PUBLIC REVIEW DRAFT
Executive Summary

Corning Subbasin
Groundwater Sustainability Plan

September 2021

Contents

GSP DEVELOPMENT BACKGROUND ES-1
ES-1 INTRODUCTION AND AGENCY INFORMATION (GSP SECTION 1) ES-5
ES-2 DESCRIPTION OF PLAN AREA (GSP SECTION 2) ES-6
ES-3 BASIN SETTING (GSP SECTION 3) ES-9
ES-4 WATER BUDGET (GSP SECTION 4) ES-16
ES-5 MONITORING NETWORK (GSP SECTION 5) ES-20
ES-6 SUSTAINABLE MANAGEMENT CRITERIA (GSP SECTION 6) ES-22
ES-7 PROJECTS AND MANAGEMENT ACTIONS (GSP SECTION 7) ES-24
ES-8 PLAN IMPLEMENTATION (GSP SECTION 8) ES-27

Figures

Figure ES-1. Corning Subbasin ES-1
Figure ES-2. General GSP Development Process Overview ES-2
Figure ES-3. Corning GSP Development Approach and Goals ES-3
Figure ES-4. Agricultural Water Providers and Surface Water Conveyance in the Subbasin ES-7
Figure ES-5. Representative Groundwater Level Hydrograph ES-12
Figure ES-6. Water Budget Timeframes ES-16
Figure ES-7. Groundwater Budget Pie Charts ES-19

Tables

Table ES-1. Sustainable Management Criteria Summary ES-23
Table ES-2. Priority Management Actions ES-25
Table ES-3. Priority Projects ES-26

GSP DEVELOPMENT BACKGROUND

In 2014, the State Legislature passed the Sustainable Groundwater Management Act (SGMA) that fundamentally changes how groundwater is managed in the state. This legislative act requires the formation of Groundwater Sustainability Agencies (GSAs) responsible for preparing and implementing a Groundwater Sustainability Plan (GSP or Plan) for all high- and medium-priority groundwater basins in California. The Corning Subbasin (Subbasin) is a high-priority basin required to submit a GSA-adopted GSP to the California Department of Water Resources (DWR) by January 31, 2022. This document fulfills the requirements of SGMA and GSP Regulations developed by DWR. The GSAs will implement this Plan to achieve groundwater sustainability within the 20-year planning and 50-year implementation horizon. The Subbasin location and the GSAs that formed within the Glenn and Tehama County portions of the Subbasin are shown on Figure ES-1.

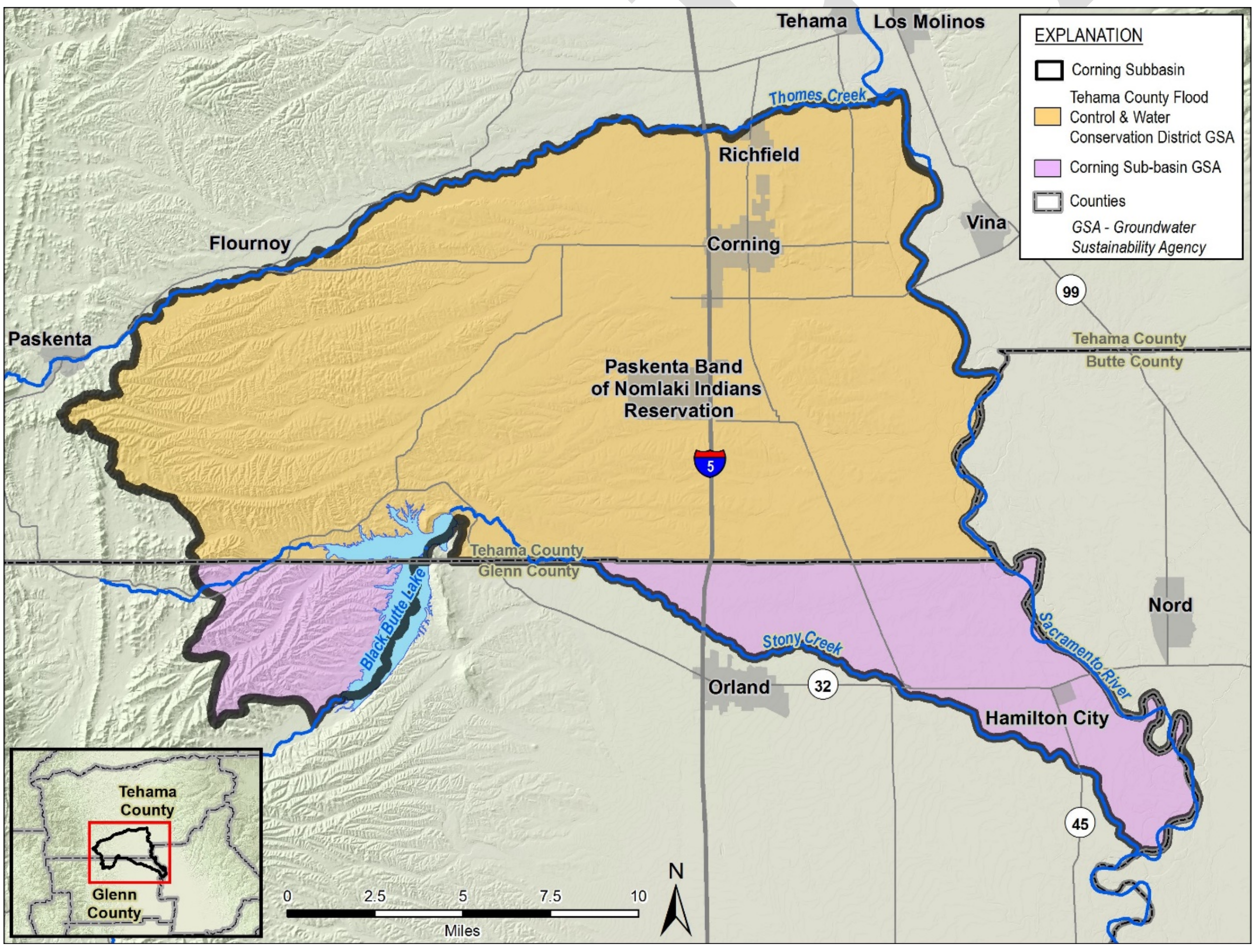

Figure ES-1. Corning Subbasin

The Corning Subbasin GSP is a local groundwater management plan developed by Glenn and Tehama County stakeholders within the Corning Subbasin to protect an agricultural way-of-life ingrained within the fabric of the local communities, while also providing access to groundwater for all residents and visitors to the Subbasin. Beneficial users relying on groundwater and its connection to rivers and creeks include municipal, rural, and tribal communities; agricultural, industrial, and commercial livelihoods; recreational activities, and plant and animal species. The GSP was developed collaboratively over the course of several years by the Corning Subbasin GSAs and technical consultants, with guidance from an Advisory Board and feedback from local stakeholders with a variety of interests. The iterative process for developing the GSP, general concepts shown on Figure ES-2, ensures that a sound and inclusive plan is in place to achieve groundwater sustainability per the requirements of SGMA.

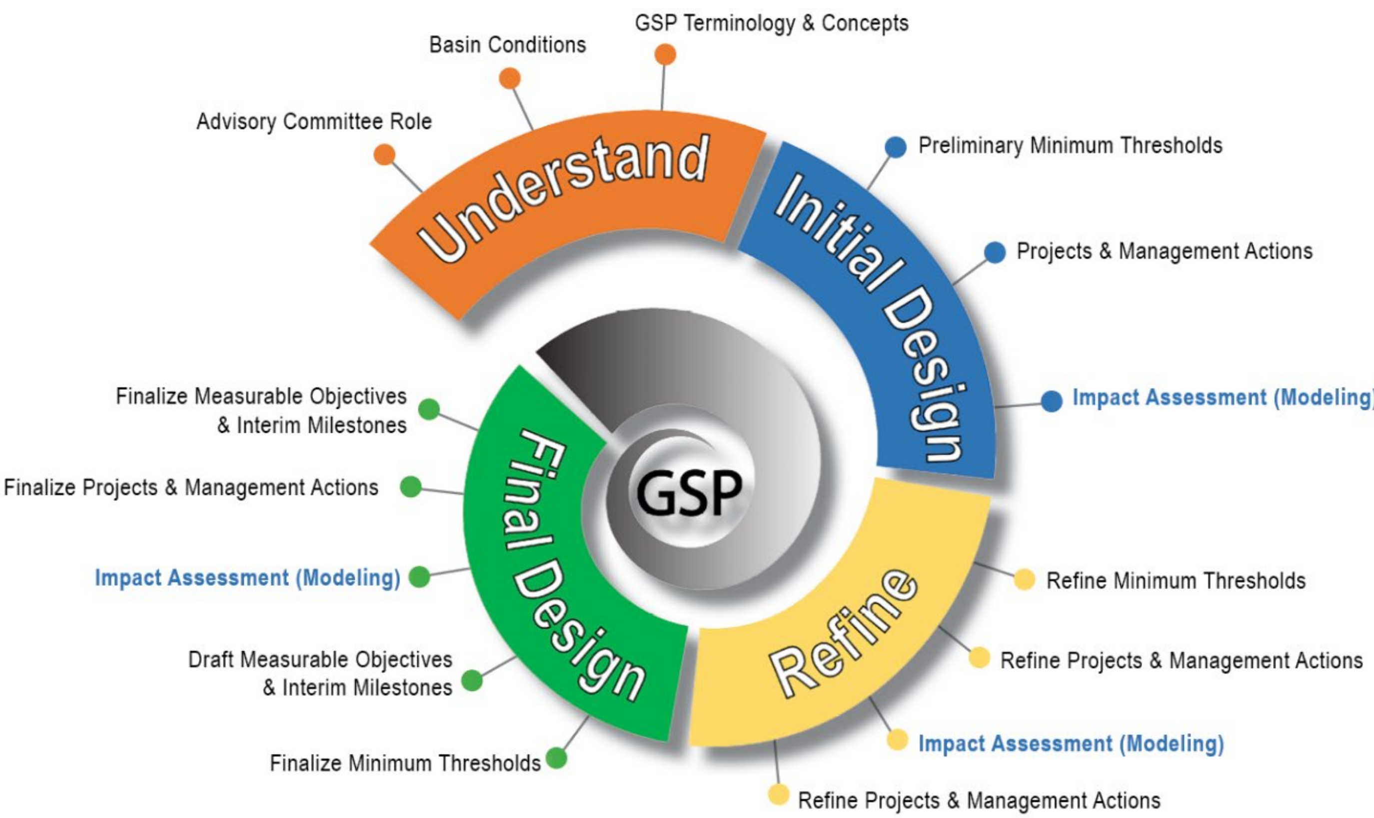

Figure ES-2. General GSP Development Process Overview

Figure ES-3 shows the key findings and goals of the GSP, developed through the process shown on Figure ES-2.

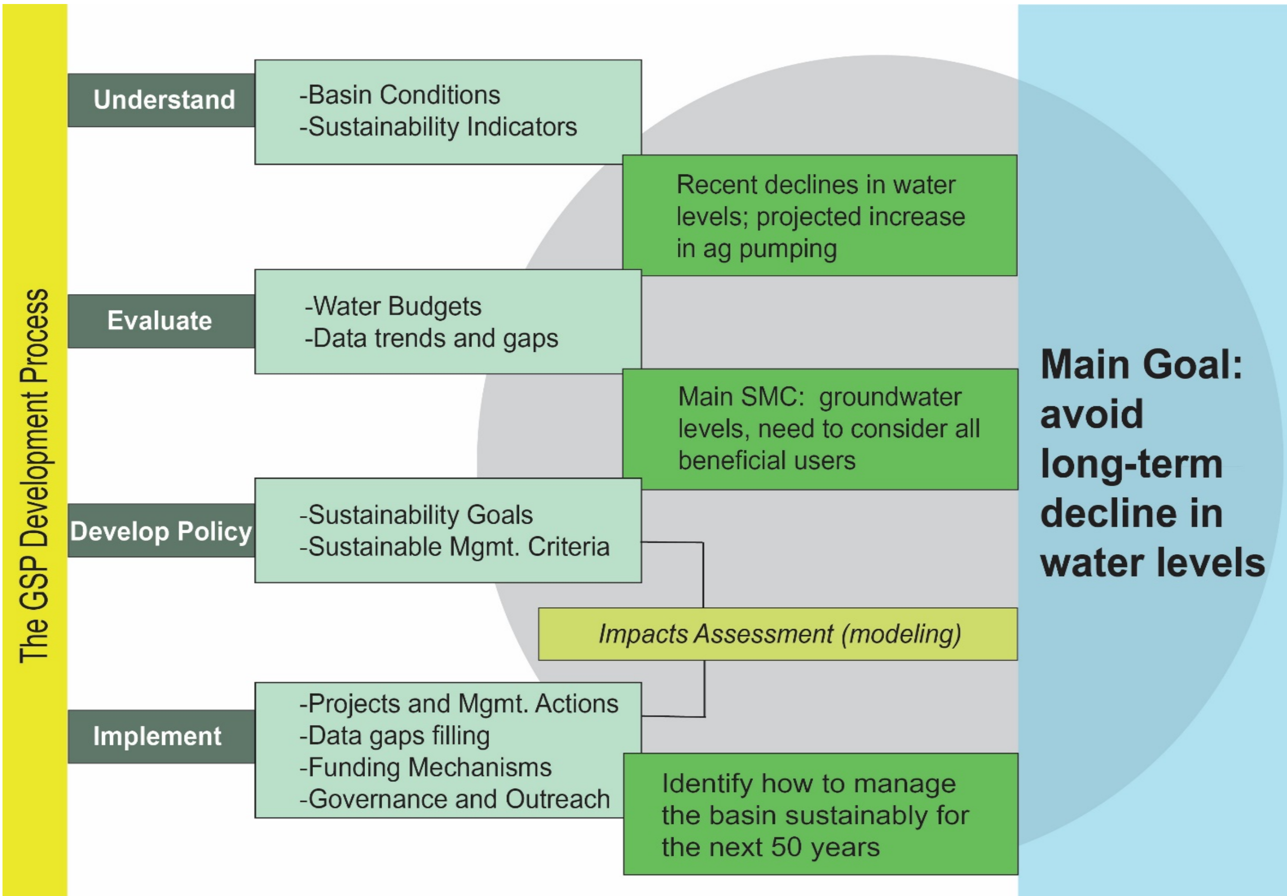

Figure ES-3. Corning GSP Development Approach and Goals

Water use in the Subbasin is largely for agricultural irrigation, which uses over 90% of the Subbasin's water supply. Groundwater historically makes up about 75% of the irrigation water supply and surface water contributes approximately 25%. Many growers within water districts are switching their supply from surface water to groundwater due to cost and supply reliability factors. Perennial orchards have expanded, replacing annual crops and previously uncultivated land. Increased groundwater use and dry conditions have led to a general groundwater level decline, particularly in the last decade and in portions of the Subbasin where groundwater is used extensively for irrigation and is not recharged by the Sacramento River or other creeks, such as in the western portion of the Subbasin. The decline has caused shallower wells to go dry and increased costs to access groundwater from greater depths.

Increased water use efficiency is key in preventing a continuation of the recent declines in groundwater levels and associated impacts, particularly with a projected increase in irrigated farmland and agricultural groundwater pumping along with projected climate change. Achieving groundwater sustainability will require the GSAs, in collaboration with other water and conservation agencies in the Subbasin, to implement multi-benefit collaborative projects and management actions across water resources (conjunctive use), where surface water is used when available so that groundwater levels can recover during wet periods and can be pumped during drought periods when surface water supplies are not available.

Preparation of this GSP is the first step for the GSAs to achieve groundwater sustainability in the Corning Subbasin. To evaluate progress toward groundwater sustainability during implementation, annual reports and 5-year updates to the GSP will be prepared as required by SGMA. The GSAs recognize that sustainability is only possible with support of stakeholders and coordination of local, state, and federal agencies and the managed use of both surface and groundwater resources. The GSAs will collaborate with local stakeholders on a continual basis to develop local best practices for water management and projects and management actions to achieve sustainability. The GSAs will seek assistance for financial and technical support from the DWR, the United States Bureau of Reclamation (USBR), and other entities to help with the financial burden imposed by the monitoring and management requirements of the Plan.

ES-1 INTRODUCTION AND AGENCY INFORMATION (GSP SECTION 1)

The introduction section describes in detail the GSAs' organization and management structure and each agency's specific authorities granted by SGMA. The GSAs shown on Figure ES-1 include the Corning Sub-basin GSA (CSGSA) and the Tehama County Flood Control and Water Conservation District (TCFCWCD). The CSGSA is the exclusive GSA for the Glenn County portion of the Subbasin and consists of 3 individual agencies that formed a GSA under a Memorandum of Agreement: Glenn County, Glenn-Colusa Irrigation District (GCID), and the Monroeville Water District. The TCFCWCD is the exclusive GSA for the portion of the Subbasin within Tehama County.

The GSAs signed a Memorandum of Understanding (MOU) to collaboratively prepare and implement the GSP while maintaining autonomy of the individual members. The MOU established the Corning Subbasin Advisory Board (Advisory Board) to receive and review groundwater sustainability planning information during the GSP planning process. The Advisory Board Member Directors made recommendations to the GSAs for the key Plan elements, as GSP decision-making authority ultimately resided with the Member's governing bodies.

ES-2 DESCRIPTION OF PLAN AREA (GSP SECTION 2)

The Subbasin lies within the northwestern portion of the Sacramento Valley hydrologic region, covering an area of 207,342 acres of which about 78% is within Tehama County and 22% within Glenn County. The Subbasin comprises the City of Corning and the census-designated places of Richfield and Hamilton City. The Paskenta Band of Nomlaki Indians is a federally recognized tribe with jurisdiction over the Paskenta Band of Nomlaki Indians Reservation (Paskenta Reservation).

The Subbasin extent is defined by a combination of geologic, hydrologic, and jurisdictional boundaries including the Coast Range to the west, Thomes Creek to the north, Sacramento River to the east, and generally Stony Creek to the south. The Subbasin is bounded by 5 neighboring Sacramento Valley subbasins for which GSPs are concurrently being developed.

Land use in the Subbasin is primarily agricultural, either for non-irrigated rangeland or irrigated farmland. Rangeland is generally used for seasonal cattle grazing. Within the irrigated lands, the most common crops are fruit and nut orchards, row crops, field crops, and pasture. Other prominent land uses include urban and rural residential, and open space or conservation land. Most of the irrigated farmland and residential land is east of Interstate 5 (I-5), although in recent decades agricultural development has expanded west of I-5. Urban land use is concentrated in the City of Corning and Hamilton City. Other residential and commercial centers are found in Richfield and the Paskenta Reservation. Rural residences are scattered throughout the Subbasin. State and federally managed conservation land is found along much of the Sacramento River riparian corridor and non-irrigated rangeland and open space covers large portions of the western Subbasin.

Primary water uses in the Subbasin are agriculture irrigation, public water supply, private domestic water supply, and industrial food processing. Based on average water use inventories for 2000 to 2015 in Glenn County and 2000 in Tehama County, average water use is about 210,000 acre-feet per year (AF/yr), with 90% or 195,000 (AF) used for irrigation. Groundwater supplies about 75% or 157,000 AF/yr of average water used for irrigation, urban, private domestic, and industrial supply. Most of this pumping is for irrigation, with about 5,000 AF/yr for public supply and other uses. Surface water provides about 50,000 AF/yr for irrigation and about 3,000 AF/yr is reused from agricultural drains and canal tailwater.

Surface water is available through U.S. Bureau of Reclamation (USBR) contracts via the Central Valley Project (CVP), and the Orland Project. The Corning and Tehama-Colusa CVP canals convey surface water from the Sacramento River diversion in Red Bluff and are operated by the Tehama-Colusa Canal Authority (TCCA). The agencies with CVP surface water rights on the TCCA canals include the Corning Water District (WD), Thomes Creek WD, and Kirkwood WD. The Orland Unit Water Users Association (OUWUA) utilizes pre-CVP Orland Project water rights from Stony Creek for irrigation through dam releases by the USBR at the Black Butte Dam. Although GCID's primary diversion on the Sacramento River is in the Subbasin near Hamilton City, all of the water diverted is used in the Colusa Subbasin to the South. The agricultural water providers and surface water conveyance canals are shown on Figure ES-4.

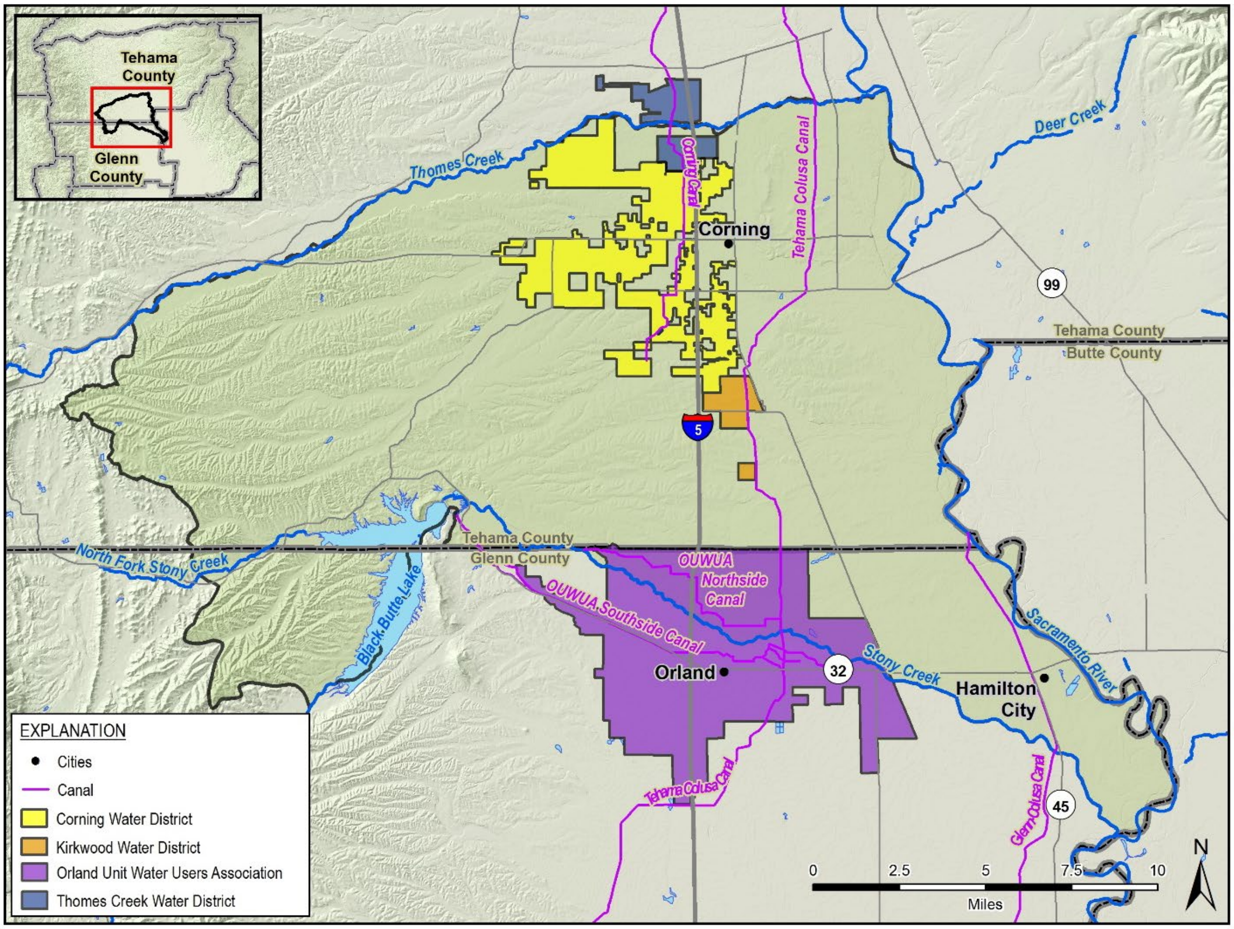

Figure ES-4. Agricultural Water Providers and Surface Water Conveyance in the Subbasin

Since the 2012-2016 drought, areas historically irrigated with surface water have been increasingly irrigated with groundwater. Factors that led to this conversion include decreased availability of CVP water supply during droughts, increased cost of surface water, investments made in groundwater well development, flexibility of groundwater use, surface water delivery systems that prevent on-demand irrigation, and cropping changes. All these factors have led to water districts not using all of their allocated surface water. In addition, some districts have sold some of their existing allocations back to the CVP to repay infrastructure costs.

Both Glenn and Tehama counties developed pre-SGMA groundwater management plans to establish regional groundwater level management goals in agricultural areas of the Counties. These plans established the well networks for monitoring groundwater levels and triggers tied to groundwater levels. It became apparent that GSPs would have an impact on these management plans, and although no specific communications have transpired, it seems reasonable to assume the County's groundwater management plans will be replaced by GSPs. The Counties also led the efforts to comply with the California Statewide Groundwater Elevation Monitoring (CSAGEM) program, now being replaced by the GSP monitoring program.

Additional monitoring networks exist to meet the requirements of regional and state regulatory programs. Existing monitoring networks and programs that collect data relevant to the GSP include the following:

- Municipal, small water system, and other groundwater quality monitoring overseen by the State Water Resources Control Board (SWRCB) and Central Valley Regional Water Resources Control Board (CVRWQCB)
- Regional subsidence monitoring data collected by DWR including a network of survey monuments periodically monitored in collaboration with the Counties, satellite data, and one well extensometer
- Stream stage and discharge monitoring performed by the USBR, the United States Army Corps of Engineers (USACE), and DWR

Other Glenn and Tehama County planning resources considered in development of the GSP include flood control portions of Hazard Mitigation Plans, existing water resource ordinances, well permitting policies, and General Plans. Local and regional planning resources reviewed to develop the GSP included the City of Corning General Plan, local Urban and Agricultural Water Management Plans, the Northern Sacramento Valley Integrated Regional Water Management Plan, and existing groundwater quality regulatory programs.

The GSP was developed through a robust and collaborative planning effort between the GSAs, technical consultants, Advisory Board, and stakeholders with groundwater and sustainability interests in the Subbasin. A Communications and Engagement Plan documents the extensive public outreach efforts for development of this GSP and identifies the beneficial uses and users of groundwater in the Subbasin, including the threatened and endangered species that rely on groundwater-dependent ecosystems and the locations of disadvantaged communities by census block.

ES-3 BASIN SETTING (GSP SECTION 3)

The Basin Setting describes the hydrogeologic conceptual model (HCM) and summarizes groundwater conditions in the Subbasin. The HCM "provides an understanding of the general physical characteristics related to regional hydrology, land use, geology, geologic structure, water quality and aquifers" (DWR, 2016). The groundwater conditions subsection summarizes the current (after January 1, 2015) and historical conditions (before January 1, 2015) relevant to the GSP.

Subbasin geologic stratigraphy is marked by distinct deposition of marine and continental sediments. Marine formations were deposited early in the Subbasin's history, from the Jurassic through the Miocene. During this period, the majority of northern Sacramento Valley was a marine basin formed via action of the Pacific-North American plate subduction zone. Continental sedimentary formations were deposited in the Subbasin by alluvial and volcanic processes from the Pliocene onward, as uplift of the Coast Ranges created the Sacramento Valley as it stands today. The plate subduction processes shaped the local topography and subsurface geologic layers through faulting and folding of the geologic formations.

Water supply wells in the Subbasin are installed in coarse-grained sand and gravel layers within a fine-grained sedimentary matrix. There are no regionally extensive fine-grained layers or aquitards that prevent vertical flow of groundwater between geologic formations. This description is consistent with the definition of a principal aquifer in the GSP Regulations: "*…systems that store, transmit, and yield significant or economic quantities of groundwater to wells, springs, or surface water systems*". For this reason, the Subbasin is best described for the purposes of the GSP as a single principal aquifer, comprised of inter-fingered geologic units.

This hydrogeologic description of the Subbasin aquifers is consistent with the 3 geologic formations that comprise the principal aquifer are, from shallowest to deepest:

1. Quaternary Alluvium - recent sedimentary deposits that form a relatively thin veneer on top of underlying Tehama Formation; local variation in sediment composition results in drainage and groundwater recharge through high permeability sediments and perching and runoff over low permeability sediments.
2. Tehama Formation – consolidated sandstone and siltstone deposited in a floodplain environment from west (Coast Range) to the east. The coarse-grained sandstone layers are the primary source for groundwater pumping in the Subbasin.
3. Tuscan Formation – consolidated volcanic-sedimentary deposits formed by volcanic debris flows and reworked by streams flowing from the east (Cascades) to the west. The coarse-grained layers are a major source of groundwater pumping regionally but are limited in extent in the Subbasin and only found east of I-5. The Tuscan and the Tehama

Formations are inter-fingered within the Subbasin as they were deposited over the same geologic timeframe.

The base of the principal aquifer is defined as the base of the freshwater Tehama and Tuscan formations which varies between about 500 and 2,000 feet deep. Deeper sediments found below the Tehama and Tuscan Formations are not typically used as a water supply. These formations, including the Princeton Valley Fill and Great Valley Sequence, contain marine-deposited meta-sedimentary rocks that produce brackish and saline groundwater, respectively. In the western portion of the Subbasin, where these formations are closer to land surface, they may contribute to higher salinity in domestic and agricultural supply wells.

Groundwater is pumped from wells screened in the 3 formations of the principal aquifer. In general, domestic wells are installed at depths shallower than 450 feet below ground surface (bgs) in the Quaternary Alluvium and Tehama Formation, pumping at low but relatively constant rates. Irrigation wells are larger and deeper than domestic wells, pump at greater rates, and are mainly pumped during the irrigation season from April to October. The relatively few municipal supply wells that supply the City of Corning and Hamilton City (11 total wells) have similar designs to irrigation wells, though unlike irrigation wells, are pumped year-round. Many production wells have long screen intervals, or multiple screen intervals that intersect multiple geologic formations and productive layers of the aquifer.

Major surface water bodies in the Subbasin include the Sacramento River, Stony Creek, and Thomes Creek. The Sacramento River and Stony Creek are dammed and managed by USBR for irrigation supply and for flood control by USACE. In addition, the Sacramento River flows released at Shasta Dam are controlled to keep water temperature lower to accommodate fish. Thomes Creek and smaller ephemeral streams found within the Subbasin are not a significant source of water supply due to their intermittent nature and lack of storage reservoirs.

The Sacramento River and the two creeks are interconnected with groundwater at some locations and at certain times of the year. The Sacramento River and the other creeks, to a lesser extent, provides a significant source of groundwater recharge to the alluvial aquifer. Surface water flow and recharge of groundwater aquifers is greatest in the winter and spring when precipitation is highest; flow in the river and creeks in the summer and fall dry season is generally supported by baseflow from groundwater and very little groundwater recharge occurs.

Data gaps identified in the HCM that will be addressed with additional studies during GSP implementation include the following:

- **Western Boundary of the Subbasin:** there is some uncertainty as to the western boundary of the alluvial basin, as there is anecdotal evidence that some wells in this portion of the Subbasin are drilled into fractured rock and not the alluvial aquifer.

- **Tehama-Tuscan Transition Zone:** The geologically complex environment created by the cotemporaneous deposition of the Tehama and Tuscan Formations is not completely understood and further investigations could be used to refine the groundwater model that supports the GSP.

- **Hydrogeologic Parameters:** Existing knowledge of aquifer parameters is limited for some of the Subbasin's formations, namely the Tuscan and Tehama Formations. Refinement of aquifer properties could improve calibration of the groundwater modeling that supports the GSP

Groundwater conditions for each of the 6 SGMA sustainability indicators are described below:

Groundwater Elevations – Groundwater level data collected from the 1920s to the 2000s reflect a long-term stable groundwater level trend, with groundwater level declines in dry period followed by recovery during wet periods. Since the early 2000s, most wells in the Subbasin show a general groundwater level decline, particularly in the last decade and in portions of the Subbasin where groundwater is used extensively for irrigation and is not recharged much by surface water. A representative hydrograph showing groundwater levels in a well over time is shown on Figure ES-5.

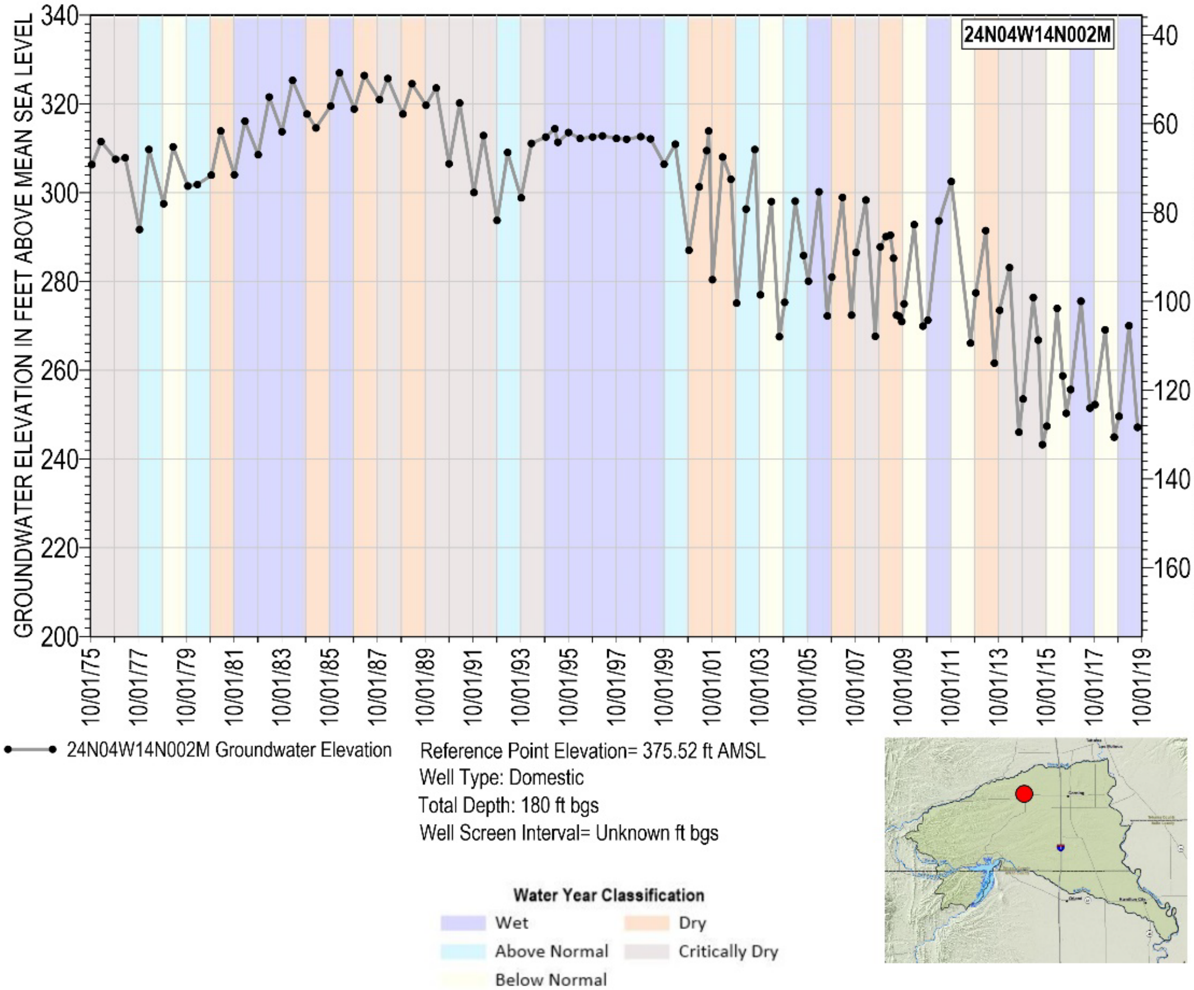

Figure ES-5. Representative Groundwater Level Hydrograph

Due to increasing water demands, groundwater levels are 40 feet lower than they were in the early 2000s in some areas, with the greatest declines found in the northern and western portions of the Subbasin. In the southern portion of the Subbasin where surface water supplies are more reliable and groundwater is recharged by Stony Creek, groundwater levels are relatively stable. Similarly, closer to the Sacramento River in the eastern portion of the Subbasin, groundwater levels are also stable. Seasonal groundwater level fluctuation on the order of 10 to 30 feet occurs in most wells, with seasonal highs around March/April and seasonal lows around October. Long-term groundwater level trends are consistent at various depths in the principal aquifer.

Change in Groundwater Storage – Change in groundwater storage is directly related to change in groundwater levels. Historically, the water levels fluctuated seasonally, and average change in storage over time was positive. Since 2000, groundwater levels have a net decline across portions of the Subbasin, causing an annual loss of groundwater in storage. Change in groundwater storage is estimated using the groundwater model developed for the GSP. The annual average change in groundwater storage simulated by the groundwater model between 2000 and 2015 is about 7,600 AF/yr, resulting in a cumulative net loss of 114,500 acre-ft. More information on groundwater storage is provided in Section 4 water budgets.

Subsidence – Land subsidence refers to the gradual lowering or sudden sinking of the land surface and if allowed to occur may impact critical infrastructure such as roads, bridges, irrigation canals, and wells. Aquifer-system compaction can occur in certain sedimentary basins where more groundwater is withdrawn than is being replenished, causing dewatering of sediments. Dewatering depressurizes the aquifer skeleton and compacts clay layering, leading to decline in the ground surface. There are many factors that can contribute to land subsidence, though per the GSP Regulations only inelastic, or irreversible, subsidence caused by groundwater pumping is the responsibility of the GSAs. Subsidence data collected during 2004 to 2017 land surface elevation surveys, since 2015 by satellite, and since 2004 at a single extensometer installed in a monitoring well have largely indicated that minimal inelastic subsidence has occurred to date. However, the southern portion of the Subbasin near Orland has some risk of future subsidence based on measured subsidence to the south in the Colusa Subbasin that is correlated with up to 50 feet of groundwater level decline since 2005.

Sacramento Valley-wide change in land surface elevation data from the Corning Subbasin between 2008 and 2017 was generally small, with one outlying measurement of 0.3 foot on the Colusa Subbasin border near Orland. Review of Interferometric Synthetic-Aperture Radar (InSAR) satellite data measured in the Subbasin since 2015 is also minimal, with cumulative subsidence of less than or equal to 0.1 foot throughout the Subbasin between 2015 and 2019. There have been no impacts to infrastructure reported in the Subbasin related to land surface subsidence.

Groundwater Quality – Groundwater quality in the Subbasin is typically very good and is suitable for all beneficial uses. Overall, the Subbasin relies on groundwater that generally meets or exceeds primary and secondary drinking water quality standards, or maximum contaminant levels (MCLs) established by the SWRCB.

- Anthropogenic contamination of groundwater is not extensive in the Subbasin with only a few known contaminant releases from dry cleaners, gas stations, and other industrial sites in urban areas. The assessment and remediation of these sites is being overseen by the CVRWQCB or other agencies.
- The primary non-point source constituents of concern in the Sacramento Valley are salinity and nitrate. Recent regional groundwater quality data from the Subbasin reflects that regional groundwater quality is generally high quality and suitable for all beneficial uses:
    - Elevated salinity in groundwater generally occurs from natural hydrogeologic factors, such as leaching from marine sediments on the Coast Range, and can be related to accumulation and flushing of salts from soil due to irrigation. Salinity is commonly measured in drinking water wells using total dissolved

solids (TDS). TDS has a lower secondary MCL (SMCL) of 500 milligrams per Liter (mg/L) and upper SMCL of 1,000 mg/L related to taste and odor, rather than health concerns. TDS concentrations in groundwater supply wells is less than the SMCL. There is a lack of salinity data collected in the western portion of the Subbasin; regional data suggests that TDS between the lower and upper SMCLs may be present because of shallower depths of the underlying marine-deposited sediments below the principal aquifer at the margins of the valley.

  - Nitrate in groundwater is typically anthropogenic and can originate from nitrogen fertilizers, dairy farms, and septic systems. The nitrate MCL is health-based and is 10 mg/L as nitrogen, which is equivalent to 45 mg/L as nitrate as it is sometimes reported. Recent nitrate detections above the health-based regulatory standard are limited to monitoring wells at point source contaminant sites and a single Irrigated Lands Regulatory Program (ILRP) domestic well to the northwest of the City of Corning. Nitrate concentrations are well below the MCL in public supply wells.

- Arsenic is commonly found throughout California due to its natural occurrence in some geologic formations. The health-based-arsenic MCL of 0.01 mg/L is low, making it a common risk driver. Arsenic is commonly detected in some wells in the Subbasin but is almost always at low concentrations and is below the MCL in public supply wells.

Interconnected Surface Water – Surface water connected to the groundwater system is referred to as interconnected surface water. If adjacent groundwater elevations are higher than the stream's water level, the stream is referred to as a gaining stream because it receives water from a connected aquifer. If groundwater elevations are lower than the water level in the stream, it is termed a losing stream because it loses water to the connected aquifer. If the groundwater elevation is below the streambed elevation, the stream and groundwater are considered to be disconnected. SGMA does not require that permanently disconnected stream reaches be managed. Interconnected surface water impacts prior to SGMA enaction in 2015 do not need to be addressed by the GSP. Interconnected surface water is assessed using the groundwater model discussed in Section 4 and in Appendix 4C, stream discharge measured at stream gauges, and groundwater levels in shallow wells near interconnected stream reaches.

The Subbasin's 3 major rivers and creeks are variably connected to groundwater. Areas of known interconnections between surface water and groundwater are described below:

- The Sacramento River is generally connected to shallow groundwater across the Northern Sacramento Valley Region. The Sacramento River is usually gaining, with groundwater discharging as baseflow into the River in most of the river reach along the eastern boundary of the Subbasin. In periods of high river flows and in areas with lower groundwater elevations than the stream stage, the River provides an important source of groundwater recharge to the Subbasin.

- Thomes Creek runs dry seasonally in much of the Subbasin and is mostly disconnected from groundwater as the groundwater level is much deeper than the creek bed. Where connected to groundwater closer to the Sacramento River, the creek generally recharges, or loses water to groundwater.
- Stony Creek is generally gaining baseflow from groundwater in the OUWUA service area where surface water is used for irrigation and is losing or recharging groundwater downstream of the OUWUA service area where groundwater is used for irrigation. Irrigation with surface water in-lieu of groundwater pumping by OUWUA growers both recharges the transmissive alluvial fan with applied water and avoids groundwater level declines caused by groundwater pumping. Further downstream where groundwater is the sole source of irrigation water supply, Stony Creek is an important source of groundwater recharge due to generally losing conditions induced by deeper groundwater levels.

Groundwater-Dependent Ecosystems (GDEs) - Although not a sustainability indicator, identification of groundwater-dependent ecosystems is required by §354.16(g) of the GSP Regulations for assessing interconnected surface water. GDEs are ecosystems with root systems that access shallow groundwater for sustenance and can only typically reach a maximum rooting depth of 30 feet. GDEs are present in the Subbasin, supported by groundwater at depths less than 30 feet below ground surface in close proximity to the Sacramento River and in the southeastern portion of the Subbasin near Hamilton City. Shallow groundwater is found in some portions of the Subbasin where ephemeral Burch Creek and Hall Creek merge before flowing into the Sacramento River; this could be due to perched groundwater fed by surface water runoff in this area.

Seawater Intrusion – The Corning Subbasin does not border any oceanic or deltaic environments and therefore seawater intrusion is not an applicable sustainability indicator.

Data gaps identified in the historical and current groundwater conditions that will be addressed with installation of monitoring sites and/or additional data collection during GSP implementation include the following:

- Groundwater elevation and quality data is limited in some areas of the Subbasin, mainly in the western portion of the Subbasin and along Thomes Creek
- Stream flows are not well measured on Thomes Creek

ES-4 WATER BUDGET (GSP SECTION 4)

Water budgets provide an accounting and assessment of the total annual volume of groundwater, surface water, and precipitation entering and leaving the Subbasin. The water budgets are compiled over 3 time periods depicted on Figure ES-6 and simulated with the integrated hydrologic model developed for this GSP. For the current water budget, the 2018 land use in Tehama County, 2015 land use in Glenn County, and 2015 water use is held constant over the entire simulation period and applied to the historical hydrology. For the projected water budget, DWR-developed climate change scenarios were used to replace the climate and hydrology in the historical model.

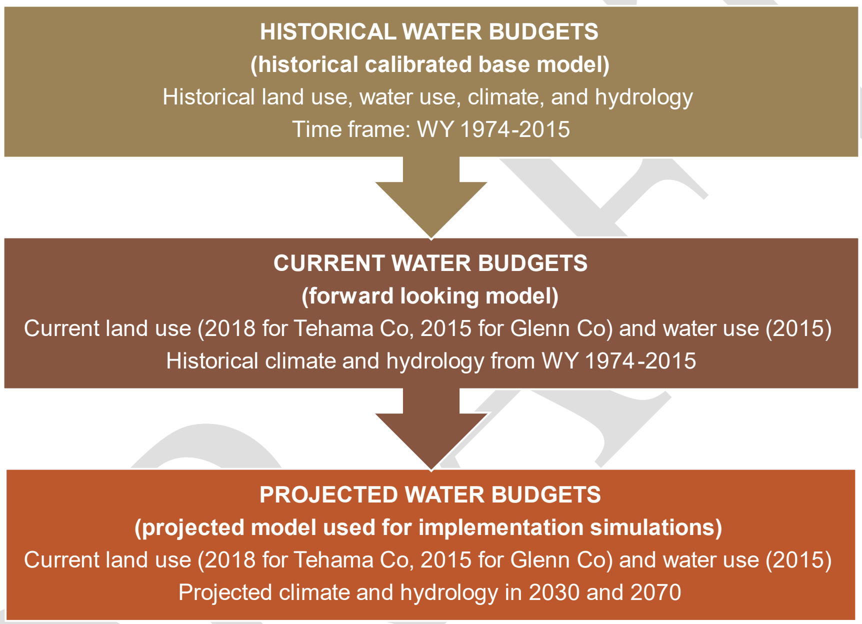

Figure ES-6. Water Budget Timeframes

The GSP Regulations require a surface water budget and a groundwater budget in addition to a total Basin-wide water budget. This GSP also describes a land-surface budget to evaluate water demands and sources of water to meet agricultural irrigation. Each water budget provides important information on relative contribution of each component to the overall water budget. When comparing the results from each of the time frames, potential trends in water budget gains and losses can be established for future groundwater management.

The groundwater budget summarizes total groundwater pumping and change in groundwater storage both annually and cumulatively over the full simulation period. The land surface budget provides information on the total water demand and relative use of surface water versus groundwater. The surface water budget primarily quantifies stream interactions with groundwater depletions. In this Subbasin, streams delineate the boundary with other subbasins which creates uncertainties in the Subbasin estimate of stream depletion due to actions in neighboring subbasins. Water budget simulation results are summarized as annual average pie charts shown on Figure ES-7.

Key take-aways from the detailed water budgets are:

- The historical average annual gain of groundwater in storage is 6,900 AF, which shows the Subbasin is generally in balance over the historical time period. The Subbasin displays a cumulative[1] gain in groundwater storage of 290,300 AF over the historical simulation period (1974-2015).
- An increase in irrigated farmland and decrease in surface water deliveries causes groundwater pumping for irrigation to increase over time. Average annual agricultural pumping increased by about 20,700 AF from the historical (132,300 AF/yr) to current simulation (153,000 AF/yr) and is projected to continue to increase in the future compared to current conditions, from 6,300 AF in 2030 (159,300 AF/yr) to 14,300 AF in 2070 (167,300 AF/yr).
- Cumulative and annual change in groundwater storage is slightly declining in the current water budget compared to the historical water budget; therefore, if water management stays the same, the Subbasin may continue to experience storage declines and water level declines and an overall worsening of conditions compared to historical conditions.
    - The average annual gain in groundwater in storage in the current simulation decreases in comparison to the historical timeframe, driven mainly by decreases in surface water availability. The annual average change in storage in the current simulation is 5,800 AF less than the historical period (Figure ES-7). This results in a cumulative gain of groundwater in storage of 56,100 AF over the 50-year simulation period, which is 234,200 AF less than for the historical groundwater budget.
    - Projected water budgets have further reductions of groundwater in storage compared to the current water budget with 700 AF/yr less storage on average in the 2030 simulation and 1,500 AF/yr less storage on average in the 2070 simulation. This results in a cumulative decrease of groundwater in storage of 34,900 AF in the 2030 projection and 75,800 AF in the 2070 projection. The 2070 projected water budget has a cumulative loss of groundwater in storage of 19,700 AF over the 50-year projected period, which is indicative of an imbalanced water budget.

[1] total annual change in storage over the simulation time frame

- The current, 2030, and 2070 water budgets have increasingly less groundwater discharge to streams and more streambed recharge to groundwater, indicating that progressively lowered groundwater elevations in the future may draw more water from the Subbasin's streams and contribute less groundwater baseflow in return.
- Overall observations on historical, current, and future baseline groundwater budgets:
    - Historical: Subbasin is generally in balance but the trend is downward in recent decades.
    - Current (if all things stay the same): Somewhat declining trend in groundwater levels due to increased pumping and decreased surface water deliveries. Overall a bit worse than historical.
    - Projected baseline with climate change: The Subbasin begins to experience continual imbalance, particularly in the 2070 projection; will probably need to implement projects and management actions to maintain groundwater levels.

The sustainable yield per the GSP Regulations is the volume of groundwater that can be pumped without causing undesirable results. Since undesirable results for the Sustainable Management Criteria (SMC) defined in Section 6 were not shown to occur in the 2070 simulation, this projection was used to define the sustainable yield. The annual average loss in storage in this simulation is 400 AF, so this volume of overdraft was subtracted from the average annual pumping of 172,200 AF, resulting in a sustainable yield of approximately 171,800 AF of groundwater pumping per year.

Simulated projected water budgets, along with sustainability indicator monitoring and SMC evaluation, will provide verification of sustainability during GSP implementation.

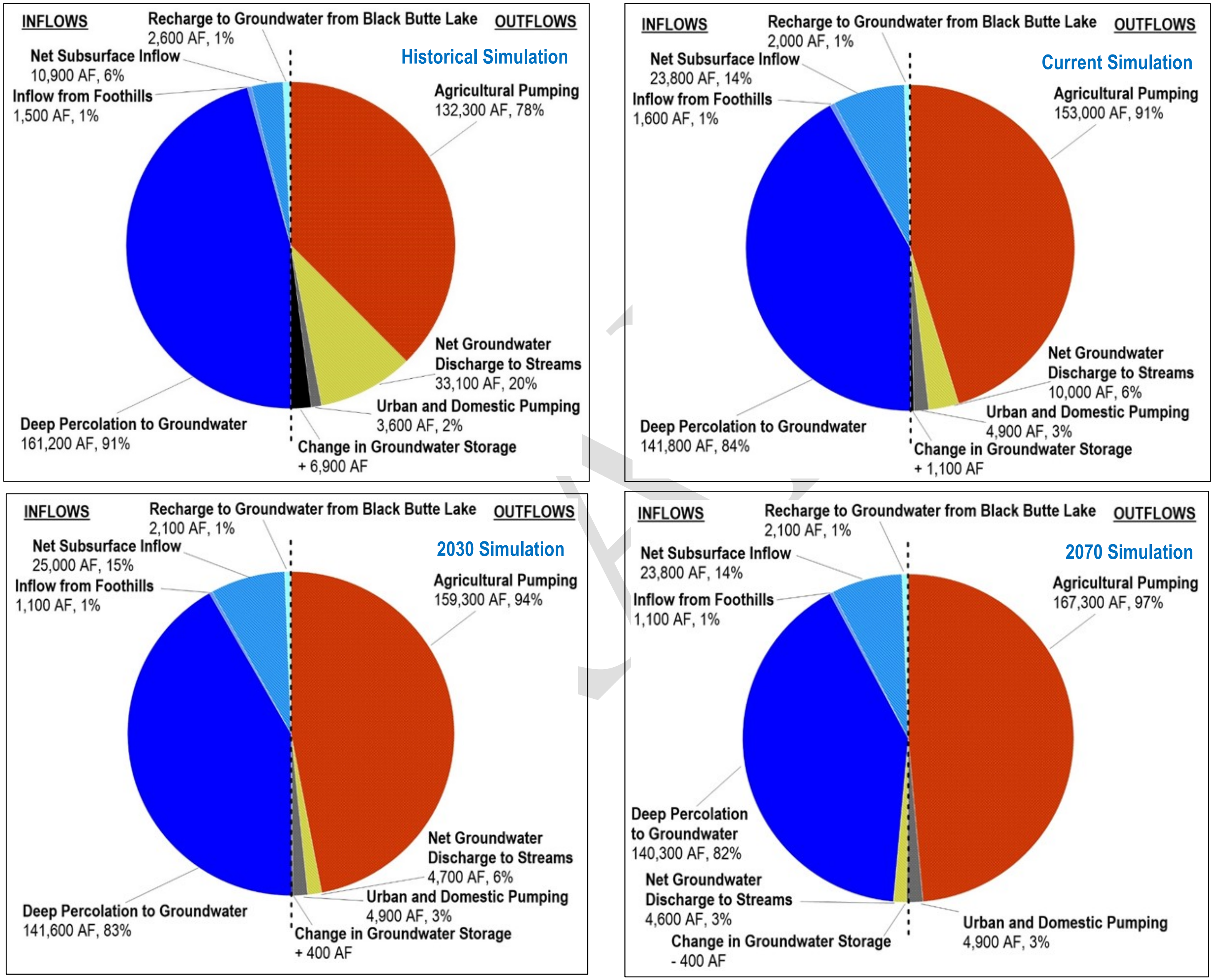

Figure ES-7. Groundwater Budget Pie Charts

ES-5 MONITORING NETWORK (GSP SECTION 5)

Monitoring networks are developed to promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater conditions in the Subbasin and to evaluate changing conditions that occur as the Plan is implemented. The GSP establishes monitoring networks for each of the 5 relevant sustainability indicators based on existing monitoring sites, with groundwater levels being used as a proxy to assess reduction of groundwater storage and depletion of interconnected surface water. For some sustainability indicators, it is necessary to expand existing monitoring systems to more effectively monitor conditions in all areas used for groundwater supply. Filling data gaps and developing more extensive and complete monitoring systems during GSP implementation will improve the GSAs' ability to demonstrate sustainability and help refine the HCM and groundwater model.

- **Groundwater Elevations** are actively measured in 102 designated monitoring wells which form a sufficient network to demonstrate groundwater occurrence, flow directions, and hydraulic gradients between the principal aquifer and surface water features. The 102 well GSP monitoring network includes 94 wells in the existing DWR CASGEM network and 8 new observation wells installed by DWR in 2021 to help Glenn and Tehama County fill data gaps for GSP groundwater level monitoring. The GSAs identified 58 representative monitoring points (RMPs) out of the 102 total wells for assessing the chronic lowering of groundwater level SMC during GSP implementation.
- **Groundwater Storage** is measured using groundwater levels as a proxy at chronic lowering of groundwater level RMP wells, and will be reevaluated every 5 years with the updated groundwater model.
- **Land Subsidence** data have historically been collected from a network of 20 survey monuments and 1 extensometer in the Subbasin. For SGMA implementation, DWR has also made available InSAR satellite data for subsidence analysis. The Subbasin will rely on the InSAR monitoring network as the RMP to assess sustainability during GSP implementation. Supplemental subsidence data from other networks will be collected and reviewed when available.
- **Groundwater Quality** is historically evaluated through a variety of groundwater quality programs, mainly overseen by the CVRWQCB, DWR, and county entities. Recent monitoring data are available from 28 public supply wells, 22 DWR observation wells, 1 ILRP supply well, 4 Dairy Program wells, 4 Glenn County irrigation supply wells, and from 6 environmental assessment and/or remediation sites. SMC for groundwater quality are based on TDS concentrations in public supply wells, so only public supply wells that are monitored for TDS are included in the groundwater quality RMP network. Other groundwater quality monitoring data collected in the Subbasin will be reviewed as available to support understanding of regional groundwater quality, although these

locations will not be used to formally assess sustainability. The GSAs will rely on other agencies to enforce ongoing regulatory programs to monitor and address point source and ambient groundwater quality impacts.

- **Interconnected Surface Water** depletion will be assessed using groundwater levels as a proxy, using a subset of the water level RMP wells that are near streams. Streamflow depletion can increase as groundwater levels decrease due to pumping. Stream stage and discharge data from stream gages will also be analyzed, although it will not be used to formally assess sustainability.

The GSAs have developed a Data Management System (DMS) to store, review, and upload data collected as part of GSP development and implementation. The Corning Subbasin DMS comprises an Access database and an initial ArcGIS Online web mapping application, including monitoring network well locations, groundwater level contours, and other data related to the GSP development process. The GSAs collaborated with Tehama County and Glenn County on the design of the DMS, web mapping application, and on the data upload process.

ES-6 SUSTAINABLE MANAGEMENT CRITERIA (GSP SECTION 6)

Sustainable Management Criteria (SMC) define the conditions that constitute sustainable groundwater management designed to achieve the locally defined sustainability goal:

> The sustainability goal of the GSP is to ensure sufficient and affordable water of good quality be available on a sustainable basis to meet the unique needs of agricultural, residential, municipal, industrial, recreational, and environmental users within the Corning Subbasin, both now and in the future. The GSAs recognize that sustainability can only be possible with the support of the public and coordination of local, state, and federal agencies and the utilization of both surface and groundwater resources.

The SMC were developed using publicly available information, feedback gathered during public meetings, and recommendations from GSA staff and CSAB members. A description of the SMC for each of the 5 applicable sustainability indicators is included in Table ES-1. Each sustainability indicator includes metrics for the following SMC:

- **Minimum thresholds** – specific, quantifiable values for each sustainability indicator used to define undesirable results *(i.e., indicators of unreasonable conditions that should not be exceeded)*
- **Measurable objectives** – specific, quantifiable goals that provide operational flexibility above the minimum thresholds *(i.e., goals the GSP is designed to achieve)*
- **Interim milestones –** target values representing measurable groundwater conditions, in increments of five years (*i.e., checkpoints to assess progress relative to the measurable objectives*)
- **Undesirable results** – quantitative combinations of minimum thresholds

These metrics were developed from the basis of what is locally defined as significant and unreasonable conditions for each sustainability indicator, as described in Section 6. The SMC detailed in Table ES-1 define the Subbasin's future conditions and commit the GSAs to actions that will meet these objectives. In general, the SMC are designed to maintain conditions similar to current conditions, while providing some flexibility to account for changes in climate and water availability in the future. The GSP addresses the impacts and benefits of meeting the SMCs on the beneficial uses and users of groundwater, including irrigation, public supply, domestic supply, and environmental uses both in the Subbasin and in neighboring Subbasins.

Table ES-1. Sustainable Management Criteria Summary

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Interim Milestones	Undesirable Result
Chronic lowering of groundwater levels	Annual fall groundwater elevation measured in representative monitoring well network by County or DWR.	Stable wells: Minimum fall groundwater elevation since 2012 minus 20-foot buffer. Declining wells: Minimum fall groundwater elevation since 2012 minus 20% of minimum groundwater level depth.	Stable wells: Maximum fall groundwater elevation since 2012 Declining wells: Maximum fall groundwater elevation in 2015	Linear trend between current conditions and measurable objective.	20% of groundwater elevations measured at RMP wells drop below the associated minimum threshold during 2 consecutive years. If the water year type is dry or critically dry then levels below the MT are not undesirable if groundwater management allows for recovery in average or wetter years.
Reduction in groundwater storage	Using groundwater levels as a proxy - same as chronic lowering of groundwater levels network.	Amount of groundwater in storage when groundwater elevations are at their minimum threshold– since groundwater levels are used as a proxy, same as chronic lowering of groundwater levels minimum thresholds.	Amount of groundwater in storage when groundwater elevations are at their measurable objective – since groundwater levels are used as a proxy, same as chronic lowering of groundwater levels measurable objectives.	Same as chronic lowering of groundwater levels.	Same as chronic lowering of groundwater levels.
Degraded groundwater quality	Annual total dissolved solids (TDS) measured by water providers at public supply wells in the Subbasin.	TDS concentration of 750 mg/L at public supply wells.	California lower limit SMCL concentration for TDS of 500 mg/L measured at public supply wells.	Identical to current conditions	At least 25% of representative monitoring sites exceed the minimum threshold for water quality for two (2) consecutive years at each well where it can be established that GSP implementation is the cause of the exceedance.
Land Subsidence	Inelastic land subsidence measured by InSAR data available from DWR, and periodic measurements at the survey monuments	No more than 0.5 foot of cumulative subsidence over a five-year period (beyond the measurement error), solely due to lowered groundwater elevations	Zero inelastic subsidence, in addition to any measurement error. If InSAR data are used, the measurement error is 0.1 ft and any measurement of 0.1 ft or less would not be considered inelastic subsidence.	Identical to current conditions	Any exceedance of a minimum threshold that is irreversible and caused by lowering groundwater elevations.
Depletion of interconnected surface water	A subset of shallow wells used for the chronic lowering of groundwater levels, of DWR observation wells near streams.	Same as chronic lowering of groundwater levels.	Same as chronic lowering of groundwater levels.	Same as chronic lowering of groundwater levels.	Same as chronic lowering of groundwater levels.

ES-7 PROJECTS AND MANAGEMENT ACTIONS (GSP SECTION 7)

Projects and management actions will be necessary during GSP implementation to maintain a viable and sustainable supply of groundwater for future generations.

Successful project and management action implementation to achieve sustainability in the Corning Subbasin will rely on the following approaches:

- Provide for more flexible use of existing water resources to increase conjunctive use. Conjunctive use means that surface water use is maximized so that groundwater in storage can be relied on when surface water is not available.
- Develop and incentivize best practices for on-farm and irrigation water management.
- Maximize groundwater recharge using available supplies.
- Facilitate collaboration with local, state, and federal agencies for successful water resources management.

The projects and management actions included in the GSP outline a framework for achieving sustainability. However, many details remain to be negotiated before most of the projects and management actions can be implemented, including:

- Additional vetting by all necessary stakeholders
- Acquisition of funding as most projects and management actions are beyond the agreed-upon scope for GSP implementation
- Coordination with neighboring GSAs for projects that benefit areas outside of the Subbasin

The list of priority projects and management actions included in Table ES-2 and Table ES-3, respectively, will be refined during GSP implementation. Not all of the projects and management actions described are likely necessary to attain sustainability. Additional alternative projects are included in the GSP to provide conceptual approaches for projects that are not well-defined at this stage and will be considered, if necessary, at a later stage during GSP implementation. The GSAs will identify specific projects and management actions to pursue during the first few years of GSP implementation and initiate plans to address some of the most feasible measures. After narrowing the list of potential projects and management actions, the GSAs will coordinate with agencies and stakeholders to assess the feasibility, funding, and design during the first 5 years of GSP implementation.

Table ES-2. Priority Management Actions

Name	Management Action Type	Purpose	Location	Description
Well Management Program	Well management	Better understand well distribution in the Subbasin and protect well owners from future impacts	Entire Subbasin	Includes various projects, incentives, and actions, such as: 1. Compile well inventory 2. Provide education and outreach to well owners 3. Develop a dry well reporting system 4. Establish a well mitigation program
Grower Education	Grower education / best management practices	Grower education relating to on-farm practices for sustainable groundwater management. This includes promoting conjunctive water use and water use efficiency.	Focus on Corning, Thomes Creek, and Kirkwood WDs	Educate growers on the value of using surface water over groundwater when available, replacing inefficient wells, adding organic amendments to improve moisture retention, soil mapping for custom irrigation timing and duration. Explore starting a groundwater users cooperative to coordinate pumping schedules (this could also happen in the Capay Area).
Policies and Ordinances	Policies and ordinances that control pumping growth	Establish water and land use management restrictions on future well pumping and new agricultural growth, for better sustainable groundwater management.	Both Counties starting with Tehama County	Establish or revise County well permitting, water use, and land use ordinance or policies to align with GSP.
Use of Full Surface Water Allocation	• Grower education / best management practices • water transfers / contracting	Incentivize growers within districts to use all contracted surface water when available in wet years, for better conjunctive use.	Water Districts	Implementation-Ready project in Corning WD. Needs infrastructure improvements in OUWUA, Thomes Creek WD, and Kirkwood WD

Table ES-3. Priority Projects

Project Name	Project Type	Purpose	Location	Project Development Status
OUWUA Infrastructure Improvements for In-Lieu Recharge	In-lieu groundwater recharge	Improve surface water conveyance and irrigation infrastructure for surface water use in lieu of groundwater pumping	Orland Project Area	Pre-Design / Planning Stage
Regional Surface Water Transfers for In-Lieu Recharge	In-lieu groundwater recharge	Incentivize the use of surface water within the subbasin by transferring water into the Subbasin from other CVP districts	Water Districts	Implementation-Ready
Invasive Plant Removal	Reduction of Non-Beneficial ET	Invasive plan removal to reduce shallow groundwater use and restore native habitat	Focus on Stony Creek	Pre-Design / Planning Stage
Groundwater Recharge through Unlined Conveyance Features	Direct Groundwater Recharge	Groundwater recharge through unlined canals and natural drainages	Tehama County	Conceptual
Off-stream Surface Water Storage	In-lieu groundwater recharge	Off-stream temporary storage of flood waters on private lands	Outside District Areas - Tehama County	Conceptual
Recycled Water Use for Irrigation	In-lieu groundwater recharge	Recycled water program for treated wastewater (Corning and Hamilton City)	City of Corning/ Hamilton City	Conceptual
City of Corning Stormwater Recharge	Direct Groundwater Recharge	City of Corning stormwater improvements/groundwater recharge	City of Corning	Pre-Design / Planning Stage

ES-8 PLAN IMPLEMENTATION (GSP SECTION 8)

The GSP provides a roadmap for addressing activities needed for GSP implementation between 2022 and 2042, focusing mainly on the activities to be started and completed within the first 5 years of implementation, between 2022 and 2027. Implementing the Plan requires the following formative activities:

- Ongoing GSA administration, stakeholder outreach, and coordination with neighboring Subbasins' GSAs
- Develop and implement funding mechanisms to support the GSA functions
- Collect and compile groundwater, surface water, and subsidence data per the GSP monitoring plan
- Prepare GSP annual reports and 5-year GSP update reports to inform DWR on the status of groundwater sustainability and other GSP implementation tasks
- Address identified data gaps
- Expand and improve the existing monitoring networks
- Update the data management system
- Update and refine the groundwater model
- Evaluate, prioritize, and refine projects and management actions

The GSAs estimate that planned activities will cost approximately $5,390,000 over the first 5 years of implementation (including a 10% contingency), or an estimated $1,078,000 per year. Potential funding mechanisms were initially reviewed during GSP development and will be refined and implemented during implementation. The GSAs assume that grant funds or assistance from the DWR, USBR, and other agencies will be available to help pay for some of the required GSP components such as monitoring network enhancement, addressing HCM data gaps, and implementing projects and management actions for groundwater sustainability.

The GSAs are prepared to begin implementation of the Plan upon adoption of the GSAs, followed by submittal of the GSP to DWR by January 31, 2022. During the first 5 years of GSP implementation, the GSAs strive to fill remaining data gaps, complete the monitoring networks, and begin to implement measures to achieve sustainability. GSP implementation is an iterative process and Plan elements will be revisited and revised as conditions change and in some cases are better understood. The ultimate goal of the GSP is groundwater sustainability in the Subbasin. This goal will be achieved by following the roadmap outlined in the Plan and through robust collaboration between the GSAs, stakeholders, agencies, growers, neighboring subbasins, and the communities in the Subbasin over the next 50 years.