# Big Valley Basin Groundwater Sustainability Plan

## Annual Report for Water Year 2021

No. 5-004 Big Valley Groundwater Basin

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# Abbreviations

| | |
|---|---|
| AEM | Airborne Electromagnetic Surveys |
| AF | Acre-feet |
| AgMAR | Agricultural Managed Recharge |
| BVAC | Big Valley Advisory Committee |
| BVGB | Big Valley Groundwater Basin |
| BVGSP | Big Valley Groundwater Sustainability Plan |
| BVMW | Big Valley Monitoring Well |
| CASGEM | California Statewide Groundwater Elevation Monitoring Program |
| CCR | California Code of Regulations |
| CIMIS | California Irrigation Management Information System |
| DWR | California Department of Water Resources |
| ET | Evapotranspiration |
| GSA | Groundwater Sustainability Agency |
| GSP | Groundwater Sustainability Plan |
| IM | Interim Milestone |
| MOU | Memorandum of Understanding |
| MO | Measurable Objective |
| MT | Minimum Threshold |
| NOAA | National Oceanic and Atmospheric Administration |
| RMW | Representative Monitoring Well |
| RVB | Round Valley Basin |
| SGMA | Sustainable Groundwater Management Act |
| SMC | Sustainable Management Criteria |
| USGS | United States Geological Survey |
| UCCE | University of California Cooperative Extension |
| WY | Water year |

# Executive Summary

The Big Valley Groundwater Basin (referred to herein as "the basin," or "BVGB" interchangeably), California Department of Water Resources (DWR) Basin No. 5-004 is classified as a "medium" priority basin. (DWR, 2019). The basin, shown in **Figure 1.1,** spans a land area of about 144 square miles in Modoc and Lassen counties (28 and 72 percent respectively). To comply with the requirements set forth by the 2014 Sustainable Groundwater Management Act (SGMA) (California Water Code, Section 10720 et seq.), both counties have taken on the role of Groundwater Sustainability Agency (GSA) for the portion of the basin within their jurisdictional boundaries.

The Groundwater Sustainability Plan (BVGSP or GSP) was adopted by both County Boards of Supervisors on December 15, 2021 and submitted to DWR on January 27, 2022. Per California Code of Regulations (CCR) 23 § 356.2, an Annual Report must be submitted to DWR by April 1 of each year following the adoption of the GSP, providing updates to basin conditions for the preceding water year (October 1, 2020 through September 30, 2021). Data covered in the basin GSP concludes in water year (WY) 2018. This first annual report covers the entire Big Valley Groundwater Basin and provides an update on basin conditions for the subsequent water years, 2019 through 2021.

For this period, updates to basin conditions are constrained by data availability limitations and discrepancies in technical support which stem from the failure of GEI, the engineering firm contracted to assist the GSAs in the development of the GSP, to fulfill contract deliverables in a timely manner. A major reason for this was the loss of the only GEI employee who had developed the models used in the development of the Big Valley GSP to DWR, where he was subsequently barred from communicating directly with the GSAs. The remaining GEI staff assigned to this project were not readily able to replicate the methods used to update the water budget, contour maps, and hydrographs essential to creating this report. As such, the GSAs have been limited in their ability to accurately assess changes in basin conditions for this first annual report, and it is their intention that future reports shall continue to amend reporting accuracy wherever possible.

Conditions in the Basin during the 2021 WY have remained consistent with those discussed in the GSP with relation to sustainability criteria. Even during the dry and critical water years of 2020 and 2021 (respectively), water elevations at all representative monitoring wells with significant historic data to analyze remained above their measurable objectives.

Since 2018, the BVGB experienced varying precipitation. The 2019 water year was classified as wet (well above average). Water years 2020 and 2021 were dry and critically dry, respectively. During the 2021 water year, the basin received 55% of its normal precipitation.[1] In 2021, the

[1] Source: https://www.cnrfc.noaa.gov/rainfall_data.php#monthly Measured at the Adin Ranger station. Consider updating to include precipitation data from Bieber too

wettest months were generally from September through February, and the driest between March and August. The Pit River and Ash Creek, major tributaries in the basin, typically experience high flows occurring during the winter months and lows during the summer, correlating with trends in precipitation and snowpack melt. Summer flows of the Pit River and all tributaries are fully allocated under existing water rights.

Within the BVGB, 22 wells were enrolled in the California Statewide Groundwater Elevation Monitoring Program (CASGEM.). During GSP implementation, five deep wells were constructed to support additional monitoring and were added to the CASGEM program. These deep wells, along with 7 other CASGEM wells, were selected to be Representative Monitoring Wells (RMWs) for basin conditions and assigned Sustainable Management Criteria (SMC). Hydrographs for each RMW are provided in **Appendix A** and summarized in **Table 2.1.2** relative to their SMCs**.**

Depth-to-groundwater data taken from the RMWs was used to generate groundwater elevation contours for Fall and Spring for the 2019, 2020, and 2021 water years. These wells are also used to determine change in groundwater storage. The hydraulic gradients illustrated by the contour maps generally indicate north-south directional flow on the west side of the basin, and east-west directional flow on the east side of the basin. Seasonal variations are apparent as gradient steepness increases in the fall and decreases in the spring across the basin, corresponding with times of groundwater extraction and recharge respectively.  This remains consistent with seasonal variance observed in the 2018 and preceding water year contours. Updated estimates of groundwater storage for water years 2019 through 2021 are reported in **Figure 2.2.4,** which shows water year type (precipitation), the annual change in groundwater storage, and the cumulative change in groundwater storage from WY 1983 to WY 2021.

Although this model is limited by its reliance on assumptions about aquifer structure and the quality of data available for the water budget, it is sufficiently accurate for this report. As implementation progresses and more data is made available, refining this and other models will improve the accuracy of estimates.  A map showing annual changes in groundwater storage between the fall season of WY 2020 to 2021 can be found in **Appendix E.**

As described in the GSP, land use sectors in Big Valley "differ from DWR's water use sectors identified in Article 2 of the GSP regulations because DWR's sectors don't adequately describe the uses in Big Valley." (BVGSP 3-8). At the time of this report, the best data available to estimate land use by water use sector remains that which was reported in the development of the GSP. However, this dataset was identified as inaccurate, and as such, remains a data gap in this report. **Table 2.2.1** (Table 3-2 in the GSP**)** continues to provide the best summary of water use sectors for water years 2019, 2020, and 2021.

Overall, basin conditions during the 2021 water year have remained consistent with the trends anticipated in the GSP. **Table 2.1.2** provides a summary of water levels and SMCs in the RMWs.

For wells where there is sufficient data to analyze, groundwater levels have remained above the measurable objectives and as such, remain well above Minimum Thresholds.

Implementation of the GSP has been ongoing concurrently with its development, as outlined in Chapter 9: Project and Management Actions. Due to limited data availability, as with in the GSP, the water budget and other models used in this report draw heavily on assumptions about environmental factors such as evapotranspiration (ET), crop water use efficiency, and land use data. Improving data quality for basin management is a major goal of the GSAs. Therefore, the primary focus of work at this time has been to address the data gaps identified in the GSP, many of which carry over into this report. Outreach efforts have recruited a total of 14 participants for the Voluntary Well Metering Program, for which installation of flow meters is anticipated to start in the spring of 2022. The planned stream gage on the Pit River where it enters the basin will be critical for future monitoring efforts to improve the accuracy of the surface water flow measurements. Likewise, the proposed installation of a California Irrigation Management Information System (CIMIS) sensor in the basin would help refine estimates of a number of variables, none the least of which include precipitation and evapotranspiration.

# 1. General Information

## 1.1 Background

The local community in the Big Valley Groundwater Basin and surrounding areas is extremely rural, economically disadvantaged and resource capacity limited. As with much of the surrounding region, the economy is largely agricultural, but unlike many other groundwater basins in California, the growing season in Big Valley is constrained to about 101 days per year by hard freezes and snow. Considering these limitations, the majority of farmed land employs low impact farming techniques to produce low-input crops such as hay and pasture crops. The ensuing cropping systems support an abundance of wildlife habitat and help maintain pristine quality in both surface and groundwater systems.

### 1.1.1 Big Valley Basin GSAs and Big Valley Advisory Committee

With no other existing agency to take up this task, Modoc and Lassen Counties were established as GSAs for their respective portions of the basin in 2017 to attempt to retain local control of groundwater management.

When DWR finalized the basin's medium priority designation in 2019, the GSAs elected to collaborate on a single GSP and developed a Memorandum of Understanding (MOU) which details the coordination between the two GSAs. The MOU provided for the establishment of a local advisory committee to oversee the development of the GSP. Applications for this committee, known as the Big Valley Advisory Committee (BVAC) were solicited from local landowners and residents following public noticing protocols. Appointments were made by the County Boards of Supervisors. The BVAC was comprised of a board member from each county, one alternate board member from each county, and two public applicants from each county.

### 1.1.2 Big Valley Basin Groundwater Sustainability Plan

From chapter one of the Big Valley GSP, "the sustainability goal for the Big Valley Groundwater Basin is to maintain a locally governed, economically feasible, sustainable groundwater basin and surrounding watershed for existing and future legal beneficial uses with a concentration on agriculture. Sustainable management will be conducted in context with the unique culture of the basin, character of the community, quality of life of the Big Valley residents, and the vested right of agricultural pursuits through the continued use of groundwater and surface water." (BVGSP p. 1-5).

Management of the basin prioritizes the interests of the basin's legal beneficial users in all decisions, as defined under the sustainability goal. To this effect, projects and management actions were identified in Chapter 9 of the GSP and are being implemented to refine existing data gaps. Consistent with this objective and to avoid undesirable results, monitoring networks to evaluate quantifiable management criteria (minimum thresholds, measurable objectives, and interim milestones[2]) were established for the six sustainability indicators[3].

In compliance with 23 CCR §352.6[4], monitoring data is stored on a SharePoint site, accessible by Modoc and Lassen GSAs, and technical support staff.

## 1.2 Plan Area

With ground elevations averaging around 4,500 feet, the basin is located in the volcanic high desert region of California's far northeastern corner. It is one of many similar basins spread throughout the region classified by their relative isolation and small size. The total land area covered by the basin is about 144 square miles, with Modoc County representing around 40 square miles in the north and Lassen County comprising roughly 104 square miles in the south. A map showing the basin boundary and county jurisdictions is provided in **Figure 1.1**.

Geologically, "The BVGB is bounded to the north and south by Pleistocene and Pliocene basalt and Tertiary pyroclastic rocks of the Turner Creek Formation, to the west by Tertiary rocks of the Big Valley Mountain volcanic series and to the east by the Turner Creek Formation. The Pit River enters the Basin from the north and exits at the southernmost tip of the valley through a narrow canyon gorge. Ash Creek flows into the valley from Round Valley and disperses into Big Swamp. Near its confluence with the Pit River, Ash Creek reforms as a tributary at the western edge of Big Swamp. Annual precipitation ranges from 13 to 17 inches." (DWR 2003). Since 2003, the Ash Creek Wildlife Refuge was established and now occupies most of the area formerly known as Big Swamp. A series of restoration projects and farming practices have been implemented within its boundaries, resulting in changes to the stream channel where it flows through the refuge.

The definable bottom of the aquifer sits at about 1,200 feet (BVGSP, ES-4), at which depth all production wells are represented. Models used in basin management assume a single principle aquifer because no distinct, widespread confining beds have been identified in the subsurface.

Although the BVGB is isolated and does not share a boundary with another basin, the Round Valley Basin (RVB), which received a very low prioritization, is located directly to the north from where Ash Creek flows into the BVGB at the town of Adin. Hydraulic communication between the two basins where they are separated by a half-mile gap of alluvium is suspected by the GSAs but has not been confirmed by DWR or GEI. Surrounding upland areas are also

[2] Interim Milestones are optional criteria not subject to enforcement and none have been set for the BVGB.
[3] The six sustainability indicators defined under SGMA are: chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and depletions of interconnected surface water. The BVGB was not found to experience direct impacts from seawater intrusion, subsidence, depletion of interconnected surface water, or degraded water quality.
[4] 23 CCR §352.6. Data Management System, "Each Agency shall develop and maintain a data management system that is capable of storing and reporting information relevant to the development or implementation of the Plan and monitoring of the basin."

thought to contribute to basin recharge and were mapped as such by DWR in 1963. An upland assessment being completed by GEI is also working towards clarifying this relationship.

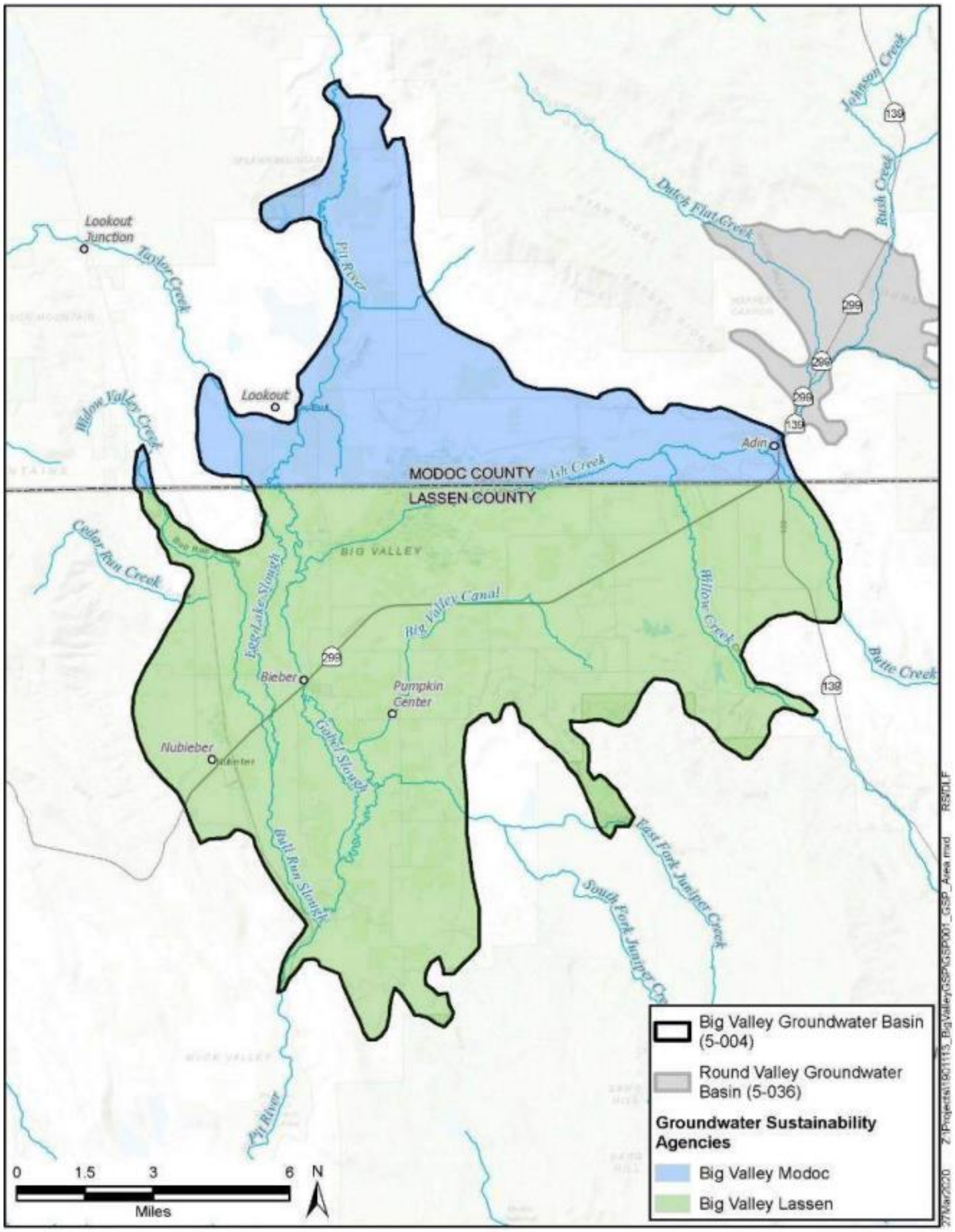


**Figure 1.1 Big Valley Groundwater Basin Map (BVGSP ES-2***)*

### 1.2.1 Climate

The climate of the BVGB is highly variable depending on season and year. On average, temperatures range between 32 and 69 degrees Fahrenheit. However, the summer months regularly see temperatures exceeding 90°F, and temperatures in winter months can fall as low as -10°F. These hard freezes limit agricultural production for much of the year.

Historic climate data was recorded in the basin at two stations, Bieber 4 NW and Adin RS, which were administered by the National Oceanic and Atmospheric Administration (NOAA). Both stations are no longer active. Current precipitation data used in the water budget estimations is drawn from the nearest CIMIS station in McArthur CA, #43, which is separated from the BVGB by the Big Valley Mountains to the west. Monthly averages of climate data from 1983 to 2021 are presented in **Table 1.2** with the caveat that the use of this data, which is not specific to the microclimate of the BVGB, lends some uncertainty to current estimates of the water budget. The installation of a CIMIS station at a location within the basin is highly desirable to improve data reliability.

**Table 1.2 Monthly Climate Data from CIMIS Station #43 in McArthur, CA (1984-2021)**

| Month | Average Rainfall (inches) | Average Reference ET[5] (inches) | Average Daily Temperature (°F) |
|---|---|---|---|
| October | 1.31 | 3.04 | 49 |
| November | 2.22 | 1.22 | 38 |
| December | 2.83 | 0.75 | 32 |
| January | 2.51 | 0.89 | 33 |
| February | 2.65 | 1.59 | 37 |
| March | 2.50 | 3.02 | 42 |
| April | 1.71 | 4.47 | 48 |
| May | 1.62 | 5.96 | 55 |
| June | 0.61 | 7.32 | 63 |
| July | 0.15 | 8.19 | 69 |
| August | 0.18 | 7.17 | 66 |
| September | 0.44 | 5.03 | 60 |

**(CIMIS Monthly Averages)**

### 1.2.2 Surface Water and Drainage Features

The two major sources of surface water in the BVGB are the Pit River and Ash Creek, which enter the basin near the towns of Lookout and Adin respectively. There are several other small creeks which connect into the two larger systems throughout the basin. Water is diverted through a series of unlined drainage ditches and canals, which have been identified along with agricultural land for their potential to contribute to recharge. Historically, several stream gages have monitored water levels on the Pit River, Ash Creek, and Willow Creek, shown in **Figure 1.2**. For this reporting period, data is available from two gages on the Pit River: The Muck

[5] Reference ET refers to Evapotranspiration that has been adjusted to account for irrigation.

Valley gage through a verbal data sharing agreement with Brookfield Renewable Energy, and from the USGS Canby Gage. The stream gage on Ash Creek measured flow from 1981 to 1999 and was reactivated in 2019 to provide data at 15-minute intervals. Future monitoring will include a gage on the Pit River just above where it enters the basin, and the Willow Creek gage, which DWR is working to reestablish.

Annual average daily streamflow at the Canby gage is reported for water years 2010 through 2021 in **Table 1.2.1.** Flows are shown to correlate with water year type, with highest daily averages occurring concurrently with the wet years in 2011, 2017 and 2019, and the lowest daily flows occurring during the less than normal years of 2012, 2014 and 2021. This data demonstrates the extreme variability in surface water availability in the Pit River. The wettest year recorded 20 times more volume in surface water flows than the driest, and the difference between the second wettest year saw flows 13 times the volume of the flows recorded in the second driest year.

**Table 1.2.1 Annual Average Daily Streamflow at the Canby USGS Gage**

| Water Year | Average Daily Flow (cfs) at Canby Gage | SRI Water Year[1] |
|---|---|---|
| 2010 | 56.4 | BN |
| 2011 | 380.8 | W |
| 2012 | 66 | BN |
| 2013 | 73.6 | D |
| 2014 | 20.9 | C |
| 2015 | 41.7 | C |
| 2016 | 208.2 | BN |
| 2017 | 456.1 | W |
| 2018 | 138.5 | BN |
| 2019 | 387.2 | W |
| 2020 | 69.3 | D |
| 2021 | 30.6 | C |

Notes:

1Sacramento Valley Water Year Indices Water year type. C = Critical, D = Dry, BN = Below Normal, AN = Above Normal, W = Wet

**Source(s): USGS Surface Water Data; DWR Data Exchange Center Historic Water Year Hydrologic Classification Indices.**

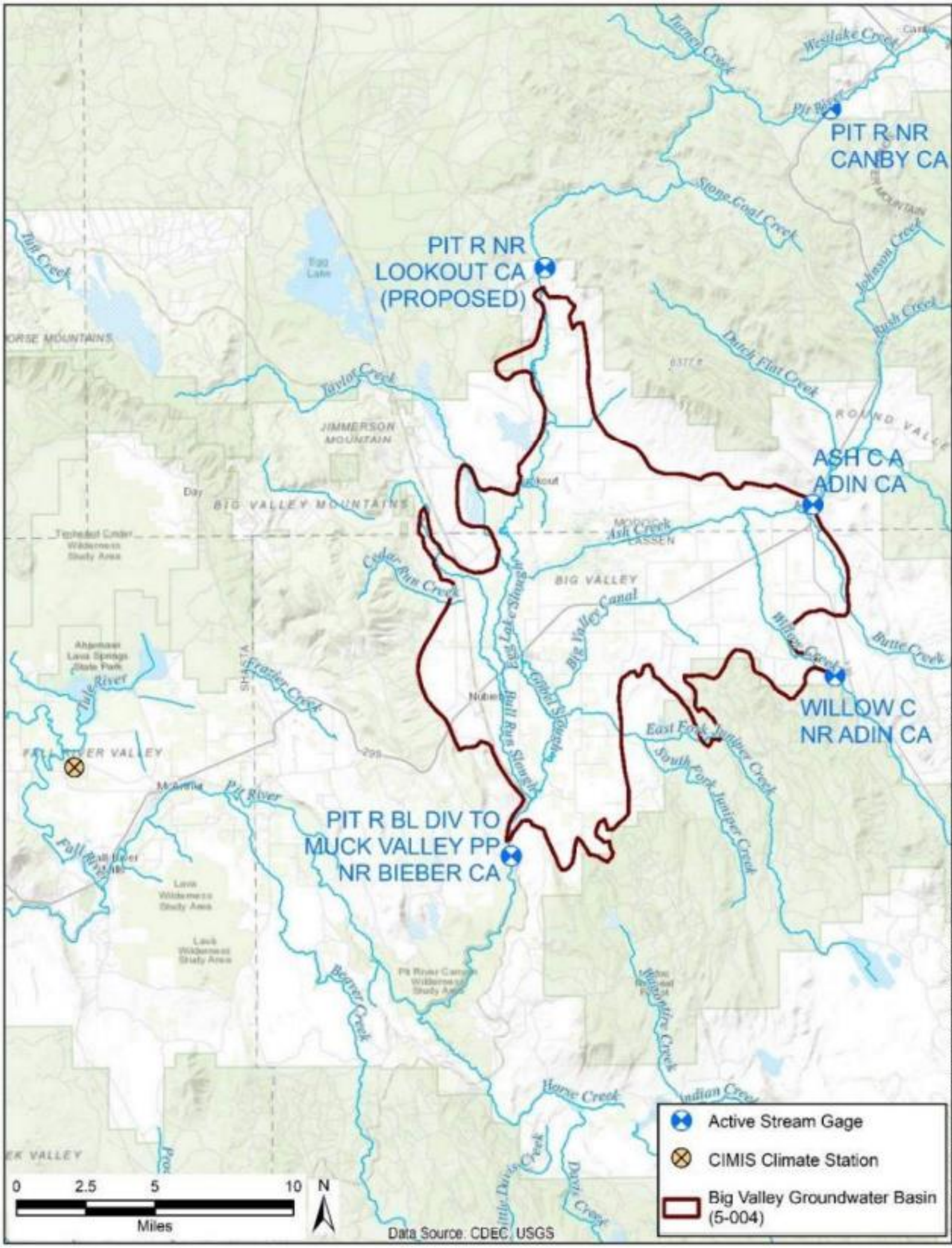


**Figure 1.2 Map of Current and Proposed Stream Gage Locations (BVGSP 9-11)**

# 2 Groundwater Conditions

This section provides an update on changes in groundwater conditions in the BVGB for the 2019, 2020, and 2021 water years.

## 2.1 Groundwater Elevations

### 2.1.1 Groundwater Elevation Contour Maps

Spring and fall groundwater contours included in the GSP are current through the 2019 WY. However, for consistency, 2019, 2020 and 2021 changes in groundwater elevation are discussed in this report. Throughout this reporting period, water levels in the basin have declined slightly during the dry and critical years of 2020 and 2021, respectively. The 2019 water year was a wet year, which allowed groundwater levels to recover.

Fall groundwater elevations rose between 2019 and 2020 and declined slightly between 2020 and 2021. For all three years, groundwater levels in the northeastern region of the basin remained relatively unchanged, and slight fluctuations in groundwater levels were observed near the basin's center and southern region.

Spring groundwater elevations across all three years have generally followed the same patterns consistent with water year type, although water levels across all three years recovered significantly between the fall and spring seasons. Notably, spring water elevations recovered in the 2021 WY to nearly the levels of the preceding water year despite the differential in precipitation between the two years.

These spring trends suggest that the basin's storage capacity is resilient, provided that sufficient water is available for recharge. In years where precipitation is limited, a combination of surface water storage options and off-season recharge projects may help enhance this process and mitigate further groundwater level decline.

DWR has measured water levels for many decades and has indicated that it will continue to measure water levels for the foreseeable future. The period covered by this report coincides with an extended period of limited data availability, particularly in the southern portion of the basin for the 2019-2021 water years. Covid-19 is suspected to have contributed to this data gap by constraining the ability of DWR staff to conduct necessary field work, which has required technical staff to estimate water levels for some parts of the basin. This uncertainty could be ameliorated in future reports if data availability and reporting improve.

### 2.1.2 Groundwater Elevation Hydrographs

Twelve Representative Monitoring Wells were selected and assigned measurable objectives[6] (MOs) and minimum thresholds (MTs) to assess groundwater elevation and depth to water conditions. **Figure 2.1.2** shows the relative distribution of these RMWs within the BVGB. Of these, the five Big Valley Monitoring Wells (BVMWs) are each located at one of the clusters of monitoring wells that the GSAs received funding from DWR to drill in 2019 and 2020. Data from the BVMW clusters notably can be used to determine the directional flow of groundwater within the basin. MOs were set at the 2015[7] fall water elevation levels wherever possible. The newer wells included in the monitoring network were assigned MOs at the earliest fall water elevation reported. For the five new BVMWs, 2020 was the first year fall monitoring data was collected. The ACWA-3 well was assigned an MO at its 2017 fall level. Given the differences in conditions that occurred in the basin between the 2015, 2017 and 2019 water years, the MOs set for the newer wells may be adjusted in the future to better reflect basin conditions.

During the time period covered by this report, conditions in the basin have remained sustainable. Substantively, the wells with sufficient historic data to predict future trends are all projected to remain above their respective MOs through 2040. Wells installed or added to the representative monitoring network after 2015, which include the five new BVMWs and ACWA-3, do not have significant historical data to analyze at this point. However, preliminary data suggests low seasonal variance across these sites.

Historic water level trends, estimated from the hydrograph trend lines, have suggested an average groundwater level decline of approximately 0.53 ft/year across the basin. However, evaluating basin conditions in this way can be misleading considering that changes to water levels vary greatly.

Water level trends for all wells appear to correlate with water year type, although the degree of change differs from site to site. Three wells, 08F1, ACWA-3, and 26E1 have fluctuated minimally with projected rates of change falling between a very slight decline of .04 ft/year and a slight increase of .16 ft/year. Preliminary data from BVMW wells 2-1, 3-1, and 5-1 appear to reflect similar trends. Again, however, empirical data from the five new monitoring wells cannot be meaningfully interpreted at this time due to the limited period for which it has been collected. Preliminary trends for BVMW 1-1 and 4-1 are not apparent for this reason. By the time of the five-year report, however, that is expected to change as six years of monitoring will have been completed.

[6] "Measurable objective (MO): Numeric Values that reflect the desired groundwater conditions at a particular monitoring site. MOs must be set for the same monitoring sites as the MTs and are not subject to enforcement." (BVGSP 7-1)

[7] Measurable objectives were set at the fall 2015 levels, which were generally the lowest, most recent groundwater level measurements prior to the adoption of the BVGSP. These levels provide a reasonable proxy for desired conditions because agricultural uses remain feasible at them. (BVGSP 7-3).

Two wells, 13K2 and 20B6 have demonstrated slight declining trends in water levels at a rate of 0.70 and 0.72 ft/year respectively. It should be noted that since 2015, data has not been reported for 20B6 and has been reported sporadically for 13K2. Given the uncertainty produced by this lack of data, it is imperative that either efforts to consistently collect and report data for these sites are improved, or new sites are selected to reflect basin conditions in future reports. The first of these options is the most desirable outcome to maintain reporting consistency through future years, keeping in mind that these wells are also used for contour mapping.

The trends reflected in 01A1 and 16D1 indicate moderate levels of decline at the rates of 1.20 and 1.28 ft/year respectively. Of the twelve RMWs, the data represented in the hydrographs for these sites are the most variable, particularly during the dry period from 2011 to 2016. Although spring water levels have generally been declining, they have consistently remained above fall water levels for the same water year. The relationship between depletion and recharge appears nonlinear and elastic, with greater differences between fall and spring water levels observed the closer fall water levels come to the measurable objective.

This relationship highlights the correlation between recharge and seasonality which suggests that much of the water pumped in the basin from one year to another was likely recharged during the preceding year. The GSAs suspect that much of the recharge observed in the basin is contributed by upland areas within the watershed, but which fall outside the basin’s current boundaries. For this reason, the GSAs are interested in expanding basin boundaries. Additionally, increases in demand on groundwater supplies correlate with dry periods such as seen in the hydrograph for well 01A1, which implies that groundwater is used most often when surface water is not available. Economically, this makes sense because groundwater extraction is much more energy intensive than surface water diversions and thus more expensive. The trends observed in the hydrographs support the need for enhancements to surface water storage capacity in and around the basin. Even an additional 5,000 AF of storage would greatly help to offset the slight overdraft estimated in the water budget.

Water levels have been generally increasing at well 01A1 and decreasing at well 16D1 since 2015, which marked the end of the considerable dry period that prompted the passage of the Sustainable Groundwater Management Act. Spring water levels at well 16D1 remained just about level with the two preceding years, although fall water levels did decline considerably more than they had in the same time frame. DWR has not reported fall WY 2021 water levels for well 16D1, but spring levels at this site fell to an all-time low for the season. However, water levels at both sites have remained above their measurable objectives and are projected to remain above 2015 levels well into the future. A summary of spring elevations for the 2021 water year and corresponding sustainable management criteria is provided in **Table 2.1.2** to highlight current conditions in the basin.

Minimum thresholds were set to reflect the water level at which pumping costs would render agricultural pursuits unviable. For this reporting period, water levels have remained well above these levels and are not projected to come anywhere near to them within the next 20 years. Conditions in the basin will continue to be monitored at these locations with respect to their sustainable management criteria, and updates will be provided in future reports.

**Table 2.1.2 Water Year 2021 RMW Hydrograph Summary Table[1]**

| Well Name | Spring Groundwater Elevation (ft) | Fall Groundwater Elevation (ft) | Minimum Threshold (ft) | Measurable Objective (ft) |
|---|---|---|---|---|
| 01A1 | 4127.6 | 4084.5 | 3895 | 4035 |
| 08F1 | 4227.7 | 4226.9 | 4082 | 4222 |
| 13K2 | N/A | 4081 | 3922 | 4062 |
| 16D1 | 4095.7 | N/A | 3939 | 4079 |
| 20B6 | N/A | N/A | 3945 | 4085 |
| 26E1 | 4126.6 | 4118.1 | 3974 | 4114 |
| ACWA-3 | 4148.3 | 4139 | 3996 | 4136 |
| BVMW 1-1 | 4181.2 | 4156.8 | 4022 | 4162 |
| BVMW 2-1 | 4194.1 | 4194.1 | 4054 | 4194 |
| BVMW 3-1 | 4148.6 | 4144.3 | 4006 | 4146 |
| BVMW 4-1 | 4120.3 | 4094.9 | 3948 | 4088 |
| BVMW 5-1 | 4085.4 | 4078.8 | 3942 | 4082 |

Notes:

1 Data reported in this table was downloaded from the online SGMA Data Viewer (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer)

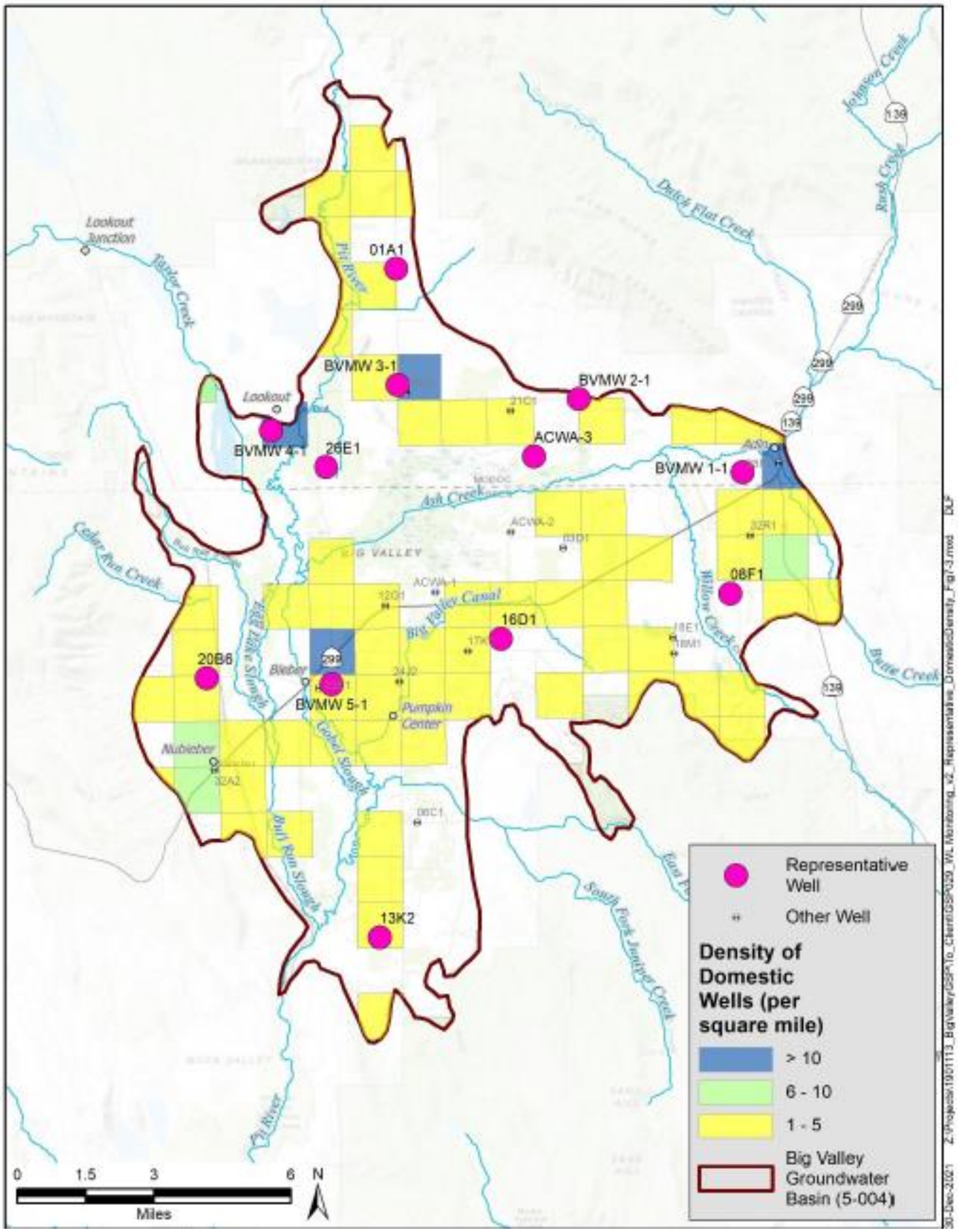


**Figure 2.1.2 Map of Domestic Well Densities and Representative Groundwater Wells (BVGSP 7-6)**

## 2.2 Water Budget

GEI, the engineering firm contracted to be the technical lead for the Big Valley GSP, chose to develop the water budget (**Appendix D**) using an excel spreadsheet tool. This method was selected as both an economically and technologically feasible way for the GSAs to create the water budget for the GSP, and to calculate water budget estimates for future reports. As discussed in depth in the GSP, the many assumptions and data gaps that were present when completing the water budget carry over into this report. GSA staff was unable to review the data necessary to complete the water budget updates for the 2021 and preceding water years. This was due to the only staff member at GEI who had the skill set to update the excel water budget leaving the firm on December 31, 2021. The water budget included in this report continues to rely upon the assumptions determined by GEI, and the excel table was completed by GEI staff. The output figure in this report is exactly what was received by the GSAs for completion of the annual report. Updating the water budget with new information from additional monitoring wells, surface water monitoring, recharge calculations and more will begin in the 2022 annual report.

### 2.2.1 Groundwater Extraction

Groundwater extraction within Big Valley is estimated in the water budget using a combination of pumping, land use, ET, and extraction data. Groundwater extraction by land use sector has not been quantified due to the data gaps from the GSP that carry over into this report. The exact amount of extraction occurring within the basin is not easily quantified, and current estimates draw on the locations of wells shown in **Figure 2.1.2** (above). Using the estimates that were first created by GEI for the GSP, it is apparent that there are strong positive relationships between groundwater pumping, surface water availability and annual precipitation. 2019 had below average groundwater extraction of 38,400 feet but the subsequent two dry and critically dry years saw increased pumping of 53,700 and 54,000 acre feet, respectively. Additionally, during dry years, groundwater extraction is exacerbated in the downstream regions of the basin, correlating with the priority of riparian rights.

Future reports will include estimates of groundwater extraction by sector, once the data and methodology used to make these estimates is transmitted from GEI to the GSAs. For now, the general understanding of extractions within the basin is sufficient to manage the basin until more data becomes available. Table 3-2, carried over from the GSP, summarizes land use by water use sector. A map illustrating the distribution of land use sectors throughout the basin is available in **Appendix C**. Evaluated together, these figures indicate the areas where groundwater extraction is most likely to occur, although they do not provide good estimates of extraction. For this reason, it is necessary to refer to the contour maps to intuit where most extraction occurs which can be accomplished by analyzing the hydrologic gradients. In doing so, the agricultural sector generally represents the greatest amount of groundwater extraction within the basin, most notably in years when there is not sufficient surface water to maintain crop yield and survival.

**Table 2.2.1 2016 Land Use Summary by Water Use Sector**

| Water use sector | Acres | Percent of Total |
|---|---|---|
| Community[a] | 250 | <1% |
| Industrial | 196 | <1% |
| Agricultural | 22,246 | 24% |
| State Wildlife Area[b] | 14,583 | 26% |
| Managed Recharge | - | 0% |
| Native Vegetation and Rural Domestic[c] | 54,782 | 60% |
| **Total** | 92,057 | 100% |

Notes:

a Includes the use in the communities of Bieber, Nubieber and Adin

b Made up of a combination of wetlands and non-irrigated upland areas

c Includes the large areas of land in the Valley which have domestic wells interspersed (Source: Modified from DWR 2020b by GEI)

**BVGSP (3-9)**

### 2.2.2 Surface Water Supply

The Pit River and Ash Creek are the primary sources of surface water into the BVGB. Stream inflow and outflow volume is not well understood in the basin, but recent efforts to increase data sharing between entities and a new stream gage on the Pit River should improve estimates in the future. Surface water supply varied exceptionally from 2019 to 2021. From the water budget tables provided in **Appendix C,** in 2019, stream flow was over 683,000 AF with total inflow estimated at 819,000 AF. 2020 received 80% less stream flow and 2021 received 90% less stream flow than 2019 at 130,700 and 67,900 acre-feet respectively.

Drastic variation in stream flow is reflected in the water budget between wet and dry years. The water budget highlights the importance of surface water availability for meeting the needs of agriculture production and habitat in the basin. Notably, the highest volume of surface water deliveries in the basin occurs during dry and critical years such as 2020 and 2021, respectively. Outflow, as a result, is significantly reduced. During these times, as established in previous sections, demand for groundwater is also higher. Cumulatively, the relationships between water supply and demand both from surface and groundwater sources indicate that increased surface water storage options are required to support the continued sustainability of the basin. DWR climate model forecasts, which predict increased precipitation and in the form of rain instead of snow in the Big Valley Region in years to come, provide another reason for more surface water storage and water buffering availability to create a sustainable water resource for basin users.

### 2.2.3 Total Water Available

As discussed in preceding sections, there is currently not sufficient data available to quantify water use by sector for the basin. For the period covered by this report, a definite relationship can be seen between surface water availability and groundwater extraction in Big Valley. In years high surface water availability, considerably less groundwater is used to support all water users.

**Table 2.2.3** provides a summary of water budget estimates of water available for use by all sectors combined for the water years covered in this report. Although users do tend to use less water overall in dry and critically dry years, developing more surface storage and off-season recharge opportunities for plentiful years could significantly abate groundwater dependence. Comparing total outflow in the land system verse the surface water system, in dry years water coming from groundwater and the land system is marginally more than coming from the surface water system. In wet years, the water coming from the land system is markedly less than that coming from the surface water system. This indicates that water is leaving the basin in large quantities, again pointing to the importance of expanding surface water storage opportunities.

**Table 2.2.3 Total Available Water For Use By All Sectors[1]**

| Water Year | Groundwater (AF) | Surface Water (AF) | Total Water (AF) |
|---|---|---|---|
| 2019 | 38,400 | 70,000 | 108,400 |
| 2020 | 53,700 | 84,900 | 138,600 |
| 2021 | 54,000 | 86,400 | 140,400 |

Notes:

1 Numbers reported in this table are derived from the water budget provided by GEI (**Appendix C**). Data available for use in future reports is anticipated to improve in quality, at which point water use by sector can be estimated with greater accuracy. Estimates of combined water sources are not available at this time.

### 2.2.4 Change in Groundwater Storage

As explained in section 5.2 of the BVGSP, change in groundwater elevation is directly correlated with change in groundwater storage. (BVGSP 5-9). The contour maps included in **Appendix B** provide a static representation of groundwater storage for the spring and fall seasons of each water year reported herein. Therefore, the annual change in groundwater storage for the 2020-2021 WY was estimated in ArcGIS by calculating the difference in groundwater surface elevation between spring 2020 and spring 2021. Spring values were used for this estimate as they provide a more stable short-term reference to measure storage capacity than fall values, given the amount of recharge that occurs between the two seasons. The resulting map is provided in **Appendix E.** Simply put, this estimate draws on the basin storage model, represented by the following equation: (1200ft definable bottom- average depth to water) x (92,057 Acre Basin Area) x (5% specific yield). Trends, delineated by the contours, show that most of the basin saw an increase in storage ranging between 1 to 5 feet, and, notably, 6 to 10 feet and 11 to 15 feet in some areas. One small area in the basin had a noticeable decline in storage greater than -9 feet. **Figure 2.2.4** gives the cumulative change in storage vs. precipitation for water years 1983-2021. Corresponding with water year type, storage in the BVGB increased by approximately 12,000 AF during the above average wet year of 2019. In 2020, a dry year, storage decreased by an estimated 27,000 AF and dropped by an additional 30,000 AF during the critically dry 2021 water year.

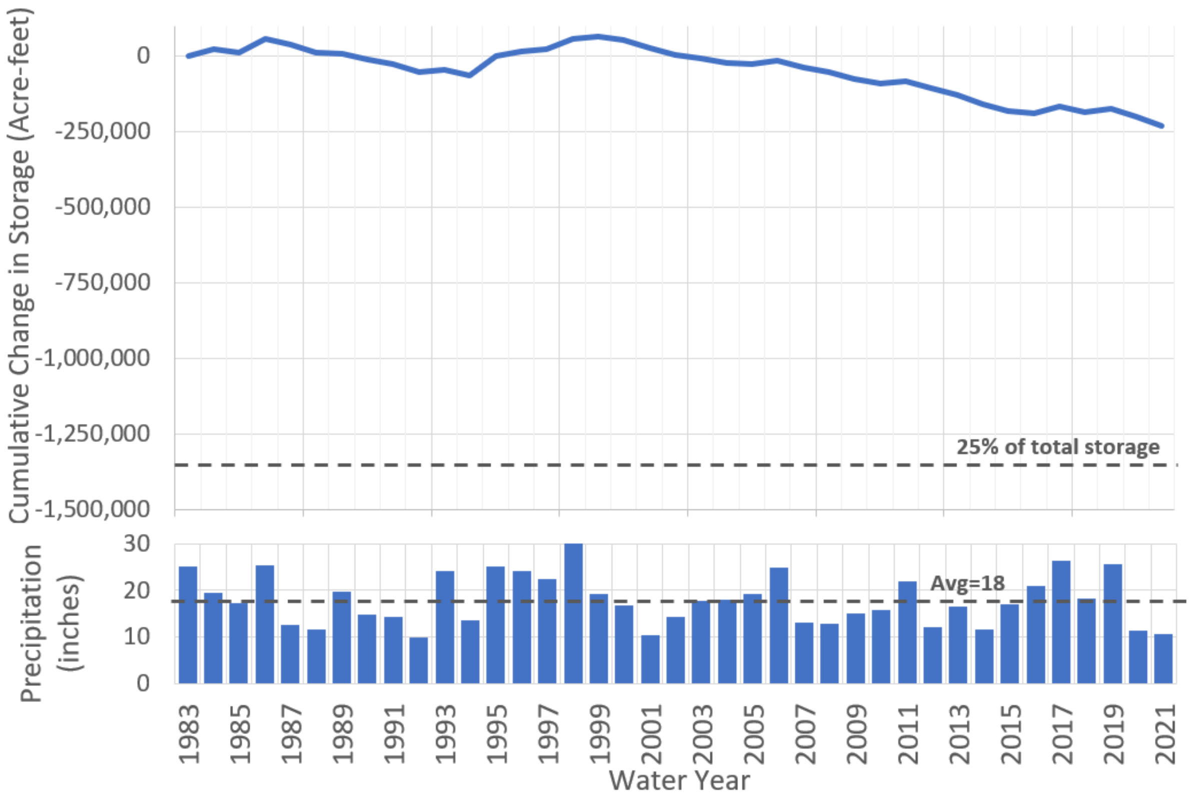


**Figure 2.2.4: Estimated Cumulative Change in Groundwater Storage Vs. Precipitation (GEI)**

Cumulatively, the storage capacity of the basin has declined minimally since 2018. Intuitively this figure suggests that the basin will remain sustainable well into the future, as the change in storage capacity has not exceeded 250,000 acre-feet in the 38 years between 1983 and 2021.

# 3 GSP Implementation Progress

The objectives of the projects laid out in Ch. 9 of the GSP, Projects and Management Actions, target the data gaps which have driven the current assumptions about basin conditions. For this reason, adaptive management is a strategy identified in the GSP to inform its implementation as better data becomes available. In support of this, many of the projects identified in the GSP have been running concurrently with its development.

Throughout the development of the GSP, strong efforts were made to engage stakeholders at monthly BVAC meetings, University of California Cooperative Extension (UCCE) workshops and mailings, and via social media. These interactions have helped inform the types and scopes of projects important to Big Valley groundwater users and other represented groups. Communication through mailings, social media, and email has also been used to keep interested parties up to date and informed about opportunities to participate.

At the time of this report, the stream gage assessment has been completed and construction will soon begin at the site north of Lookout. At other proposed gage sites identified in the assessment, other parties have stepped in to either share data or restore existing gage infrastructure. Other marks of project progress include the recruitment of fourteen participants for the voluntary well metering program for which enrolled wells will provide data to help refine basin groundwater pumping estimates. More progress is anticipated to expand this program further.

As part of a wider research effort lead by UCCE in cooperation with local landowners, data for the feasibility of Agricultural Managed Recharge (AgMAR) has been collected for 2021 and is currently being analyzed. A study evaluating the relationship between evapotranspiration and applied water was also conducted to help refine future water budget estimates. The widespread implementation of these projects in the basin has been impeded by regulatory limitations and financial burden of off-season diversions. More work is necessary to determine the circumstances under which AgMAR projects present viable options for recharge given these constraints. Most importantly, regulatory impediments also restrict the ability of technical staff to perform the upstream water availability assessment identified in section 9.1 of the BVGSP, which would help basin water users obtain permits for recharge.

Progress has also been made in identifying potential upland areas for juniper removal and other forest health projects to improve water availability for the basin. It is anticipated that these projects, combined with efforts to improve mapping accuracy, may be used to support the expansion of basin boundaries.  The GSAs are still waiting to receive results hear back from GEI for the upland assessment which was started in October 2019.

Following the installation of five representative monitoring well clusters in 2019 and 2020, data has been continuously downloaded from the transducers, which are set to record at 15-minute intervals. Depth-to-water measurements at these wells have been hand recorded monthly by GSA affiliate staff since 2020. Surface water quality has been sampled on the same days that staff monitors the wells from sites on the Pit River and Ash Creek. Presently, the GSAs are looking forward to reviewing the data DWR recently collected during the AEM survey of the basin in October 2021 to better understand the basin's hydrogeological structure.

# 4. References


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# 5. Appendices

## Appendix A: Hydrographs

# Groundwater Level Report

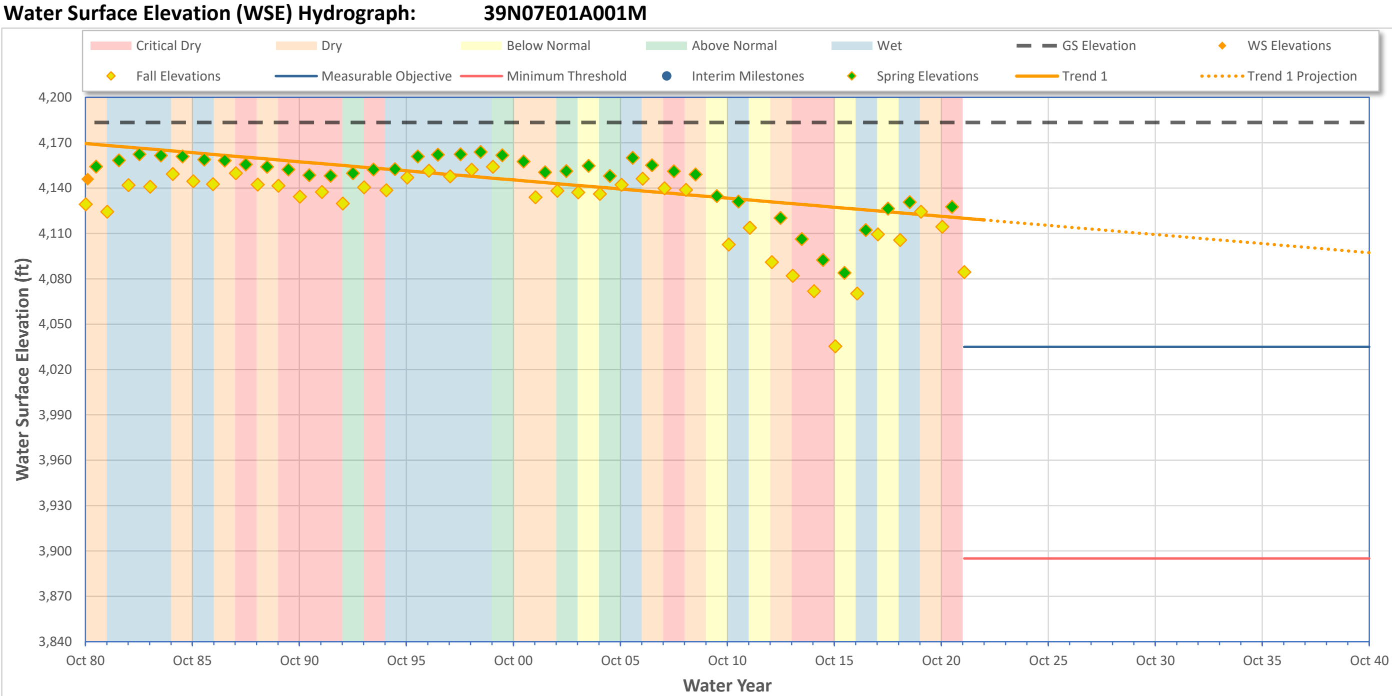
Date: 2/22/2022

| Well Information | |
|---|---|
| Well ID | 036673_39N07E01A001M |
| Well Name | 39N07E01A001M |
| State Number | 39N07E01A001M |
| WCR Number | 14565 |
| Site Code | 412539N1211050W001 |
| **Well Location** | |
| County | Modoc |
| Basin | Big Valley |
| Hydrologic Region | Sacramento River |
| Station Organization | Modoc County Planning Department |
| **Well Type Information** | |
| Well Use | Stockwatering |
| Completion Type | Single Well |

| Well Coordinates/Geometry | | |
|---|---|---|
| Location | Lat: | 41.2539 |
| | Long: | -121.1050 |
| Well Depth | | 300 ft |
| Ground Surface Elevation | | 4183.4 ft |
| Ref. Point Elevation | | 4184.40 ft |
| Screen Depth Range | | - |
| Screen Elevation Range | | - |
| **Well Period of Record** | | |
| Period-of-Record | | 1979..2022 |
| WS Elev-Range | Min: | 4035.4 ft |
| | Max | 4163.9 ft |

| Trend Analysis | | |
|---|---|---|
| Seasonal Data Method | | Apr1/Oct1 |
| **Show Trend 1** | | Spring Data |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | Yes |
| Trend Results | Slope | (1.203 ft/yr) |
| **Show Trend 2** | | None |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | No |
| Trend Results | Slope | - |

## Water Surface Elevation (WSE) Hydrograph: 39N07E01A001M




## Sustainability Indicator Considerations

| Observed WS Elevations | | |
|---|---|---|
| **Parameter** | | **Value** |
| WS Elevation Range | Min: | 4035.4 ft |
| | Max | 4163.9 ft |
| 2015 WS Elevations | Spring: | 4092.5 ft |
| | Fall: | 4035.4 ft |
| Current WS Elevations | Spring: | 4127.6 ft |
| | Fall: | 4084.5 ft |

| Trend Projections | | |
|---|---|---|
| **Year** | **Trend 1** | **Trend 2** |
| 2025 | 4115.3 ft | - |
| 2030 | 4109.3 ft | - |
| 2035 | 4103.3 ft | - |
| 2040 | 4097.2 ft | - |
| | - | - |
| | - | - |

## Sustainability Indicator Settings

| Key | Threshold Type | Effect. Yr. | Value | Description |
|---|---|---|---|---|
| MT | Minimum Threshold | 2022 | 3895.0 ft | |
| MO | Measureable Objective | 2022 | 4035.0 ft | |

# Groundwater Level Report

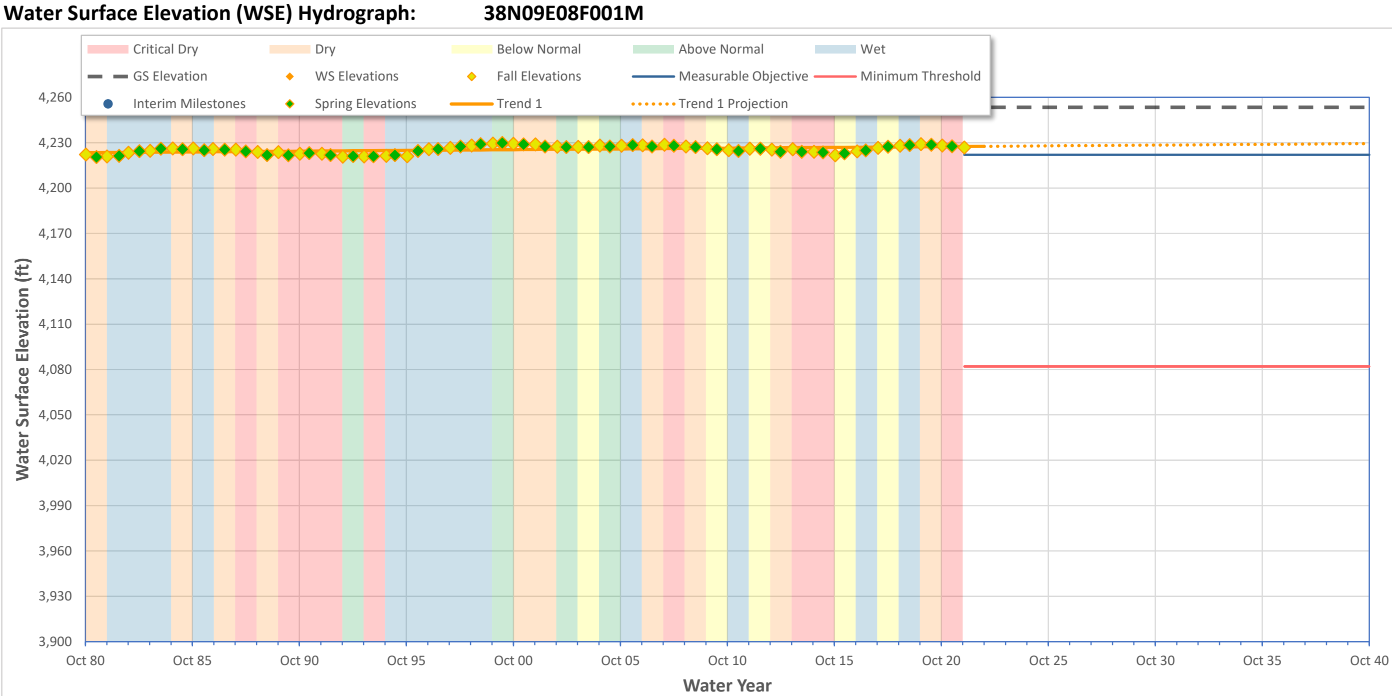
Date: 2/17/2022

| Well Information | |
|---|---|
| Well ID | 036672_38N09E08F001M |
| Well Name | 38N09E08F001M |
| State Number | 38N09E08F001M |
| WCR Number | 49934 |
| Site Code | 411493N1209656W001 |
| **Well Location** | |
| County | Lassen |
| Basin | Big Valley |
| Hydrologic Region | Sacramento River |
| Station Organization | Lassen County Department of Planning and Building Services |
| **Well Type Information** | |
| Well Use | Other |
| Completion Type | Single Well |

| Well Coordinates/Geometry | | |
|---|---|---|
| Location | Lat: | 41.1493 |
| | Long: | -120.9656 |
| Well Depth | | 217 ft |
| Ground Surface Elevation | | 4253.4 ft |
| Ref. Point Elevation | | 4255.40 ft |
| Screen Depth Range | | - |
| Screen Elevation Range | | - |
| **Well Period of Record** | | |
| Period-of-Record | | 1979..2022 |
| WS Elev-Range | Min: | 4220.5 ft |
| | Max | 4229.8 ft |

| Trend Analysis | | |
|---|---|---|
| Seasonal Data Method | | Apr1/Oct1 |
| **Show Trend 1** | | Spring Data |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | Yes |
| Trend Results | Slope | 0.100 ft/yr |
| **Show Trend 2** | | None |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | No |
| Trend Results | Slope | - |

**Water Surface Elevation (WSE) Hydrograph:** **38N09E08F001M**




## Sustainability Indicator Settings

| Key | Threshold Type | Effect. Yr. | Value | Description |
|---|---|---|---|---|
| MT | Minimum Threshold | 2022 | 4082.0 ft | |
| MO | Measureable Objective | 2022 | 4222.0 ft | |

# Groundwater Level Report

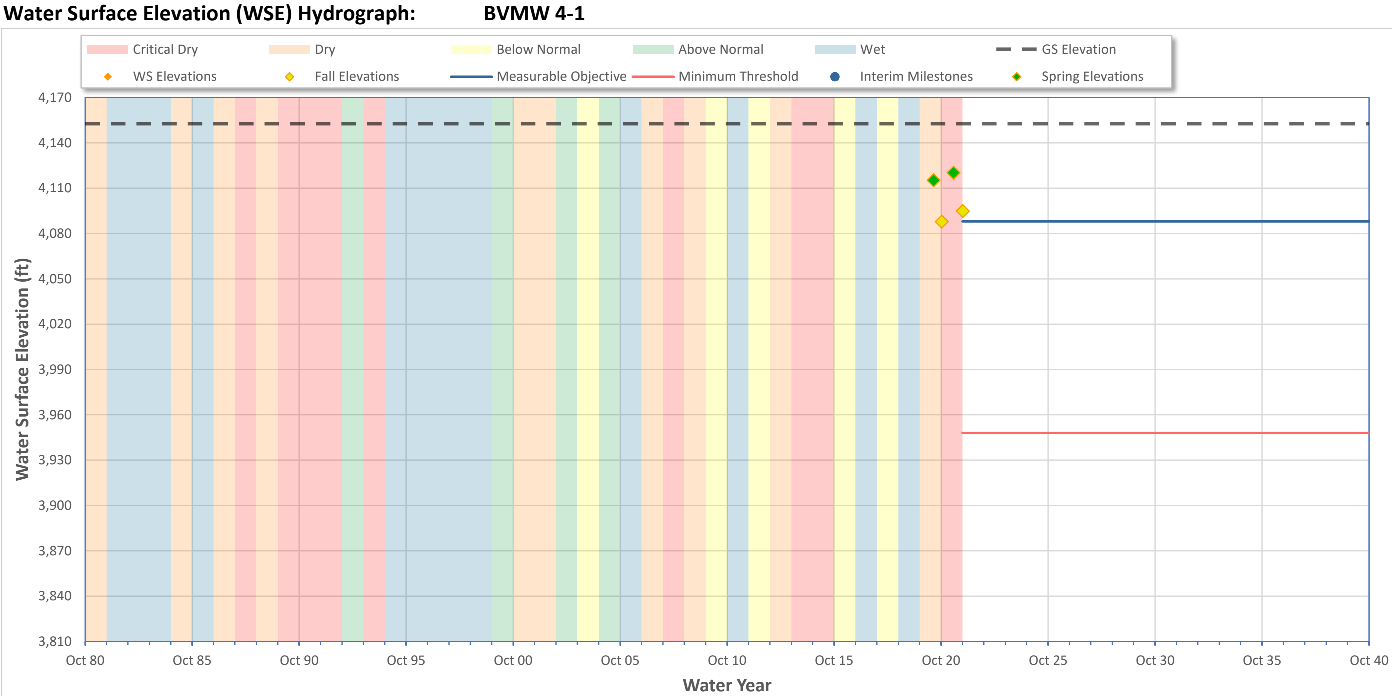
Date: 2/21/2022

| Well Information | |
|---|---|
| Well ID | 055627_BVMW 4-1 |
| Well Name | BVMW 4-1 |
| State Number | - |
| WCR Number | WCR2019-017359 |
| Site Code | 412029N1211587W001 |
| **Well Location** | |
| County | Lassen |
| Basin | Big Valley |
| Hydrologic Region | Sacramento River |
| Station Organization | Modoc County Planning Department |
| **Well Type Information** | |
| Well Use | Observation |
| Completion Type | Single Well |

| Well Coordinates/Geometry | | |
|---|---|---|
| Location | Lat: | 41.2029 |
| | Long: | -121.1587 |
| Well Depth | | 425 ft |
| Ground Surface Elevation | | 4152.7 ft |
| Ref. Point Elevation | | 4152.40 ft |
| Screen Depth Range | | 385 to 415 ft |
| Screen Elevation Range | | 3829 to 3799 ft |
| **Well Period of Record** | | |
| Period-of-Record | | 2020..2022 |
| WS Elev-Range | Min: | 4088.0 ft |
| | Max | 4120.3 ft |

| Trend Analysis | | |
|---|---|---|
| Seasonal Data Method | | Apr1/Oct1 |
| **Show Trend 1** | | Spring Data |
| Date Range (Optional) | Start WY: | 2014 |
| | End WY: | |
| Extend Trend Line | | Yes |
| Trend Results | Slope | 5.361 ft/yr |
| **Show Trend 2** | | None |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | No |
| Trend Results | Slope | - |

## Water Surface Elevation (WSE) Hydrograph: BVMW 4-1




## Sustainability Indicator Settings

| Key | Threshold Type | Effect. Yr. | Value | Description |
|---|---|---|---|---|
| MT | Minimum Threshold | 2022 | 3948.0 ft | |
| MO | Measureable Objective | 2022 | 4088.0 ft | |

# Groundwater Level Report

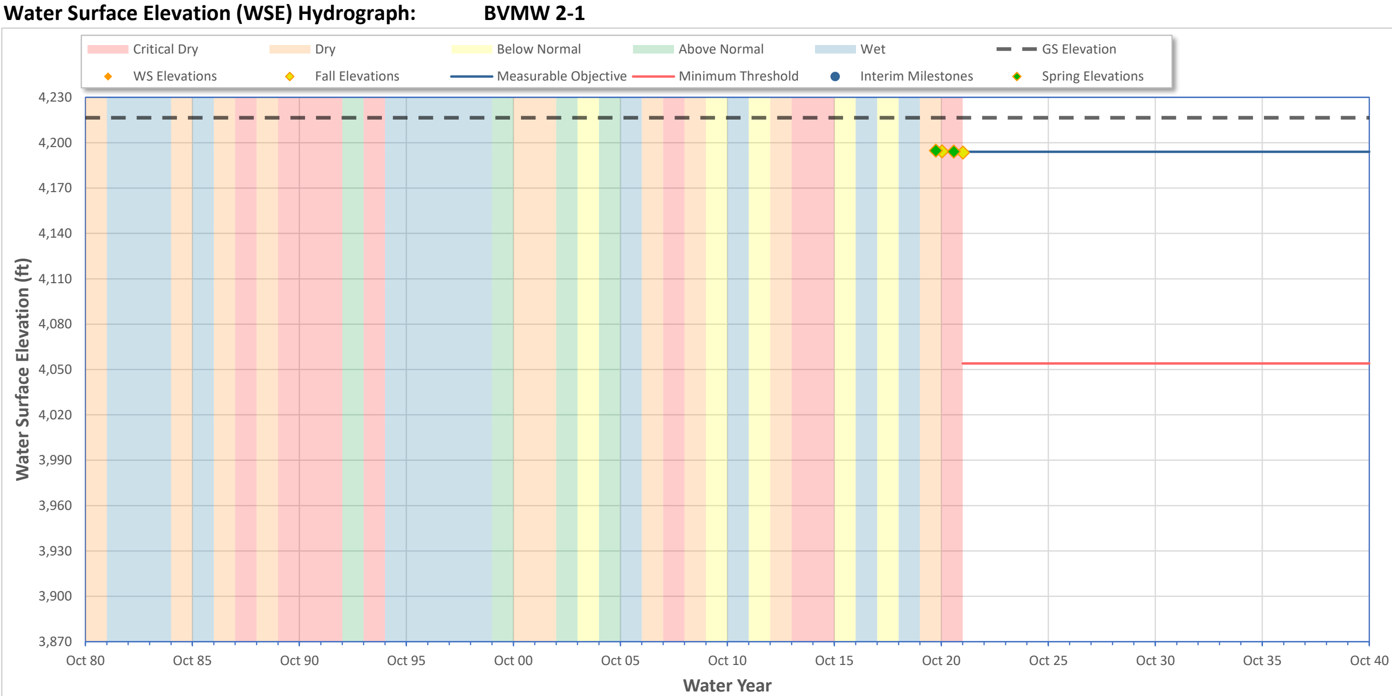
Date: 2/21/2022

| Well Information | |
|---|---|
| Well ID | 055619_BVMW 2-1 |
| Well Name | BVMW 2-1 |
| State Number | - |
| WCR Number | WCR2020-006667 |
| Site Code | 412119N1210286W001 |
| **Well Location** | |
| County | Lassen |
| Basin | Big Valley |
| Hydrologic Region | Sacramento River |
| Station Organization | Modoc County Planning Department |
| **Well Type Information** | |
| Well Use | Observation |
| Completion Type | Single Well |

| Well Coordinates/Geometry | | |
|---|---|---|
| Location | Lat: | 41.2119 |
| | Long: | -121.0286 |
| Well Depth | | 250 ft |
| Ground Surface Elevation | | 4216.5 ft |
| Ref. Point Elevation | | 4216.18 ft |
| Screen Depth Range | | 210 to 250 ft |
| Screen Elevation Range | | 3942 to 3902 ft |
| **Well Period of Record** | | |
| Period-of-Record | | 2020..2022 |
| WS Elev-Range | Min: | 4193.6 ft |
| | Max | 4194.9 ft |

| Trend Analysis | | |
|---|---|---|
| Seasonal Data Method | | Apr1/Oct1 |
| **Show Trend 1** | | Spring Data |
| Date Range (Optional) | Start WY: | 2014 |
| | End WY: | |
| Extend Trend Line | | Yes |
| Trend Results | Slope | (0.863 ft/yr) |
| **Show Trend 2** | | None |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | No |
| Trend Results | Slope | - |

**Water Surface Elevation (WSE) Hydrograph: BVMW 2-1**




## Sustainability Indicator Considerations

| Observed WS Elevations | | |
|---|---|---|
| **Parameter** | | **Value** |
| WS Elevation Range | Min: | 4193.6 ft |
| | Max | 4194.9 ft |
| 2015 WS Elevations | Spring: | - |
| | Fall: | - |
| Current WS Elevations | Spring: | 4194.1 ft |
| | Fall: | 4193.6 ft |

| Trend Projections | | |
|---|---|---|
| **Year** | **Trend 1** | **Trend 2** |
| 2025 | 4190.3 ft | - |
| 2030 | 4186.0 ft | - |
| 2035 | 4181.7 ft | - |
| 2040 | 4177.4 ft | - |
| | - | - |
| | - | - |

## Sustainability Indicator Settings

| Key | Threshold Type | Effect. Yr. | Value | Description |
|---|---|---|---|---|
| MT | Minimum Threshold | 2022 | 4054.0 ft | |
| MO | Measureable Objective | 2022 | 4194.0 ft | |

# Groundwater Level Report

Date: 2/21/2022

## Well Information

| | |
|---|---|
| Well ID | 055623_BVMW 3-1 |
| Well Name | BVMW 3-1 |
| State Number | - |
| WCR Number | WCR2020-006592 |
| Site Code | 412169N1211050W001 |

## Well Location

| | |
|---|---|
| County | Lassen |
| Basin | Big Valley |
| Hydrologic Region | Sacramento River |
| Station Organization | Modoc County Planning Department |

## Well Type Information

| | |
|---|---|
| Well Use | Observation |
| Completion Type | Single Well |

## Well Coordinates/Geometry

| | | |
|---|---|---|
| Location | Lat: | 41.2169 |
| | Long: | -121.1050 |
| Well Depth | | 185 ft |
| Ground Surface Elevation | | 4164.8 ft |
| Ref. Point Elevation | | 4164.41 ft |
| Screen Depth Range | | 135 to 185 ft |
| Screen Elevation Range | | 4079 to 4029 ft |

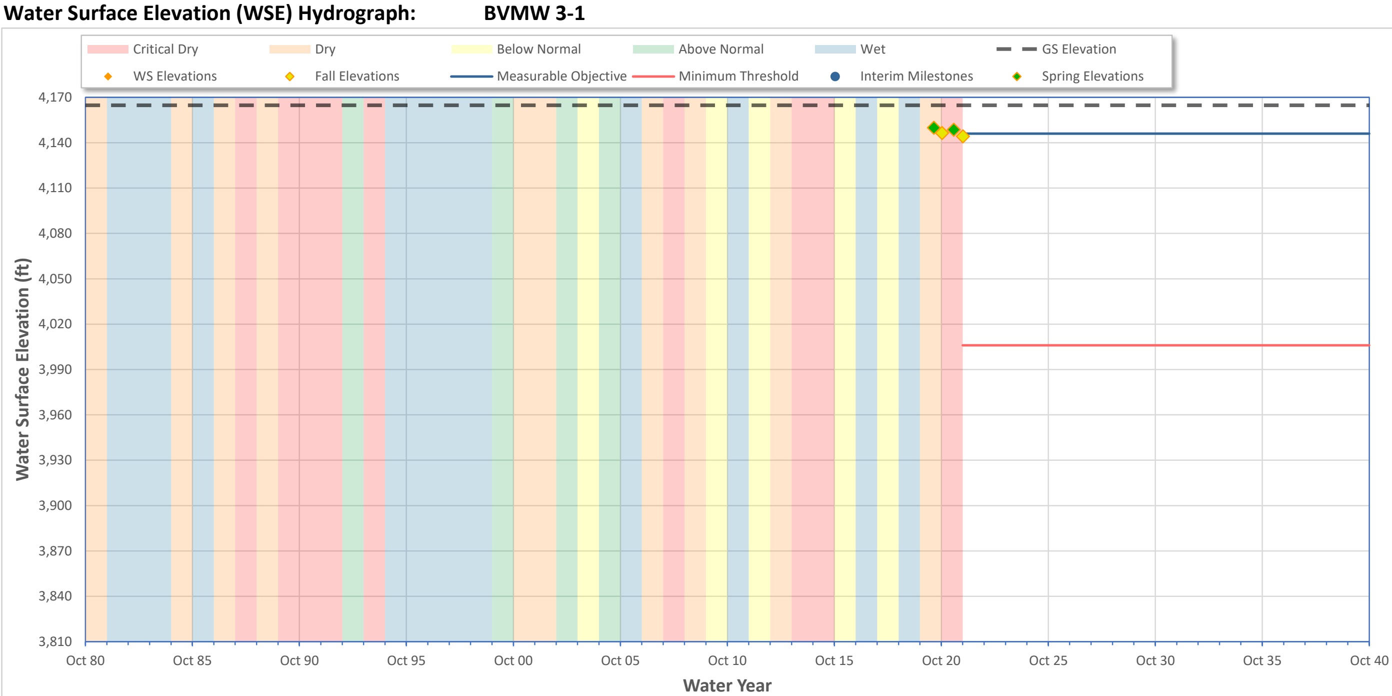
## Well Period of Record

| | | |
|---|---|---|
| Period-of-Record | | 2020..2022 |
| WS Elev-Range | Min: | 4144.3 ft |
| | Max | 4149.9 ft |

## Trend Analysis

| | | |
|---|---|---|
| Seasonal Data Method | | Apr1/Oct1 |
| **Show Trend 1** | | Spring Data |
| Date Range (Optional) | Start WY: | 2014 |
| | End WY: | |
| Extend Trend Line | | Yes |
| Trend Results | Slope | (3.300 ft/yr) |
| **Show Trend 2** | | None |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | No |
| Trend Results | Slope | - |

**Water Surface Elevation (WSE) Hydrograph: BVMW 3-1**




## Sustainability Indicator Considerations

**Observed WS Elevations**

| Parameter | | Value |
|---|---|---|
| WS Elevation Range | Min: | 4144.3 ft |
| | Max | 4149.9 ft |
| 2015 WS Elevations | Spring: | - |
| | Fall: | - |
| Current WS Elevations | Spring: | 4181.2 ft |
| | Fall: | 4156.8 ft |

**Trend Projections**

| Year | Trend 1 | Trend 2 |
|---|---|---|
| 2025 | 4166.6 ft | - |
| 2030 | 4150.1 ft | - |
| 2035 | 4133.6 ft | - |
| 2040 | 4117.1 ft | - |
| | - | - |
| | - | - |

## Sustainability Indicator Settings

| Key | Threshold Type | Effect. Yr. | Value | Description |
|---|---|---|---|---|
| MT | Minimum Threshold | 2022 | 4006.0 ft | |
| MO | Measureable Objective | 2022 | 4146.0 ft | |

# Groundwater Level Report

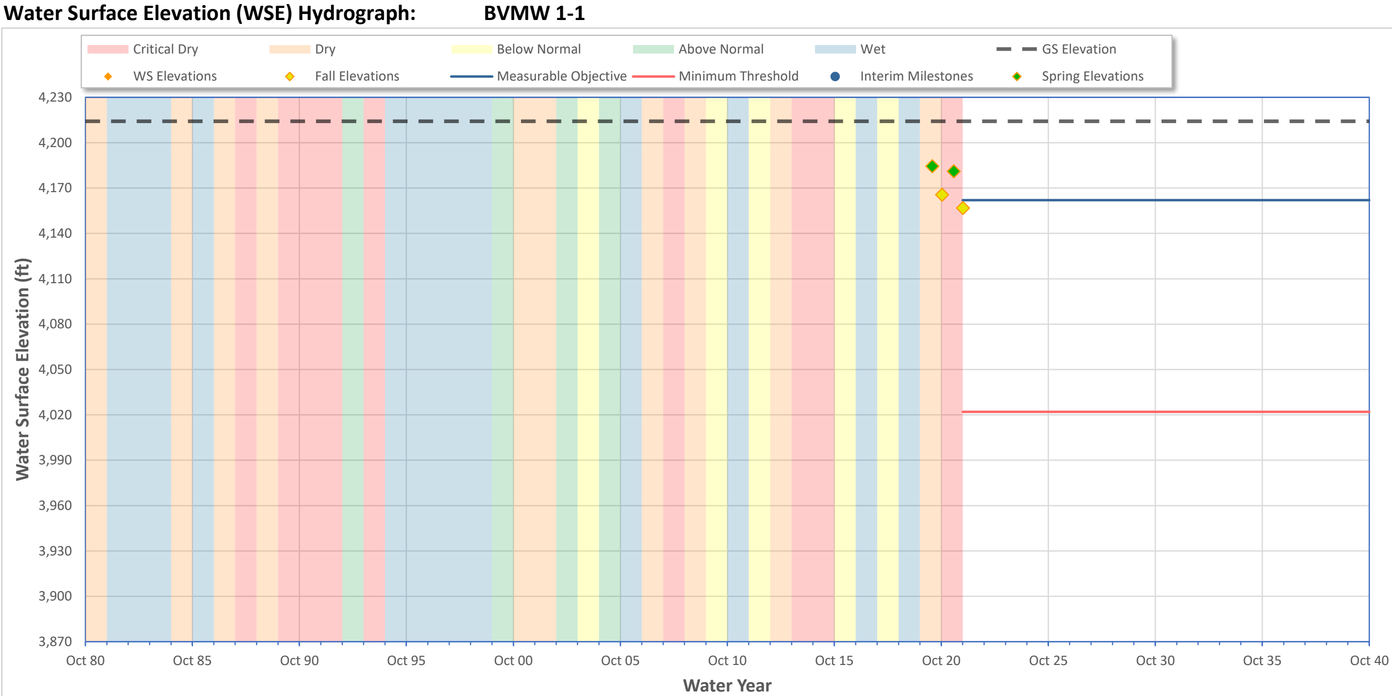
Date: 2/21/2022

| Well Information | |
|---|---|
| Well ID | 055615_BVMW 1-1 |
| Well Name | BVMW 1-1 |
| State Number | - |
| WCR Number | WCR2020-006214 |
| Site Code | 411880N1209599W001 |
| **Well Location** | |
| County | Lassen |
| Basin | Big Valley |
| Hydrologic Region | Sacramento River |
| Station Organization | Modoc County Planning Department |
| **Well Type Information** | |
| Well Use | Observation |
| Completion Type | Single Well |

| Well Coordinates/Geometry | | |
|---|---|---|
| Location | Lat: | 41.1880 |
| | Long: | -120.9599 |
| Well Depth | | 265 ft |
| Ground Surface Elevation | | 4214.2 ft |
| Ref. Point Elevation | | 4213.84 ft |
| Screen Depth Range | | 175 to 265 ft |
| Screen Elevation Range | | 4039 to 3949 ft |
| **Well Period of Record** | | |
| Period-of-Record | | 2020..2022 |
| WS Elev-Range | Min: | 4156.8 ft |
| | Max | 4184.5 ft |

| Trend Analysis | | |
|---|---|---|
| Seasonal Data Method | | Apr1/Oct1 |
| **Show Trend 1** | | Spring Data |
| Date Range (Optional) | Start WY: | 2014 |
| | End WY: | |
| Extend Trend Line | | Yes |
| Trend Results | Slope | (3.300 ft/yr) |
| **Show Trend 2** | | None |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | No |
| Trend Results | Slope | - |

## Water Surface Elevation (WSE) Hydrograph: BVMW 1-1




## Sustainability Indicator Considerations

| Observed WS Elevations | | |
|---|---|---|
| **Parameter** | | **Value** |
| WS Elevation Range | Min: | 4156.8 ft |
| | Max | 4184.5 ft |
| 2015 WS Elevations | Spring: | - |
| | Fall: | - |
| Current WS Elevations | Spring: | 4181.2 ft |
| | Fall: | 4156.8 ft |

| Trend Projections | | |
|---|---|---|
| **Year** | **Trend 1** | **Trend 2** |
| 2025 | 4166.6 ft | - |
| 2030 | 4150.1 ft | - |
| 2035 | 4133.6 ft | - |
| 2040 | 4117.1 ft | - |
| | - | - |
| | - | - |

## Sustainability Indicator Settings

| Key | Threshold Type | Effect. Yr. | Value | Description |
|---|---|---|---|---|
| MT | Minimum Threshold | 2022 | 4022.0 ft | |
| MO | Measureable Objective | 2022 | 4162.0 ft | |

# Groundwater Level Report

Date: 2/21/2022

| Well Information | |
|---|---|
| Well ID | 051537_ACWA-3 |
| Well Name | ACWA-3 |
| State Number | 39N08E28A001M |
| WCR Number | 951365 |
| Site Code | 411938N1210478W001 |
| **Well Location** | |
| County | Modoc |
| Basin | Big Valley |
| Hydrologic Region | Sacramento River |
| Station Organization | Lassen County Department of Planning and Building Services |
| **Well Type Information** | |
| Well Use | Irrigation |
| Completion Type | Single Well |

| Well Coordinates/Geometry | | |
|---|---|---|
| Location | Lat: | 41.1938 |
| | Long: | -121.0478 |
| Well Depth | | 720 ft |
| Ground Surface Elevation | | 4159.0 ft |
| Ref. Point Elevation | | 4159.83 ft |
| Screen Depth Range | | 60 to 720 ft |
| Screen Elevation Range | | 4154 to 3494 ft |
| **Well Period of Record** | | |
| Period-of-Record | | 2016..2022 |
| WS Elev-Range | Min: | 4135.9 ft |
| | Max | 4150.6 ft |

| Trend Analysis | | |
|---|---|---|
| Seasonal Data Method | | Apr1/Oct1 |
| **Show Trend 1** | | Spring Data |
| Date Range (Optional) | Start WY: | 2014 |
| | End WY: | |
| Extend Trend Line | | Yes |
| Trend Results | Slope | 0.160 ft/yr |
| **Show Trend 2** | | None |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | No |
| Trend Results | Slope | - |

**Water Surface Elevation (WSE) Hydrograph: ACWA-3**


## Sustainability Indicator Considerations

| Observed WS Elevations | | |
|---|---|---|
| **Parameter** | | **Value** |
| WS Elevation Range | Min: | 4135.9 ft |
| | Max | 4150.6 ft |
| 2015 WS Elevations | Spring: | - |
| | Fall: | - |
| Current WS Elevations | Spring: | 4148.3 ft |
| | Fall: | 4139.0 ft |

| Trend Projections | | |
|---|---|---|
| **Year** | **Trend 1** | **Trend 2** |
| 2025 | 4150.0 ft | - |
| 2030 | 4150.8 ft | - |
| 2035 | 4151.6 ft | - |
| 2040 | 4152.4 ft | - |
| | - | - |
| | - | - |

## Sustainability Indicator Settings

| Key | Threshold Type | Effect. Yr. | Value | Description |
|---|---|---|---|---|
| MT | Minimum Threshold | 2022 | 3996.0 ft | |
| MO | Measureable Objective | 2022 | 4136.0 ft | |

# Groundwater Level Report

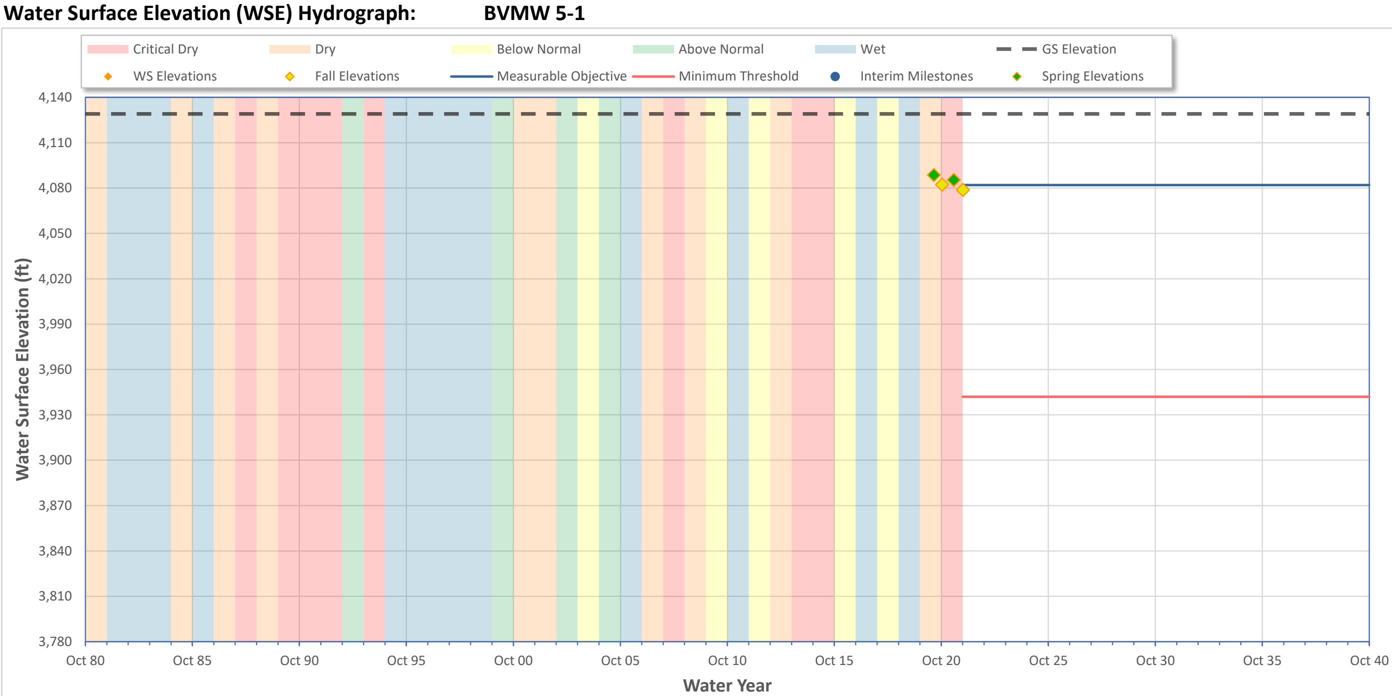
Date: 2/21/2022

| Well Information | |
|---|---|
| Well ID | 055525_BVMW 5-1 |
| Well Name | BVMW 5-1 |
| State Number | - |
| WCR Number | WCR2020-006658 |
| Site Code | 411219N1211339W001 |
| **Well Location** | |
| County | Lassen |
| Basin | Big Valley |
| Hydrologic Region | Sacramento River |
| Station Organization | Lassen County Department of Planning and Building Services |
| **Well Type Information** | |
| Well Use | Observation |
| Completion Type | Single Well |

| Well Coordinates/Geometry | | |
|---|---|---|
| Location | Lat: | 41.1219 |
| | Long: | -121.1339 |
| Well Depth | | 540 ft |
| Ground Surface Elevation | | 4129.1 ft |
| Ref. Point Elevation | | 4129.05 ft |
| Screen Depth Range | | 485 to 535 ft |
| Screen Elevation Range | | 3679 to 3629 ft |
| **Well Period of Record** | | |
| Period-of-Record | | 2020..2022 |
| WS Elev-Range | Min: | 4078.8 ft |
| | Max | 4088.7 ft |

| Trend Analysis | | |
|---|---|---|
| Seasonal Data Method | | Apr1/Oct1 |
| **Show Trend 1** | | Spring Data |
| Date Range (Optional) | Start WY: | 2014 |
| | End WY: | |
| Extend Trend Line | | Yes |
| Trend Results | Slope | (3.534 ft/yr) |
| **Show Trend 2** | | None |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | No |
| Trend Results | Slope | - |

**Water Surface Elevation (WSE) Hydrograph: BVMW 5-1**




## Sustainability Indicator Considerations

| Observed WS Elevations | | |
|---|---|---|
| **Parameter** | | **Value** |
| WS Elevation Range | Min: | 4078.8 ft |
| | Max | 4088.7 ft |
| 2015 WS Elevations | Spring: | - |
| | Fall: | - |
| Current WS Elevations | Spring: | 4085.4 ft |
| | Fall: | 4078.8 ft |

| Trend Projections | | |
|---|---|---|
| **Year** | **Trend 1** | **Trend 2** |
| 2025 | 4069.8 ft | - |
| 2030 | 4052.2 ft | - |
| 2035 | 4034.5 ft | - |
| 2040 | 4016.8 ft | - |
| | - | - |
| | - | - |

## Sustainability Indicator Settings

| Key | Threshold Type | Effect. Yr. | Value | Description |
|---|---|---|---|---|
| MT | Minimum Threshold | 2022 | 3942.0 ft | |
| MO | Measureable Objective | 2022 | 4082.0 ft | |

# Groundwater Level Report

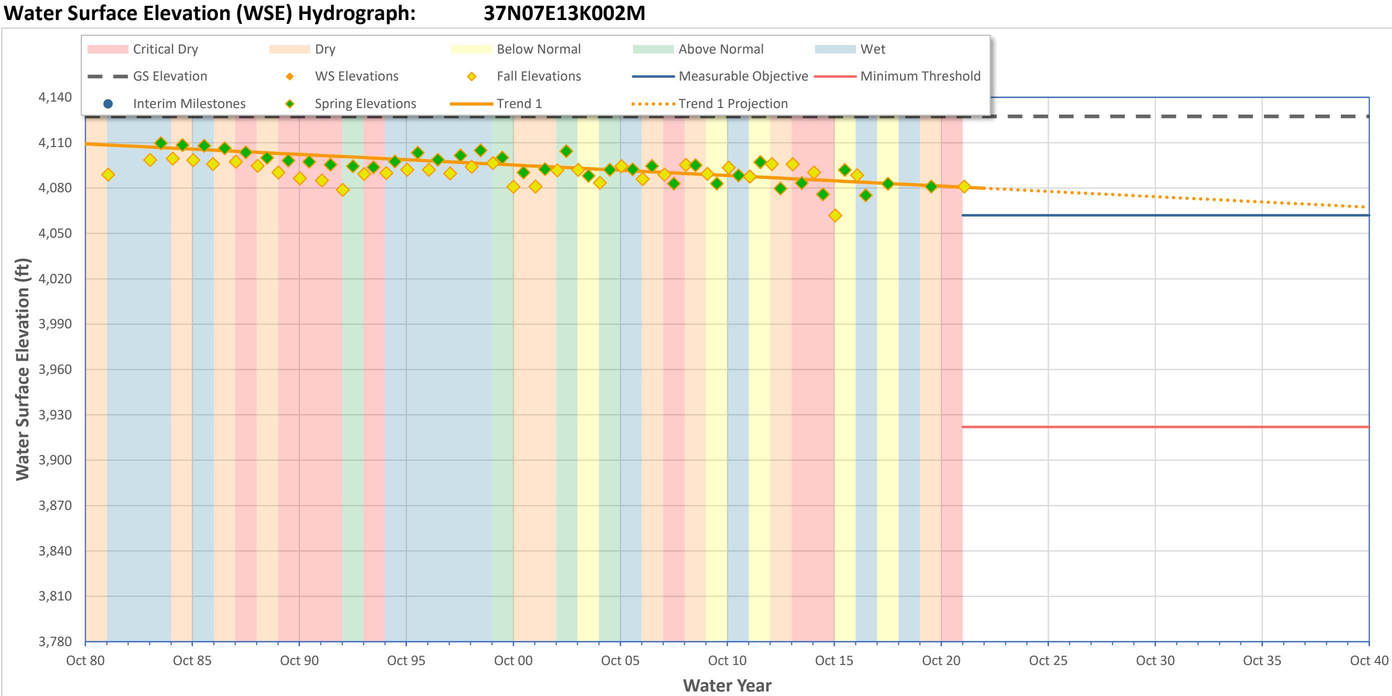
Date: 2/17/2022

| Well Information | |
|---|---|
| Well ID | 036667_37N07E13K002M |
| Well Name | 37N07E13K002M |
| State Number | 37N07E13K002M |
| WCR Number | 90029 |
| Site Code | 410413N1211147W001 |
| **Well Location** | |
| County | Lassen |
| Basin | Big Valley |
| Hydrologic Region | Sacramento River |
| Station Organization | Lassen County Department of Planning and Building Services |
| **Well Type Information** | |
| Well Use | Irrigation |
| Completion Type | Single Well |

| Well Coordinates/Geometry | | |
|---|---|---|
| Location | Lat: | 41.0413 |
| | Long: | -121.1147 |
| Well Depth | | 260 ft |
| Ground Surface Elevation | | 4127.4 ft |
| Ref. Point Elevation | | 4127.90 ft |
| Screen Depth Range | | - |
| Screen Elevation Range | | - |
| **Well Period of Record** | | |
| Period-of-Record | | 1982..2022 |
| WS Elev-Range | Min: | 4061.9 ft |
| | Max | 4109.7 ft |

| Trend Analysis | | |
|---|---|---|
| Seasonal Data Method | | Apr1/Oct1 |
| **Show Trend 1** | | Spring Data |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | Yes |
| Trend Results | Slope | (0.699 ft/yr) |
| **Show Trend 2** | | None |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | No |
| Trend Results | Slope | - |

**Water Surface Elevation (WSE) Hydrograph: 37N07E13K002M**




**Sustainability Indicator Settings**

| Key | Threshold Type | Effect. Yr. | Value | Description |
|---|---|---|---|---|
| MT | Minimum Threshold | 2022 | 3922.0 ft | |
| MO | Measureable Objective | 2022 | 4062.0 ft | |

# Groundwater Level Report

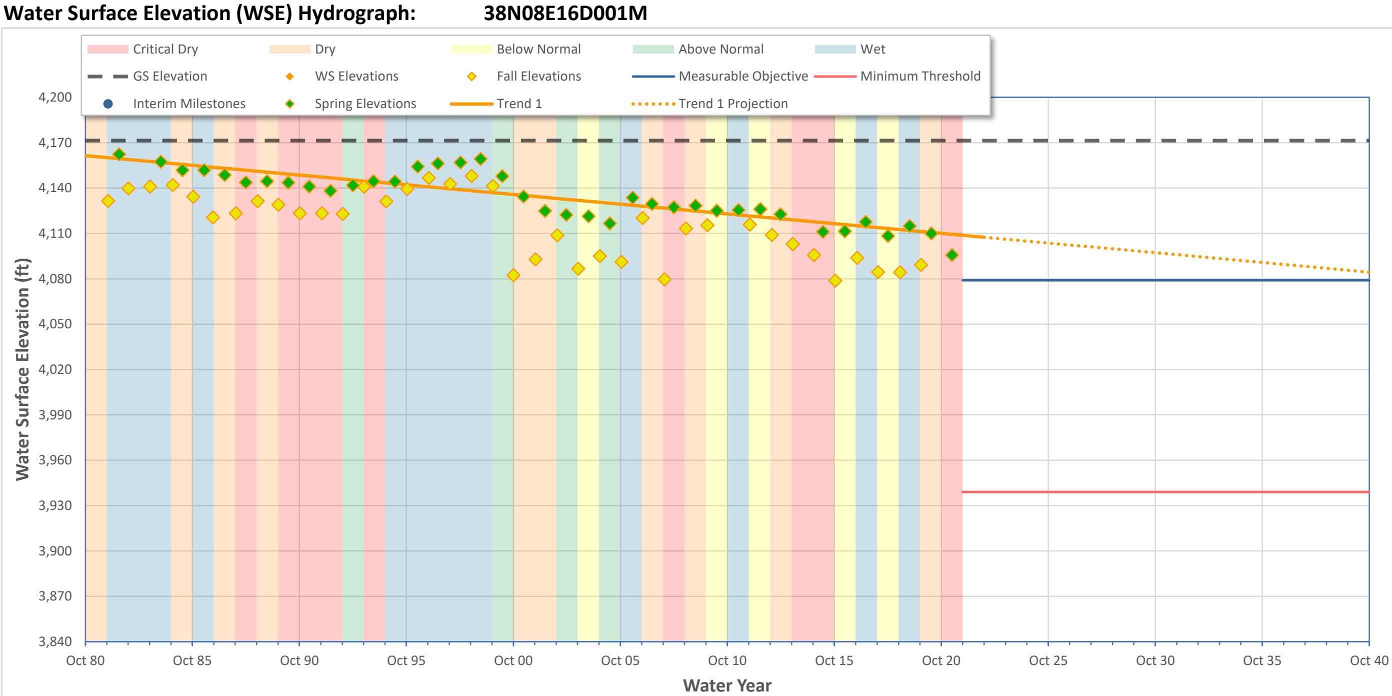
Date: 2/17/2022

| Well Information | |
|---|---|
| Well ID | 022097_38N08E16D001M |
| Well Name | 38N08E16D001M |
| State Number | 38N08E16D001M |
| WCR Number | 90143 |
| Site Code | 411359N1210625W001 |
| **Well Location** | |
| County | Lassen |
| Basin | Big Valley |
| Hydrologic Region | Sacramento River |
| Station Organization | Lassen County Department of Planning and Building Services |
| **Well Type Information** | |
| Well Use | Irrigation |
| Completion Type | Single Well |

| Well Coordinates/Geometry | | |
|---|---|---|
| Location | Lat: | 41.1358 |
| | Long: | -121.0625 |
| Well Depth | | 491 ft |
| Ground Surface Elevation | | 4171.4 ft |
| Ref. Point Elevation | | 4171.60 ft |
| Screen Depth Range | | - |
| Screen Elevation Range | | - |
| **Well Period of Record** | | |
| Period-of-Record | | 1982..2022 |
| WS Elev-Range | Min: | 4078.7 ft |
| | Max | 4162.4 ft |

| Trend Analysis | | |
|---|---|---|
| Seasonal Data Method | | Apr1/Oct1 |
| **Show Trend 1** | | Spring Data |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | Yes |
| Trend Results | Slope | (1.284 ft/yr) |
| **Show Trend 2** | | None |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | No |
| Trend Results | Slope | - |

**Water Surface Elevation (WSE) Hydrograph:** 38N08E16D001M




**Sustainability Indicator Settings**

| Key | Threshold Type | Effect. Yr. | Value | Description |
|---|---|---|---|---|
| MT | Minimum Threshold | 2022 | 3939.0 ft | |
| MO | Measureable Objective | 2022 | 4079.0 ft | |

# Groundwater Level Report

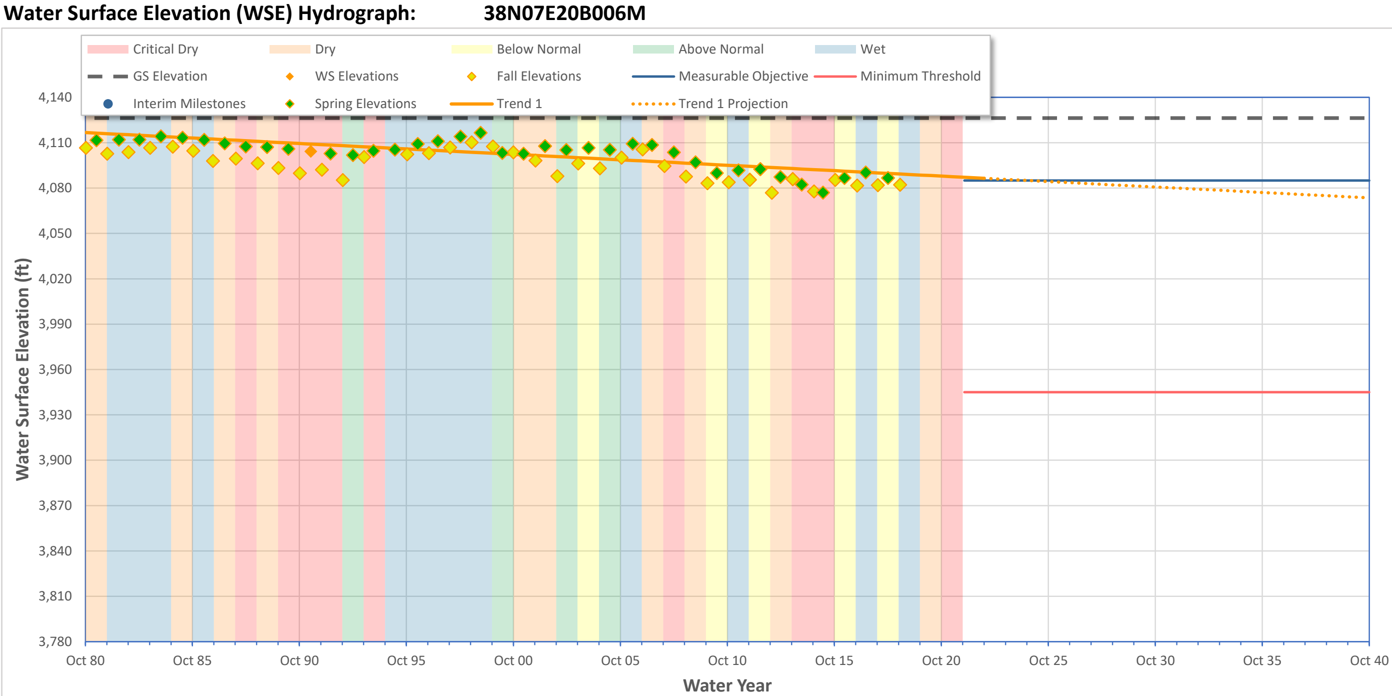
Date: 2/17/2022

| Well Information | |
|---|---|
| Well ID | 022094_38N07E20B006M |
| Well Name | 38N07E20B006M |
| State Number | 38N07E20B006M |
| WCR Number | 128135 |
| Site Code | 411242N1211866W001 |
| **Well Location** | |
| County | Lassen |
| Basin | Big Valley |
| Hydrologic Region | Sacramento River |
| Station Organization | Lassen County Department of Planning and Building Services |
| **Well Type Information** | |
| Well Use | Residential |
| Completion Type | Single Well |

| Well Coordinates/Geometry | | |
|---|---|---|
| Location | Lat: | 41.1242 |
| | Long: | -121.1866 |
| Well Depth | | 183 ft |
| Ground Surface Elevation | | 4126.3 ft |
| Ref. Point Elevation | | 4127.30 ft |
| Screen Depth Range | | - |
| Screen Elevation Range | | - |
| **Well Period of Record** | | |
| Period-of-Record | | 1979..2022 |
| WS Elev-Range | Min: | 4076.9 ft |
| | Max | 4116.6 ft |

| Trend Analysis | | |
|---|---|---|
| Seasonal Data Method | | Apr1/Oct1 |
| **Show Trend 1** | | Spring Data |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | Yes |
| Trend Results | Slope | (0.720 ft/yr) |
| **Show Trend 2** | | None |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | No |
| Trend Results | Slope | - |

**Water Surface Elevation (WSE) Hydrograph: 38N07E20B006M**




**Sustainability Indicator Settings**

| Key | Threshold Type | Effect. Yr. | Value | Description |
|---|---|---|---|---|
| MT | Minimum Threshold | 2022 | 3945.0 ft | |
| MO | Measureable Objective | 2022 | 4085.0 ft | |

# Groundwater Level Report

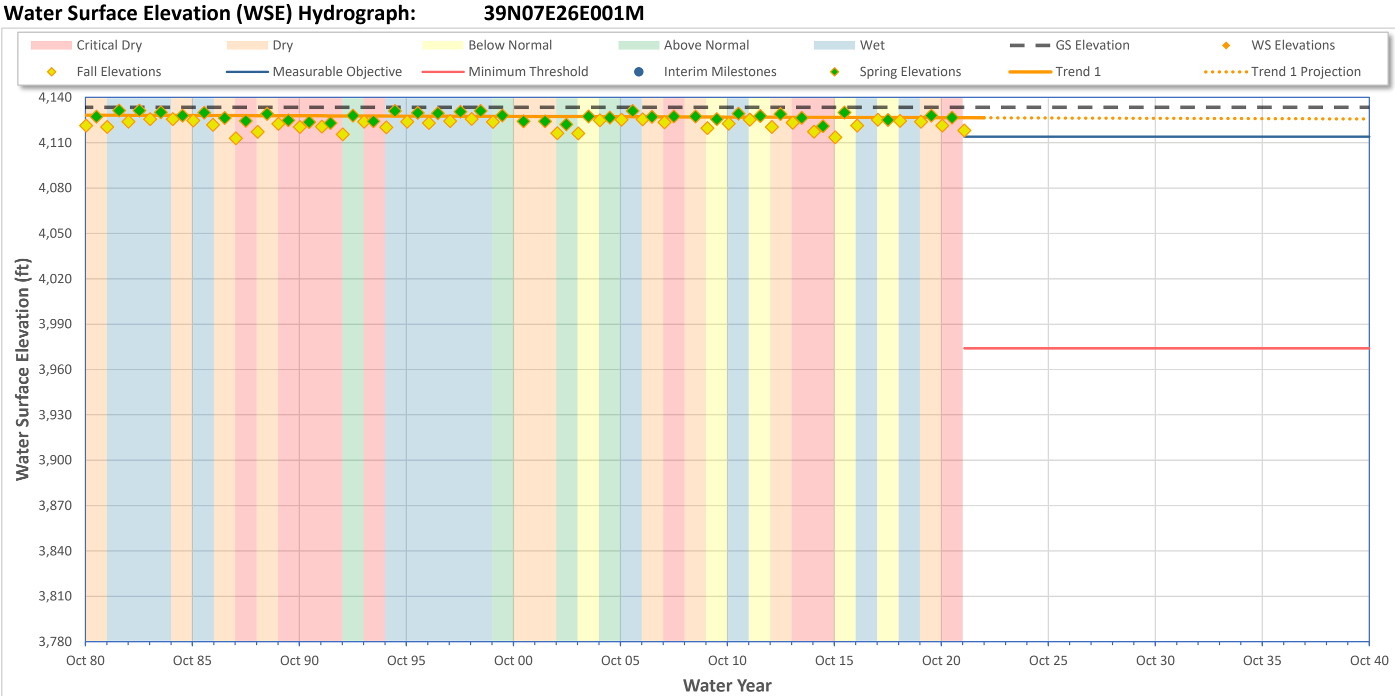
Date: 2/21/2022

| Well Information | |
|---|---|
| Well ID | 022102_39N07E26E001M |
| Well Name | 39N07E26E001M |
| State Number | 39N07E26E001M |
| WCR Number | 127484 |
| Site Code | 411911N1211354W001 |
| **Well Location** | |
| County | Modoc |
| Basin | Big Valley |
| Hydrologic Region | Sacramento River |
| Station Organization | Modoc County Planning Department |
| **Well Type Information** | |
| Well Use | Irrigation |
| Completion Type | Single Well |

| Well Coordinates/Geometry | | |
|---|---|---|
| Location | Lat: | 41.1911 |
| | Long: | -121.1354 |
| Well Depth | | 400 ft |
| Ground Surface Elevation | | 4133.4 ft |
| Ref. Point Elevation | | 4135.00 ft |
| Screen Depth Range | | 20 to 400 ft |
| Screen Elevation Range | | 4115 to 3735 ft |
| **Well Period of Record** | | |
| Period-of-Record | | 1979..2022 |
| WS Elev-Range | Min: | 4113.0 ft |
| | Max | 4131.3 ft |

| Trend Analysis | | |
|---|---|---|
| Seasonal Data Method | | Apr1/Oct1 |
| **Show Trend 1** | | Spring Data |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | Yes |
| Trend Results | Slope | (0.042 ft/yr) |
| **Show Trend 2** | | None |
| Date Range (Optional) | Start WY: | |
| | End WY: | |
| Extend Trend Line | | No |
| Trend Results | Slope | - |

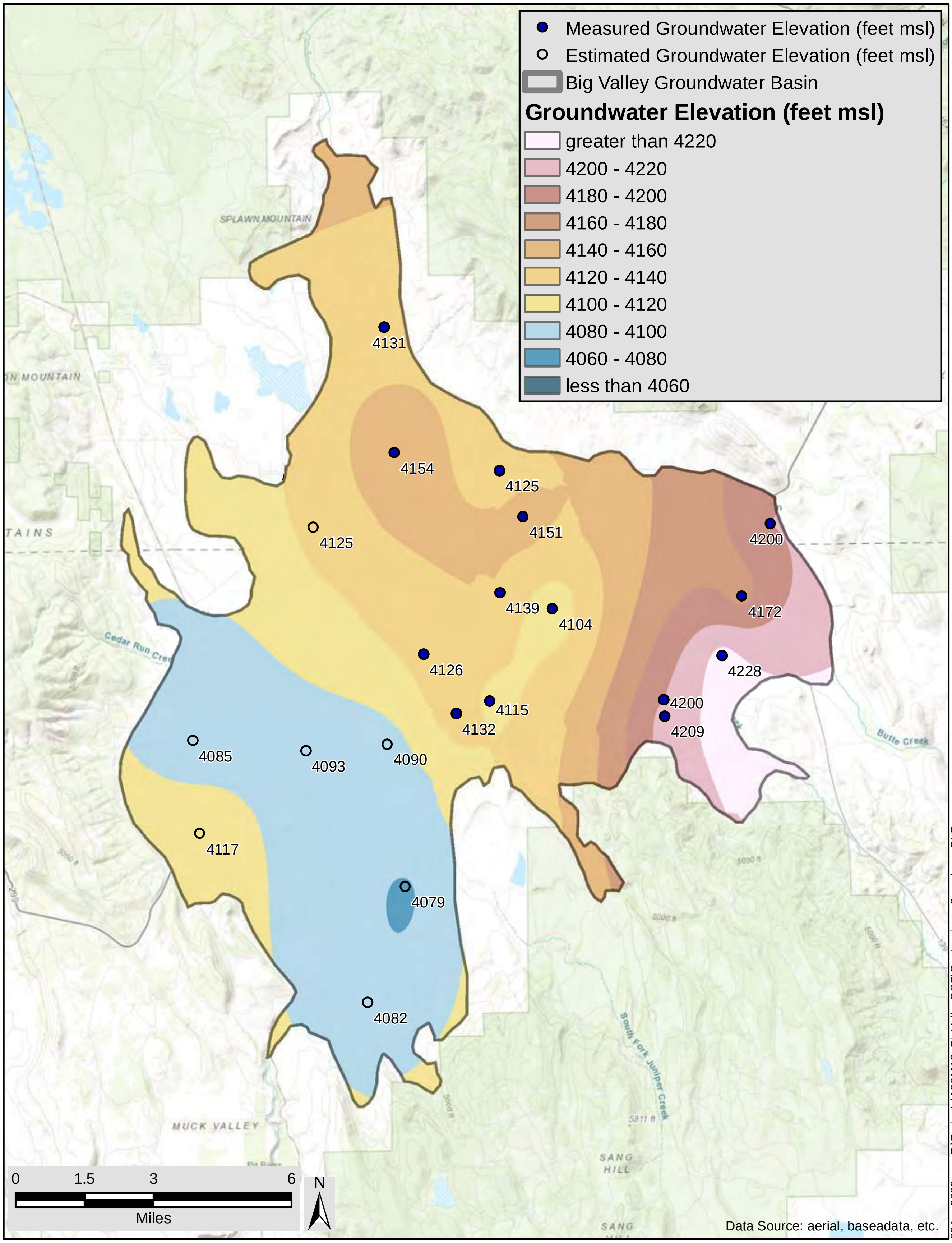
**Water Surface Elevation (WSE) Hydrograph: 39N07E26E001M**




**Sustainability Indicator Settings**

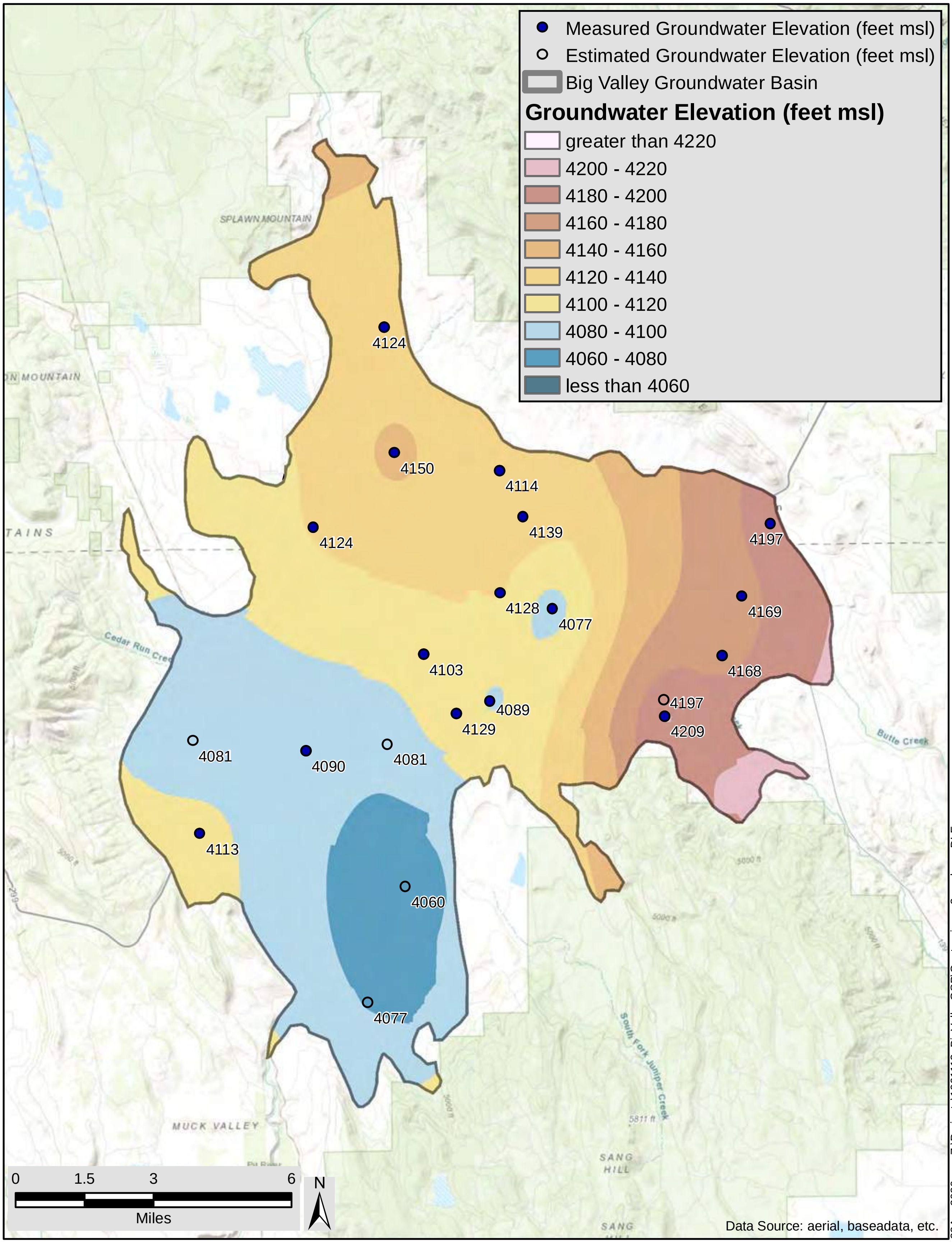
| Key | Threshold Type | Effect. Yr. | Value | Description |
|---|---|---|---|---|
| MT | Minimum Threshold | 2022 | 3974.0 ft | |
| MO | Measureable Objective | 2022 | 4114.0 ft | |

## Appendix B: Groundwater Elevation Contours



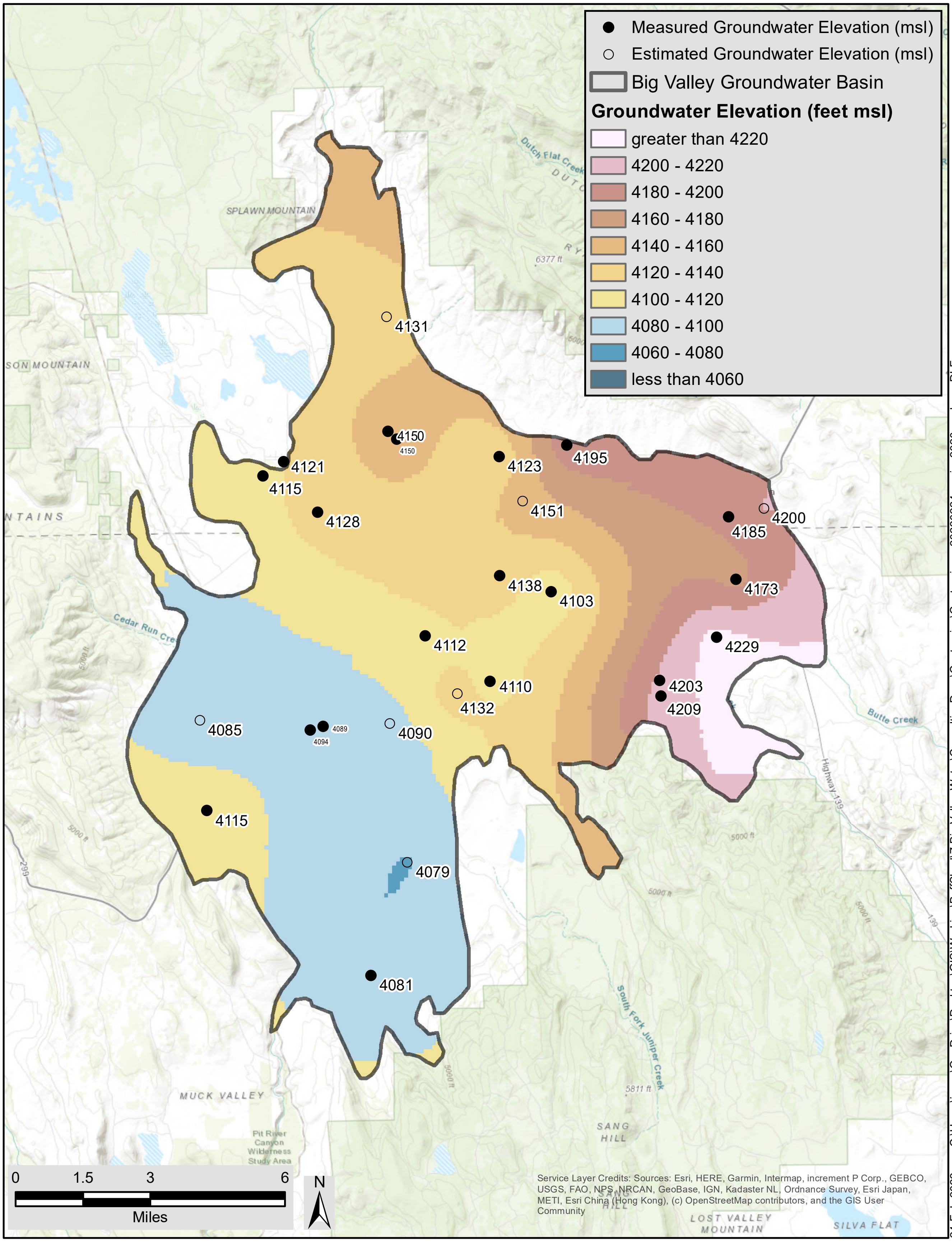

DLF Z:\Projects\1901113_BigValleyGSP\Contouring_v3.mxd 22Aug2020

| | | |
|---|---|---|
| Big Valley Basin Groundwater Sustainability Plan<br>Modoc and Lassen Counties, California | GEI Consultants | Groundwater Elevations<br>Spring 2019 |
| Big Valley Groundwater Basin GSAs | | FEBRUARY 2022 **FINAL** FIGURE |




22Aug2020 Z:\Projects\1901113_BigValleyGSP\Contouring_v3.mxd DLF

| Big Valley Basin Groundwater Sustainability Plan<br>Modoc and Lassen Counties, California | GEI Consultants | Groundwater Elevations<br>Fall 2019 |
|---|---|---|
| Big Valley Groundwater Basin GSAs | | FEBRUARY 2022 **FINAL** FIGURE |




DLF
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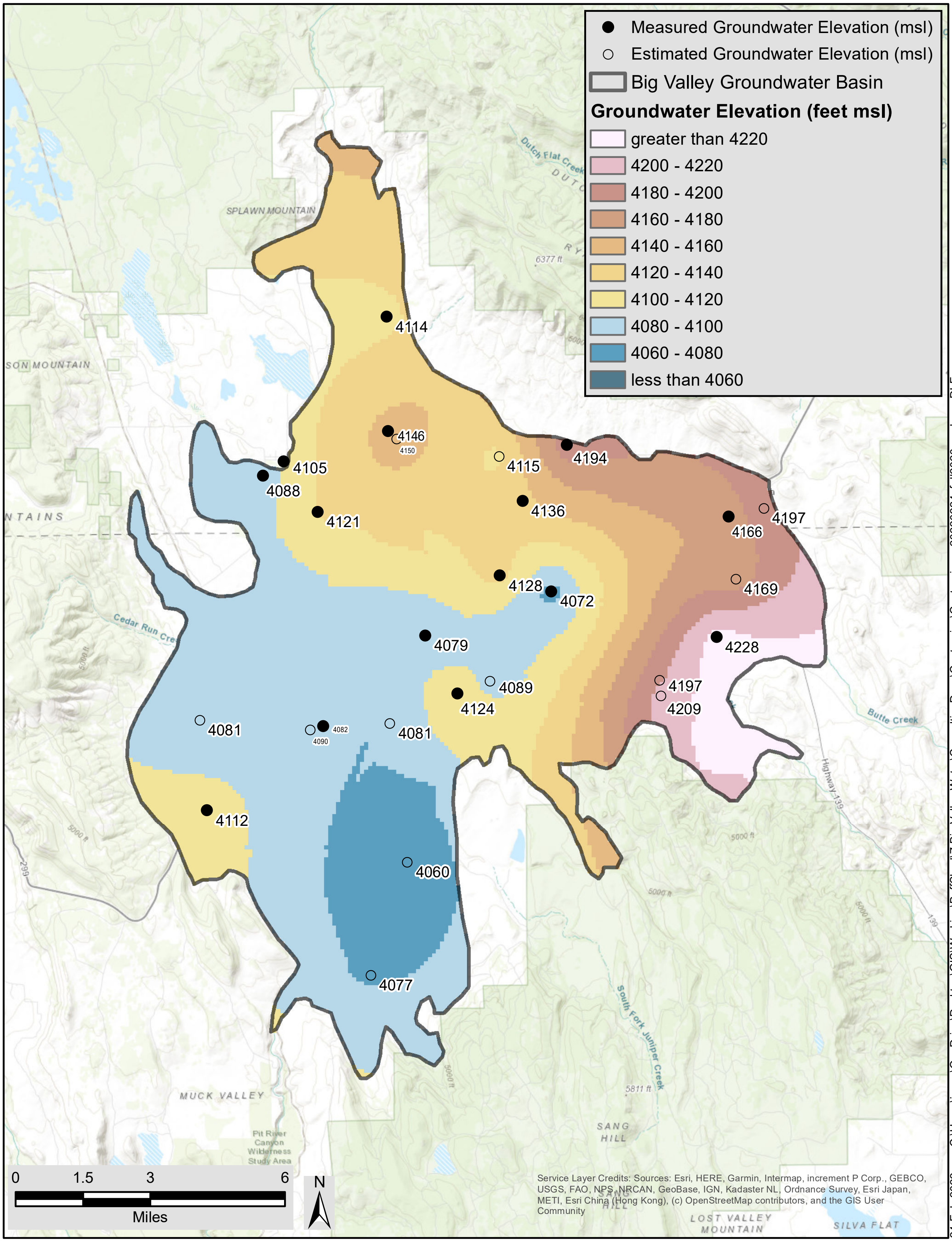
24-Feb-2022

| Big Valley Basin Groundwater Sustainability Plan<br>Modoc and Lassen Counties, California | | Groundwater Elevations<br>Spring 2020 | | |
|---|---|---|---|---|
| Big Valley Groundwater Basin GSAs | | FEBRUARY 2022 | **FINAL** | FIGURE |




DLF
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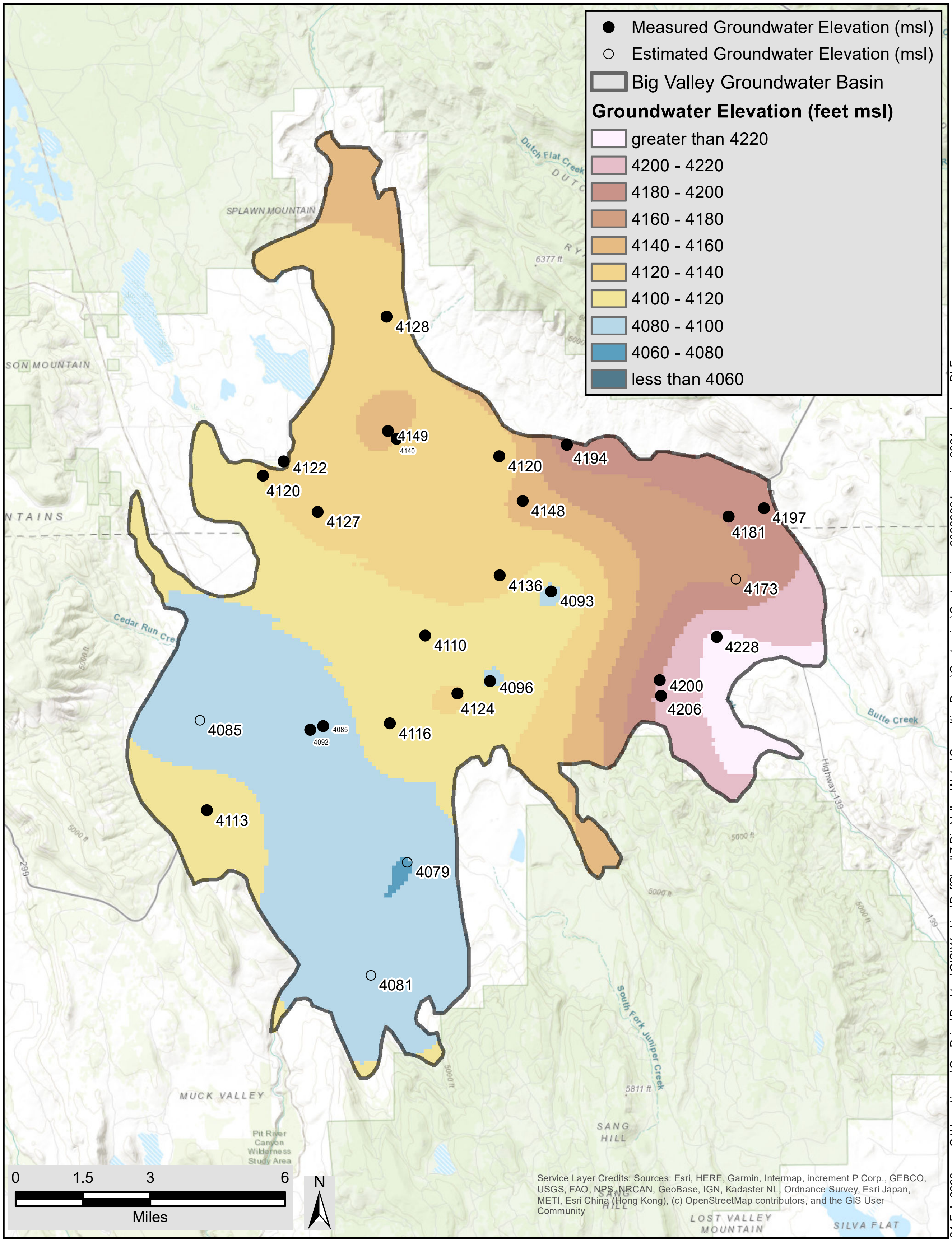
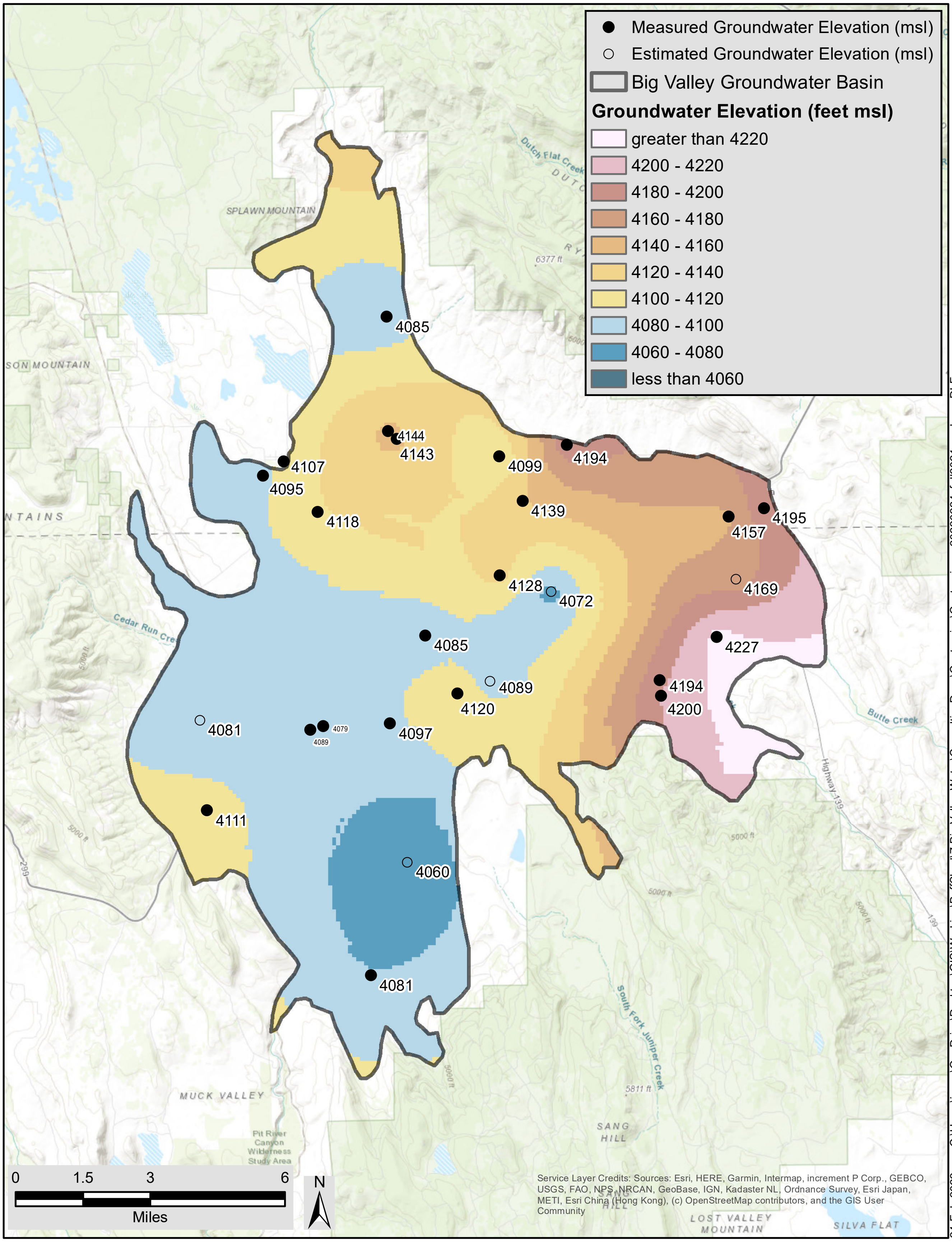
24-Feb-2022

| Big Valley Basin Groundwater Sustainability Plan<br>Modoc and Lassen Counties, California | | Groundwater Elevations<br>Fall 2020 |
|---|---|---|
| Big Valley Groundwater Basin GSAs | | FEBRUARY 2022 **FINAL** FIGURE |




24-Feb-2022 C:\Users\janyn\OneDrive\Desktop\GIS\Working\BuffSked\Z-Big Valley Water\ConsultingDocs\Contouring\Contouring_v20220224_spring2021.mxd DLF

| Big Valley Basin Groundwater Sustainability Plan<br>Modoc and Lassen Counties, California | | Groundwater Elevations<br>Spring 2021 |
|---|---|---|
| Big Valley Groundwater Basin GSAs | | FEBRUARY 2022 **FINAL** FIGURE |




Big Valley Basin Groundwater Sustainability Plan
Modoc and Lassen Counties, California

Big Valley Groundwater Basin GSAs

Groundwater Elevations
Fall 2021

FEBRUARY 2022 **FINAL** FIGURE

DLF
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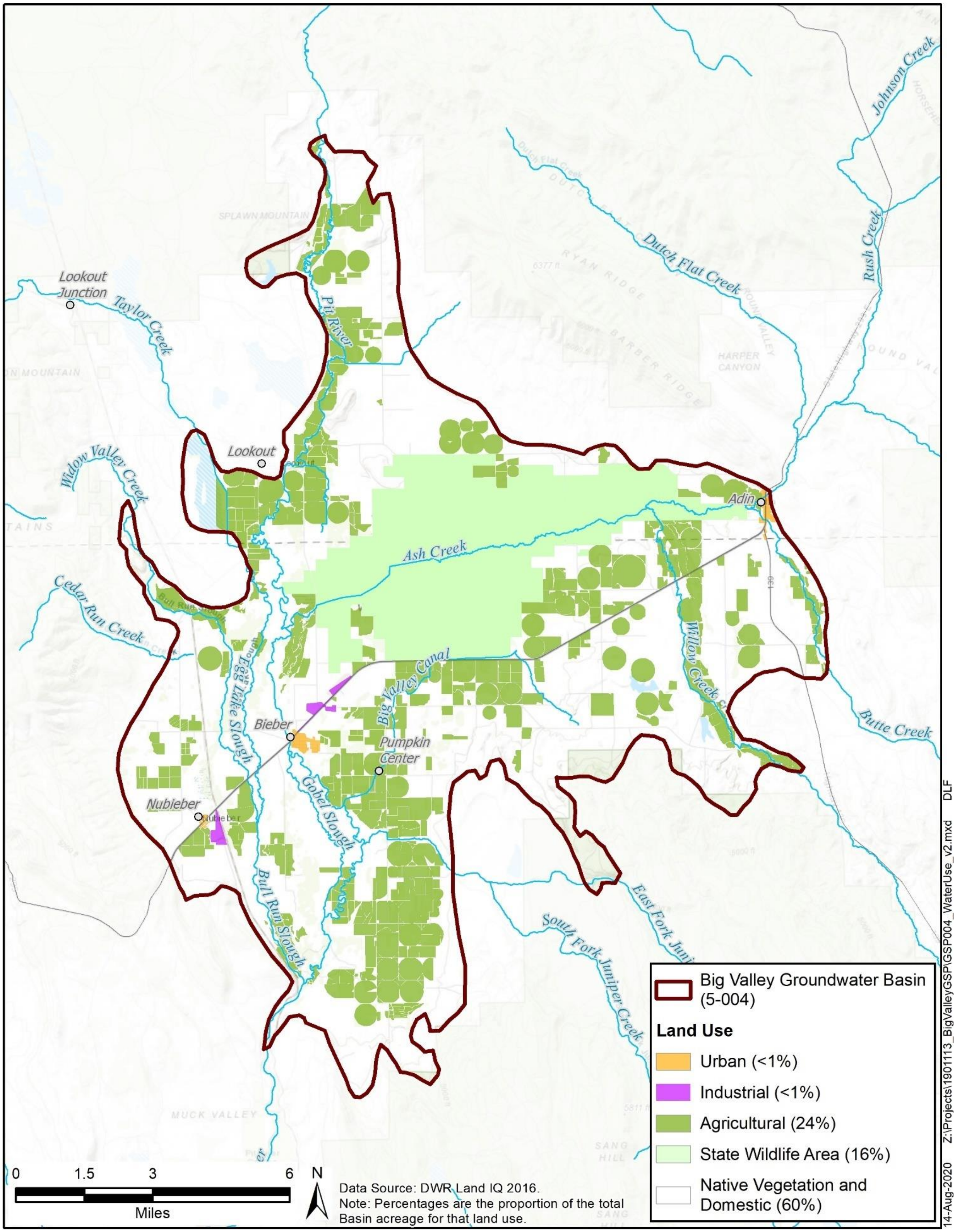
24-Feb-2022

## Appendix C: Land Use by Water Use Sector Map




**Land Use by Water Use Sector**

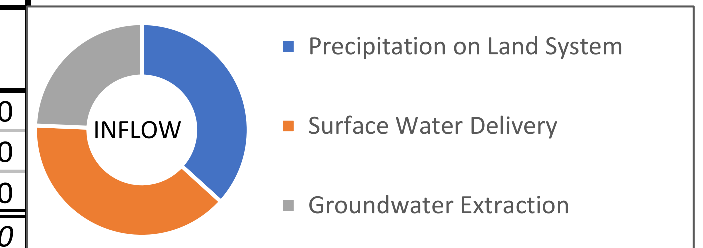
## Appendix D: Water Budget

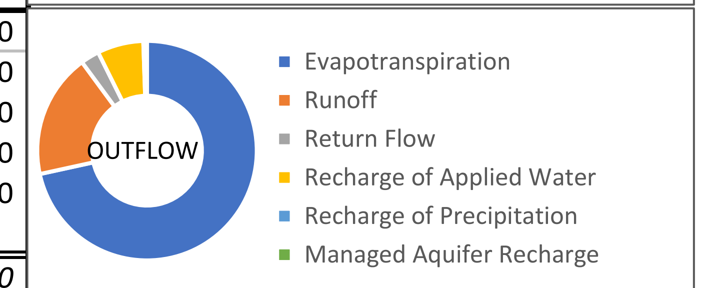
# Big Valley Groundwater Basin Water Budget

## LAND SYSTEM

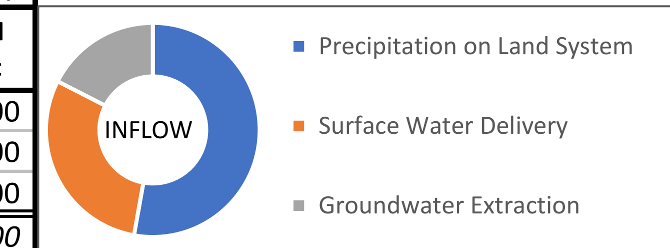
| item | | Flow Type | Origin/ Destination | Component | 2017 Estimated Acre-Feet | 2018 Estimated Acre-Feet | 2019 Estimated Acre-Feet | 2020 Estimated Acre-Feet | 2021 Estimated Acre-Feet | Average (1984-2021) Estimated Acre-Feet |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | (1) | Inflow | Into Basin | Precipitation on Land System | 201,600 | 140,000 | 195,300 | 87,100 | 81,500 | 135,600 |
| 2 | (2) | Inflow | Between Systems | Surface Water Delivery | 75,000 | 77,900 | 70,000 | 84,900 | 86,400 | 76,200 |
| 3 | (3) | Inflow | Between Systems | Groundwater Extraction | 42,400 | 46,900 | 38,400 | 53,700 | 54,000 | 44,900 |
| 4 | (4) | Inflow | *(1)+(2)+(3)* | *Total Inflow* | *319,000* | *265,000* | *304,000* | *226,000* | *222,000* | *257,000* |
| 5 | (5) | Outflow | Out of Basin | Evapotranspiration | 160,000 | 153,500 | 154,400 | 155,000 | 158,900 | 154,200 |
| 6 | (6) | Outflow | Between Systems | Runoff | 139,400 | 91,100 | 131,100 | 48,700 | 40,700 | 82,700 |
| 7 | (7) | Outflow | Between Systems | Return Flow | 4,800 | 5,300 | 4,300 | 6,000 | 6,100 | 5,000 |
| 8 | (8) | Outflow | Between Systems | Recharge of Applied Water | 12,900 | 13,500 | 12,000 | 14,800 | 15,100 | 13,200 |
| 9 | (9) | Outflow | Between Systems | Recharge of Precipitation | 1,900 | 1,500 | 1,900 | 1,200 | 1,200 | 1,600 |
| 10 | (10) | Outflow | Between Systems | Managed Aquifer Recharge | - | - | - | - | - | - |
| 11 | (11) | Outflow | *(5)+(6)+(7)+(8)+(9)+(10)* | *Total Outflow* | *319,000* | *265,000* | *304,000* | *226,000* | *222,000* | *257,000* |
| 12 | (12) | Storage Change | (4)-(11) | Change in Land System Storage | - | - | - | - | - | - |

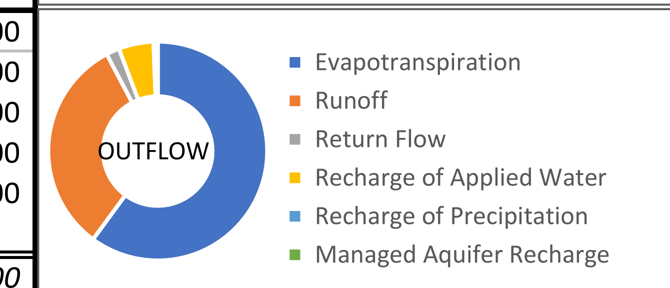
### 2021




### Average (1984-2021)

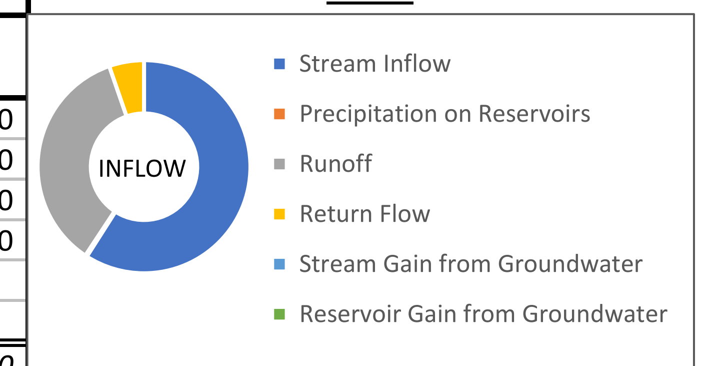


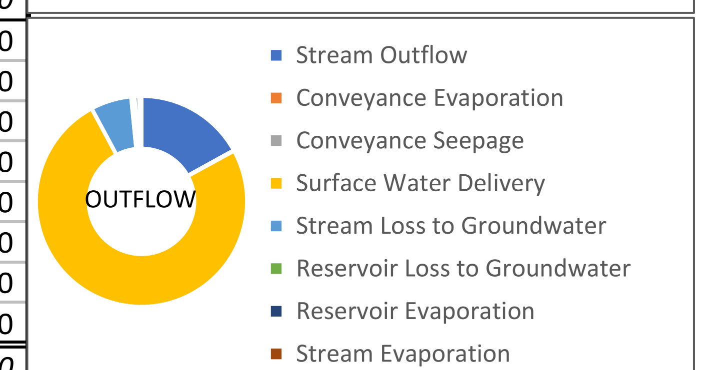




## SURFACE WATER SYSTEM

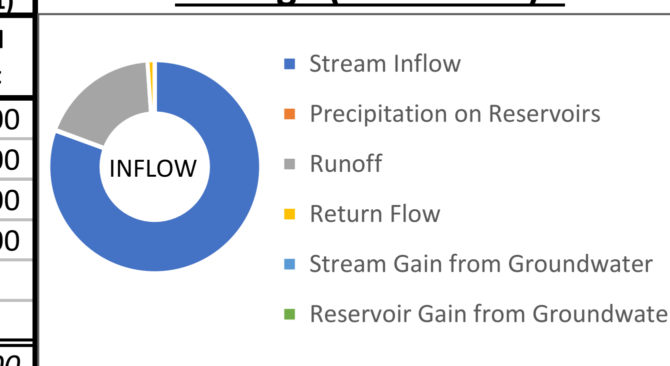
| item | | Flow Type | Origin/ Destination | Component | 2017 Estimated Acre-Feet | 2018 Estimated Acre-Feet | 2019 Estimated Acre-Feet | 2020 Estimated Acre-Feet | 2021 Estimated Acre-Feet | Average (1984-2021) Estimated Acre-Feet |
|---|---|---|---|---|---|---|---|---|---|---|
| 13 | (13) | Inflow | Into Basin | Stream Inflow | 809,000 | 243,100 | 683,300 | 130,700 | 67,900 | 365,100 |
| 14 | (14) | Inflow | Into Basin | Precipitation on Reservoirs | 700 | 500 | 700 | 300 | 300 | 500 |
| 6 | (6) | Inflow | Between Systems | Runoff | 139,400 | 91,100 | 131,100 | 48,700 | 40,700 | 82,700 |
| 7 | (7) | Inflow | Between Systems | Return Flow | 4,800 | 5,300 | 4,300 | 6,000 | 6,100 | 5,000 |
| 15 | (15) | Inflow | Between Systems | Stream Gain from Groundwater | - | - | - | - | - | - |
| 16 | (16) | Inflow | Between Systems | Reservoir Gain from Groundwater | - | - | - | - | - | - |
| 17 | (17) | Inflow | *(13)+(14)+(6)+(7)+(15)+(16)* | *Total Inflow* | *954,000* | *340,000* | *819,000* | *186,000* | *115,000* | *453,000* |
| 18 | (18) | Outflow | Out of Basin | Stream Outflow | 827,900 | 245,000 | 712,000 | 88,800 | 19,500 | 351,800 |
| 19 | (19) | Outflow | Out of Basin | Conveyance Evaporation | 50 | 50 | 40 | 50 | 50 | 50 |
| 20 | (20) | Outflow | Between Systems | Conveyance Seepage | 30 | 30 | 30 | 30 | 30 | 30 |
| 2 | (2) | Outflow | Between Systems | Surface Water Delivery | 75,000 | 77,900 | 70,000 | 84,900 | 86,400 | 76,200 |
| 21 | (21) | Outflow | Between Systems | Stream Loss to Groundwater | 49,200 | 15,300 | 35,800 | 10,100 | 7,200 | 23,500 |
| 22 | (22) | Outflow | Between Systems | Reservoir Loss to Groundwater | 600 | 600 | 600 | 600 | 600 | 600 |
| 23 | (23) | Outflow | Out of Basin | Reservoir Evaporation | 700 | 700 | 700 | 800 | 800 | 700 |
| 24 | (24) | Outflow | Out of Basin | Stream Evaporation | 400 | 400 | 400 | 400 | 400 | 400 |
| 25 | (25) | Outflow | *(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)* | *Total Outflow* | *954,000* | *340,000* | *819,000* | *186,000* | *115,000* | *453,000* |
| 26 | (26) | Storage Change | (17)-(25) | Change in Surface Water Storage | - | - | - | - | - | - |

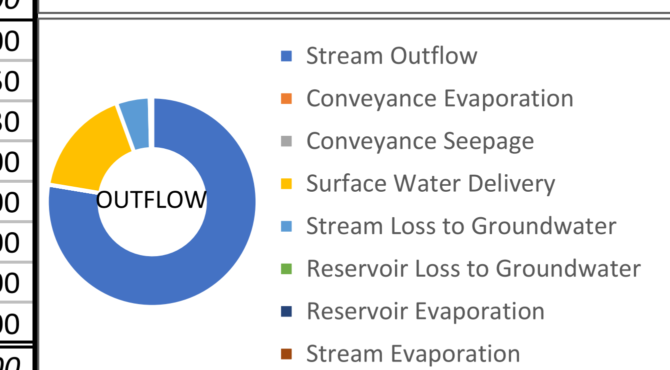
### 2021




### Average (1984-2021)

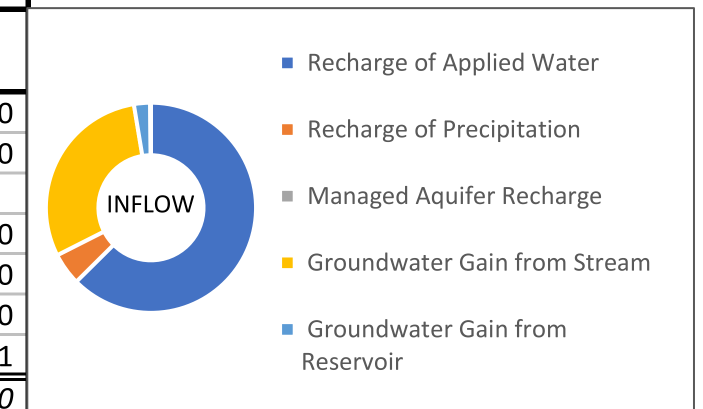


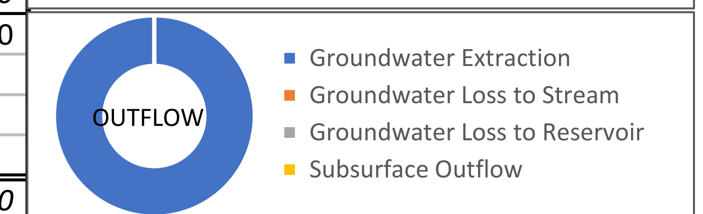



# Big Valley Groundwater Basin Water Budget

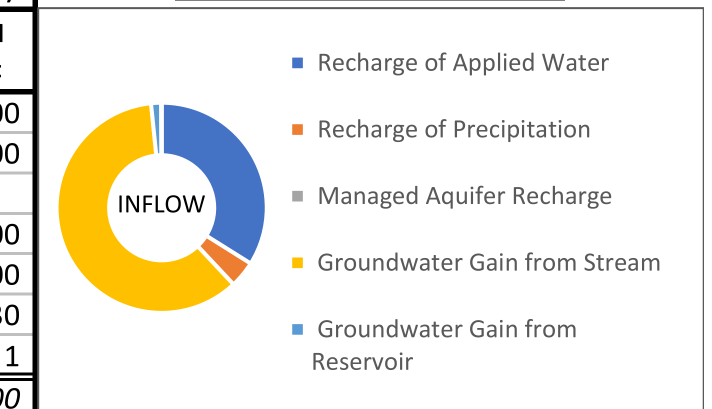
| | item | GROUNDWATER SYSTEM | | | 2017 | 2018 | 2019 | 2020 | 2021 | Average (1984-2021) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Flow Type | Origin/ Destination | Component | Estimated Acre-Feet | Estimated Acre-Feet | Estimated Acre-Feet | Estimated Acre-Feet | Estimated Acre-Feet | Estimated Acre-Feet |
| 8 | (8) | Inflow | Between Systems | Recharge of Applied Water | 12,900 | 13,500 | 12,000 | 14,800 | 15,100 | 13,200 |
| 9 | (9) | Inflow | Between Systems | Recharge of Precipitation | 1,900 | 1,500 | 1,900 | 1,200 | 1,200 | 1,600 |
| 10 | (10) | Inflow | Between Systems | Managed Aquifer Recharge | - | - | - | - | - | - |
| 21 | (21) | Inflow | Between Systems | Groundwater Gain from Stream | 49,200 | 15,300 | 35,800 | 10,100 | 7,200 | 23,500 |
| 22 | (22) | Inflow | Between Systems | Groundwater Gain from Reservoir | 600 | 600 | 600 | 600 | 600 | 600 |
| 20 | (20) | Inflow | Between Systems | Conveyance Seepage | 30 | 30 | 30 | 30 | 30 | 30 |
| 27 | (27) | Inflow | Into Basin | Subsurface Inflow | 1 | 1 | 1 | 1 | 1 | 1 |
| 28 | (28) | Inflow | *(8)+(9)+(10)+(21)+(22)+(20)+(27)* | *Total Inflow* | *64,700* | *30,900* | *50,400* | *26,700* | *24,100* | *38,900* |
| 3 | (3) | Outflow | Between Systems | Groundwater Extraction | 42,400 | 46,900 | 38,400 | 53,700 | 54,000 | 44,900 |
| 15 | (15) | Outflow | Between Systems | Groundwater Loss to Stream | - | - | - | - | - | - |
| 16 | (16) | Outflow | Between Systems | Groundwater Loss to Reservoir | - | - | - | - | - | - |
| 29 | (29) | Outflow | Out of Basin | Subsurface Outflow | - | - | - | - | - | - |
| 30 | (30) | Outflow | *(3)+(15)+(16)+(29)* | *Total Outflow* | *42,400* | *46,900* | *38,400* | *53,700* | *54,000* | *44,900* |
| 31 | (31) | Storage Change | (28)-(30) | Change in Groundwater Storage | 22,000 | (16,000) | 12,000 | (27,000) | (30,000) | (6,000) |

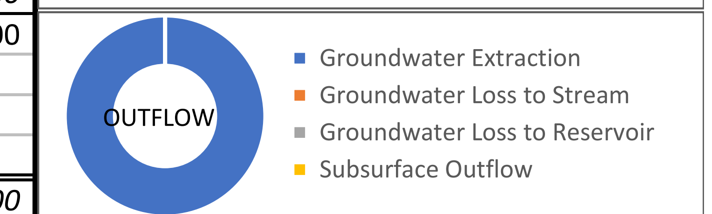
## 2021



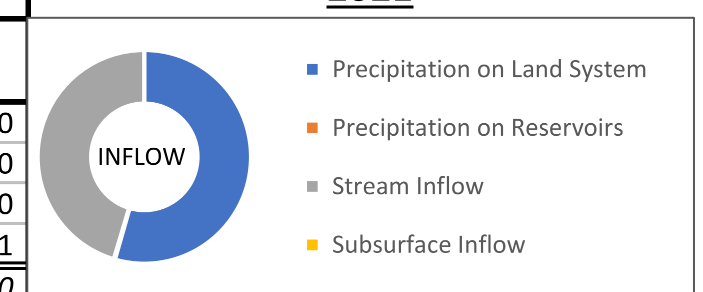

## Average (1984-2021)

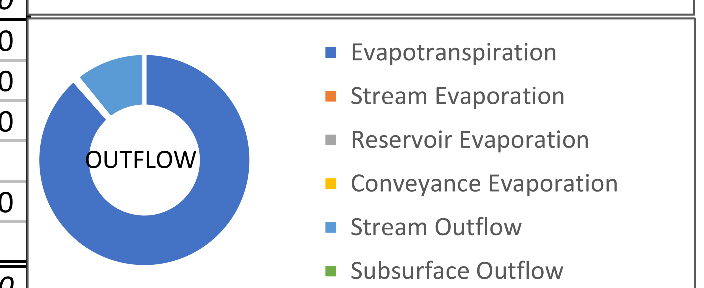


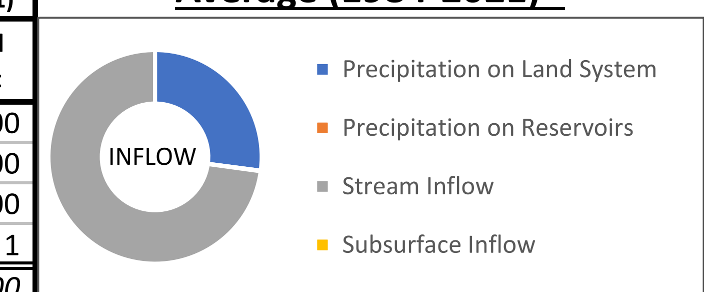

| | item | TOTAL BASIN WATER BUDGET | | | 2017 | 2018 | 2019 | 2020 | 2021 | Average (1984-2021) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Flow Type | Origin/ Destination | Component | Estimated Acre-Feet | Estimated Acre-Feet | Estimated Acre-Feet | Estimated Acre-Feet | Estimated Acre-Feet | Estimated Acre-Feet |
| 1 | (1) | Inflow | Into Basin | Precipitation on Land System | 201,600 | 140,000 | 195,300 | 87,100 | 81,500 | 135,600 |
| 14 | (14) | Inflow | Into Basin | Precipitation on Reservoirs | 700 | 500 | 700 | 300 | 300 | 500 |
| 13 | (13) | Inflow | Into Basin | Stream Inflow | 809,000 | 243,100 | 683,300 | 130,700 | 67,900 | 365,100 |
| 27 | (27) | Inflow | Into Basin | Subsurface Inflow | 1 | 1 | 1 | 1 | 1 | 1 |
| 32 | (32) | Inflow | *(1)+(14)+(13)+(27)* | *Total Inflow* | *1,011,300* | *383,600* | *879,300* | *218,100* | *149,700* | *501,100* |
| 5 | (5) | Outflow | Out of Basin | Evapotranspiration | 160,000 | 153,500 | 154,400 | 155,000 | 158,900 | 154,200 |
| 24 | (24) | Outflow | Out of Basin | Stream Evaporation | 400 | 400 | 400 | 400 | 400 | 400 |
| 23 | (23) | Outflow | Out of Basin | Reservoir Evaporation | 700 | 700 | 700 | 800 | 800 | 700 |
| 19 | (19) | Outflow | Out of Basin | Conveyance Evaporation | - | - | - | - | - | - |
| 18 | (18) | Outflow | Out of Basin | Stream Outflow | 827,900 | 245,000 | 712,000 | 88,800 | 19,500 | 351,800 |
| 29 | (29) | Outflow | Out of Basin | Subsurface Outflow | - | - | - | - | - | - |
| 33 | (33) | Outflow | *(5)+(24)+(23)+(19)+(18)+(29)* | *Total Outflow* | *989,000* | *399,600* | *867,400* | *245,100* | *179,600* | *507,100* |
| 34 | (34) | Storage Change | (32)-(33) | Change in Total System Storage | 22,000 | (16,000) | 12,000 | (27,000) | (30,000) | (6,000) |

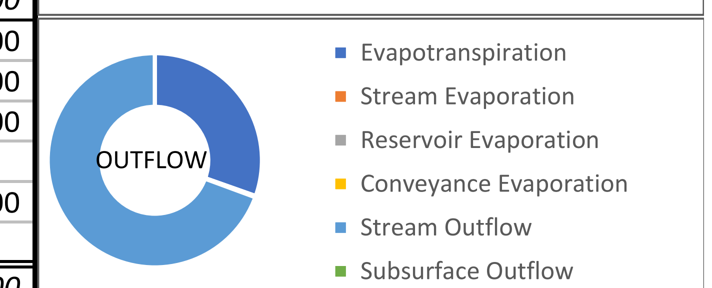
## 2021



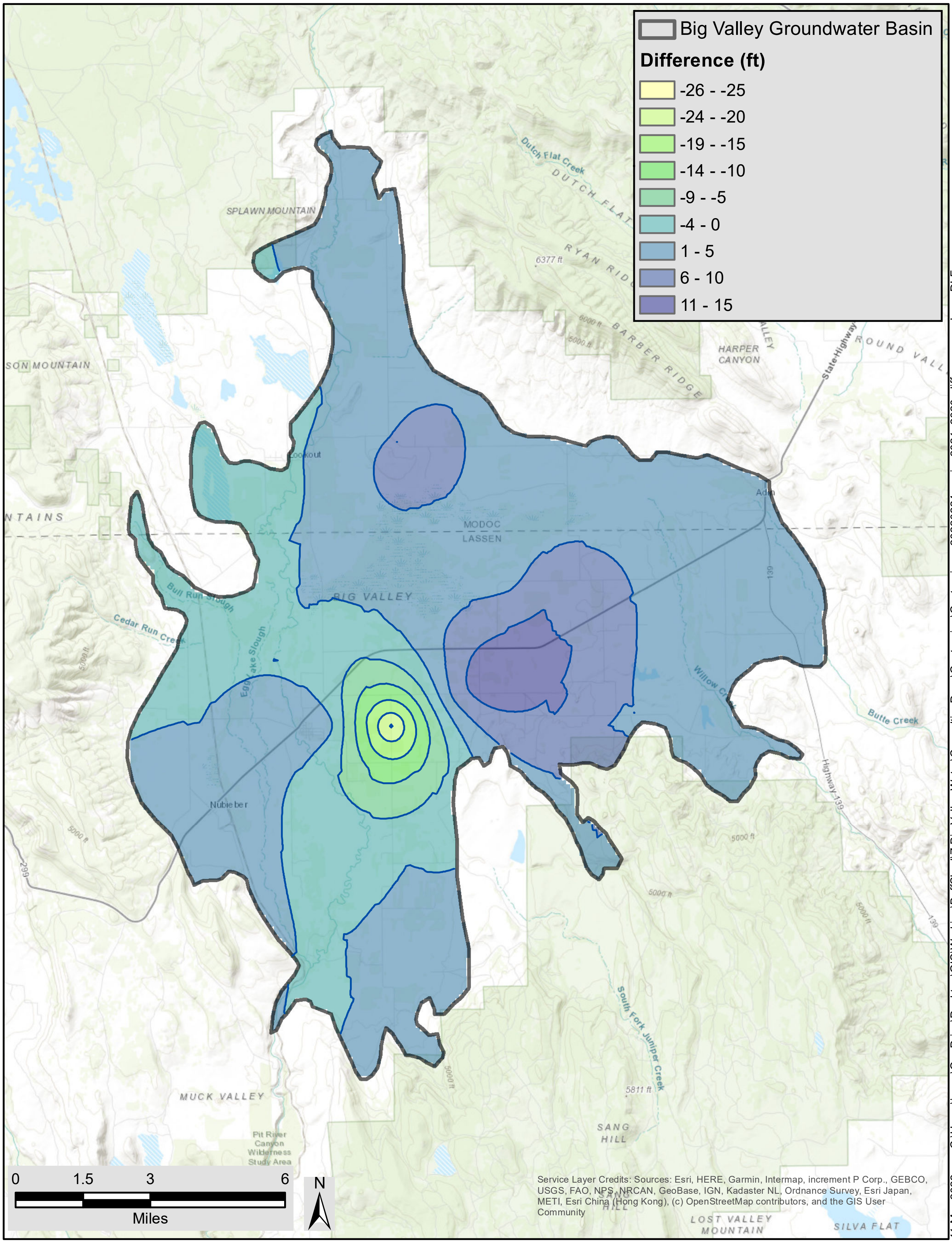




## Average (1984-2021)



## Appendix E: Map of Storage Change

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| Big Valley Basin Groundwater Sustainability Plan<br>Modoc and Lassen Counties, California | | Groundwater Elevations<br>Spring 2020 and 2021 Difference |
|---|---|---|
| Big Valley Groundwater Basin GSAs | | MARCH 2022 **FINAL** FIGURE |