well electrical logs interpreted by United (2012) indicate variable amounts of coarse-grained (permeable) materials. Borehole geophysical (resistivity) logs reviewed by United (2018) indicate the Hueneme Aquifer is generally thickest (typically 1,000 ft) along the northeast-southwest axis of the Basin, becoming thinner (200 to 600 ft) along the northern and southern basin boundaries. Most of the water supply wells in Mound Basin are screened primarily or entirely in the Hueneme Aquifer.

Based on calibration of its regional groundwater flow model, United (2021a) estimated the horizontal hydraulic conductivity of the Hueneme Aquifer to be 20 ft/d throughout Mound Basin, and vertical hydraulic conductivity to be 2 ft/d. The specific yield for the Hueneme Aquifer in Mound Basin in the model is 10% where unconfined (along the northern basin margin), and the storage coefficient is 0.005 (dimensionless) where confined (throughout most of the Basin).

As described in more detail in Section 3.1.4.4, the Hueneme Aquifer stores, transmits, and yields significant or economic quantities of groundwater to wells; therefore, it is considered a “principal aquifer” of Mound Basin.

Hueneme-Fox Canyon Aquitard

Below the Hueneme Aquifer, laterally extensive deposits of silt and clay of the San Pedro Formation up to approximately 100 ft thick (Figures 3.1-05 through 3.1-08) with interbeds of sand and gravel form an aquitard between the Hueneme and Fox Canyon aquifers throughout Mound Basin. This HSU is referred to by United (2018) as the Hueneme-Fox Canyon Aquitard.

Based on calibration of its regional groundwater flow model, United (2021a) estimated the horizontal hydraulic conductivity of the Hueneme-Fox Canyon Aquitard to be 0.01 ft/d in most of Mound Basin, and vertical hydraulic conductivity to be 0.001 ft/d. The specific yield for the Mugu-Hueneme Aquitard in Mound Basin in the model is 5% where unconfined (along the northern basin margin), and the storage coefficient estimated to be 0.0005 (dimensionless) where confined (throughout most of the Basin).

Fox Canyon Aquifer

Lower portions of the San Pedro Formation consist principally of sand and gravel zones with variable thicknesses of interstratified clay and silt (United, 2018). In a northerly direction across Mound Basin, these coarser-grained water-bearing strata are somewhat lenticular and generally become thinner (John F. Mann Jr. & Associates, 1959; Geotechnical Consultants, 1972), similar to the Hueneme Aquifer. The sand and gravel zone located at or near the base of the San Pedro Formation is known as the Fox Canyon Aquifer in the Oxnard Basin, and United (2012, 2018) extends that nomenclature for this HSU to Mound Basin as well. Electrical-log data and outcrops near the base of the San Pedro Formation in the foothills on the north side of Mound Basin do not indicate the same aquifer thickness or sediment coarseness as observed at the location in Fox Canyon on the south flank of South Mountain, 11 miles southeast of Mound Basin (Geotechnical Consultants, 1972; United, 2012). However, the distinct borehole resistivity-log signature of the Fox Canyon Aquifer is discernible across Mound Basin and adjacent areas (United, 2012). The Fox Canyon Aquifer commonly occurs at depths greater than 1,000 ft in Mound Basin and is not targeted for groundwater supply (United, 2012), with the exception of two active water supply wells that are screened partly in the Fox Canyon Aquifer and partly in the overlying Hueneme Aquifer (Table 3.1-02).

Borehole resistivity logs reviewed by United (2018) indicate that the Fox Canyon Aquifer in Mound Basin is typically 400 to 600 ft thick (Figures 3.1-05 through 3.1-08). However, as discussed above, the coarser-grained layers that comprise the main water-producing zones of the Fox Canyon Aquifer thin and become more lenticular in a northerly direction across Mound Basin, as shown on the resistivity logs on Figures 3.1-06 and 3.1-07. In the Oxnard Basin, John F. Mann Jr. & Associates (1959) further divided the Fox Canyon Aquifer into a “main” (sometimes called “upper”) member and a “basal” member (at the base of the San Pedro Formation), separated by a 50-ft-thick aquitard consisting primarily of fine-grained sediments. United (2018) incorporated this subdivision of the Fox Canyon Aquifer into their regional groundwater flow model. No water supply wells in Mound Basin are screened to the depth needed to reach the basal Fox Canyon Aquifer; therefore, the hydraulic characteristics of this unit are uncertain.

Based on calibration of its regional groundwater flow model, United (2021a) estimated the horizontal hydraulic conductivity of the main Fox Canyon Aquifer to be 10 ft/d in most of Mound Basin, and vertical hydraulic conductivity to be 1 ft/d. The specific yield for the main Fox Canyon Aquifer in Mound Basin in the model is 10% where unconfined (along the northern basin margin), and the storage coefficient is 0.005 (dimensionless) where confined (throughout most of the Basin). Identical hydraulic parameters are assumed for the basal Fox Canyon Aquifer (United, 2021a).

Owing to the lack of wells screened in the Fox Canyon Aquifer, it does not meet the SGMA definition of a principal aquifer because it does not currently (and has not, historically) “store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems” in Mound Basin. If future water supply wells are screened in the Fox Canyon Aquifer, then this designation should be reconsidered as part of the required periodic GSP update process.

3.1.4.2 Groundwater Recharge and Discharge Areas [§354.14(d)(4)]

> **§354.14 Hydrogeological Conceptual Model.**
>
> *(d) Physical characteristics of the basin shall be represented on one or more maps that depict the following:*
>
> ***(4) Delineation of existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas, including significant active springs, seeps, and wetlands within or adjacent to the basin.***

Multiple sources of groundwater recharge (water that enters an underlying groundwater system from land surface) occur in Mound Basin (United, 2018), including:

- Infiltration of precipitation—Most infiltration of precipitation recharges the Shallow Alluvial Deposits, although some infiltration of precipitation occurs in outcrops of the Hueneme and Fox Canyon aquifers in the foothills in the northern part of Mound Basin.
- Mountain-front recharge—For this report, the term “mountain-front recharge” refers to infiltration of runoff from the foothills north of Mound Basin, where many of the small drainages in Mound Basin have watersheds that extend northward beyond the basin boundary. Both United (2018) and the USGS (2003a) computed monthly runoff in each of these small catchment areas based on rainfall and incorporated infiltration of this runoff into aquifers as a recharge component in their regional numerical models. Infiltration of this runoff is assumed to occur within a short distance (2,000 ft) south of the basin boundary, where the Hueneme and Fox Canyon aquifers are exposed at land surface. In Mound Basin, infiltration of this runoff recharges the Hueneme and Fox Canyon aquifers. To simplify the input to United’s (2021a) regional groundwater flow model, all areal recharge (as well as mountain-front recharge) in the northern foothills of Mound Basin was simulated to infiltrate the Hueneme Aquifer. This simplification should not significantly affect the aquifer-specific groundwater budgets discussed in Section 3.3, because recharge entering the Hueneme Aquifer is allowed to flow vertically to the Fox Canyon Aquifer in the model if a downward hydraulic gradient is present between the aquifers. If the model is updated in the future such that the model grid is refined (smaller grid cells) in the northern foothills, apportionment of areal recharge between the Hueneme and Fox Canyon aquifers can potentially be revised to better reflect the outcrop area of each aquifer.
- M&I return flows—This term refers to water applied for landscape irrigation, leaked water from water supply and wastewater pipelines, and storm water that is collected in detention basins or other facilities and allowed to infiltrate into the ground. Most of these return flows recharge the Shallow Alluvial Deposits, but some may contribute to recharge of the Hueneme Aquifer and Fox Canyon Aquifer in the foothills in the north part of Mound Basin, where residential development exists on the hillsides.
- Agricultural return flows— This term refers to water applied for agricultural irrigation (in addition to rainfall) that infiltrates deeper than the root zone of crops. Some “excess” irrigation of farmland is required to leach salts from shallow soil, and some irrigation inefficiencies occur due to the variability in irrigation application and soil infiltration capacity. These infiltrating return flows may be intercepted by perched zones in near-surface soil horizons or continue downward to the uppermost aquifer, which in most of Mound Basin is the Shallow Alluvial Deposits. However, some return flows in the foothills in the north part of Mound Basin may contribute to recharge of the Hueneme Aquifer and Fox Canyon Aquifer, where avocado and other orchards are present in areas where these aquifers are present at or near land surface.

- Stream-channel recharge—This term refers to infiltration of surface water flows in “losing” reaches of major streams (excluding areas of mountain-front recharge as described above). The quantity of recharge occurring in the narrow channels of the barrancas in Mound Basin, most of which only flow briefly following storm events, is so small as to be considered by United (2018) to be indistinguishable from areal recharge of agricultural and M&I return flows. The Santa Clara River is the only major stream in Mound Basin, and the reach of the Santa Clara River in Mound Basin is considered to usually be the site of groundwater discharge, rather than recharge (Stillwater Sciences, 2011; United, 2018). However, the lower Santa Clara River in the area of its estuary is reported to fluctuate from gaining to losing cycles as water levels rise and fall in response to breaching of the barrier sand at the mouth of the river (Stillwater Sciences, 2011). When the elevation of surface water in the estuary rises (following closure of the barrier bar), some of the rising water infiltrates (recharges) the shallow deposits adjacent to the river. Then, typically in the following winter or spring, a large storm will produce sufficient flows in the river that it will breach the barrier bar and cause rapid decline of surface water levels in the estuary, causing groundwater in the adjacent shallow deposits to discharge back into the river over a sustained period.

Areas where these sources of recharge occur in Mound Basin are shown on Figure 3.1-11, and further discussion of the nature and quantities of these sources of recharge are discussed in Section 3.3. In addition to the types of recharge (from land surface) listed above, subsurface inflow of groundwater also occurs in Mound Basin as a result of groundwater underflow from adjacent basins (United, 2018), as discussed in Section 3.3.

Within Mound Basin, groundwater discharge occurs from the Shallow Alluvial Deposits along the lower, gaining reach of the Santa Clara River (area 11 on Figure 3.1-11), and via tile drains installed under farmland adjacent to the river, as noted on Figure 3.1-11. These areas of groundwater discharge in Mound Basin are shown on Figure 3.1-11, and their quantities are discussed in Section 3.3. As noted in Section 3.1.1.2, no springs or seeps are shown on USGS topographic maps within or adjacent to the boundaries of Mound Basin. In addition to the types of discharge listed above, extraction of groundwater also occurs in Mound Basin at water supply wells, as discussed in Section 3.1.4.4.

3.1.4.3 Groundwater Quality [§354.14(b)(4)(D)]

> **§354.14 Hydrogeological Conceptual Model.**
> ***(b)*** *The hydrogeologic conceptual model shall be summarized in a written description that includes the following:*
> ***(4)*** *Principal aquifers and aquitards, including the following information:*
> ***(D) General water quality of the principal aquifers, which may be based on information derived from existing technical studies or regulatory programs.***

Available groundwater quality data and existing technical studies were reviewed to understand the age, major-ion chemistry, and spatial and temporal trends in key groundwater quality indicator constituents, such as total dissolved solids (TDS), sulfate, chloride, and nitrate, in the principal aquifers of Mound Basin.

Groundwater quality data are available from wells screened in three HSUs in Mound Basin: the fine-grained Pleistocene deposits, Mugu Aquifer, and Hueneme Aquifer. Maps of recent (2017) concentrations of the key indicator constituents and time-series graphs of historical concentrations detected at selected wells are shown on Figures 3.1-12 through 3.1-25. Water quality data for 2017 (VCWPD, 2021) were selected for these maps because 2017 was the most recent year when a relatively large number of Mound Basin wells were sampled; fewer wells were sampled in 2018 by VCWPD due to staffing issues. The major-ion chemistry of the HSUs is shown using stiff diagrams on Figures 3.1-21 through Figure 3.1-23. Comparison of the stiff diagrams reveals that groundwater in the fine-grained Pleistocene deposits has a very different chemistry than groundwater in the principal aquifers (Mugu and Hueneme aquifers). Groundwater in the fine-grained Pleistocene deposits is 3 to 5 times more mineralized and has a different major-ion signature than groundwater in the Mugu and Hueneme aquifers. The degree of mineralization and major-ion chemistry in the Mugu and Hueneme aquifers are similar, with Hueneme Aquifer groundwater generally being slightly more mineralized. One exception is the shallow, dedicated monitoring well at Community Park (CWP-510), which is screened in the upper Hueneme Aquifer and has major-ion chemistry that bears similarities to the fine-grained Pleistocene deposits (Figure 3.1-23). The dramatic difference between groundwater chemistry in the fine-grained Pleistocene deposits versus the Mugu and Hueneme aquifers is explained by different geochemical processes operative in the shallow HSUs versus the deeper, principal aquifers. S.S. Papadopulos & Associates, Inc. (SSP&A, 2020) concluded that groundwater in the principal aquifers appears to be similar in composition to regional groundwater in other local basins; in contrast, shallow groundwater is additionally influenced by reactions with local aquifer minerals, principally gypsum and perhaps other evaporites that do not appear to be present in the principal aquifers.

SSP&A (2020) further concluded that there is no significant evidence for interactions between groundwater in the principal aquifers and shallow groundwater (CWP-510 is included here) or deeper, mineralized water. SSP&A (2020) also concluded that groundwater at the sample locations in the Basin is at least 1,000 years old. These conclusions together suggest that vertical movement of water percolating from land surface is not a major source of recharge to the principal aquifers, except where they are exposed at land surface in the northern portion of the Basin.

Groundwater quality in each of the principal aquifers, as discussed further below, is relatively stable at many Mound Basin wells having long-term groundwater quality records, consistent with the conclusion by previous investigators that natural causes are the primary source of elevated concentrations of dissolved constituents in groundwater.

The Basin Plan of the Regional Water Quality Control Board (RWQCB), Los Angeles region (RWQCB-LA) establishes groundwater quality “objectives” (WQOs) as “the allowable limits or levels of water quality constituents or characteristics which are established for the reasonable protection of beneficial uses of water or the prevention of nuisance within a specific area” (RWQCB-LA, 2019). The WQOs for Mound Basin are shown in Table 3.1-03.

Mugu Aquifer

Maximum TDS, sulfate, chloride, and nitrate concentrations detected in 2017 at five wells screened in the Mugu Aquifer (including wells with screens that extend above or below the Mugu Aquifer) were reported to or obtained by United (Figures 3.1-12 through 3.1-15). Four of these five wells are located along the west-southwest to east-northeast axis of the Basin, and one is located in the southeast quadrant of the Basin. Also shown on Figures 3.1-12 through 3.1-15 are water quality data at wells in adjacent areas of the Oxnard and Santa Paula basins, as they may provide some insight to groundwater quality along the southern and eastern margins of Mound Basin.

The maximum TDS concentrations detected in 2017 at wells screened in the Mugu Aquifer in Mound Basin ranged from 880 to 3,040 milligrams per liter (mg/L) (Figure 3.1-12). The two highest TDS concentrations were detected at wells 02N22W07P01S (near the intersection of U.S. Highway 101 and State Highway 126, in the central portion of Mound Basin) and well 02N22W08G01S (near the intersection of State Highway 126 and Victoria Avenue, also in the central portion of Mound Basin). The TDS concentrations detected at these wells are not considered representative of Mugu Aquifer groundwater quality. After excluding the unrepresentative results, the range of maximum TDS concentrations measured in the remaining three wells is 880 to 1,420 mg/L (Figure 3.1-12). For comparison and as shown in Table 3.1-03, the RWQCB-LA WQO for TDS in confined aquifers of the lower Santa Clara River basins (including Mound Basin) is 1,200 mg/L (RWQCB-LA, 2019). The California Division of Drinking Water (DDW) lists a "recommended secondary" maximum contaminant level (MCL) range (MCLR) for TDS in public water supplies of 500 mg/L.

The maximum sulfate concentrations detected in 2017 at wells screened in the Mugu Aquifer in Mound Basin ranged from 312 to 1,550 mg/L (Figure 3.1-13). Similar to TDS, the two highest TDS concentrations were detected at wells 02N22W07P01S and well 02N22W08G01S, in the central portion of the Basin. Similar to TDS, the sulfate results from these wells are not considered representative of Mugu Aquifer groundwater quality. After excluding the unrepresentative results, the range of maximum sulfate concentrations measured in the remaining three wells is 312 to 698 mg/L (Figure 3.1-13). The RWQCB-LA's applicable WQO for sulfate (Table 3.1-03) in Mound Basin is 600 mg/L (RWQCB-LA, 2019). The DDW-recommended secondary MCLR for sulfate in public water supplies is 250 mg/L. DDW also lists an "upper secondary" MCLR for sulfate in public water supplies of 500 mg/L.

The maximum chloride concentrations detected in wells screened in the Mugu Aquifer in Mound Basin ranged from 45 to 138 mg/L (Figure 3.1-14). Similar to TDS and sulfate, the two highest TDS concentrations were detected at wells 02N22W07P01S and well 02N22W08G01S, in the central portion of the Basin. Similar to TDS and sulfate, the chloride results from these wells are not considered representative of Mugu Aquifer groundwater quality. After excluding the unrepresentative results, the range of maximum chloride concentrations measured in the remaining three wells is 45 to 76 mg/L (Figure 3.1-14). The RWQCB-LA's applicable WQO for chloride (Table 3.1-03) in Mound Basin is 150 mg/L (RWQCB-LA, 2019). DDW's recommended secondary MCLR for chloride in public water supplies is 250 mg/L and DDW's upper MCLR for chloride in public water supplies is 500 mg/L.

The maximum nitrate as (as nitrate [NO_3]) concentrations detected in 2017 at wells screened in the Mugu Aquifer in Mound Basin ranged from less than the detection limit (0.4 mg/L) to 64.6 mg/L (Figure 3.1-15). Nitrate concentrations are occasionally reported by laboratories in equivalent weight as nitrogen; in this GSP, nitrate results reported as nitrogen have been recalculated to equivalent concentrations as NO_3, unless otherwise noted. Similar to the other common dissolved constituents noted above, the highest nitrate concentrations in the Mugu Aquifer in 2017 were detected at wells 02N22W07P01S and well 02N22W08G01S, in the central portion of the Basin. Similar to TDS, sulfate, and chloride, the nitrate concentrations in these wells are anomalously high compared to other Mugu Aquifer wells in the Basin, suggesting influence of shallow groundwater through a possibly compromised well seal or well casing. Nitrate concentrations were below the detection limit at two of the three remaining (representative) wells in the Mugu Aquifer and 8.4 mg/L at well 02N22W09K01S (Figure 3.1-15). The RWQCB-LA's applicable WQO for nitrate (as NO_3) in Mound Basin is 45 mg/L (RWQCB-LA, 2019). Similarly, DDW lists a "primary" MCL for nitrate in public water supplies of 45 mg/L (as NO_3).

Figures 3.1-20 through 3.1-25 show times series of measured historical TDS, chloride, and sulfate in selected wells in Mound Basin, including three wells screened in the Mugu Aquifer. At Well 02N23W14K01S, which is screened in both the Mugu and Hueneme aquifers, TDS exceeded the WQO of 1,200 mg/L for the Basin from the early 1930s to 1957. However, for the rest of the period of historical record (from the mid-1960s through the early 1980s), TDS concentrations at well 02N23W14K01S remained below the current WQO, with the exception of two samples from the late 1960s. Sulfate concentrations measured at the same well have been below the current WQO of 150 mg/L from the early 1930s through the last sample taken in the early 1980s, with the exception of one sample from the early 1960s that appears to be an outlier. Chloride concentrations measured at the same well have been below the WQO of 150 mg/L from the early 1930s through the last sample taken in the early 1980s, with the exception of one sample (also from the early 1960s) that appears to be an outlier. TDS, chloride, and sulfate concentrations at other wells (Figure 3.1-21 and 3.1-22) have been at or below the WQO throughout the available period of record from 1995 through 2020, with the exception of three detections of TDS above the WQO of 1,200 mg/L prior to 2010. TDS, sulfate, and chloride concentrations have been below the RWQCB-LA WQOs for the entire period of record at Marina Park and Camino Real Park monitoring wells 02N23W15J02S and 02N22W07M02S, screened in the Mugu Aquifer (Figures 3.1-21 and 3.1-22).

Measured historical boron concentration slightly exceeded the Basin WQO in October of 2013 at only one well (02N22W07P01S). The average boron concentration measured at Well 02N22W07P01S over the available period of record of 2000 to 2017 was 0.71 mg/L. The one-time exceedance was likely due to the major drought that occurred in 2013. It is also noted that this well has consistently had anomalously high concentrations of common constituents, suggesting influence of shallow groundwater within this well, possibly through a compromised well seal or well casing; therefore, boron results from this well are considered non-representative of the Mugu Aquifer. All the samples taken after October 2013 at the same well had concentrations less than the Basin WQO and did not show any specific trend.

Hueneme Aquifer

Maximum TDS, sulfate, chloride, and nitrate concentrations detected in 2017 at nine wells screened in the Hueneme Aquifer (including wells with screens that extend above or below the Hueneme Aquifer) were reported to or obtained by United (Figures 3.1-16 through 3.1-19). Five of these nine wells are located along the west-southwest to east-northeast axis of the Basin, and four are located in the southeast quadrant of the Basin. Figures 3.1-21 through 3.1-25 show concentrations of TDS, sulfate, and chloride over time at selected wells with historical data available in Mound Basin, including six wells screened in the Hueneme Aquifer. It is noted that wells 02N23W13K03S, 02N22W08F01S, and 02N22W09L04S exhibit anomalously high concentrations of TDS, sulfate, chloride, and nitrate, suggesting influence of shallow groundwater, possibly through a compromised well seal or well casing. Thus, the elevated concentrations of TDS, sulfate, and chloride reported for these wells should not be considered representative of Hueneme Aquifer groundwater quality.

The maximum TDS concentrations detected in 2017 at wells screened in the Hueneme Aquifer in Mound Basin ranged from 1,060 to 6,390 mg/L (Figure 3.1-16). The highest TDS concentration was detected at monitoring well 02N22W09L04S, in the southeast quadrant of the Basin. As stated above, the TDS result from this well and two others are not considered representative of Hueneme Aquifer groundwater quality. After excluding the unrepresentative results, the range of maximum TDS concentrations measured in the remaining six wells is 1,060 to 1,420 mg/L (Figure 3.1-16). Four of the six representative wells have TDS concentrations below the RWQCB-LA WQO and two are above.

The maximum sulfate concentrations detected in 2017 at wells screened in the Hueneme Aquifer in Mound Basin ranged from 412 to 3,620 mg/L (Figure 3.1-17). Similar to TDS in the Hueneme Aquifer, the single highest sulfate concentration was detected at monitoring well 02N22W09L04S, in the southeast quadrant of the Basin. As stated above, the sulfate result from this well and two others are not considered representative of Hueneme Aquifer groundwater quality. After excluding the unrepresentative results, the range of maximum sulfate concentrations measured in the remaining six wells is 412 to 698 mg/L (Figure 3.1-17). Five of the six representative wells have sulfate concentrations below the RWQCB-LA WQO and one is above.

The maximum chloride concentrations detected in 2017 at wells screened in the Hueneme Aquifer in Mound Basin ranged from 67 to 181 mg/L (Figure 3.1-18). Similar to TDS and sulfate in the Hueneme Aquifer, the single highest chloride concentration was detected at monitoring well 02N22W09L04S, in the southeast quadrant of the Basin. As stated above, the chloride result from this well and two others are not considered representative of Hueneme Aquifer groundwater quality. After excluding the unrepresentative results, the range of maximum chloride concentrations measured in the remaining six wells is 67 to 86 mg/L (Figure 3.1-18). All six representative wells have chloride concentrations below the RWQCB-LA WQO.

The maximum nitrate concentrations detected in 2017 at wells screened in the Hueneme Aquifer in Mound Basin ranged from less than the laboratory detection limit (0.4 mg/L) to 136 mg/L (Figure 3.1-19). Similar to the other common dissolved constituents detected in the Hueneme Aquifer, the single highest nitrate concentration in the Hueneme Aquifer was detected at monitoring well 02N22W09L04S, in the southeast quadrant of the Basin. It is noted that the nitrate concentrations in this well (together with well 02N23W13K03S) are anomalously high compared to other Hueneme Aquifer wells in Mound Basin, suggesting influence of shallow groundwater, possibly through a compromised well seal or well casing. Nitrate concentrations were below the detection limit at five wells in the Hueneme Aquifer in Mound Basin (Figure 3.1-19).

Municipal water supply well 02N22W08F01S (Victoria 2) is one of the few wells in Mound Basin where increasing trends are clearly discernible in past (1995 to 2006) TDS and sulfate concentrations (Figure 3.1-24). This well has three screened intervals (580 to 640; 900 to 940; and 1,060 to 1,180 ft bgs) in the Hueneme Aquifer. As noted above, concentrations of these constituents are anomalously high, suggesting a potential influence of an overlying HSU on water quality at these wells, possibly through a compromised well seal or well casing. As groundwater production increased from this well in the 1990s, TDS concentrations increased from approximately 1,000 mg/L to approximately 1,500 mg/L by 2006. Concentrations have since stabilized and have not increased further. The cause of the groundwater quality changes at this well is currently unknown. It is noted that all other wells screened in the Hueneme Aquifer with historical water quality data exhibit generally stable trends for all constituents (Figures 3.1-21 through 3.1-25).

Measured historical boron concentrations have exceeded the Basin WQO at five wells screened in the Hueneme Aquifer. The maximum measured boron concentrations at these wells ranged from 1.05 to 1.30 with the exception of one well (02N23W24G01S), which only had reported data during the 1950s. The reported concentrations at Well 02N23W24G01S show that boron was 7.0 mg/L in October 1953, whereas the rest of the reported concentrations at the same well were below 0.59 mg/L. The 7.0 mg/L reported for October 1953 appears to be an outlier and thus should not be considered. Boron concentrations at the remaining four wells screened in the Hueneme Aquifer show boron concentrations below the Basin WQO for the entire period of record with the exception of one or two samples from one well (02N22W08F01S); these results are not typical of the record of sampling data, which are consistently below the WQO.

3.1.4.4 Primary Beneficial Uses [§354.14(b)(4)(E)]

§354.14 Hydrogeological Conceptual Model.

(b) *The hydrogeologic conceptual model shall be summarized in a written description that includes the following:*

(4) *Principal aquifers and aquitards, including the following information:*

(E) Identification of the primary use or uses of each aquifer, such as domestic, irrigation, or municipal water supply.

The primary uses of each principal aquifer in Mound Basin (Mugu and Hueneme) are reflected in the extraction records that are reported to United (and included in the MBGSA DMS). Importantly, there are no active or recently active domestic wells in the Basin. Recent (as of 2019) extraction records for groundwater in Mound Basin reported to United include agricultural water supply (at 22 wells) and M&I water supply (at 4 wells). In 2019, 2,873 AF (45% of the total of 6,319 AF of groundwater extracted from Mound Basin) was used for agriculture, and 3,446 AF (55% of the total) was used for M&I purposes. The locations of all 26 water supply wells active in Mound Basin in 2019 and relative volumes of groundwater extracted by each well are shown on Figure 3.1-26. The quantities of groundwater extracted for agricultural and M&I uses from the principal aquifers underlying Mound Basin during the past 40 years (1980 through 2019) are shown on Figures 3.1-27 through 3.1-29. None of the wells active in 2019 were reportedly used for domestic supply, likely due to the availability of potable water from Ventura Water and the significant expense required to drill a domestic water supply well to the depth required to reach a principal aquifer in Mound Basin. The following subsections provide more detail regarding the primary uses of groundwater extracted from each principal aquifer in Mound Basin.

Shallow Alluvial Deposits

No wells extract groundwater from the Shallow Alluvial Deposits in the Basin.

Mugu Aquifer Extraction

Five active wells are screened solely in the Mugu Aquifer and one active well is believed to produce water primarily from the Mugu Aquifer, despite possibly being screened partly in the Hueneme Aquifer (Table 3.1-02). In 2019, five of these six wells supplied 948 AF of groundwater for agricultural use, which was approximately 15% of the total extracted from Mound Basin that year. The remaining well supplied 1,740 AF of groundwater for M&I use, which was approximately 28% of the total extracted from Mound Basin in 2019.

Hueneme Aquifer Extraction

Ten active wells are screened solely in the Hueneme Aquifer and one active well is believed to produce water primarily from the Hueneme Aquifer, despite possibly being screened partly in the Mugu Aquifer (Table 3.1-02). In 2019, three of these wells supplied 1,706 AF of groundwater for M&I use, which was approximately 27% of the total extraction from Mound Basin. The remaining eight wells supplied 1,129 AF of groundwater for agricultural use, which was approximately 18% of the total extracted from Mound Basin in 2019.

Extraction from Wells Screened Across Multiple Aquifers

Four active water supply wells are screened in (and are assumed to withdraw significant quantities of groundwater from) both the Mugu and Hueneme aquifers; all groundwater extracted from these wells is used for agricultural purposes (Table 3.1-02). In 2019, a total of 134 AF was extracted from these wells, which was approximately 2% of the total extracted from Mound Basin that year.

Two active water supply wells are screened in both the Hueneme and Fox Canyon aquifers; the water extracted from these wells is used for agricultural purposes (Table 3.1-02). In 2019, a total of 191 AF was extracted from this well, which was about 3% of the total quantity of groundwater extracted from Mound Basin that year. Due to the generally higher hydraulic conductivity and transmissivity of the Hueneme Aquifer in Mound Basin compared to the Fox Canyon Aquifer, most of the groundwater extracted from these wells likely was derived from the Hueneme Aquifer.

Extraction from Wells with Unknown Screened Intervals

The depths of the screened intervals for three active water supply wells in Mound Basin have not been reported. The water extracted from these wells is used for agricultural purposes (Table 3.1-02). In 2019, a total of 472 AF was extracted from these wells, which was approximately 7% of the total extracted from Mound Basin that year.

Other Beneficial Uses

In addition to groundwater production from the principal aquifers, discharge of small quantities of groundwater from the Shallow Alluvial Deposits to the lower reach of the Santa Clara River in Mound Basin may contribute to GDEs. This potential beneficial groundwater use is further described in Section 3.2.7 and Appendix G.

3.1.5 Data Gaps and Uncertainty [§354.14(b)(5)]

§354.14 Hydrogeological Conceptual Model.
(b) *The hydrogeologic conceptual model shall be summarized in a written description that includes the following:*
(5) Identification of data gaps and uncertainty within the hydrogeologic conceptual model.

The discussion of data gaps and uncertainty within the HCM of Mound Basin is provided below, organized according to the HCM elements listed in the GSP Emergency Regulations.

Topography [§354.14(d)(1)]

No data gaps or significant uncertainties were identified.

Surface Water Bodies [§354.14(d)(5)]

No data gaps or significant uncertainties were identified.

Imported Water [§354.14(d)(6)]

No data gaps or significant uncertainties were identified.

Regional Geology and Structural Setting [§354.14(b)(1),(d)(2)]

No data gaps or significant uncertainties were identified.

Soil Characteristics [§354.14(d)(3)]

No data gaps or significant uncertainties were identified.

Vertical and Lateral Extent of Mound Basin [§354.14(b)(2),(b)(3),(c)]

The precise location, orientation, and hydraulic impact of the Basin-bounding McGrath Fault (south boundary) and Country Club Fault (east boundary) are not known precisely because they do not offset surficial units within the Basin. However, the south and east boundaries are jurisdictional and thus do not depend on precise knowledge of the fault locations. Going forward, MBGSA will work with the adjacent basin institutions (Santa Paula Basin Technical Advisory Committee and FCGMA), as well as United, to improve the understanding of the location and hydraulic barrier effects of the Basin-bounding faults, when opportunities arise.

With regard to the western Basin boundary, it is defined as the Pacific Ocean shoreline, of which the location is known with certainty. From a purely hydraulic perspective, the western Basin boundary is more appropriately considered to be the location where the principal aquifers are exposed to seawater. The principal aquifers of Mound Basin are believed to extend up to approximately 10 miles offshore under the Pacific Ocean west of the shoreline, to the location where they are mapped as cropping out on the continental shelf edge, as shown on Figure 3.1-10. However, it is unknown if the aquitards that separate the principal aquifers from the seafloor have been eroded away or otherwise compromised by faulting or folding between the shoreline and the continental shelf edge. This is a very significant uncertainty in the HCM that directly impacts management relative to the seawater intrusion sustainability indicator.

The vertical extent (definable bottom) of the Basin is known only from a relatively small number of oil well logs. This is because few wells tap the deepest freshwater aquifer and none fully penetrate it. The uncertainty in the vertical extent of the Basin is not considered a significant data gap or uncertainty in the HCM because there is little, if any, groundwater extracted from the deepest freshwater aquifer.

Groundwater Flow Barriers [§354.14(b)(4)(C) and (c)]

The prior discussion of uncertainty concerning the location, orientation, and hydraulic impact of the Basin-bounding faults (McGrath and Country Club Faults) also applies to this part of the HCM.

In addition, the hydraulic impact of Pitas Point, Ventura, and Foothill faults, located in the northern portion of the Basin, are uncertain. These faults have uplifted the principal aquifers in the northern portion of the Basin, exposing them at land surface. Given the significant offset of the principal aquifers and the juxtaposition of different HSUs across the fault plane, it can be inferred that these faults likely impede groundwater flow in the principal aquifers to some degree. There are no groundwater monitoring wells located north and immediately south of these faults to detect groundwater elevation change across the faults. Neither the USGS (2003a) nor United (2018) regional groundwater flow models incorporated these faults as horizontal flow barriers because of this lack of data. This is considered a significant uncertainty in the HCM because MBGSA's knowledge of groundwater flow directions is largely derived from United's groundwater model (2021a), which currently assumes no impedance of flow from the principal aquifer outcrops north of these faults. If these faults impede flow, the groundwater flow directions and water budget for Mound Basin derived from the groundwater flow model might be significantly different. MBGSA will work with United to test alternative model calibrations that consider varying degrees of potential barrier effects of these faults to evaluate uncertainty in groundwater flow directions and water budget and the resulting impact on Basin management decisions.

Formation Names and Hydraulic Properties [§354.14(b)(4)(A), (b)(4)(B)]

The lateral and vertical extents of the Basin HSUs are well established, except for the bottom of the deepest freshwater aquifer, as discussed above.

As noted in Section 3.1.4, no aquifer tests have been reported in the literature. The best available information for aquifer and aquitard hydraulic properties in Mound Basin is from the calibrated regional groundwater flow model (United, 2018). Use of model-derived hydraulic properties values is considered appropriate and, therefore, the lack of aquifer tests results is not considered a significant data gap or uncertainty at this time. Going forward, MBGSA will work with well owners in the Basin to conduct aquifer tests when opportunities arise, such as when new or replacement wells are constructed.

Groundwater Recharge and Discharge Areas [§354.14(d)(4)]

No data gaps or significant uncertainties were identified; however, as described above, the degree of hydraulic connectivity of the principal aquifer outcrops in the northern part of Mound Basin with the remainder of the Basin (south of the Ventura, Pitas Point, and Foothills faults) is uncertain.

Water Quality [§354.14(b)(4)(D)]

Groundwater in the principal aquifers in the northern and western portions of Mound Basin has not been sampled in recent years (and in some areas, it has never been sampled) for water quality analysis. No wells currently are known to exist that can be used to obtain samples in these areas. However, there is no groundwater production in these portions of the basins, so this is not considered to be a significant data gap or uncertainty in the HCM.

Primary Beneficial Uses [§354.14(b)(4)(E)]

No data gaps or significant uncertainties were identified.

3.2 Groundwater Conditions [§354.16]

This subsection provides a description of current and historical groundwater conditions in the principal aquifers of the Mound Basin, based on best available information. Groundwater conditions during the past 10 years, and particularly from 2015 to present, are the primary focus of this subsection, although historical data are also discussed where such data provide relevant information about long-term trends in groundwater conditions. Additional details regarding historical groundwater conditions in Mound Basin and the vicinity in the first half of the 20th century are provided by Mukae and Turner (1975) and John F. Mann Jr. & Associates (1959). In addition, USGS (2003a) estimated groundwater levels and movement throughout the region from the 1890s to the early 1990s, based on data synthesis and modeling. United and other local agencies have been collecting groundwater elevation and groundwater quality data from wells in Mound Basin and adjacent basins since the 1920s. United maintains a comprehensive, up-to-date database of groundwater elevations in Mound Basin, incorporating selected data from the VCWPD and other sources that supplement the data collected by United. Therefore, the source of most of the data relied upon in this subsection is United's database, supplemented with additional data from the City of Ventura, the County of Ventura, and other agencies as appropriate. All of the above-described data have been incorporated into the MBGSA DMS.

3.2.1 Groundwater Elevations [§354.16(a)]

Maps of groundwater elevation data combined with hydrographs showing changes in groundwater elevations over time can help illustrate groundwater occurrence and movement in an aquifer system. Groundwater elevation data are available for nearly 60 wells located within Mound Basin. However, not all of these wells are being monitored at present. The distribution of wells is heavily skewed towards the southern half of the Basin, with relatively few wells existing in the northern half of the Basin (north of Highway 126). As noted in Section 3.1, faults near the southern and eastern boundaries of the Basin affect groundwater movement. Therefore, groundwater level data from adjacent areas of the Oxnard and Santa Paula basins are also presented in this section to help define lateral gradients along the eastern and southern boundaries of Mound Basin.

3.2.1.1 Groundwater Elevation Contours [§354.16(a)(1)]

§354.16 Groundwater Conditions. *Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:*

- ***(a)*** *Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including:*
  - ***(1) Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin.***

The contouring of groundwater levels in Mound Basin is complicated by the sparse data, particularly in the northern portion of the Basin. Groundwater level measurements obtained from wells screened in the

Mugu and Hueneme aquifers (the principal aquifers in Mound Basin) during 2012 and 2019 are shown on Figures 3.2-01 through 3.2-08. Year 2012 was the most recent year when groundwater levels in Mound Basin were representative of average conditions, while year 2019 represents more recent conditions, which continue to be influenced by overall drought conditions that started in 2012 and the associated deficit of groundwater recharge compared to discharge. The groundwater elevations posted on Figures 3.2-01 through 3.2-08 are seasonal high and seasonal low groundwater levels, which typically occur during the spring and fall, respectively, of each year. Data shown were generally collected in March or April (for spring highs) and September or October (for fall lows). Due to the limited distribution of wells where groundwater elevations can be measured, groundwater elevations simulated by United using the Ventura Regional Groundwater Flow Model (United, 2018, 2021a, 2021b) for the Mugu and Hueneme aquifers in 2012 and 2019 were contoured to illustrate groundwater flow directions and horizontal groundwater gradients throughout Mound Basin and are shown on Figures 3.2-01 through 3.2-08.

As discussed in the HCM (Section 3.1), Mound Basin is structurally complex. The main groundwater flow pattern is from east-northeast to the west-southwest, along the axis of the Mound Basin, towards the Pacific Ocean (United, 2012). Available information indicates that Mound Basin receives groundwater underflow from both the Santa Paula Basin to the east and the Oxnard Forebay/ Oxnard Plain to the south (United, 2018). Generalized conceptual groundwater flow paths in the principal aquifers of Mound Basin are depicted on Figure 3.2-09. More detail regarding inflows and outflows of groundwater in Mound Basin are presented in Section 3.3.

Figures 3.2-01 and 3.2-02 show modeled groundwater elevation contours in the Mugu Aquifer during spring and fall of 2012, together with spring-high and fall-low groundwater level measurements reported for wells screened in the Mugu Aquifer. Overall, the pattern of groundwater contours in the Basin during spring and fall are similar, with groundwater levels about 10 ft lower in the fall than spring. The groundwater flow direction in the Mugu Aquifer is consistent with the typical flow pattern, from the eastern side of the Basin to the west-southwest toward the Pacific Ocean, with a gradient of approximately 0.002 ft/ft. Groundwater flows from areas of high groundwater elevation to areas of low groundwater elevation. The highest contoured groundwater elevation in the Mugu Aquifer during 2012, 210 ft msl, occurred in the northeastern portion of the Basin. The lowest contoured groundwater elevations in the Mugu Aquifer in 2012, 20 ft msl and 10 ft msl, occurred during spring and fall, respectively, in the central portion of Mound Basin. During the fall, a 5 ft msl contour in the Oxnard Basin extends slightly into the southwest corner of the Mound Basin.

Figures 3.2-03 and 3.2-04 show modeled groundwater elevation contours in the Hueneme Aquifer during spring and fall of 2012, together with spring-high and fall-low groundwater levels measured at wells screened in the Hueneme Aquifer. The groundwater flow direction in the Hueneme Aquifer during the spring was consistent with the typical flow pattern, from the eastern side of the Basin to the west-southwest toward the Pacific Ocean, with a gradient of approximately 0.002 ft/ft. However, during the fall of 2012, groundwater flow was to the south toward the boundary with the Oxnard Basin with a gradient of approximately 0.002 ft/ft. Groundwater levels in the Basin were more than 10 ft lower in the fall than spring. The highest contoured groundwater elevation in the Hueneme Aquifer during 2012, 295 ft msl, again occurred in the northeastern portion of the Basin. The lowest contoured groundwater elevation in the Hueneme Aquifer during spring 2012, 15 ft msl, occurred in the southwest portion of Mound Basin. The lowest contoured groundwater elevation in the Hueneme Aquifer in fall 2012, 0 ft msl (equal to mean sea level), occurred at the southern boundary with Oxnard Basin.

Figures 3.2-05 and 3.2-06 show modeled groundwater elevation contours in the Mugu Aquifer during spring and fall of 2019, together with spring-high and fall-low groundwater level measurements reported for wells screened in the Mugu Aquifer. Contours show the ongoing effects of the 2012-2016 drought in the region, with groundwater elevations across much of the Basin below sea level during both spring and fall. Overall, the pattern of groundwater contours in Mound Basin during spring and fall are similar, with groundwater levels about 5 ft lower in the fall than spring. The hydraulic gradients (groundwater flow directions) in both the Mugu and Hueneme aquifers in spring and fall of 2019 are consistently toward the southwest in the east part of the Basin (magnitude of the hydraulic gradient in this area is approximately 0.002 ft/ft), shifting southward in the central area of the Basin. The potentiometric surface is nearly flat in the central and western portions of the Basin in 2019. The highest contoured groundwater elevation in the Mugu Aquifer during 2019, 220 ft msl, occurred in the northeastern portion of the Basin. The lowest contoured groundwater elevations in the Mugu Aquifer in 2019, -15 ft msl and -20 ft msl (spring and fall, respectively), occurred in the central and west portions of Mound Basin.

Figures 3.2-07 and 3.2-08 show modeled groundwater elevation contours in the Hueneme Aquifer during spring and fall of 2019, together with spring-high and fall-low groundwater levels measured at wells screened in the Hueneme Aquifer. Similar to the Mugu Aquifer, contours show drought conditions, with heads in much of the Basin measured below sea level. The groundwater flow direction in the Hueneme Aquifer was westward in the eastern portion of the Basin (magnitude of the hydraulic gradient was approximately 0.002 ft/ft), shifting southward in the central part of Mound Basin. Overall, the pattern of groundwater contours in Mound Basin during spring and fall are similar, with groundwater levels about 5 ft lower in the fall than spring. Again, the potentiometric surface is nearly flat in the central and western portions of the Basin in 2019. The highest contoured groundwater elevation in the Hueneme Aquifer during spring 2019, 295 ft msl, occurred in the northeastern portion of the Basin. The lowest contoured groundwater elevations in the Hueneme Aquifer in 2019, -15 ft msl and -25 ft msl (spring and fall, respectively) occurred at the southern boundary with Oxnard Basin.

3.2.1.2 Groundwater Elevation Hydrographs [§354.16(a)(2)]

> **§354.16 Groundwater Conditions.** *Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:*
>
> ***(a)*** *Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including:*
>
> ***(2) Hydrographs depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients between principal aquifers.***

Groundwater elevations in Mound Basin fluctuate in response to seasonal, annual, and longer-term changes in rainfall, which influences several water-balance components in Mound Basin (as discussed in Section 3.3). Changes in groundwater levels can vary both by location and by aquifer within Mound Basin, although the general patterns of decline and recovery are similar throughout the Basin within the principal aquifers. The cumulative departure from the average precipitation is used to identify historical wet and dry periods to aid in interpretation of groundwater level trends over time. The cumulative departure from average precipitation is calculated by accumulating the annual differences between annual precipitation and the long-term average annual precipitation. Precipitation records from rain gage station 222 (at "Ventura, Thille Ranch") and station 222A (at the Ventura County Government Center) were used to calculate the cumulative departure curves, which are shown on the graphs included in Figures 3.2-10 through 3.2-13. These stations were selected because of their central location and long period of record (1926 to present). During this period, the calculated average annual precipitation in the central Mound Basin is 15.56 inches. For the discussion of groundwater elevation hydrographs below, wells have been grouped geographically within Mound Basin (south, north, central, east, west) with locations shown on Figures 3.2-10 through 3.2-13. In general, extended periods of low groundwater levels were recorded between the late 1920s and early 1930s, late 1940s and early 1950s, mid-1980s, early 1990s, and 2012 to 2018. These time periods are coincident with multi-year droughts, as shown in the declining limb of the curve showing cumulative departure from average precipitation, plotted on Figures 3.2-10 through 3.2-13. Groundwater elevations in both principal aquifers briefly declined below sea level during the historical droughts, but recovered during the subsequent wet periods.

Measured groundwater levels in southern Mound Basin have varied over about a 120-ft range over the period of record, ranging from approximately -60 to +60 ft msl (Figure 3.2-10). Groundwater levels generally rise and fall consistent with the cumulative departure curve for rainfall (Figure 3.2-10). Groundwater elevations at wells located south of the Oak Ridge Fault are similar to groundwater elevations measured at wells in the adjacent Oxnard Basin, to the south (Figure 3.2-10). Wells located in the southeast Mound Basin closest to the Forebay area of the Oxnard Basin (e.g., well 02N22W16K01S) exhibit the greatest annual variability in groundwater elevations, as a response to the large volumes of artificial recharge and extraction that occur in the Forebay area, although the range of recorded groundwater levels in Mound Basin is smaller than the range in the Forebay area (United, 2017b).

Groundwater level records are known to exist for only one well in the northern portion of Mound Basin, 02N23W01P01S, with a total depth of 300 ft (Figure 3.2-11). No information about the screened interval of this well is available; only total depth was provided by the VCWPD. However, the total depth of 300 ft suggests this well likely is screened in the fine-grained Pleistocene deposits instead of a principal aquifer. Groundwater level records for this well are available solely for the mid-1970s; at that time, groundwater levels at this well were about 100 ft higher than in wells located in the central portion of the Basin.

Measured groundwater levels in central Mound Basin have varied about a 120-ft range over the period of record, ranging from approximately -40 to +80 ft msl (Figure 3.2-11). The high groundwater levels shown for monitoring well 02N22W07M03S reflect groundwater levels in the fine-grained Pleistocene deposits.

Measured groundwater levels in eastern Mound Basin have varied over about a 140-ft range during the period of record, ranging from approximately -40 to +100 ft msl (Figure 3.2-12). Groundwater elevations in some principal aquifer wells in the eastern Mound Basin are approximately 80 to more than 100 ft lower than similarly screened wells in western Santa Paula Basin (Figures 3.2-01 through 3.2-08). This differential in groundwater elevations produces a large hydraulic gradient across the basin boundary between Santa Paula Basin and Mound Basin (DBSA, 2017; United, 2018). However, groundwater elevations at other wells in this area are similar to western Santa Paula Basin groundwater levels (Figure 3.2-12). These differences are likely related to the complex structural geology in the eastern Mound Basin area that is associated with the intersection of the Country Club and Oak Ridge faults. The time domain electromagnetic (TDEM) surface geophysical survey conducted by United (2020), documented changes in resistivity of the sediments across the Mound-Santa Paula and adjacent Oxnard Basin (Forebay area) boundaries. Anomalous zones of high and low resistivity (indicating sands/gravels and silts/clays, respectively) were observed in eastern Mound Basin, consistent with structural complexities related to faulting in this area (United, 2020).

Measured groundwater levels in western Mound Basin have varied over about a 60-ft range over the period of record, ranging from approximately -20 to +40 ft msl (Figure 3.2-13). Near the coast, few wells existed prior to the 1990s. In 1995, United and the City of Ventura jointly funded installation of three monitoring wells at Marina Park near the north side of Ventura Harbor to assess groundwater conditions at the coast. Artesian conditions (aquifer with sufficient water pressure to cause the groundwater level in a cased well to rise above land surface) are common in the shallowest of these wells, 02N23W15J03S, which is screened in the fine-grained Pleistocene deposits (170 to 240 ft bgs), as shown on Figure 3.2-13. Artesian heads of 30 ft above land surface are commonly recorded at this well. Coincident with overall drought conditions since 2012, groundwater levels in most wells in the western Mound Basin have been below sea level since approximately 2014, but heads in the monitoring well screened in the fine-grained Pleistocene deposits have remained artesian. The deeper wells at Marina Park (well 02N23W15J02S, screened from 480 to 660 ft bgs in the Mugu Aquifer and 02N23W15J01S (screened from 970 to 1070 ft bgs in the Hueneme Aquifer) commonly displayed weak artesian conditions before the recent drought began in 2012. In the agricultural area east of Ventura Harbor, groundwater levels commonly are below sea level during dry periods (Figure 3.2-13). For example, groundwater elevations of 25 ft below sea level were recorded in 1991 and 14 ft below sea level in 2004; since 2014 groundwater levels have declined up to 20 ft below sea level.

Vertical groundwater gradients between principal aquifers in Mound Basin are measured using groundwater level data collected at two of the three monitoring well clusters in Mound Basin. One cluster-well site is at Marina Park (wells 02N23W15J01S, 02N23W15J02S, 02N23W15J03S), located at the coast north of the Ventura Harbor (Figure 3.2-14). Another site is at Camino Real Park (wells 02N22W07M01S, 02N22W07M02S, 02N22W07M03S), located 2 miles inland near the intersection of U.S. Highway 101 and State Highway 126 (Figure 3.2-15). The last site (wells 02N22W09L03S, 02N22W09L04S) is farther east at the Community Water Park on Kimball Rd (Figure 3.2-16), but both wells in this cluster are interpreted to be screened within the Hueneme Aquifer. The sites at Marina Park and Camino Real Park have three monitoring wells, one screened in each of the following HSUs: fine-grained Pleistocene deposits, Mugu Aquifer, and Hueneme Aquifer. Hydrographs for these monitoring wells are shown on Figures 3.2-14 through 3.2-16. Groundwater levels in the shallowest wells, screened in the fine-grained Pleistocene deposits, are shown with a green line; groundwater levels in the middle depth wells, screened in the Mugu Aquifer, are shown with an orange line; and groundwater levels in the deepest wells, screened in the Hueneme Aquifer, are shown with a blue line. Since the monitoring wells at the Community Water Park are both screened in the Hueneme Aquifer, the groundwater level for the deeper screened well is shown in a darker blue than the groundwater level record for the shallower well. Table 3.2-01 provides the calculated vertical gradients at the three monitoring well sites. This includes the vertical gradient from the fine-grained Pleistocene deposits to the underlying Mugu Aquifer and from the Mugu Aquifer to the underlying Hueneme Aquifer at Marina Park and Camino Real Park. The vertical gradient is also calculated from upper to deeper strata of the Hueneme Aquifer at the Community Water Park, near Kimball Road. Vertical gradients were calculated using the available data record, from 1995 through 2019 at Marina Park and Camino Real Park and from 2008 through 2019 at the Community Water Park near Kimball Road. A positive vertical gradient value represents downward flow, and a negative vertical gradient value represents an upward flow.

Near the coast, groundwater levels in the well screened in the fine-grained Pleistocene deposits at Marina Park are significantly higher than those in the deeper wells (Figure 3.2-14), indicating that this aquitard is in poor hydraulic communication with the underlying principal aquifers of Mound Basin. The vertical gradient from the fine-grained Pleistocene deposits to the underlying Mugu Aquifer ranged from 0.009 to 0.120 ft/ft and averaged 0.075 ft/ft. Groundwater levels in the well screened in the Mugu Aquifer at this location are generally higher than the deepest well, which is screened in the Hueneme Aquifer, indicating a downward vertical gradient. Since the recent drought began in 2012, groundwater levels for the wells screened in the Mugu and Hueneme aquifers are similar (Figure 3.2-14). The vertical gradient from the Mugu Aquifer to the underlying Hueneme Aquifer ranged from -0.020 to 0.033 ft/ft and averaged 0.008 ft/ft.

Farther inland at Camino Real Park, groundwater levels in the well screened in the fine-grained Pleistocene deposits are significantly higher than the deeper wells (Figure 3.2-15), again indicating limited hydraulic communication with deeper aquifers. The vertical gradient from the fine-grained Pleistocene deposits to the underlying Mugu Aquifer ranged from 0.219 to 0.325 ft/ft and averaged 0.276 ft/ft. Prior to 2010, groundwater levels in the well screened in the Mugu Aquifer at this location were generally higher than those in the deepest well, indicating a downward vertical gradient. After 2010, groundwater levels in the deepest well, screened in the Hueneme Aquifer, were usually similar to or occasionally higher than the groundwater level in the well screened in the Mugu Aquifer, indicating neutral to slightly upward vertical gradient. The vertical gradient from the Mugu Aquifer to the underlying Hueneme Aquifer ranged from -0.028 to 0.043 ft/ft and averaged 0.008 ft/ft.

The monitoring well site furthest inland at the Community Water Park at Kimball Road show that groundwater levels in the shallower well are usually higher than the deeper well, indicating a downward vertical gradient (Figure 3.2-16). The vertical gradient from the shallow to deeper depth in the Hueneme Aquifer ranged from -0.018 to 0.070 ft/ft and averaged 0.038 ft/ft. Both wells in this cluster are interpreted to be screened within the Hueneme Aquifer. The electric log at this location indicates the Hueneme Aquifer consists of a series of coarse-grained zones separated by fine-grained zones of varying thickness. The electric log shows fine-grained zones between the monitoring well screen intervals, including a 30-ft-thick clay unit. The water quality data from the upper well at this location show anomalous major-ion chemistry, and groundwater levels recover very slowly after sampling events, sometimes taking several months to return to a similar groundwater level as before the sampling event. Thus, the vertical gradients reported at this location may not be representative of vertical gradients throughout the Hueneme Aquifer.

3.2.2 Change in Storage [§354.16(b)]

§354.16 Groundwater Conditions. *Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:*

(b) A graph depicting estimates of the change in groundwater in storage, based on data, demonstrating the annual and cumulative change in the volume of groundwater in storage between seasonal high groundwater conditions, including the annual groundwater use and water year type.

The annual change in volume of groundwater stored in a basin is the product of change in potentiometric head (measured as groundwater elevation), the storativity, and the area of each HSU. Similar to contouring of groundwater levels in Mound Basin (as described above), estimation of historical changes in groundwater stored in the Basin is complicated by sparse groundwater elevation data, particularly in the northern portion of the Basin and in HSUs with few monitoring points. Due to these limitations, annual and cumulative changes in groundwater in storage were estimated using United's (2018, 2021a, 2021b) groundwater flow model, which is generally well calibrated on a regional scale to groundwater elevation measurements.

Figure 3.2-17 graphically depicts the estimated annual change in groundwater storage in Mound Basin from 1986 through 2019, which is the historical period used to calibrate and validate United's (2018, 2021a, 2021b) model. The changes in storage estimated by the model from March 31 of a given year to March 31 of the subsequent year is depicted on Figure 3.2-17 as "estimated annual change in groundwater in storage" (seasonal high groundwater elevations in Mound Basin most commonly occur in March or April of each year). Also depicted on Figure 3.2-17 are:

- the cumulative change in storage, calculated as the sum of annual changes in storage up to the given year.
- the estimated groundwater use (volume of groundwater extracted) in Mound Basin during each water year.
- water year type.

The annual changes in groundwater storage in Mound Basin result from multiple groundwater inflows and outflows, as described in Section 3.3 of this GSP. However, some notable general trends are apparent from inspection of Figure 3.2-17, including:

- During most years with below-average rainfall ("dry years") and near-average rainfall ("average years"), groundwater in storage typically declined modestly (2,000 to 5,000 AF), although greater declines in storage (up to 9,000 AF annually) occurred during the exceptional droughts of 1987-1990 and 2012-2016. The greatest annual decreases in storage have not consistently been associated with years of the highest extraction rates, suggesting that other water budget components can have a significant influence on groundwater in storage.
- During most years with above-average rainfall ("wet years"), groundwater in storage often increased by 7,000 to 13,000 AF. These increases in groundwater storage were typically much larger than the annual declines observed during dry and average years, reflecting the importance of the region's infrequent wet years in recharging groundwater basins.
- The estimated cumulative change in groundwater in storage in Mound Basin declined markedly during the two exceptional droughts that occurred in the region (1987-1990 and 2012-2016). Cumulative change in storage quickly rebounded to pre-drought conditions in the four years following the 1987-1990 drought and remained positive (greater than initial conditions in 1986) until the next exceptional drought in the region (2012-2016). During the 2012-2016 exceptional drought, cumulative change in groundwater in storage sharply declined again, although not to the same magnitude as occurred from 1987-1990, likely due to the smaller volumes of groundwater extracted from Mound Basin in the past decade compared to the late 1980s. Unlike the 1987-1990 drought, wet years did not immediately follow the 2012-2016 drought;

consequently, cumulative change in storage remained at approximately 2016 levels through 2019.

3.2.3 Seawater Intrusion [§354.16(c)]

§354.16 Groundwater Conditions. *Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:*

(c) Seawater intrusion conditions in the basin, including maps and cross-sections of the seawater intrusion front for each principal aquifer.

SGMA defines seawater intrusion as “the advancement of seawater into a groundwater supply that results in degradation of water quality in the basin, and includes seawater from any source.” The primary cause for seawater intrusion in coastal aquifers is development of a landward hydraulic gradient in areas where groundwater extraction has caused groundwater elevations to decline below the hydraulic head necessary to prevent landward movement of seawater. If groundwater elevations inland of the coast fall below this protective elevation, and assuming there is a pathway for seawater to enter one of the principal aquifers, then landward migration of seawater from the ocean into freshwater aquifers can occur. This process is referred to herein as “lateral seawater intrusion.” The principal aquifers of the adjacent Oxnard Basin are highly vulnerable to lateral seawater intrusion due to the existence of two deep submarine canyons just offshore from Port Hueneme and Point Mugu where erosion during periods of lower sea level (ice age) exposed the aquifers to seawater in the canyon walls at a very close distance to the shoreline (Figure 3.1-10). However, no such submarine canyons exist offshore of Mound Basin, greatly reducing the likelihood that seawater can find a near-shore path for intrusion into the principal aquifers (Mugu and Hueneme aquifers) (Figure 3.1-10). Instead, the Mound Basin principal aquifers may only be exposed to seawater where they crop out on the continental shelf edge, approximately 10 miles offshore (Figure 3.1-10).

Previous investigators (John F. Mann Jr. & Associates, 1959; Geotechnical Consultants, 1972; Fugro West, 1996) did not find evidence of lateral seawater intrusion into the principal aquifers of Mound Basin. Geotechnical Consultants (1972) conducted the most detailed review to that point and determined that “to date, there is no evidence that seawater intrusion has occurred historically or that it is occurring presently in Mound Basin.” Their report notes that a landward hydraulic gradient existed in the area of Pierpont Bay from 1957 to 1961, as a result of extraction from municipal water supply wells in the Pierpont Bay area. Those wells have since been decommissioned. The landward gradient was a concern as a potential source of seawater intrusion at that time, and chloride concentrations increased at the former Pierpont Bay wells in the same general timeframe. However, Geotechnical Consultants (1972) proposed that downward movement of poor-quality groundwater from shallower aquifer zones via “improper well seals and/or over-extended gravel envelopes” was the cause for the increasing chloride concentrations detected at the Pierpont Bay wells, rather than seawater intrusion. Monitoring data at the Marina Park cluster of monitoring wells, located near Pierpont Bay, have shown no signs of seawater intrusion in the principal aquifers (Figure 3.1-21).

Consistent with the findings of Geotechnical Consultants (1972) nearly 50 years ago, recent water quality data for wells near the coast do not show evidence of lateral seawater intrusion into the aquifers of Mound Basin. The maximum recorded chloride concentrations from the 2017 calendar year are shown on

Figures 3.1-14 and 3.1-18 (data for 2017 are shown because data are available for most wells in Mound Basin; fewer wells were sampled in 2018 by VCWPD due to staffing issues). Most coastal well samples contained chloride concentrations below 100 mg/L; however, four wells located farther inland (Figures 3.1-14 and 3.1-18) had chloride concentrations at or above 100 mg/L, a target water quality threshold for many agricultural operations. These chloride concentrations are not believed to be associated with seawater intrusion, as they are farther inland than coastal monitoring wells that did not show indications of seawater intrusion. The shallowest well in the Marina Park coastal monitoring well cluster, 02N23W15J03S (Figure 3.1-21), is screened from 170 to 240 ft bgs in the fine-grained Pleistocene deposits and has the poorest water quality in the area. In this well, TDS concentrations are above 3,000 mg/L and chloride values average nearly 100 mg/L. However, strong artesian heads (well above sea level) are consistently measured in this well (Figure 3.2-14). The high artesian heads in this well indicate offshore groundwater gradients in this vicinity. Groundwater quality in the principal aquifers at the Marina Park monitoring well cluster have not shown any evidence of seawater intrusion (Figure 3.1-21). Groundwater levels in the principal aquifers at this location have been typically above sea level, except briefly in 2004 and since 2014, suggesting that offshore groundwater flow has occurred more frequently than onshore flow (Figure 3.2-14). Well 02N23W14K01S, located approximately 0.75 miles inland of the Marina Park monitoring well cluster (Figure 3.1-20), has produced groundwater of good quality for the period of record (1933 to 1981). Concentrations for most analytes are fairly stable, with TDS concentrations averaging less than 1,200 mg/L (Figure 3.1-20). This agricultural well is screened in the Mugu Aquifer from 475 to 915 ft bgs. One outlier of elevated chloride (376 mg/L) was detected in 1962; otherwise, water quality data from this coastal production well show no evidence of saltwater intrusion. In summary, available data do not indicate that seawater is or has been present in the onshore portions of the principal aquifers to date. There are no available data concerning the presence or absence of seawater in the offshore portions of the aquifers.

Due to the lack of evidence of seawater intrusion in onshore portions of the Basin and lack of data concerning the location of any offshore seawater intrusion front in the principal aquifers, the maps and cross-sections of the seawater intrusion front required pursuant to §354.16(c) cannot be prepared.

3.2.4 Groundwater Quality Impacts [§354.16(d)]

> **§354.16 Groundwater Conditions.** *Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:*
>
> ***(d) Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes.***

This section describes groundwater quality issues that may affect the supply and beneficial uses of groundwater.

Groundwater Contamination Sites and Plumes

Information available on the State Water Resources Control Board (SWRCB) GeoTracker mapping site (SWRCB, 2020) and the Department of Toxic Substances Control (DTSC) mapping website (DTSC, 2020) were reviewed for locations of known groundwater contamination sites and plumes. Sixteen sites out of approximately 200 leaking underground storage tank (LUST) sites and other soil or groundwater cleanup sites are identified as open cases in Mound Basin on GeoTracker. None of the DTSC sites were noted as having groundwater contamination. A map showing the locations of the open Geotracker cases is presented in Figure 3.2-18. Based on review of the open LUST cases, none are reported to have impacted groundwater quality in the principal aquifers (Mugu and Hueneme aquifers). The uppermost principal aquifer in the developed portion of Mound Basin is the Mugu Aquifer, which is vertically separated from the known waste sites by the fine-grained Pleistocene deposits aquitard (generally 350 to 585 ft thick in Mound Basin) and the Shallow Alluvial Deposits (typically 50 to 100 ft thick). Releases from most LUST sites in southwestern Ventura County, which typically involve fuel spills, do not commonly impact groundwater below the shallowest water table. No contamination sites were identified where the deeper aquifers crops out at land surface in the hillside area along the northern margin of Mound Basin (this is in an area of mostly undeveloped land, approximately 1 mile from the nearest currently active water supply well). Based on the review of open cases, the principal aquifers in Mound Basin do not appear to have been impacted by contamination sites and plumes.

Nitrate concentrations in excess of the drinking water MCL of 45 mg/L (as NO_3) were detected at three agricultural water supply wells that are screened in principal aquifers (Mugu and Hueneme aquifers) in Mound Basin in 2017 (the most recent year with abundant water quality data), as follows:

- 02N22W07P01S—Nitrate was detected at a concentration of 64.6 mg/L at this well screened in the Mugu Aquifer near the center of Mound Basin (Figure 3.1-15).
- 02N23W13K03S—Nitrate was detected at a concentration of 61.4 mg/L at this well screened in the Hueneme Aquifer in the southwest part Mound Basin (Figure 3.1-19).
- 02N22W09L04S—Nitrate was detected at a concentration of 136 mg/L at this well screened in the Hueneme Aquifer in the southeast part Mound Basin (Figure 3.1-19).

It should be noted that none of these wells are used for municipal or industrial water supply, and that wells 02N22W07P01S, 02N23W13K03S, and 02N22W09L04 also exhibit anomalously high concentrations of TDS, sulfate, and chloride, suggesting influence of shallow groundwater, possibly through a compromised well seal or well casing (as discussed in Section 3.1.4.3), rather than presence of nitrate "plumes" in the Mugu and Hueneme aquifers in Mound Basin. It is further noted that other wells in the Basin do not exhibit elevated nitrate concentrations, further reinforcing the conclusion that nitrate is not a widespread issue in the Mound Basin principal aquifers.

As discussed in Section 3.1.4.3, the common ion chemistry of the groundwater in the Mugu and Hueneme principal aquifers is not ideal, but is beneficially used by municipal and agricultural users across the Basin. Common ions with RWQCB-LA WQOs include sulfate, boron, and chloride (RWQCB-LA, 2019). TDS also has a WQO. In general, TDS, sulfate, boron, and chloride concentrations are lower in the Mugu Aquifer and meet the WQOs with few exceptions. In general, TDS, sulfate, boron, and chloride concentrations are higher in the Hueneme Aquifer and meet the WQOs for the majority of the sampled locations. Dissolved constituents are derived from natural sources, and groundwater extraction does not appear to be correlated with common ion chemistry concentrations. Elevated TDS and sulfate concentrations relative to drinking water secondary MCLRs are mitigated by blending with other water sources by the City of Ventura. The City of Ventura is pursuing its VenturaWaterPure Project (fully advanced treated recycled water) and an interconnection to facilitate delivery of its SWP entitlement, both of which may provide further opportunities to blend water produced from its Mound Basin wells.

Groundwater Quality Trends at Clustered Monitoring Wells

Three monitoring wells (02N23W15J01S, 02N23W15J02S, and 02N23W15J03S), jointly funded by United and the City of Ventura, were installed in 1995 in a cluster near the coast at Marina Park, on the north side of Ventura Harbor. Groundwater quality in these three wells has been fairly stable since the wells were installed, as indicated by the chemical hydrographs shown on Figure 3.1-21. The shallowest well at this location, well 02N23W15J03S, is screened in the fine-grained Pleistocene deposits from 170 to 240 ft bgs and has the poorest groundwater quality, with TDS typically above the WQO, exceeding 3,000 mg/L; however, there is no groundwater production from this unit in the Basin. The deepest well, screened in the Hueneme Aquifer from 970 to 1,070 ft bgs, routinely records TDS concentrations near 1,300 mg/L, slightly above the WQO, and sulfate concentrations of approximately 500 mg/L, below the WQO. Well 02N23W15J02S, screened in the Mugu Aquifer between 480 and 660 ft bgs, records lower TDS and sulfate concentrations, with TDS around 900 mg/L and sulfate around 400 mg/L, both below WQOs. Chloride concentrations at all three of these wells typically are approximately 100 mg/L, which is less than the RWQCB-LA WQO and lower than chloride concentrations detected at many of the wells located farther inland in Mound Basin, indicating that none of the monitored zones at this location are impacted by seawater intrusion. Additionally, results from a geochemical investigation by SSP&A (2020) suggest that groundwater from the shallow well is not impacted by seawater intrusion, noting that samples were more depleted in bromide, boron, and iodide compared to typical groundwater that has mixed with saline water.

A cluster of three monitoring wells (02N22W07M01S, 02N22W07M02S, and 02N22W07M03S) was also installed by United and the City of Ventura at Camino Real Park in the central portion of the Basin. These wells are the site of the only groundwater quality samples collected from north of Highway 126 in Mound Basin. As with the Marina Park wells, solute concentrations are slightly higher in the Hueneme Aquifer (well 02N22W07M01S, with a screen depth of 1,200 to 1,280 ft bgs) than in the Mugu Aquifer (well 02N22W07M02S, with a screen depth of 710 to 780 ft bgs). In the deeper screened interval, TDS concentrations of 1,100 mg/L are commonly recorded, which is below the WQO for the Basin. TDS is generally less than 1,000 mg/L in the well screened in the Mugu Aquifer (Figure 3.1-22), which is less than the RWQCB-LA WQO. Sulfate accounts for about half of the TDS of the groundwater, as is typical for other wells in the Basin. Well 02N22W07M03S, which is the shallowest of the three wells at the Camino Real Park site (screened from 210 to 280 ft bgs in the fine-grained Pleistocene deposits), has the poorest water quality in the cluster. TDS in this well sometimes exceeds 5,000 mg/L. Chloride and nitrate are also found at high concentrations in this well. However, there is no groundwater production from this unit in the Basin. The recent geochemical investigation by SSP&A (2020) found that the primary dissolved anion in samples collected from the shallow well was sulfate, which if derived from local aquifer minerals and evaporates implies a potential similar evaporitic origin for chloride.

Two monitoring wells (2N22W09L04S and 2N22W09L03S) were installed in Mound Basin near Kimball and Telegraph Roads in 2008 as part of a siting study for a potential new production well for the City of Ventura (Hopkins, 2009). These two wells are in the southeast quadrant of Mound Basin near the boundary between Mound and Santa Paula Basins. Groundwater quality data are available for these wells since 2011. Groundwater quality has consistently been very poor in the shallower well (2N22W09L04S, which is screened in the upper strata of the Hueneme Aquifer, from 480 to 510 ft bgs). Groundwater samples from this well routinely contain TDS concentrations over 6,000 mg/L and sulfate concentrations over 3,500 mg/L. Nitrate and chloride concentrations are also high. Such concentrations exceed the WQOs for the Basin. Groundwater samples from the deeper well (screened in deeper strata of the Hueneme Aquifer, from 890 to 950 ft bgs) contain dissolved constituent concentrations that are more typical of Hueneme Aquifer elsewhere (Figures 3.1-16 through 3.1-19).

3.2.5 Land Subsidence [§354.16(e)]

§354.16 Groundwater Conditions. *Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:*

(e) The extent, cumulative total, and annual rate of land subsidence, including maps depicting total subsidence, utilizing data available from the Department, as specified in Section 353.2, or the best available information.

A review of available reports during preparation of this GSP did not indicate any documented groundwater-related subsidence. DWR (2014) prepared a summary of recent, historical, and future subsidence potential for groundwater basins, described in detail in DWR Bulletin 118 (DWR, 2021a). The stated intent of the document was to provide screening-level information with respect to subsidence. Mound Basin was listed as having a “low” overall estimated potential for future subsidence.

DWR provides subsidence data on their “SGMA Data Viewer” web-based geographic information system (GIS) viewer (DWR, 2020b) to support development of GSPs. The DWR data includes land subsidence estimates for Mound Basin based on interferometric synthetic aperture radar (InSAR) measurements for the period from June 13, 2015, through September 19, 2019 (TRE Altamira, 2020). This subsidence dataset is provided by DWR as a raster image depicting the range of estimated average vertical displacement values in 100-ft by 100-ft grid cells throughout Mound Basin and adjacent groundwater basins. This subsidence dataset was downloaded, mapped, and reviewed (as presented in Figure 3.2-19). The data accuracy report for the InSAR data (Towill, 2020) states that “InSAR data accurately models change in ground elevation to an accuracy tested to be 16 millimeters (mm) at 95% confidence.” The measurement accuracy when converting from the raw InSAR data to the maps provided by DWR is 0.048 feet with 95% confidence level. The total estimated error is therefore 0.1 ft.

Areas falling below the reported accuracy are shown in gray on Figure 3.2-19. Areas depicted in color on Figure 3.2-19 indicate measurable subsidence above the accuracy tolerance. Although a sizeable area of the Basin shows measured subsidence that exceeds the accuracy tolerance of the InSAR data, there are several considerations that should be accounted for when evaluating the data.

As shown on Figure 3.2-19, the highest subsidence rate reported in the InSAR raster data set are concentrated in the southwestern area of the Basin. This InSAR raster data set was apparently derived by interpolating the data points shown on the same figure as black squares. As shown on the figure, there is relatively sparse coverage by the InSAR data points used to derive a full coverage of raster data within this area. In addition, it appears that deriving this high subsidence rate area was highly influenced by interpolating data points that represent a hot spot located outside the Basin. Such a hot spot represents a landfill that is located in the Oxnard Basin. It also appears that values in the southwestern portion of the Mound Basin were estimated by interpolating data points from outside the Basin across the McGrath Fault, which appears to have resulted in erroneous estimates of subsidence in the southwestern portion of the Mound Basin.

Another important consideration is the fact that the InSAR results do not differentiate between subsidence caused by groundwater withdrawal and other potential causes, such as tectonic activity. The Mound Basin is located in a high tectonic activity area characterized by north-south compression. In fact, the Mound Basin is a synclinal basin, caused by ongoing downwarping associated with this compression. The west-east axis of the Basin follows along the Ventura-Santa Clara River Syncline (a downwarp or downward fold) that plunges (deepens) to the west. Additionally, the Mound Basin is bounded by faults to the north (Ventura-Pitas Point Fault) and south (McGrath Fault), along which the majority of the Basin is being down-dropped (Figures 3.1-05 through 3.1-08). Thus, it is to be expected that tectonic activity may be causing the observed subsidence. In fact, inspection of the InSAR data (Figure 3.2-19) reveals that the limits of measurable subsidence are constrained by the Ventura-Pitas Point Fault on the north and narrow to the west, consistent with a west-plunging synclinal structure. Unfortunately, the lack of InSAR data points to the south, and interpolation artifacts associated with the Oxnard Basin landfill prevent further evaluation of tectonic origins of subsidence along the southern Mound Basin boundary.

In addition to the InSAR results, data from a continuous Ground Positioning System (GPS), VNCO, which is maintained by a non-profit university consortium, were reviewed (Figure 3.2-19) (UNAVCO, 2020). The VNCO site is the only continuous GPS location in the Basin. The VNCO GPS site indicates a steady decline in ground position during the period of record, which began in 2000. Comparison with groundwater level data shows that the rate of ground position decline does not vary with groundwater levels, suggesting that the subsidence is unrelated to groundwater levels or extraction (Figure 3.2-19). This comparison further suggests that the measured subsidence in the Basin is of tectonic origin.

In summary, available data suggest that the Mound Basin south of the Ventura-Pitas Point Fault is subsiding at steady rate of approximately 5 mm per year due to tectonic activity. Further investigation may be warranted to confirm these conclusions and more conclusively rule out groundwater levels as a causal factor in the observed subsidence.

3.2.6 Interconnected Surface Water Systems [§354.16(f)]

§354.16 Groundwater Conditions. *Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:*

(f) Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or the best available information.

Available data and numerical modeling analysis suggest that depletion of interconnected surface water systems within Mound Basin caused by groundwater use does not occur. The following paragraphs summarize available information regarding groundwater-surface water interaction that support this conclusion. Detailed information is provided in Appendix G.

Santa Clara River

The lowest approximate 1-mile reach of the Santa Clara River from its mouth (at the Pacific Ocean), including its estuary and adjacent areas of riparian vegetation, is within Mound Basin. The Santa Clara River flows perennially during most years along some or all of the 5-mile reach upstream from its mouth to approximately one-quarter mile northeast of the U.S. Highway 101 bridge between the cities of Ventura and Oxnard (Figure 3.1-11) at the southwest limit of the Forebay area of the Oxnard Basin. Baseflow in the perennial reach has been estimated at approximately 2 cubic feet per second (cfs), which is equivalent to an annual discharge of 1,500 AF/yr (Stillwater Sciences, 2018). Much of this baseflow is groundwater discharge from the semi-perched aquifer of the Oxnard Basin (approximately ¾ of the perennial reach of the Santa Clara River overlies the Oxnard Basin). Total annual flow (including storm flows) in the Santa Clara River, like most streams in southern California, is highly variable, and can exceed 400,000 AF/yr during particularly wet years. Figure 3.2-20 shows records for three stream gages located along the Santa Clara River near Mound Basin; all three gages are located in the adjacent Oxnard Basin (gage locations are shown on Figure 3.1-01). No permanent stream gages have ever existed on the Santa Clara River within Mound Basin. Thus, any change in baseflow downstream of the gage 723, including within Mound Basin, is not known. It should be noted that gage 723 is poorly calibrated to low flows in the river (Stillwater Sciences, 2018).

There are multiple inferred sources of baseflow in the perennial reach of the Santa Clara River. These sources include discharge from the stream terrace deposits of the Mound Basin, discharge from the semi-perched aquifer in Oxnard Basin, agricultural tile drain systems present in both basins, and urban runoff via storm drains. The contributions of these different sources have not been documented in literature.

As discussed in Section 3.1.4.1.3, the presence of tile drains on agricultural lands situated on the stream terrace deposits (Figure 3.1-10) suggests that the stream terrace deposits are poorly permeable and, therefore, are not considered to be an aquifer, despite the occurrence of perched water in these deposits. Perched water within the stream terrace deposits, fed by percolating rainfall and agricultural return flows, is the primary groundwater that is interconnected with Santa Clara River baseflow within Mound Basin. It can be concluded that there is no direct depletion of interconnected surface water of the Santa Clara River and its estuary because there is no groundwater extraction from the Shallow Alluvial Deposits. Indirect depletion of Santa Clara River flows by groundwater extraction from the deeper, principal aquifers does not occur at material rates because the thick zone of fine-grained materials that lies between the Shallow Alluvial Deposits and the Mugu Aquifer significantly limits the propagation of hydraulic responses between these units. A detailed analysis of the potential for indirect depletion is presented in Appendix G. The results of that analysis indicated that there is no material depletion of surface water. The lack of material indirect depletion of interconnected Santa Clara River flows will be further confirmed with data obtained from a future monitoring well planned for the construction at the Ventura Wastewater Treatment Plant (WWTP) and planned interim shallow groundwater data collection and analysis along the Santa Clara River (see Section 6.6).

Barrancas

Surface water flows in the various barrancas crossing Mound Basin are brief in response to precipitation events. These flows may be briefly interconnected with the Shallow Alluvial Deposits or perched groundwater, but this cannot be verified with available data. Regardless of the questions and uncertainty surrounding interconnection of the Shallow Alluvial Deposits with surface water flows in the barrancas, it can be concluded that there is no direct depletion of interconnected surface water in the barrancas because the Shallow Alluvial Deposits do not have any known groundwater extractions within the Mound Basin. Additionally, there is no groundwater extraction north of the Pitas Point-Ventura-Foothill Faults in the northern portion of the Basin where the principal aquifers are exposed and underlie the barrancas. Based on the foregoing, extraction from the principal aquifers is not believed to deplete surface water in the barrancas. Indirect depletion of barranca flows by groundwater extraction from the deeper, principal aquifers does not occur at material rates because the thick zone of fine-grained materials that lies between the Shallow Alluvial Deposits and the Mugu Aquifer significantly limits the propagation of hydraulic responses between these units. A detailed analysis of the potential for indirect depletion of the Santa Clara River is presented in Appendix G, which also applies to the brief flows in the barrancas. The results of that analysis indicated that there is no material depletion of surface water.

3.2.7 Groundwater-Dependent Ecosystems [§354.16(g)]

§354.16 Groundwater Conditions. *Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:*

(g) Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information.

This section summarizes the current best available information concerning potential GDEs in Mound Basin. Detailed assessment of potential GDEs is presented in Appendix H. This understanding is primarily informed by regional information sources including (1) the DWR statewide database of iGDEs and supporting documentation and (2) descriptions of vegetation alliances from the United States Department of Agriculture (USDA) Classification and Assessment with Landsat of Visible Ecological Groupings (CALVEG), which generally correspond with the Natural Communities Commonly Associated with Groundwater (NCCAG) classifications discussed below.

The Natural Communities (NC) dataset is a compilation of 48 publicly available state and federal agency datasets that map vegetation, wetlands, springs, and seeps in California. A working group comprised of DWR, the California Department of Fish and Wildlife (CDFW), and The Nature Conservancy (TNC) reviewed the compiled dataset and conducted a screening process to exclude vegetation and wetland types less likely to be associated with groundwater and retain types commonly associated with groundwater, based on criteria described in Klausmeyer et al. (2018) and available online from the California Natural Resources Agency (2020). Because there is uncertainty in the knowledge of when and how plants and animals depend on groundwater, the spatial database identifies ecosystems that potentially rely on groundwater and, therefore, are referred to as “indicators of groundwater-dependent ecosystems (iGDEs)” (TNC, 2019). TNC suggests using the iGDEs as a starting point for the identification and analysis of GDEs under SGMA, including specifically steps to validate the groundwater dependency of iGDEs with local information (TNC, 2019). Determining whether an iGDE is actually a GDE requires local detailed data about the land use, groundwater levels, surface water hydrology, and geology. Per TNC guidance (TNC, 2019), it is suggested that this statewide database be refined using local information to ensure that the map accurately reflects local conditions. Once a connection from the iGDE to groundwater is determined/ground-truthed, the Basin’s GDE map can be finalized (TNC, 2019).

The iGDEs are categorized into the following two NCCAG classifications:

- Wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions. Note, the wetlands class also includes wetlands within the channel of rivers which may also be referred to as aquatic habitat in other publications.

- Vegetation types commonly associated with the subsurface presence of groundwater (phreatophytes) (CNRA, 2020).

Figure 3.1-11 shows areas of iGDEs mapped in Mound Basin. A map of each numbered iGDE area is presented in Appendix H, indicating the NCCAG class or classes mapped. Each iGDE was screened in general accordance with TNC recommendations to evaluate groundwater dependency (TNC, 2018). The screening results are presented in Appendix H.

As presented in Appendix H, iGDE areas 1 through 10 have been screened out and are not considered GDEs, because the plants present in the mapped iGDE areas appear to meet their transpiration needs using non-groundwater sources of water, such as urban runoff (iGDEs mapped along barrancas) or irrigation (iGDEs located within or adjacent to parks or backyards).

The Area 11 iGDEs is retained as a GDE because the vegetation in this area appears to be at least partially dependent on groundwater encountered within the Shallow Alluvial Deposits (specifically, groundwater and agricultural drainage encountered within the stream terrace deposits). However, it is noted that there is no known groundwater extraction from the Shallow Alluvial Deposits within Mound Basin. Indirect impacts from deep, principal aquifer groundwater extractions on shallow groundwater levels—and, hence, the Area 11 GDE—do not occur because the thick zone of fine-grained materials that lies between the Shallow Alluvial Deposits and the Mugu Aquifer significantly limits the propagation of hydraulic responses between these units. A detailed analysis of the potential for deep, principal aquifer extraction effects on shallow groundwater levels and the Area 11 GDE is presented in Appendix G. The results of that analysis indicated that there are no material effects. The lack of material effects on the Area 11 GDE will be further confirmed with data obtained from a future monitoring well planned for the construction at the Ventura WWTP and planned limited-duration shallow groundwater level monitoring the Santa Clara River (see Section 6.6). Additionally, MBGSA will monitor well permit applications for proposed uses of shallow groundwater in the vicinity of Area 11 and take appropriate actions if the potential for significant and unreasonable effects is indicated by analysis of the proposed uses.

Area 11 includes federally designated critical habitat for southern California Distinct Population Segment steelhead, tidewater goby, western snowy plover, and southwestern willow flycatcher. Additionally, the area provides potential habitat for eight special status plant species and twenty-eight special status wildlife species. As such, the Area 11 GDE Unit is of high ecological value. See Appendix H for more information on the GDEs within Area 11.

3.3 Water Budget [§354.18(a),(b)(1),(b)(2),(b)(3),(b)(4),(b)(6),(e), and (f)]

§354.18 Water Budget.

(a) *Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form.*

(b) *The water budget shall quantify the following, either through direct measurements or estimates based on data:*

- ***(1)*** *Total surface water entering and leaving a basin by water source type.*
- ***(2)*** *Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.*
- ***(3)*** *Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.*
- ***(4)*** *The change in the annual volume of groundwater in storage between seasonal high conditions.*
- ***(6)*** *The water year type associated with the annual supply, demand, and change in groundwater stored.*

(e) *Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow. If a numerical groundwater and surface water model is not used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater, the Plan shall identify and describe an equally effective method, tool, or analytical model to evaluate projected water budget conditions.*

(f) *The Department shall provide the California Central Valley Groundwater-Surface Water Simulation Model (C2VSIM) and the Integrated Water Flow Model (IWFM) for use by Agencies in developing the water budget. Each Agency may choose to use a different groundwater and surface water model, pursuant to Section 352.4.*

This section presents the estimated water budgets for the Mound Basin, including information required by the SGMA Regulations and information that is important for developing an effective plan to achieve sustainability. In accordance with the SGMA Regulations §354.18, the GSP must include a water budget for the Basin that provides an accounting and assessment of the total annual volume of surface water and groundwater entering and leaving the Basin, including historical, current, and projected water budget conditions, and the change in the volume of water stored. Water budgets must be reported in graphical and tabular formats, where applicable. A description of each water budget term and data sources is provided below, and the historical, current, and projected (future) quantitative water budgets for Mound Basin are presented below in Subsections 3.3.1, 3.3.2, and 3.3.3, respectively.

In accordance with GSP Emergency Regulations §354.18(e), MBGSA relied up on the best available information and best available science to quantify the water budget for the Basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow. A numerical groundwater flow model was used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater (United, 2018, 2021a, 2021b, 2021c). The numerical model is based on available hydrogeologic and land use data from the past several decades, previous studies of Basin hydrogeologic conditions, and an earlier version of the model (United, 2018). The numerical model gives insight into how the complex hydrologic processes are operating in the Basin. During previous studies, available data and a peer-review process were used to calibrate the numerical model to Basin hydrogeologic conditions (United 2018). Results of the previous calibration process demonstrated that the modeled groundwater and surface water flow conditions were similar to observed conditions. The numerical model was updated in 2020 (United, 2021a), and the calibration was improved compared to the previous model (United, 2021a). Based on the developments of the model, it is considered appropriate for the GSP.

Estimates and projections of groundwater flow components made with the numerical model have uncertainty due to limitations in available data and limitations from assumptions made to develop the model (United, 2018, 2021a). Model uncertainty was considered when developing the water budgets during the planning process and is discussed in Section 3.3.3.

In accordance with GSP Emergency Regulations §354.18(d), MBGSA utilized the following required information, provided by DWR or other data of comparable quality, to develop the water budget:

- Historical water budget information for mean annual temperature, mean annual precipitation, water year type, and land use;
- Current water budget information for temperature, water year type, evapotranspiration (ET), and land use; and
- Projected water budget information for population, population growth, climate change, and sea level rise.

Precipitation (specifically rainfall, as snow is extremely uncommon in Mound Basin) is not a direct groundwater or surface water budget component. However, precipitation is an important parameter that strongly influences several groundwater and surface water budget components directly or indirectly, such as groundwater recharge and surface water flows in streams. Data sources are provided in Table 3.3-01.

Qualitative descriptions of each inflow or outflow component of the water budgets are detailed below:

Surface Water Entering and Leaving Mound Basin

Surface water enters and leaves Mound Basin via the Santa Clara River and several smaller and ephemeral streams (barrancas) where they cross the Basin's boundaries, as shown on Figure 3.1-01. More detail regarding characteristics and sources of data are discussed in Section 3.1.1.2, and how these surface water components are incorporated in the water budget is discussed below:

Santa Clara River

Surface water flows in the Santa Clara River enter Mound Basin along the Basin's southern boundary (Figure 3.1-01) and leave Mound Basin approximately 1 mile downstream from this entry point, discharging into the Pacific Ocean.

Stream gages for surface flows in the Santa Clara River are located upstream from Mound Basin (Figure 3.1-01), in the Oxnard Basin. These gages are operated by the VCWPD and USGS. Stillwater Sciences (2018) noted the following uncertainties regarding stream gaging data in the Santa Clara River: “The Santa Clara River discharge is based upon a stage versus flow rating curve over a large width with a seasonally variable cross-section due to sediment mobilization. In addition to periodic stage measurement equipment malfunctions, the Santa Clara River discharge rating curve is inaccurate at low flows (i.e., when water depth is below the lowest rating curve value) and during periods after storms between rating curve adjustments.” However, considering the negligible interaction between surface water and groundwater in the principal aquifers of Mound Basin (as described in Section 3.2.6 and Appendix G), the uncertainty in surface water flow rates does not impact the groundwater sustainable management of the Basin. Surface water flows and rates of groundwater recharge from and discharge to the Santa Clara River are estimated using United’s (2021a, 2021b, 2021c) numerical models, as discussed later in this section.

It is noted that United diverts surface water from the Santa Clara River via the Vern Freeman Diversion located approximately 10 miles upstream of where the Santa Clara River enters the Mound Basin. The water budgets presented in this GSP account for historical and projected diversions by United.

Ephemeral streams that cross Mound Basin’s boundaries

Review of USGS topographic maps for the Oxnard (1949), Ventura (1951), and Saticoy (1967) 7.5-minute quadrangles indicates the presence of five subwatersheds in the foothills north of Mound Basin that convey ephemeral surface water flows across the northern boundary of Mound Basin (Figure 3.1-01). These subwatersheds north of Mound Basin include the areas supplying ephemeral flows to:

- an unnamed drainage north of Kalorama Street in northwestern Mound Basin (289 acres).
- Sanjon Barranca (171 acres).
- Prince Barranca and Hall Canyon (2,878 acres).
- the combined subwatershed areas of Sexton Canyon, Barlow Canyon, and Arundell Barranca (2,261 acres).
- Harmon Canyon and Barranca (1,838 acres).

Surface flows in these five subwatersheds are most likely to occur during and immediately following moderate to heavy rainfall events, typically in winter and spring. Some of this stormflow infiltrates permeable sediments of the San Pedro Formation along the northern Mound Basin boundary (Figure 3.1-11) in a process referred to as mountain-front recharge by United (2018) and is described as “ungauged streamflow” by the USGS (2003a). The remainder of these ephemeral flows are rapidly conveyed across Mound Basin in barrancas, some of which are partially lined with concrete, before discharging to the Pacific Ocean or Santa Clara River.

Within Mound Basin, the VCWPD operates one stream gage each in Prince, Arundell, and Harmon barrancas (Figure 3.1-01). Records are available for storm-event peak discharges in Prince (period of record from 1974 through 2017) and Harmon (1971-2018) barrancas, while both storm-event peak discharges (1963-2016) and average daily flows (1963-2006) are available for Arundell Barranca. The locations of these gages (in the central portion of Mound Basin) do not allow calculation of the difference between ephemeral surface water flows that enter and exit Mound Basin via these or the other, smaller drainage courses. However, average daily flow data available for Arundell Barranca were used to estimate annual (water year) surface flows in all five of the watersheds and subwatersheds in Mound Basin from

1986 through 2006 and extrapolated to estimate flows for the remainder of the historical period (1986-2015; Section 3.3.1) and current period (2016-2019; Section 3.3.2). The data was also used to estimate future annual surface flows for the projected period (2022-2096; Section 3.3.3). Specifically, VCWPD data for rainfall at Ventura County Government Center and average daily streamflow in Arundell Barranca for 1986-2006 (VCWPD, 2021) were compared to develop a correlation between annual rainfall (in inches) and annual streamflow (in AF) at the Arundell stream gage (Station 700), per acre of watershed area contributing to flows in Arundell Barranca (7,452 acres total, including 2,261 acres north of Mound Basin and 5,191 acres within Mound Basin upstream from Station 700). The linear best-fit regression is:

Annual streamflow in Arundell Barranca (at Station 700) per acre of watershed area =
*0.043 * annual rainfall – 0.1652*

The coefficient of determination (R-squared) for this relationship is 0.93, indicating a good correlation. This relationship was applied to the subwatersheds draining into Mound Basin (excluding the Santa Clara River, which is discussed separately, above) to estimate total surface water flows entering Mound Basin in the barrancas each year. To estimate surface water exiting Mound Basin from the barrancas, surface water flows generated within Mound Basin in response to rainfall (applying the above relationship to the total area of Mound Basin) were added to the water entering Mound Basin in the barrancas (as described above). The volume of surface flows in the barrancas were then calculated by United's (2021a, 2021b, 2021c) model to be "lost" to mountain-front recharge each year and were subtracted from the surface water budget.

The surface water entering the Basin via these ephemeral drainages consist chiefly of storm flows, which are conveyed rapidly across the Basin in narrow and sometimes lined channels and discharge to the ocean or the Santa Clara River. The surface water flows are expected to have a small to negligible interaction with groundwater in Mound Basin, and ET of these surface flows is assumed to be negligible. Rates of recharge resulting from these flows were estimated from precipitation data and input to United's (2021a) groundwater flow model, as discussed later in this section. Interaction between surface water and groundwater in the Harmon Barranca was modeled (United 2021a) explicitly using MODFLOW's (McDonald and Harbaugh, 1988) stream (SFR) package, due to the relatively large area of its watershed compared to other barrancas in Mound Basin.

Imported water

Surface water and groundwater are imported from adjacent basins via pipeline for M&I and agricultural uses in Mound Basin (see Section 3.1.1.3; B. Bondy, 2020; United, 2021c; Ventura Water, 2020b). Surface water is imported to Mound Basin via pipeline from Casitas MWD and from Ventura Water's groundwater extraction facilities at Foster Park in the Upper Ventura River Basin. In addition, the City of Ventura is planning to begin importing SWP water to Mound Basin by 2025 (Ventura Water, 2020b). Each purveyor reports the quantities of imported water conveyed to Mound Basin. Surface water imported to Mound Basin by Ventura Water (from Casitas MWD) is primarily used for M&I purposes; therefore, the majority of this surface water "exits" the Basin via consumptive use. Specifically, after use it is assumed that 95% of this imported surface water is either conveyed to Ventura's WWTP for treatment and discharge to the Santa Clara River estuary (immediately upstream from the Pacific Ocean) or evapotranspired following application to outdoor landscaping and parks. The remaining 5% of imported surface water is estimated to recharge underlying HSUs as M&I return flows, as described below.

Inflows to the Groundwater System by Water Source Type

Subsurface groundwater inflow

As described in Sections 3.1 and 3.2, groundwater underflow into and out of Mound Basin occurs at the boundaries with the adjacent Santa Paula and Oxnard Basins. The boundary between Mound Basin and the Lower Ventura River Basin consists of a hydraulic divide, which by definition means little to no groundwater underflow occurs across this boundary. The direction and magnitude of inflow and outflow from Santa Paula and Oxnard Basins vary by aquifer, location, and time, depending largely on the direction of the hydraulic gradient within each aquifer at any given time. Another factor affecting groundwater underflow between basins is the nature of each boundary: the boundary between Santa Paula Basin and Mound Basin consists of a low-permeability fault zone with an offset of bedding, which constrains the quantity of groundwater that can flow between the two basins (see Section 3.2.1.1). Hydrogeologic conditions underlying the boundary between Oxnard Basin and Mound Basin are more complex, including a fault, a fold, and stratigraphic changes (described in Section 3.1.4.1). These features allow underflow to varying degrees, depending on depth (aquifer) and location along the boundary. In addition to groundwater underflow across basin boundaries, subsurface groundwater inflow to (or outflow from) Mound Basin may occur along the coastline for portions of the aquifers that extend west of Mound Basin under the floor of the Pacific Ocean. Because of the complexity and variability of subsurface inflow to Mound Basin, United's (2021a) calibrated groundwater flow model is the best available tool for estimating quantities of interbasin flows and was therefore used to quantify subsurface flows for the water budget.

Recharge to the groundwater system

Precipitation, runoff, streamflow, or other indirect sources of recharge that infiltrate to the underlying aquifer are collectively defined as recharge. The sources of recharge known to occur in Mound Basin are described in Section 3.1.4.2 of this GSP. Similar to groundwater underflow, described above, recharge is subject to temporal and spatial variability. Details regarding how recharge rates were estimated for input to United's (2018, 2021a, 2021c) groundwater model for the region are summarized as follows:

- **Infiltration of Precipitation**: Infiltration of precipitation can recharge aquifers exposed at land surface, including the Shallow Alluvial Deposits, Hueneme Aquifer, and Fox Canyon Aquifer in Mound Basin. Monthly precipitation from Ventura County (VCWPD, 2021) and land use data from Southern California Association of Governments (SCAG) (SCAG, 2008) were utilized to estimate infiltration of precipitation. Land use changes throughout the historical model period were updated using the California Department of Conservation's "Farmland Monitoring and Mapping Program" GIS data (California Department of Conservation, 2018) at years 1990, 1996, 2002, 2008, and 2012 to adjust the baseline land use (from SCAG) designations over time. On agricultural and undeveloped land, United (2018) estimated infiltration of precipitation based on monthly precipitation. Specifically, when monthly precipitation in an agricultural or undeveloped area exceeded 0.75 inches, a fraction of that precipitation ranging from 10 to 30% of the monthly total was assumed to infiltrate deeply enough to become recharge. For developed lands, including residential, commercial, and industrial areas, a fixed ratio of 5% of monthly precipitation was assumed to become recharge. In United's (2018, 2021a) model, infiltration of precipitation includes all recharge that occurs in response to rainfall, unless explicitly modeled as mountain-front recharge or stream-channel recharge in the Santa Clara River and Harmon Barranca.

- **Mountain-front Recharge**: United (2018, 2021a) uses the term mountain-front recharge to describe infiltration of runoff at a small portion of the San Pedro formation in the northern margin of Mound Basin (Figure 3.1-11). The source of this surface water is rainfall in the small sub-watersheds in the foothills immediately north of Mound Basin. The USGS (2003a) describes this as “ungauged streamflow” in their modeling report for the Santa Clara-Calleguas watersheds. The USGS estimated this ungauged streamflow as a percentage of the precipitation occurring in each mountain sub-watershed area that drains to the study area. Similar to the USGS (2003a) approach, United (2021a, 2021c) estimated mountain-front recharge rates in outcrops of the San Pedro Formation in the northern part of Mound Basin based on monthly precipitation rates and the area of each sub-watershed receiving the precipitation. As described in the HCM (Section 3.1.4.2), the United model (2021a) assumes mountain-front recharge in the northern Mound Basin to model layers representing the Hueneme and Fox Canyon aquifers of the San Pedro formation. The Mugu Aquifer is not known to crop out at land surface within Mound Basin (Figures 3.1-07 and 3.1-08), as it underlies the fine-grained Pleistocene deposits. Therefore, the Mugu Aquifer does not receive direct areal recharge. This assumption does not have a substantial effect on the water budgets for the Basin or for individual aquifers.
- **M&I Return Flows**: M&I return flows include leakage from distribution pipelines, recharge of “excess” water applied to residential and municipal landscaping, and infiltration of storm water that is retained in urban or suburban areas of communities. Sources for M&I water supply that contribute to M&I return flow in Mound Basin include groundwater extracted from within Mound Basin and imported groundwater and surface water from other basins, as described in Section 3.1.4.4. The magnitude of these M&I return flows varies substantially in both location and timing. Most of the City of Ventura overlies alluvial and stream terrace deposits; therefore, infiltrating M&I return flows have the potential to reach the Shallow Alluvial Deposits if they are not intercepted by the thin perched groundwater zones described in Section 3.1.3. In developed hillside areas of the City that directly overlie the San Pedro Formation, M&I return flows may contribute to recharge in the Hueneme and Fox Canyon aquifers. The United (2018) groundwater model applied M&I return flows of 5% of the total M&I water use, which resulted in a good model calibration. During development of the Ventura Regional Groundwater Flow Model (VRGWFM), a study of urban recharge in a portion of Los Angeles County was completed by the Water Replenishment District of Southern California and the USGS (Hevesi and Johnson, 2016). Their investigation used a daily precipitation runoff model to estimate recharge and runoff for the greater Los Angeles area, and found average recharge in the urban portion of their study area to be 8% of the combined inflow from precipitation and urban irrigation. Applying the Hevesi and Johnson (2016) results to urban portions of the United (2018, 2021a) model area, and assuming that 50% of M&I water is used for outdoor irrigation (landscaping and parks), the calculated percentage of M&I water that becomes return-flow recharge is 4%, which is close to the 5% adopted by United (2018).
- **Agricultural Return Flows**: Farmers apply irrigation water to meet evaporation, transpiration, and salt-leaching requirements on their fields when rainfall is insufficient to meet those demands, with the goal of maintaining acceptable crop yields. The primary sources of water used for agricultural irrigation in Mound Basin are groundwater extracted from wells in Mound Basin, and groundwater extracted from wells in Santa Paula and Oxnard Basins that is imported to Mound Basin via pipeline (Section 3.1.1.3 of this GSP). The salt-leaching requirement is the

percentage of "excess" irrigation water required to control salt concentrations in the root zone of agricultural fields. Water applied to meet the leaching requirement is assumed to flow past the root zone to recharge the underlying groundwater. Initially, United (2018) input agricultural return flows of 14% of applied water on farmland (based on previous research in the region [United, 2013]), and assumed that the leaching requirement was the sole driver for "excess" irrigation. However, during model calibration the initial agricultural return-flow estimates were evaluated and adjusted upward or downward to improve calibration. In Mound Basin, increasing model-input agricultural return flows to 20% resulted in improved model calibration. Most agriculture in Mound Basin occurs in the southern half of the Basin; therefore, most of the agricultural return flows provide recharge to units located above the principal aquifers. Tile drains are present under some farmland in southern Mound Basin (Figure 3.1-11), which intercept agricultural return flows almost immediately after infiltration, then convey them to the Santa Clara River via drainage ditches. In avocado and citrus orchards present in the foothills where the San Pedro Formation crops out, agricultural return flows are modeled as contributing to recharge in the Hueneme and Fox Canyon aquifers.

- **Stream-channel Recharge**: As described in Sections 3.1.4.2 and 3.2.6 a small amount of stream-channel recharge may occur in the barrancas flowing across the alluvial and stream terrace deposits in Mound Basin, which may reach the Shallow Alluvial Deposits. This stream-channel recharge is distinct from mountain-front recharge, as it occurs throughout the Basin—not just along the northern margins. Stream-channel recharge in most of the barrancas in Mound Basin (excluding Harmon Barranca) was modeled as part of United's (2021a) estimates of "infiltration of precipitation" determined during model calibration, as described above. Stream-channel recharge in Harmon Barranca and the Santa Clara River in Mound Basin was modeled explicitly by United (2021a) using MODFLOW's (McDonald and Harbaugh, 1988) stream (STR) package.

Outflows from the Groundwater System

Evapotranspiration

ET of groundwater occurs where the water table is present at very shallow depths (in United's [2018, 2021a] groundwater flow model, ET is assumed to occur within the upper 5 ft of the soil zone). In Mound Basin, such conditions occur in and adjacent to the Santa Clara River in the southwest part of the Basin, and ET rates in these areas are computed by United's (2021a) groundwater model based on computed groundwater elevations and estimates of the other parameters that control ET (ET surface elevation, extinction depth, and maximum flux rate).

Groundwater extraction (by use sector)

Historical groundwater extractions by use sector (M&I and agriculture) in Mound Basin are described in detail in Section 3.1.4.4 and illustrated on Figures 3.1-27 through 3.1-29. Extraction (pumping) data for water supply wells in Mound Basin consist of records for two 6-month periods (January 1 through June 30 and July 1 through December 31) reported to United by pumpers each year as required by United pursuant the authority provided in California Water Code §74500-74554. For the purpose of estimating monthly extraction from each well during a given year, United developed a precipitation-weighted formula that assumes an inverse relationship between groundwater extraction and rainfall (United, 2018), since both agricultural and, to a lesser extent, M&I water demand are inversely correlated with monthly precipitation.

United's (2021a) MODFLOW (McDonald and Harbaugh, 1988) groundwater flow model is calculated with uniform 2,000 ft X 2,000 ft grid cells, which do not align precisely with the boundaries of Mound Basin (i.e., there is a small amount of overlap and undercutting of no more than a few hundred feet). As a result, one well in Oxnard Basin (02N22W19J03S), located approximately 130 ft south of Mound Basin's boundary, is captured within the model grid. Extraction from this well is included in the water budget estimates and represents around 5% of the total groundwater extraction rates from Mound Basin; thus, inclusion of this well in the water budget is not considered to create a significant discrepancy. Extraction from this well cannot simply be subtracted from the modeled groundwater budget for Mound Basin without creating a small imbalance in the modeled groundwater flow budget. Therefore, it was determined that it would be better to retain the extraction at this well in the Mound Basin groundwater budget for the purpose of developing this GSP. If United's model grid is discretized differently in future model updates, this issue can be revisited.

Groundwater discharge to surface water

As described in Section 3.2.6, groundwater discharge from the Shallow Alluvial Deposits may contribute to the perennial flow observed during most years in the Santa Clara River in the southwestern part of Mound Basin, together with discharge from tile drains, drainage ditches, and perched zones in shallow soils of the Mound Basin and sources from the Oxnard Basin. Similar to stream-channel recharge, as described above, groundwater discharge to the Santa Clara River is dependent on the difference between river stage and groundwater elevations in the underlying perched zones or the Shallow Alluvial Deposits, as well as the physical characteristics of the riverbed (width and slope) and is calculated by United's (2021a) groundwater flow model. Discharge of groundwater from the principal aquifers (Mugu and Hueneme) to the barrancas in Mound Basin is not known to occur and is not included in United's (2021a) groundwater flow model for the region.

Groundwater discharge to tile drains

Tile or other agricultural drainage systems are reported (Isherwood and Pillsbury, 1958) to have been installed across much of the Oxnard Plain in the 20th century and extend into the southern Mound Basin (United, 2018; location shown on Figure 3.1-11 of this GSP). Tile drains were installed to prevent waterlogging of the roots of crops in areas where the water table may rise close to land surface. In the area of Mound Basin where tile drains exist, the water table in the Shallow Alluvial Deposits could potentially approach land surface if tile drains were not present. Similar to groundwater discharge to stream channels, as described above, the rate of groundwater discharge to tile drains depends on the difference between the depth and conductance of tile drains and groundwater elevations in the underlying Shallow Alluvial Deposits. Groundwater discharge from the Shallow Alluvial Deposits to tile drains is calculated by United's (2021a) groundwater flow model using MODFLOW's (McDonald and Harbaugh, 1988) drain (DRN) package.

Subsurface groundwater outflow

Similar to subsurface groundwater inflow, subsurface groundwater outflow can occur from Mound Basin to the adjacent Santa Paula and Oxnard Basins. Subsurface groundwater outflow from Mound Basin may also occur along the coastline at the Basin's western boundary to portions of the aquifers which extend offshore under the floor of the Pacific Ocean. As noted previously in this section, United's (2021a) calibrated groundwater flow model is the best available tool for quantifying these flows.

Change in the Annual Volume of Groundwater in Storage between Seasonal high Conditions

Annual changes in the volume of groundwater in storage in the Basin reflect annual imbalances between inflows and outflows. In years when inflow (recharge) exceeds outflow (discharge), the volume of groundwater in storage increases; such conditions manifest as a rise in groundwater levels in wells. Conversely, when outflows exceed inflows, the volume of groundwater in storage in an aquifer decreases (referred to in this GSP as "groundwater released from storage"), and declining groundwater levels are observed in wells. Groundwater storage cannot be directly measured; rather it can only be estimated using groundwater levels and knowledge of the basin geometry and subsurface hydraulic properties., There is a significant amount of uncertainty in such an approach, particularly in a basin such as the Mound Basin that has a multiple principal aquifers and a significant uncertainty in the distribution of storage properties between HSUs and within the transitional areas between confined and unconfined portions of the Basin. Therefore, United's (2021a) groundwater flow model is considered to be the best available tool for estimating changes in groundwater storage in the Mound Basin.

Water Year Types

GSP Emergency Regulations §354.18(b)(6) requires presentation of the water year type associated with annual water budget terms. GSP Emergency Regulation §351(an) defines "water year type" as the "classification provided by the Department to assess the amount of annual precipitation in a basin." DWR provided a water year type designation for each year (from 1931 through 2018) for the entire Santa Clara River watershed—including the portion in Los Angeles County. The DWR based their designation system on spatially averaged rainfall throughout the watershed in a given year and the previous year, relative to the 30-year moving average rainfall amounts for the region (DWR, 2021b). Unfortunately, the DWR designations do not correlate well with observed groundwater conditions (i.e., rising and falling groundwater levels) in Mound Basin. Therefore, MBGSA elected to develop an alternative water year type classification that is more representative of local trends. Years when rainfall is 75% or less of the average are referred to herein as "dry years." Years when rainfall is 125% or more of the average are referred to as "wet years." Years when annual rainfall is between 75 and 125% of the average are referred to as "near-average years." These quantitative breakpoints for defining dry, near-average, and wet years correlate well with periods of increasing, approximately stable, and decreasing groundwater elevations in Mound Basin, as described subsequently in this section.

3.3.1 Historical Water Budget [§354.18(b)(1),(2),(3),(4),(6),(c)(2)(B), and (d)(1)]

§354.18 Water Budget.

(b) *The water budget shall quantify the following, either through direct measurements or estimates based on data:*

- ***(1)*** *Total surface water entering and leaving a basin by water source type.*
- ***(2)*** *Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.*
- ***(3)*** *Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.*
- ***(4)*** *The change in the annual volume of groundwater in storage between seasonal high conditions.*
- ***(6)*** *The water year type associated with the annual supply, demand, and change in groundwater stored.*

(c) *Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:*

- ***(2)*** *Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following:*
  - ***(B)*** *A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon.*

(d) *The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:*

- ***(1)*** *Historical water budget information for mean annual temperature, mean annual precipitation, water year type, and land use.*

The SGMA Regulations require that the historical surface water and groundwater budget be based on a minimum of 10 years of historical data. Water years 1986 through 2015 (30 years) were selected to represent the historical water budget. Water year 1986 is the first complete water year included in United's regional groundwater flow model (United, 2021a), which is the primary source of information for several key water budget components estimated for Mound Basin. Prior to January 1985, groundwater extraction data were increasingly sparse, which is why United selected water year 1986 as the first year for their historical model calibration. The historical period is long enough to capture typical climate variations and include two significant drought cycles (1987-1990 and 2012-2016).

The historical surface water and groundwater budgets are presented in the following tables and figures and described below:

- Surface Water Budget: Table 3.3-02 and Figure 3.3-01
- Basin Groundwater Budget: Table 3.3-03 and Figures 3.3-02 and 3.3-03
- Hydrostratigraphic Unit Groundwater Budgets: Table 3.3-04

Historical Surface Water Budget

Inspection of Table 3.3-02 and Figure 3.3-01 indicates that the largest source of surface water inflow to and outflow from Mound Basin during the historical period is the Santa Clara River, with inflows ranging from less than 100 AF/yr during drought periods to over 1,000,000 AF/yr during high-rainfall years. The historical average of surface flows in the Santa Clara River entering and exiting Mound Basin is nearly an order of magnitude or greater than the average of all other inflows or outflows combined (Table 3.3-02). As noted previously, much of this flow occurs during or soon after (days to weeks) major storms; baseflow in the Santa Clara River is estimated to be only about 1,500 AF/yr (Section 3.2.6). Surface water inflows and outflows in the Santa Clara River during water years 1993, 1995, 1998, and 2005 were particularly large, correlating with El Nino/Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO)-driven high-rainfall events. As shown on Figure 3.1-01, the length of the reach of the Santa Clara River that is within Mound Basin is only 1 mile; therefore, high flows that follow storm events pass rapidly through this reach with little groundwater interaction (Section 3.2.6). However, a small fraction of these flows infiltrates the river channel and banks to become stream-channel recharge to the underlying Shallow Alluvial Deposits during high-flow years (Table 3.3-02).

Ephemeral streamflows entering, generated within, and leaving Mound Basin in barrancas are typically the next largest components of surface water inflows and outflows, after Santa Clara River. Identical to the Santa Clara River, the majority of the higher flows occur during and immediately following storms, with little to no baseflow other than leakage of return flows from perched zones of the Shallow Alluvial Deposits and fine-grained Pleistocene deposits, as described in Section 3.2.6. Imported surface water to Mound Basin can exceed ephemeral streamflows during some years, particularly those with low rainfall (Table 3.3-02).

Historical Groundwater Budget

Inspection of Tables 3.3-03 and 3.3-04, and Figure 3.3-02 and 3.3-03, indicates that the largest sources of groundwater inflow to Mound Basin during the historical period included underflow from the Santa Paula Basin, areal recharge (the sum of infiltration of precipitation, M&I return flows, and agricultural irrigation return flows), and mountain-front recharge. Surface water percolation from Santa Clara River and Harmon Barranca provided considerably less recharge to the Basin. Outflow of groundwater from Mound Basin largely occurs as groundwater extractions (pumping) and groundwater outflow to the Oxnard Basin during dry periods. Groundwater flow to the offshore portions of HSUs, ET from the Shallow Alluvial Deposits, and groundwater discharge from the Shallow Alluvial Deposits to surface water are secondary mechanisms of discharge.

Some groundwater budget components are consistently positive (representing inflows to Mound Basin), including underflow from Santa Paula Basin, areal recharge, mountain-front recharge, and return flows. Other components are consistently negative (outflows from Mound Basin), including groundwater extractions (pumping from wells), ET from the Shallow Alluvial Deposits, and discharge to tile drains. Some water budget components vary in sign (negative, representing outflow; to positive, representing inflow) over time, which is largely dependent on rainfall (i.e., recharge), as shown on Figure 3.3-02.

Each of these variable components is described further as follows:

- **Groundwater Underflow between the Mound and Oxnard Basins**: Groundwater underflow between the Mound and Oxnard Basins typically occurred as outflow from Mound Basin during dry years, and as inflow to Mound Basin during wet years. During near-average years, a modest volume of groundwater (usually less than 2,000 AF) flowed either into or out of Mound Basin along its boundary with Oxnard Basin. During the droughts in 1987-1990 and 2012-2016, groundwater underflow from Mound Basin to Oxnard Basin was typically the second-largest outflow component of the groundwater budget for Mound Basin, after groundwater extractions from wells. During the extended wet period from 1992 through 2005, this condition reversed, and groundwater underflow from Oxnard Basin to Mound Basin was frequently an important inflow component of the groundwater budget for Mound Basin, occasionally exceeding the annual volumes of recharge in Mound Basin and underflow from Santa Paula Basin. The reversal in flow direction is correlated with United's artificial recharge operations in the Oxnard Basin.
- **Groundwater Exchange Between Onshore and Offshore Areas**: Groundwater underflow between the Mound Basin and offshore areas west of the coastline has typically consisted of net outflow from Mound Basin (Figure 3.3-02 and Table 3.3-03). However, modest volumes of inflow to Mound Basin occurred across the coastline during the droughts from 1987-1990 and 2012-2016. As described in Section 3.1.4 and depicted in Figure 3.1-10, the offshore portions of the principal aquifers of Mound Basin store significant quantities of fresh groundwater. For this reason, groundwater flowing into Mound Basin from across the coastline during droughts should not be assumed to consist of seawater. As described in Section 3.2.3 of this GSP, there are no historical or recent data suggesting that seawater intrusion has occurred in the principal aquifers within Mound Basin.
- **Groundwater Exchange with Santa Clara River**: Figure 3.3-02 and Table 3.3-03 indicate a modest volume (generally less than 2,000 AF) of groundwater has discharged from the Shallow Alluvial Deposits to the lower Santa Clara River in Mound Basin during most average to dry years. During wet years and two average years (2017 and 2019), the stage in the Santa Clara River was higher than groundwater elevations in the Shallow Alluvial Deposits, resulting in surface water percolating into the Shallow Alluvial Deposits as recharge. These modeled surface water and groundwater interactions are consistent with field observations of discharge to the Santa Clara River (Stillwater Sciences, 2018).
- **Groundwater Exchange with Harmon Barranca**: In every year except 1998, the model estimated that the net effect of groundwater/surface water interaction in Harmon Barranca was to provide a small volume of recharge to the underlying aquifers. The sole exception, water year 1998, had the highest rainfall total during the historical period (1986-2015); the model estimated that a small volume (142 AF) of groundwater was discharged to the channel of Harmon Barranca that year (Table 3.3-03).
- **Groundwater Storage**: In response to the annual variability in inflows and outflows to the groundwater system in Mound Basin, the volume of groundwater in storage in the Basin has increased or decreased, reflected in rising and falling groundwater elevations that can be measured in wells. In wet years, groundwater inflows (e.g., recharge) often exceeded outflows (e.g., groundwater extraction from wells), resulting in rising groundwater levels and adding to the volume of groundwater in storage in the Basin. When groundwater is added to storage in the Basin, for accounting purposes it is counted as an outflow from the groundwater budget. That groundwater added to storage remains in the Basin as a "reserve" of groundwater that can

be drawn from in subsequent dry years. When that reserve of groundwater in storage is used for water supply or flows out of the Basin—corresponding to declining groundwater elevations—it is counted in the groundwater budget as an inflow. As can be seen on Figure 3.3-02, these changes in the volume of groundwater in storage in Mound Basin balance any difference between inflows and outflows each year (shown by white bars with a dashed black outline) such that total inflows equaled total outflows. The result is that the groundwater budget each year remained in balance on both an annual basis and over the historical period, with an average net decline in groundwater in storage of 469 AF/yr.

While the GSP Emergency Regulations do not require water budgets for each principal aquifer, sustainable management of the Mound Basin benefits from such an understanding. The historical water budget for each HSU, including the principal aquifers, is presented in Table 3.3-04. Review of water budget components for specific aquifers (Table 3.3-04) indicates that average groundwater inflows and outflows have varied substantially from aquifer to aquifer within Mound Basin. Table 3.3-04 also shows average vertical groundwater flow volumes between aquifers within Mound Basin; with this information, the model-estimated groundwater budget for each aquifer was balanced (sum of all components for each aquifer equals zero). Following are some of the salient conclusions that can be drawn from review of the HSU breakdown of the historical water budget:

- As expected, all ET, discharge to tile drains, and interaction between groundwater and surface water in the Santa Clara River occurred in the Shallow Alluvial Deposits, which is the uppermost aquifer across most of Mound Basin. Most areal recharge (including infiltration of precipitation, agricultural return flows, and M&I return flows) infiltrated to the Shallow Alluvial Deposits, with smaller volumes infiltrating into outcrops of the Hueneme and Fox Canyon aquifers in the foothills of the north part of Mound Basin. The Mugu Aquifer is not known to crop out at land surface within Mound Basin (Figures 3.1-07 and 3.1-08), as it underlies the fine-grained Pleistocene deposits. Therefore, the Mugu Aquifer does not receive direct areal recharge. A significant volume (approximately 2,600 AF) of mountain-front recharge occurred in Mound Basin in the northern foothills, primarily into the Hueneme Aquifer.
- Nearly all groundwater extraction (pumping from wells) occurred in the Mugu and Hueneme aquifers, as was described in Section 3.1.4.4 of this GSP. A minor amount of groundwater extraction occurred in the Fox Canyon Aquifer and no extraction occurred in the Shallow Alluvial Deposits.
- Vertical exchanges of groundwater with overlying and underlying HSUs can be important flow components for the principal aquifers.
- Most groundwater inflow to Mound Basin from Santa Paula Basin occurred in the Hueneme and Fox Canyon aquifers. Although the Country Club fault system at the boundary between the Mound and Santa Paula basins impedes groundwater flow to some degree (evidenced by steeper groundwater elevation contours along this boundary as described in Section 3.1.4 of this GSP), approximately 4,400 AF/yr of groundwater flow into Mound Basin occurred during the historical water budget period.
- Most of the groundwater inflow to the Mound Basin from Oxnard Basin (approximately 2,600 AF/yr, on average) during the historical period occurred in the Shallow Alluvial Deposits and in the fine-grained Pleistocene deposits, which is stratigraphically equivalent to the Oxnard

Aquifer in the Oxnard Basin (Section 3.1 of this GSP). Most of the groundwater outflow from Mound Basin to Oxnard Basin (approximately 3,900 AF/yr, on average) occurred in the Hueneme and Fox Canyon aquifers

- Approximately 1,800 AF/yr of groundwater flowed from Mound Basin to the offshore (submarine) areas of the aquifers in the Shallow Alluvial Deposits during the historical period, while much smaller volumes of groundwater outflow occurred in the Mugu and Fox Canyon aquifers. A modest quantity (500 AF/yr) of groundwater flowed into Mound Basin from offshore areas in the Hueneme Aquifer. As noted above and in Section 3.2.3, significant quantities of fresh groundwater are present in the aquifers offshore from Mound Basin. Intrusion of seawater has not been detected in the aquifers of Mound Basin to date.
- Cumulative changes in groundwater in storage (from April of each year through March of the next year) in the principal aquifers (Mugu and Hueneme), together with annual groundwater extractions in Mound Basin, are shown on Figure 3.3-03. Changes in storage in the principal aquifers generally correlate with changes in storage in the Basin as a whole but are more subdued.

3.3.1.1 Reliability of Historical Surface Water Supplies [§354.18(c)(2)(A)]

> **§354.18 Water Budget.**
> ***(c)*** *Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:*
> ***(2)*** *Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following:*
> ***(A)*** *A quantitative evaluation of the availability or reliability of historical surface water supply deliveries as a function of the historical planned versus actual annual surface water deliveries, by surface water source and water year type, and based on the most recent ten years of surface water supply information.*

As described in Section 3.1.1.3 and summarized at the beginning of Section 3.3, surface water is imported to Mound Basin via pipeline from Casitas MWD by the City of Ventura for use within the Casitas MWD service area (Figure 2.2-01).

Figure 3.3-04 shows surface water deliveries and groundwater production for the City of Ventura in Mound Basin for the past 10 years. Inspection of Figure 3.3-04 indicates that during 2010 and 2011, prior to the 2012-2016 drought in Ventura County, total surface water imports from the Ventura River to Mound Basin averaged approximately 4,100 AF/yr. From 2012 through 2014 (the first three years of the 2012-2016 drought), total surface water imports declined to approximately 3,600 AF/yr. Conservation and increased groundwater extraction from the City's wells in Mound Basin and Oxnard Basin increased to make up the difference. From 2016 through 2019, total surface water imports declined further to an average of approximately 1,500 AF/yr. Table 3.3-05 summarizes the City of Ventura's planned (Kennedy/Jenks Consultants, 2011; 2016) and actual (Ventura Water, 2020b) imports of surface water from Casitas MWD for the 10-year period from 2010 through 2019. The values shown on this table include surface water imports from Casitas MWD delivered to the City's entire service area, not just the portion in Mound Basin. Review of the differences between planned and actual surface water deliveries indicates that less surface water from Casitas MWD was actually delivered than was planned from 2012 through

2019; this period included an exceptional drought from 2012 through 2016. The lower-than-anticipated surface water deliveries were related to a combination of factors, including mandated conservation goals along with the associated penalties.

3.3.1.2 Impact of Historical Conditions on Basin Operations [§354.18(c)(2)(C)]

> **§354.18 Water Budget.**
>
> ***(c)*** *Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:*
>
> ***(2)*** *Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following:*
>
> ***(C)*** *A description of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability of the Agency to operate the basin within sustainable yield. Basin hydrology may be characterized and evaluated using water year type.*

GSP Emergency Regulations §354.18(c)(2)(C) require a description of how historical water budget conditions have impacted the ability of MBGSA to operate that Basin within sustainable yield. The estimated sustainable yield for Mound Basin is provided in Section 3.3.4. Prior to adoption of this GSP, MBGSA has had neither the regulatory authority nor the technical justification to "operate the basin within sustainable yield." Thus, GSP Emergency Regulations §354.18(c)(2)(C) appear inapplicable to the Mound Basin. However, the impacts of historical conditions can provide insight into what challenges MBGSA may have faced had it existed historically and with authority to manage the Basin.

Review of the historical water budgets indicates that a small amount of declining groundwater storage occurred over time (the average groundwater released from storage between seasonal highs is 469 AF/yr; Table 3.3-03). This suggests a relatively minor amount of overdraft may have occurred during the historical period equal to approximately 6.3% of the average groundwater extraction rates during that timeframe. However, undesirable results were not reported during the historical period, suggesting negligible, if any, impacts on the ability of the Basin to operate within the sustainable yield.

The existence of multiple sources of water (local groundwater, imported groundwater, and imported surface water) available to meet demand in Mound Basin is a key reason why the Mound Basin has not historically experienced undesirable results for the sustainability indicators. The City of Ventura seeks to maximize wet-year water supplies from Casitas MWD and its facilities in the Upper Ventura River Basin and rely less on Mound Basin groundwater and other basin groundwater supplies and vice versa. In addition, the City implements a water shortage contingency plan to reduce water demands through increased conservation. The diverse water supply portfolio and conservation actions have helped reduce pressure on Mound Basin groundwater supplies, keeping basin operations within the sustainable yield and preventing significant and unreasonable effects from occurring.

3.3.2 Current Water Budget [§354.18(b)(1),(2),(3),(4),(6),(c)(1), and (d)(2)]

§354.18 Water Budget.

(b) *The water budget shall quantify the following, either through direct measurements or estimates based on data:*

- ***(1)*** *Total surface water entering and leaving a basin by water source type.*
- ***(2)*** *Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.*
- ***(3)*** *Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.*
- ***(4)*** *The change in the annual volume of groundwater in storage between seasonal high conditions.*
- ***(6)*** *The water year type associated with the annual supply, demand, and change in groundwater stored.*

(c) *Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:*

- ***(1)*** *Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, water demand, and land use information.*

(d) *The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:*

- ***(2)*** *Current water budget information for temperature, water year type, evapotranspiration, and land use.*

The SGMA Regulations require that the current surface water and groundwater budget be based on the most recent hydrology, water supply, water demand, and land use information. Water year 2019 is the last complete water year included in United's regional groundwater flow model (United, 2021b), which is the primary source of information for most water budget components estimated for Mound Basin. Therefore, water years 2016 through 2019 were selected to represent the current water budget, as they are representative of recent water use trends and groundwater conditions in Mound Basin. The current water budget period corresponds to a period of average to dry annual precipitation, with an average of about 14% less precipitation than the historical average. It should also be noted that the current water budget period was preceded by an exceptional drought that occurred in the region from 2012 through 2016. As a result of the antecedent groundwater conditions caused by this drought (i.e., record- or near-record-low groundwater elevations at most wells in Mound Basin and adjacent basins), combined with below-average rainfall during water year 2018, estimated volumes for some of the water budget components during the current period are significantly different than they were during the historical period. As a result, the current water budget period represents a drier than average condition with antecedent drought conditions in the Basin and is therefore not appropriate for sustainability planning.

The current surface water and groundwater budgets are presented in the following tables and figures and described below:

- Surface Water Budget: Table 3.3-02 and Figure 3.3-01
- Basin Groundwater Budget: Table 3.3-03 and Figures 3.3-02 and 3.3-03
- Hydrostratigraphic Unit Groundwater Budgets: Table 3.3-04

Current Surface Water Budget

Inspection of Table 3.3-02 and Figure 3.3-01 indicates that the largest source of surface water inflow and outflow for Mound Basin during the current period is the Santa Clara River, consistent with the historical water budget. A notable difference is that both average inflow from the Santa Clara River and from imported water from Casitas MWD during the current water budget period are both less than half of what they were during the historical water budget period (Table 3.3-02). This difference is due to the relatively low average rainfall during the current period compared to the historical period. The averages for most other surface water budget components during the current period largely remained similar to values estimated for the historical period, although they are overall less than the historical, resulting from overall drier conditions can be seen in Table 3.3-02.

Current Groundwater Budget

Average volumes of groundwater estimated to comprise each component of the current water budget for the principal aquifers together with the Shallow Alluvial Deposits and fine-grained Pleistocene deposits HSU in Mound Basin are quantified in Table 3.3-03.

Following are key aspects of the current groundwater budget and notable differences compared to the historical groundwater budget:

- Groundwater underflow from Mound Basin to Oxnard Basin was substantially greater during the current period compared to the average over the historical period. This increase in outflow comprises the largest difference between the historical and current groundwater budgets for Mound Basin and is a result of greater drawdown in the Oxnard Basin than in Mound Basin since 2012 (largely due to the 2012-2016 drought). This differential drawdown temporarily created a steeper hydraulic gradient—inducing greater groundwater underflow—from the Mound Basin to Oxnard Basin.
- The net direction and magnitude of groundwater underflow across the coastline (to and from areas where the aquifers underlie the seafloor) changed substantially during the current period as compared to the historical period. During the historical period, the net direction of groundwater underflow was seaward (toward the ocean), with small to modest volumes of landward flow, on average, in the fine-grained Pleistocene deposits and the Hueneme Aquifer. During the current period, landward groundwater underflow occurred in all HSUs, except for the Shallow Alluvial Deposits (where seaward flow continued). However, monitoring results do not indicate intrusion of seawater into the aquifers of the Mound Basin during this period, as described in Section 3.2.3 of this GSP.
- As a result of below-average annual rainfall during the current water budget period, recharge volumes were also less than the average historical values during the current water budget period.
- Less ET and discharge to tile drains occurred during the current water budget period compared to the historical period, due to lower groundwater elevations in the Shallow Alluvial Deposits.
- Average annual groundwater extraction rates (pumping from wells) were lower in the current period than in the historical period.

- As can be seen on Figure 3.3-03 and Tables 3.3-03 and 3.3-04, a small decline in the quantity of groundwater stored in Mound Basin (and the principal aquifers) occurred during the current water budget period.

3.3.3 Projected Water Budget

SGMA Regulations require the development of a projected surface water and groundwater budget to estimate future baseline conditions of supply, demand, and aquifer response to GSP implementation. The future water budget provides a baseline against which management actions will be evaluated over the GSP implementation period from 2022-2041. The projected water budget was developed for a 77-year period that is subdivided into three periods, including the 20-year implementation period required under SGMA (water years 2022-2041), the 30-year sustaining period under SGMA (water years 2042-2071), and a 25-year post-SGMA period (water years 2072-2096). This section describes the methods used to estimate the projected water budget for Mound Basin, provides a quantitative estimate for each projected water budget component, and evaluates uncertainty in the projected water budget by considering potential effects of future DWR-recommended climate change scenarios. The DWR's climate change scenarios could result in changes to inflows and outflows in Mound Basin compared to the "baseline" future water budget.

3.3.3.1 Projected Water Budget Calculation Methods [§354.18(c)(3)(A),(c)(3)(B),(c)(3)(C),(e), and (f)]

§354.18 Water Budget.

(c) *Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:*

- ***(3)*** *Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:*
  - ***(A)*** *Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with projections of climate change and sea level rise.*
  - ***(B)*** *Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand. The projected water demand information shall also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate.*
  - ***(C)*** *Projected surface water supply shall utilize the most recent water supply information as the baseline condition for estimating future surface water supply. The projected surface water supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply identified in Section 354.18(c)(2)(A), and the projected changes in local land use planning, population growth, and climate.*

(e) *Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow. If a numerical groundwater and surface water model is not used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater, the Plan shall identify and describe an equally effective method, tool, or analytical model to evaluate projected water budget conditions.*

(f) *The Department shall provide the California Central Valley Groundwater-Surface Water Simulation Model (C2VSIM) and the Integrated Water Flow Model (IWFM) for use by Agencies in developing the water budget. Each Agency may choose to use a different groundwater and surface water model, pursuant to Section 352.4.*

The projected water budget for Mound Basin was developed using the same tools and methods as the historical and current water budgets, and is primarily based on United's (2018, 2021a, 2021b, 2021c) surface water and groundwater flow modeling, modified to incorporate projections of future hydrology and demand, as described in the following subsections. The future projections utilize United's best available estimates of future surface water diversions from the Santa Clara River via the Vern Freeman Diversion.

3.3.3.1.1 Projected Hydrology [§354.18(c)(3)(A)]

§354.18 Water Budget.

(c) *Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:*

(3) *Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:*

(A) *Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with projections of climate change and sea level rise.*

In accordance with GSP Emergency Regulations §354.18 (c)(3)(A), the future water budget must be based on 50 years of historical precipitation, ET, and streamflow information. To satisfy this regulation, the forward version of the numerical model used for the projected water budget includes 77 years of historical precipitation, ET, and streamflow data from the period 1943-2019, which supports a time period from 2022-2096. The streamflow values were modified to incorporate United's best available estimates of future surface water diversions from the Santa Clara River via the Vern Freeman Diversion.

It is believed that the selected historical period is representative and is the best available information for groundwater sustainability planning purposes. This period includes two major drought cycles for the Santa Clara River watershed and was therefore preferred over any single 50-year period (the minimum timeframe required under SGMA regulations) available in DWR's historical dataset, which includes water years 1931-2019 for rainfall (DWR, 2021b) and 1916-2011 for streamflow change factors (DWR, 2018).

Baseline future streamflow in the Santa Clara River and its major contributing tributaries (including Santa Paula Creek, Sespe Creek, Pole Creek, Hopper Creek, Piru Creek, and Castaic Creek, all of which are located east and upstream of Mound Basin) was projected based on historical stream gaging records provided by the USGS and VCWPD. Streamflow in the small subwatersheds present in the foothills north of Mound Basin that contribute to mountain-front recharge, as described in the introduction to Section 3.3, was projected to change in direct proportion to increases or decreases in rainfall in accordance with 2030 and 2070 climate change factors provided by DWR (2018), and is described further below. Projected annual rainfall rates assumed under future baseline, 2030, and 2070 climate change scenarios are shown on Figure 3.3-05. The future baseline scenario assumed no sea level rise, the 2030 climate change scenario assumed 15 centimeters (6 inches) of sea level rise, and the 2070 climate change scenario assumed 45 centimeters (18 inches) of sea level rise, consistent with DWR (2018) guidance. Sea level rise was addressed by increasing the head along the general-head boundary representing the Pacific Ocean in United's (2021c) groundwater model. These changes in model boundary conditions were forecasted to have small impacts on groundwater elevations and groundwater budget components in Mound Basin and are discussed further in Section 3.3.3.2.

For the purpose of projecting future streamflows in the Santa Clara River, the historical stream gage records were modified and supplemented as follows:

- Where data gaps existed in the 1943-2019 records for specific stream gages, correlations with nearby stream gages were developed to fill those gaps. Suitable stream gage records were available to populate all data gaps in gaging data within the Santa Clara River watershed.
- Outflows for Lake Piru and Castaic Lake were simulated using reservoir operations models with historical upstream creek flows as reservoir inputs. Current reservoir operations were applied to the entire future baseline modeling period.
- Historical surface water discharge from the urban and suburban areas of the Santa Clarita Valley to the Santa Clara River was adjusted upwards, with more significant flow increases applied to older data, to reflect current levels of urban impervious area in this drainage area that underwent significant development between 1943 and 2019.
- Historical streamflow in the reach of Santa Clara River in Los Angeles County was adjusted to reflect anticipated future discharges from Water Reclamation Facilities (WRFs).

Uncertainty in future hydrology associated with potential climate change was evaluated by applying DWR (2018) streamflow change factors from their 2030 and 2070 central-tendency scenarios to the historical streamflow records for Castaic Lake (reservoir) inflows, Santa Clara River upstream of Castaic Creek (excluding WRF discharges which were added after applying streamflow change factors), Middle Piru Creek (inflow to Lake Piru), Pole Creek, Hopper Creek, Sespe Creek, and Santa Paula Creek. Daily historical flow records were adjusted to 2030 and 2070 future conditions by applying the annual and monthly streamflow change factors provided for the Santa Clara River watershed (designated HUC8_18070102 by DWR), utilizing the methodology for application of time-series change-factor data described in DWR (2018) guidance. DWR (2018) streamflow change factors are available for water years 1916-2011. Change factors for water years 2012-2019 were modeled by selecting analogous water years in the historical record and applying the streamflow change factors published for these analogous water years. Analogous water years were determined using the monthly precipitation record for VCWPD rain gage 245 (Santa Paula), which has a complete data record from 1915-2019, and is representative of the average annual precipitation observed in much of the Santa Clara River watershed, particularly the Ventura County portion. Analogous water years for 2012-2019 were determined by calculating the root mean square error (RMSE) based on monthly precipitation with each water year from 1915-2011. Generally, the year with the lowest RMSE was selected as the analogous water year.

Compared to historical streamflow between 1943 and 2019, annual average streamflow decreased by 3.8-4.7% for the 2030 climate change scenario, and by 2.6-3.5 % for the 2070 climate change scenario. The calculated change in streamflow for the 2030 and 2070 climate change scenarios is mostly driven by the monthly change factors provided by DWR (as opposed to annual change factors). The Santa Clara River watershed (HUC8_18070102) monthly change factors vary significantly between years, especially during the months of January through March, when much of the precipitation occurs in the Santa Clara River watershed. During these months, projected streamflow may increase or decrease in the 2030 and 2070 climate change scenarios and are more variable for the 2070 climate change scenario. Monthly change factors are mostly less than 1.0—indicating reduced flow compared to the historical period—during the months April, May, June, October, and November. Therefore, streamflow in the Santa Clara River is projected to decrease outside the main wet season under the 2030 and 2070 climate change scenarios.

A more detailed description of the surface water hydrology models utilized to simulate reservoir operations, modifications to streamflow records for future hydrology, application of DWR streamflow change factors, and interaction between the surface water and groundwater models is presented in United's model documentation (United, 2021a, 2021c).

3.3.3.1.2 Projected Water Demand [§354.18(c)(3)(B)]

> **§354.18 Water Budget.**
>
> ***(c)*** *Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:*
>
> ***(3)*** *Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:*
>
> ***(B)*** *Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand. The projected water demand information shall also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate.*

GSP Emergency Regulations §354.18(c)(3)(B) require use of the most recent land use, ET, and crop coefficient information as the baseline condition for estimating future water demand and as a baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning,

For the purpose of developing a projected water budget for Mound Basin, baseline future water demand in Mound Basin was input to United's (2021c) groundwater flow model using current (most recent) land use information, agricultural and M&I water use trends, and assumptions regarding future climatic conditions (including rainfall and ET).

Projected Agricultural Water Demands

Projected agricultural groundwater demand was provided by MBAWG (Section 2.3). MBAWG was provided historical groundwater extraction data and was asked to provide input on future groundwater demands. MBAWG advised that baseline average year irrigation demands are estimated to be 3,300 AF/yr. Wet year and dry year baseline irrigation demands were assumed to be slightly lower (2,873 AF/yr) and higher (3,548 AF/yr), respectively. Climate change effects on irrigation demand were also considered by accounting for changes in future precipitation and temperature. Future precipitation projections were developed based on historical precipitation records (with baseline conditions taken from 1943-2019) and climate change factors provided by DWR (2018) for SGMA planning purposes. Irrigation demands for future wet, average, and dry conditions (based on total precipitation for the water year) were based on historical irrigation demands for similar wet, average, and dry conditions (based on reported historical groundwater extraction). To account for future increased temperatures due to climate change, the future annual irrigation demands were further scaled by a factor representing the average annual increase (over the projected period of 1943-2019) in future ET (calculated from ET climate change factors provided by DWR). The average ET climate change factor for the 2030s was 1.0359 (increase of 3.6%) and for the 2070s was 1.0825 (increase of 8.25%); hence irrigation demand was increased by the corresponding factors to account for higher ET uptake (demand) of irrigation water. Similar to the ET climate change factors, the net agricultural demand for groundwater extracted from Mound Basin was estimated to increase 3.6%

and 8.5% for the 2030 and 2070 climate change scenarios, respectively, as compared to baseline conditions. The baseline and climate change projections of agricultural water demand also apply to groundwater imported from the Santa Paula and Oxnard Basins for agricultural use, which is reflected in the return flow calculations.

Projected Municipal and Industrial Demands

The City of Ventura provides most of the municipal and industrial water supply in the Basin. The City of Ventura forecasts that it will extract 4,000 AF/yr from the Mound Basin during 2021-2030 on average (Ventura Water, 2020a). As described in Section 3.1.1.3, the City has a diverse water supply portfolio, making it impossible to predict how its Mound Basin groundwater extraction might vary from year to year. Thus, the projected water budget assumes a fixed value of 4,000 AF of groundwater extraction each year. The projected groundwater extraction for the two private industrial wells in the Basin were assumed to continue at historical average rates.

Changes in future application of local and imported water sources in Mound Basin also change future agricultural and M&I return flows in Mound Basin. Changes in return flows each year are simulated in United's (2021c) groundwater flow model as a function of changes in water demand (described above) and adjusted by precipitation (as described in the beginning of Section 3.3). The methodology for calculating the projected changes in return flow and the associated values for the baseline, 2030, and 2070 scenarios are further described in the model documentation (United 2021c).

Land Use and Population Change Effects on Water Demand

As described in Section 2.2.3, changes in land use that could have a significant impact on groundwater demand are not expected in the foreseeable future.

As of December 2019, there are 47 infill development projects within the City of Ventura that are either approved or under construction, which collectively have an estimated 921 AF/yr of water demand (Ventura Water, 2020a). These new demands are accounted for in the City's projected Mound Basin groundwater extraction estimate of 4,000 AF/yr, discussed above.

Any additional future development (and associated population increase) is not expected to impact water demands for groundwater in the Mound Basin because the City's Water Rights Dedication and Water Resource Net Zero Fee Ordinance and Resolution ("Net Zero Policy", adopted June 6, 2016), requires all new and intensified development to offset the demand associated with its impact on the City's potable water system. Offsets can take the form of water rights dedication (i.e. transfer existing rights to extract groundwater from the Mound Basin or the adjacent Oxnard or Santa Clara basins) or payment of a fee that funds development of new City water supplies. Future water supplies include VenturaWaterPure (potable reuse of advanced treated tertiary treated effluent from the VWRF) and an interconnection with Calleguas MWD that will allow the City to access its 10,000 AF/yr Table A entitlement from the California SWP.

Significant development of agricultural land or open space is not expected because agricultural land and open space in the Basin is subject to the City of Ventura and County of Ventura SOAR voter initiatives currently approved through 2050 (County of Ventura, 2020). The SOAR initiatives require a majority vote of the people to rezone unincorporated open space, agricultural, or rural land for development. In addition to the SOAR initiatives, the City of Ventura HVPAA (City of Ventura, 2005), also approved through 2050, requires voter approvals for development or the extension of City urban services into the hillsides. The existence of the SOAR and HVPPA make it very unlikely that a material change in land use will occur during the foreseeable future. Because agricultural land and open space is not expected to convert to other uses, it is assumed that there is little potential for new development that could impact basin recharge or water demands. These assumptions will be revisited during each 5-year GSP assessment.

3.3.3.1.3 Projected Surface Water Supply [§354.18(c)(3)(C)]

§354.18 Water Budget.

(c) *Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:*

(3) *Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:*

(C) *Projected surface water supply shall utilize the most recent water supply information as the baseline condition for estimating future surface water supply. The projected surface water supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply identified in Section 354.18(c)(2)(A), and the projected changes in local land use planning, population growth, and climate.*

As explained in Section 3.1.1.3 and summarized at the beginning of Section 3.3, surface water from Casitas MWD is imported to Mound Basin as part of the City's M&I water supply. The City of Ventura's projected future water deliveries from Casitas MWD are calculated for normal years and drought years at approximately 6,000 AF/yr and 3,400 AF/yr, respectively (Ventura Water, 2020b). These values are consistent with actual surface water deliveries for normal to wet years 2010 and 2011, and the average for dry to near-average water years 2012 through 2019 (Table 3.3-05). The City's diverse water supply portfolio must be considered when evaluating the reliability of surface water supplies because the diversity tends to compensate for shortages of one supply. In addition, the City is pursuing new water supplies including VenturaWaterPure (potable reuse of advanced treated tertiary treated effluent from the VWRF) and an interconnection with Calleguas MWD that will allow the City to access its 10,000 AF/yr Table A entitlement from the California SWP. Based on the foregoing, changes in surface water supply availability would not necessarily impact the City's Mound Basin groundwater extraction. Based on the foregoing, MBGSA concludes that the GSP Emergency Regulations §354.18(c)(3)(C) requirement to "evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply…" is not particularly relevant to the Mound Basin GSP. Surface water supply availability and any impacts on the Mound Basin will be evaluated during each 5-year GSP assessment.

3.3.3.2 Projected Water Budget [§354.18(b)(1),(2),(3),(4),(6), and (d)(3)]

§354.18 Water Budget.

(b) *The water budget shall quantify the following, either through direct measurements or estimates based on data:*

- ***(1)*** *Total surface water entering and leaving a basin by water source type.*
- ***(2)*** *Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.*
- ***(3)*** *Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.*
- ***(4)*** *The change in the annual volume of groundwater in storage between seasonal high conditions.*
- ***(6)*** *The water year type associated with the annual supply, demand, and change in groundwater stored.*

(d) *The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:*

- ***(3)*** *Projected water budget information for population, population growth, climate change, and sea level rise.*

The projected baseline surface water and groundwater budgets are presented in the following tables and figures and described below:

- Surface Water Budget: Table 3.3-06 and Figure 3.3-07
- Basin Groundwater Budget: Table 3.3-07 and Figures 3.3-08 and 3.3-09
- Hydrostratigraphic Unit Groundwater Budgets: Table 3.3-08

Projected Surface Water Budget

Average annual volumes for each component of the projected baseline surface water budget in Mound Basin are quantified in Table 3.3-06. The projected surface water budget is subdivided into three periods, including the 20-year implementation period required under SGMA (water years 2022-2041), the 30-year sustaining period under SGMA (water years 2042-2071), and a 25-year post-SGMA period (water years 2072-2096). Baseline projected annual Basin totals for each surface water budget component are shown graphically on Figure 3.3-07. Following are salient results of modeling the baseline projected surface water budget, focusing on notable differences compared to the historical and current water budgets (shown on Table 3.3-02):

- Similar to the historical and current surface water budget periods, the largest source of surface water inflow to and outflow from Mound Basin in the projected water budget is the Santa Clara River, with inflows ranging from zero during drought periods to over 1,000,000 AF/yr during high-rainfall years (Table 3.3-06). Ephemeral streamflows typically comprise the next largest sources of inflows and outflows, although imports of surface water (from Casitas MWD) are greater than ephemeral streamflows during dry years.
- Surface water inflows and outflows in the Santa Clara River and ephemeral streamflows are projected to be substantially smaller during the implementation period than during the sustaining and post-SGMA periods, largely as a result of the smaller average rainfall assumed during the implementation period (Table 3.3-06).

- The long-term average inflow and outflow in the Santa Clara River during the projected water budget period are approximately 4% smaller than long-term average inflow and outflow during the historical and current periods (combined). This difference is partly explained by slightly lower (1% less) rainfall assumed during the projected period compared to rainfall during the combined historical and current periods. The remainder of this difference likely results from changes in hydrologic and groundwater conditions modeled by United (2021c) upstream from Mound Basin in the Santa Clara River watershed (less than 1% of the Santa Clara River's watershed is within Mound Basin).

As was described in Section 3.3.3.1.1 of this GSP, the projected surface water budget was also modeled under two climate change scenarios (2030 and 2070) in accordance with DWR (2018) guidance. Projected surface water budget components under the 2030 climate change scenario are summarized in Table 3.3-09 and graphically illustrated on Figure 3.3-10. Projected surface water budget components under the 2070 climate change scenario are summarized in Table 3.3-10 and graphically illustrated on Figure 3.3-11. The effect of the simulated climate change scenarios on the projected surface water budget components is small; the largest change in long-term average flow projections is less than 3% (larger) compared to baseline surface water budget components.

Projected Groundwater Budget

Average annual volumes of groundwater that comprise each component of the baseline projected water budget for the principal aquifers, Shallow Alluvial Deposits, and fine-grained Pleistocene deposits HSU in Mound Basin are quantified in Table 3.3-08. The projected water budget is subdivided into three periods, including the 20-year implementation period required under SGMA (water years 2022-2041), the 30-year sustaining period under SGMA (water years 2042-2071), and a 25-year post-SGMA period (water years 2072-2096). Baseline projected annual Basin totals for each groundwater budget component are provided in Table 3.3-07 and shown graphically on Figure 3.3-08. Following are salient results of modeling the baseline projected groundwater budget, focusing on notable differences compared to the historical and current water budgets (shown on Tables 3.3-03 and 3.3-04):

- Groundwater underflow (considering all aquifers) between Oxnard Basin and Mound Basin nearly always comprises net inflow to Mound Basin under the future baseline scenario instead of fluctuating between inflow and outflow during the historical period. Exceptions to this net positive inflow to Mound Basin are small amounts of net outflow projected to occur during or immediately after droughts. The overall projected increase in underflow into Mound Basin comprises the largest difference between the baseline projected water budget compared to the historical and current groundwater budgets for Mound Basin. The increase in groundwater inflow from Oxnard Basin to Mound Basin is in large part due to projected increases in groundwater elevations in Oxnard Basin (that increase the hydraulic gradient towards Mound Basin), which in turn are expected to result from implementation of the GSP for the Oxnard Basin (Dudek, 2019). It should be noted that a modest quantity of net outflow from Mound Basin to Oxnard Basin is projected to occur in the Hueneme and Fox Canyon aquifers, albeit at significantly lower rates (Table 3.3-08).
- The net direction and magnitude of groundwater underflow across the coastline (between Mound Basin and areas to the west where the aquifers underlie the seafloor) during the baseline projected water budget period also changed substantially compared to the historical

and current periods. During the projected baseline period, the net direction of groundwater underflow for all aquifers combined is forecasted to be nearly always seaward (toward the ocean), including during drought periods, at a rate of approximately 5,000 AF/yr; during the historical and current periods, influx of water across the coastline occurred during drought periods. However, small to modest quantities of landward flow are projected across the coastline during the GSP implementation period (water years 2022-2041) in the Hueneme and Fox Canyon aquifers. However, seawater intrusion into the aquifers of Mound Basin is not projected to occur as a result of this landward flow, owing to the presence of fresh water in the offshore areas of the Hueneme and Fox Canyon aquifers.

- The projected annual volume of groundwater inflow to Mound Basin from Santa Paula Basin is approximately 800 AF/yr less during the baseline future water budget period (decreasing slightly from the implementation period through the post-SGMA period), compared to the historical and current water budget periods. This decrease in groundwater inflow from Santa Paula Basin is primarily due to projected increases in groundwater elevations in Mound Basin, which would decrease the hydraulic gradient between Santa Paula and Mound Basins.
- The magnitude of groundwater/surface water interaction in the Santa Clara River during the baseline projected water budget period is substantially different compared to the historical and current periods. During the projected baseline period, the net effect of groundwater/surface water interaction is recharge to the Shallow Alluvial Deposits from surface flows in the Santa Clara River, at rates of approximately 1,000 AF/yr, on average, during the implementation period; 1,600 AF/yr during the sustaining period; and 1,300 AF/yr during the post-SGMA period (Table 3.3-08). However, during the historical period, groundwater discharge to the river was approximately equal to infiltration of surface flows into the Shallow Alluvial Deposits (net discharge of approximately 30 AF/yr on average to the river from the shallow aquifer), becoming 270 AF/yr of recharge to the Shallow Alluvial Deposits on average during the current period.
- The net volume of groundwater released from storage in Mound Basin during the entire baseline projected water budget period is approximately -80 AF/yr on average, meaning a small amount of groundwater is projected to be added to storage (associated with rising groundwater levels) on average (Table 3.3-07 and Figure 3.3-09). This is compared with an average of 550 AF/yr of groundwater storage loss during the combined historical and current period.
- Differences in the remaining projected baseline water budget components compared to historical and current water budget components are modest to negligible, as can be seen by comparing Table 3.3-07 and Figure 3.3-08 to Table 3.3-03 and Figure 3.3-02.

As was described in Section 3.3.3.1.1 of this GSP, the projected groundwater budget was also modeled under two climate change scenarios (2030 and 2070) in accordance with DWR (2018) guidance. Projected groundwater budget components under the 2030 climate change scenario are summarized in Tables 3.3-11 and 3.3-12 and Figures 3.3-12 and 3.3-13. Projected groundwater budget components under the 2070 climate change scenario are summarized in Tables 3.3-13 and 3.3-14 and Figures 3.3-14 and 3.3-15. The effect of the simulated climate change scenarios on the projected water budget components is small; the largest change is an 8% decrease in groundwater underflow from the Oxnard Basin to Mound Basin in the 2070 climate change scenario compared to the baseline scenario. The simulated effects of climate change on other water budget components are smaller, ranging from less than 1% to a few percent. It should be noted that existing cyclical climate phenomena, such as the ENSO and PDO, have historically had a greater effect on water budget components in Mound Basin than the projected effects of the 2030 and 2070 climate change scenarios. In other words, the effects of existing climate cycles (ENSO and PDO) likely will have greater impacts on future groundwater conditions in Mound Basin than the longer-term climate change assumptions recommended by DWR (2018) to evaluate potential uncertainty in the projected water budget.

3.3.4 Overdraft Assessment and Sustainable Yield Estimate [§354.18(b)(5) and (b)(7)]

§354.18 Water Budget.

(b) *The water budget shall quantify the following, either through direct measurements or estimates based on data:*

(5) *If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.*

(7) *An estimate of sustainable yield for the basin.*

3.3.4.1 Overdraft Assessment

GSP Emergency Regulations § 354.18(b)(5) requires quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions if overdraft conditions exist.

Bulletin 118, Update 2003 (DWR, 2003) describes groundwater overdraft as "[t]he condition of a groundwater basin or subbasin in which the amount of water withdrawn by extraction exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions. Overdraft can be characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years. If overdraft continues for a number of years, significant adverse impacts may occur, including increased extraction costs, costs of well deepening or replacement, land subsidence, water quality degradation, and environmental impacts."

Review of the historical, current and projected groundwater budgets indicate small amounts of declining groundwater storage over time (469 and 147 for the historical and current periods, respectively), as shown in Table 3.3-03. These results suggest a minor amount of overdraft may have occurred during the historical and current period of 6.3% and 2.3%, respectively, of the groundwater extraction during that timeframe. However, these values are considered to be within the range of uncertainty of the water budget calculations and no undesirable results have been reported historically. Therefore, it is does not appear that overdraft has occurred historically in the Basin.

The projected water budget suggests that groundwater in storage would increase slightly (68 to 84 AF/yr) between 2022 and 2096, under the assumed future precipitation rates modeled. During the implementation period (2022-2041), declines in storage range from 4 to 38 AF/yr are projected, depending on the climate change assumptions (Tables 3.3-07, 3.3-11, and 3.3-13). These values are considered to be within the range of uncertainty of the water budget calculations. Therefore, MBGSA concludes that overdraft during the 50-year GSP planning horizon is not likely under the assumed conditions.

Although the water budget projections suggest groundwater storage will not decline significantly during the 50-year GSP planning horizon, the model results indicate 318 to 458 AF/yr of groundwater inflow will occur from offshore portions of the Hueneme Aquifer into onshore portions of the aquifer during the implementation period (2022-2041), depending on climate change assumptions (Tables 3.3-08, 3.3-12, and 3.3-14). Modeled flow across the coastline during the next 55 years (sustaining and post-GSP periods, 2042-2096) is projected to reverse (consist of outflow from Mound Basin to the offshore areas), on average. As discussed in Section 3.2.3, available data do not indicate that seawater is or has been present in the onshore portions of the principal aquifers to date. With projected average net outflows of groundwater from Mound Basin to the offshore areas west of the coastline of approximately 5,000 AF/yr (Tables 3.3-08, 3.3-11, and 3.3-14), seawater intrusion into Mound Basin is considered unlikely to occur. Additionally, Section 4.6 presents model results of particle tracking analyses, which suggest that it will take more than 100 years for the seawater front in the Hueneme Aquifer to reach the shoreline of the Mound Basin. This is clearly beyond the 50-year GSP planning horizon and neither SGMA nor the GSP Emergency Regulations explicitly require consideration of potential undesirable results that could manifest after the 50-year GSP planning horizon. Nonetheless, this GSP prudently includes SMC and a monitoring network for seawater intrusion. A contingency plan for unexpected seawater intrusion during the 50-year GSP planning horizon will also be developed and can survive following the 50-year GSP planning horizon and be used to address any future potential landward movement of seawater in the Hueneme Aquifer.

3.3.4.2 Sustainable Yield

GSP Emergency Regulations § 354.18(b)(7) requires an estimate of the sustainable yield for the Basin. Water Code §10721(w) defines "Sustainable yield" as the maximum quantity of water, calculated over a base period representative of long-term conditions in the Basin and including any temporary surplus that can be withdrawn annually from a groundwater supply without causing an undesirable result.

Modeling results for the future projection periods indicate that the projected inflow and outflows will be approximately balanced during the 20-year GSP implementation period (change in storage ranging from 4 to 38 AF/yr; Tables 3.3-07, 3.3-10, and 3.3-13), depending on climate change assumptions. The modeling results also suggest that the minimum thresholds will not be exceeded. Therefore, an estimate of the sustainable yield is approximately equal to the projected extraction (averaging 7,900 to 8,200 AF/yr), depending on climate change assumptions (Tables 3.3-07, 3.3-10, and 3.3-13). It is recognized that increasing extraction rates above these amounts could increase underflow from adjacent basins, thereby increasing the sustainable yield of the Mound Basin; however, this could impact sustainable management of the adjacent Santa Paula and/or Oxnard basins and is not included the sustainable yield estimate at this time.

3.4 Management Areas [§354.20]

No management areas were established for this GSP.

4.0 Sustainable Management Criteria [Article 5, SubArticle 3]

4.1 Introduction to Sustainable Management Criteria [§354.22]

§354.22 Introduction to Sustainable Management Criteria. *This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator.*

This chapter defines the conditions that direct sustainable groundwater management in the Mound Basin, discusses the process by which MBGSA characterized undesirable results, and established minimum thresholds, measurable objectives, and interim milestones for each applicable sustainability indicator.

Defining the SMC requires a significant level of analysis and scrutiny; this section presents the data and methods used to develop the SMC for the Mound Basin and explains how the SMC affect the interests of beneficial uses and users of groundwater and/or land uses and property interests. The SMC presented in this Section were developed using the best available science and information for the Basin. As noted in this GSP, data gaps exist in the HCM, and uncertainty caused by these data gaps was considered during SMC development. The SMC will be reevaluated during each Plan assessment and potentially modified in the future as new data become available.

The layout for this GSP groups the SMC by each sustainability indicator, and their order is kept consistent with the SGMA regulatory text for minimum thresholds (§354.28). For this GSP, land subsidence is the most limiting sustainability indicator, and it may benefit the reader to understand the SMC for Section 4.8 before reading Sections 4.4 through 4.7. The following sustainability indicators are applicable in the Basin:

- Chronic lowering of groundwater levels (Section 4.4)
- Reduction in groundwater storage (Section 4.5)
- Seawater Intrusion (Section 4.6)
- Degraded water quality (Section 4.7)
- Land subsidence (Section 4.8)

The sixth sustainable management criterion, depletion of interconnected surface water, is not applicable in the Basin because surface water is not materially affected by groundwater extraction for the reasons described in the Basin Setting (see Sections 3.1.4.2, 3.2.6, and 3.3, and Appendix G for further information). There is no direct depletion of interconnected surface water of the Santa Clara River and its estuary because there is no groundwater extraction from the Shallow Alluvial Deposits. Indirect depletion of Santa Clara River flows by groundwater extraction from the deeper, principal aquifers does not occur at material rates because the thick zone of fine-grained materials that lies between the Shallow Alluvial Deposits and the Mugu Aquifer significantly limits the propagation of hydraulic responses between these units. A detailed analysis of the potential for indirect depletion is presented in Appendix G. The results of that analysis indicated that there is no material depletion of surface water.

To retain an organized approach, this chapter follows the same structure for each sustainability indicator. The description of each SMC contains all the information required by §354.22 et seq. of the SGMA regulations and outlined in DWR BMP 6, Sustainable Management Criteria (DWR, 2017), including:

- Description of undesirable results:
    - Potential effects on beneficial uses and users of groundwater, on land uses and property interests, and other potential effects (§354.26(b)(3)).
    - The cause of groundwater conditions that would lead to or has led to undesirable results (§354.26(b)(1)).
    - The criteria used to define when and where the effects of groundwater conditions cause undesirable results (i.e., the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin) (§354.26(b)(2)).
- How minimum thresholds were developed:
    - The information and methodology used to develop minimum thresholds (§354.28 (b)(1)).
    - The relationship between minimum thresholds and the relationship of these minimum thresholds to other sustainability indicators (§354.28 (b)(2)).
    - The effect of minimum thresholds on neighboring basins (§354.28 (b)(3)).
    - The effect of minimum thresholds on beneficial uses and users (§354.28 (b)(4)).
    - How minimum thresholds relate to relevant Federal, State, or local standards (§354.28 (b)(5)).
    - The method for quantitatively measuring minimum thresholds (§354.28 (b)(6)).
- How measurable objectives and interim milestones were developed:
    - The methodology for setting measurable objectives (§354.30).
    - Interim milestones (§354.30 (a), §354.30 (e), §354.34 (g)(3)).

Minimum thresholds, measurable objectives, and interim milestones have been established to evaluate chronic lowering of groundwater levels, reduction in groundwater storage, and land subsidence (Table 4.1-01), water quality (Tables 4.1-02 and 4.1-03), and seawater intrusion (Table 4.1-03). For this GSP and pursuant to GSP Emergency Regulations §354.28(d), a groundwater elevation minimum threshold serves as the metric for chronic lowering of groundwater levels (Section 4.4) and land subsidence (Section 4.8) sustainability indicators. Adequate evidence demonstrating groundwater levels are a reasonable proxy is presented in Sections 4.4.2 and 4.8.2. More information about specific minimum thresholds, measurable objectives, and interim milestones relating to each groundwater condition is available in Sections 4.4 through 4.8.

To facilitate discussion of the land subsidence minimum thresholds the Basin is divided into a “western half,” “eastern half,” and “coastal area” (Figure 4.1-01), and these terms are used throughout the GSP.

4.2 Sustainability Goal [§354.24]

§354.24 Sustainability Goal. *Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon.*

The sustainability goal is key to the SMC development process because it provides policy guidance for defining undesirable results and desirable conditions for each applicable sustainability indicator and for the Basin as a whole. Recognizing the importance of the sustainability goal, MBGSA's SMC process began with developing and adopting the sustainability goal. MBGSA used a deliberate process to develop the sustainability goal, which included providing ample opportunity for input on the goal. Sustainability goal outreach included a GSP newsletter article, web-posting, multiple email notices to the interested parties list, discussion at a GSP Workshop, and discussion at four Board of Director meetings. The sustainability goal was adopted by the Board of Directors on September 17, 2020, after three months of outreach. Information from the Basin setting used to establish the sustainability goal is described in the subsections for each individual sustainability indicator.

The sustainability goal for the MBGSA GSP is as follows:

> *The goal of this Groundwater Sustainability Plan (GSP) is to sustainably manage the groundwater resources of the Mound Basin for the benefit of current and anticipated future beneficial users of groundwater and the welfare of the general public who rely directly or indirectly on groundwater. Sustainable groundwater management will ensure the long-term reliability of the Mound Basin groundwater resources by avoiding undesirable results pursuant to the Sustainable Groundwater Management Act (SGMA) no later than 20 years from GSP adoption through implementation of a data-driven and performance-based adaptive management framework. It is the express goal of this GSP to develop sustainable management criteria and plan implementation measures to avoid undesirable results for the applicable SGMA sustainability indicators by:*
>
> 1. *Using best available science and information, including consideration of uncertainty in the basin setting and groundwater conditions;*
> 2. *Conducting active and meaningful stakeholder engagement;*
> 3. *Considering potential impacts on the management of adjacent basins and, where necessary coordinating with adjacent basins; and*
> 4. *Balancing economic, social, and environmental impacts and benefits associated with current and anticipated future beneficial users of groundwater, by considering:*
>   a. *Water supply reliability for agriculture and municipal and industrial users;*
>   b. *Availability of alternative water sources for domestic groundwater beneficial users;*
>   c. *Identifying and considering potential impacts to groundwater-dependent ecosystems;*

   d. *State, federal, or local standards relevant to applicable sustainability indicators;*
   e. *Feasibility of projects and management actions necessary to achieve proposed measurable objectives; and*
   f. *Economic impact of projects and management actions necessary to achieve proposed measurable objectives on all beneficial users, with special consideration of disadvantage communities and agricultural landowners lacking alternative land use options.*

The measures that will be implemented to ensure that the Basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation (and is likely to be maintained through the planning and implementation horizon) is presented in Section 6 (Projects and Management Actions) and Section 7 (Plan Implementation).

4.3 Process for Establishing Sustainable Management Criteria [§354.26(a), §354.34(g)(3)]

§354.26 Undesirable Results.
(a) *Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.*

§354.34 Monitoring Network
(g) *Each Plan shall describe the following information about the monitoring network:*
   (3) *For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.*

On June 18, 2020, the MBGSA Board of Directors adopted a deliberate process for developing SMC for this GSP (depicted in Figure 4.3-01 below).

As shown in Figure 4.3-01, a key part of the SMC development process is defining undesirable results (GSP Emergency Regulations §354.26(a)). The process for defining undesirable results was modified as the work was completed and consisted of multiple steps:

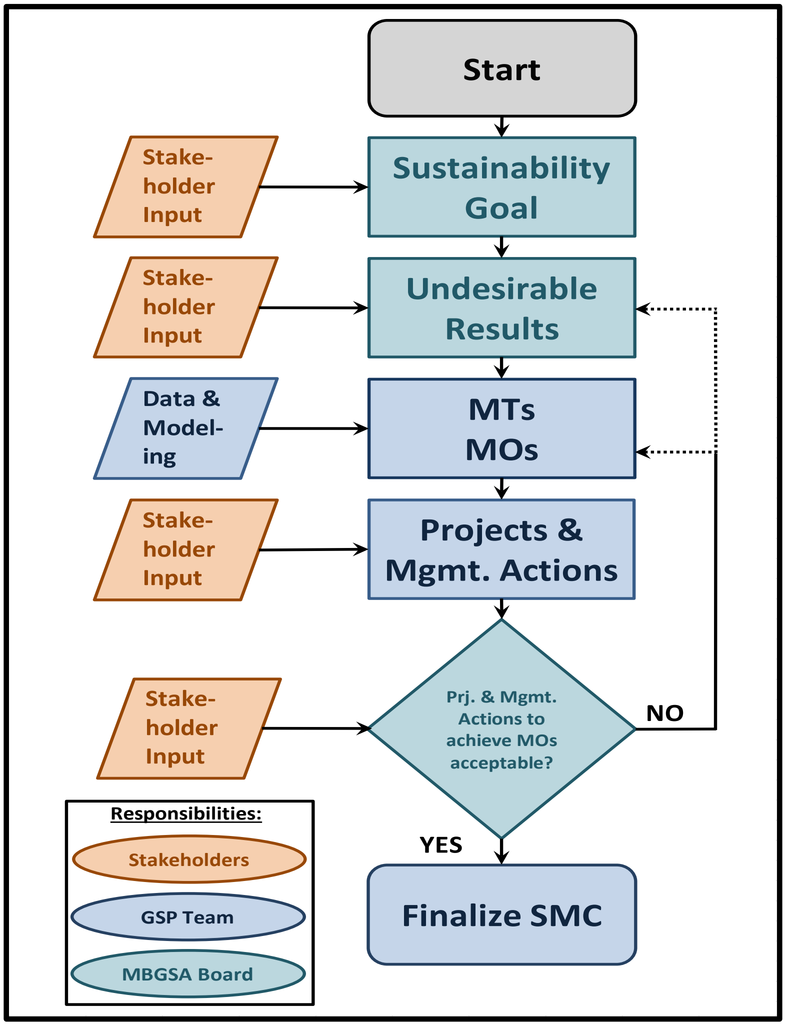
1. First, potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other effects were evaluated and described qualitatively.
2. This qualitative undesirable results statement was then translated and quantified into minimum thresholds at specific monitoring network sites (existing and proposed).
3. Lastly, a combination of minimum threshold exceedances representing undesirable results (when significant and unreasonable effects occur on any of the sustainability indicators) in the Basin was established.

The Board of Directors and stakeholders reviewed SMC proposals prepared by staff. Written proposals were provided in the form of staff reports and presentations at numerous Board of Directors meetings, which included information on SGMA requirements, relevant information from the Basin Setting section, and results of additional analyses completed to support SMC development. Meeting summaries (minutes) were posted on the MBGSA website to reflect the discussions that took place for each sustainability indicator.

SMC were also presented at two GSP workshops. The first GSP workshop was held on September 3, 2020, and focused on providing foundational information for SMC development, including the Basin setting, groundwater model, SMC development process, and sustainability goal. The second GSP workshop was held on March 4, 2021, and focused on detailed SMC proposals. The Board approved the SMC for inclusion in the draft GSP on March 18, 2021.

The proposed SMC were also subject to review and comment during the Draft GSP comment period. Outreach was performed throughout the SMC development process to encourage input on the proposed SMC, including GSP newsletters, e-mails to the interested parties list, social media posts, telephone communications with stakeholders, updates at the Santa Clara River Watershed Committee, public notices, and a bilingual bill stuffer in the City of Ventura's consumer water bills.

Figure 4.3-01 Sustainable Management Criteria Development Process



4.4 Chronic Lowering of Groundwater Levels

4.4.1 Undesirable Results [§354.26(a),(b)(1),(b)(2),(b)(3)]

§354.26 Undesirable Results.
(a) *Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.*
(b) *The description of undesirable results shall include the following:*
- ***(1)*** *The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.*
- ***(2)*** *The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.*
- ***(3)*** *Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.*

Process and Criteria for Defining Undesirable Results [§354.26(a)]

The overall process relied upon to define undesirable results for this GSP is described in Section 4.3. The specific process and criteria for defining undesirable results applied to the chronic lowering of groundwater levels sustainability indicator are described below.

Evaluation of Potential Effects on Beneficial Uses and Users, Land Uses, and Property Interests [§354.26(b)(3)]

The process for defining undesirable results for chronic lowering of groundwater levels began with considering the potential effects on beneficial uses and users of groundwater, land uses, and property interests.

Potential effects on beneficial uses and users of groundwater include the following:

- Impact on the ability of existing and future wells to produce groundwater at an adequate rate for beneficial uses, and
- Significant financial burden to groundwater beneficial users related to increased extraction costs, well repairs or modifications, and well replacements.

Potential effects on land uses and property interests include decreased property values resulting from decreased well yields and/or increased costs to produce water or purchase supplemental water.

The above-listed potential effects were analyzed by evaluating information about the following:

- Historical groundwater elevation data;
- Depths and locations of existing wells; and

- Numerical modeling results of groundwater level conditions from the 50-year projected water budget.

Chronic lowering of groundwater levels has not historically occurred and is not currently occurring in the Basin. The results of the analysis indicate that groundwater levels could decline by a considerable amount below historical low levels in many areas of the Basin before a significant and unreasonable depletion of supply would occur. The reason for this available groundwater level decline is related to the fact that wells are located in the confined portion of the Basin and the aquifers occur at considerable depths (see Figures 3.1-05 through 3.1-08). In short, there is a high enough water column in most wells to support large groundwater declines before a significant loss of production capacity would occur. The analysis results are supported by the lack of reported pumping problems during historical periods of lowered groundwater levels. While accessing water from depths below historical low groundwater levels may require deeper pump settings than current, the cost for lowering pumps is not considered significant and unreasonable. Significant and unreasonable effects are assumed to occur if wells could no longer be used as designed. Because wells in the Basin are designed to produce from confined aquifers, this means maintaining pumping levels above the top of the aquifers.

Based on the foregoing, the qualitative description of undesirable results is chronic lowering of groundwater levels that causes a significant number of wells in the Basin to no longer be capable of being operated as designed for the confined aquifers of the Mound Basin.

Cause of Groundwater Conditions That Could Lead to Undesirable Results [§354.26(b)(1)]

The cause of groundwater conditions that could lead to undesirable results would be lowering of the groundwater potentiometric surface to depths that cause pumping levels to drop below an operable height above the top of the principal aquifer in a significant number of wells.

The following factors could result in groundwater levels declining to such levels:

1. Mound Basin groundwater extractions rates that significantly exceed those assumed for the projected water budget analysis.
2. Droughts that exceed the duration and severity of droughts included in the hydrologic period used for the projected water budget analysis.
3. If Oxnard Basin does not meet the sustainability goal in its GSP, which would impact underflow between the basins to the detriment of the Mound Basin.
4. Increased groundwater extraction in the adjacent Oxnard Basin near the boundary with the Mound Basin, which would impact underflow between the basins to the detriment of the Mound Basin.
5. Increased groundwater extraction in the adjacent Santa Paula Basin near the boundary with the Mound Basin, which would impact underflow between the basins to the detriment of the Mound Basin.
6. Combinations of items 1 through 5.

Criteria Used to Define Undesirable Results [§354.26(b)(2)]

The combination of minimum threshold exceedances that is deemed to cause significant and unreasonable effects in the Basin for chronic lowering of groundwater levels is minimum threshold exceedances in 50% of the groundwater level monitoring sites in either principal aquifer. Exceedances beyond 50% would indicate widespread significant and unreasonable effects in either principal aquifer leading to undesirable results in the Basin.

4.4.2 Minimum Thresholds [§354.28]

The minimum thresholds for the chronic lowering of groundwater levels are set at the historical low groundwater level for each monitoring well (Appendix I). The basis, description, and definition for the minimum threshold is discussed in the subsequent sections below.

4.4.2.1 Information and Criteria to Define Minimum Thresholds [§354.26(c), §354.28(a),(b)(1),(c)(1)(A),(c)(1)(B),(d), and (e)]

§354.26 Undesirable Results.

(c) *The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.*

§354.28 Minimum Thresholds.

(a) *Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.*

(b) *The description of minimum thresholds shall include the following:*

  (1) *The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by the uncertainty in the understanding of the basin setting.*

(c) *Minimum thresholds for each sustainability indicator shall be defined as follows:*

  (1) *Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:*

    (A) *The rate of groundwater elevation decline based on historical trend, water year type, and projected water use in the basin.*

(d) *An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.*

(e) *An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.*

The evaluation of potential effects on beneficial uses and users, land uses, and property interests that would be affected by chronic lowering of groundwater levels was described in the evaluation of undesirable results (Section 4.4.1). Summarizing Section 4.4.1, significant and unreasonable effects from chronic lowering of groundwater levels would be causing wells to no longer be capable of being operated as designed for the confined aquifers of the Mound Basin. Wells are designed to not have the screens desaturate. For the confined aquifers in the Mound Basin, this means the maximum available drawdown is generally limited by the water column above the top of the aquifer (Driscoll, 1986). Drawing groundwater levels into the screen and aquifer causes cascading water in the well, which can cause pump cavitation and can accelerate biofouling, corrosion, and encrustation of the well screen. These effects can rapidly cause a significant loss of well production capacity and can render wells inoperable. Therefore, preventing significant and unreasonable effects requires that static groundwater levels be maintained at levels that provide sufficient water column for pumping levels to remain above the top of the aquifers.

With respect to the undesirable results described above, the groundwater elevations that indicate depletion of supply were calculated for each monitoring location to evaluate potential minimum thresholds for chronic lowering of groundwater levels. The calculations were completed by adding the estimated drawdown for a typical pumping well to 40 ft above the top elevation of the aquifer (see Appendix I for additional details and results of these calculations). Although this calculation was considered for the minimum threshold for the chronic lowering of groundwater levels sustainability indicator, it was noted that some calculated levels are several hundred feet lower in elevation than the measured historical low groundwater elevation (especially for the Hueneme aquifer), while others are similar to the historical low elevations. This is due to the significant folding of the principal aquifers that create a variable depth to the top of aquifer throughout the Basin. Other considerations include the prevention of land subsidence, avoiding potentially unrecoverable reduction of groundwater storage, and impacting underflows to/from the adjacent Oxnard Basin. After considering these factors, the minimum thresholds for the chronic lowering of groundwater levels were set at the historical low groundwater elevations in the monitoring wells. This approach will protect the wells near anticlines (upward folds), prevent land subsidence, prevent the Basin groundwater levels from falling beyond a point from which groundwater storage may not fully recover, and ensure that underflow to/from the Oxnard Basin is not unduly impacted. The resulting minimum thresholds are provided in Table 4.1-01 and are depicted on the time-series plots (hydrographs) included in Appendix I.

Pursuant to GSP Emergency Regulations §354.28(c)(1)(A), the rate of groundwater elevation decline based on historical trend, water year type, and projected water use in the Basin were considered during development of the minimum thresholds for chronic lowering of groundwater levels. Declining groundwater levels have been observed during periods of multiple consecutive dry water years or sequences with alternating dry and normal water years (e.g. Figures 3.2-10 through 3.2-13 and 3.3-02). Projected water use in the Basin is accounted for in the numerical modeling of the 50-year projected period and the modeling results suggest that projected extraction rates will not cause minimum threshold exceedances (Appendix I).

4.4.2.1.1 Evaluation of Multiple Minimum Thresholds [§354.26(c)]

> **§354.26 Undesirable Results.**
> ***(c)*** *The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.*

This requirement is not applicable because only one minimum threshold is established for the chronic lowering of groundwater levels sustainability indicator.

4.4.2.1.2 Evaluation of Representative Minimum Thresholds [§354.28(d)]

> **§354.28 Minimum Thresholds.**
> ***(d)*** *An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.*

As discussed in Section 4.8, InSAR data is not adequate for monitoring land subsidence in the western half of the Basin. Because of this inadequacy, groundwater level elevations are used as a proxy for land subsidence minimum thresholds in the western half of the Basin. As such, groundwater elevation is used as a representative minimum threshold for multiple sustainability indicators (land subsidence and chronic lowering of groundwater levels in the western half of the Basin). Groundwater levels are a reasonable proxy for multiple minimum thresholds for these sustainability indicators because they are closely correlated. Groundwater levels could decline below historical low levels without causing undesirable results for the chronic lowering of groundwater levels sustainability indicator at some locations in the western half of the Basin based on the drawdown analysis described in Appendix I. However, undesirable results for land subsidence could occur in the "Coastal Area" (see Figure 4.1-01) if groundwater levels decline below historical low levels in the western half of the Basin. Therefore, it is appropriate to use the historical low as minimum thresholds for the land subsidence and chronic lowering of groundwater levels sustainability indicators in the western half of the Basin. Appendix I describes the calculation of the minimum thresholds and measurable objectives for each monitoring well in the Basin.

4.4.2.2 Relationships Between Minimum Thresholds and Sustainability Indicators [§354.28(b)(2)]

> **§354.28 Minimum Thresholds.**
> ***(b)*** *The description of minimum thresholds shall include the following:*
> ***(2)*** *The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.*

The relationships between the minimum thresholds for the chronic lowering of groundwater levels sustainability indicator and other sustainability indicators are described in Section 4.4.2.5.

4.4.2.3 Minimum Thresholds in Relation to Adjacent Basins [§354.28(b)(3)]

> **§354.28 Minimum Thresholds.**
> ***(b)*** *The description of minimum thresholds shall include the following:*
> ***(3)*** *How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.*

The minimum thresholds for the chronic lowering of groundwater levels sustainability indicator are based on historical low groundwater elevations, which is considered protective of both the Mound Basin and the adjacent Oxnard Basin. Deeper groundwater levels could potentially increase underflow into the Mound Basin from the Oxnard and/or Santa Paula Basins (or decrease underflow to the Oxnard Basin), which could potentially contribute to undesirable results in those Basins. Underflow between the basins will be estimated during Plan implementation using groundwater level data near the basin boundary and numerical modeling to evaluate whether the minimum thresholds are unduly impacting sustainable management of the Oxnard Basin.

4.4.2.4 Impact of Minimum Thresholds on Beneficial Uses and Users [§354.28(b)(4)]

> **§354.28 Minimum Thresholds.**
> ***(b)*** *The description of minimum thresholds shall include the following:*
> ***(4)*** *How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.*

The chronic lowering of groundwater levels minimum thresholds may have several effects on beneficial users and land uses in the Basin:

Groundwater Beneficial Users (All Types)

The minimum thresholds will prevent significant and unreasonable depletions of supply and prevent significant financial burdens for well repairs and well replacements. Numerical modeling results suggest that the future groundwater levels will be above the minimum thresholds and achieve the measurable objective without the need for extraction rate reductions or any projects or other management actions. Therefore, the minimum thresholds are not anticipated to limit the beneficial use of groundwater.

Land Uses and Property Interests (All Types)

The minimum thresholds will prevent significant and unreasonable effects on land uses and property interests by preserving water supply for beneficial uses, thereby helping maintain property values. As discussed in Section 2.2.3.1, agricultural land and open space in the Basin is subject to the City of Ventura and County of Ventura SOAR voter initiatives currently approved through 2050 (SOAR, 2015). The SOAR initiatives require a majority vote of the people to rezone unincorporated open space, agricultural, or rural land for development. The existence of SOAR makes it very unlikely that agricultural land could be developed. Therefore, it is important to ensure that agricultural beneficial uses of groundwater are protected by the minimum thresholds because there is no practical alternative land use for most agricultural land in the Basin. Absent groundwater supplies, agricultural property values would likely be significantly impacted. The impact on property values for other land uses and property uses in the Basin is less directly tied to Mound Basin groundwater because the City of Ventura (water supplier for majority of the non-agricultural areas of the Basin) has a diverse water supply portfolio that includes multiple supplies derived from sources located outside of the Basin.

4.4.2.5 Potential Effects on other Sustainability Indicators [§354.28(c)(1)(B)]

> **§354.28 Minimum Thresholds.**
> ***(c)*** *Minimum thresholds for each sustainability indicator shall be defined as follows:*
> ***(1)*** *Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:*
> ***(B)*** *Potential effects on other sustainability indicators.*

Pursuant to GSP Emergency Regulations §354.28(c)(1)(B), potential effects on other sustainability indicators were considered. The following effects were identified:

- **Land Subsidence in the Western Half of the Basin**: As discussed in Section 4.8, InSAR data is not adequate for monitoring land subsidence in the western half of the Basin; therefore, groundwater level elevations are used as a proxy for land subsidence minimum thresholds. The minimum thresholds are the same for the chronic lowering of groundwater levels and land subsidence sustainability indicators in the western half of the Basin. The potential effect of the chronic lowering of groundwater levels minimum thresholds is prevention of minimum threshold exceedances for the land subsidence sustainability indicator in the western half of the Basin.

  Land Subsidence in the Eastern Half of the Basin: As discussed in Section 4.8, InSAR data is adequate for monitoring land subsidence in the eastern half of the Basin and the land subsidence minimum thresholds are a rate and extent of subsidence. The chronic lowering of groundwater levels minimum threshold is the historical low groundwater level elevations, which should prevent inelastic subsidence. Thus, the potential effect of the chronic lowering of groundwater levels minimum thresholds is prevention of minimum threshold exceedances for the land subsidence sustainability indicator in the eastern half of the Basin.

- **Reduction of Groundwater Storage**: Managing groundwater levels above historical lows is expected to prevent unrecoverable groundwater storage loss because the Basin has been demonstrated to recover from historical low groundwater elevations historically. Thus, the potential effect of the chronic lowering of groundwater levels minimum thresholds is prevention of unrecoverable reduction of groundwater storage.

- **Seawater Intrusion**: Numerical modeling results suggest that seawater intrusion is not anticipated during the 50-year SGMA planning and implementation period (Section 4.6). In addition, the Mugu and Hueneme aquifers crop out on the continental shelf approximately 10 miles offshore without any submarine canyons (Figure 3.1-10), greatly reducing the likelihood that seawater can find a near-shore path for intrusion. Several investigations have concluded that seawater intrusion is not occurring for Mound Basin. Therefore, the effect of groundwater level minimum thresholds on the seawater intrusion sustainability indicators is not significant. However, it is noted that maintaining groundwater levels above historical low levels will help limit inland gradients in the Hueneme Aquifer that could eventually lead to onshore migration of seawater in the future (beyond the 50-year SGMA planning and implementation period).

- **Degraded Water Quality**: Managing groundwater levels above historical lows is expected to prevent water quality degradation associated with groundwater extraction because the Basin has not experienced degradation of water quality in the principal aquifers during periods of historical low groundwater elevations. Thus, the potential effect of the chronic lowering of groundwater levels minimum thresholds is prevention of degradation of water quality associated with groundwater extraction.

- **Depletion of Interconnected Surface Water**: This sustainability indicator is not applicable to the Mound Basin.

4.4.2.6 Current Standards Relevant to Sustainability Indicator [§354.28(b)(5)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
  (5) *How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.*

MBGSA is unaware of any federal, state, or local standards for chronic lowering of groundwater levels.

4.4.2.7 Measurement of Minimum Thresholds [§354.28(b)(6)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
  (6) *How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.*

Groundwater elevations will be directly measured to determine their relation to minimum thresholds. Groundwater level monitoring will be conducted in accordance with the monitoring plan outlined in Section 5. Section 7 Plan Implementation includes an implementation budget to install additional monitoring sites identified in Section 5.

4.4.3 Measurable Objectives and Interim Milestones [§354.30(a),(b),(c),(d),(e),(g)]

§354.30 Measurable Objectives.
(a) *Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.*
(b) *Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.*
(c) *Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.*
(d) *An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.*
(e) *Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.*
(g) *An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.*

4.4.3.1 Description of Measurable Objectives

The chronic lowering of groundwater levels measurable objectives were developed by applying the concept of providing a reasonable margin of operational flexibility under adverse conditions (GSP Emergency Regulations §354.30(c)). Adverse conditions for the Mound Basin include drought-phases of the long-term and climatic-driven groundwater level cycles, as described in Section 3.2 (Groundwater Conditions). The reasonable margin of operational flexibility was determined to be groundwater levels following wet phases that are sufficiently high to prevent groundwater levels from dropping below the minimum thresholds during a subsequent drought phase (Figures 3.2-10 through 3.2-13). The measurable objectives were developed for each monitoring site using the following approach:

1. Modeled groundwater level data were plotted for the projected period for each monitoring site.
2. The maximum modeled groundwater level decline during the 50-year GSP planning and implementation horizon was determined and, when necessary, adjusted using professional judgment based on model calibration results (see Appendix I for additional details on the methodology);
3. The maximum projected groundwater level decline was added to the minimum threshold to establish the range of operational flexibility.

The measurable objectives are listed along with minimum thresholds for each monitoring site in Table 4.1-01 (§354.30(b)) and apply following wet phases of the climate cycle. Failure to meet the measurable objectives during other times shall not be considered failure to sustainably manage the Basin. Time-series plots (hydrographs) showing the measured and modeled groundwater elevation data and measurable objectives are included in Appendix I.

4.4.3.2 Interim Milestones [§354.30(e)]

> **§354.30 Measurable Objective.**
> ***(e)*** *Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin with 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.*

Interim milestones were developed to illustrate a reasonable path to achieve the sustainability goal for the Basin within 20 years of Plan implementation. Development of interim milestones is significantly complicated by the fact that the hydrologic conditions for the next 20 years cannot be predicted. Currently, groundwater levels in the Basin are below the measurable objectives for approximately ⅓ of the wells because the Basin has experienced overall dry conditions for much of the past decade. It is anticipated that groundwater levels will rise during the next wet period and as a result of Oxnard Basin GSP implementation. It is anticipated that the measurable objectives will be met at some point during the 20-year GSP planning period and then may fluctuate above or below the measurable objective thereafter. Because of the uncertainty concerning when the measurable objectives will be met, the interim milestones are shown as a linear path toward the measurable objective over the 20-year sustainability timeframe. This interim milestone path should not be taken literally because it is climate dependent. The interim milestones and path to sustainability will be reviewed during each required 5-year GSP assessment

(GSP Emergency Regulations §354.38(a)). The interim milestones are listed in Table 4.1-01 and are plotted on the time-series plots (hydrographs) included in Appendix I.

Once the measurable objectives are met, numerical modeling results suggests that sustainability will be maintained during the remainder of the 50-year GSP planning and implementation horizon (Appendix I). The causes of groundwater conditions that could lead to undesirable results for the land subsidence sustainability indicator (described in Section 4.8.1) will be carefully reviewed during each required 5-year GSP assessment. The GSP will be updated to include any projects or management actions deemed necessary to maintain sustainable conditions in the Basin.

4.5 Reduction of Groundwater Storage

4.5.1 Undesirable Results [§354.26(a),(b)(1),(b)(2),(b)(3)]

> **§354.26 Undesirable Results.**
> ***(a)*** *Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.*
> ***(b)*** *The description of undesirable results shall include the following:*
> ***(1)*** *The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.*
> ***(2)*** *The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.*
> ***(3)*** *Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.*

Process and Criteria for Defining Undesirable Results [§354.26(a)]

The overall process relied upon to define undesirable results for this GSP was described in Section 4.3. The specific process and criteria for defining undesirable results applied to the reduction of groundwater storage sustainability indicator are described below.

Pursuant to Water Code §10721(x)(2) the undesirable result for the reduction of groundwater storage sustainability indicator is a “significant and unreasonable reduction of groundwater storage.” The reduction in groundwater storage sustainability indicator is measured as the “total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results” (GSP Emergency Regulations §354.28(c)(2)).

The HCM for the Mound Basin describes the principal aquifers (Mugu and Hueneme) as extensively deep and confined, except where the Hueneme unit outcrops in the higher elevations to the north (Section 3.1.4.1.3). The principal aquifers are also regional flow-through units, with groundwater underflow from the upgradient Santa Paula Basin contributing to rebound from declines in storage associated with drier periods (Figure 3.3-03). In addition, historical low groundwater levels are consistently well above the top of the principal aquifer units (Figures 3.1-05 – 3.1-07). Storage is not directly measured for the Basin;

therefore there are no storage targets or goals associated with groundwater use. These combinations of factors indicate that groundwater storage is not a directly relevant sustainability indicator for the Basin. Regardless, the potential impacts of the reduction of groundwater storage are evaluated under the guidelines of the GSP Emergency Regulations to maintain compliance.

In many basins, including the Mound Basin, the effects of decreasing groundwater storage would manifest as effects for other sustainability indicators; the reduction of groundwater storage is associated with chronic lowering of groundwater levels and subsidence. For example, a key concern for the Mound Basin would be a reduction in groundwater storage that causes groundwater levels to decline to a point that undesirable results for the land subsidence sustainability indicator occur.

Based on the foregoing, the qualitative description of undesirable results is reduction of groundwater storage that will likely cause other sustainability indicators to have undesirable results.

Evaluation of Potential Effects on Beneficial Uses and Users, Land Uses, and Property Interests [§354.26(b)(3)]

The evaluation of potential effects on beneficial uses and users, land uses, and property interests for the reduction of groundwater storage sustainability indicator is the same as for the other sustainability indicators and is incorporated herein by reference to Sections 4.4.2.4, 4.6.2.4, and 4.7.2.4.

Reduction of groundwater storage has the potential to impact the beneficial uses and users of groundwater in the Mound Basin by limiting the volume of groundwater available that can be economically extracted for agricultural, municipal, and industrial use. These impacts can affect all users of groundwater in the Mound Basin. Groundwater elevations are used to determine whether significant and unreasonable reduction of groundwater in storage is occurring.

Cause of Groundwater Conditions That Could Lead to Undesirable Results [§354.26(b)(1)]

The cause of groundwater conditions that could lead to undesirable results would be reduction of groundwater storage that subsequently causes undesirable results for the other sustainability indicators.

The following factors could result in groundwater storage reductions that could lead to undesirable results for the other sustainability indicators:

1. Mound Basin groundwater extractions rates that significantly exceed those assumed for the projected water budget analysis.
2. Droughts that exceed the duration and severity of droughts included in the hydrologic period used for the projected water budget analysis.
3. If Oxnard Basin does not meet the sustainability goal in its GSP, which would impact underflow between the basins to the detriment of the Mound Basin.
4. Increased groundwater extraction in the adjacent Oxnard Basin near the boundary with the Mound Basin, which would impact underflow between the basins to the detriment of the Mound Basin.

5. Increased groundwater extraction in the adjacent Santa Paula Basin near the boundary with the Mound Basin, which would impact underflow between the basins to the detriment of the Mound Basin.
6. Combinations of items 1 through 5.

Criteria Used to Define Undesirable Results [§354.26(b)(2)]

Because there is a single minimum threshold that applies to the entire Basin, the criteria used to define undesirable results for the reduction of groundwater storage sustainability indicator is the exceedance of the minimum threshold. If the reduction of groundwater storage minimum threshold is exceeded, MBGSA will assess the other sustainability indicators to determine if undesirable results are occurring or are likely to occur.

4.5.2 Minimum Thresholds [§354.28]

The minimum threshold for the reduction of groundwater storage sustainability indicator is the estimated sustainable yield of 8,200 AF/yr of the Basin calculated over a long-term, balanced hydrologic period. Because the minimum threshold applies over an averaging period, groundwater extractions exceeding the minimum threshold in any given year will not automatically be considered to indicate undesirable results are occurring in the Basin (please see Section 4.5.1).

4.5.2.1 Information and Criteria to Define Minimum Thresholds [§354.26(c), §354.28(a),(b)(1),(c)(2), (d), and (e)]

§354.26 Undesirable Results.

(c) *The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.*

§354.28 Minimum Thresholds.

(a) *Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.*

(b) *The description of minimum thresholds shall include the following:*

(1) *The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by the uncertainty in the understanding of the basin setting.*

(c) *Minimum thresholds for each sustainability indicator shall be defined as follows:*

(2) *Reduction of Groundwater Storage. 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 my 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.*

(d) *An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.*

(e) *An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.*

Groundwater storage cannot be directly measured; rather it can only be estimated using measured or modeled groundwater levels and knowledge of basin geometry and subsurface hydraulic properties, and there is a calibrated numerical model that is used to relate groundwater levels to storage (United, 2021c). Groundwater extraction values from the Basin's principal aquifers are a more direct and reliable measure as compared to estimated storage changes. For these reasons, groundwater extraction rates will be used for the reduction of groundwater storage sustainability indicator. The information used to define the minimum threshold (sustainable yield) is the water budgets presented in Section 3.3, which are based on the numerical modeling performed for GSP development.

4.5.2.1.1 Evaluation of Multiple Minimum Thresholds [§354.26(c)]

§354.26 Undesirable Results.

(c) *The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.*

This requirement is not applicable because only one minimum threshold is established for the reduction of groundwater storage sustainability indicator.

4.5.2.1.2 Evaluation of Representative Minimum Thresholds [§354.28(d)]

> **§354.28 Minimum Thresholds.**
> ***(d)*** *An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.*

This requirement is not applicable to the reduction of groundwater storage sustainability indicator.

4.5.2.2 Relationships Between Minimum Thresholds and Sustainability Indicators [§354.28(b)(2)]

> **§354.28 Minimum Thresholds.**
> ***(b)*** *The description of minimum thresholds shall include the following:*
> ***(2)*** *The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.*

The relationships between the minimum thresholds for the reduction of groundwater storage sustainability indicator and other sustainability indicators are as follows:

- **Chronic Lowering of Groundwater Levels**: Extraction rates directly influence groundwater levels within the principal aquifers, so there is a direct relationship between the reduction of groundwater storage and the chronic lowering of groundwater levels minimum thresholds. Maintaining the long-term average groundwater extraction rates to below the sustainable yield is expected to minimize minimum threshold exceedances for the chronic lowering of groundwater levels sustainability indicator.
- **Land Subsidence:** A lowering of groundwater levels below the historical low levels could cause land subsidence in the Basin. Because extraction rates directly influence groundwater levels within the principal aquifers, the groundwater storage minimum threshold has a direct relationship to land subsidence if groundwater levels fall below the historical low. Maintaining the long-term average groundwater extraction rates to below the sustainable yield should minimize minimum threshold exceedances for the land subsidence sustainability indicator.
- **Seawater Intrusion**: Numerical modeling results suggest that seawater intrusion is not anticipated during the 50-year SGMA planning and implementation period (Section 4.6). In addition, the Mugu and Hueneme aquifers crop out on the continental shelf approximately 10 miles offshore without any submarine canyons (Figure 3.1-10), greatly reducing the likelihood that seawater can find a near-shore path for intrusion. Several investigations have concluded that seawater intrusion is not occurring for Mound Basin. Therefore, the relationship between reduction of groundwater storage minimum thresholds and the seawater intrusion sustainability indicator is not significant. Nevertheless, maintaining the long-term average groundwater extraction rates to below the sustainable yield should further minimize any potential for seawater intrusion.
- **Degraded Water Quality**: A lowering of groundwater levels below the historical low levels could cause degradation of water quality in the principal aquifers. Maintaining the long-term average

groundwater extraction rates to below the sustainable yield will help prevent degradation of water quality associated with groundwater extraction.

- **Depletion of Interconnected Surface Water**: This sustainability indicator is not applicable to the Mound Basin.

4.5.2.3 Minimum Thresholds in Relation to Adjacent Basins [§354.28(b)(3)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
  (3) *How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.*

The minimum threshold for the reduction of groundwater storage sustainability indicator will ensure groundwater storage does not decrease over long-term, average hydrologic conditions. This is considered protective of both the Mound Basin and the adjacent Oxnard Basin. If storage was allowed to decline over a long-term period of average hydrologic conditions, deeper groundwater levels would result, which could potentially increase underflow into the Mound Basin from the Oxnard and/or Santa Paula basins (or decrease underflow to the Oxnard Basin), which could potentially contribute to undesirable results in those basins. Underflow between the basins will be estimated during Plan implementation using groundwater level data near the basin boundary and numerical modeling to evaluate whether the minimum thresholds are unduly impacting sustainable management of the Oxnard Basin.

4.5.2.4 Impact of Minimum Thresholds on Beneficial Uses and Users [§354.28(b)(4)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
  (4) *How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.*

The effects on beneficial users and land uses in the Basin are the same as analyzed for the other sustainability indicators and are incorporated herein by reference.

4.5.2.5 Current Standards Relevant to Sustainability Indicator [§354.28(b)(5)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
  (5) *How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.*

MBGSA is unaware of any federal, state, or local standards for reduction of groundwater storage.

4.5.2.6 Measurement of Minimum Thresholds [§354.28(b)(6)]

> **§354.28 Minimum Thresholds.**
> ***(b)*** *The description of minimum thresholds shall include the following:*
> ***(6)*** *How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.*

Groundwater extractions will be directly measured and recorded to determine their relation to minimum thresholds. Extraction rate monitoring will be conducted in accordance with the monitoring plan outlined in Section 5.

4.5.3 Measurable Objectives and Interim Milestones [§354.30(a),(b),(c),(d),(e),(g)]

> **§354.30 Measurable Objectives.**
> ***(a)*** *Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.*
> ***(b)*** *Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.*
> ***(c)*** *Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.*
> ***(d)*** *An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.*
> ***(e)*** *Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.*
> ***(g)*** *An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.*

4.5.3.1 Description of Measurable Objectives

The reduction of groundwater storage measurable objective is 90% of the sustainable yield (i.e., 7,400 AF/yr), based on professional judgement and to account for uncertainty in the sustainable yield estimate. Like the minimum threshold, the measurable objective applies over a long-term period of average hydrology. It is anticipated that the measurable objective will be met in wet periods, but not met in drier than average periods and perhaps some average years. Failure to meet the measurable objective during average to dry years shall not be considered failure to sustainably manage the Basin. The measurable objective will be tracked over time and updated based on measured and recorded extraction rates for the Basin.

4.5.3.2 Interim Milestones [§354.30(e)]

§354.30 Measurable Objective.

(e) *Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin with 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.*

Interim milestones were developed to illustrate a reasonable path to achieve the sustainability goal for the Basin within 20 years of Plan implementation. Development of interim milestones is significantly complicated by the fact that the hydrologic conditions for the next 20 years cannot be predicted. The historical and current average groundwater extractions are lower than the minimum threshold value (7,391 and 7,288 AF/yr compared to 8,200 AF/yr). The historical and current average groundwater extractions are also less than the measurable objective (7,400 AF/yr), so the interim milestones are set to be equal to the measurable objective. Numerical modeling results suggest that sustainability will be maintained during the remainder of the 50-year GSP planning and implementation horizon (Appendix I).

4.6 Seawater Intrusion

As described in Section 3.2.3 Seawater Intrusion, available data indicate that seawater has not been present in the onshore portions of the principal aquifers to date. Section 3.2.3 also explains that the Mound Basin principal aquifers may only be exposed to seawater where they crop out on the continental shelf edge, approximately 10 miles offshore, greatly reducing the likelihood that seawater can find a near-shore path for intrusion into the principal aquifers (Figure 3.1-10).

Additional numerical modeling analysis of seawater intrusion potential was conducted to support SMC development. Particle tracking was performed to estimate historical movement of seawater over the last approximate 100-year period to represent groundwater flow conditions since predevelopment. The calibrated MODFLOW model was coupled with MODPATH (Pollock, 2016) for this analysis. Particles were released at the offshore aquifer subcrop locations to simulate seawater movement in the principal aquifers over the 100-year period. The particle tracking results suggests that seawater has moved an average of approximately 0.5 miles from the offshore subcrop toward the shoreline in the Hueneme Aquifer during the past 100 years (Figure 4.6-01). The particle tracking results suggest no migration occurred in the Mugu Aquifer during the same period.

Particle tracking results demonstrate onshore migration of seawater did not occur under historical conditions and is not anticipated during the 50-year SGMA planning and implementation horizon. This is due to the large distance between the shoreline and the edge of the continental shelf where the aquifers are hydraulically connected to seawater. The travel time for seawater to reach the coast is estimated to be multiple centuries or more. This is in contrast with the adjacent Oxnard Plain Basin, where the aquifers are highly vulnerable to lateral seawater intrusion due to the existence of two deep submarine canyons at Port Hueneme and Point Mugu that expose the aquifers to seawater in the walls of the canyons at a very close distance to the shoreline. Although the numerical model results indicate onshore flow in the Hueneme Aquifer, it is believed this water will most likely continue to consist of fresh groundwater from the offshore portion of the aquifer.

While the above-described modeling results are encouraging, it is necessary to consider the possibility that a short-circuit pathway for seawater could exist nearshore (for example along the Oak Ridge Fault). A nearshore short-circuit pathway could allow seawater to enter the aquifer and potentially migrate onshore during the SGMA planning horizon. The impact of potential short-circuit pathways for seawater was evaluated with additional particle tracking simulations. The 50-year baseline numerical model simulation performed for the projected water budget was coupled with MODPATH for this analysis. Particles were released in each principal aquifer at the shoreline to simulate seawater migration from a hypothetical near-shore short-circuit pathway. This simulation provides information for the worst-case scenario of potential seawater intrusion, in the event that seawater is just offshore and migrates onshore due to inland hydraulic gradients. Particles traces were exported after 20 and 50 years of migration to provide results for the 20-year GSP implementation period and the full 50-year SGMA planning period (Figures 4.6-02 and 4.6-03). As shown in Figures 4.6-02 and 4.6-03, the particle traces indicate an approximate average of 500 and 800 ft of potential migration (under the worst-case scenario) over the 20-year implementation and 50-year planning periods, respectively. Even under the worst-case scenario the inland extent of seawater migration is approximately 1 mile from the nearest active production well. It is recognized that migration rates in the more permeable portions of the aquifers could be several times higher than the average rates simulated. Even so, the results of these simulations indicate that it is unlikely that beneficial users of groundwater would be impacted during the 50-year SGMA planning and implementation horizon (see active wells plotted on Figures 4.6-02 and 4.6-03) by onshore migration of seawater via potential short-circuit pathways located near the coast.

Despite the very encouraging model results for seawater intrusion, SMC are included in the GSP to protect current and future beneficial users and users and property interests against potential unexpected seawater intrusion.

4.6.1 Undesirable Results [§354.26(a),(b)(1),(b)(2),(b)(3)]

§354.26 Undesirable Results.

(a) *Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.*

(b) *The description of undesirable results shall include the following:*

- ***(1)*** *The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.*
- ***(2)*** *The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.*
- ***(3)*** *Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.*

Process and Criteria for Defining Undesirable Results [§354.26(a)]

The overall process relied upon to define undesirable results for this GSP is described in Section 4.3. The specific process and criteria for defining undesirable results applied to the seawater intrusion sustainability indicator are described below.

Evaluation of Potential Effects on Beneficial Uses and Users, Land Uses, and Property Interests [§354.26(b)(3)]

The process for defining undesirable results for seawater intrusion began with considering the potential effects on beneficial uses and users of groundwater, land uses, and property interests.

The potential effect on beneficial uses and users of groundwater would be that seawater intrusion would render groundwater unusable for beneficial use. Current and future anticipated beneficial uses of groundwater lie east of Harbor Boulevard. Based on land use designations, there are no current or future anticipated beneficial uses of groundwater in the Coastal Area located west of Harbor Boulevard (Figure 2.1-03).

Given that the beneficial uses immediately east of Harbor Boulevard are agricultural, the potential effect of seawater intrusion on land uses and property interests would be the economic impacts of decreased agricultural activity and decreased property values resulting from the inability to produce water for agricultural activities. As discussed in Section 2.2.3.1, agricultural land and open space in the Basin lies is subject to the City of Ventura and County of Ventura SOAR voter initiatives currently approved through 2050 (SOAR, 2015). The SOAR initiatives require a majority vote of the people to rezone unincorporated open space, agricultural or rural land for development. The existence of the SOAR makes it very unlikely that agricultural land could be developed. Therefore, it is important to ensure that agricultural beneficial uses of groundwater are protected by the minimum thresholds because there is no practical alternative land use for most agricultural land in the Basin.

Based on the foregoing, the qualitative description of undesirable results is seawater intrusion extending east of Harbor Boulevard into areas with current or anticipated future beneficial uses.

Cause of Groundwater Conditions That Could Lead to Undesirable Results [§354.26(b)(1)]

As discussed in the beginning of Section 4.6, undesirable results for seawater intrusion are not anticipated during the 50-year SGMA planning and implementation period even if a near-shore short-circuit pathway for seawater intrusion exists.

The following combination of factors would be required for seawater intrusion to cause undesirable results during the 50-year SGMA planning and implementation period:

1. A near-shore short-circuit pathway for seawater to enter the principal aquifers would need to exist;
2. Onshore groundwater flow rates would need to be significantly greater than simulated (note the model suggest there is offshore flow in the Mugu Aquifer). This could potentially occur in the highest permeability zones of the aquifer, particularly if the onshore groundwater flow gradient increases above that observed historically. The groundwater flow gradient could increase as a result of the following:
    a. Mound Basin groundwater extractions rates that significantly exceed those assumed for the projected water budget analysis.
    b. Droughts that exceed the duration and severity of droughts included in the hydrologic period used for the projected water budget analysis.

c. If Oxnard Basin does not meet the sustainability goal in its GSP, which would impact underflow between the basins to the detriment of the Mound Basin.

d. Increased groundwater extraction in the adjacent Oxnard Basin near the boundary with the Mound Basin, which would impact underflow between the basins to the detriment of the Mound Basin.

e. Increased groundwater extraction in the adjacent Santa Paula Basin near the boundary with the Mound Basin, which would impact underflow between the basins to the detriment of the Mound Basin.

f. Combinations of items a through e.

Criteria Used to Define Undesirable Results [§354.26(b)(2)]

The criteria used to define when and where the effects of the groundwater conditions cause undesirable results is based on the qualitative description of undesirable result, which is seawater intrusion extending east of Harbor Boulevard into areas with current or anticipated future beneficial uses. Preventing undesirable results for seawater intrusion means that the chloride concentrations should be maintained below concentration indicative of seawater intrusion impacts at monitoring sites along Harbor Boulevard. Therefore, the combination of minimum threshold exceedances that is deemed to cause significant and unreasonable effects would be an isocontour line that exceeds the minimum threshold at or east of Harbor Boulevard (Table 4.1-01).

4.6.2 Minimum Thresholds [§354.28]

4.6.2.1 Information and Criteria to Define Minimum Thresholds [§354.26(c), §354.28(a),(b)(1),(c)(3)(A),(c)(3)(B),(d), and (e)]

> **§354.26 Undesirable Results.**
>
> ***(c)*** *The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.*
>
> **§354.28 Minimum Thresholds.**
>
> ***(a)*** *Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.*
>
> ***(b)*** *The description of minimum thresholds shall include the following:*
>
> ***(1)*** *The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by the uncertainty in the understanding of the basin setting.*
>
> ***(c)*** *Minimum thresholds for each sustainability indicator shall be defined as follows:*
>
> ***(3)*** *Seawater Intrusion. The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results. Minimum thresholds for seawater intrusion shall be supported by the following: .*
>
> ***(A)*** *Maps and cross-sections of the chloride concentration isocontour that defines the minimum threshold and measurable objective for each principal aquifer.*
>
> ***(B)*** *A description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels.*
>
> ***(d)*** *An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.*
>
> ***(e)*** *An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.*

Contrary to the general rule for setting minimum thresholds for other sustainability indicators, seawater intrusion minimum thresholds do not have to be set at individual monitoring sites. Rather, the minimum threshold is set along an isocontour (GSP Emergency Regulations §354.28(c)(3). However, for practical purposes of monitoring the isocontour, minimum thresholds are set at the monitoring and production wells used to define the isocontour.

Information used for establishing the chloride isocontour seawater intrusion minimum thresholds and measurable objectives include:

- Description of undesirable results (Section 4.6.1);
- Depths, locations, and logged lithology of existing wells used to monitor groundwater quality;
- Historical and current chloride concentrations in monitoring and production wells near the coast; and

- Minimum thresholds for chloride for the degraded water quality sustainability indictor.

Based on analysis of the above-listed factors, the seawater intrusion minimum threshold was established as a 150 mg/L chloride concentration isocontour along Harbor Boulevard. The minimum threshold is the same for both principal aquifers.

Figures 4.6-04 and 4.6-05 show the minimum threshold isocontour in map view and cross-section view for both principal aquifers, as required by GSP Emergency Regulations §354.28(c)(3)(A). Table 4.1-03 summarizes the seawater intrusion minimum threshold and measurable objective for the Mugu and Hueneme aquifers for the planned monitoring wells discussed in Section 4.6.2.6 below.

GSP Emergency Regulations §354.28(c)(3)(B) requires a description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels. As described in Sections 3.3 and 3.3.3, modeling for the 50-year projected water budget includes scenarios the considered 2030 and 2070 climate change conditions. The future baseline scenario assumed no sea level rise, the 2030 climate change scenario assumed 15 centimeters (6 inches) of sea level rise, and the 2070 climate change scenario assumed 45 centimeters (18 inches) of sea level rise, consistent with DWR (2018) guidance. The projected sea level rise amounts were incorporated into the general head boundary used to simulate the offshore seawater interface with the aquifer. The results of the 2030 and 2070 climate change model simulations are not significantly different from the baseline (no climate change) model simulation (Appendix I).

4.6.2.1.1 *Evaluation of Multiple Minimum Thresholds [§354.26(c)]*

> **§354.26 Undesirable Results.**
> ***(c)*** *The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.*

This requirement is not applicable because only one minimum threshold is established for the seawater intrusion sustainability indicator.

4.6.2.1.2 *Evaluation of Representative Minimum Thresholds [§354.28(d)]*

> **§354.28 Minimum Thresholds.**
> ***(d)*** *An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.*

This requirement is not applicable to the seawater intrusion sustainability indicator because groundwater levels are not used as proxy.

4.6.2.2 Relationships Between Minimum Thresholds and Sustainability Indicators [§354.28(b)(2)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
> ***(2)*** *The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.*

The relationships between the minimum thresholds for the sweater intrusion sustainability indicator and other sustainability indicators are as follows:

- **Chronic Lowering of Groundwater Levels**: Numerical modeling results suggest that seawater intrusion is not anticipated during the SGMA planning and implementation periods. Therefore, the relationship between the seawater intrusion and chronic lowering of groundwater levels sustainability indicator is not significant. However, it is noted that maintaining groundwater levels above historical low levels will help limit inland gradients in the Hueneme Aquifer that could eventually lead to onshore migration of seawater in the future (beyond the 50-year SGMA planning and implementation period).
- **Reduction of Groundwater Storage:** Numerical modeling results suggest that seawater intrusion is not anticipated during the SGMA planning and implementation periods. Therefore, the relationship between the seawater intrusion and reduction of groundwater storage sustainability indicator is not significant. However, it is noted that maintaining groundwater extraction totals will help limit the onshore movement of fresh groundwater in the Hueneme Aquifer that could eventually lead to onshore migration of seawater.
- **Land Subsidence**: Numerical modeling results suggest that seawater intrusion is not anticipated during the SGMA planning and implementation periods. Therefore, the relationship between the land subsidence sustainability and seawater intrusion indicators is not significant. However, it is noted that maintaining groundwater levels above historical low levels for the land subsidence sustainability indicator in the western half of the Basin will help limit the onshore movement of fresh groundwater in the Hueneme Aquifer that could eventually lead to onshore migration of seawater.
- **Degraded Water Quality**: The minimum threshold for seawater intrusion is consistent with the chloride minimum threshold for the degraded water quality sustainability indicator.
- **Depletion of Interconnected Surface Water**: This sustainability indicator is not applicable to the Mound Basin.

4.6.2.3 Minimum Thresholds in Relation to Adjacent Basins [§354.28(b)(3)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
> ***(3)*** *How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.*

The seawater intrusion minimum thresholds do not affect management of the adjacent Oxnard and Santa Paula basins.

4.6.2.4 Impact of Minimum Thresholds on Beneficial Uses and Users [§354.28(b)(4)]

> **§354.28 Minimum Thresholds.**
> ***(b)*** *The description of minimum thresholds shall include the following:*
> ***(4)*** *How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.*

Seawater intrusion minimum thresholds affect beneficial users and land uses in the Basin in the following ways:

Groundwater Beneficial Users (All Types)

The minimum thresholds will prevent significant and unreasonable degradation of groundwater quality by seawater intrusion, thereby avoiding loss of groundwater supply. Numerical modeling results suggest that the minimum thresholds will be met without the need for extraction rate reductions or any projects or management actions. Therefore, the minimum thresholds are not anticipated to limit the beneficial use of groundwater.

Land Uses and Property Interests (All Types)

The minimum thresholds will prevent significant and unreasonable effects on land uses and property interests by preserving water supply for beneficial uses, thereby helping maintain property values. As discussed in Section 4.6.1, the existence of SOAR makes it very unlikely that agricultural land could be developed. Therefore, it is important to ensure that agricultural beneficial uses of groundwater are protected by the minimum thresholds because there is no practical alternative land use for most agricultural land in the Basin. Absent useable groundwater supplies, agricultural property values would likely be significantly impacted. The impact on property values for other land uses and property uses in the Basin is not applicable because M&I wells are located inland, away from area that could be impacted by seawater intrusion.

4.6.2.5 Current Standards Relevant to Sustainability Indicator [§354.28(b)(5)]

> **§354.28 Minimum Thresholds.**
> ***(b)*** *The description of minimum thresholds shall include the following:*
> ***(5)*** *How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.*

MBGSA is unaware of any federal, state, or local standards for seawater intrusion other than the WQOs included in the RWQCB-LA Basin Plan (RWQCB-LA, 2019). The minimum threshold for seawater intrusion is equal to the RWQCB Basin Plan WQO for chloride.

4.6.2.6 Measurement of Minimum Thresholds [§354.28(b)(6)]

§354.28 Minimum Thresholds.

(b) *The description of minimum thresholds shall include the following:*

- ***(6)*** *How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.*

Chloride concentrations will be directly measured to determine their relation to the minimum threshold. Groundwater quality monitoring will be conducted in accordance with the monitoring plan outlined in Section 5.

A minimum of two monitoring sites are needed along Harbor Boulevard to monitor chloride concentrations relative to the minimum threshold chloride isocontour. As described in Section 5, two monitoring sites are planned to satisfy this requirement. In addition, a potential shoreline "early warning" well may eventually augment cluster well 02N23W15J0X. This well will be evaluated following the 5-year GSP review. The shoreline wells will provide early detection of seawater intrusion, thereby providing time to react to any unexpected landward migration of seawater before the minimum thresholds are exceeded. Section 7 on Plan Implementation includes an implementation budget to install additional monitoring sites identified in Section 5.

4.6.3 Measurable Objectives and Interim Milestones [§354.30(a),(b),(c),(d),(e),(g)]

§354.30 Measurable Objectives.

(a) *Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.*

(b) *Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.*

(c) *Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.*

(d) *An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.*

(e) *Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.*

(g) *An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.*

The seawater intrusion sustainability indicator measurable objectives and interim milestones are based on the chloride measurable objectives and interim milestones developed for the degraded water quality sustainability indicator. As such, the measurable objective is a 75-mg/L chloride isocontour for the Mugu Aquifer and a 100-mg/L chloride isocontour for the Hueneme Aquifer, both along Harbor Boulevard

(Figures 4.6-04 and 4.6-05). Based on available water quality data, it is anticipated that the measurable objective will already be met. However, this cannot be confirmed until the planned monitoring wells are drilled and sampled. Therefore, interim milestones are assumed to be equal to the measurable objective, but this needs to be confirmed in the first GSP update.

Please see Section 4.7.3 for more information concerning basis for the measurable objectives and interim milestones.

4.7 Degraded Water Quality

GSP Emergency Regulations 354.28(c)(4) requires GSAs to address 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. As discussed in Section 3.2.4, Groundwater Quality Impacts, there are no known contaminant plumes in the Basin. Potential impacts related to elevated concentrations of common ions and nitrate are there the focus for the degraded water quality sustainability indicator. It is noted that DWR has been consistent in its responses when asked about this sustainability indicator that GSAs are only responsible for managing water quality degradation that is caused by groundwater extraction or GSP projects or management actions. The SMC for the water quality degradation sustainability indicator were developed with this construct in mind.

As described in Section 3.1.4.3, Groundwater Quality, and Section 3.2.4, Groundwater Quality Impacts, the common ion chemistry of the groundwater in the Mugu and Hueneme principal aquifers is not ideal, but is beneficially used by municipal and agricultural users across the Basin. Common ions with RWQCB WQOs include sulfate, boron, and chloride. TDS also has a WQO. In general, TDS, sulfate, boron, and chloride concentrations are lower in the Mugu Aquifer and meet the WQOs with few exceptions. In general, TDS, sulfate, boron, and chloride concentrations are higher in the Hueneme Aquifer and meet the WQOs at most of the locations. The dissolved constituents are derived from natural sources, and groundwater extraction does not appear to be correlated with common ion chemistry concentrations.

It is noted that the City of Ventura has experienced elevated TDS and sulfate concentrations relative to secondary MCLs and detectable nitrate in extracted water from its wells. Based on comparison with monitoring data from other wells in the Basin, the elevated concentrations of sulfate and TDS in the City's wells appear to be related to well seal or casing integrity issues that facilitate intrusion of very poor-quality water from the shallow groundwater system into the well. This is considered a well construction/condition issue and not an indicator of regional degradation of water quality in the principal aquifer that can or should be managed by the GSA. This same pattern is also observed in some agricultural wells.

Nitrate can impact drinking water beneficial uses. The nitrate MCL is 45 mg/L (as NO_3; equivalent to 10 mg/L as N). Nitrate concentrations in excess of the drinking water MCL have been detected in groundwater samples from three agricultural wells that are screened in principal aquifers in Mound Basin (Mugu and Hueneme aquifers). Nitrate is also detected frequently in one of the two City of Ventura wells at concentrations above background but below the MCL. The other City of Ventura well has periodic low-level detections of nitrate. All of these wells exhibit anomalously high concentrations of TDS, sulfate, and chloride, suggesting influence of shallow groundwater through a possibly compromised well seal or well casing rather than presence of nitrate "plumes" in the Mugu and Hueneme aquifers in Mound Basin. It is further noted that other wells in the Basin do not exhibit elevated nitrate concentrations, further reinforcing the conclusion that nitrate is not a widespread issue in the Mound Basin principal aquifers.

In summary, groundwater quality in the Mound Basin is marginal due to natural geochemical processes, and groundwater extraction does not appear to exacerbate these natural processes. Occurrences of elevated sulfate, TDS, and nitrate concentrations appear to be related to well construction/condition issues that facilitate intrusion of very poor-quality water from the shallow groundwater system into these wells, as opposed to being an indicator of regional water quality degradation in the principal aquifers. In conclusion, it does not appear that significant or unreasonable groundwater quality degradation has occurred in the Mound Basin. However, it is recognized that potential future increases in Mugu Aquifer groundwater extraction could induce downward movement of very poor-quality water from the shallow groundwater system into the Mugu Aquifer, which could potentially lead to undesirable results. Additionally, improperly constructed wells that remain in use and abandoned wells that have not been properly destroyed (backfilled) can provide conduits for downward movement of very poor-quality water from the shallow groundwater system into the Mugu and/or Hueneme aquifers. Therefore, MBGSA must establish water quality sustainability criteria and monitor groundwater quality relative to those criteria.

4.7.1 Undesirable Results [§354.26(a),(b)(1),(b)(2),(b)(3)]

§354.26 Undesirable Results.

(a) *Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.*

(b) *The description of undesirable results shall include the following:*

- ***(1)*** *The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.*
- ***(2)*** *The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.*
- ***(3)*** *Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.*

Process and Criteria for Defining Undesirable Results [§354.26(a)]

The overall process relied upon to define undesirable results for this GSP is described in Section 4.3. The specific process and criteria for defining undesirable results applied to the degraded water quality sustainability indicator are described below.

Evaluation of Potential Effects on Beneficial Uses and Users, Land Uses, and Property Interests [§354.26(b)(3)]

The process for defining undesirable results for degraded water quality began with considering the potential effects on beneficial uses and users of groundwater, land uses, and property interests.

Potential effects on municipal beneficial uses would be increased costs for treatment or blending to meet drinking water standards. Potential effects on agricultural beneficial uses could include lower quality crops, increased water use to meet leaching requirements, and implementation of treatment or blending to reduce salinity. The potential effects on agricultural beneficial uses would result in increased costs and potential impacts on lease rates and land values.

The above-listed potential effects were analyzed by evaluating information about the following:

- Historical groundwater quality data;
- Relevant local, state, and federal water quality standards applicable to the Basin; and
- The 50-year projected water budget.

The analysis revealed that the common ion chemistry of the groundwater in the Mugu and Hueneme principal aquifers is not ideal but has been and continues to be beneficially used by municipal and agricultural users across the Basin. Based on the foregoing, the qualitative description of undesirable results is groundwater quality that exceed historical concentrations and significantly impacts beneficial uses.

Cause of Groundwater Conditions That Could Lead to Undesirable Results [§354.26(b)(1)]

Potential future increases in Mugu Aquifer extraction could potentially induce downward movement of very poor-quality water from the shallow groundwater system into the Mugu Aquifer, which could potentially lead to undesirable results. Additionally, improperly constructed wells that remain in use and abandoned wells that have not been properly destroyed (backfilled) can provide conduits for downward movement of very poor-quality water from the shallow groundwater system into the Mugu and/or Hueneme aquifers.

Criteria Used to Define Undesirable Results [§354.26(b)(2)]

The effects of groundwater conditions deemed to cause undesirable results is considered to occur when all representative monitoring wells in a principal aquifer exceed the minimum threshold concentration for a constituent for two consecutive years.

4.7.2 Minimum Thresholds [§354.28]

4.7.2.1 Information and Criteria to Define Minimum Thresholds [§354.26(c), §354.28(a),(b)(1),(c)(4), (d), and (e)]

> **§354.26 Undesirable Results.**
>
> ***(c)*** *The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.*
>
> **§354.28 Minimum Thresholds.**
>
> ***(a)*** *Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.*
>
> ***(b)*** *The description of minimum thresholds shall include the following:*
>
> ***(1)*** *The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by the uncertainty in the understanding of the basin setting.*
>
> ***(c)*** *Minimum thresholds for each sustainability indicator shall be defined as follows:*
>
> ***(4)*** *Degraded Water Quality. 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. 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.*
>
> ***(d)*** *An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.*
>
> ***(e)*** *An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.*

Minimum thresholds were developed to address the qualitative description of undesirable results provided in Section 4.7.1: “groundwater quality that exceed historical concentrations and significantly impacts beneficial uses.” The potential effects on beneficial uses and users were considered together with applicable local, state, and federal water quality standards applicable to the Basin.

These criteria were considered when developing the minimum thresholds:

- **Primary MCLs**: Applicable to nitrate only. It is desirable to maintain existing water quality at levels suitable potable water for human consumption for current and future beneficial uses. Widespread occurrence of nitrate in excess of the MCL is considered a significant and unreasonable effect.
- **Secondary MCLs**: Applicable to TDS, sulfate, and chloride. It is desirable to maintain water quality at levels acceptable to consumers. Widespread occurrence of TDS, sulfate, or chloride concentrations in excess of the short-term consumer acceptance level established by the DDW would be considered a significant and unreasonable effect.

- **RWQCB WQOs**: These standards are designed to protect beneficial uses and preserve existing water quality at the time of RWQCB Basin Plan (RWQCB-LA, 2019) development from degradation, consistent with the Porter-Cologne Act and SWRCB Antidegradation Policy (Resolution No. 68-16).
- **Agricultural Thresholds**: Certain crops grown in the Basin are sensitive to chloride and boron in irrigation water. The RWQCB WQOs were developed, in part to protect agricultural beneficial uses of water. Therefore, widespread chloride or boron concentrations in excess of WQOs for these constituents would be considered a significant and unreasonable effect.
- **Existing Water Quality**: Current groundwater quality is known to support beneficial uses in the Basin and there is an absence of significant and unreasonable effects due to water quality. Therefore, minimum thresholds should be set equal to or greater than existing water quality to recognize the absence of significant and unreasonable effects at present.
- **MBGSA's Ability to Improve Water Quality**: TDS, sulfate, chloride, and boron are naturally occurring constituents that are derived from groundwater interaction with subsurface sediments. The GSA has no feasible means of reducing the existing in situ concentrations of these constituents in the Basin. The GSA can take measures to minimize the downward migration of these constituents and nitrate from the shallow groundwater into the principal aquifers.

In general, the minimum thresholds were selected be consistent with the RWQCB WQOs. The one exception is TDS in the Hueneme Aquifer, which has historically exceeded the RWQCB WQO. The TDS minimum threshold was set higher than the RWQCB WQO based on the upper range of concentrations observed in representative monitoring wells during the previous 10 years. Setting the minimum threshold above the RWQCB WQO is not considered an issue because there are no direct potable uses of groundwater and the City of Ventura manages water quality through blending within its system. It is also noted that the minimum threshold is less than the short-term consumer acceptance level established by the DDW. The minimum thresholds and specific rationale for each water quality constituent minimum threshold are provided in Table 4.1-02. The minimum thresholds and measurable objectives with respect to each aquifer are shown on Table 4.1-03. The minimum thresholds are also shown on the water quality plots provided in Appendix J.

4.7.2.1.1 Evaluation of Multiple Minimum Thresholds [§354.26(c)]

> **§354.26 Undesirable Results.**
> ***(c)*** *The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.*

This requirement is not applicable because only one minimum threshold is established for the degraded water quality sustainability indicator.

4.7.2.1.2 Evaluation of Representative Minimum Thresholds [§354.28(d)]

§354.28 Minimum Thresholds.
(d) *An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.*

The requirement is not applicable to the degraded water quality sustainability indicator because groundwater elevations are not used as a proxy for the minimum thresholds.

4.7.2.2 Relationships Between Minimum Thresholds and Sustainability Indicators [§354.28(b)(2)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
  (2) *The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.*

The relationships between the minimum thresholds for the degraded water quality and other sustainability indicators are as follows:

- **Chronic Lowering of Groundwater Levels**: Managing groundwater levels above historical lows is expected to prevent water quality degradation associated with groundwater extraction because the Basin has not experienced degradation of water quality in the principal aquifers during periods of historical low groundwater elevations. Thus, the potential effect of the chronic lowering of groundwater levels minimum thresholds is prevention of degradation of water quality associated with groundwater extraction.
- **Reduction of Groundwater Storage**: A lowering of groundwater levels below the historical low levels could cause degradation of water quality in the principal aquifers. Maintaining the long-term average groundwater extraction rates below the sustainable yield will help prevent degradation of water quality associated with groundwater extraction.
- **Land Subsidence**: The land subsidence minimum thresholds are designed to minimize future potential inelastic land subsidence. Because poor-quality water is expelled from clays when inelastic subsidence occurs, minimizing inelastic land subsidence helps prevent significant and unreasonable effects for the degraded water quality sustainability indicator.
- **Seawater Intrusion**: The seawater intrusion minimum threshold is consistent with the degraded water quality minimum threshold for chloride.
- **Depletion of Interconnected Surface Water**: This sustainability indicator is not applicable to the Mound Basin.

4.7.2.3 Minimum Thresholds in Relation to Adjacent Basins [§354.28(b)(3)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
> ***(3)*** *How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.*

The degraded water quality minimum thresholds help protect that quality of groundwater that underflows into the adjacent Oxnard Basin.

4.7.2.4 Impact of Minimum Thresholds on Beneficial Uses and Users [§354.28(b)(4)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
> ***(4)*** *How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.*

Groundwater Beneficial Users (All Types)

The minimum thresholds will prevent significant and unreasonable degradation of groundwater quality that would limit the beneficial use of groundwater. Potential effects on municipal beneficial uses would be increased costs for treatment or blending to meet drinking water standards. Potential effects on agricultural beneficial uses could include lower quality crops, increased water use to meet leaching requirements, and implementation of treatment or blending to reduce salinity. The potential effects on agricultural beneficial uses would result in increased costs and potential impacts on lease rates and land values.

Land Uses and Property Interests (All Types)

The minimum thresholds will prevent significant and unreasonable effects on land uses and property interests by preserving water supply for beneficial uses, thereby helping maintain property values. As discussed in Section 2.2.3.1, agricultural land and open space in the Basin lies is subject to the City of Ventura and County of Ventura SOAR voter initiatives currently approved through 2050 (SOAR, 2015). The SOAR initiatives require a majority vote of the people to rezone unincorporated open space, agricultural or rural land for development. The existence of the SOAR makes it very unlikely that agricultural land could be developed. Therefore, it is important to ensure that agricultural beneficial uses of groundwater are protected by the minimum thresholds because there is no practical alternative land use for most agricultural land in the Basin. Absent useable groundwater supplies, agricultural property values would likely be significantly impacted. The impact on property values for other land uses and property uses in the Basin is less directly tied to Mound Basin groundwater because the City of Ventura (water supplier for majority of the non-agricultural areas of the Basin) has a diverse water supply portfolio that includes multiple supplies derived from sources located outside of the Basin.

4.7.2.5 Current Standards Relevant to Sustainability Indicator [§354.28(b)(5)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
  (5) *How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.*

The state, federal, and local standards applicable to the degraded water quality sustainability indicator are discussed in Section 4.7.2.1.

4.7.2.6 Measurement of Minimum Thresholds [§354.28(b)(6)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
  (6) *How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.*

Groundwater quality will be directly measured to determine where dissolved constituent concentrations are in relation to minimum thresholds. Groundwater quality monitoring will be conducted in accordance with the monitoring plan outlined in Section 5.

4.7.3 Measurable Objectives and Interim Milestones [§354.30(a),(b),(c),(d),(e),(g)]

§354.30 Measurable Objectives.
(a) *Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.*
(b) *Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.*
(c) *Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.*
(d) *An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.*
(e) *Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.*
(g) *An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.*

The measurable objectives were developed using the same information and criteria used to develop the minimum thresholds, which are described in Section 4.7.2.1. In general, the measurable objectives were selected to preserve existing water quality for beneficial uses in the Basin. The measurable objectives and specific rationale for each water quality constituent measurable objective are provided in Table 4.1-02. The measurable objectives provide a reasonable range of operational flexibility above the minimum thresholds and historical concentrations observed in the Basin, as shown in the water quality plots provided in (Appendix J).

4.7.3.1 Interim Milestones [§354.30(e)]

> **§354.30 Measurable Objective.**
> ***(e)*** *Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin with 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.*

Based on available water quality data, the measurable objectives are already being met. Therefore, interim milestones are equal to the measurable objective.

4.8 Land Subsidence

As described in Section 3.2.5 Land Subsidence, no land subsidence due to groundwater extraction has been documented historically in the Mound Basin. Section 3.2.5 also explains that the Mound Basin is considered to have a low estimated potential for inelastic land subsidence. Numerical modeling for the water budget suggests that future groundwater levels will remain above historical low levels, which would prevent inelastic subsidence due to groundwater extraction (Appendix I). Despite these factors, sustainable management is prudent because groundwater levels could decline below historical levels and trigger inelastic land subsidence if actual future conditions differ significantly from those assumed in the projected water budget analysis.

4.8.1 Undesirable Results [§354.26(a),(b)(1),(b)(2),(b)(3), and (c)]

> **§354.26 Undesirable Results.**
> ***(a)*** *Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.*
> ***(b)*** *The description of undesirable results shall include the following:*
> ***(1)*** *The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.*
> ***(2)*** *The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.*
> ***(3)*** *Potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results.*
> ***(c)*** *The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.*

Process and Criteria for Defining Undesirable Results [§354.26(a)]

The overall process relied upon to define undesirable results for this GSP was described in Section 4.3. The specific process and criteria for defining undesirable results applied to the land subsidence sustainability indicator are described below.

Evaluation of Potential Effects on Beneficial Uses and Users, Land Uses, and Property Interests [§354.26(b)(3)]

The process for defining undesirable results for land subsidence began with considering the potential effects on beneficial uses and users of groundwater, land uses, and property interests. Beneficial uses and users of groundwater are not anticipated to be affected by the low amounts of land subsidence that could potentially occur in this basin (i.e. potential subsidence does not appear sufficient to damage wells). Therefore, the process for defining undesirable results focused on assessing potential effects on land uses and property interests in the Basin. This was accomplished by reviewing best available information concerning land uses (existing and planned), 100-year floodplain extents, infrastructure, sea level rise and related coastal hazards. The City of Ventura, which overlies most of the Basin, was consulted in this process.

Evaluation of the above-listed factors revealed that the Coastal Area located west of Harbor Boulevard is particularly susceptible to impacts of land subsidence (Figure 4.1-01). Primary sewer lines to the City's wastewater treatment plant run along Harbor Boulevard and have a low slope that could be impacted by relatively small amounts of land subsidence. Available studies indicate that the developed areas located west of Harbor Boulevard, including the Pierpont community and Ventura Harbor, will be impacted by sea level rise (Figure 4.8-01a and 4.8-01b) (VCWPD, 2018). Inelastic land subsidence in this area would unreasonably exacerbate the already significant impacts associated with sea level rise. For these reasons it was determined that any measurable (0.1 ft or greater) inelastic land subsidence in the Coastal Area could potentially result in undesirable results, particularly as the effects of sea level rise act to increase coastal hazards in the Coastal Area during the planning and implementation horizons. The potential impact of land subsidence on the remainder of the Basin is less clear.

Based on the foregoing, the qualitative description of undesirable results is:

> *Land subsidence in the Coastal Area that exacerbates coastal hazards associated sea level rise or that impacts the City of Ventura's sewer mains along Harbor Boulevard and/or that substantially interferes with surface land uses in elsewhere in the Basin.*

Cause of Groundwater Conditions That Could Lead to Undesirable Results [§354.26(b)(1)]

The cause of groundwater conditions that could lead to undesirable results would be groundwater levels that decline below historical low levels resulting in inelastic land subsidence in the Coastal Area.

The following factors could result in groundwater levels declining below historical low levels:

1. Mound Basin groundwater extractions rates that significantly exceed those assumed for the projected water budget analysis.
2. Droughts that exceed the duration and severity of droughts included in the hydrologic period used for the projected water budget analysis.

3. If Oxnard Basin does not meet the sustainability goal in its GSP, which would impact underflow between the basins to the detriment of the Mound Basin.
4. Increased groundwater extraction in the adjacent Oxnard Basin near the boundary with the Mound Basin, which would impact underflow between the basins to the detriment of the Mound Basin.
5. Increased groundwater extraction in the adjacent Santa Paula Basin near the boundary with the Mound Basin, which would impact underflow between the basins to the detriment of the Mound Basin.
6. Combinations of items 1 through 5.

Criteria Used to Define Undesirable Results [§354.26(b)(2), (c)]

The criteria used to define when and where the effects of the groundwater conditions cause undesirable results is based on the qualitative description of undesirable result, which is land subsidence in the Coastal Area (Figure 4.1-01) that exacerbates coastal hazards associated with sea level rise or that impacts the City of Ventura's sewer mains along Harbor Boulevard and/or that substantially interferes with surface land uses elsewhere in the Basin.

InSAR is the best available method for measuring the rate and extent of land subsidence over large areas, such as a groundwater basin. As described in Section 4.8.2, InSAR data utility is impacted by a significant lack of coverage in the western half of the Mound Basin as well as other factors (Figure 3.2-19) and is inadequate to be relied upon for developing the land subsidence sustainability indicators. As a result, the minimum thresholds described in Section 4.8.2 were developed using groundwater levels as a proxy for the western half of the Basin. Subsidence rates that will be monitored using InSAR are used for the minimum threshold for the eastern half of the Basin because there is adequate InSAR coverage in that area. Therefore, multiple minimum thresholds are evaluated to determine whether an undesirable result is occurring for the land subsidence sustainability indicator.

Western Half of Mound Basin

For the Coastal Area, preventing undesirable results for land subsidence would mean that the groundwater levels are maintained above historical low levels, which avoids inelastic land subsidence. Because land subsidence can propagate radially away from an area of depressed groundwater levels, it is also necessary to maintain groundwater levels above historical lows in the remainder of the western half of the Basin to prevent inelastic land subsidence that could propagate into the Coastal Area. Based on the foregoing, the combination of minimum threshold exceedances that is deemed to cause significant and unreasonable effects in the western half of the Basin for land subsidence is minimum threshold exceedances in 50% of monitoring sites (Table 4.1-01). This combination is intended to indicate significant and unreasonable effects are widespread in the western half of the Basin. If InSAR coverage and other data issues are resolved in the future, MBGSA will update the GSP to use a rate and extent of land subsidence for the minimum threshold in the western half of the Basin.

Eastern Half of Mound Basin

By regulation, the land subsidence undesirable result is a quantitative combination of subsidence minimum threshold exceedances. For the eastern half of the Mound Basin, no land subsidence that substantially interferes with surface land uses is acceptable. Therefore, the combination of minimum threshold exceedances that may cause undesirable results in the eastern half of the Basin for land subsidence is as follows: in any one year, there will be zero exceedances of the minimum thresholds for subsidence *caused by groundwater conditions*, as indicated by InSAR. To determine whether InSAR-indicated land surface elevation changes were caused by groundwater conditions, InSAR data will only be considered when groundwater levels are below historical low levels. The InSAR data will be adjusted to account for rates of subsidence related to tectonic activity using continuous GPS data historical trends to determine if the minimum threshold has been exceeded.

4.8.2 Minimum Thresholds [§354.28]

4.8.2.1 Information and Criteria to Define Minimum Thresholds [§354.26(c), §354.28(a),(b)(1),(c)(5)(A),(c)(5)(B),(d), and (e)]

§354.26 Undesirable Results.

(c) *The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.*

§354.28 Minimum Thresholds.

(a) *Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.*

(b) *The description of minimum thresholds shall include the following:*

  (1) *The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by the uncertainty in the understanding of the basin setting.*

(c) *Minimum thresholds for each sustainability indicator shall be defined as follows:*

  (5) *Land Subsidence. 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. Minimum thresholds for land subsidence shall be supported by the following:*

    (A) *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.*

    (B) *Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.*

(d) *An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.*

(e) *An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.*

Land uses and property interests that would be affected by land subsidence in the Basin were described in the evaluation of undesirable results (Section 4.8.1). Summarizing Section 4.8.1, the Coastal Area of the Basin is particularly vulnerable to land subsidence impacts because land subsidence in this area would exacerbate coastal hazards associated with sea level rise in the Pierpont community and Ventura Harbor and could impact the City of Ventura's sewer mains that feed the City's WWTP. Section 4.8.1 concluded that any measurable inelastic land subsidence in the Coastal Area could potentially result in undesirable results, particularly as the effects of sea level rise act to increase coastal hazards in the Coastal Area during the planning and implementation horizons. However, because land subsidence can propagate radially away from an area of depressed groundwater levels, it is also important to prevent land subsidence in proximal areas adjacent to the Coastal Area in order to prevent inelastic land subsidence from propagating into the Coastal Area. It was further concluded that the potential impact of land subsidence on the remainder of the Basin is less clear.

Western Half of Mound Basin

Pursuant to GSP Emergency Regulations §354.28(c)(5), 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. InSAR is the best available method for measuring the rate and extend of land subsidence over large areas, such as a groundwater basin. However, the interpolated InSAR data for the Mound Basin are impacted by multiple factors:

1. There is a significant lack of coverage in the western half of the Mound Basin (Figure 3.2-19), which causes the interpolated InSAR subsidence rates to be unreliable.
2. InSAR data provided by DWR are interpolated across the basin boundary between Mound and Oxnard basins. This is not appropriate because of the faults and folds that comprise the basin boundary. These structures likely impact the propagation of any subsidence between the basins (Figures 3.1-02, 3.1-06, and 3.2-19).
3. There is a subsidence "hotspot" that corresponds with a landfill located just south of the Mound Basin in the adjacent Oxnard Basin, which would be representing natural land compaction at the landfill. Careful inspection of the InSAR interpolation reveals that the hotpot greatly influences the subsidence values in the western portion of the Mound Basin, which lacks InSAR data (Figure 3.2-19).

For these reasons, InSAR is not considered a reliable method for measuring land subsidence in the western half of the Mound Basin and groundwater levels will be used as a proxy minimum threshold, as provided for in GSP Emergency Regulations §354.28(d). This regulation section allows the use of groundwater levels as a proxy for other sustainability indicators if a significant correlation between groundwater elevations and the other sustainability indicators can be demonstrated. The preconsolidation stress, the effective stress threshold at which inelastic compaction begins, generally is exceeded when groundwater levels decline past historical low levels (California Water Foundation, 2014). Therefore, groundwater levels are an appropriate proxy for monitoring inelastic land subsidence due to groundwater extraction. Based on the discussion of undesirable results in Section 4.8.1, minimum thresholds must be established to prevent inelastic land subsidence caused by groundwater conditions in the Coastal Area of the Basin. This means that the GSP should prevent groundwater levels from declining below historical low levels within the Coastal Area. Because land subsidence propagates radially away from an area of depressed groundwater levels, it is also necessary to maintain groundwater levels above historical lows in the remainder of the western half of the Basin to prevent inelastic land subsidence that could propagate into the Coastal Area. Therefore, the minimum thresholds for land subsidence in the western half of the Basin are defined as the historical low groundwater levels (Table 4.1-01).

The historical low groundwater elevations which define the minimum thresholds in the western half of the Basin were established using the following approach:

1. Review of available historical data presented in the Basin Setting (Section 3; Figures 3.2-10 through 3.2-13), suggests that historical low groundwater levels occurred in late 1990 to early 1991.
2. Measured and modeled groundwater level data were plotted for the historical period for each monitoring site.
3. If measured data are available during late 1990 to early 1991, the historical low groundwater elevation was established using the lowest measured groundwater levels during this period.
4. If measured data were not available during late 1990 to early 1991, the historical low groundwater elevations were estimated based on numerically modeled groundwater levels, accounting for bias in simulated low water levels compared to observed groundwater levels (where available) from the recent drought (Appendix I).

Time-series plots (hydrographs) showing the measured and modeled groundwater elevation data and minimum thresholds are included in Appendix I.

Eastern Half of Mound Basin

For the eastern half of the Basin, InSAR provides adequate coverage and there are no apparent interpolation issues. As such, the minimum threshold for land subsidence for the eastern half of the Basin is the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Section 3.2.5 explains that available reports do not indicate any documented groundwater-related subsidence in the Mound Basin, and the DWR (2014) screening of the Mound Basin indicated a “low” overall estimated potential for future subsidence. Thus, significant and unreasonable effects from inelastic land subsidence caused by groundwater conditions are considered unlikely in the eastern half of the Basin. No basin-specific data exist to determine rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results (GSP Emergency Regulations §354.28(c)(5)). MBGSA staff consulted with land subsidence expert Michelle Sneed of the USGS concerning methods for predicting rates of subsidence that could substantially interfere with surface land uses. Ms. Sneed was unaware of any studies or proven methodologies for predicting rates of subsidence that could substantially interfere with surface land uses (M. Sneed of USGS, personal communication, July 24, 2020). Given the apparent lack of a published methodology for predicting rates of subsidence that could substantially interfere with surface land uses in the eastern half of the Basin, MBGSA estimated these rates of subsidence based on a literature review of subsidence case studies. The case studies provide insight into subsidence amounts that have led to significant and unreasonable impacts in other groundwater basins. A summary of case studies from the 10 basins identified in the literature review is presented in Table 4.8-01. As indicated in Table 4.8-01, the rates of subsidence that led to undesirable results ranged from approximately 1.2 to 4.5 inches per year (0.1 to 0.38 feet per year [ft/yr]). Reported cumulative subsidence ranged from 0.6 to 10 ft. MBGSA concluded that it may be reasonable to assume a threshold for potential significant and unreasonable effects based on the low end of the values reported from the case studies (i.e., 0.1 ft/yr, 0.6 ft cumulative). These values were selected as the basis for minimum thresholds for the eastern half of the Basin and will be revised later if basin-specific information becomes available. To determine whether InSAR-indicated land surface elevation changes were caused by groundwater conditions, InSAR data will only be considered when groundwater levels are at or below historical low levels. The InSAR data will be adjusted to account for subsidence related to tectonic activity using continuous GPS data and historical trends to determine if the minimum threshold has been exceeded.

Figure 4.8-02 shows the minimum thresholds and measurable objectives in map view, as required pursuant to GSP Emergency Regulations §354.28(c)(5)(B).

4.8.2.1.1 Evaluation of Representative Minimum Thresholds [§354.28 (d)]

> **§354.28 Minimum Thresholds.**
> ***(d)*** *An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.*

As discussed in Section 4.8.2.1, InSAR data is not adequate for monitoring land subsidence in the western half of the Basin. Because of this, groundwater level elevations are used as a proxy for land subsidence minimum thresholds. As such, groundwater elevation is used as a representative minimum threshold for multiple sustainability indicators (land subsidence and chronic lowering of groundwater levels) in the Basin. Numerical modeling results (Appendix I) indicate that groundwater levels could decline below historical low levels without causing undesirable results for the chronic lowering of groundwater levels sustainability indicator for some locations in the western half of the Basin. However, undesirable results for land subsidence could occur in the Coastal Area if groundwater levels decline below historical low levels in the western half of the Basin. Therefore, it is appropriate to use groundwater level elevations as representative minimum thresholds for the land subsidence sustainability indicator.

4.8.2.2 Relationships Between Minimum Thresholds and Sustainability Indicators [§354.28(b)(2)]

> **§354.28 Minimum Thresholds.**
> ***(b)*** *The description of minimum thresholds shall include the following:*
> ***(2)*** *The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.*

The relationships between the minimum thresholds for the land subsidence sustainability indicator and other sustainability indicators are as follows:

- **Chronic Lowering of Groundwater Levels in the Western Half of the Basin:** The minimum thresholds are the same for the land subsidence and chronic lowering of groundwater levels sustainability indicators in the western half of the Basin. The potential effect of the chronic lowering of groundwater levels minimum thresholds is prevention of minimum threshold exceedances for the land subsidence sustainability indicator in the western half of the Basin.
- **Chronic Lowering of Groundwater Levels in the Eastern Half of the Basin:** The chronic lowering of groundwater levels minimum threshold is the historical low groundwater level elevations, which should prevent inelastic subsidence. Thus, the potential effect of the chronic lowering of groundwater levels minimum thresholds is prevention of minimum threshold exceedances for the land subsidence sustainability indicator in the eastern half of the Basin.

- **Reduction of Groundwater Storage:** A lowering of groundwater levels below the historical low levels could cause land subsidence in the Basin, and because extraction rates directly influence groundwater levels within the principal aquifers, the groundwater storage minimum threshold has a direct relationship to land subsidence if groundwater levels fall below the historical low. Maintaining the long-term average groundwater extraction rates below the sustainable yield should prevent minimum threshold exceedances for the land subsidence sustainability indicator.
- **Seawater Intrusion**: Numerical modeling results suggest that seawater intrusion is not anticipated during the SGMA planning and implementation periods. Therefore, the relationship between the land subsidence sustainability and seawater intrusion indicators is not significant. However, it is noted that maintaining groundwater levels above historical low levels for the land subsidence sustainability indicator in the western half of the Basin will help limit inland gradients in the Hueneme Aquifer that could eventually lead to onshore migration of seawater in the future (beyond the 50-year SGMA planning and implementation period).
- **Degraded Water Quality**: The land subsidence sustainability indicator minimum thresholds will limit future groundwater level declines, which will help prevent downward movement of very poor-quality water from the shallow groundwater system into the Mugu Aquifer, which could potentially lead to undesirable results.
- **Depletion of Interconnected Surface Water**: This sustainability indicator is not applicable to the Mound Basin.

4.8.2.3 Minimum Thresholds in Relation to Adjacent Basins [§354.28(b)(3)]

> **§354.28 Minimum Thresholds.**
> ***(b)*** *The description of minimum thresholds shall include the following:*
> ***(3)*** *How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.*

The land subsidence sustainability indicator minimum thresholds will limit future groundwater level declines, thereby minimizing impacts to underflow, which will help prevent undesirable results in the adjacent Oxnard and Santa Paula basins.

4.8.2.4 Impact of Minimum Thresholds on Beneficial Uses and Users [§354.28(b)(4)]

> **§354.28 Minimum Thresholds.**
> ***(b)*** *The description of minimum thresholds shall include the following:*
> ***(4)*** *How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.*

Land subsidence minimum thresholds may have several effects on beneficial users and land uses in the Basin:

Groundwater Beneficial Users (All Types

Beneficial uses and users of groundwater are not anticipated to be affected by the low amounts of land subsidence that could potentially occur in this basin (i.e. potential subsidence does not appear sufficient to damage wells); therefore, the minimum thresholds do not effect groundwater beneficial uses and users. Numerical modeling results suggest that the minimum thresholds will be met without the need for groundwater extraction reductions or any projects or management actions. Therefore, the minimum thresholds are not anticipated to limit the beneficial use of groundwater.

Land Uses and Property Interests (All Types)

The minimum thresholds will protect land uses and property interests against significant and unreasonable inelastic land subsidence.

4.8.2.5 Current Standards Relevant to Sustainability Indicator [§354.28(b)(5)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
  (5) *How state, federal, or local standards relate to the relevant sustainability indicator. If the minimum threshold differs from other regulatory standards, the Agency shall explain the nature of and basis for the difference.*

MBGSA is unaware of any federal, state, or local standards for land subsidence.

4.8.2.6 Measurement of Minimum Thresholds [§354.28(b)(6)]

§354.28 Minimum Thresholds.
(b) *The description of minimum thresholds shall include the following:*
  (6) *How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.*

For the western half of the Basin, groundwater elevations will be directly measured to determine their relation to minimum thresholds. Groundwater level monitoring will be conducted in accordance with the monitoring plan outlined in Section 5. Section 7, Plan Implementation, includes an implementation budget to install additional monitoring sites identified in Section 5.

For the eastern half of the Basin, InSAR data will be used to measure inelastic subsidence in relation to the minimum thresholds. To determine whether InSAR data indicated land surface elevation changes were caused by groundwater conditions, InSAR data will only be considered when groundwater levels are below historical low levels. The InSAR data will be adjusted to account for subsidence related to tectonic activity using continuous GPS data and historical trends to determine if the minimum threshold has been exceeded.

4.8.3 Measurable Objectives and Interim Milestones [§354.30(a),(b),(c),(d),(e),(g)]

§354.30 Measurable Objectives.

(a) *Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.*

(b) *Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.*

(c) *Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.*

(d) *An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.*

(e) *Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.*

(g) *An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.*

4.8.3.1 Description of Measurable Objectives

Western Half of Mound Basin

The measurable objectives for land subsidence in the western half of the Basin were developed by applying the concept of providing a reasonable margin of operational flexibility under adverse conditions (GSP Emergency Regulations §354.30(c)). Adverse conditions for the Mound Basin include long-term drought phases and climatic-driven groundwater level cycles, as described in Section 3.2 (Groundwater Conditions). The reasonable margin of operational flexibility was determined to be groundwater levels following wet phases that are sufficiently high to prevent groundwater levels from dropping below the minimum thresholds during a subsequent drought phase (Figures 3.2-10 through 3.2-13). The measurable objectives were developed for each monitoring site using the following approach:

1. Modeled groundwater level data were plotted for the projected period for each monitoring site.
2. The maximum modeled groundwater level decline during the 50-year GSP planning and implementation horizon was determined and, when necessary, adjusted using professional judgment based on model calibration results (see Appendix I for additional details on the methodology).
3. The maximum projected groundwater level decline was added to the minimum threshold.

The measurable objectives along with minimum thresholds for each monitoring site are listed in Table 4.1-01 (354.30 (b)) and apply following wet phases of the climate cycle. Failure to meet the measurable objectives during other times shall not be considered failure to sustainably manage the Basin. Time-series plots (hydrographs) showing the measured and modeled groundwater elevation data and measurable objectives are included in Appendix I.

Eastern Half of Mound Basin

The measurable objective for land subsidence for the eastern half of the Basin is no measurable inelastic land subsidence due to groundwater level declines. Measurable inelastic land subsidence is the minimum amount of subsidence that can be detected using the InSAR method when water levels are at or below historical lows. The InSAR data provided by DWR are subject to measurement error. DWR has stated that on a statewide level for the total vertical displacement measurements between June 2015 and June 2018, the errors are as follows (Paso Robles GSA, 2020):

1. The error between InSAR data and continuous GPS data is 16 mm (0.052 ft) with a 95% confidence level, and
2. The measurement accuracy when converting from the raw InSAR data to the maps provided by DWR is 0.048 ft with 95% confidence level.

The total estimated error, therefore, is 0.1 ft. A land surface change of less than 0.1 ft, therefore, is within the noise of the data collection and processing and is considered equivalent to no measurable subsidence in this GSP. The measurable objective is, therefore, equal to the minimum threshold for the eastern half of the Basin. To determine whether InSAR-indicated land surface elevation changes are caused by groundwater conditions, InSAR data will only be considered when groundwater levels are below historical low levels. The InSAR data will be adjusted to account for subsidence related to tectonic activity using continuous GPS data and historical trends to determine if the minimum threshold has been exceeded.

4.8.3.2 Interim Milestones [§354.30(e)]

§354.30 Measurable Objective.
(e) *Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin with 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.*

Western Half of Mound Basin

Interim milestones were developed to illustrate a reasonable path to achieve the sustainability goal for the Basin within 20 years of Plan implementation for the western half of the Basin. Development of interim milestones is significantly complicated by the fact that there is significant uncertainty in predicting hydrologic conditions for the next 20 years. Currently, groundwater levels in the Basin are below the measurable objectives for approximately ⅓ of the wells because the Basin has experienced overall dry conditions for the better part of the last decade. It is anticipated that groundwater levels will rise during the next wet period and as a result of Oxnard Basin GSP implementation. It is anticipated that the measurable objectives will be met at some point during the 20-year GSP implementation period and then may fluctuate above or below the measurable objective thereafter. Because of the uncertainty concerning when the measurable objectives will be met, the interim milestones are shown as a linear path toward the measurable objective over the 20-year sustainability timeframe. This interim milestone path should not be taken literally because it is climate dependent. The interim milestones and path to sustainability will be reviewed during each required 5-year GSP assessment (GSP Emergency Regulations §354.38(a)). The interim milestones are listed in Table 4.1-01 and are plotted on the time-series plots (hydrographs) included in Appendix I.

Once the measurable objectives are met, numerical modeling results suggest that sustainability will be maintained during the remainder of the 50-year GSP planning and implementation horizon (Appendix I). The causes of groundwater conditions that could lead to undesirable results described in Section 4.8.1 will be carefully reviewed during each required 5-year GSP assessment. The GSP will be updated to include any projects or management actions deemed necessary to maintain sustainable conditions in the Basin.

Eastern Half of Mound Basin

The InSAR data available for GSP development indicate that the measurable objective for the eastern half of the Basin is already met. Therefore, the land subsidence interim milestones for the eastern half of the Basin are equal to the measurable objective.

4.9 Depletions of Interconnected Surface Water [§354.26(d)]

> **§354.26 Measurable Objectives.**
> ***(d)*** *An Agency that is able to demonstrate that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators.*

Depletions of interconnected surface water is not an applicable indicator of groundwater sustainability in the Mound Basin and, therefore, no SMC are set. Section 3.2.6, Interconnected Surface Water Systems, and Appendix G provides the evidence for the inapplicability of this sustainability indicator.

4.10 Measurable Objectives and Interim Milestones for Additional Plan Elements [§354.30(f)]

> **§354.30 Measurable Objectives.**
> ***(f)*** *Each Plan may include measurable objectives and interim milestones for additional Plan elements described in Water Code Section 10727.4 where the Agency determines such measures are appropriate for sustainable groundwater management in the basin.*

No measurable objectives were developed for the additional plan elements included in the GSP.

5.0 Monitoring Networks [Article 5, SubArticle 4]

5.1 Introduction to Monitoring Networks [§354.32]

§354.32 Introduction to Monitoring Networks. *This Subarticle describes the monitoring network that shall be developed for each basin, including monitoring objectives, monitoring protocols, and data reporting requirements. The monitoring network 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 that occur through implementation of the Plan.*

Section 5 describes existing monitoring networks and improvements to those monitoring networks that will be developed as part of GSP implementation. Section 5 is prepared in accordance with the GSP Emergency Regulations §354.32 - §354.40 and includes monitoring objectives, monitoring protocols, data reporting requirements, assessment of the monitoring network, and DMS.

Consistent with GSP Emergency Regulations §354.34(e), the monitoring networks presented in this chapter are based primarily on existing monitoring sites. The existing monitoring networks in the Basin have been used for several decades to collect information to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface water conditions. The monitoring networks include features for the collection of data to monitor the groundwater sustainability indicators applicable to the Basin. Additional monitoring sites will be added to enhance the existing monitoring network based on the assessment herein, pursuant to GSP Emergency Regulations §354.38. The additional monitoring sites are necessary to fully demonstrate sustainability and will also help refine the HCM and improve the numerical model.

Monitoring networks are described for each applicable sustainability indicator, and data gaps are identified for each, as appropriate in the following sections. As discussed in Sections 3.2.6 and 4.9, depletion of interconnected surface water is not an applicable sustainability indicator in the Basin and therefore monitoring of surface water flow is not included in the monitoring network. Section 3.3 and Table 3.3-01 do, however, include the sources of publicly available surface water monitoring data.

5.2 Monitoring Network Objectives and Design Criteria [§354.34(a),(b)(1),(b)(2),(b)(3),(b)(4),(d),(f)(1),(f)(2),(f)(3), and (f)(4)]

§354.34 Monitoring Network.

(a) *Each Agency shall develop a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation.*

(b) *Each Plan shall include a description of the monitoring network objectives for the basin, including an explanation of how the network will be developed and implemented to monitor groundwater and related surface conditions, and the interconnection of surface water and groundwater, with sufficient temporal frequency and spatial density to evaluate the affects and effectiveness of Plan implementation. The monitoring network objectives shall be implemented to accomplish the following:*

- ***(1)*** *Demonstrate progress toward achieving measurable objectives described in the Plan.*
- ***(2)*** *Monitor impacts to the beneficial uses or users of groundwater.*
- ***(3)*** *Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.*
- ***(4)*** *Quantify annual changes in water budget components.*

(d) *The monitoring network shall be designed to ensure adequate coverage of sustainability indicators. If management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the basin setting and sustainable management criteria specific to that area**.***

(f) *The Agency shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors:*

- ***(1)*** *Amount of current and projected groundwater use.*
- ***(2)*** *Aquifer characteristics, including confined or unconfined aquifer conditions, or other physical characteristics that affect groundwater flow.*
- ***(3)*** *Impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal.*
- ***(4)*** *Whether the Agency has adequate long-term existing monitoring results or other technical information to demonstrate an understanding of aquifer response**.***

5.2.1 Monitoring Network Objectives

The GSP Emergency Regulations require monitoring networks be developed to collect data of sufficient quality, frequency, and spatial distribution to characterize groundwater and related surface water conditions (if applicable) in the Basin, and to evaluate changing conditions that occur during implementation of the GSP. Monitoring networks should accomplish the following (§354.34(b)):

- Demonstrate progress toward achieving measurable objectives described in the GSP.
- Monitor impacts to the beneficial uses and users of groundwater.
- Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.
- Quantify annual changes in water budget components.

Each of these objectives is described further below with specific discussion relevant to the planned Mound Basin GSP monitoring network:

1. **Demonstrate progress toward achieving measurable objectives described in Section 4 of this GSP:** As described in Section 4.9 of this GSP, the depletion of interconnected surface water indicator is not applicable to this basin. The remaining five sustainability indicators are applicable but have already met the corresponding measurable objectives historically and are expected to meet them going forward. Therefore, the focus of this objective for the Mound Basin is to demonstrate continued compliance with the measurable objectives as opposed to progress toward meeting the measurable objectives.

2. **Monitor impacts to the beneficial uses or users of groundwater:** The beneficial uses of groundwater in the primary aquifers (i.e., Mugu and Hueneme aquifers) of Mound Basin include municipal, industrial, and agricultural water supply. The beneficial users include the City of Ventura, owners of wells that are pumped for industrial water supply (two as of 2021), and owners of 22 wells used for agricultural water supply. These uses and users could be impacted by degradation of water quality, seawater intrusion, and declining groundwater levels and storage (which are an important causative factor in land subsidence). Key design criteria considered in developing a network to monitor these potential impacts on uses and users of groundwater include the following:

    - <u>Monitoring Parameters</u>: Monitoring groundwater levels, extraction rates, and groundwater quality can indicate trends that could precede land subsidence or seawater intrusion, as well as trends that could affect operation and associated costs of production wells (e.g., declining groundwater elevations may require setting a pump deeper in a well, combined with greater energy requirements to pump each AF of water). Monitoring common dissolved constituents in groundwater at or near active water supply wells can detect changes in groundwater quality that might affect groundwater users. Groundwater levels can be directly measured at monitoring wells using a manual sounder (where monthly, quarterly, or semiannual measurement is appropriate) or an installed pressure transducer with datalogger (where high-frequency measurement is needed). Groundwater extraction rates and amounts are reported to United by the well owners pursuant to Water Code §75611. Monitoring for seawater intrusion is commonly performed by analyzing groundwater samples for chloride, although analysis for other dissolved ions can be helpful for distinguishing chloride resulting from seawater intrusion versus other potential sources. In addition, rates of inland movement of fresh groundwater from offshore portions of the aquifer can be provided by monitoring groundwater elevations inland from the coast.

    - <u>Monitoring Locations</u>: As noted in DWR's best management practices for monitoring networks (DWR, 2016c), "Areas that are subject to greater groundwater pumping, greater fluctuations in conditions, significant recharge areas, or specific projects may require more monitoring (temporal and/or spatial) than areas that experience less activity or are more static." Under this guidance, appropriate monitoring sites in Mound Basin are in the southern portion of Mound Basin where all the Basin's active water supply wells are located (Figure 3.1-26) and groundwater levels are known to fluctuate. Monitoring in the northern portion of the Basin is low priority due to the lack of beneficial uses. In the event that seawater is detected in shoreline monitoring wells, additional monitoring wells may be warranted to ensure protection of beneficial users of groundwater in the western portion of the Basin. DWR's BMPs for monitoring networks also notes that "[u]nderstanding conditions at or across basin boundaries is important." Variable groundwater underflow occurs along the southern boundary of Mound Basin adjacent to Oxnard Basin; therefore, coverage of this area by the Mound Basin monitoring network can help confirm underflow estimated in the water budget. Finally, monitoring groundwater quality and elevations along the coastline and just inland from the coast can provide early warning of any unexpected seawater intrusion during the SGMA implementation period, as well as rates of movement of fresh groundwater to or from offshore portions of the aquifer.

- Screened Intervals (depths) of Monitoring Wells: In basins with multiple aquifers, such as Mound Basin, the depth of monitoring is an important consideration. For Mound Basin, this means ensuring monitoring takes place in both principal aquifers in the Basin (i.e., the Mugu and Hueneme aquifers). However, the emphasis should be on monitoring the Hueneme Aquifer because most of the groundwater extracted from the Basin is from wells screened in this aquifer.
- Monitoring Frequency: In Mound Basin, where groundwater elevations are subject to both seasonal fluctuations (due to changes in groundwater extraction and recharge rates) and longer-term cyclical fluctuations (due to climatic variability), the frequency of groundwater level measurements, extraction rate reporting, and groundwater quality sampling is an important design consideration. Therefore, this objective for Mound Basin includes a frequency of groundwater level measurements and extraction rates sufficient to capture the range (seasonal highs and lows) of groundwater elevations occurring within the Basin over the course of each year. For monitoring seawater intrusion, the frequency of sampling should be sufficient to detect unexpected inland advancement of seawater in time to institute mitigation measures that can prevent undesirable results (e.g., before chloride concentrations at agricultural water supply wells increase to the point that they become harmful to crops). Due to the relatively slow rate of groundwater movement, annual monitoring for seawater intrusion should suffice with the caveat that the sampling frequency should be increased if indications of seawater are detected. The frequency of groundwater level measurement and groundwater quality sampling at or near active water supply wells should be sufficient to detect any long-term trends in water quality that could result from vertical migration of poor-quality water into the principal aquifers. Due to the relatively slow rate of potential vertical migration, annual water quality monitoring should suffice.

3. **Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds:** Similar to #1 above, the focus of this objective for the Mound Basin is to demonstrate continued compliance with the measurable objectives. As discussed in Section 4.4.2.1.2, groundwater levels are used as a proxy for the land subsidence minimum threshold in the western half of the Basin. The reduction of groundwater storage sustainability indicator is monitored by reported extraction rates. Thus, monitoring of changes in groundwater conditions relative to minimum thresholds and measurable objectives will be accomplished using groundwater level, extraction rate, and groundwater quality monitoring. Monitoring in the Mound Basin should focus on whether the trend of these parameters is deviating from a pattern that is consistent with continued maintenance of groundwater conditions relative to the measurable objectives. If a significant change from historical extraction rate patterns or groundwater quality were to occur in the future (e.g., groundwater extraction from an aquifer

that was largely unused historically, or new reports of discharge of contaminants to groundwater in an area of the Basin with few monitoring wells), then modifications to the monitoring network could be required.

4. **Quantify annual changes in water budget components:** As described in Section 3.3 of this GSP, United's (2021a) groundwater flow model is the best tool currently available for estimating the quantities of most of the water budget components involving groundwater flow in the Mound Basin. Exceptions include:
    - Groundwater extractions, which are measured by well owners and reported to the MBGSA and United semiannually.
    - Groundwater imports from adjacent basins, which are recorded by the City of Ventura, FICO, and Alta MWC. Quantities of imported water are available to the MBGSA upon request. Imports from the California SWP, when Ventura's SWP Interconnection Project is completed, will also be recorded by the City of Ventura and made available to the MBGSA upon request.
    - Areal recharge, which can be quantified based on rainfall data and land use information. Rainfall data are collected by the VCWPD, and land use data are updated annually to biennially by several county and state agencies and can be downloaded from their websites.

The above data will be input to United's flow model for calculating future annual changes in subsurface water budget components and change in storage. Surface flows in the Santa Clara River are measured daily by the VCWPD at flow-gaging station "723 - Santa Clara River at Victoria Ave" located outside of the Basin. Data from this station are available online and can be downloaded annually to update this surface water component of the Mound Basin water budget (VCWPD, 2021). MBGSA intends to continue using data from these existing sources as input to United's model, which will in turn be used periodically to quantify changes in water budget components. At present, this GSP does not contemplate development of a new monitoring network or modification of existing monitoring networks to obtain data regarding groundwater extraction, imported water, or recharge quantities because it is MBGSA's opinion that these water budget components are currently adequate for sustainable management of the Basin.

5.2.2 Monitoring Network Design Criteria

Design criteria are discussed for each sustainability indicator regarding GSP Emergency Regulations §354.34(c)(1) through (6) and are addressed in the subsections that discuss the monitoring networks specific to each sustainability indicator.

GSP Emergency Regulations §354.34(d) adds the overarching design criteria, which echo the third monitoring network objective described in GSP Emergency Regulations §354.34(b)(3) (see #3 in Section 5.2.1 above), to "[e]nsure adequate coverage of sustainability indicators." No management areas have been established for the Basin, so the sufficient quantity and density of monitoring sites is addressed for each sustainability indicator for the entire Basin.

GSP Emergency Regulations §354.34(f) provide additional design considerations for the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors:

- Amount of current and projected groundwater use.
- Aquifer characteristics, including confined or unconfined aquifer conditions, or other physical characteristics that affect groundwater flow.
- Impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal.
- Whether the Agency has adequate long-term existing monitoring results or other technical information to demonstrate an understanding of aquifer response.

Other criteria from DWR BMP 2, Monitoring Networks and Identification of Data Gaps (DWR, 2016c), were also considered in developing the monitoring network. These include:

- **Access issues**: Most of the land within Mound Basin has been developed for urban/suburban uses or consists of privately owned farmland. The majority of open land occurs on the steep hillsides in the northern portion of the Basin, where access by drilling rigs would be difficult. Due to the large depth to the principal aquifers in most parts of the Basin, drilling and construction of new groundwater monitoring wells will likely require a large construction "footprint." Therefore, construction of new monitoring wells will be difficult in much of the Basin and may not be feasible in some areas. Although some new monitoring wells are proposed in this GSP (in Sections 5.3 and 5.5), existing wells should be used for monitoring to the extent practicable.
- **Consider all sustainability indicators**: DWR (2016c) recognizes that "GSAs should look for ways to efficiently use monitoring sites to collect data for more than one or all of the sustainability indicators," including those indicators that are not currently known to affect (or be affected by) uses and users of groundwater from the principal aquifers. In keeping with DWR (2016c) guidance, to the extent practicable, the proposed Mound Basin GSP monitoring network is designed to collect the most data possible with a minimum of monitoring points/resources. Potential opportunities for modifying the existing monitoring network to provide additional data regarding groundwater quality, land subsidence, and interconnected surface water in Mound Basin are provided in the following subsections of this GSP.
- **Cost**: Cost is a critical factor for MBGSA because of the small amount of groundwater extraction in this basin, compared to most medium- and high-priority basins. This means there is a significantly greater cost burden on each groundwater user to fund additional monitoring sites as compared to groundwater users in most other basins.

5.2.3 Monitoring Network Design Analysis

The objectives and design criteria set forth in the GSP Emergency Regulations were analyzed in a Basin-specific context. The analysis resulted in the following key monitoring network design factors:

1. The applicable sustainability indicator measurable objectives have been met historically and are expected to be met going forward. Therefore, the focus of this objective for the Mound Basin is to demonstrate continued compliance with the measurable objectives as opposed to progress toward meeting the measurable objectives.
2. The depletion of interconnected surface water indicator is not applicable to this basin and percolation of surface water is not a significant water budget element. Therefore, surface water monitoring is not a priority for the Mound Basin.
3. Because groundwater levels are used as a proxy for the land subsidence in the western half of the Basin (see Figure 4.1-01), the reduction of groundwater storage is monitored using extraction rates, and surface water is not an important factor in the Mound Basin, monitoring should focus on groundwater levels, extraction rates, and groundwater quality monitoring.
4. No management areas have been established in the Mound Basin under this GSP. Therefore, adequate coverage of the sustainability indicators applies at the basin level.
5. The area of greatest risk for undesirable results is in the western half of the Basin due to the sensitivity of land uses and critical infrastructure to land subsidence in the Coastal Area, and proximity of agricultural beneficial users to the shoreline for any unexpected seawater intrusion. Thus, MBGSA’s highest priority for its limited fiscal resources is to ensure adequate monitoring near the coast to protect land uses and beneficial uses relative to the land subsidence and seawater intrusion sustainability indicators.
6. Current and projected groundwater beneficial uses and users are limited to the southern portion of the Basin. Monitoring sites should be prioritized in the southern portion of the Basin, and MBGSA’s limited fiscal resources should be prioritized to address monitoring needs in this area, as opposed to the northern portion of the Basin which has no groundwater extraction.
7. Data limitations in the northern portion of the Basin are not believed to limit MBGSA’s ability to sustainably manage the Basin as there are no beneficial uses in that area and because the numerical model can be used to estimate the potentiometric surface and storage change in that area.
8. Current and projected groundwater extractions for beneficial uses are heavily skewed toward the Hueneme Aquifer. Therefore, the monitoring sites should be prioritized in the Hueneme Aquifer. All other factors being equal, MBGSA’s limited fiscal resources should be prioritized to address monitoring needs in Hueneme Aquifer, as opposed to the Mugu and non-principal aquifers in the Basin.
9. Groundwater underflow from Oxnard Basin is more variable than underflow from the Santa Paula Basin, as described in Section 3.3 of this GSP. Additionally, sustainable groundwater management of the Mound Basin will be affected by the implementation of the Oxnard Basin GSP by the FCGMA, whereas Santa Paula Basin is adjudicated. Therefore, monitoring that supports the assessment of underflow should be prioritized along the Oxnard Basin boundary as compared to the Santa Paula Basin boundary.
10. Monitoring Frequencies: The following circumstances were considered when evaluating monitoring frequencies:

a. Measurable objectives have consistently been met historically;
b. MBGSA has long-term existing monitoring results;
c. The Basin has a relatively small amount of groundwater extraction; and
d. The aquifers are deep and confined and, therefore, do not exhibit large seasonal changes (in response to climate variations) in groundwater levels and storage and are not susceptible to rapid changes in groundwater quality from surface activities.

Based on the foregoing, high-frequency monitoring is not necessary to characterize short-term, seasonal, and long-term trends in groundwater levels, quality, and water budget components. Quarterly groundwater level monitoring, semiannual extraction rate reporting, and annual groundwater quality sampling frequencies are considered adequate. More frequent monitoring may be desirable, but not considered necessary for sustainable management of the Basin, unless conditions change. The monitoring frequencies, among other aspects, should be evaluated during the periodic Plan assessments.

How the monitoring objectives and design criteria were specifically applied to each SMC to develop the GSP monitoring network is described in the following subsections.

5.3 Groundwater Levels Monitoring Network [§354.34(e),(g)(3),(h), and (j)]

§354.34 Monitoring Network.
(e) *A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network.*
(g) *Each Plan shall describe the following information about the monitoring network:*
  (3) *For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.*
(h) *The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.*
(j) *An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.*

Table 5.3-01 summarizes construction and other information for the 23 existing wells in Mound Basin that have regularly been used for groundwater level monitoring historically. These wells are referred to as the "existing groundwater level monitoring network." Locations of groundwater level monitoring wells screened in the Mugu and Hueneme aquifers are shown on Figures 5.3-01 and 5.3-02, respectively. Inspection of Table 5.3-01 indicates that most (15) existing groundwater level monitoring wells are screened exclusively or almost exclusively in the Hueneme Aquifer, which is one of the two principal aquifers in the Basin and supplies most of the groundwater extracted from Mound Basin (Table 3.1-02). Five wells are screened solely in the Mugu Aquifer, which is the other principal aquifer. One well is screened in portions of both the Hueneme and Fox Canyon aquifers, and one well is screened across significant intervals of both the Mugu and Hueneme aquifers. Two wells in the existing monitoring well network are screened in the fine-grained Pleistocene Deposits overlying the Mugu Aquifer. Wells screened in the fine-grained Pleistocene Deposits, the Fox Canyon Aquifer, or across multiple aquifers are shown on Figure 5.3-03.

Wells 02N22W07M01S/02S/03S and 02N23W07J01S/02S/03S are clustered wells that were jointly installed by United and the City of Ventura in the 1990s and provide data concerning vertical hydraulic gradients between the principal aquifers and the fine-grained Pleistocene deposits.

Two additional monitoring well clusters are planned in the Coastal Area to provide monitoring sites for implementation of the seawater intrusion sustainability indicator (Sites A and B on Table 5.3-02 and Figures 5.3-01 and 5.3-02). These monitoring well clusters will include discrete screen intervals in each principal aquifer, which will provide additional definition of the potentiometric surface in both principal aquifers and additional vertical gradient data. Site C is a potential “early warning” well and the plans to install this well will be evaluated following the 5-year review.

Ventura Water monitors several shallow wells located along the Santa Clara River, which are not part of the Mound Basin GSP monitoring network. Shallow groundwater levels from these wells will be collected and analyzed as part of the interim shallow groundwater data collection and analysis described in Section 6.6.

5.3.1 Attainment of Monitoring Objectives and Other Requirements [§354.34(c)(1)(A),(c)(1)(B), and (g)(1)]

§354.34 Monitoring Network.
(c) *Each monitoring network shall be designed to accomplish the following for each sustainability indicator:*
  (1) *Chronic Lowering of Groundwater Levels. Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features by the following methods:*
    (A) *A sufficient density of monitoring wells to collect representative measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer.*
    (B) *Static groundwater elevation measurements shall be collected at least two times per year, to represent seasonal low and seasonal high groundwater conditions.*
(g) *Each Plan shall describe the following information about the monitoring network:*
  (1) *Scientific rationale for the monitoring site selection process.*

In accordance with GSP Emergency Regulations §354.34(b) and (d), the groundwater level monitoring network sites have been selected using MBGSA’s scientific judgment to (1) demonstrate progress toward achieving measurable objectives described in the GSP, (2) monitor impacts to the beneficial uses and users of groundwater, (3) monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds, (4) quantify annual changes in water budget components, and (5) to provide adequate coverage of sustainability indicators. Importantly, there is no groundwater extraction in the northern portion of the Basin; thus, the sustainability indicators that rely on groundwater levels directly (or as a proxy) and the groundwater monitoring network are necessarily focused on the southern portion of the Basin. The monitoring network has a special focus in areas of greatest risk for undesirable results: the western half of the Basin where land uses and critical infrastructure are sensitive to land subsidence effects, and agricultural beneficial users proximal to the coastline would be at risk if unexpected seawater intrusion occurs. Additional monitoring well clusters are proposed in the western half of the Basin to address these concerns.

Pursuant to GSP Emergency Regulations §354.34(c)(1)(A), the groundwater level monitoring network sites have been selected to provide a sufficient density of monitoring wells to collect representative measurements through depth-discrete intervals to characterize the potentiometric surface for each principal aquifer. The existing and planned groundwater level monitoring wells screened in the Hueneme Aquifer and the Mugu Aquifer provide sufficient density for the following scientific and practical reasons consistent with the key Basin-specific monitoring network design factors discussed in Section 5.2:

- The groundwater level monitoring sites (existing and proposed) were selected to provide focused monitoring of groundwater gradients and flow directions over time in the western half of the Basin where the greatest risk for undesirable results exists.
- The groundwater level monitoring sites (existing and proposed) were selected to provide coverage across the southern portion of the Basin to monitor the regional groundwater gradient and flow direction over time in the area where current and projected groundwater beneficial uses exist.
- Groundwater level monitoring sites are located along the southern Basin boundary to monitor gradients and flow to/from the Oxnard Basin.
- The lack of monitoring sites in the northern portion of the Basin is not believed to limit MBGSA’s ability to sustainably manage the Basin because there are no beneficial uses in that area and the numerical model can be used as needed to estimate the potentiometric surface and storage changes in this area.
- A higher density of groundwater level monitoring sites has been selected in the Hueneme Aquifer commensurate with the fact that this aquifer supplies most of the water extracted from the Basin.
- The relatively limited number of groundwater level monitoring sites in the Mugu Aquifer is not believed to limit MBGSA’s ability to sustainably manage the Basin because there is limited groundwater extraction from this aquifer and the existing and proposed monitoring sites provide sufficient coverage to map the regional potentiometric surface in the Mugu Aquifer.

Consistent with to GSP Emergency Regulations §354.34(c)(1)(B), static groundwater levels will be measured quarterly (or more frequently, as feasible) at wells in the groundwater level monitoring network to represent seasonal-low and seasonal-high groundwater conditions. Groundwater elevations have been measured manually on a monthly, bi-monthly, or quarterly basis at wells in the groundwater level monitoring network, exceeding the SGMA requirement for semiannual (fall and spring) measurements. In addition, United collects automated groundwater elevation measurements at 4-hour intervals in four Mound Basin monitoring wells screened in principal aquifers (Figures 5.3-01 and 5.3-02) to provide high-frequency data useful for understanding daily to seasonal variability in groundwater elevations. This is helpful for more accurately determining the precise timing of spring-high and fall-low groundwater elevations each year and for evaluating the interference effects of nearby groundwater extraction on static groundwater levels.

Additional factors considered during selection of the groundwater level monitoring sites include:

1. From a scientific perspective, monitoring sites were selected to provide data in areas where groundwater elevations and hydraulic gradients are known to fluctuate over time. In Mound Basin, such fluctuations occur chiefly in the vicinity of water supply wells, which are limited

to the southern portion of the Basin, and along the boundary with the Oxnard Basin to evaluate interbasin underflow.

2. To the extent practicable, existing wells have been used as monitoring sites to avoid the cost and public nuisance associated with drilling new wells in a largely urban setting. However, in areas where groundwater level monitoring would provide crucial information, but no existing wells are present (or are unsuitable for some reason, such as being screened at a depth that would not provide useful data), new wells have been installed in parks and other public spaces in Mound Basin in the past.
3. DWR's BMP for developing monitoring networks (2016c) cites guidance stating that the density of monitoring wells should be 6.3 wells per 100 square miles (mi^2) to 4.0 wells per 100 mi^2 (Hopkins, 2016; applies to basins with groundwater extractions of more than 10,000 AF per 100 mi^2). In the principal aquifers of the Mound Basin (which has an area of approximately 23 mi^2), there are five existing groundwater level monitoring wells (density of 22 wells per 100 mi^2) screened solely in the Mugu Aquifer and 13 existing groundwater level monitoring wells (density of 57 wells per 100 mi^2) screened solely in the Hueneme Aquifer. Therefore, the density of monitoring sites in the existing groundwater level monitoring network exceeds the metrics recommended by DWR.

5.3.2 Data and Reporting Standards [§354.34(g)(2)]

§354.34 Monitoring Network.
(g) *Each Plan shall describe the following information about the monitoring network:*
  (2) *Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained.*

The groundwater level monitoring sites are generally consistent with applicable data and reporting standards set forth in GSP Emergency Regulations §352.4. Exceptions to the standards are described below:

- Two existing monitoring sites—wells 02N22W09K05S and 02N22W08G01S—are screened across two aquifers, as shown on Table 5.3-01. DWR (2016b) notes that groundwater levels measured at wells screened across multiple aquifers should be considered composite groundwater levels rather than being representative of specific aquifers, and that these data must be used with caution. Fortunately, wells 02N22W09K05S and 02N22W08G01S are located near other wells that are screened in individual aquifers and are monitored by United (Figures 5.3-01 and 5.3-02). Therefore, the composite groundwater levels measured at wells 02N22W09K05S and 02N22W08G01S are not necessary for evaluating groundwater elevations in the principal aquifers or for preparing groundwater elevation contour maps, but are included in the GSP groundwater level monitoring network for completeness because they are part of the existing monitoring program in the Basin.
- The depth of the screened interval for well 02N22W16H01S is not reported (Table 5.3-01); therefore, the aquifer that this well is screened in is unknown. The well is part of the existing groundwater level monitoring network and is included as such but is not relied upon for meeting SGMA and GSP regulatory requirements.

5.3.3 Monitoring Protocols [§354.34(i)]

§354.34 Monitoring Network.
(i) *The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2(f) for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies.*

United, VCWPD, and the City of Ventura collect and report groundwater elevation data from the groundwater level monitoring network in general conformance with the CASGEM program's "Procedures for Monitoring Entity Reporting" (DWR, 2010) and DWR BMP 1 for monitoring protocols, standards, and sites (DWR, 2016b). Some key elements of DWR guidance include (but are not limited to) the following:

- Depth to groundwater must be measured relative to an established reference point on the well casing;
- Depth to groundwater must be measured to an accuracy of 0.1 ft below the reference point (it is preferable to measure depth to groundwater to an accuracy of 0.01 ft);
- Transducers must be able to record groundwater levels with an accuracy of 0.1 ft;
- Transducer data should periodically be checked against hand-measured groundwater levels to monitor electronic drift or cable movement.

More details are provided in the referenced guidance documents (DWR, 2010, 2016b), and are not repeated in this GSP. It is presently anticipated that United, VCWPD, and the City of Ventura will continue collecting groundwater level data from the existing monitoring network, including any improvements or modifications made in the future, and report those data to CASGEM and the MBGSA.

5.3.4 Assessment and Improvement of Monitoring Network [§354.38(a),(b),(c)(1),(c)(2),(d),(e)(1),(e)(2),(e)(3), and (e)(4)]

> **§354.38 Assessment and Improvement of Monitoring Network**.
> ***(a)*** *Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.*
> ***(b)*** *Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.*
> ***(c)*** *If the monitoring network contains data gaps, the Plan shall include a description of the following:*
> ***(1)*** *The location and reason for data gaps in the monitoring network.*
> ***(2)*** *Local issues and circumstances that limit or prevent monitoring.*
> ***(d)*** *Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.*
> ***(e)*** *Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:*
> ***(1)*** *Minimum threshold exceedances.*
> ***(2)*** *Highly variable spatial or temporal conditions.*
> ***(3)*** *Adverse impacts to beneficial uses and users of groundwater.*
> ***(4)*** *The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.*

The existing groundwater level monitoring network is considered generally suitable for groundwater sustainability planning relative to the criteria provided in DWR's GSP and CASGEM guidance (DWR, 2016c, 2010), and has met the needs of United, the City of Ventura, and VCWPD for the past three decades relative to their objectives for monitoring groundwater conditions.

Pursuant to GSP Emergency Regulations §354.38, MBGSA has assessed the existing groundwater level monitoring network and determined that certain data gaps exist. These data gaps and, where applicable, planned actions to address the data gaps before the next 5-year assessment are discussed below.

Western Half of Mound Basin

The western half of the Basin has the greatest risk for undesirable results due to the vulnerability of land uses and critical infrastructure to land subsidence in the Coastal Area and the proximity of agricultural beneficial users to the shoreline for any unexpected seawater intrusion. This area is MBGSA's highest priority for expending its limited fiscal resources, to ensure adequate monitoring near the coast to protect land uses and beneficial uses relative to the land subsidence and seawater intrusion sustainability indicators. Two additional monitoring well clusters are planned in the Coastal Area to provide additional monitoring sites for implementation of the seawater intrusion sustainability indicator (Sites A and B on Figures 5.3-01, 5.3-02, 5.3-04, and 5.3-05). These monitoring well clusters will include discrete intervals in each principal aquifer, which will provide additional definition of the potentiometric surface in both principal aquifers and additional vertical gradient data. Site C is an additional potential "early warning" shoreline well and the plans to install the well will be evaluated following the 5-year review.

- Site A is planned for construction in 2021 (supported by a SGMA Technical Support Services [TSS] grant from DWR). The wells in this cluster will be screened in the Mugu and Hueneme aquifers. The primary purpose of this monitoring site is to provide a location for application of minimum thresholds and measurable objectives for the seawater intrusion sustainability indicator. This monitoring site will also be used for the land subsidence sustainability indicator and, more generally, to better define the potentiometric surface near the coast and provide additional vertical gradient data.

- Site B is planned for construction prior to the first 5-year GSP assessment. Site B is located along Harbor Boulevard and its primary purpose is to monitor groundwater in relation to the minimum thresholds and measurable objectives for the seawater intrusion sustainability indicator. This site will also be used for the land subsidence sustainability indicator and, more generally, to better define the potentiometric surface near the coast and provide additional vertical gradient data.
- Site C is a potential "early warning" monitoring well cluster planned for construction following review of the first 5-year GSP assessment. Site C is located near the coastline and its primary purpose would be to provide early warning for unexpected seawater intrusion. This site would also be used to better define the potentiometric surface near the coast and provide additional vertical gradient data.

Northern Portion of Mound Basin

The northern portion of the Basin lacks groundwater level monitoring sites screened in the principal aquifers. The lack of groundwater level monitoring sites is due to the lack of water supply wells. Future groundwater beneficial uses are not anticipated in the northern portion of the Basin due to the dominance of residential tract housing, which is supplied with potable water from the City of Ventura. Because there are no current or anticipated future beneficial uses and because the calibrated numerical model can be used to estimate the potentiometric surface in areas without data (the model can integrate existing monitoring data with modeled results to provide estimates to the northern area), this data gap is not considered a limiting factor for sustainable management of the Basin and will not be addressed unless changing conditions in the Basin warrant monitoring sites.

In addition to the efforts to address the above-described data gaps, MBGSA will consider expanding the monitoring network as opportunities arise. For example, when new or replacement wells are drilled, MBGSA will consider working with the owner to obtain access for monitoring.

5.4 Groundwater Storage Monitoring Network [§354.34(e),(g)(3),(h), and (j)]

23 Cal. Code Regs. §354.34 Monitoring Network.
(e) *A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network.*
(g) *Each Plan shall describe the following information about the monitoring network:*
  (3) *For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.*
(h) *The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.*
(j) *An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.*

As noted in DWR's (2016c) BMP for monitoring networks, changes in groundwater storage are not a directly measurable condition. Rather, estimation of changes in groundwater storage relies on collection of accurate groundwater levels. Measured groundwater level changes can then be used to calculate changes in storage based on understanding of aquifer thickness, porosity, and connectivity (DWR, 2016c), or can be calculated using a groundwater model. Therefore, the "groundwater storage monitoring network" consists of the groundwater level monitoring network, which is described above in Section 5.3.

An additional component of monitoring for the reduction of groundwater storage sustainability indicator involves tracking the groundwater extraction rates against the measurable objectives and minimum thresholds. The network consists of the pumping well owners and the extraction rates are reported semiannually to United by the well owners pursuant to Water Code §75611.

5.4.1 Attainment of Monitoring Objectives and Other Requirements [§354.34(c)(2) and (g)(1)]

§354.34 Monitoring Network.
(c) *Each monitoring network shall be designed to accomplish the following for each sustainability indicator:*
  (2) *Reduction of Groundwater Storage. Provide an estimate of the change in annual groundwater in storage.*
(g) *Each Plan shall describe the following information about the monitoring network:*
  (1) *Scientific rationale for the monitoring site selection process.*

The reduction of groundwater storage monitoring network design criterion provided in GSP Emergency Regulations §354.34(c)(2) is to provide an estimate of the change in annual storage.

As noted in Section 5.3, static groundwater levels and groundwater extraction rates will be measured and reported twice (or more) per year at wells in the groundwater level monitoring network and active extraction wells, respectively to achieve the overall monitoring objectives described in Section 5.2, and additionally to estimate annual change in groundwater in storage in the two principal aquifers used for water supply in Mound Basin—the Mugu and Hueneme aquifers. Spring is the time of year when aquifers in the region typically are in a positive water-balance condition (inflows exceed outflows) and potentiometric surfaces are at their highest; therefore, the spring-high groundwater levels will be used for annual estimates of changes in storage. Fall-low groundwater levels in Mound and adjacent basins can be strongly influenced by short-term, local factors such as timing of the first winter rainfall event and the presence or absence of Santa Ana winds in fall (which can result in a significant increase in demand for irrigation). Therefore, fall groundwater elevations provide a less reliable indicator of annual changes in groundwater in storage compared to spring groundwater elevations.

The data limitation in the northern portion of the Basin is acknowledged but is not believed to limit MBGSA's ability to attain the monitoring objective because the numerical model can be used to estimate the potentiometric surface and storage change in areas without measured groundwater levels (Appendix I).

5.4.2 Data and Reporting Standards [§354.34(g)(2)]

§354.34 Monitoring Network.
(g) *Each Plan shall describe the following information about the monitoring network:*
  (2) *Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained.*

The data and reporting standards for groundwater storage monitoring are identical to those for groundwater level monitoring because groundwater levels are used to estimate groundwater in storage.

5.4.3 Monitoring Protocols [§354.34(i)]

23 Cal. Code Regs. §354.34 Monitoring Network.
(i) *The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2(f) for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies.*

The monitoring protocols for groundwater storage monitoring are identical to those for groundwater levels monitoring (Section 5.3.3), because groundwater levels will be used to estimate aquifer storage.

5.4.4 Assessment and Improvement of Monitoring Network [§354.38(a),(b),(c)(1),(c)(2),(d),(e)(1),(e)(2),(e)(3), and (e)(4)]

§354.38 Assessment and Improvement of Monitoring Network.

(a) *Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.*

(b) *Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.*

(c) *If the monitoring network contains data gaps, the Plan shall include a description of the following:*

  (1) *The location and reason for data gaps in the monitoring network.*

  (2) *Local issues and circumstances that limit or prevent monitoring.*

(d) *Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.*

(e) *Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:*

  (1) *Minimum threshold exceedances.*

  (2) *Highly variable spatial or temporal conditions.*

  (3) *Adverse impacts to beneficial uses and users of groundwater.*

  (4) *The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.*

Assessment and potential improvements of the monitoring network for groundwater storage are identical to those for groundwater level monitoring (Section 5.3.4), because groundwater levels are used to estimate aquifer storage.

As noted above in Section 5.4.1, storage changes in the northern portion of the Basin will be addressed by using the numerical model.

A relationship between measured groundwater levels and storage (a.k.a. a “storage curve” approach) has been developed using the numerical model that addresses this data gap. This relationship will be used to calculate the annual storage change. More information about the storage curve approach to estimating annual change in storage is provide in Appendix K.

Groundwater extraction is reported to Untied for each active well on a semiannual basis per Water Code §75611. Thus, there are no spatial reporting gaps to address. It is noted that reporting is made for the periods January-June and July-December. MBGSA will use this reporting to estimate water year extractions.

5.5 Seawater Intrusion Monitoring Network [§354.34(e),(g)(3),(h), and (j)]

§354.34 Monitoring Network.
(e) *A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network.*
(g) *Each Plan shall describe the following information about the monitoring network:*
 (3) *For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.*
(h) *The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.*
(j) *An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.*

A subset of the degraded water quality monitoring network consisting of cluster wells 02N23W15J01S/02S and planned monitoring well clusters at Sites A and B will be used to monitor for seawater intrusion (Figures 5.3-04 and 5.3-05). Cluster wells 02N23W15J01S/02S and the potential for planned cluster “early warning” wells at Site C will provide shoreline monitoring for early detection of any unexpected seawater intrusion. Planned cluster wells at Sites A and B will be used to monitor relative to the measurable objectives and minimum thresholds that are designed to protect beneficial uses of groundwater which exist at each of these locations (there are no groundwater beneficial uses in the Coastal Area west of planned cluster well Sites A & B). The aforementioned monitoring sites will be sampled and analyzed for chloride and other dissolved constituents and parameters no less frequently than annually as part of the degraded water quality monitoring network.

5.5.1 Attainment of Monitoring Objectives and Other Requirements [§354.34(c)(3) and (g)(1)]

§354.34 Monitoring Network.
(c) *Each monitoring network shall be designed to accomplish the following for each sustainability indicator:*
 (3) *Seawater Intrusion. Monitor seawater intrusion using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated.*
(g) *Each Plan shall describe the following information about the monitoring network:*
 (1) *Scientific rationale for the monitoring site selection process.*

In accordance with GSP Emergency Regulations §354.34(b) and (d), the seawater intrusion monitoring network sites have been selected using MBGSA’s scientific judgment to demonstrate progress toward (1) achieving measurable objectives described in the GSP, (2) monitor impacts to the beneficial uses and users of groundwater, (3) monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds, and (4) provide adequate coverage of sustainability indicators. The seawater intrusion monitoring network focuses on the Coastal Area of the Basin where agricultural beneficial users are proximal to the Coast and would be at risk if unexpected seawater intrusion occurs (Figure 5.3-04 and 5.3-05).

Pursuant to GSP Emergency Regulations §354.34(c)(3), the seawater intrusion monitoring network sites have been selected to provide chloride concentrations to assess the projected rate and extent of seawater intrusion for each principal aquifer. The existing and planned groundwater quality monitoring wells screened in the Hueneme Aquifer and the Mugu Aquifer are considered to provide sufficient density for the following scientific and practical reasons, consistent with the key Basin-specific monitoring network design factors discussed in Section 5.2:

- The groundwater quality monitoring sites (existing and proposed) were selected to provide coverage across the Coastal Area where seawater intrusion could occur.
- The seawater intrusion monitoring sites (existing and proposed) were sited to provide both early warning of seawater intrusion and measurements relative to minimum thresholds and measurable objectives to protect groundwater beneficial uses.
- An annual sampling frequency is considered adequate because numerical modeling suggests that the average travel time between the shoreline wells and planned cluster wells A & B is more than the 50-year SGMA implementation timeframe, although it is possible that travel times could be shorter in the more permeable zones of an aquifer. If monitoring results suggest seawater may be present in any of the monitoring sites, the well will be resampled and, if confirmed, the sampling frequency will be increased to quarterly.

5.5.2 Data and Reporting Standards [§354.34(g)(2)]

> **§354.34 Monitoring Network**.
> ***(g)*** *Each Plan shall describe the following information about the monitoring network:*
> ***(2)*** *Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained.*

The data and reporting standards for seawater intrusion monitoring are identical to those for the degraded water quality monitoring network, described in Section 5.6.2.

5.5.3 Monitoring Protocols [§354.34(i)]

> **23 Cal. Code Regs. §354.34 Monitoring Network**.
> ***(i)*** *The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2(f) for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies.*

The monitoring protocols for seawater intrusion monitoring are identical to those for the degraded water quality monitoring network (Section 5.6.2).

5.5.4 Assessment and Improvement of Monitoring Network [§354.38(a),(b),(c)(1),(c)(2),(d),(e)(1),(e)(2),(e)(3), and (e)(4)]

§354.38 Assessment and Improvement of Monitoring Network.

(a) *Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.*

(b) *Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.*

(c) *If the monitoring network contains data gaps, the Plan shall include a description of the following:*

- ***(1)*** *The location and reason for data gaps in the monitoring network.*
- ***(2)*** *Local issues and circumstances that limit or prevent monitoring.*

(d) *Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.*

(e) *Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:*

- ***(1)*** *Minimum threshold exceedances.*
- ***(2)*** *Highly variable spatial or temporal conditions.*
- ***(3)*** *Adverse impacts to beneficial uses and users of groundwater.*
- ***(4)*** *The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.*

Pursuant to GSP Emergency Regulations §354.38, MBGSA has assessed the existing seawater intrusion monitoring network and determined that certain data gaps exist. MBGSA concluded that additional wells are needed for measurements relative to minimum thresholds and measurable objectives. Planned monitoring well cluster Sites A and B were identified to address these gaps (Figure 5.3-04 and 5.3-05). An additional cluster wells at Site C will be considered to augment existing cluster well 02N23W15J01S/02S for early warning of seawater intrusion along the shoreline. Construction of Site C will be considered following the 5-year GSP evaluation, based on monitoring results and funding availability.

5.6 Degraded Water Quality Monitoring Network [§354.34(e),(g)(3),(h), and (j)]

23 Cal. Code Regs. §354.34 Monitoring Network.
(e) *A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network.*
(g) *Each Plan shall describe the following information about the monitoring network:*
  (3) *For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.*
(h) *The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.*
(j) *An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.*

Table 5.3-01 summarizes information regarding depth, sampling frequency, and purpose of the ten existing wells in Mound Basin that have been regularly sampled for water quality analysis. These wells are referred to as the “existing groundwater quality monitoring network.” Locations of wells previously used to monitor groundwater quality in the Mugu and Hueneme aquifers are shown on Figures 5.3-04 and 5.3-05, respectively. Inspection of Table 5.3-01 indicates that most (six) existing groundwater quality monitoring sites are screened solely in the Hueneme Aquifer (one additional well is screened chiefly in the Hueneme Aquifer, but its screen may extend into the Mugu Aquifer), which is one of the two principal aquifers where most of the groundwater is extracted from Mound Basin (Table 3.1-02). Three groundwater quality monitoring sites are screened solely in the Mugu Aquifer, which is the other principal aquifer. In addition to these 10 groundwater quality monitoring sites, the existing monitoring wells screened in the fine-grained Pleistocene deposits overlying the Mugu Aquifer (02N22W07M03S and 02N23W07J03S) will be sampled occasionally to characterize the quality of the water that could leak into the Mugu Aquifer (Figure 5.3-03).

Two additional monitoring well clusters are planned in the Coastal Area to provide additional water quality monitoring sites for the seawater intrusion sustainability indicator (Sites A and B on Table 5.3-02 and Figures 5.3-04 and 5.3-05). These planned monitoring well clusters will include discrete screen intervals in each principal aquifer and will be incorporated into the groundwater quality monitoring network once constructed. Site C is a potential “early warning” shoreline well and the plans to install the well will be evaluated following the 5-year review.

The aforementioned monitoring sites (existing and planned) will be sampled and analyzed annually for inorganic constituents (general mineral analysis) and common water quality parameters (Table 5.6-01). In addition to this annual sampling (in fall), United currently is conducting supplemental sampling at many of the monitoring wells for an abbreviated analyte list every spring; this spring sampling by United is expected to continue in the future as part of the GSP.

5.6.1 Attainment of Monitoring Objectives and Other Requirements [§354.34(c)(4) and (g)(1)]

§354.34 Monitoring Network.
(c) *Each monitoring network shall be designed to accomplish the following for each sustainability indicator:*
  (4) *Degraded Water Quality. Collect sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues.*
(g) *Each Plan shall describe the following information about the monitoring network:*
  (1) *Scientific rationale for the monitoring site selection process.*

In accordance with GSP Emergency Regulations §354.34(b) and (d), the groundwater quality monitoring network sites have been selected using MBGSA's scientific judgment to demonstrate progress toward (1) achieving measurable objectives described in the GSP, (2) monitor impacts to the beneficial uses and users of groundwater, (3) monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds, and (4) provide adequate coverage of sustainability indicators. Importantly, there is no groundwater extraction in the northern portion of the Basin; thus, the sustainability indicators that rely on groundwater quality are necessarily focused on the southern portion of the Basin. The groundwater quality monitoring network has a special focus in areas of greatest risk for undesirable results: the western half of the Basin where agricultural beneficial users are proximal to the coast and would be at risk if unexpected seawater intrusion occurs. Additional monitoring well clusters are proposed in the western half of the Basin to address these concerns.

Pursuant to GSP Emergency Regulations §354.34(c)(4), the groundwater quality monitoring network sites have been selected to provide sufficient spatial and temporal data from each principal aquifer to determine groundwater quality trends. The existing and planned groundwater quality monitoring wells screened in the Hueneme and Mugu aquifers are considered to provide sufficient density for the following scientific and practical reasons consistent with the key Basin-specific monitoring network design factors discussed in Section 5.2:

- The groundwater quality monitoring sites (existing and proposed) were selected to provide focused monitoring of the western half of the Basin, where the greatest risk for undesirable results exists (i.e., seawater intrusion leading to increased chloride concentrations).
- The groundwater quality monitoring sites (existing and proposed) were selected to provide coverage across the southern portion of the Basin where current and projected groundwater beneficial uses exist.
- The lack of monitoring sites in the northern portion of the Basin is not believed to limit MBGSA's ability to sustainably manage the Basin because there are no groundwater beneficial uses in that area.
- A higher density of groundwater level monitoring sites has been selected in the Hueneme Aquifer commensurate with the fact that this aquifer supplies most of the water extracted from the Basin.
- The relatively limited number of groundwater level monitoring sites in the Mugu Aquifer is not believed to limit MBGSA's ability to sustainably manage the Basin; additional groundwater

quality monitoring sites would be helpful in the Mugu Aquifer, but the proposed network is considered adequate given the small amount of groundwater extraction from the aquifer.

- The annual sampling frequency is considered adequate. More frequent monitoring, when feasible, is desirable but not considered necessary for sustainable management of the Basin unless conditions change. The monitoring frequency will be increased if unexpected changes in water quality are observed. This will happen based on the Plan Manager's professional judgment and the changes will be reflected as described in the Annual Report and incorporated in the next GSP update.

Additional factors considered during selection of the groundwater quality monitoring sites include:

1. To the extent practicable, existing wells have been used as monitoring sites to avoid the cost and public nuisance associated with drilling new wells in a largely urban setting. However, in areas where groundwater quality monitoring would provide crucial information, but no existing wells are present (or are unsuitable for some reason, such as being screened at a depth that would not provide useful data), new wells have been installed in parks and other public spaces in Mound Basin in the past.
2. DWR's BMPs for developing monitoring networks (2016c) cites guidance stating that the density of monitoring wells should be 6.3 wells per 100 mi^2 to 4.0 wells per 100 mi^2 (Hopkins, 2016; applies to basins with groundwater extractions of more than 10,000 AF per 100 mi^2). In the principal aquifers of the Mound Basin (which has an area of approximately 23 mi^2), there are two existing groundwater quality monitoring wells (density of nine wells per 100 mi^2) screened solely in the Mugu Aquifer and six existing groundwater quality monitoring wells (density of 27 wells per 100 mi^2) screened solely in the Hueneme Aquifer. Therefore, the density of monitoring sites in the existing groundwater quality monitoring network exceeds the metrics recommended by DWR.

5.6.2 Data and Reporting Standards [§354.34(g)(2)]

§354.34 Monitoring Network.
(g) *Each Plan shall describe the following information about the monitoring network:*
  (2) *Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained.*

The groundwater quality monitoring sites are generally consistent with applicable data and reporting standards set forth in GSP Emergency Regulations §352.4. Exceptions to the standards are described below:

- Well 02N23W13F02S is screened primarily in the Hueneme Aquifer, with a small length of screened interval in the Mugu Aquifer, as noted on Table 5.3-01. Results of water quality analyses for samples obtained from this well historically have been consistent with water quality at other wells screened in the Hueneme Aquifer in Mound Basin, suggesting it extracts groundwater primarily from the Hueneme Aquifer. Therefore, this well will remain in the GSP groundwater level monitoring network.

- Well 02N22W08G01S is believed to be screened in both the Mugu Aquifer and the upper part of the Hueneme Aquifer, as noted on Table 5.3-01. Additionally, water quality samples obtained from this well have been anomalous in the past, as described in Section 3.1.4.3, suggesting influence of shallow groundwater, possibly through a compromised well seal or well casing. This well is included in the GSP groundwater level monitoring network for completeness because it has been part of the existing monitoring program in the Basin; however, results of water quality analysis for samples from this well may not be consistent with groundwater chemistry in either the Mugu or Hueneme aquifers in the vicinity of this well and will not be a determining factor when analyzing concentrations relative to the minimum threshold and measurable objectives.

5.6.3 Monitoring Protocols [§354.34(i)]

23 Cal. Code Regs. §354.34 Monitoring Network.

(i) *The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2(f) for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies.*

United and VCWPD collect groundwater quality data from wells in Mound Basin (Table 5.3-01) in general conformance with the DWR's BMPs for monitoring protocols, standards, and sites (DWR, 2016b). The City of Ventura must additionally meet United States Environmental Protection Agency and California DDW standards for municipal water supply. Data and reporting standards for groundwater quality sampling at their municipal water supply wells typically exceed the recommended standards described in DWR's BMPs (2016b). The key DWR "standardized protocols" for groundwater quality sampling as described in Section 5.5.2 are followed by United, VCWPD, and the City of Ventura. More details are provided in the referenced guidance document (DWR, 2016b), and are not repeated in this GSP. It is presently anticipated that United, VCWPD, and the City of Ventura will continue collecting groundwater quality data from the existing monitoring network, including any improvements or modifications made in the future, and report those data to the MBGSA.

5.6.4 Assessment and Improvement of Monitoring Network [§354.38(a),(b),(c)(1),(c)(2),(d),(e)(1),(e)(2),(e)(3), and (e)(4)]

§354.38 Assessment and Improvement of Monitoring Network.

(a) *Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.*

(b) *Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.*

(c) *If the monitoring network contains data gaps, the Plan shall include a description of the following:*

- ***(1)*** *The location and reason for data gaps in the monitoring network.*
- ***(2)*** *Local issues and circumstances that limit or prevent monitoring.*

(d) *Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.*

(e) *Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:*

- ***(1)*** *Minimum threshold exceedances.*
- ***(2)*** *Highly variable spatial or temporal conditions.*
- ***(3)*** *Adverse impacts to beneficial uses and users of groundwater.*
- ***(4)*** *The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.*

The existing groundwater quality monitoring network, as introduced in Section 5.6, is considered generally suitable for groundwater sustainability planning relative to the criteria provided in DWR's GSP and CASGEM guidance (DWR, 2016a, 2010), and has met the needs of United and the City of Ventura in past decades.

Pursuant to GSP Emergency Regulations §354.38, MBGSA has assessed the existing groundwater quality monitoring network and determined that certain data gaps exist. Planned actions to address the data gaps before the next 5-year assessment are discussed below.

Northern Portion of Mound Basin

As discussed in Section 5.6.1, the northern portion of the Basin lacks groundwater quality monitoring sites. The lack of groundwater quality monitoring sites is due to the lack of groundwater extraction wells in the northern half of the Basin. Future groundwater beneficial uses are not anticipated in the northern part of the Basin due to the dominance of residential tract housing. Because there are no current or anticipated future beneficial uses, this data gap is not considered to a limiting factor for sustainable management of the Basin and will not be addressed unless changing conditions in the Basin warrant monitoring sites.

Mugu Aquifer

As discussed in Section 5.6.1, there are a relatively limited number of groundwater quality monitoring sites in the Mugu Aquifer. This data gap is not believed to limit MBGSA's ability to sustainably manage the Basin because there is limited groundwater extraction from this aquifer. Additional groundwater quality monitoring sites would be helpful in the Mugu Aquifer, but the existing network is considered adequate given the small amount of groundwater extraction from the aquifer. However, it is noted that the planned monitoring sites to address seawater intrusion (planned cluster sites A-C; Section 5.3.4) will provide additional water quality data in the Mugu Aquifer.

5.7 Land Subsidence Monitoring Network [§354.34(e),(g)(3),(h), and (j)]

23 Cal. Code Regs. §354.34 Monitoring Network.

(e) *A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network.*

(g) *Each Plan shall describe the following information about the monitoring network:*

(3) *For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.*

(h) *The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.*

(j) *An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.*

As described in Section 4.8.2 of this GSP, InSAR is not considered a reliable method for measuring land subsidence in the western half of the Mound Basin due to multiple factors:

1. There is a significant lack of coverage in the western half of the Mound Basin (Figure 3.2-19), which causes the interpolated InSAR subsidence rates to be unreliable.
2. InSAR data provided by DWR are interpolated across the basin boundary between Mound and Oxnard basins. This is not appropriate because of the faults and folds that comprise the basin boundary. These structures likely impact the propagation of any subsidence between the basins (Figures 3.1-02, 3.1-06, and 3.2-19).
3. There is a subsidence “hotspot” that corresponds with a landfill located just south of the Mound Basin in the adjacent Oxnard Basin, which would be representing natural land compaction at the landfill. Careful inspection of the InSAR interpolation reveals that the hotpot greatly influences the subsidence values in the western portion of the Mound Basin, which lacks InSAR data (Figure 3.2-19).

For these reasons, groundwater elevations will be used as a proxy to detect and monitor the potential onset of inelastic land subsidence that may result from future groundwater extractions in Mound Basin (i.e., if groundwater elevations decline below historical low levels). Therefore, the land subsidence monitoring network utilizes the groundwater level monitoring network for the western half of the Basin, which is described above in Section 5.3. To ensure the best available data is used for monitoring, the eastern half of the Basin utilizes InSAR data to measure land surface elevation changes when groundwater levels are below historical lows (Section 4.8).

5.7.1 Attainment of Monitoring Objectives and Other Requirements [§354.34(c)(5) and (g)(1)]

§354.34 Monitoring Network.
(c) *Each monitoring network shall be designed to accomplish the following for each sustainability indicator:*
  (5) *Land Subsidence. Identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method.*
(g) *Each Plan shall describe the following information about the monitoring network:*
  (1) *Scientific rationale for the monitoring site selection process.*

The land subsidence monitoring network design criterion provided in GSP Emergency Regulations §354.34(c)(5) is to identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate methods. Using groundwater levels as a proxy for inelastic land subsidence is an appropriate method because it is mentioned in the GSP Emergency Regulations (§354.36(b)) and because the sustainability goal of no measurable inelastic land subsidence due to groundwater extractions is directly correlated with maintaining groundwater levels above historical low levels. Declining groundwater levels (typically resulting from groundwater extractions) are one potential cause for land subsidence in California, especially when groundwater levels decline below historical lows (Sneed et al., 2013). However, after fine-grained sediments have been compacted during an episode of historically low groundwater levels, there is low probability of additional subsidence unless groundwater elevations decline further—specifically, below the previous historical lows (DWR, 2014). For these reasons, the groundwater level monitoring network will be used to attain the monitoring objectives for the land subsidence monitoring network.

5.7.2 Data and Reporting Standards [§354.34(g)(2)]

§354.34 Monitoring Network.
(g) *Each Plan shall describe the following information about the monitoring network:*
  (2) *Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained.*

The data and reporting standards for land subsidence monitoring are identical to those for groundwater level monitoring since groundwater levels will be used as a proxy for indicating potential onset of land subsidence.

For the eastern half of the Basin, InSAR data acquired from DWR along with available GPS data will be reported in feet to an accuracy of at least 0.1 feet relative to North American Vertical Datum of 1988 (NAVD88). The InSAR and GPS data will be compared with groundwater level data to analyze the rate of ground position decline with variation in groundwater levels to determine subsidence in relation to groundwater levels or extraction rates. Results will be mapped, graphed, and reported consistent with standards described in GSP Emergency Regulations (§352.4 (d)), and provided with the GSP updates.

5.7.3 Monitoring Protocols [§354.34(i)]

> **23 Cal. Code Regs. §354.34 Monitoring Network.**
> ***(i)*** *The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2(f) for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies.*

The monitoring protocols for land subsidence monitoring are identical to those for groundwater level monitoring, as groundwater levels will be used as a proxy for indicating potential onset of land subsidence.

Subsidence data for the eastern half of the Basin will be acquired from DWR from their SGMA Data Viewer web-based GIS viewer (DWR, 2020b), and reviewed. In addition to the InSAR results, data from a continuous GPS, VNCO, which is maintained by a non-profit university consortium, will be downloaded and reviewed (UNAVCO, 2020). GPS data will be compared with groundwater level data to analyze the rate of ground position decline with variation in groundwater levels to determine subsidence in relation to groundwater levels or extraction rates.

5.7.4 Assessment and Improvement of Monitoring Network [§354.38(a),(b),(c)(1),(c)(2),(d),(e)(1),(e)(2),(e)(3), and (e)(4)]

> **§354.38 Assessment and Improvement of Monitoring Network.**
> ***(a)*** *Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.*
> ***(b)*** *Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.*
> ***(c)*** *If the monitoring network contains data gaps, the Plan shall include a description of the following:*
> ***(1)*** *The location and reason for data gaps in the monitoring network.*
> ***(2)*** *Local issues and circumstances that limit or prevent monitoring.*
> ***(d)*** *Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.*
> ***(e)*** *Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:*
> ***(1)*** *Minimum threshold exceedances.*
> ***(2)*** *Highly variable spatial or temporal conditions.*
> ***(3)*** *Adverse impacts to beneficial uses and users of groundwater.*
> ***(4)*** *The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.*

Assessment and potential improvements of the monitoring network for land subsidence are identical to those for groundwater level monitoring since groundwater levels are used as a proxy for indicating potential onset of land subsidence.

MBGSA has assessed the available InSAR and GPS data for the eastern half of the Basin and has considered it generally suitable for estimating land subsidence in the case that groundwater levels are below the historical low. There are some minor gaps in InSAR raster coverage in the eastern half of the Basin (see Figure 3.2-19) but will not significantly impact the interpolation of the InSAR land displacement.

5.8 Depletions of Interconnected Surface Water Monitoring Network [§354.34(e),(g)(3),(h), and (j)]

> **23 Cal. Code Regs. §354.34 Monitoring Network**.
> ***(e)*** *A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network.*
> ***(g)*** *Each Plan shall describe the following information about the monitoring network:*
> ***(3)*** *For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.*
> ***(h)*** *The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.*
> ***(j)*** *An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.*

As was described in Section 3.2.6 and 4.9 of this GSP, the depletions of interconnected surface water sustainability criterion was determined not to be applicable to Mound Basin. Therefore, a monitoring network for depletions of interconnected surface water is not required.

5.9 Representative Monitoring Sites [§354.36(a),(b)(1),(b)(2), and (c)]

> **§354.36 Representative Monitoring**. *Each Agency may designate a subset of monitoring sites as representative of conditions in the basin or an area of the basin, as follows:*
> ***(a)*** *Representative monitoring sites may be designated by the Agency as the point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined.*
> ***(b)*** *Groundwater elevations may be used as a proxy for monitoring other sustainability indicators if the Agency demonstrates the following:*
> ***(1)*** *Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy.*
> ***(2)*** *Measurable objectives established for groundwater elevation shall include a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for the sustainability indicators for which groundwater elevation measurements serve as a proxy.*
> ***(c)*** *The designation of a representative monitoring site shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area.*

At present, the MBGSA plans to use data collected from all of the monitoring sites described in Sections 5.3 and 5.6 to monitor relevant groundwater sustainability indicators in Mound Basin and is not currently designating a subset of monitoring sites as representative of conditions in the Basin.

5.10 Reporting Monitoring Data to the Department (Data Management System) [§354.40]

§354.40 Reporting Monitoring Data to the Department. *Monitoring data shall be stored in the data management system developed pursuant to Section 352.6. A copy of the monitoring data shall be included in the Annual Report and submitted electronically on forms provided by the Department.*

Pursuant to Section §352.6, monitoring data will be stored in MBGSA's DMS. Data will be transmitted to DWR with the GSP, annual reports, and GSP updates electronically on the forms provided by DWR. Information concerning the MBGSA DMS is provided in Appendix L.

6.0 Projects and Management Actions

[Article 5, SubArticle 5]

6.1 Introduction [§354.42, 354.44(a),(b)(2),(b)(9),(c), and (d)]

§354.42 Introduction to Projects and Management Actions. *This Subarticle describes the criteria for projects and management actions to be included in a Plan to meet the sustainability goal for the basin in a manner that can be maintained over the planning and implementation horizon.*

§354.44 Projects and Management Actions

(a) *Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.*

(b) *Each Plan shall include a description of the projects and management actions that include the following:*

  (2) *If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.*

  (9) *A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.*

(c) *Projects and management actions shall be supported by best available information and best available science.*

(d) *An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.*

This section describes the projects and management actions included in the plan to ensure the sustainability goal is met and to address additional plan elements. Determination of the projects and management actions is based on the best available information and best available science and accounts for the level of uncertainty associated with the Basin setting.

The GSP Emergency Regulations specifically require the inclusion of projects or management actions to address the following:

- **Overdraft (§354.44(b)(2))**: A description of the projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft, if and overdraft condition is identified through the analysis required by §354.18.
- **Drought Offset Measures §354.44(b)(9)**: A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.

As described in earlier sections, the 50-year modeling projections developed for the water budget suggest that the measurable objectives for the applicable sustainability indicators will be met without the need for overdraft mitigation or drought offset measures. However, several management actions are included to respond to potential changing conditions in the Basin and to help protect groundwater quality.

6.2 Seawater Intrusion Monitoring Wells for Sustainable Management Criteria Implementation [§354.44(b)(1) and (d)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
  (1) *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent.*
(d) *An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.*

As described in Sections 4.6.2.6 and 5.5.4, MBGSA has assessed the existing seawater intrusion monitoring network and determined that additional monitoring wells are needed between the shoreline and locations of water wells to implement minimum thresholds and measurable objectives designed to protect beneficial uses (monitoring well clusters at Sites A and B (Figure 5.3-04 and 5.3-05)). These wells are needed to meet the SGMA requirement for using a chloride concentration isocontour to delineate the seawater intrusion minimum thresholds and measurable objectives. At least two wells are needed along Harbor Boulevard to establish an isocontour between the coast and the beneficial users of groundwater located to the east. The Site A monitoring well is planned for construction in 2021 and will be funded by the DWR TSS program. The Site B monitoring well would be funded by MBGSA, unless a grant is obtained. Because monitoring wells are required for SMC implementation, they must be constructed before the first 5-year GSP assessment (GSP Emergency Regulations §354.38(d)).

6.2.1 Relevant Measurable Objective(s) [§354.44(b)(1)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
  (1) *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent.*

The relevant measurable objective for the seawater intrusion monitoring wells project is the measurable objective for the seawater intrusion sustainability indicator. The planned Site A and B wells would also provide groundwater level and quality data that would be relevant to the measurable objectives for the other sustainability indicators.

6.2.2 Implementation Triggers [§354.44(b)(1)(A)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
  (1) *The Plan shall include the following:*
    (A) *A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.*

The implementation trigger for the seawater intrusion monitoring wells project is GSP Emergency Regulations §354.38(d), which requires GSAs to address data gaps before the first 5-year GSP assessment. This project is already underway, with the Site A monitoring well scheduled for construction in 2021 with funding from the DWR TSS program. No known criteria would trigger the termination of this Project, and the conditions requiring the implementation of this project are discussed in Sections 4.6.2.6 and 5.5.4.

6.2.3 Public Notice Process [§354.44(b)(1)(B)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(1)*** *The Plan shall include the following:*
> ***(B)*** *The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.*

MBGSA will continue to follow its adopted SEP to inform the public about progress implementing the seawater intrusion monitoring wells project.

6.2.4 Permitting and Regulatory Process [§354.44(b)(3)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(3)*** *A summary of the permitting and regulatory process required for each project and management action.*

The seawater intrusion monitoring wells project will require the following permits:

- CEQA compliance (most likely a categorical exemption).
- Administrative Coastal Development Permit (City of Ventura).
- Ventura County Well Permit.

6.2.5 Implementation Timeline [§354.44(b)(4)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(4)*** *The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.*

This project is already underway and will be completed prior to the first 5-year GSP assessment. The Site A monitoring well is scheduled for construction in 2021 with funding from the DWR TSS program. Site B monitoring wells are budgeted for construction in 2026 but would be completed sooner if grant funding is available.

6.2.6 Anticipated Benefits [§354.44(b)(5)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(5)*** *An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.*

The primary benefit of the seawater intrusion monitoring wells project is to provide monitoring sites to implement SMC for the seawater intrusion sustainability indicator.

6.2.7 Implementation Approach [§354.44(b)(6)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(6)*** *An explanation of how the project or management action will be accomplished. If the project or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.*

The Site A monitoring well is scheduled for construction in 2021 with funding from the DWR TSS program.

The Site B monitoring well will be completed by MBGSA. The project will be implemented as a typical design-bid-build project. MBGSA staff will obtain right-of-way, design, bid, and issue a construction contract with the assistance of legal counsel and consultants.

6.2.8 Legal Authority [§354.44(b)(7)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(7)*** *A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.*

MBGSA will rely on the authority provided for under SGMA to contract for the construction of monitoring wells.

6.2.9 Cost & Funding [§354.44(b)(8)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(8)*** *A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.*

The Site A monitoring well cluster is funded by the DWR TSS program. Unreimbursed costs paid by MBGSA include Coastal Development permit application development and permit fees, well permit fees, and labor to obtain right-of-way and coordinate with DWR. MBGSA' estimated costs for the Site A monitoring wells are $50,000.

Site B monitoring well cluster is budgeted for construction in 2026. The total project costs (all-in) is estimated to be $884,000 (escalated from 2021 dollars assuming 3% per year inflation). The Site B monitoring wells will be funded using groundwater extraction fees, unless grant funding is available.

6.3 Seawater Intrusion Contingency Plan and Additional Shoreline Monitoring Well [§354.44(b)(1) and (d)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(1)*** *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent.*
> ***(d)*** *An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.*

As described in Section 3.2.3 Seawater Intrusion, available data indicate that seawater has not been present in the onshore portions of the principal aquifers to date. Section 3.2.3 also explains that the Mound Basin principal aquifers may only be exposed to seawater where they crop out on the continental shelf edge, approximately 10 miles offshore, greatly reducing the likelihood that seawater can find a near-shore path for intrusion into the principal aquifers (Figure 3.1-10). As discussed in Section 4.6, particle tracking simulations indicated that GSP indicate that onshore migration of seawater is not anticipated during the 50-year SGMA planning and implementation horizon from the offshore aquifer subcrops. The possibility of nearshore short-circuit pathways that could allow seawater to enter the aquifer (for example along the Oak Ridge Fault) and migrate onshore during the SGMA planning horizon were also considered in the particle tracking analysis. The particle tracking results indicate that it is unlikely that beneficial users of groundwater would be impacted during the 50-year SGMA planning and implementation horizon by onshore migration of seawater via potential short-circuit pathways located near the coast.

Despite the very encouraging model results for seawater intrusion, MBGSA believes it would be prudent to develop a contingency plan to address any unexpected seawater intrusion. The contingency plan will be developed to identify measures that would be taken to address unexpected seawater intrusion. The contingency plan will be developed prior the first 5-year GSP assessment. A related aspect of the contingency plan would be the construction of an additional shoreline monitoring well cluster (Site C on Figures 5.3-04 and 5.3-05) to provide early warning of any onshore flow of seawater. The Site C monitoring wells would complement the existing shoreline monitoring wells located at Marina Park (02N23W15J01/2). Because the Site C monitoring wells are not required for SMC implementation, they can be constructed after the first 5-year GSP assessment. Therefore, the GSP budget projections assume this well cluster would be constructed in 2032, just before the second 5-year GSP assessment.

6.3.1 Relevant Measurable Objective(s) [§354.44(b)(1)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(1)*** *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent.*

The relevant measurable objective for the seawater intrusion contingency plan and additional shoreline monitoring well project is the measurable objective for the seawater intrusion sustainability indicator.

The Site C monitoring well cluster would help ensure the measurable objective is met by providing early warning of unexpected seawater intrusion. The Site C wells would also provide groundwater level and quality data that would be relevant to the measurable objectives for the other sustainability indicators.

6.3.2 Implementation Triggers [§354.44(b)(1)(A)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(1)*** *The Plan shall include the following:*
> ***(A)*** *A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.*

The seawater intrusion contingency plan and additional shoreline monitoring well project is a voluntary measure that will be undertaken by the MBGSA at its discretion. As such, there is no definitive implementation trigger for developing the contingency plan or constructing the Site C wells.

6.3.3 Public Notice Process [§354.44(b)(1)(B)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(1)*** *The Plan shall include the following:*
> ***(B)*** *The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.*

MBGSA will continue to follow its adopted SEP to inform the public about progress implementing the seawater intrusion contingency plan and additional shoreline monitoring well project.

6.3.4 Permitting and Regulatory Process [§354.44(b)(3)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(3)*** *A summary of the permitting and regulatory process required for each project and management action.*

No permits or regulatory approvals are required to develop the seawater intrusion contingency plan.

The additional shoreline monitoring well project will require the following permits:

- CEQA compliance (most likely a categorical exemption).
- Administrative Coastal Development Permit (City of Ventura).
- Ventura County Well Permit.

6.3.5 Implementation Timeline [§354.44(b)(4)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(4) *The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.*

The seawater intrusion contingency plan and additional shoreline monitoring well project is a voluntary measure that will be undertaken by the MBGSA at its discretion. Contingency plan development is anticipated to be completed during the first 5-year GSP assessment period (i.e., before 2027). Due to funding constraints, the additional shoreline monitoring well project is scheduled for construction in 2032 but would be completed sooner if grant funding is available.

6.3.6 Anticipated Benefits [§354.44(b)(5)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(5) *An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.*

The seawater intrusion contingency plan and additional shoreline monitoring well project will benefit beneficial users and property interests in the Basin by providing early warning of unexpected seawater intrusion and ensuring pre-planned measures are in place to address it before undesirable results could occur.

6.3.7 Implementation Approach [§354.44(b)(6)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(6) *An explanation of how the project or management action will be accomplished. If the project or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.*

The seawater intrusion contingency plan will be developed through a collaborative stakeholder driven process that identifies triggers, actions, and funding mechanisms to address unexpected seawater intrusion. Engineering assistance will be obtained from consultants as needed during the seawater intrusion contingency plan development process.

The Site C additional shoreline monitoring well will be completed by MBGSA. The project will be implemented as a typical design-bid-build project. MBGSA staff will obtain right-of-way, design, and bid, and issue a construction contract with the assistance of legal counsel and consultants.

6.3.8 Legal Authority [§354.44(b)(7)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(7) *A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.*

MBGSA will rely on the authority provided for under SGMA to develop the seawater intrusion contingency plan or to contract for the construction of monitoring well.

6.3.9 Cost & Funding [§354.44(b)(8)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
- ***(8)*** *A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.*

The estimated cost for seawater intrusion contingency plan development is $85,000 (shared with the land subsidence contingency plan development). The estimated all-in cost for the new shoreline monitoring well is $1,052,000 (escalated form 2021 dollars assuming 3% per year inflation). The seawater intrusion contingency plan and monitoring wells will be funded using groundwater extraction fees, unless grant funding is available.

6.4 Land Subsidence Contingency Plan [§354.44(b)(1) and (d)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
- ***(1)*** *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent.*

(d) *An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.*

As described in Section 3.2.5 Land Subsidence, no land subsidence due to groundwater extraction has been documented historically in the Mound Basin. Section 3.2.5 also explains that the Mound Basin is considered to have a low estimated potential for inelastic land subsidence. Numerical modeling for the water budget suggests that future groundwater levels will remain above historical low levels, which would prevent inelastic subsidence due to groundwater extraction (Appendix I). Despite these factors, sustainable management is prudent because groundwater levels could decline below historical levels and trigger inelastic land subsidence if actual future conditions differ significantly from those assumed in the projected water budget analysis.

As described in Section 4.8.1, the Coastal Area (Figure 4.1-01) located west of Harbor Boulevard would be particularly susceptible to impacts of land subsidence. Primary sewer lines to the City's WWTP run along Harbor Boulevard and have a low slope that could be impacted by relatively small amounts of land subsidence. Available studies indicate that the developed areas located west of Harbor Boulevard, including the Pierpont community and Ventura Harbor, will be impacted by sea level rise (Figure 4.8-01a) (VCWPD, 2018). Inelastic land subsidence in this area would unreasonably exacerbate the already significant impacts associated with sea level rise. For these reasons it was determined that any measurable inelastic land subsidence in the Coastal Area could potentially result in undesirable results, particularly as the effects of sea level rise act to increase coastal hazards in the Coastal Area during the planning and implementation horizons.

Despite the very encouraging model results that suggest that land subsidence is not expected during the 50-year GSP implementation period, MBGSA believes it would be prudent to develop a contingency plan to address unexpected conditions that could cause groundwater levels to decline below historical low levels in the western half of the Basin and potentially trigger inelastic land subsidence in the Coastal Area. The contingency plan will be developed to identify triggers and measures that would be taken to halt groundwater level declines before historical low levels are exceeded in the western half of the Basin.

6.4.1 Relevant Measurable Objective(s) [§354.44(b)(1)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(1) *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent.*

The relevant measurable objective for the land subsidence contingency plan is the measurable objective for the land subsidence sustainability indicator.

6.4.2 Implementation Triggers [§354.44(b)(1)(A)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(1) *The Plan shall include the following:*
(A) *A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.*

The land subsidence contingency plan is a voluntary measure that will be undertaken by the MBGSA at its discretion. As such, there is no definitive implementation trigger for developing the contingency plan.

6.4.3 Public Notice Process [§354.44(b)(1)(B)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(1) *The Plan shall include the following:*
(B) *The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.*

MBGSA will continue to follow its adopted SEP to inform the public about progress developing the land subsidence contingency plan.

6.4.4 Permitting and Regulatory Process [§354.44(b)(3)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(3) *A summary of the permitting and regulatory process required for each project and management action.*

No permits or regulatory approvals are required to develop the land subsidence contingency plan.

6.4.5 Implementation Timeline [§354.44(b)(4)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(4) *The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.*

The land subsidence contingency plan is a voluntary measure that will be undertaken by the MBGSA at its discretion. The land subsidence contingency plan development is anticipated to be completed during the first 5-year GSP assessment period (i.e., before 2027).

6.4.6 Anticipated Benefits [§354.44(b)(5)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(5) *An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.*

the land subsidence contingency plan will benefit beneficial users and property interests in the Basin by providing early warning of groundwater levels declines that could lead to potential land subsidence in the Coastal Area and by ensuring pre-planned measures are to address it before undesirable results could occur.

6.4.7 Implementation Approach [§354.44(b)(6)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(6) *An explanation of how the project or management action will be accomplished. If the project or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.*

The land subsidence contingency plan will be developed through a collaborative stakeholder-driven process that identifies triggers, actions, and funding mechanisms to address unexpected groundwater level declines that could lead to potential land subsidence in the Coastal Area. Engineering assistance will be obtained from consultants as needed during the land subsidence contingency plan development process.

6.4.8 Legal Authority [§354.44(b)(7)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(7)*** *A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.*

MBGSA will rely on the authority provided for under SGMA to develop the land subsidence contingency plan.

6.4.9 Cost & Funding [§354.44(b)(8)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(8)*** *A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.*

The estimated cost for land subsidence contingency plan development is $88,4000 (shared with the seawater intrusion contingency plan development).

6.5 Groundwater Quality Protection Measures [§354.44(b)(1) and (d)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(1)*** *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent.*

(d) *An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.*

MBGSA will coordinate with the County of Ventura to identify and address improperly constructed or abandoned wells that create conduits for migration of poor-quality water from the Shallow Alluvial Deposits into the principal aquifers. MBGSA will also coordinate with County of Ventura to review the County well permit ordinance and modify, if necessary, to ensure the future wells are properly sealed to prevent migration of poor-quality water from the Shallow Alluvial Deposits into the principal aquifers.

6.5.1 Relevant Measurable Objective(s) [§354.44(b)(1)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(1)*** *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent.*

The relevant measurable objective for the groundwater quality protection measures management action is the measurable objective for the degraded water quality sustainability indicator.

6.5.2 Implementation Triggers [§354.44(b)(1)(A)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
 (1) *The Plan shall include the following:*
  (A) *A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.*

The groundwater quality protection measures management action is a voluntary measure that will be undertaken by the MBGSA at its discretion. As such, there is no definitive implementation trigger for developing the contingency plan.

6.5.3 Public Notice Process [§354.44(b)(1)(B)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
 (1) *The Plan shall include the following:*
  (B) *The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.*

MBGSA will continue to follow its adopted SEP to inform the public about progress implementing the groundwater quality protection measures management action.

6.5.4 Permitting and Regulatory Process [§354.44(b)(3)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
 (3) *A summary of the permitting and regulatory process required for each project and management action.*

No permits or regulatory approvals are required to implement groundwater quality protection measures management action.

6.5.5 Implementation Timeline [§354.44(b)(4)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
 (4) *The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.*

The groundwater quality protection measures management action is a voluntary measure that will be undertaken by the MBGSA at its discretion. However, it is anticipated that the Groundwater Quality

Protection Measures management action will be initiated during the first 5-year GSP assessment period (i.e., before 2027).

6.5.6 Anticipated Benefits [§354.44(b)(5)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(5)*** *An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.*

The groundwater quality protection measures management action will benefit beneficial users and property interests in the Basin by protecting groundwater quality from degradation.

6.5.7 Implementation Approach [§354.44(b)(6)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(6)*** *An explanation of how the project or management action will be accomplished. If the project or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.*

The groundwater quality protection measures management action will be developed through collaboration with the County of Ventura, the well permitting agency for the Basin.

6.5.8 Legal Authority [§354.44(b)(7)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(7)*** *A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.*

MBGSA will rely on the County of Ventura’s legal authority as the well permitting agency for the Basin.

6.5.9 Cost & Funding [§354.44(b)(8)]

> **§354.44 Projects and Management Actions.**
> ***(b)*** *Each Plan shall include a description of the projects and management actions that include the following:*
> ***(8)*** *A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.*

The estimated costs for the groundwater quality protection measures management action are included in the groundwater management, coordination, and outreach budget. Grant funding will be pursued to address any improperly constructed or abandoned wells that are identified.

6.6 Interim Shallow Groundwater Data Collection and Analysis [§354.44(b)(1) and (d)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
  (1) *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent.*
(d) *An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.*

As described in Section 3.1.4.1.3, Section 3.2.6, and Appendix G, the current HCM, data, and modeling indicate that there is virtually no impact of principal aquifer groundwater extractions on groundwater levels in the Shallow Alluvial Deposits or surface flows in the Santa Clara River. In response to concerns communicated by several commenters on the draft GSP, MBGSA will partner with the City of Ventura and United to collect interim shallow groundwater levels and water quality data from existing shallow wells located near the Santa Clara River leading up to the first 5-year GSP assessment to confirm the above-described conclusions. MBGSA is currently coordinating with the City of Ventura and United to perform the interim monitoring of shallow groundwater levels in several shallow wells located along the Santa Clara River (see Figure 6.6-01, Table 6.6-01). Note, these wells are not part of the Mound Basin GSP monitoring network, but data from these wells will be collected and analyzed on an interim basis. If data from the interim study confirm the existing conclusions, then no further monitoring will be necessary. If the data suggest a significant relationship exists between the Shallow Alluvial Deposits and Santa Clara River flows with the deeper, principal aquifers, the GSP will be updated to reflect those findings and an appropriate amount of monitoring will be continued.

Consistent with to GSP Emergency Regulations §354.34(c)(1)(B), static groundwater levels will be measured monthly (or more frequently, as feasible) at the shallow wells to represent seasonal-low and seasonal-high groundwater conditions. Groundwater elevations have been measured continuously by the City of Ventura with transducers, or manually on a monthly or bi-monthly basis at the shallow wells, exceeding the SGMA requirement for semiannual (fall and spring) measurements. The continuous data from the transducers is helpful for more accurately determining the precise timing of spring-high and fall-low groundwater elevations each year and for evaluating the interference effects of nearby groundwater extraction on static groundwater levels.

The City of Ventura collects and reports groundwater elevation data from the shallow wells in general conformance with the CASGEM program's "Procedures for Monitoring Entity Reporting" (DWR, 2010) and DWR's (2016b) BMPs for monitoring protocols, standards, and sites. Some key elements of DWR guidance include (but are not limited to) the following:

- Depth to groundwater must be measured relative to an established reference point on the well casing;
- Depth to groundwater must be measured to an accuracy of 0.1 ft below the reference point (it is preferable to measure depth to groundwater to an accuracy of 0.01 ft);
- Transducers must be able to record groundwater levels with an accuracy of 0.1 ft;

- Transducer data should periodically be checked against hand-measured groundwater levels to monitor electronic drift or cable movement.

More details are provided in the referenced guidance documents (DWR, 2010, 2016b), and are not repeated in this GSP. It is presently anticipated that MBGSA, United, and the City of Ventura will continue collecting groundwater level data from the existing shallow wells, including any improvements or modifications made in the future, and report those data to CASGEM and DWR.

6.6.1 Relevant Measurable Objective(s) [§354.44(b)(1)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(1) *A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent.*

There is no relevant measurable objective for the interim shallow groundwater data collection and analysis management action.

6.6.2 Implementation Triggers [§354.44(b)(1)(A)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(1) *The Plan shall include the following:*
(A) *A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.*

The interim shallow groundwater data collection and analysis management action is a voluntary measure that will be undertaken by the MBGSA at its discretion. As such, there is no definitive implementation trigger for developing this effort.

6.6.3 Public Notice Process [§354.44(b)(1)(B)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(1) *The Plan shall include the following:*
(B) *The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.*

MBGSA will continue to follow its adopted SEP to inform the public about progress implementing the interim shallow groundwater data collection and analysis management action.

6.6.4 Permitting and Regulatory Process [§354.44(b)(3)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(3) *A summary of the permitting and regulatory process required for each project and management action.*

No permits or regulatory approvals are required to implement the interim shallow groundwater data collection and analysis management action.

6.6.5 Implementation Timeline [§354.44(b)(4)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(4) *The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.*

MBGSA is currently coordinating with the City and United to initiate the monitoring program and data management. The interim shallow groundwater data collection and analysis management action is anticipated to be initiated in 2022 and completed during the first 5-year GSP assessment period (i.e., before 2027).

6.6.6 Anticipated Benefits [§354.44(b)(5)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(5) *An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.*

The interim shallow groundwater data collection and analysis management action will benefit beneficial users of the shallow groundwater (GDEs) and surface water (instream uses) within the Basin by providing additional data to ensure no impacts from groundwater extraction in the deeper principal aquifers is occurring. If the data indicate a hydraulic connection between the Shallow Alluvial Deposits and the deeper principal aquifers, then the data and analysis will provide the basis and data to update the HCM, SMC, and monitoring network to protect beneficial uses associated with the Shallow Alluvial Deposits and Santa Clara River from any groundwater extraction impacts.

6.6.7 Implementation Approach [§354.44(b)(6)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
(6) *An explanation of how the project or management action will be accomplished. If the project or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.*

The interim shallow groundwater data collection and analysis management action is being developed through collaboration with the City of Ventura and United to collect and manage the data. MBGSA will develop a temporary monitoring plan and conduct the data analysis.

6.6.8 Legal Authority [§354.44(b)(7)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
  (7) *A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.*

The legal authority for the interim shallow groundwater data collection and study are currently being assessed and will be updated in the next annual report.

6.6.9 Cost & Funding [§354.44(b)(8)]

§354.44 Projects and Management Actions.
(b) *Each Plan shall include a description of the projects and management actions that include the following:*
  (8) *A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.*

The estimated costs for the interim shallow groundwater data collection and analysis management action are currently being assessed and will be updated in the next annual report.

7.0 GSP Implementation

This GSP section presents the anticipated GSP implementation costs and schedule. Please note that the costs and schedule are approximate estimates based on currently available information and will be updated annually as needed to satisfy GSP annual reporting requirements and for the Agency's annual budgeting process.

7.1 Estimate of GSP Implementation Costs [§354.6(e)]

> **§354.6 Agency Information.** *When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:*
>
> ***(e)*** *An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.*

This subsection provides an estimate of the cost to implement the GSP and a general description of how the MBGSA plans to meet those costs. Implementation cost considerations include MBGSA administration, monitoring, data management, maintaining a prudent fiscal reserve, and other costs estimated over the GSP 20-year implementation horizon. The funding sources and mechanisms are also presented. The costs for projects and management actions are not included because none are anticipated to be required to meet the sustainability goal for the Mound Basin. However, costs to develop contingency plans to address unexpected land subsidence or seawater intrusion are included.

The following subsections present estimated costs for each major expense category. The estimated costs include annual costs for ongoing activities and estimated costs for one-time activities that are scheduled to occur within the first 5-year GSP assessment period. This approach enables calculating the 5-year total cost estimate, which is annualized to better inform MBGSA's general estimate of the costs by the major categories. Because costs are based on the best available estimates at the time of preparation, actual costs may vary from those used in the projections below.

The following subsections describe the scope of the various GSP implementation activities. Associated costs are presented in Table 7.1-01. In general, all costs were developed using 2021 dollars and escalated by 3% per year for the remainder of the 20-year GSP implementation period.

7.1.1 Agency Administration

This category includes the costs related to the administration of the MBGSA, including administrative staff support, finance staff support and related expenses, insurance, organizational memberships and conferences, miscellaneous supplies, and materials. The estimated costs are presented in Table 7.1-01. The MBGSA uses a collaborative staffing model to accomplish its work. Executive management is provided under contract with an independent consultant, Bondy Groundwater Consulting, Inc. (Bryan Bondy). Mr. Bondy serves as the Agency's Executive Director and the GSP Plan Manager. Administrative and accounting support is provided under contract with member agency United. This budget category includes finance-related costs for routine accounts payable and receivable functions, extraction fee billing, budgeting, financial reporting, and financial audits. Administrative costs also include annual liability insurance costs, IT services (website, email, and cloud storage), and incidentals (postage, copies, etc.). MBGSA does not own or lease any office space or office equipment.

7.1.2 Legal Counsel

Legal services are provided under contract with Klein Denatale Goldner on an as-needed basis. The budget assumes legal review of contracts and access agreements as well as consultation on other matters, such as Brown Act matters and groundwater extraction fee issues.

7.1.3 Groundwater Management, Coordination, and Outreach

GSP implementation will require certain management and coordination activities. The Executive Director will monitor activities of the Member Agencies, land use planning efforts, the Santa Paula Technical Advisory Committee (management of the adjacent adjudicated Santa Paula Basin), and FCGMA (GSP implementation for the adjacent Oxnard Basin), and the Santa Clara River Watershed Committee (Integrated Regional Water Management program). The Executive Director will also stay abreast of DWR updates concerning the SGMA and related programs. This task also includes ongoing outreach required by the SGMA concerning GSP implementation in accordance with the MBGSA Board-approved SEP (Appendix D).

This cost category also includes miscellaneous technical support that may be needed to implement the GSP that is not captured in other cost categories. The specific needs and costs are yet to be identified but it is expected as the initial GSP implementation efforts proceed that these needs will become evident. Examples of technical support are potential tasks such as ongoing data review (outside of annual reporting and GSP evaluation); day-to-day data management, review of funding mechanisms; development of alternative funding mechanisms (grants), and other technical issues that may arise during GSP implementation. It is envisioned that much of the work will be completed by the Executive Director with support from United staff and other consultants, as needed.

Lastly, the year one (Fiscal Year 2022) included $25,000 for the application for a GSP Implementation Grant.

7.1.4 Data Collection

The MBGSA's proposed monitoring program is presented in the monitoring section (Section 5). The initial monitoring networks for the GSP consist of the existing monitoring programs implemented by United and to a lesser extent the VCWPD and City of Ventura. The existing monitoring networks will be supplemented with monitoring well clusters to be constructed by MBGSA (see Sections 5.3.4 and 6.2) and perhaps several existing wells where opportunities arise.

7.1.4.1 Monitoring Well Construction

Sections 5.3.4, 5.5.4, and 5.6.4 describe monitoring network gaps. In summary, MBGSA concluded that two monitoring wells are needed between the shoreline and locations of water wells to implement minimum thresholds and measurable objectives designed to protect beneficial uses. Two multi-level monitoring wells (clusters) will be constructed to address these needs. The wells were also sited to address monitoring needs for the land subsidence sustainability indicator and, more generally, to better define the potentiometric surface near the coast and provide additional vertical gradient data.

Pursuant to GSP Emergency Regulations § 354.38(d), the multi-level monitoring wells will be installed in a phased approach at prioritized locations within the next 5 years. One well is planned for construction in 2021 under DWR's TSS program (Site A on Figures 5.3-01 through 5.3-04). The fiscal year 2022 budget includes $30,000 for coordination with the DWR TSS. MBGSA will budget for and seek to install the other multi-level monitoring well (Site B on Figures 5.3-01 through 5.3-04) before the 5-year GSP assessment. The MBGSA's cost to construct the multi-level monitoring wells in 2026 is estimated to be approximately $750,000 per site in 2021 dollars. The estimated costs include access agreements, permitting, project management, and construction costs. These approximate costs are estimates as there are uncertainties such as site-specific considerations and construction bid environment, as well as a variety of other factors that will ultimately determine the all-in construction costs.

In addition to the monitoring wells described above, another monitoring well is proposed to provide early detection of seawater at the shoreline (Site C on Figures 5.3-01 through 5.3-04). However, because this well is not needed for establishing minimum thresholds and measurable objectives, this well does not need to be constructed before first 5-year GSP assessment. It is assumed that the well would be constructed before the second 5-year GSP assessment, if funding is available.

7.1.4.2 Groundwater Elevation Monitoring

There is a combined network of 24 wells in the Basin monitored at least quarterly. Monitoring is performed by United and to a lesser extent the VCWPD and City of Ventura (Table 5.3-01). Monitoring is described in detail in Section 5.3. The costs for ongoing monitoring of the existing monitoring network are included in the budgets of the current monitoring entities. United staff have indicated a willingness to incorporate the above-described new monitoring sites into its existing network, but that MBGSA would need to cover the costs for pressure transducers. Therefore, costs are included for pressure transducers.

7.1.4.3 Groundwater Quality Monitoring

There is a combined network of 10 wells in the Basin monitored at least quarterly. Monitoring is performed by United and to a lesser extent the VCWPD and City of Ventura (Table 5.3-01). Monitoring is described in detail in Section 5.6. The costs for ongoing monitoring of the existing monitoring network are included in the budgets of the current monitoring entities. United staff have indicated a willingness to incorporate the above-described new monitoring sites into its existing network, but that MBGSA would need to cover the laboratory fees for water quality testing. Therefore, costs are included for water quality testing.

7.1.4.4 Groundwater Extraction Monitoring

Groundwater extractions are reported semiannually to United pursuant to the Water Code §75611. The reported extractions are shared with MBGSA. There is no cost to MBGSA to obtain the extraction volume data.

7.1.5 Annual Reporting

SGMA regulations require submittal of annual reports to DWR on the status of GSP implementation and basin conditions. The reporting requirements are presented in GSP Emergency Regulations §356.2. In general, the annual report must include an executive summary, description, and graphical presentation basin conditions (groundwater levels and storage), reporting of groundwater extractions, reporting of surface water supplies to the Basin, reporting of total water use in the Basin, and discussion of GSP implementation progress relative to the SMC. It is anticipated the annual reports will be prepared by the Executive Director in coordination with United staff and with consultant support. Additional consultant support will be obtained, as needed, to complete the reports. The cost for the first annual report is anticipated to be greater than the cost for subsequent reports because the first report must be developed from scratch and will include several years of data to bridge the gap between data presented in the GSP and water year 2020/2021. The first annual report is due in April 2022.

Ongoing maintenance for the SMGA-required DMS is included in the annual reporting costs. Please see Section 5.10 and Appendix L for more information concerning the DMS.

7.1.6 Projects and Management Actions

Costs to develop a contingency plan for unexpected land subsidence or seawater intrusion are included. Further information about the contingency plans can be found in Sections 6.3 and 6.4. In addition, MBGSA developed a groundwater protection measures management action to identify and address improperly constructed or abandoned wells that create conduits for migration of poor-quality water from the Shallow Alluvial Deposits into the principal aquifers. This management action will also include coordination with the County of Ventura to review the County well permit ordinance and modify, if necessary, to ensure the future wells are properly sealed to prevent migration of poor-quality water from the Shallow Alluvial Deposits into the principal aquifers. Grant funding will be pursued to address any improperly constructed or abandoned wells that are identified.

7.1.7 GSP Evaluations and Amendments

GSP Emergency Regulations § 356.4 require MBGSA to evaluate the GSP at least every 5 years and in conjunction with any GSP amendments. The initial 5-year GSP evaluation is due to DWR in 2027. It is assumed that any Plan amendments will be timed such that only one GSP assessment will be performed per 5-year period. GSP evaluations will require the activities described in the following subsections.

7.1.7.1 Numerical Model Updates and Simulations

Prior to performing each 5-year GSP evaluation, the numerical flow model used to support GSP development will be updated. The updated model will help inform ongoing performance assessment of the SMC. Periodic updates to the groundwater model will be required to continue to refine and improve its capabilities and maintain ongoing functionality. This includes incorporating new model tools and features, updates to data, and updates to calibration. The model will be an important tool to inform the evaluation of GSP implementation over time. Numerical model updates will be performed by United as part of the activities undertaken to achieve its mission. Therefore, there are no anticipated costs to MBGSA for model updates. Model simulations requested by MBGSA will be performed by United (for a fee) or a consultant. Therefore, estimated costs for model simulations are included in the GSP implementation budget.

7.1.7.2 GSP Evaluation

SGMA regulations require submittal of written evaluation of the GSP to DWR at least once every 5 years. The GSP evaluation requirements are presented in GSP Emergency Regulations §356.4. In general, the GSP evaluation must include a description of groundwater conditions relative to each sustainability indicator, discussion of GSP implementation, proposed revisions to the Basin setting, SMC in light of new information or changes in water use, assessment of the monitoring networks, regulatory actions taken by MBGSA, summary of coordination with agencies located within the Basin and in adjacent basins, and a description of any proposed or adopted GSP amendments. It is anticipated the GSP evaluation will be prepared by the Executive Director in coordination with United staff and with consultant support. The cost of the first GSP evaluation is anticipated to be greater than the cost for subsequent reports because the first evaluation must be developed from scratch.

7.1.7.3 GSP Amendments

To control costs, MBGSA will seek to perform any Plan amendments in conjunction with the required 5-year evaluations. Pertinent sections of the GSP will be amended, as appropriate, based on new information, groundwater conditions and monitoring results, water use, land use changes, land use plan updates, and groundwater conditions and management status of adjacent basins. It is anticipated the GSP evaluation will be prepared by the Executive Director in coordination with United staff and with consultant support.

7.1.8 Respond to DWR GSP Evaluations and Assessments

MBGSA will respond to DWR comments on the initial GSP and requests for additional information following its review of the adopted GSP. It is assumed that DWR comments on the initial GSP will be received and addressed during fiscal year 2024. MBGSA will respond to DWR comments and requests for information associated with its subsequent 5-year GSP assessments. It is anticipated the GSP evaluation will be prepared by the Executive Director in coordination with United staff and with consultant support.

7.1.9 Contingencies

Contingency is included in the budget in recognition that the GSP implementation is new and there is potential for unanticipated expenses. For the purposes of conservatively estimating the cost to implement the GSP, the budget estimate includes a 10% contingency based upon the annual fiscal year budget estimate. The actual need for contingency will be reviewed during each annual budgeting process. It is anticipated the contingency needs will be reduced over time as MBGSA becomes more certain about ongoing GSP implementation costs.

7.1.10 Financial Reserves

Prudent financial management requires that MBGSA carry a general reserve in order to manage cash flow. General reserves have no restrictions on the types of expenses they can be used to fund. Current Board Direction policy on reserve level is $25,000.

7.2 Total Estimated Implementation Costs Through 2042 [§354.6(e)]

§354.6 Agency Information. *When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:*

(e) *An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.*

GSP implementation costs are presented in Table 7.1-01. The estimated cost is presented by budget categories discussed in Section 7.1. The estimated total cost of the GSP implementation over the 20-year planning horizon is [$7,002,188]. Costs through the first 5-year assessment periods are also provided as subtotal, and are estimated to be [1,937,618]. The annual costs include an annual rate of inflation of 3.0% factored into the cost projections. These estimated costs are based on the best available information at the time of Plan preparation and submittal. It represents the MBGSA's current understanding of Basin conditions and the current roles and responsibilities of the MBGSA under SGMA.

7.3 Funding Sources and Mechanisms [§354.6(e)]

§354.6 Agency Information. *When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:*

(e) *An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.*

Funding for GSP implementation will be obtained from groundwater extraction fees charged to groundwater users in the Basin. This funding approach has been used since the MBGSA's formation. This funding approach will be reevaluated over time as the GSP implementation progresses. The MBGSA obtained a $760,000 Proposition 1 Sustainable Groundwater Planning Grant from DWR to fund, in part, the development of the GSP. In addition, the Site A monitoring wells planned for construction in 2021 is being funded by DWR's TSS program. MBGSA will continue to pursue funding from state and federal sources to support GSP planning and implementation.

7.4 Implementation Schedule [§354.44(b)(4)]

§354.44 Projects and Management Actions.

(b) *Each Plan shall include a description of the projects and management actions that include the following:*

- ***(4)*** *The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.*

The GSP is anticipated to be presented to the MBGSA Board for adoption in December 2021 and will be submitted to DWR no later than January 31, 2022. Many of the budget categories consist of ongoing tasks and efforts that will be conducted throughout GSP implementation. GSP reporting will occur on an annual basis, with reports for the preceding water year due to DWR by April 1. Periodic evaluations (every 5 years) and associated GSP amendments will be submitted to DWR by April 1 at least every 5 years (2027, 2032, 2037, and 2042).

The proposed monitoring well clusters are scheduled for construction in 2021, 2026, and 2032, but it is noted that site identification, access agreements, and permitting will take place in the years immediately preceding construction. Then first well scheduled for 2021 construction will be paid for by DWR's TSS program (Site A on Figures 5.3-01 through 5.3-04). Due to the significant construction costs for the remaining monitoring wells, it is anticipated that the second well (Site B) will be constructed during fiscal year 2026 to provide time to accumulate funding. If necessary, the third well (Site C) would be constructed in 2032 to provide time to accumulate funding after completing the second well[2].

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[2] Because this well is not needed for establishing minimum thresholds and measurable objectives, this well does not need to be constructed before first five-year GSP assessment.

8.0 References and Technical Studies [§354.4(b)]

§354.4 General Information.

(b) *Each Plan shall include the following general information: A list of references and technical studies relied upon by the Agency in developing the Plan. Each Agency shall provide to the Department electronic copies of reports and other documents and materials cited as references that are not generally available to the public.*

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Figures

Figures

Section 2

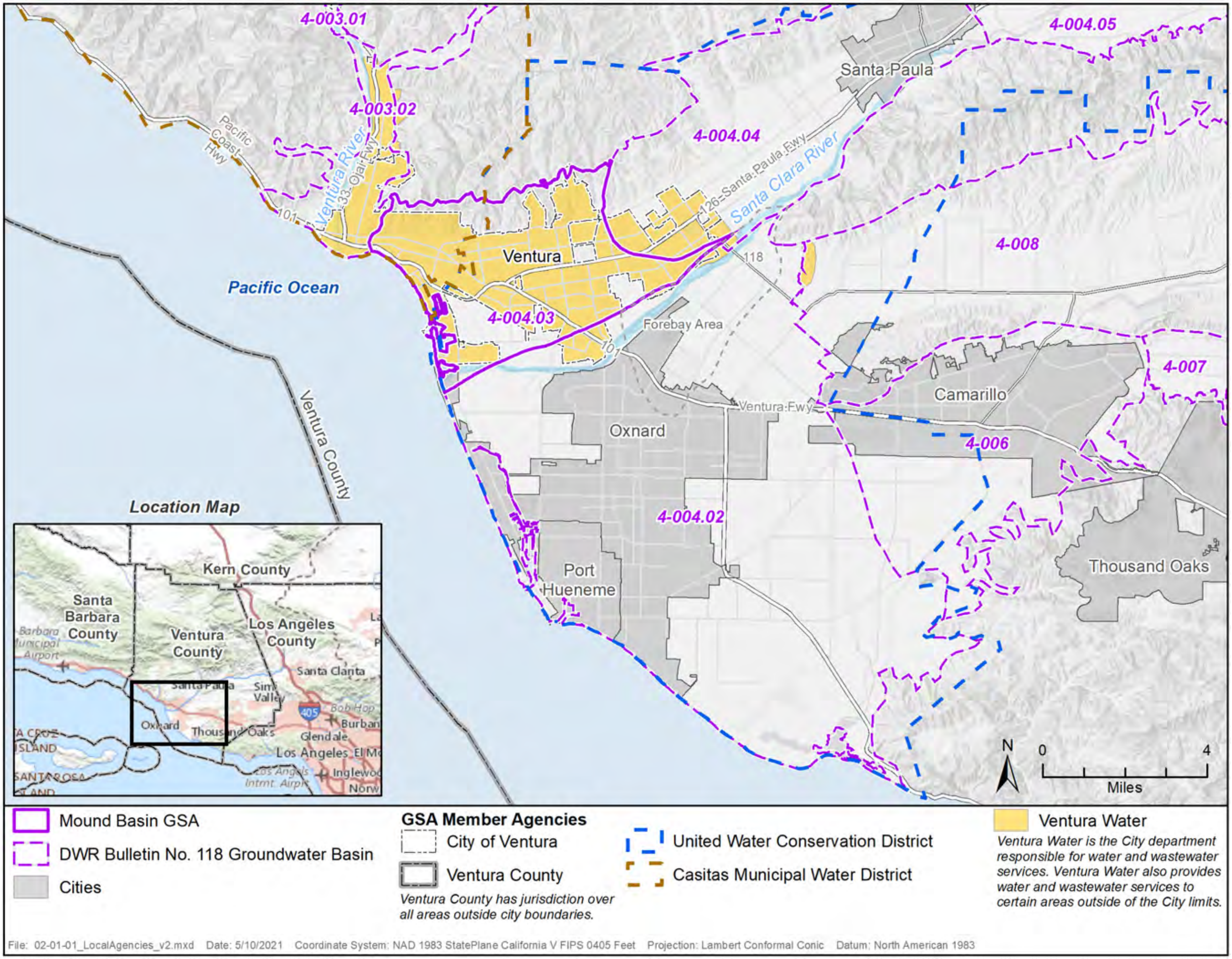


Figure 2.1-01 Local Agency Boundary Map.

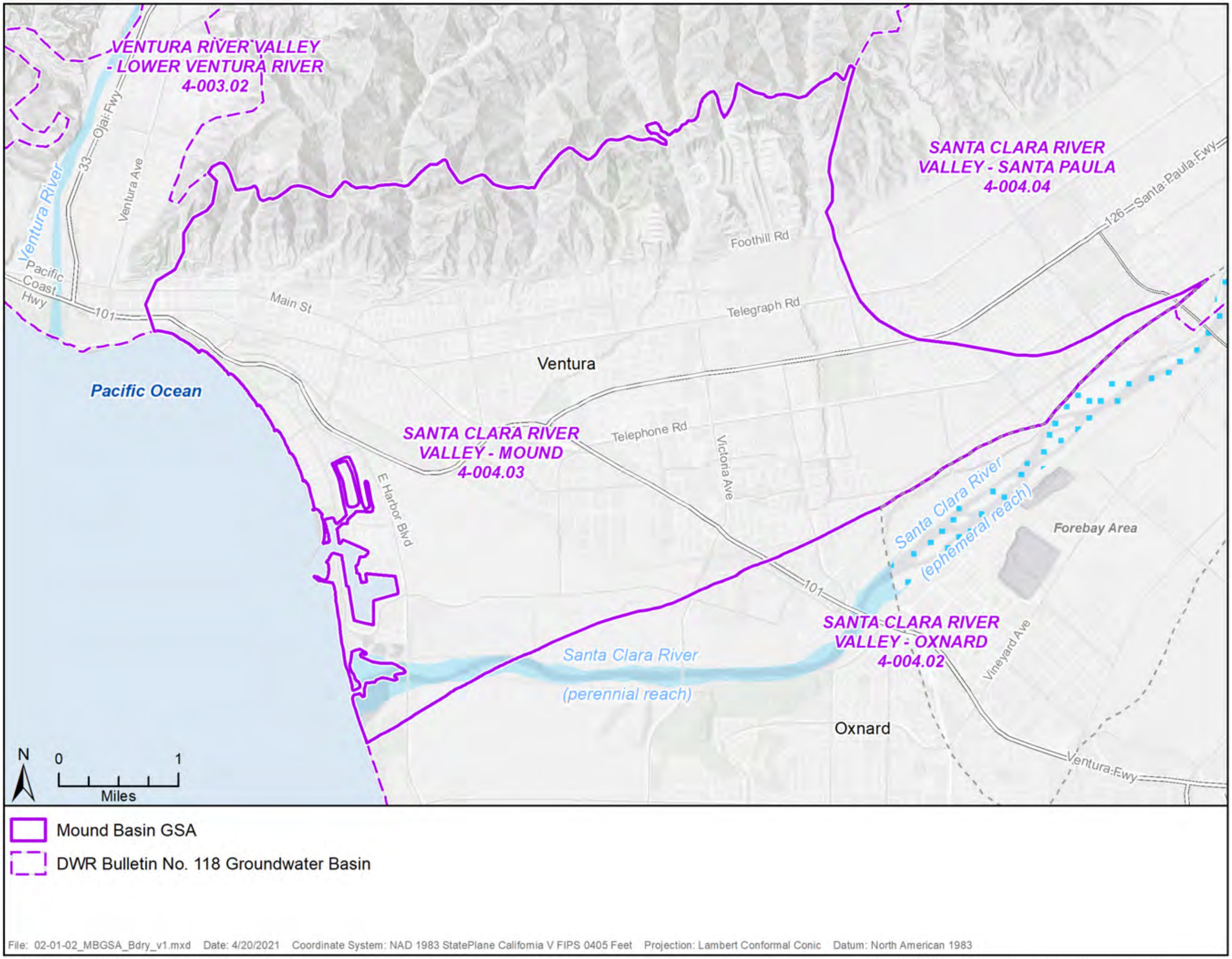


Figure 2.1-02 Mound Basin Groundwater Sustainability Agency Boundary Map.

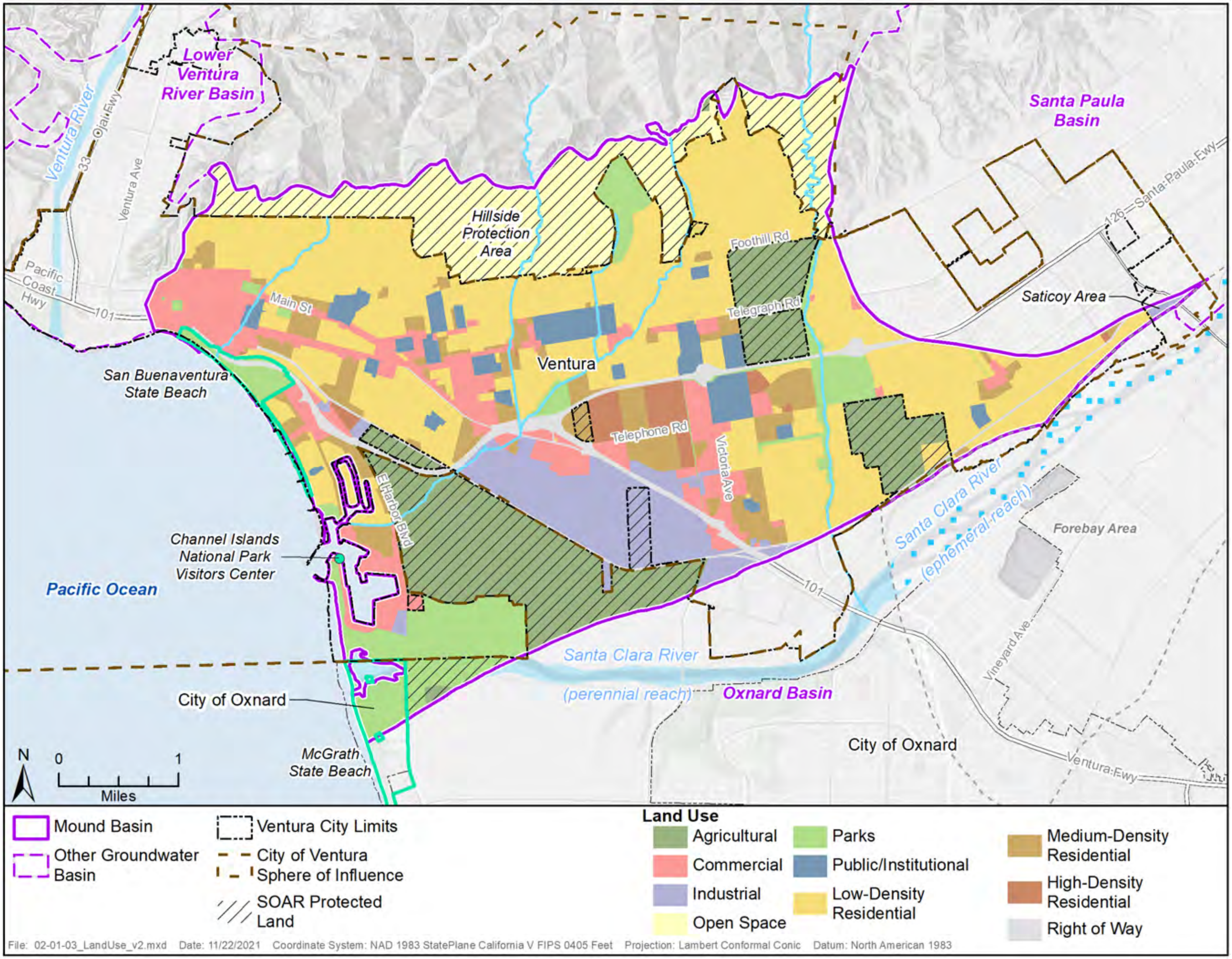
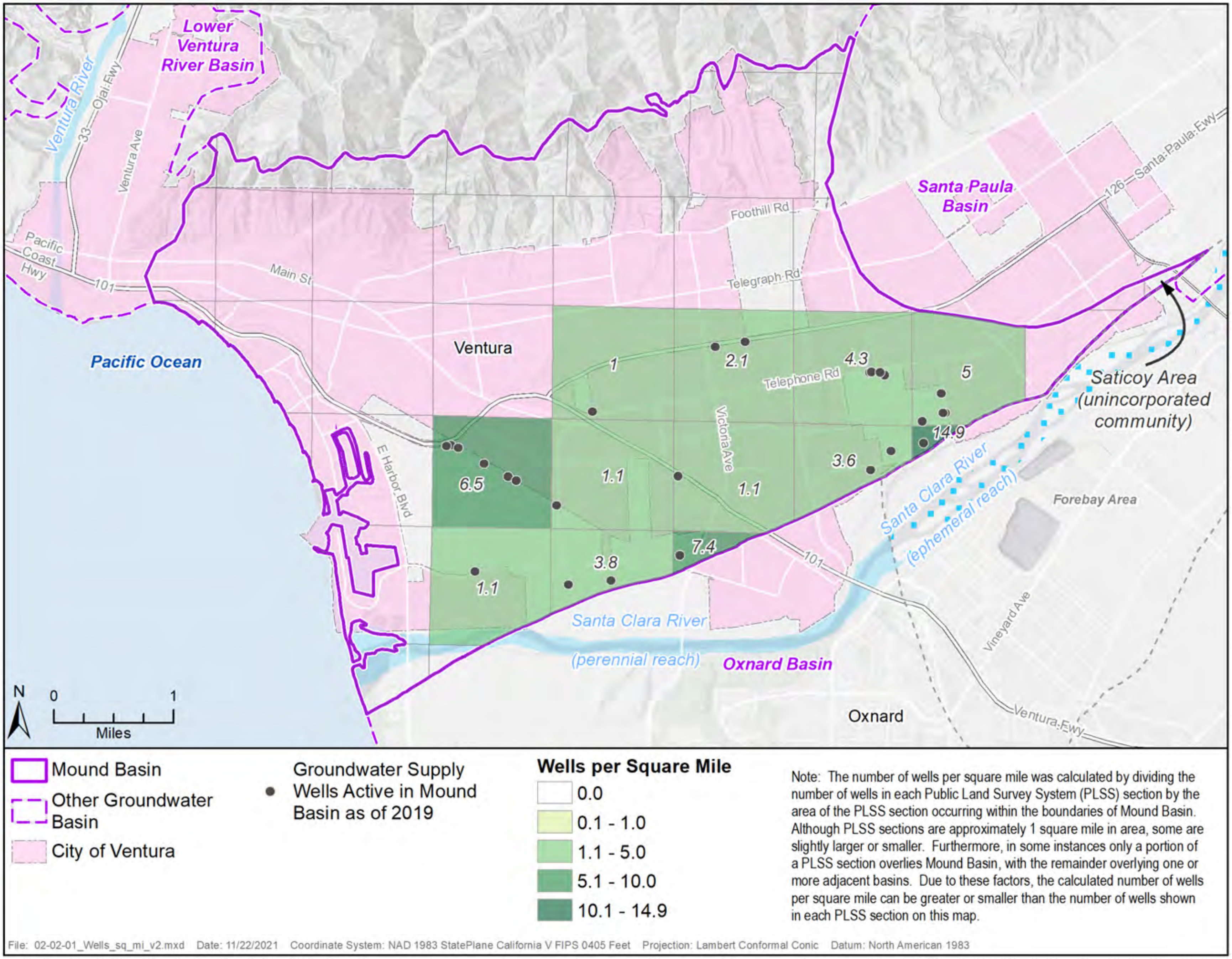


Figure 2.1-03 Mound Basin Land Use Map.



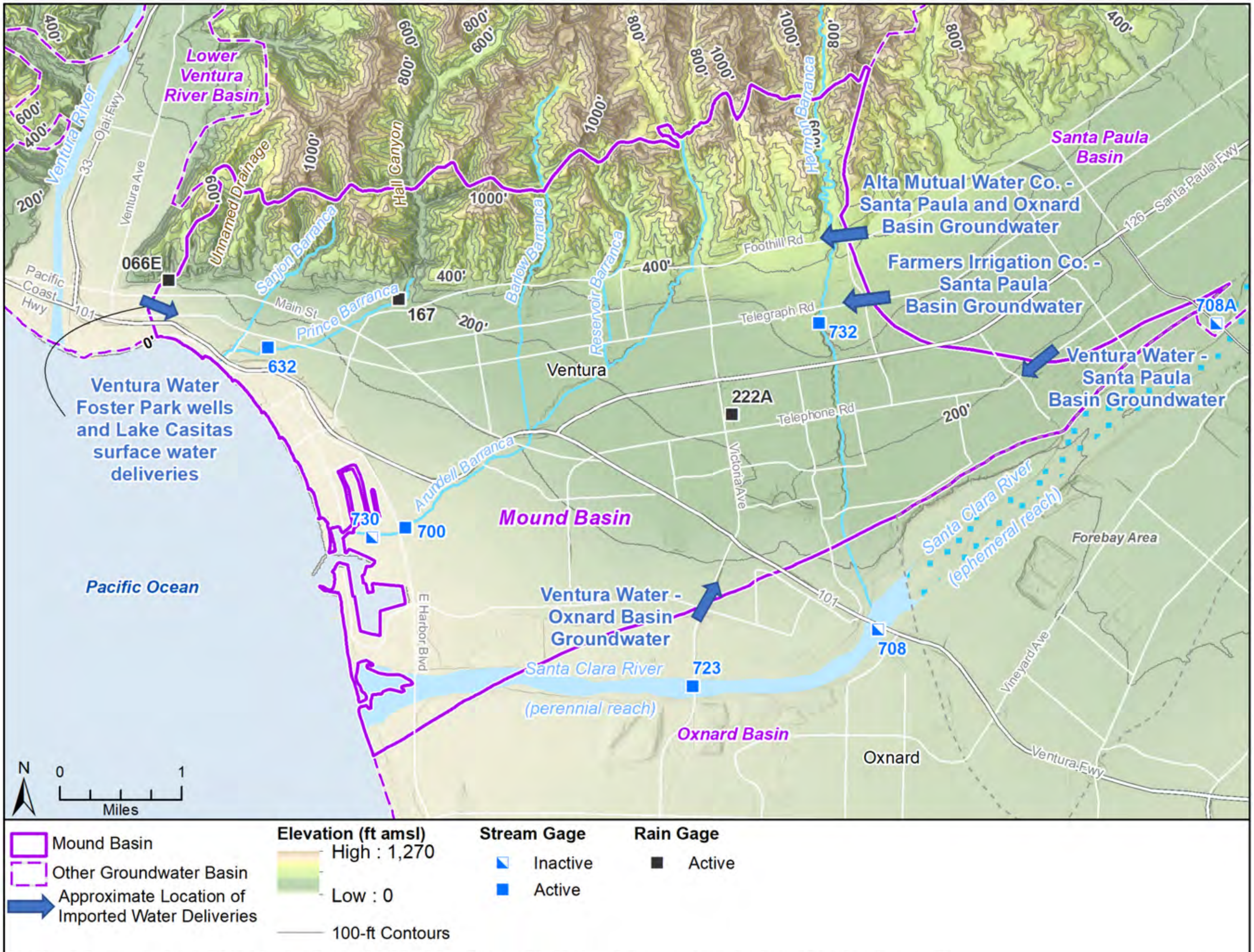
Note: The number of wells per square mile was calculated by dividing the number of wells in each Public Land Survey System (PLSS) section by the area of the PLSS section occurring within the boundaries of Mound Basin. Although PLSS sections are approximately 1 square mile in area, some are slightly larger or smaller. Furthermore, in some instances only a portion of a PLSS section overlies Mound Basin, with the remainder overlying one or more adjacent basins. Due to these factors, the calculated number of wells per square mile can be greater or smaller than the number of wells shown in each PLSS section on this map.

File: 02-02-01_Wells_sq_mi_v2.mxd Date: 11/22/2021 Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet Projection: Lambert Conformal Conic Datum: North American 1983

Figure 2.2-01 Groundwater Supply Wells Active in Mound Basin as of 2019 and Communities Dependent on Groundwater.

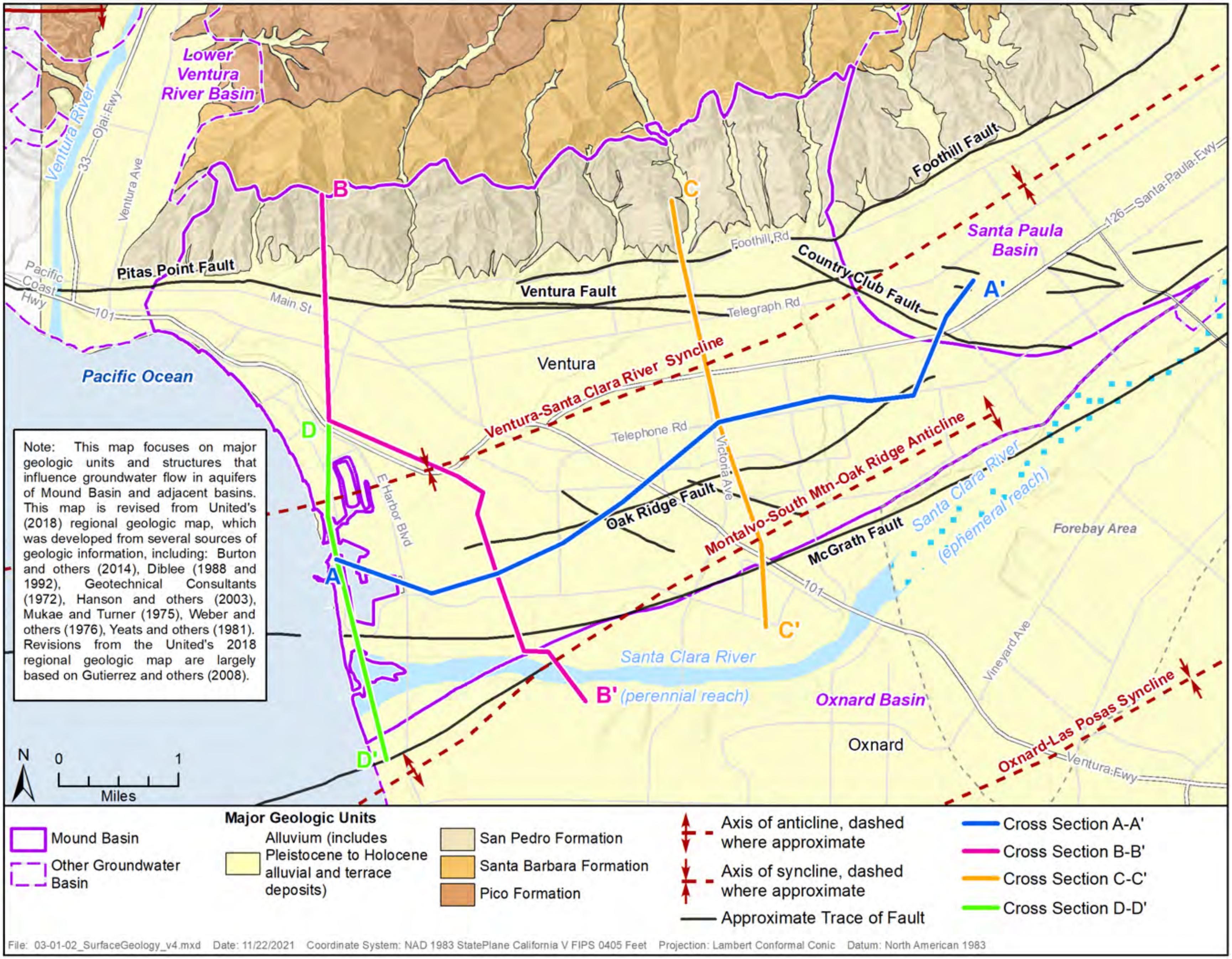
Figures

Section 3



File: 03-01-01_Topo_v6.mxd Date: 11/22/2021 Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet Projection: Lambert Conformal Conic Datum: North American 1983

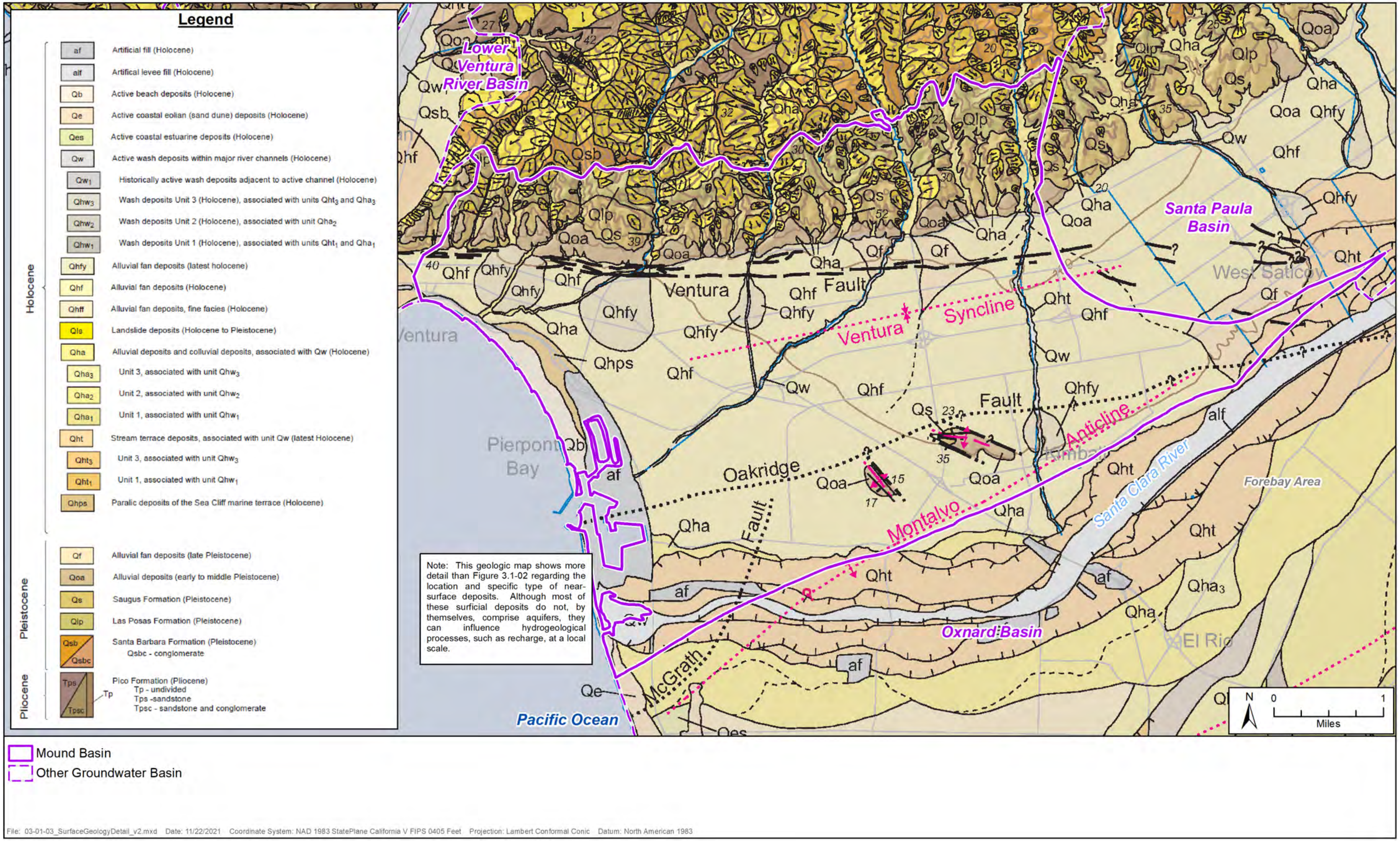
Figure 3.1-01 Topographic Map of Mound Basin with Stream and Precipitation Gage Stations and Imported Water.



Note: This map focuses on major geologic units and structures that influence groundwater flow in aquifers of Mound Basin and adjacent basins. This map is revised from United's (2018) regional geologic map, which was developed from several sources of geologic information, including: Burton and others (2014), Diblee (1988 and 1992), Geotechnical Consultants (1972), Hanson and others (2003), Mukae and Turner (1975), Weber and others (1976), Yeats and others (1981). Revisions from the United's 2018 regional geologic map are largely based on Gutierrez and others (2008).

File: 03-01-02_SurfaceGeology_v4.mxd Date: 11/22/2021 Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet Projection: Lambert Conformal Conic Datum: North American 1983

Figure 3.1-02 Simplified Surface Geologic Map of Mound Basin, showing Locations of Cross-Section Lines.



Note: This geologic map shows more detail than Figure 3.1-02 regarding the location and specific type of near-surface deposits. Although most of these surficial deposits do not, by themselves, comprise aquifers, they can influence hydrogeological processes, such as recharge, at a local scale.

File: 03-01-03_SurfaceGeologyDetail_v2.mxd Date: 11/22/2021 Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet Projection: Lambert Conformal Conic Datum: North American 1983

Figure 3.1-03 Detailed Surface Geologic Map of Mound Basin, from Gutierrez et al. (2008).