Butte County Department of Water and Resource Conservation

Groundwater Status Report

2018 Water Year

Revised with TAC January 2019 comments

Executive Summary - 2018 WY

The 2018 water year (WY) started out with a wet November, but dry conditions returned and continued through the rest of the winter months. Spring rains in March and April made a marked improvement to the water year overall which ended with statewide precipitation amounts of about 75% of average. The state's water supply conditions continued to benefit from the abundant runoff of the previous wet 2017 WY which propped up reservoir storage throughout 2018 even with below average rainfall, snow pack and runoff conditions. Water supply conditions led to a 35% allocation for State Water Project contractors statewide.

The 2018 WY began October 1, 2017 and was classified as a below normal water year type for the Sacramento Valley. It followed a wet year, below normal year, two critical years, and a dry year. According to the Northern Sierra Precipitation 8 Station Index, the 2018 WY ended on September 30, 2018 with 41.0 cumulative inches of precipitation, 79% of the long-term average. Another measure of hydrologic conditions is the amount of runoff to streams and rivers. The Sacramento River Region unimpaired runoff during the 2018 WY was 12.7 million acre-feet (MAF), which is about 71% of average and only about one third of the runoff that occurred in the historically wet 2017 WY. April 1 snowpack statewide was 58% of the April 1 average. Although there was below average rainfall and runoff, carryover storage in the reservoirs from 2017 resulted in statewide reservoir storage of 105% of the April 1 average.

A return of drier conditions in 2018 from the record wet year of 2017 once again brought modest declines to groundwater levels, specifically in groundwater dependent areas of the county. The Department, in cooperation with the Department of Water Resources Northern Region Office, conducts four (spring, July, August, fall) groundwater level measurements annually. Spring groundwater levels in 2018 were 3 feet lower on average compared to the spring of 2017 (see Table 4). Fall groundwater levels in October 2018 were about 1.3 feet lower on average compared to October 2017. Almost half of the monitored wells with assigned alert stages remain at a spring and/or fall alert stage 1 or 2 indicating levels remain near historical lows (Table 8 and Table 9).

The Department conducted its seventeenth year of groundwater quality trend monitoring for evidence of saline intrusion during July 23, 2018 through July 26, 2018. All samples were within the acceptable range for electrical conductivity and pH, and temperatures remained relatively consistent. The 2018 Water Quality Trend Monitoring Report can be found in Appendix D and highlights are included later in this report.

Subsidence is monitored by periodic land surveys and by use of extensometers. No inelastic land subsidence was detected in Butte County from an evaluation of the extensometer records in the proposed Butte subbasin. A Sacramento Valley-wide GPS survey was conducted during 2017. Results of the survey are available at https://water.ca.gov/News/News-Releases/2019/January/Survey-Shows-Areas-of-Land-Subsidence. This survey to provide additional land subsidence data to better measure and detect possible subsidence throughout the county.

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Foreword

This report presents the status of groundwater conditions and ground surface elevation monitoring based on data collected by Butte County and the California Department of Water Resources (DWR) during the 2018 Water Year (WY), October 1, 2017 - September 30, 2018. The fall measurements taken in mid-October 2018 are also included since they reflect conditions and activities of the 2018 WY. The report gives general information regarding locations of wells and extensometers, statistics related to groundwater level trends and historical precipitation information. This report was prepared by the Butte County Department of Water and Resource Conservation (Department) with assistance from DWR, Northern Region and the Technical Advisory Committee. This report complies with reporting requirements established in Chapter 33, Chapter 33A of the Butte County Code, and the California Statewide Groundwater Elevation Monitoring program (CASGEM).

In November 1996, the voters in Butte County approved "AN ORDINANCE TO PROTECT THE GROUNDWATER RESOURCES IN BUTTE COUNTY." One of the stated purposes of the ordinance was that "the groundwater underlying Butte County is a significant water resource which must be reasonably and beneficially used and conserved for the benefit of the overlying land by avoiding extractions which harm the Butte Basin aquifer, causing exceedance of the safe yield or a condition of overdraft." The ordinance is now codified as Chapter 33 of the Butte County Code relating to groundwater conservation. Section 3.01 – "Groundwater Planning Process" requires the preparation of a groundwater status report based upon the data gathered and analyzed pursuant to Section 3.02 – "Groundwater Monitoring". Until 2010, this reporting was completed by the Butte Basin Water Users Association (BBWUA).

In 2000, the Butte County Board of Supervisors amended Chapter 33, the Groundwater Conservation Ordinance, to require the Groundwater Status Report be delivered by February 21st of each year. In 2010, the Water Commission designated the Department of Water and Resource Conservation as the entity responsible for creating and submitting the annual report. Over the years, as responsibilities and water resource programs including advisory committees have shifted more and more to the County, the Butte Basin Water Users Association participation has declined. In 2012, its members voted to dissolve the organization, after twenty years of serving the region.

In February 2004, the Butte County Board of Supervisors adopted the Groundwater Management Ordinance which was codified as Chapter 33A of the Butte County Code. Chapter 33A calls for the establishment of a monitoring network and Basin Management Objectives (BMOs) for groundwater elevation, groundwater quality related to saline intrusion, and land subsidence. The BMO concept was incorporated into California Water Code §10750 et. seq., as a component of AB 3030 Groundwater Management Plans (GMPs). On September 28, 2004, the Butte County Board of Supervisors formally approved Resolution 04-181 adopting the countywide AB 3030 GMP that includes the components of the BMO program. In 2011, Chapter 33A was amended and retitled to "Basin Management Objectives (BMO)" and now requires the BMO report be submitted in February of each year. The foregoing actions by the Board allow the reporting of groundwater conditions from Chapter 33 and 33A to be consolidated into a single report to be submitted by the Department on an annual basis in February.

The Groundwater Status Report is in the process of undergoing revisions over the next few years in order to meet requirements of the Sustainable Groundwater Management Act (SGMA). On September 16, 2014, Governor Brown signed into law a package of bills collectively called SGMA. The Sustainable Groundwater Management Act requires local management of groundwater basins, and provides the state with broad oversight authority and the ability to intervene. Local management of basins is the responsibility of a local public agency or combination of local agencies that designate themselves as the "Groundwater Sustainability Agency" for all or a portion of their basin or subbasin. Local public agencies eligible to be a Groundwater Sustainability Agency (GSA) must have water supply, water management or land use responsibilities. GSA formation was required by June 30, 2017, with the consequence of the State Water Board assuming management of any basins unable to meet these requirements. All four of the original groundwater subbasins within Butte County have established GSAs covering the entirety of the subbasins. Discussions among GSAs to establish governance structures for how groundwater will be managed and Plans developed in these subbasins began in earnest in 2018 and will continue in 2019. Proposed basin boundary modifications are currently pending approval by DWR and will reduce the number of subbasins from four to three: Vina, Butte, and Wyandotte Creek subbasins. Groundwater Sustainability Agencies must prepare and implement Groundwater Sustainability Plans ("Plan") for their basin/subbasin or their portion of their basin or face the prospect of state intervention. Plans must be adopted by January 31, 2020 for basins that are in critical overdraft condition or by January 31, 2022, for all other basins. Since the subbasins in Butte County are not in critical overdraft, Plans will have to be submitted by January 31, 2022. Plans must contain the same elements as those in Groundwater Management Plans. Additionally, Plans must include a water budget covering a 50 year planning horizon, measurable objectives and interim milestones (every five years) that will lead to sustainability in 20 years. Plans must address "undesirable results" that include chronic lowering of groundwater levels and significant and unreasonable reduction in groundwater storage, degradation of water quality, land subsidence and surface water depletions. Plans are exempt from the California Environmental Quality Act but projects or actions to implement the plan are not exempt. Groundwater Sustainability Agencies must submit an annual report to DWR by April 1st. The report must include the following information:

- Groundwater elevation data
- Annual aggregated data identifying groundwater extraction for the preceding WY
- Surface water supply used for, or available for use for groundwater recharge or in-lieu use
- Total water use
- Change in groundwater storage.

The first annual report will not be required until 2023. The approach will be to modify this County annual Groundwater Status Report to meet the requirements of the report that must be submitted by GSAs for each subbasin.

In addition, in light of new requirements of SGMA, revisions to Chapter 33A are underway to continue the transition from the BMO program to implementation of SGMA in each of the subbasins in Butte County. The BMO program has been a critical component of the County's water management effort. Over the past fourteen years, the BMO program has made enormous progress in developing, analyzing, and disseminating factual information on local groundwater conditions. The strengths and benefits of the BMO program will be incorporated into the governance, Plans, and outreach established under SGMA. As a result, revisions to Chapter 33A will incorporate an expiration date for the ordinance of January 31, 2022 to align with the final deadline for submittal of Plans to DWR under SGMA for subbasins in Butte County. In the meantime, monitoring and reporting of groundwater conditions (levels, water quality, and land subsidence) will continue, but will become consistent with the extents of the three subbasins managed under SGMA and new revised sub-inventory units will replace the original 16 sub-inventory units for reporting purposes. This annual report begins to make this transition in the tables and maps included in the appendices.

The CASGEM program was amended to the Water Code in 2009 through the enactment of SBx7-6, Groundwater Monitoring, as part of the Comprehensive Water Package. CASGEM mandates statewide groundwater elevation monitoring to track seasonal and long-term trends in basins throughout the state. The legislation created a statewide program to collect groundwater elevation data, facilitate collaboration among monitoring entities, and develop a means of reporting groundwater data to the public. The Department has this responsibility as the monitoring and reporting entity for Butte County. As described in the Butte County CASGEM Monitoring Plan, the Butte County CASGEM program will utilize approximately 72 wells from the network for the CASGEM program. A map of these locations can be located in Appendix B. The 72 wells comprise primarily dedicated monitoring wells and some key wells identified in the Annual Groundwater Status Report.

Data from published reports prepared for the Butte County Department of Water and Resource Conservation are included throughout this document where relevant, and the referenced documents are listed in Appendices or as references, as well as being available on the Department's website at www.buttecounty.net/waterresourceconservation. All past years' Groundwater Status Reports and BMO documents are also available on the Butte County Department of Water and Resource Conservation website.

Hydrologic Conditions

There are a number of data sources and indices available to characterize hydrologic conditions. The data sources typically report hydrologic data on a Water Year (WY) basis, or the 12-month period from October through September. The 2018 WY began on October 1, 2017 and ended on September 30, 2018. The 2018 WY was classified as *below normal* for the Sacramento Valley. At the end of the 2018 WY on September 30, 2018, *statewide* hydrologic conditions were as follows: precipitation was 75% of average; runoff was 70% of average; and reservoir storage, 100% of average. Sacramento River Region unimpaired runoff observed through September 30, 2018 was about 12.7 MAF, which is about 71% of average. For comparison, Table 1 shows the volume and percent of average runoff for the previous WYs since the wet year in 2011. Colors represent the corresponding WY type as depicted in Figure 2.

Table 1. Sacramento River Region Unimpaired Runoff (Million Acre Feet)

WATER YEAR	2018	2017	2016	2015	2014	2013	2012	2011
UNIMPAIRED RUNOFF (MAF)	12.7	37.9	17.4	9.2	7.5	11.9	11.8	25.2
% OF AVERAGE	71%	212%	98%	51%	41%	65%	65%	138%

The Northern Sierra 8-Station Precipitation Index (Figure 1) serves as a precipitation index for the Sacramento River hydrologic region by averaging measurements taken at the following precipitation stations: Blue Canyon, Brush Creek Ranger Station, Mineral, Mount Shasta City, Pacific House, Quincy Ranger Station, Shasta Dam, and Sierraville Ranger Station.[1] This index provides a representative sample of the region's major watersheds: the upper Sacramento, Feather, Yuba, and American Rivers, which produce inflow to some of California's largest reservoirs - the source of much of the state's water supply. The 2018 WY ended with 41.0 cumulative inches of precipitation which is 79% of the long term average. The 2018 WY curve is labeled "2017-2018 (current)" on Figure 1.

[1] http://cdec.water.ca.gov/cgi-progs/products/PLOT_ESI.pdf

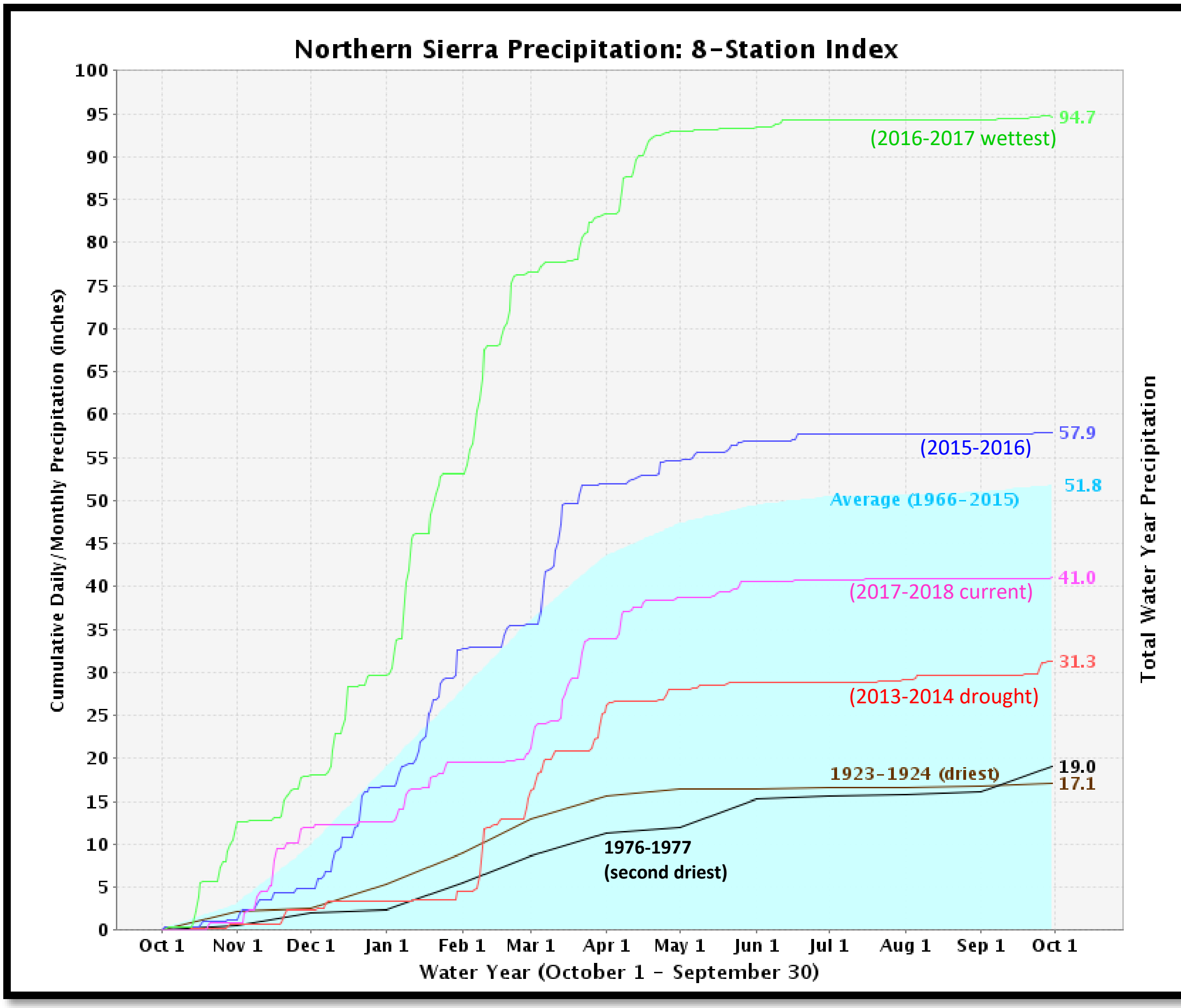


Figure 1. Northern Sierra Precipitation: 8 Station Index

Figure 2 shows the WY type classifications based on the Sacramento Valley 40-30-30 Index going back to 1960. The Sacramento Valley was classified as *below normal* for the 2018 WY with an index value of 7.2 (Figure 2). Water year classification systems provide a means to assess the amount of water originating in a basin.

WY classification systems are useful in water planning and management and have been developed for several hydrologic basins in California. The Sacramento Valley 40-30-30 Index was developed by the State Water Resources Control Board (SWRCB) for the Sacramento hydrologic basins based on Sacramento River runoff. This system defines one *"wet"* classification, two *"normal"* classifications (above and below normal), and two *"dry"* classifications (dry and critical), for a total of five WY types.

The Sacramento Valley 40-30-30 Index is computed as a weighted average of the current WY's April-July runoff forecast (40 percent), the current WY's October-March runoff (30 percent), and the previous WY's index (30 percent). A cap of ten MAF is put on the previous year's index to account for required flood control reservoir releases during wet years. Sacramento River runoff is the sum of the Sacramento River flow at Bend Bridge, Feather River inflow to Lake Oroville, Yuba River at Smartville, and American River inflow to Folsom Lake[2].

Sacramento Valley WY Hydrologic Classification is:

Year Type	**Water Year Index**
Wet	Equal to or greater than 9.2
Above Normal	Greater than 7.8, and less than 9.2
Below Normal	Greater than 6.5 and equal to or less than 7.8
Dry	Greater than 5.4, and equal to or less than 6.5
Critical	Equal to or less than 5.4

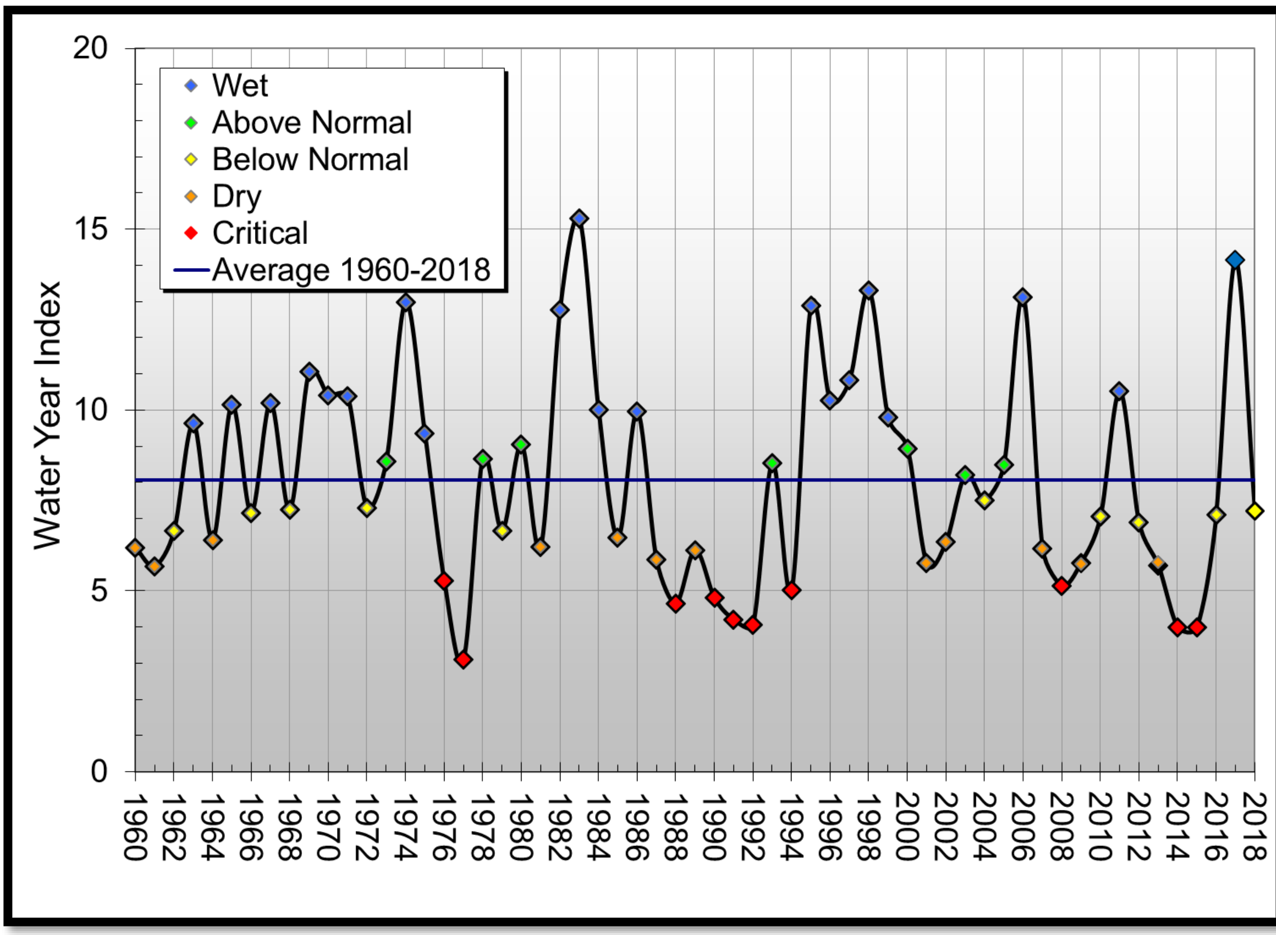


Figure 2. Sacramento Valley Water Year Type Index 40-30-30

[2] http://cdec.water.ca.gov/cgi-progs/iodir/WSIHIST

Precipitation

Figure 3 shows the total annual precipitation at the Western Canal Station for the 58-year period, WYs 1960 through 2018. Precipitation for the 2018 WY measured at Western Canal Water District's Climatological Observation Station totaled 13.29 inches (63% of average). This is 7.86 inches below the 50-year (1960-2010) average of 21.15 inches.

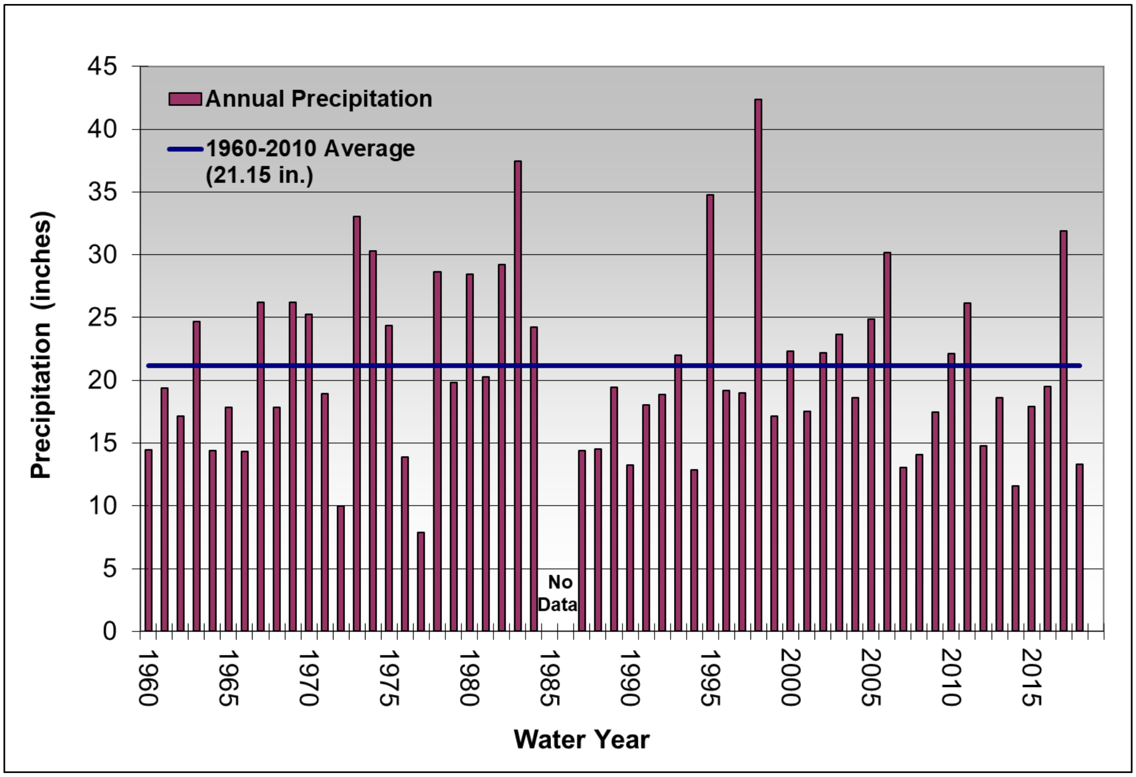


Figure 3. Annual Precipitation 1960-2018 Water Years -Western Canal Climate Station

The timing of rainfall in the valley influences irrigation water use. The daily precipitation in the 2018 WY reported from the California Irrigation Management Information System (CIMIS) station in Durham provides an indication of when and how much rainfall occurred and how that may affect the irrigation season (Figure 4).

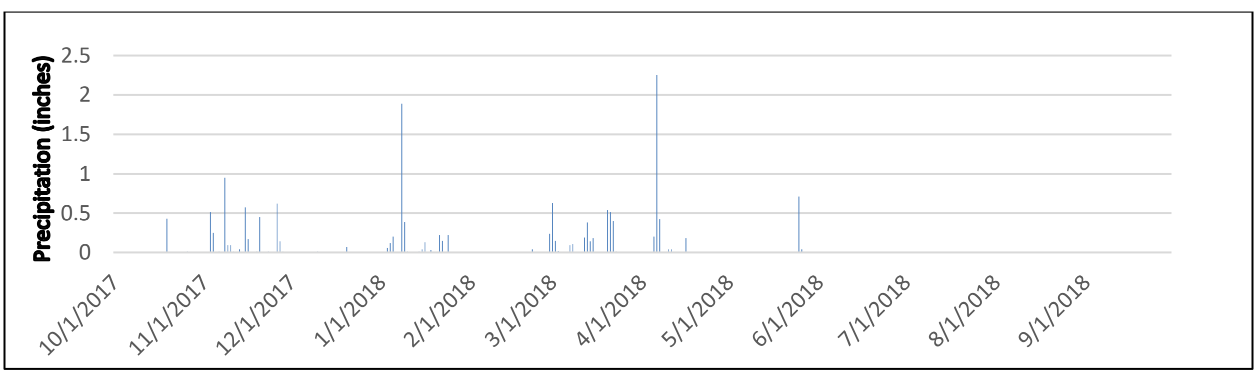


Figure 4. Daily Precipitation (inches) - Durham CIMIS station

The graph of daily precipitation shows storm activity throughout the fall, winter, and spring with only two separate storm events measuring over one inch of precipitation in a single day. During the wet spring from April rains, the irrigation season began later than usual, likely near the beginning of May. According to discussions with growers in the Durham / Chico area a significantly increased amount of water use was required for frost protection this WY than in years past. While the requirements varied by specific site, approximately 10-14 nights were irrigated for frost protection throughout the spring from mid- to late-February, a few days throughout March and also into late-April.

Feather River Surface Water Diversions

Surface water is an important component of the water supply and has benefits to aquifer recharge in the Butte Basin. During the 2018 WY, a total of 937,004 acre-feet (AF) of surface water was diverted by Western Canal Water District (WCWD) and the Joint Water Districts Board. The 2018 WY diversions increased by 56,371 AF from the 2017 WY amount and by approximately 295,000 AF more than in 2015. Rice growers participated in fallowing water transfers in 2018 and late spring rains led to lower April water deliveries than in years with dry spring conditions. In the 2015 WY, WCWD and the Joint Water Districts Board had a 50% curtailment of their surface water deliveries due to the drought. It was the first curtailment in 23 years. Reliable surface water supplies reduce or eliminate the need for groundwater pumping, except when curtailments occur, and provide some recharge to the basin. This results in generally shallow and stable groundwater conditions in these district areas. Table 2 summarizes diversions in acre-feet to Western Canal Water District and the Joint Water Districts Board for WYs 2000 to 2018.

Table 2. Surface Water Diversions (acre-feet)

Water Year	Western Canal Water District	Joint Water Districts Board*	TOTAL
2000	314,737	707,018	1,032,392
2001	302,784	718,489	1,021,562
2002	305,460	597,529	902,989
2003	271,867	682,403	954,270
2004	329,700	790,663	1,120,363
2005	284,188	750,128	1,034,316
2006	294,898	743,345	1,038,243
2007	318,159	824,286	1,142,445
2008	332,500	740,748	1,073,248
2009	327,184	711,693	1,038,877
2010	313,196	689,518	1,002,714
2011	288,912	718,771	1,007,683
2012	309,213	706,671	1,015,884
2013	324,128	731,560	1,055,688
2014	319,073	654,696	973,769
2015**	249,965	392,091	642,056
2016	283,071	546,999	830,070
2017	263,179	617,454	880,633
2018	284,192	652,812	937,004

* Joint Water Districts Board includes Biggs-West Gridley Water District, Butte Water District, Richvale Irrigation District, and Sutter Extension Water District.

** 50% Curtailment of surface water deliveries occurred this year due to drought

Groundwater Conditions

Monitoring Frequency

Butte County Code, Chapter 33 and 33A, calls for the establishment of a monitoring network for groundwater quality related to saline intrusion, land subsidence, and groundwater levels. The Groundwater Quality Trend Monitoring Program is designed to track single monitoring events throughout the county during the peak irrigation season on an annual basis. The data is collected each July or August at the peak of irrigation season to establish baseline levels across the county to detect changes, which may require further investigation.

Monitoring frequency for land subsidence is conducted on a continuous basis by extensometers. Groundwater level monitoring occurs four times per year. Sections 33-4 of the Butte County Code enacted in 1996 and 33A-8 of the Butte County Code enacted in 2004 state that groundwater level measurements shall be taken from all designated monitoring wells at least four (4) times per year, during the months of March, July, August, and October. The California Department of Water Resources (DWR) and the Butte County Department of Water and Resource

Conservation (Department) share the monitoring duties. DWR conducts the majority of the spring, summer and fall measurements while the Department collects the July measurements.

Groundwater Quality Trend Monitoring

Temperature, pH, and electrical conductivity (EC) are recorded for water samples from a network of thirteen wells throughout the county. These parameters provide the basis to evaluate for evidence of saline intrusion.

Summary Highlights from 2018

- 12 of the 13 wells were sampled July 23, 2018 through July 26, 2018
- 1 well was temporarily inaccessible
- Temperatures remained relatively consistent in all water samples
- All measurements were within the acceptable range for pH
- All samples were within the acceptable range for electrical conductivity
- No evidence of saline intrusion was detected

Water quality parameters have naturally occurring variability, so year-to-year changes are expected and nothing in this year's measurements give cause for further investigation or analysis. Further investigation would be advisable if values were to fall outside of the acceptable range. The 2018 Water Quality Trend Monitoring Report (Interdepartmental Memorandum) can be found in Appendix D.

Program Background

The Butte County Groundwater Quality Trend Monitoring Program is required by the Groundwater Conservation Ordinance (Chapter 33 of the Butte County Code) and administered through the Basin Management Objective (BMO) Ordinance (Chapter 33A of the Butte County Code). Degraded water quality is a common effect of over-utilizing groundwater resources and can occur by saline intrusion from, among other sources, marine formations underlying freshwater aquifers. In Butte County, the primary freshwater bearing formations include the Tuscan Formations, and overlying alluvium deposits, basin deposits, and the Riverbank and Modesto Formations. A number of marine formations beneath the Tuscan Formation make up the underlying saline aquifer system.[3] Increasing salinity in groundwater wells could indicate over utilization of groundwater resources. To ensure sustainable management of local groundwater resources, monitoring efforts need to provide baseline trends related to salinity. This program is not designed to characterize specific groundwater contamination due to pollutants.

Results are evaluated against established water quality standards and BMOs. Data that fall outside of a BMO for a specific parameter can trigger a BMO Alert Stage. For example, if the temperature is more than five degrees outside of the historical range of measurements a BMO Alert Stage is reached. If the pH is below 6.5 or above 8.5, a BMO Alert Stage is reached. A BMO Alert Stage for electrical conductivity (EC) is reached if the measurements are greater than 900 microsiemens per centimeter (µS/cm) for drinking water or greater than 700 µS/cm for

[3] Fulton, Allan. "Seeking an Understanding of the Groundwater Aquifer systems in the Northern Sacramento Valley: An Update". Article No. 1 – September 2005

agricultural water use. These ranges are based on secondary water quality standards established by the US Environmental Protection Agency (US EPA). Secondary standards relate to the taste, odor, color, corrosivity, foaming, and staining properties of water whereas primary standards are based on health considerations.

2018 Results

To date, temperature has been relatively consistent in all wells. Temperature is a standard parameter measured when assessing water quality and is important because it affects chemical reactions that may occur in groundwater. Also, considerable changes in temperature could be an indication of other source waters migrating into the aquifer system such as stream seepage or flow from a different aquifer system. All but one of the 2018 measurements were within 1.0^{o} Celcius (C) of the average temperature for each well. The Chico Urban well was $3.3\,^{o}$C higher than the well's recorded 11-year average. The 17-year temperature range for all wells was less than 5^{o} C. The lowest temperature reading was in the Thermalito well (17.8^{o} C) and the highest was in the Chico Urban well (22.6^{o} C). At the Chico Urban well, temperature was recorded from the first sample pulled after purging the well as it was deemed most representative of the temperatures recorded.

Measurements for pH remained relatively stable compared to previous years. The lowest pH was found in the Durham / Dayton area well (6.7) and the highest pH was found in the Llano Seco well (7.8). All measurements for pH were well within the secondary water quality thresholds of 6.5 - 8.5.

Electrical conductivity (EC) measures the ability of a solution to conduct an electrical current due to the presence of ions. Observed readings for electrical conductivity can have a large range, up to 447 µS/cm at a particular well (Western Canal-west), yet 2018 measurements were all well within the secondary water quality thresholds established by State and Federal regulatory agencies. The highest EC measurement was from the Esquon well (529 µS/cm) and the lowest was from the Llano Seco well (186 µS/cm). The greatest change compared to 2017 EC levels occurred in the M&T well which decreased in value by 161 µS/cm; however, his well has one of the largest ranges of observed EC levels over its period of record, possibly due to previous varying lengths of time the pump had been run from year to year before sampling prior to establishing an effective purge time for EC stabilization. Appendix D contains a monitoring network map, data tables and graphs.

Land Subsidence

Land subsidence is a gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials often caused by groundwater or oil extraction. To date, no inelastic land subsidence has been recorded in Butte County. The potential effects of land subsidence include differential changes in elevation and gradients of stream channels, drains, and water transport structures, failure of water well casings due to compressive stresses generated by compaction of aquifer systems, and compressional strain in engineering structures and houses.

Land subsidence in the Sacramento River, San Joaquin River, and Tulare Lake Basins would most likely occur as a result of aquitard consolidation. An aquitard is a saturated geologic unit that is incapable of transmitting significant quantities of water. As the pressure created by the height of water (i.e. head) declines in response to groundwater withdrawals, aquitards between production zones are exposed to increased vertical loads. These loads can cause materials in aquitards to rearrange and consolidate leading to land subsidence. Factors that influence the rate and magnitude of consolidation in aquitards include mineral composition, the amount of prior consolidation, cementation, the degree of aquifer confinement, and aquitard thickness. Subsidence has elastic and inelastic deformation components. As the head lowers in the aquifer, the load that was supported by the hydrostatic pressure is transferred to the granular skeletal framework of the formation. As long as the increased load on the formation does not exceed the pre-consolidation pressure, the formation will remain elastic. Under elastic conditions, the formation will rebound to its original volume as hydrostatic pressure is restored. However, when the head of the formation is lowered to a point where the load exceeds pre-consolidation pressure, inelastic deformation may occur. Under inelastic consolidation, the formation will undergo a permanent volumetric reduction as water is expelled from aquitards[4].

Butte County will prevent or limit inelastic subsidence as required through Chapter 33. To determine whether subsidence is occurring, three extensometers measure land surface displacement in Butte County (Figure 5). These extensometers have a period of record beginning in 2005 and continuously monitor for subsidence. Records are available by contacting DWR Northern Region or from the DWR Water Data Library[5]. To date, no inelastic land subsidence has been recorded in Butte County.

Figure 5. Extensometer Locations (daily data available online)

Extensometer data is shown in Figure 6 for each monitoring station. For practical purposes, the error in measurements is about +/- 0.01 feet so the graphs include only changes in negative displacement greater than this amount within a 24 hour period indicating subsidence (rather

4 http://water.usgs.gov/ogw/pubs/fs00165/
5 http://wdl.water.ca.gov/waterdatalibrary/docs/Hydstra/index.cfm

than uplift). Data is available through August 8, 2018. In addition, a Sacramento Valley-wide GPS survey was conducted during 2017. Results of the survey are available here https://water.ca.gov/News/News-Releases/2019/January/Survey-Shows-Areas-of-Land-Subsidence.

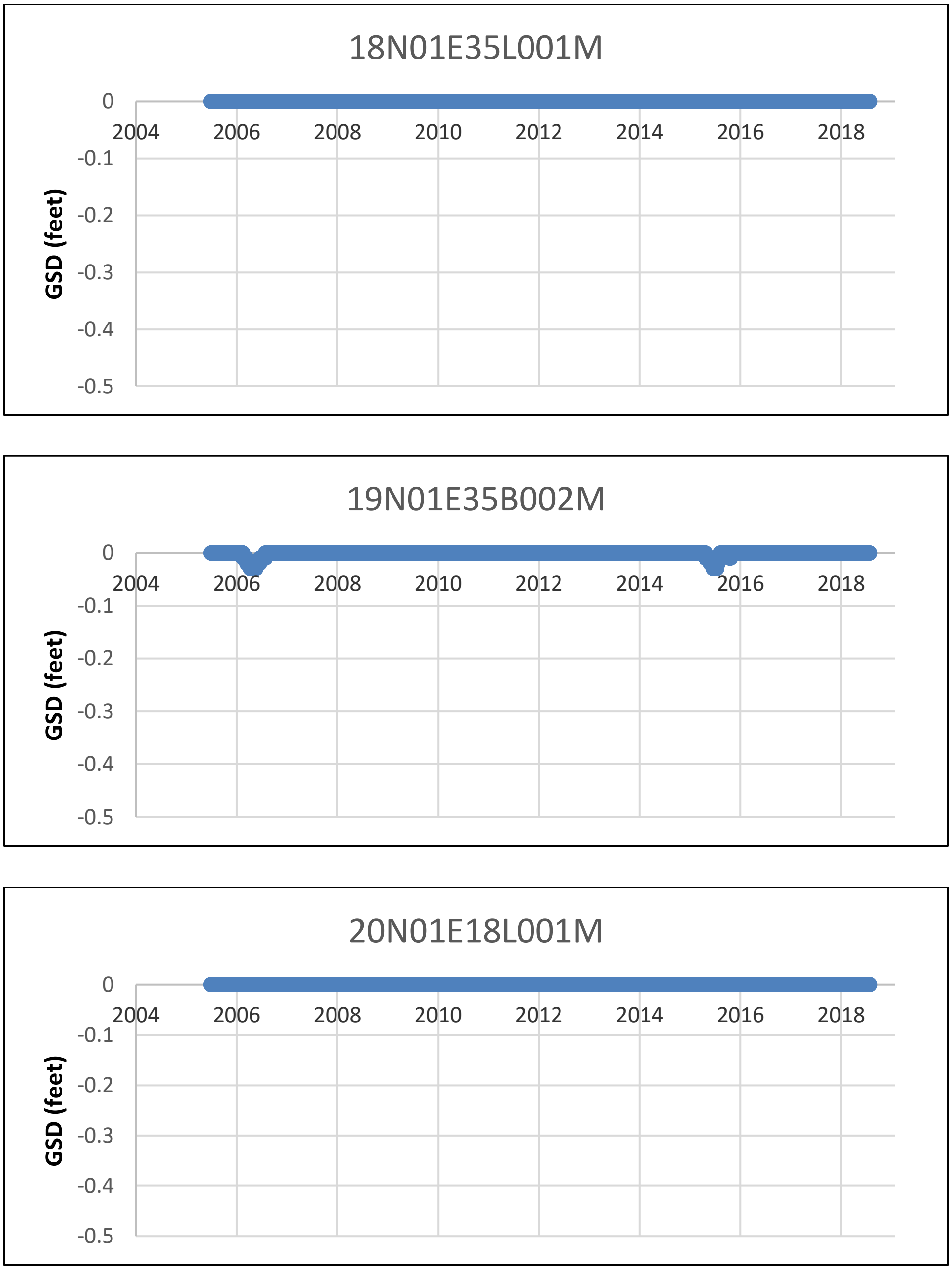


Figure 6. Ground Surface Displacement (GSD) in Feet

Well Permits

Well permits are issued by the Butte County Department of Environmental Health for all water wells drilled throughout the county. Although the number of well permit applications does not necessarily reflect the number of wells actually drilled, the numbers provide a general indication of the development of the groundwater resource and potential drilling activities. According to the 2016 Water Inventory and Analysis Report, Butte County has over 12,000 domestic wells and 2,500 irrigation wells. When combined with municipal, monitoring and other well types (stock water, test wells, abandoned, or unidentified wells) the total well count in the county is about 17,554[6]. Table 3 shows the number of well permit applications received by the Department of Environmental Health for the following categories from 2006 - 2018: Small Diameter, Large Diameter, and Well Repairs and Deepening. Each of the categories is described below in Table 3.

Table 3. Number of Well Permit Applications Per Water Year

Well Type	2006*	2007	2008	2009	2010	2011*	2012	2013	2014	2015	2016	2017*	2018
Small Diameter	260	228	176	188	140	77	102	221	259	175	129	95	129
Large Diameter	17	24	36	29	16	16	21	28	71	68	37	17	30
Well Repair & Deepening	4	9	15	20	10	9	7	10	17	19	10	1	**

** 2006, 2011 and 2017 were wet years, all others are below normal, dry, or critical WYs*
***The number of well repair and / or deepening in 2018 were not available at the time of reporting and are included in the total number of small and large diameter wells listed*

Small Diameter- wells with a casing diameter of eight inches or less.
Large Diameter- wells with a casing diameter greater than eight inches, generally for irrigation.
Well Repairs & Deepening- an existing well is deepened to access groundwater in a deeper zone of the aquifer likely because the water level in the well has fallen below the bottom of the well.

Well deepening permits are an indication that the existing well infrastructure is not sufficient given the current groundwater levels. During dry periods and drought as water levels fall in areas with heavy groundwater use (i.e. Durham / Dayton, Vina, Chico Urban Area, etc.), shallower domestic wells become especially vulnerable and may "go dry." This means the groundwater level in the well falls below the elevation of the pump in the well or below the bottom of the well itself. The pump can be lowered if the well is deep enough and allows for that. This does not require a permit from the County. If the well is not deep enough, it may be possible to deepen it. Well permits are issued for this activity and homeowners should enlist a licensed well driller to conduct the work.

Groundwater Level Monitoring

Groundwater levels typically fluctuate seasonally and from year to year. Seasonal fluctuation of groundwater levels occur in response to groundwater pumping and recovery, land and water use activities, recharge, and natural discharge. Precipitation, applied irrigation water, local creeks and rivers, and the Thermalito Forebay and Afterbay all recharge groundwater in Butte County. Groundwater pumping for irrigation typically occurs April - September although depending on the timing of rainfall, it may shift earlier and later. Consequently, groundwater levels are usually highest in the spring and lowest during the irrigation season in the summer months.

[6] Butte County Water Inventory and Analysis, 2016

Long-term fluctuations occur when there is an imbalance between the volume of water recharged into the aquifer and the volume of water removed from the aquifer, either by extraction or natural discharge to surface water bodies. If, over a period of years, the amount of water recharged to the aquifer exceeds the amount of water removed from the aquifer, then groundwater levels will increase. Conversely, if, over time, the amount of water removed from the aquifer exceeds the amount of water recharged then groundwater levels decline. These long-term changes can be linked to various factors including increased or decreased groundwater extraction or variations in recharge associated with wet or dry hydrologic cycles.

Currently 130 wells are monitored for groundwater levels in Butte County as part of the BMO program (79 of them are assigned BMO spring alert levels). These wells consist of a mixture of domestic and irrigation wells, along with dedicated observation wells and ten Cal Water municipal supply wells in Chico and Oroville. Approximately 59 of the wells measured by DWR and the Department are equipped with data loggers (i.e. transducers) which continuously monitor and record hourly changes in groundwater levels. These and the remaining wells are measured by hand four times per-year, in March, July, August, and October. From 2014 to 2016, groundwater levels were measured monthly from April through October due to severe drought conditions. The approximate locations of groundwater level wells monitored in Butte County are shown in Appendix B. The groundwater level monitoring methods are consistent with the procedures described in the Department of Water Resources' Groundwater Elevation Monitoring Guidelines (December 2010)[7].

Groundwater elevations are measured using a steel tape, electric sounder, or by transducers. The accuracy of the groundwater level measurement ranges from 0.01 feet to 0.1 feet. In addition to the groundwater level monitoring conducted by Butte County and the DWR, California Water Service Company currently measures monthly groundwater levels in approximately sixty municipal groundwater supply wells in the Chico Urban and Oroville areas. Ten of these wells are included in the BMO program and assigned alert stages.

Data from groundwater level monitoring can be obtained through DWR and the Department's websites. The primary access to the data is through the California Statewide Groundwater Elevation Monitoring (CASGEM) program (https://water.ca.gov/Programs/Groundwater-Management/Groundwater-Elevation-Monitoring--CASGEM). The CASGEM program was part of legislation passed in 2009, SBx7-6, which mandates statewide groundwater elevation monitoring to track seasonal and long-term trends in basins throughout the state. As a result of this legislation, DWR migrated the groundwater level data from the Water Data Library (WDL) to the CASGEM database. DWR has reintroduced access to groundwater monitoring data through an updated WDL (http://wdl.water.ca.gov/waterdatalibrary/). Groundwater level data is also available through DWR's online SGMA Data Viewer tool (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). Summary data tables of

[7] https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/CASGEM/Files/CASGEM-DWR-GW-Guidelines-Final-121510.pdf

groundwater surface elevations from spring, summer, and fall measurements are included in Appendix E and are available from the Department's website.

Change in Groundwater Levels: 2017 to 2018

The 2018 WY was classified as a below normal year with relatively dry conditions as measured by the Northern Sierra 8 Station Index. Groundwater conditions responded as expected to the dry winter as compared to the previous WY which was recorded as the wettest year on record with generally lower groundwater levels in 2018 compared to 2017. The overall average change in observed groundwater levels from spring 2017 to spring 2018 was a decrease of three feet. Of the 117 comparable wells, 19 of them had a higher spring level compared to 2017. The average increase was 2.4 feet and of the 95 wells that had lower measurements in 2018 compared to 2017, the average decrease was 4.1 feet (Table 4). The below normal winter conditions of WY 2018, which followed the wettest WY on record yet, led to lower groundwater levels particularly in the areas to the north and east of Chico and the Durham area which also experienced some of the greatest declines during the 2012-2015 drought period. Decreases in groundwater levels throughout the groundwater dependent portions of the basin in 2018 were also likely affected by significant frost control pumping that occurred in later February and March, close to the time that spring measurements were taken.

Table 4. Groundwater Elevation Change - Spring 2017 to Spring 2018

Number of Wells		Change (ft)	SIU
117	**Average GWL Change**	**-3.0**	
	Median GWL Change	-2.6	
19	**Average Increase**	**2.4**	
	Median Increase	1.4	
	Max Increase	12.1	*Wyandotte Creek*
95	**Average Decrease**	**-4.1**	
	Median Decrease	-3.3	
	Max Decrease	-13.1	*Wyandotte Creek*

Note: Groundwater level measurements characterized as "Questionable measurements" i.e. measurements taken during pumping, when nearby pumps were operating or taken from wells pumped recently were not included and three wells measured had no groundwater level change between Spring of 2017 and Spring of 2018.

In order to better understand the context of the 2017 to 2018 WY change in spring groundwater levels and how the change between the 2017 and 2018 WYs compares to changes between recent years, the cumulative amount of change between years was compiled for the last seven water years. Figure 7 below depicts this change beginning with the 2012 WY set as zero for the baseline change. WY 2012 was a *below normal* year following a *wet year* (2011) similar to the current 2018 *below normal* WY following the 2017 *wet* WY.

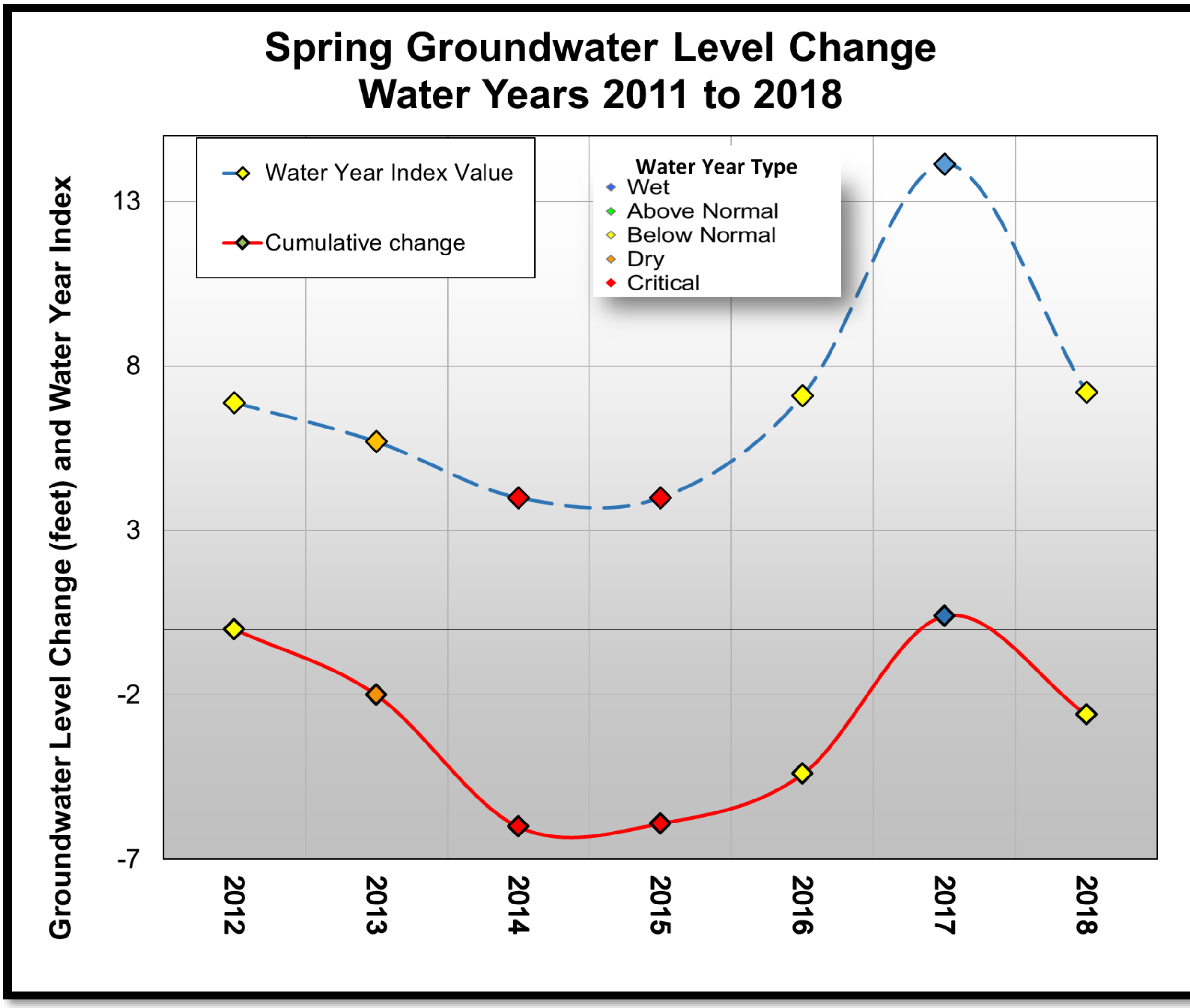


Figure 7. Cumulative Spring Groundwater Level Change from Water Years 2012 to 2018

Summer measurements, as required by Chapter 33A, are conducted in July and August each year during peak pumping for irrigation. This results in more questionable measurements because measured or nearby wells are more likely to be pumping during the irrigation season than in the spring or fall. However, a number of wells in certain areas have a qualitative BMO related to maintaining summer groundwater levels at a level that will assure an adequate and affordable irrigation groundwater supply. Therefore, even though the data is less consistent because of direct pumping effects on water elevations, it provides a baseline for summer groundwater conditions on a regional scale. Summer data is reported by averaging the July and August measurements for each well. The summer groundwater levels in 2018 were 3.7 feet higher on average compared to groundwater levels in 2017 (Table 5). Even with questionable measurements included, these measurements and comparisons primarily reflect static groundwater conditions (non-pumping).

Table 5. Groundwater Elevation Change – Average Summer 2017 to Average Summer 2018

Number of wells		Change (ft.)	Area
113	Average GWL Change	-3.7	
	Median GWL Change	-3.7	
18	Average Increase	1.2	
	Median Increase	0.5	
	Max Increase	7.5	Vina South
94	Average Decrease	-4.7	
	Median Decrease	-4.4	
	Max Decrease	-18.2	Vina South

Note: Groundwater level measurements characterized as "Questionable measurements" i.e. measurements taken during pumping, when nearby pumps were operating or taken from wells pumped recently are included in the data due to the frequency of these observed field conditions and one well measured had no groundwater level change between Summer of 2017 and Summer of 2018.

Like spring levels, fall water levels in 2018 decreased in most areas compared to 2017 fall levels by an overall average change of 1.3 feet (Table 6). Of the 121 comparable well measurements, 19 of them had a higher 2017 fall level (average increase of 1.9 feet) than the corresponding 2017 fall measurement. Of the 99 measurements that were lower in 2018 compared to 2017, the average decrease was 2.6 feet. Hydrographs of individual groundwater level conditions in specific wells provide greater historical context for groundwater level trends (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer) and the groundwater level change maps (Appendix F) show where the greatest changes occurred.

Table 6. Groundwater Elevation Change - Fall 2017 to Fall 2018

Number of wells		Change (ft.)	Area
121	Average GWL Change	-1.3	
	Median GWL Change	-1.8	
19	Average Increase	1.9	
	Median Increase	1.5	
	Max Increase	5.0	Wyandotte Crk. Oroville
99	Average Decrease	-2.6	
	Median Decrease	-2.4	
	Max Decrease	-10.2	Butte

Note: Groundwater level measurements characterized as "Questionable measurements" i.e. measurements taken during pumping, when nearby pumps were operating or taken from wells pumped recently are not included in the data and three wells measured had no groundwater level change between Fall of 2017 and Fall of 2018.

Seasonal Groundwater Level Change

In areas dependent on groundwater supplies for irrigation, groundwater levels decline as pumps turn on and the irrigation season progresses. To capture the effect of irrigation season pumping on groundwater conditions, summer levels are compared to spring levels of the same year. Table 7 compares groundwater levels in spring 2018 to summer 2018. Overall, the average decrease from spring of 2018 to summer of 2018 was 11.1 feet.

Table 7. Groundwater Elevation Change - Spring 2018 to Average Summer 2018

Number of wells		Change (ft.)	Area
122	Average GWL Change	-10.4	
	Median GWL Change	-10.1	
6	Average Increase	1.1	
	Median Increase	0.4	
	Max Increase	3.5	Butte
115	Average Decrease	-11.1	
	Median Decrease	-10.6	
	Max Decrease	-38.3	Vina South

Note: Groundwater level measurements characterized as "Questionable measurements" i.e. measurements taken during pumping, when nearby pumps were operating or taken from wells pumped recently are included in the data due to the frequency of these observed field conditions and one well measured had no groundwater level change between Spring of 2018 to Summer of 2018.

Basin Management Objectives (BMOs)

BMOs are established for most of the wells in the monitoring network (79 of 130 wells for spring measurements and 66 of 129 for fall). BMOs are determined from historical data collected for the specific well. When a measurement fails to achieve the BMO for the well, a BMO Alert Stage is reached. When a BMO Alert Stage is reached, the Department increases outreach to stakeholders, seeks an evaluation by the Technical Advisory Committee and may conduct additional monitoring. Under the BMO program, stakeholders participate in the evaluation and outreach of BMO data, and this will continue throughout the BMO program's transition into a more SGMA relevant program over the next few years. The BMOs provide a standardized way to evaluate spring and fall changes in groundwater levels. Two methods are used to determine BMOs, as described in Chapter 33A.

Historic Range Method

This method has two procedures depending upon the period of record for the well. The first procedure is for wells that have a period of record dating back to at least 1970. Measurements up through 2006 are used to set the BMO. The BMO is set by taking the historical low reading and adding 20% of the range of measurements, calculated from the first year on record through 2006. Measurements below the BMO and above the historical low would indicate an Alert Stage 1. Measurements at or below the historical low would indicate an Alert Stage 2. The measurements plotted after 2006 are for reference purposes only, and are not included in the calculation of the range.

The second procedure is for wells that have a period of record beginning after 1970. For these wells, the historical low measurement prior to 2006 indicates an Alert Stage 1. The historical low measurement minus the range of measurements indicates an Alert Stage 2. The measurements plotted after 2006 again are for reference purposes only, and are not included in the calculation of the range.

Specific Depth Method
For this method, the BMO is set at five feet below the average spring groundwater level calculated for the well. An Alert Stage 1 is reached if the spring measurement falls five feet below the average groundwater level (calculated from the first year on record through 2006). An Alert Stage 2 is reached if spring groundwater levels, for a second consecutive year, remain five feet below the average groundwater level established for the well. An Alert Stage 3 is reached if the spring groundwater level falls ten feet below the average spring groundwater level established for the well. All of the SIUs previously established for this program utilize the historical range method, except for Richvale and Western Canal which use the specific depth method. The specific depth method does not have corresponding fall BMOs.

Summary of Alert Stages Reached
A number of wells reached Alert Stages for both spring and fall BMOs in 2018. No wells reached an Alert Stage 3 (specific depth method only). The number of wells at an Alert Stage for 2008-2018 spring and fall BMOs are shown in Table 8 and Table 9, respectively.

Table 8. Spring BMO Alert Stages

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Alert 1	26	31	25	24	25	20	24	21	17	13	17
Alert 2	0	6	3	0	4	15	21	25	25	11	19
Alert 3	0	0	0	0	0	0	0	0	0	0	0
Total	26	37	28	24	29	35	45	46	42	24	36

Table 9. Fall BMO Alert Stages

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Alert 1	27	29	24	7	26	23	21	16	21	22	23
Alert 2	2	1	2	2	6	16	19	25	18	8	13
Total	29	30	26	9	32	39	40	41	39	30	36

*Alert 3 only applies to spring measurements

Additional details on groundwater conditions for specific wells can be found in the DWR SGMA Data viewer tool (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer). Previous annual reports included individual BMO reports prepared for the sixteen SIUs in Butte County located in one of four groundwater sub-basins: Wyandotte Creek, East Butte, West Butte, and Vina. As the Department continues to adaptively manage SGMA responsibilities and transition this annual report to meet GSP requirements some changes are underway including the removal of individual SIU BMO reports from the annual report. Future annual reports / GSPs will provide information regarding groundwater conditions and the sustainability of current and future groundwater management will be not only be more relevant, but also more enforceable.

The BMO reports from previous annual reports can be accessed from the Department's website under 'REPORTS' then 'GROUNDWATER STATUS REPORT' and 'View Previous Reports' at: https://www.buttecounty.net/waterresourceconservation/viewpreviousyears

Groundwater Status Report

Appendix A

Well Numbering System

Butte County Water and Resource Conservation

APPENDIX A
WELL NUMBERING SYSTEMS

To develop the groundwater level BMOs, all existing monitoring wells were identified for each BMO sub-inventory unit. These wells are currently monitored either by public or private entities within a given sub-inventory unit, or they are monitored as part of the DWR, Northern District groundwater levels monitoring program. To distinguish and locate these monitored wells an alphanumeric name, or ID, is used. All BMO Key Wells identified for each sub-inventory unit are referenced by these unique ID’s. Wells that are not part of the DWR monitoring network are typically assigned a local ID. Wells that are part of the DWR monitoring network are identified by the State Well Numbering System. This system is very useful in locating points on the ground, such as groundwater wells in areas with few identifying landmarks. Under this system, each well is assigned a unique number referred to as the State Well Number. This system is described further below.

State Well Numbering System

(Reference: Water Facts: Numbering Water Wells in California, No. 7, June 2000)

The State’s well-numbering system is based on a rectangular system called the “United States System of Surveying in the Public Lands,” commonly referred to as the “*Public Lands Survey*,” established by the Continental Congress in 1784. The Public Lands Survey system has been employed by DWR, USGS, and other agencies for over 50 years. This system allows for a unique ID to be assigned to each well. These unique ID’s are made up of several components, each of which is described below.

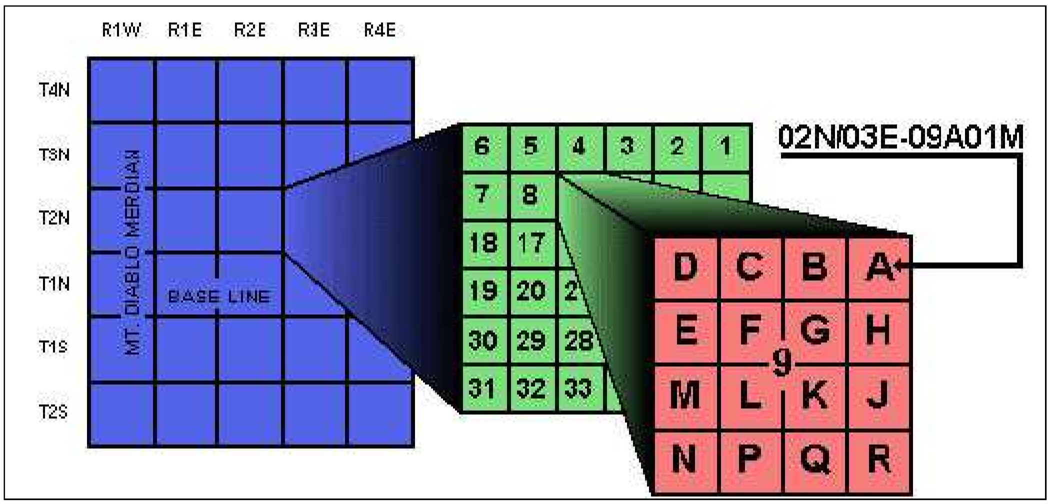
Initial Point and Corresponding Base & Meridian Pair. Under this system all tracts of land are referenced to an Initial Point. This Initial Point is defined by the intersection of a north-south line called the Meridian and an east-west line called the Base. In California there are three Initial Points each with a corresponding Base and Meridian Pair, and all of the BMO Key Wells are referenced to the Mt. Diablo Base and Meridian.

Range and Township Lines. Longitudinal lines are established at six-mile increments from the Initial Point and are east or west of the Meridian. These longitudinal lines are called Range Lines. Latitudinal lines also set at six-mile increments from the Initial Point are parallel to, and north or south of the Base. These latitudinal lines are known as Township Lines. This pattern of longitudinal and latitudinal lines defines a grid pattern consisting of 36-square-mile parcels of land. These 36-square-mile parcels are referred to as Townships. Each Township is referenced to an Initial Point by the number of 36-square-mile parcels and direction from that Initial Point.

Sections. Every Township is further divided in to 36 parts called Sections. A Section is a square parcel of land one-mile on a side, containing 640 acres.

Tract. Each Section is further divided into sixteen 40-acre parcels called Tracts. Each Tract is labeled with a letter. Once the well's location is established in the 40-acre Tract it is assigned a Sequence Number. These Sequence Numbers are assigned in chronological order (see Figure G).

State Well Number. The State Well Number is composed of the various components described above, including Township, Range, Section, Tract, Sequence Number, and Base & Meridian Pair.



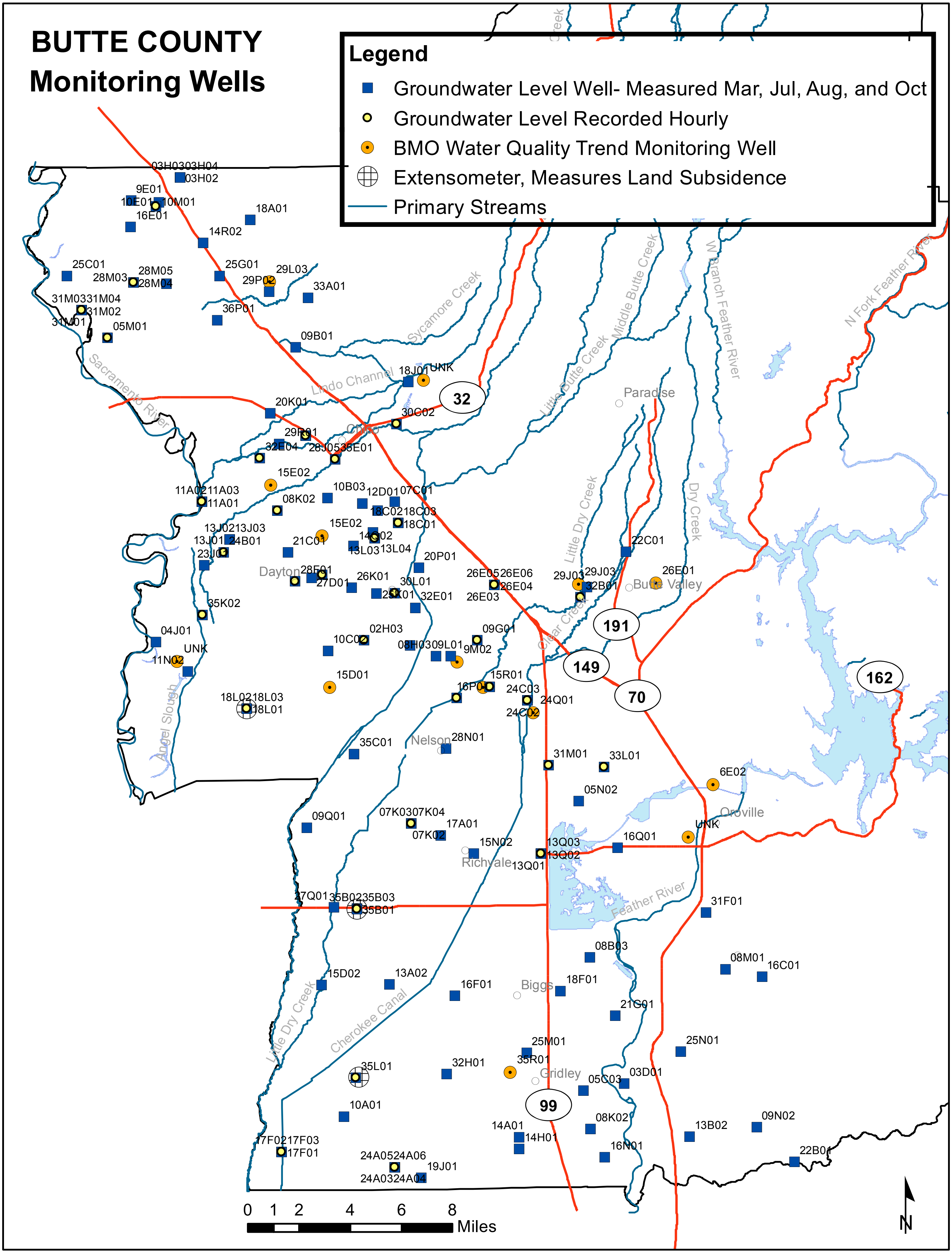
Groundwater Status Report

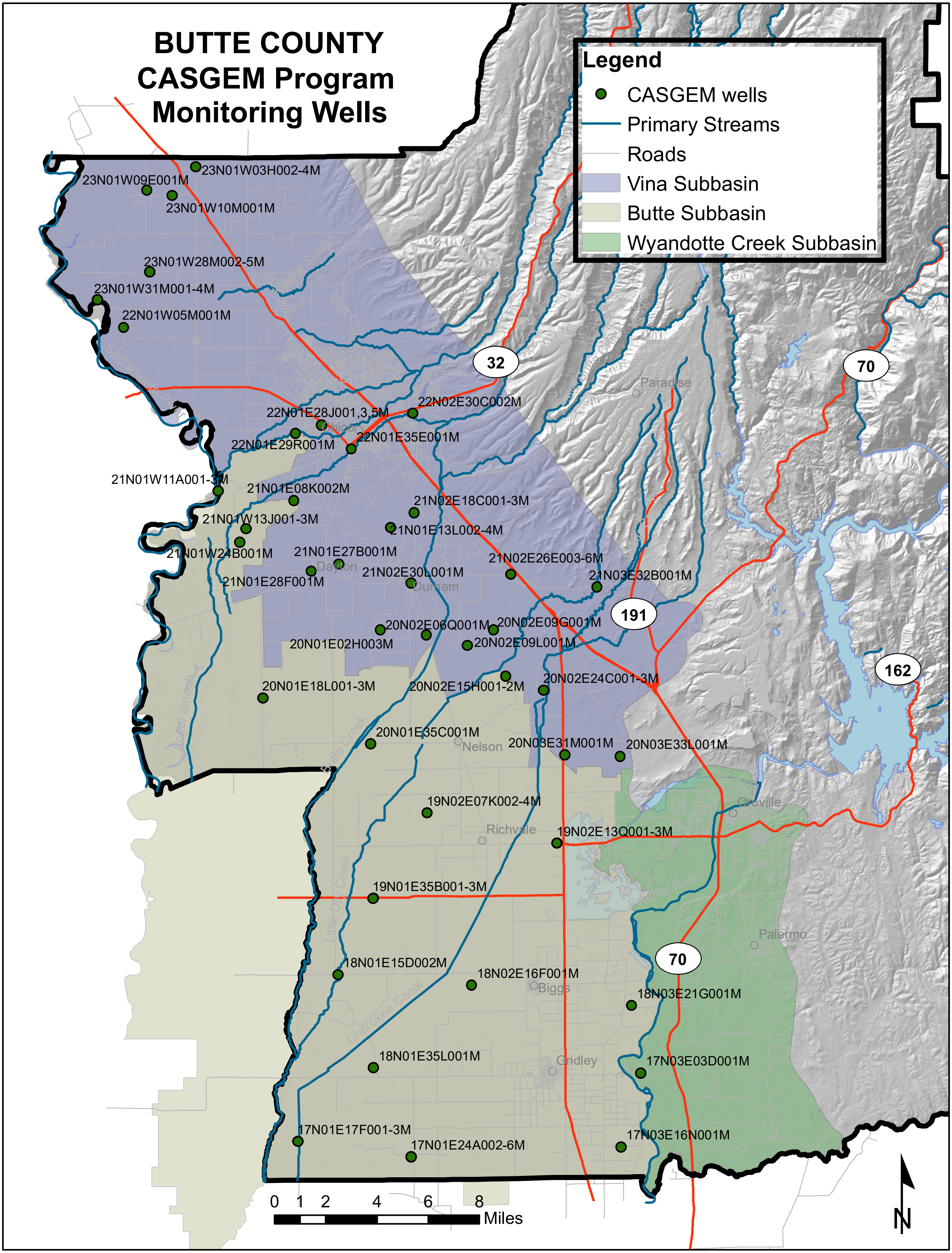
Appendix B

Butte County Monitoring & CASGEM Network

Butte County Water and Resource Conservation

BUTTE COUNTY Monitoring Wells





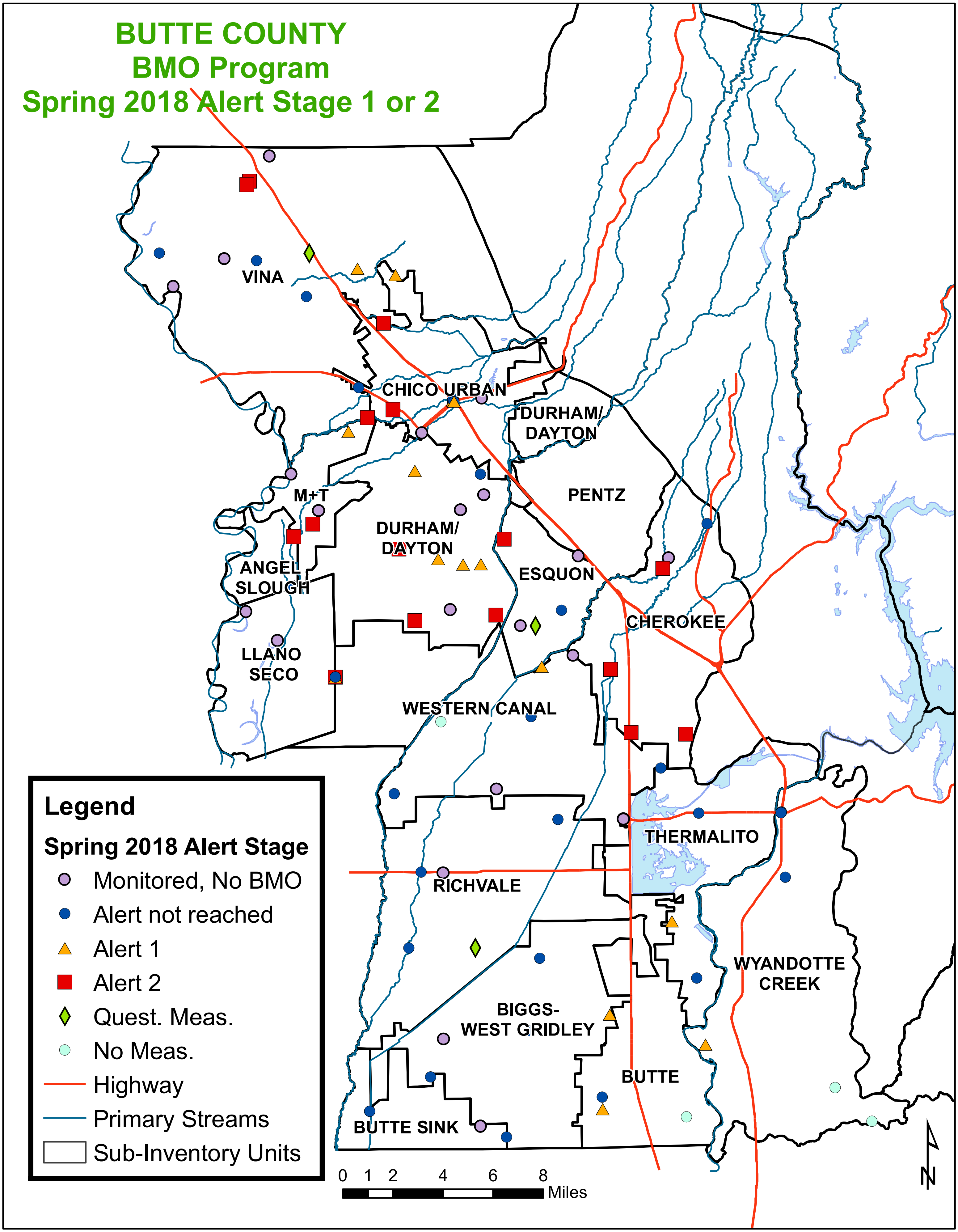
BUTTE COUNTY
CASGEM Program
Monitoring Wells
Legend
CASGEM wells
Primary Streams
Roads
Vina Subbasin
Butte Subbasin
Wyandotte Creek Subbasin
23N01W03H002-4M
23N01W09E001M
23N01W10M001M
23N01W28M002-5M
23N01W31M001-4M
22N01W05M001M
32
70
Paradise
22N02E30C002M
22N01E28J001,3,5M
Chico
22N01E35E001M
22N01E29R001M
21N01W11A001-3M
21N01E08K002M
21N02E18C001-3M
21N01W13J001-3M
21N01E13L002-4M
21N01W24B001M
21N01E27B001M
Dayton
21N02E26E003-6M
21N03E32B001M
21N02E30L001M
21N01E28F001M
Durham
191
20N02E06Q001M
20N02E09G001M
20N01E02H003M
20N02E09L001M
162
20N01E18L001-3M
20N02E15H001-2M
20N02E24C001-3M
20N01E35C001M
Nelson
20N03E31M001M
20N03E33L001M
19N02E07K002-4M
Oroville
Richvale
19N02E13Q001-3M
19N01E35B001-3M
Feather River
Palermo
70
18N01E15D002M
18N02E16F001M
Biggs
18N03E21G001M
Cherokee Canal
18N01E35L001M
Gridley
17N03E03D001M
17N01E17F001-3M
17N01E24A002-6M
17N03E16N001M
Little Dry Creek
Butte Creek
Angel Slough
0 1 2 4 6 8
Miles
N

Groundwater Status Report

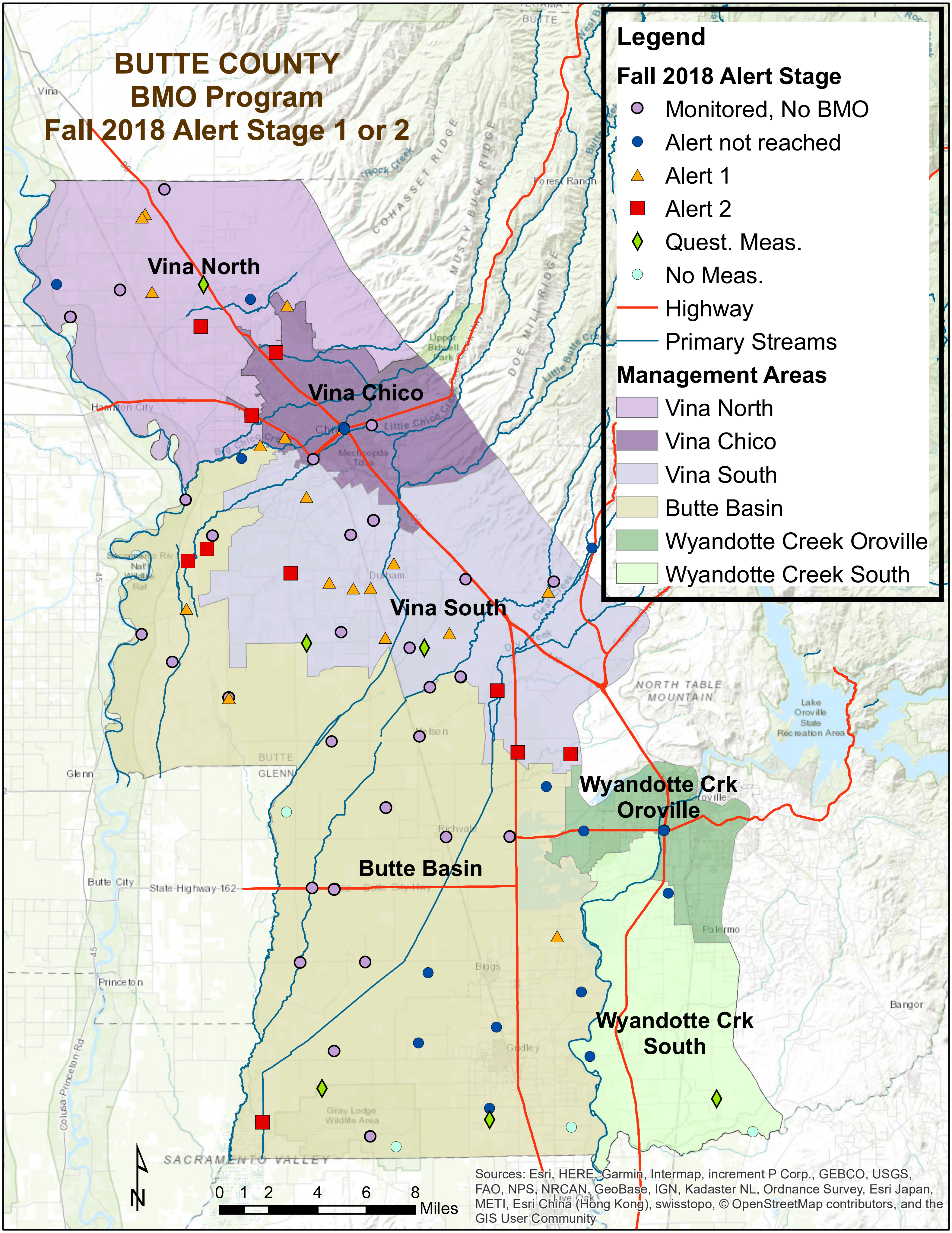
Appendix C

Groundwater Level Alert Stage Maps

Butte County Water and Resource Conservation



BUTTE COUNTY
BMO Program
Spring 2018 Alert Stage 1 or 2
VINA
CHICO URBAN
DURHAM/
DAYTON
PENTZ
M+T
DURHAM/
DAYTON
ANGEL
SLOUGH
ESQUON
CHEROKEE
LLANO
SECO
WESTERN CANAL
THERMALITO
RICHVALE
WYANDOTTE
CREEK
BIGGS-
WEST GRIDLEY
BUTTE
BUTTE SINK
Legend
Spring 2018 Alert Stage
Monitored, No BMO
Alert not reached
Alert 1
Alert 2
Quest. Meas.
No Meas.
Highway
Primary Streams
Sub-Inventory Units
0 1 2 4 6 8
Miles
N


BUTTE COUNTY
BMO Program
Fall 2018 Alert Stage 1 or 2
Legend
Fall 2018 Alert Stage
Monitored, No BMO
Alert not reached
Alert 1
Alert 2
Quest. Meas.
No Meas.
Highway
Primary Streams
Management Areas
Vina North
Vina Chico
Vina South
Butte Basin
Wyandotte Creek Oroville
Wyandotte Creek South
Vina North
Vina Chico
Vina South
Butte Basin
Wyandotte Crk
Oroville
Wyandotte Crk
South
0 1 2 4 6 8
Miles
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Groundwater Status Report

Appendix D

Water Quality Trend Monitoring Report

Butte County Water and Resource Conservation

Water and Resource Conservation Paul Gosselin, Director

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bcwater@buttecounty.net

INTERDEPARTMENTAL MEMORANDUM

TO: Butte County Water Commission

FROM: Kelly Peterson, Water Resources Scientist

SUBJECT: 2018 Groundwater Quality Trend Monitoring Update

DATE: August 24, 2018

INTRODUCTION AND BACKGROUND

The Butte County Department of Water and Resource Conservation (DW&RC) conducted its seventeenth year of groundwater quality trend monitoring within the county July 23-26, 2018. As required by Chapter 33A, the parameters monitored were temperature, pH, and electrical conductivity (EC). These parameters are the basic water quality characteristics needed to evaluate a basin for evidence of saline intrusion. The groundwater quality trend monitoring serves to establish baseline levels for these parameters throughout the county so that any future changes can be identified and further investigation and / or monitoring can subsequently be developed. In 2018, all samples fell within the acceptable range of water quality values set forth by State and Federal agencies and alert stages defined in Chapter 33A.

METHODOLOGY AND RESULTS

In 2013, DW&RC purchased a Hach HQd portable meter with a pH and conductivity probe. This was the sixth year this meter was used to do the groundwater quality testing. The sites visited in Butte County are on private land and many of the wells are used for agricultural purposes (irrigating orchards, rice, or pasture). However, the two Thermalito wells, Chico Urban Area well, Vina well, and the Llano Seco well provide domestic water supply. The sampling grid spans from north of the Chico Urban Area (Vina sub-inventory unit), west towards the Sacramento River (Llano Seco and M&T sub-inventory units), east towards the foothills (Pentz sub-inventory unit), and south towards Gridley (Biggs-West Gridley sub-inventory unit). Figure 1 shows the approximate locations of the water quality wells in relation to wells monitored four times per year for groundwater level in the Basin Management Objectives Program.

As in previous years, we are fortunate to have support and permission from local property owners who coordinate timing of sampling and allow access to their wells. We have provided them with the preliminary results from this year's monitoring.

Twelve of the thirteen wells in the network were sampled this year. The Western Canal (West) well was inaccessible due to irrigation infrastructure changes that prevented sampling. It is expected that sampling at this location will resume next year. Following standard sampling procedures, a water sample is pulled from a discharge location at or near the well and values for temperature, pH and EC are recorded when the pH reading from three subsequent water samples stabilizes. Temperature is a standard parameter measured when assessing water quality, mostly to indicate that water being sampled is representative of aquifer water and not water standing in the well itself.

The US Environmental Protection Agency (US EPA) establishes drinking water quality standards using two categories, Primary Standards and Secondary Standards[1]. Primary Standards are based on health considerations and Secondary Standards are based on taste, odor, color, corrosivity, foaming, and staining properties of water. Secondary water quality thresholds for pH and EC compared to the range of 2018 values are presented in Table 1.

Table 1. US EPA Secondary Standards for measured parameters

Parameter	Secondary Standard or Secondary WQ Threshold	Range of 2018 Values	Notes re: Butte County Results
pH	6.5 to 8.5	6.7-7.8	Within range of secondary water quality thresholds.
Electrical Conductivity (EC)	< 900 µS/cm – drinking water < 700 µS/cm – ag water	186-529	Within range of secondary water quality thresholds.

Water quality data for specific wells is presented in tables and graphs on the following pages.

Temperature is an important parameter because it affects chemical reactions that may occur in groundwater. Also, considerable changes in temperature could be an indication of other source waters migrating into the aquifer system such as stream seepage or flow from a different aquifer system. To date, temperature has been relatively consistent in all wells. Chapter 33A states that "the BMO Alert Stage for temperature will be reached when the measurement is more than five (5) degrees outside of the historic range of measurements." The 2018 measurements were all within 5.0 °C of the historic range of measurements for each well. The 17 year temperature range for all wells is also less than 5 °C (Table 3). The lowest temperature reading was in the Thermalito well (17.8 °C) and the highest recorded temperature was in the Chico Urban well (22.6 °C). At the Chico Urban well, temperature was recorded from the first sample pulled after purging the well as it was deemed most representative of the temperatures recorded.

Measurements for pH remained relatively stable compared to previous years (see attached graphs). The lowest pH was found in the Durham Dayton area at 6.7 and the highest was found in the Llano Seco well (7.8). All measurements for pH were well within the secondary water quality thresholds of 6.5 - 8.5 (Table 1, Table 4 and included graphs).

Electrical conductivity (EC) measures the ability of a solution to conduct an electrical current due to the presence of ions. Observed readings for electrical conductivity can have a large range, up to 447 µS/cm at a particular well (Western Canal-west), yet 2018 measurements were all well within the secondary water quality thresholds established by State and Federal regulatory agencies (Table 1, Table 6, and included graphs). The highest EC measurement was from the Esquon well (529 µS/cm) and the lowest was from the Llano Seco well (186 µS/cm).

CONCLUSIONS

This was the seventeenth season the DW&RC collected groundwater quality information. Overall, the results of the water quality sampling indicate no significant changes in groundwater quality with respect to temperature, pH, or electrical conductivity. The greatest change compared to 2017 EC levels occurred in the M&T well which dropped in value by 161 µS/cm. This well has one of the largest ranges of observed EC levels over the period of record. Per staff recommendations last year, when this well was sampled this year, efforts were made to sample regularly over a longer period of time than the standard minimum 15 minutes used to purge the well before sampling. This effort was taken to establish the amount of time required for pH and EC to stabilize in this well. It was determined that this well should be purged for approximately one hour before sampling to allow for the pH and EC levels to stabilize. Staff recommends

[1] http://www.epa.gov/safewater/consumer/2ndstandards.html

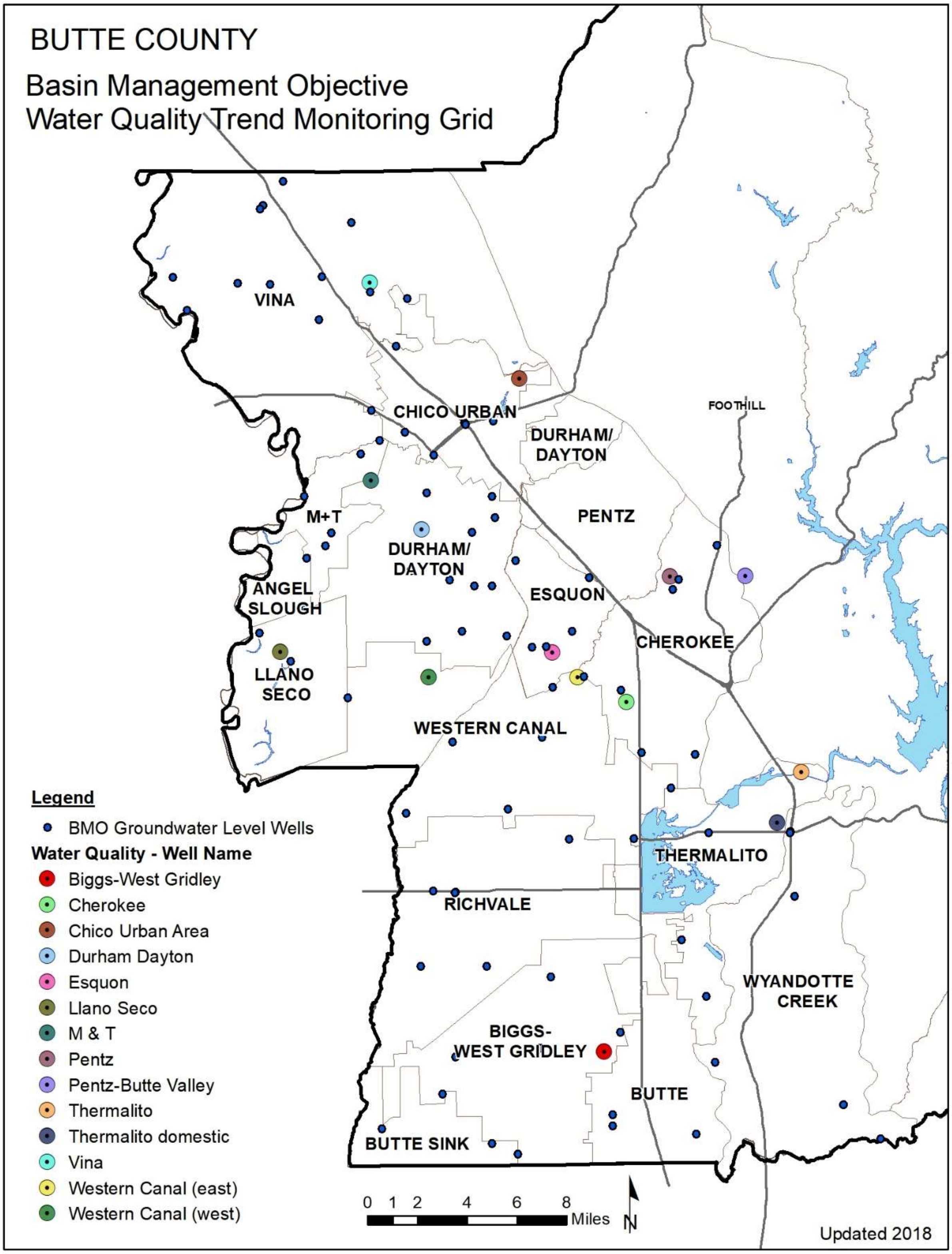
that next year, this well be sampled with EC measurements recorded from one hour after the start of the pump until EC levels stabilize for this well. It is possible that the large range in observed EC values in this well over previous years is due to varying lengths of time the pump was running from year to year before a sample was taken. This topic can be further discussed with the TAC at their upcoming meeting in November.

Water quality parameters have naturally occurring variability, so year to year changes are expected and nothing in this year's measurements gives cause for concern or immediate further investigation or analysis. Further investigation would be advisable if values were to fall outside of the acceptable range.

The focus of this trend monitoring program is to evaluate the basin for evidence of saline intrusion. No major shifts occurred in the EC measurements in the sampled wells and the basin appears to be free of saline intrusion in these areas. This data continues to help establish baseline levels for these parameters across the county so that any future changes in water quality can be evaluated and further investigation and / or monitoring can be developed.

Further information on water quality standards for different constituents can be found at www.swrcb.ca.gov or in the *Compilation of Water Quality Goals*, published by the State Water Resources Control Board.

Figure 1. Approximate well locations for water quality wells in relation to wells monitored annually (four times) for water level.



DATA TABLES AND GRAPHS

Table 2. Annual groundwater temperature (°C)

Sub-Inventory Unit	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Biggs-West Gridley	18.5	18.5	18.1	20.5	18.2	18.3	18.7	19.0	19.2	20.1	18.0	18.4	19.0	18.5	18.4	18.6	19.3
Cherokee	22.4	21.9	21.2	21.4	21.1	20.7	21.0	20.9	21.9	21.8	21.8	21.3	21.9	21.2	20.8	21.2	21.3
Chico Urban Area						18.4	20.1	18.2	18.8	19.5	21.6	18.0	NM	18.4	17.8	19.0	22.6
Durham Dayton	18.8	19.9	21.8	20.4	17.4	NM	19.3	NM	18.9	18.0	NM	18.5	19.1	18.1	18.0	18.8	19.9
Esquon	19.7	18.9	19.6	20.1	20.7	19.0	19.6	19.0	19.1	20.0	21.4	18.1	20.2	18.9	18.0	19.1	18.6
Llano Seco							20.8	20.6	20.7	20.6	21.7	20.4	23.5	19.9	20.0	19.9	20.1
M & T	17.6	18.2	17.8	19.2	18.6	18.0	17.7	18.6	17.8	NM	18.3	17.9	NM	17.1	17.2	17.2	17.9
Pentz						22.2	21.5	21.3	21.5	23.9	21.9	21.9	21.9	21.5	21.5	21.6	22.1
*Pentz-Butte Valley	27.0	26.4	26.7	23.2													
Thermalito	18.3	17.9	17.1	17.1	18.4	17.7	18.9	17.6	NM	NM	17.8	17.3	17.5	17.3	17.4	17.5	17.8
Thermalito (domestic)							19.4	19.4	19.4	NM	NM	19.8	NM	19.9	19.8	20.0	20.3
Vina	19.6	20.3	19.2	19.2	19.6	18.9	19.6	18.9	18.8	22.8	18.8	20.2	21.4	19.5	19.8	19.5	20.5
Western Canal (East)	18.4	18.2	19.9	20.5	18.8	18.6	19.1	19.0	18.8	19.0	NM	18.3	18.9	18.5	19.1	18.6	20.1
Western Canal (West)	19.0	18.1	19.8	20.8	18.5	20.6	21.8	18.5	19.1	20.5	20.1	19.1	20.2	18.6	18.8	NM	NM

*Pentz-Butte Valley well discontinued in 2006 and NM – No measurement

Table 3. Groundwater temperature average and range over 17 year sampling period (°C)

Sub-Inventory Unit	Average	Range
Biggs-West Gridley	18.8	2.5
Cherokee	21.4	1.7
Chico Urban Area	19.3	4.8
Durham Dayton	19.1	4.4
Esquon	19.4	3.4
Llano Seco	20.7	3.6
M & T	17.9	2.1
Pentz	21.9	2.6
*Pentz-Butte Valley	25.8	3.8
Thermalito	17.7	1.8
Thermalito (domestic)	19.8	0.9
Vina	19.8	4.0
Western Canal (East)	19.0	2.3
Western Canal (West)	19.6	3.7

Table 4. Annual groundwater pH

Sub-Inventory Unit	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Biggs-West Gridley	7.6	7.5	7.5	7.0	7.6	7.6	7.7	7.9	7.9	7.2	7.9	7.9	7.1	7.6	7.6	7.7	7.7
Cherokee	7.5	7.5	7.1	7.4	7.4	7.3	7.3	7.3	7.2	7.6	7.3	7.3	6.9	7.2	7.2	7.1	6.9
Chico Urban Area						6.9	6.9	6.9	7.0	7.5	7.3	7.1	NM	6.9	7.0	7.0	7.1
Durham Dayton	7.7	7.2	7.6	7.6	7.5	NM	7.5	NM	7.4	7.7	NM	7.5	NM	7.5	7.5	7.3	6.7
Esquon	7.3	7.5	7.1	7.4	7.5	7.4	7.2	7.4	7.4	7.6	7.2	7.3	5.9	7.4	7.2	7.3	6.9
Llano Seco							7.9	8.1	8.2	8.1	7.9	8.0	7.0	7.8	7.8	7.7	7.8
M & T	7.2	7.5	6.9	7.8	7.9	7.6	7.7	7.6	7.6	NM	7.2	7.9	NM	7.4	7.7	7.6	7.6
Pentz						7.6	7.4	7.5	7.4	7.3	7.8	7.5	6.7	7.0	7.4	7.2	7.3
*Pentz-Butte Valley	7.1	6.9	7.3	6.2													
Thermalito	7.0	6.5	7.1	7.1	7.9	7.4	7.4	7.4	NM	NM	8.0	7.7	7.5	7.1	7.1	7.1	7.4
Thermalito domestic							7.7	7.8	7.7	NM	NM	7.8	NM	6.9	7.6	7.6	7.4
Vina	7.5	7.6	6.9	6.2	7.7	7.5	7.5	7.4	7.6	8.0	7.3	7.8	7.9	7.1	7.4	7.3	7.4
Western Canal (East)	7.0	6.6	6.8	6.9	7.3	6.9	7.0	7.0	7.1	7.0	NM	7.2	6.5	7.1	7.0	7.0	7.0
Western Canal (West)	7.8	8.1	7.1	6.9	7.9	7.9	7.8	6.6	7.8	7.5	7.7	7.5	7.1	7.5	7.4	NM	NM

*Pentz-Butte Valley well discontinued in 2006 and NM – No measurement

Table 5. Groundwater pH average and range over 17 year sampling period

Sub-Inventory Unit	Average	Range
Biggs-West Gridley	7.6	0.9
Cherokee	7.3	0.7
Chico Urban Area	7.0	0.7
Durham Dayton	7.4	1.1
Esquon	7.2	1.6
Llano Seco	7.8	1.1
M & T	7.6	1.0
Pentz	7.3	1.1
*Pentz-Butte Valley	6.9	1.1
Thermalito	7.3	1.5
Thermalito domestic	7.6	1.0
Vina	7.4	1.8
Western Canal (East)	7.0	0.8
Western Canal (West)	7.5	1.5

Table 6. Annual groundwater Electrical Conductivity (µS/cm)

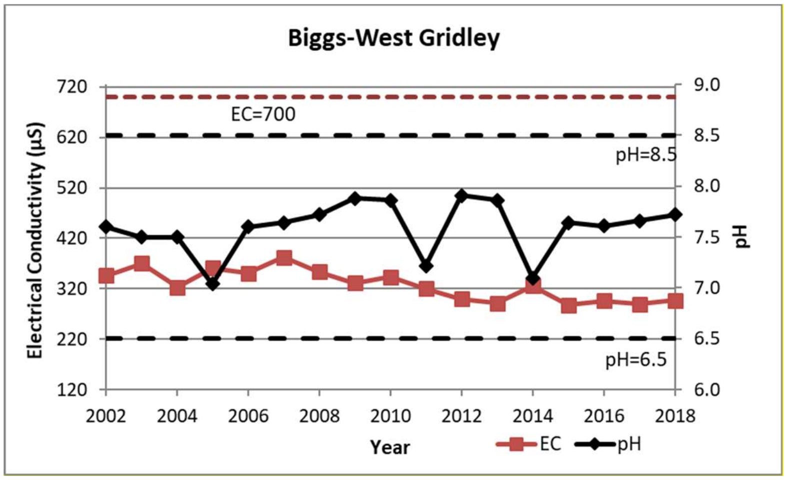
Sub-Inventory Unit	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Biggs-West Gridley	346	370	323	361	351	382	354	331	343	320	300	291	326	288	296	290	297
Cherokee	222	232	215	266	242	267	268	243	270	275	245	260	330	255	261	284	293
Chico Urban Area						280	291	260	249	250	248	217	NM	214	221	254	295
Durham Dayton	315	348	259	340	322	NM	327	NM	307	315	NM	298	304	322	316	322	355
Esquon	388	526	470	557	507	480	439	419	427	415	408	512	443	417	499	416	529
Llano Seco							204	195	196	198	192	184	240	180	182	179	186
M & T	418	551	678	504	465	451	667	445	592	NM	427	391	NM	362	333	498	337
Pentz						218	229	227	225	224	204	204	231	210	204	207	213
*Pentz-Butte Valley	195	186	211	240													
Thermalito	132	164	149	150	152	242	205	158	NM	NM	292	179	181	136	159	136	204
Thermalito domestic							374	350	354	NM	NM	342	NM	320	324	327	333
Vina	197	225	180	216	192	224	203	200	199	194	174	188	201	200	186	181	190
Western Canal (East)	447	344	400	524	492	471	482	488	465	459	NM	447	442	449	444	441	422
Western Canal (West)	464	248	407	501	309	477	469	462	455	460	630	629	695	428	581	NM	NM

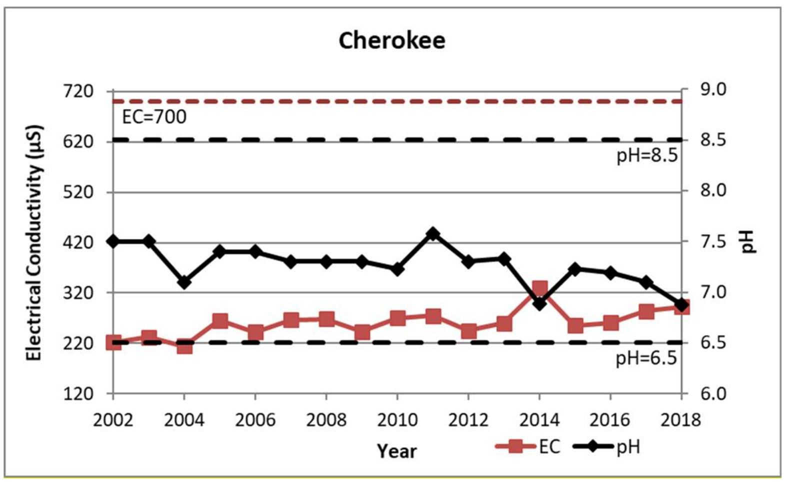
*Pentz-Butte Valley well discontinued in 2006 and NM – No measurement

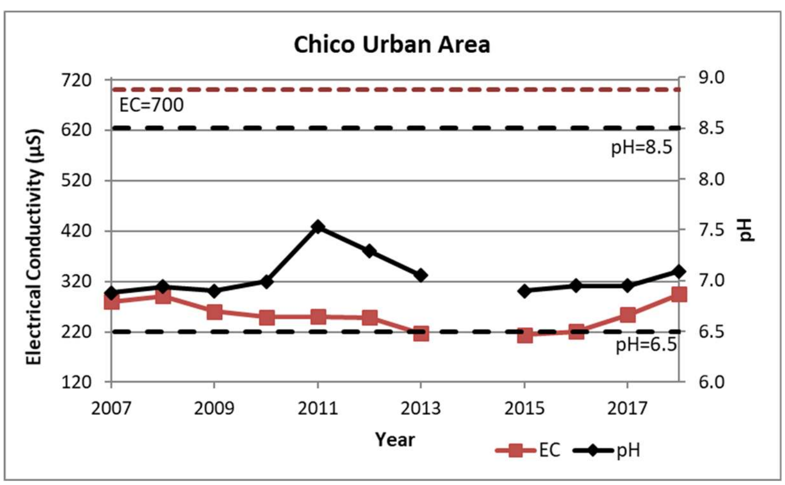
Table 7. Groundwater EC (µS/cm) average and range over 17 year sampling period

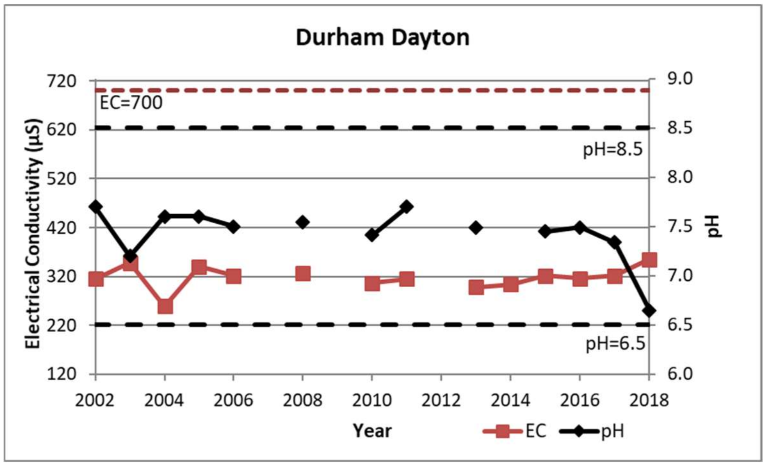
Sub-Inventory Unit	Average	Range
Biggs-West Gridley	330	94
Cherokee	258	115
Chico Urban Area	248	77
Durham Dayton	315	89
Esquon	458	169
Llano Seco	195	61
M & T	484	345
Pentz	217	27
*Pentz-Butte Valley	208	54
Thermalito	174	160
Thermalito domestic	342	54
Vina	197	51
Western Canal (East)	453	180
Western Canal (West)	481	447

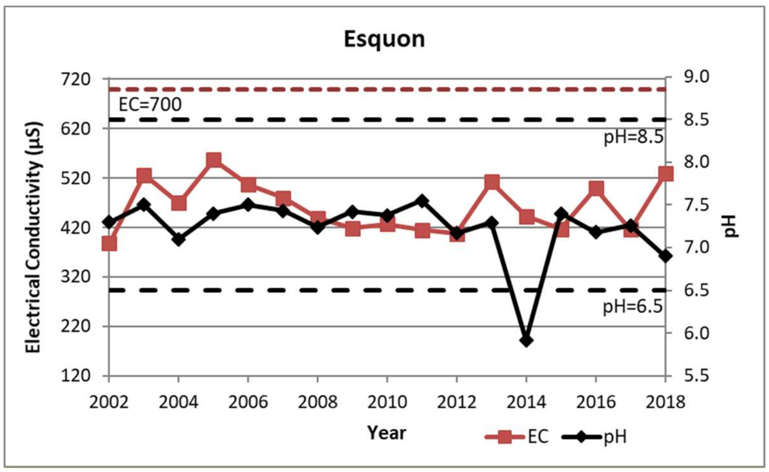
Annual Electrical Conductivity (µS/cm) and pH for each water quality sampling well. The red dashed line indicates the preferred maximum level for EC and the black dashed lines bound the acceptable pH range, 6.5-8.5. Therefore, when the red plot of EC values is below the red dashed line (as it always is), then measured EC is within the secondary standard for agricultural water (< 700 µS/cm), which is more restrictive than for drinking water (< 900 µS/cm). To be within the acceptable pH range, the solid black line should be within the black dashed lines.

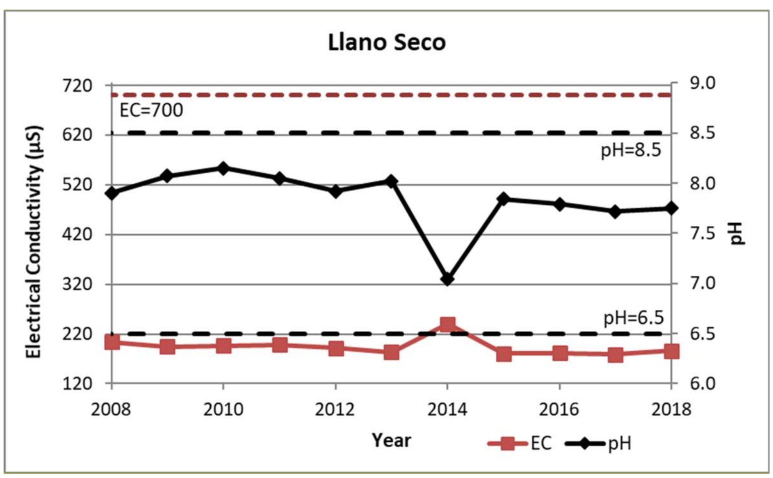




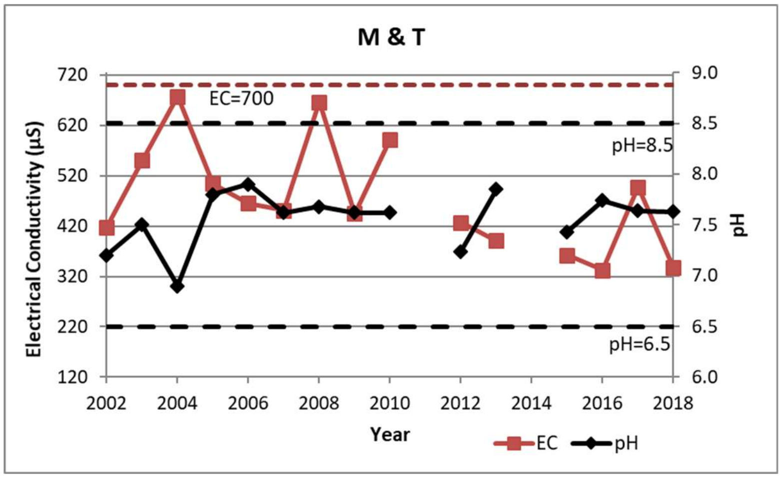


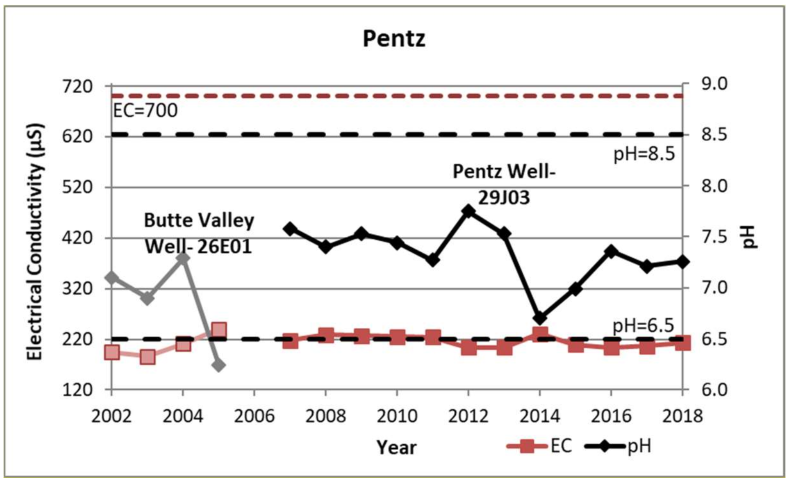


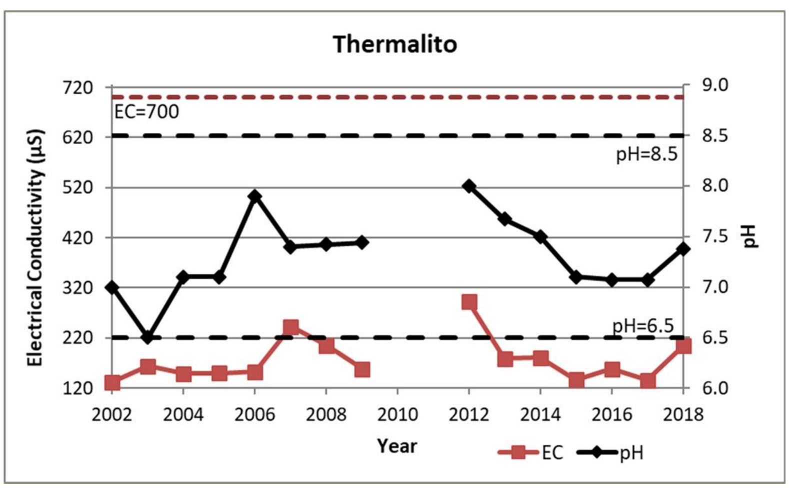




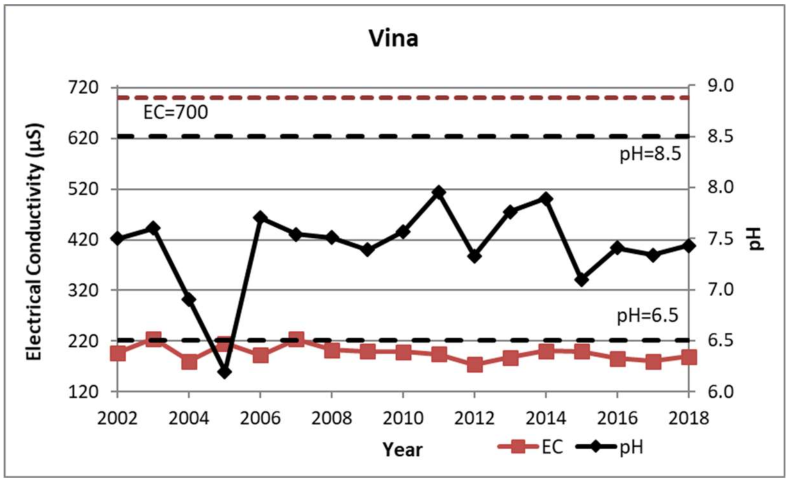
NOTE: The red dashed line indicates the preferred maximum level for EC and the black dashed lines bound the acceptable pH range, 6.5-8.5. Therefore, when the red plot of EC values is below the red dashed line (as it always is), then measured EC is within the secondary standard for agricultural water (< 700 µS/cm), which is more restrictive than for drinking water (< 900 µS/cm). To be within the acceptable pH range, the solid black line should be within the black dashed lines.

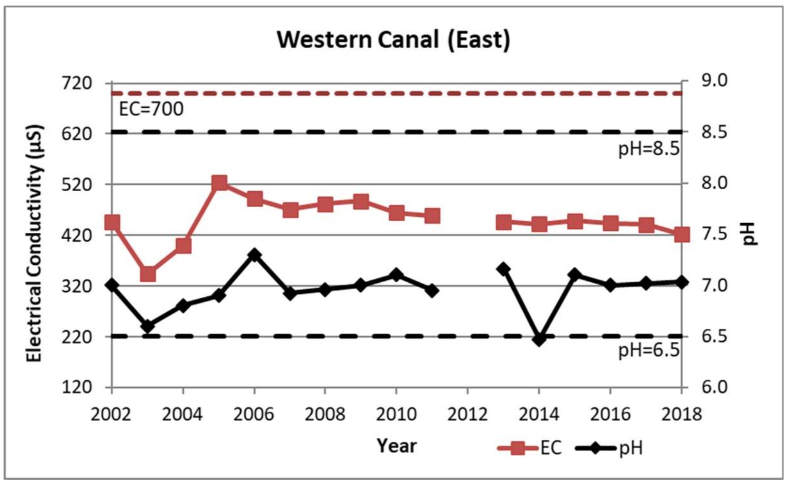


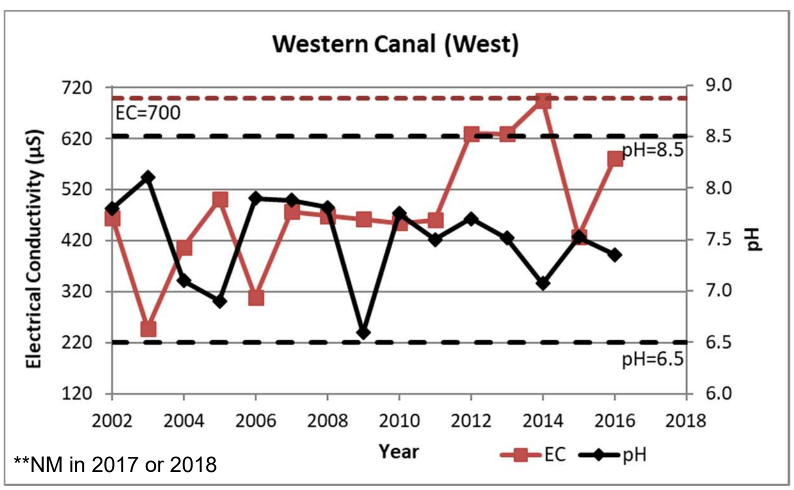




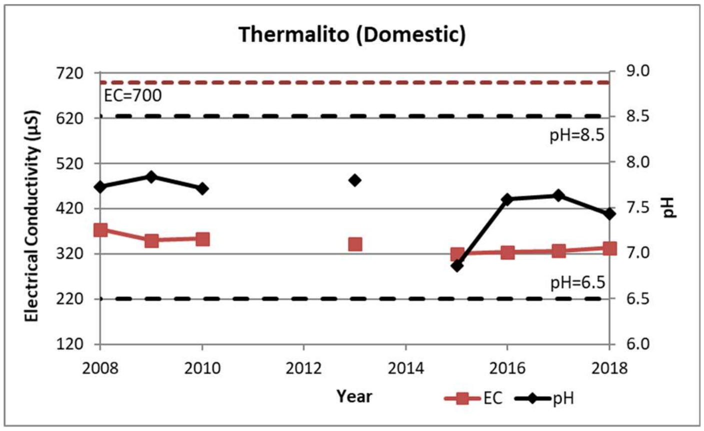
NOTE: The red dashed line indicates the preferred maximum level for EC and the black dashed lines bound the acceptable pH range, 6.5-8.5. Therefore, when the red plot of EC values is below the red dashed line (as it always is), then measured EC is within the secondary standard for agricultural water (< 700 µS/cm), which is more restrictive than for drinking water (< 900 µS/cm). To be within the acceptable pH range, the solid black line should be within the black dashed lines.







NOTE: The red dashed line indicates the preferred maximum level for EC and the black dashed lines bound the acceptable pH range, 6.5-8.5. Therefore, when the red plot of EC values is below the red dashed line (as it always is), then measured EC is within the secondary standard for agricultural water (< 700 µS/cm), which is more restrictive than for drinking water (< 900 µS/cm). To be within the acceptable pH range, the solid black line should be within the black dashed lines.



NOTE: The red dashed line indicates the preferred maximum level for EC and the black dashed lines bound the acceptable pH range, 6.5-8.5. Therefore, when the red plot of EC values is below the red dashed line (as it always is), then measured EC is within the secondary standard for agricultural water (< 700 µS/cm), which is more restrictive than for drinking water (< 900 µS/cm). To be within the acceptable pH range, the solid black line should be within the black dashed lines.

Groundwater Status Report

Appendix E

Spring, Summer, Fall BMO Summary Tables

Butte County Water and Resource Conservation

Spring 2008-2017 Groundwater Elevations - CASGEM

Sub Basin	Sub-Inventory Unit	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Elevations: Spring 2008 Water Surface Elevation (WSE) (Elev. ft)	Spring 2009 Water Surface Elevation (WSE) (Elev. ft)	Spring 2010 Water Surface Elevation (WSE) (Elev. ft)	Spring 2011 Water Surface Elevation (WSE) (Elev. ft)	Spring 2012 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2013 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2014 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2015 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2016 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2017 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2018 Water Surface Elevation (WSE) (Elev. Ft)	Spring BMO Stage 1 Alert Level (Elev. ft)	Spring BMO Stage 2 Alert Level (Elev. ft)	Analysis: Elevation Above (+) or Below (-) Alert Stage 1 (ft)	Change Spring 2017 to Spring 2018 (ft)	Spring 2018 Depth to Water (ft)
EAST BUTTE	Biggs/West Gridley*	17N01E10A001M	D	S	1953	59.6	59.2	59.7	60.5	63.7	57.7	59.8	58.9	61.0	59.6	58.9	52.9	51.2	6.0	-0.7	6.4
		18N01E35L001M	M	D	2005	74.7	74.6	74.7	75.1	74.1	74.1	NM	72.2	72.3	75.0	73.3	a	a		-1.7	-3.3
		18N02E16F001M	I	S	1947	76.7	76.4	76.6	77.2	76.5	75.8	76.9	76.0	78.8	77.4	77.8	75.3	74.6	2.5	0.4	4.5
		18N02E25M001M	I	S	1959	83.4	83.4	82.9	84.6	82.4	67.1	NM	81.5	85.7	83.9	82.2	82.7	81.9	-0.5	-1.7	7.1
		18N02E32H001M	D	S	2001	71.9	71.7	NM	72.9	71.4	70.9	72.0	72.7	75.4	71.8	71.8	70.8	68.2	1.0	0.0	6.5
	Butte*	17N02E14A001M	I	S	1947	81.5	81.5	81.3	81.2	80.4	79.6	80.8	78.9	82.8	81.9	79.7	78.5	77.0	1.2	-2.2	5.1
		17N02E14H001M	D	S	2000	79.8	80.0	79.8	82.2	79.5	78.5	79.0	79.4	80.6	80.7	77.6	79.0	76.2	-1.4	-3.1	8.7
		17N03E16N001M	D	S	1953	77.3	77.4	77.6	79.6	75.9	76.1	75.7	NM	NM	NM	NM	74.3	72.2	NM		NM
	Butte Sink	17N01E17F001M	M	S	1992	54.8	54.7	54.8	56.0	54.8	54.3	54.8	53.8	56.3	56.7	56.0	54.1	51.3	1.8	-0.7	3.0
		17N01E17F002M	M	I	1992	57.2	57.1	57.0	58.0	56.7	56.5	56.7	55.5	57.1	57.8	57.0	56.9	54.9	0.1	-0.8	2.4
		17N01E17F003M	M	I	1992	58.4	57.9	58.1	58.7	57.6	57.5	57.4	56.3	57.2	59.0	58.0	57.5	55.0	0.5	-1.1	1.4
		17N01E24A003M	M	D	2007	75.2	74.7	74.4	74.8	74.4	74.3	73.1	71.7	71.0	74.9	73.4	b	b		-1.6	-0.6
		17N01E24A004M	M	I	2007	65.8	65.4	66.0	67.2	65.2	64.0	63.7	61.9	62.5	64.5	62.6	b	b		-1.9	10.2
		17N01E24A005M	M	I	2007	65.8	65.4	65.9	67.1	65.2	64.0	63.0	61.7	62.1	64.5	62.4	b	b		-2.1	10.4
		17N01E24A006M	M	S	2007	68.1	68.1	68.2	69.2	68.3	68.7	69.5	67.8	69.3	68.7	68.3	b	b		-0.4	4.5
		17N02E19J001M	I	S/I	2000	64.1	66.2	66.9	67.2	66.7	66.6	66.1	66.6	66.2	67.1	66.8	66.0	62.8	0.8	-0.3	5.5
	Cherokee	20N02E24C001M	M	S	1999	121.0	119.5	118.9	121.2	119.3	115.4	109.7	107.0	105.8	109.5	112.1	122.8	117.6	-10.8	2.6	45.7
		20N02E24C002M	M	I	1999	120.9	119.5	118.9	121.2	119.5	115.4	109.1	107.1	105.8	109.4	111.6	122.8	117.7	-11.3	2.2	46.2
		20N02E24C003M	M	I	1999	121.0	119.6	118.9	121.2	119.4	115.4	109.4	107.1	105.8	109.9	111.1	122.5	117.0	-11.4	1.2	46.7
		20N03E31M001M	M	S	2001	118.6	118.2	117.6	118.3	115.0	113.5	110.8	110.6	110.0	115.5	114.7	120.1	117.1	-5.4	-0.8	18.3
		20N03E33L001M	I	S	1999	124.0	122.3	120.9	123.6	119.1	118.8	116.5	115.1	NM	116.5	117.5	124.5	120.6	-7.0	1.0	33.8
		21N03E22C001M	D	S	2001	380.9	381.7	382.7	381.8	381.2	380.2	373.9	367.0	360.0	373.5	NM	372.1	360.7	NM		NM
		21N03E29J003M	D	S/I	2007	224.3	230.3	230.4	NM	NM	230.7	226.9	226.9	229.6	227.3	230.0	c	c		2.7	44.3
		21N03E32B001M	I	S	1999	225.2	224.7	223.9	225.1	226.0	224.2	221.9	221.9	221.6	222.6	222.8	225.8	224.5	-3.0	0.2	15.6
	Esquon	20N02E08H003M	D	S	2008	123.3	121.5	122.6	122.8	120.7	116.5	116.1	114.5	117.3	121.1	116.2	d	d		-4.9	16.1
		20N02E09G001M	M	S	2001	124.4	121.7	121.9	124.7	120.4	116.7	114.4	110.7	113.6	116.8	115.6	114.5	99.8	1.1	-1.2	33.2
		20N02E09L001M	I	I	1953	123.8	123.5	122.9	125.3	122.4	118.6	116.9	114.0	117.7	121.0	118.0	125.5	122.7	-7.5		21.3
		21N02E20P001M	I	S/I	1995	122.8	118.5	121.0	112.3	118.8	111.6	107.3	98.9	107.8	111.9	114.2	129.4	115.1	-15.2	2.3	53.9
	Pentz	21N02E26E003M	M	D	2007	124.3	121.4	121.0	122.9	123.3	118.4	115.1	113.6	112.5	114.1	115.5	e	e		1.4	66.8
		21N02E26E004M	M	I	2007	123.5	120.4	120.3	122.0	122.8	117.8	114.7	113.1	112.3	113.4	115.2	e	e		1.8	67.0
		21N02E26E005M	M	I	2007	122.6	119.4	119.2	120.8	121.6	116.6	113.9	112.1	111.1	112.2	114.3	e	e		2.1	67.9
		21N02E26E006M	M	S	2007	116.3	113.1	112.1	113.9	116.4	110.9	108.8	107.9	105.4	105.8	109.6	e	e		3.8	72.6
	Richvale*	18N01E13A002M	I	S/I	2001	75.7	75.3	75.6	75.6	75.1	75.0	75.6	74.8	77.3	76.0	75.2	70.7	65.7	4.5		4.1
		18N01E15D002M	D	S	1976	70.8	70.4	70.6	70.8	68.2	70.5	70.8	70.3	72.4	71.3	71.3	65.3	60.3	6.0	0.0	1.1
		19N01E27Q001M	M	I	1978	84.7	84.0	84.4	85.2	84.1	83.6	84.2	83.6	85.0	84.7	83.9	79.7	74.7	4.2	-0.8	3.5
		19N01E35B001M	M	S	2002	82.7	82.4	82.7	83.5	82.7	82.1	82.9	82.2	84.3	83.5	83.3	77.5	72.5	5.7	-0.2	3.2
		19N01E35B002M	M	D	2005	91.6	90.9	91.1	91.4	90.7	90.5	89.8	89.5	88.6	91.2	90.5	f	f		-0.8	-4.0
		19N01E35B003M	M	I	2005	86.0	85.2	85.7	86.4	85.3	84.9	85.2	84.5	85.2	86.2	85.2	f	f		-1.1	1.3
		19N02E15N002M	I	U	2000	102.9	102.5	102.8	103.3	102.4	101.4	102.8	101.9	103.9	103.4	103.6	98.2	93.2	5.3	0.1	3.8

Well Type
D-Domestic, I-Irrigation
M-Monitoring, M/I-Municipal and Industrial
Well Depth
S-Shallow, I-Intermediate
D-Deep

Sub Basin	Sub-Inventory Unit	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Elevations: Spring 2008 Water Surface Elevation (WSE) (Elev. ft)	Spring 2009 Water Surface Elevation (WSE) (Elev. ft)	Spring 2010 Water Surface Elevation (WSE) (Elev. ft)	Spring 2011 Water Surface Elevation (WSE) (Elev. ft)	Spring 2012 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2013 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2014 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2015 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2016 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2017 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2018 Water Surface Elevation (WSE) (Elev. Ft)	Spring BMO Stage 1 Alert Level (Elev. ft)	Spring BMO Stage 2 Alert Level (Elev. ft)	Analysis: Elevation Above (+) or Below (-) Alert Stage 1 (ft)	Change Spring 2017 to Spring 2018 (ft)	Spring 2018 Depth to Water (ft)
EAST BUTTE	Thermalito	18N03E08B003M	I	S/I	2001	101.0	95.8	100.7	102.3	99.9	97.9	99.6	99.7	NM	103.2	99.8	100.3	96.4	-0.5	-3.4	12.5
		18N03E21G001M	I	S	1953	86.7	84.7	87.0	89.2	87.6	87.2	85.1	85.2	83.8	93.1	90.6	86.7	84.1	3.9	-2.5	15.7
		19N03E05N002M	D	S	1967	121.6	120.6	121.9	122.1	119.6	116.3	116.7	117.9	116.5	119.0	119.4	114.4	96.5	5.0	0.4	22.9
		19N03E16Q001M	D	S	2000	138.7	136.7	138.7	139.8	139.0	138.1	NM	140.3	138.9	140.7	149.9	137.8	135.4	12.1	9.2	29.4
	Western Canal*	19N01E09Q001M	I	S	1991	89.5	88.8	88.3	89.4	88.8	NM	NM	87.8	NM	NM	88.9	84.5	79.5	4.4		3.5
		19N02E07K002M	M	I	2006	NM	102.6	102.9	103.4	102.3	101.7	101.4	100.9	100.9	102.4	102.0	g	g		-0.4	0.7
		19N02E07K003M	M	I	2006	NM	99.4	99.5	100.0	99.8	99.0	99.5	98.8	100.7	99.9	100.4	g	g		0.5	2.3
		19N02E07K004M	M	S	2006	NM	99.6	99.7	100.2	99.9	99.2	99.7	98.9	100.7	100.1	100.4	g	g		0.3	2.3
		19N02E13Q001M	M	S	2002	115.8	114.1	114.7	115.5	114.8	114.3	115.4	116.2	116.9	117.0	115.9	g	g		-1.1	4.0
		19N02E13Q002M	M	I	2006	116.6	115.3	115.7	116.5	115.7	114.8	116.0	116.4	117.1	117.4	116.4	g	g		-1.1	3.5
		19N02E13Q003M	M	D	2006	117.0	115.7	116.1	117.0	116.0	115.2	116.3	116.6	117.2	117.7	116.7	g	g		-1.0	3.2
		20N01E18L001M	M	D	2000	106.3	104.3	105.2	106.6	104.1	103.4	99.4	100.7	99.9	104.5	101.4	103.3	98.3	-1.9	-3.1	5.9
		20N01E18L002M	M	I	2001	103.0	102.4	102.6	104.3	102.1	101.8	101.0	101.1	102.3	103.9	101.3	99.1	94.1	2.3	-2.6	6.0
		20N01E18L003M	M	S	2001	104.2	103.6	104.0	104.7	103.4	103.2	103.1	102.8	105.5	104.3	104.3	99.4	94.4	4.8	0.0	3.1
		20N01E35C001M	D	S	1947	99.4	98.5	98.4	99.9	NM	98.8	NM	NM	NM	NM	NM	94.3	89.3	NM		NM
		20N02E15H001M	M	S	1995	124.0	122.9	122.2	124.5	122.1	118.8	NM	112.1	113.3	116.3	115.5	g	g		-0.8	28.5
		20N02E15H002M	M	S	1995	134.5	133.7	134.2	135.7	132.7	129.9	NM	122.7	122.3	130.6	121.6	g	g		-9.0	22.5
		20N02E16P001M	I	U	1990	123.0	122.2	NM	123.3	121.8	118.9	116.1	113.3	118.0	119.9	118.1	119.3	114.3	-1.2	-1.8	13.7
		20N02E28N001M	D	S/I	1947	118.5	118.6	118.6	119.1	122.3	117.7	118.5	117.7	120.0	118.9	118.7	113.8	108.8	4.9	-0.2	4.7
WYANDOTTE CREEK	Wyandotte Creek	CWS-01	M&I	150	1978	103.0	124.0	129.0	128.0	122.0	124.0	123.0	124.0	128.0	139.0	135.0	119.0	99.0	16.0	-4.0	34.0
		CWS-02	M&I	180	1978	152.0	144.0	144.0	148.0	142.0	147.0	145.0	148.0	142.0	153.0	150.0	135.0	111.0	15.0	-3.0	34.0
		CWS-03	M&I	U	1978	163.0	151.0	165.0	159.0	163.0	159.0	154.0	149.0	155.0	174.0	168.0	154.0	135.0	14.0	-6.0	40.0
		17N03E03D001M	I	S	1947	72.6	71.5	72.4	76.0	70.2	67.8	71.1	71.1	71.3	85.3	72.2	72.8	69.8	-0.6	-13.1	25.1
		17N04E09N002M	I	S/I	2001	82.0	77.9	76.2	78.5	78.6	78.1	74.9	73.5	74.7	75.9	NM	79.2	71.1	NM		NM
		17N04E22B001M	D	S	1976	104.8	103.3	101.3	106.1	103.6	104.2	101.8	103.4	104.3	106.8	NM	98.6	96.1	NM		NM
		19N04E31F001M	D	S	2001	125.8	124.8	124.9	127.1	131.2	124.4	123.9	119.0	140.2	127.1	139.2	108.1	70.8	31.1	12.1	120.1
WEST BUTTE	Angel Slough	21N01W23J001M	I	S	1941	112.7	113.0	112.4	117.1	112.0	109.1	110.2	109.3	115.1	115.8	106.7	110.7	108.2	-4.0	-9.1	14.7
		21N01W35K002M	I	S/I	1994	102.4	102.2	103.0	107.5	100.9	100.5	99.7	101.0	103.9	107.5	99.3	94.9	80.9	4.4	-8.2	15.1
	Chico Urban Area	CWSCH01b	M&I	U	1988	127.0	132.0	130.0	131.0	131.0	126.0	123.0	120.0	123.0	131.0	124.0	g	g		-7.0	76.0
		CWSCH02	M&I	U	1988	138.0	136.0	138.0	141.0	136.0	128.0	110.0	121.0	121.0	125.0	126.0	123.0	91.0	-2.0	1.0	57.0
		CWSCH03	M&I	U	1988	123.0	128.0	129.0	123.0	126.0	122.0	120.0	118.0	122.0	123.0	123.0	128.0	81.0	-3.0	0.0	135.0
		CWSCH04	M&I	U	1988	118.0	117.0	QM	123.0	119.0	122.0	105.0	NM	118.0	142.0	130.0	126.0	106.0	11.0	-12.0	82.0
		CWSCH05	M&I	U	1988	122.0	118.0	124.0	125.0	122.0	120.0	113.0	111.0	116.0	122.0	119.0	119.0	95.0	3.0	-3.0	96.0
		CWSCH06	M&I	U	1988	118.0	115.0	126.0	115.0	117.0	117.0	96.0	105.0	121.0	131.0	128.0	116.0	93.0	13.0	-3.0	53.0
		CWSCH07	M&I	U	1991	115.0	115.0	118.0	117.0	123.0	117.0	113.0	112.0	113.0	118.0	114.0	115.0	95.0	-1.0	-4.0	156.0
		22N01E28J001M	M	I	1958	139.3	131.9	136.5	140.5	137.7	134.9	126.9	126.6	126.0	137.7	132.8	140.4	135.6	-7.6	-4.9	46.1
		22N01E28J003M	M	I	1958	143.8	138.9	140.7	145.2	141.7	139.4	131.1	130.5	129.2	141.6	136.5	136.2	130.2	0.3	-5.1	41.8
		22N01E28J005M	M	D	1958	136.6	131.3	133.0	135.9	133.7	134.2	123.3	125.0	123.6	132.8	128.6	135.1	130.8	-6.5	-4.3	50.3
		22N01E35E001M	I	S/I	2005	131.1	127.1	129.3	131.8	129.6	125.4	119.7	119.0	121.8	129.6	126.8	h	h		-2.7	55.5
		22N02E30C002M	M	S	2002	131.1	127.5	127.3	128.7	127.6	123.6	120.5	117.9	NM	126.5	126.2	h	h		-0.3	117.4
	Durham/Dayton	20N01E02H003M	M	S	2001	108.8	104.8	106.5	109.5	106.8	103.7	96.0	95.0	96.2	105.9	100.5	h	h		-5.5	31.9
		20N01E10C002M	I	S	1947	110.9	104.0	108.5	110.7	108.6	NM	NM	102.3	98.1	108.8	104.2	110.3	106.1	-6.1	-4.6	23.2
		20N02E06Q001M	I	S/I	1947	119.8	117.1	117.8	120.1	117.3	114.6	109.5	109.6	109.6	117.1	112.5	120.4	116.9	-7.9	-4.6	25.1
		21N01E10B003M	I	I	1995	126.6	121.8	123.3	126.0	124.9	NM	113.7	111.6	114.6	123.2	119.0	128.2	110.6	-9.3	-4.3	51.4
		21N01E13L002M	M	D	2012					113.4	114.4	108.2	104.9	110.2	117.1	114.2	i	i		-2.9	65.7
		21N01E13L003M	M	I	2012					109.5	114.5	108.1	105.0	102.0	117.1	114.2	i	i		-2.9	65.7
		21N01E13L004M	M	I	2012					106.0	114.8	108.0	105.2	109.7	116.9	114.1	i	i		-2.9	65.8
		21N01E25K001M	D	S	1993	113.7	108.3	110.6	113.6	112.2	106.5	95.9	99.2	97.7	106.2	103.6	118.5	100.4	-14.9	-2.6	50.7
		21N01E26K001M	I	I	1993	111.2	104.3	101.1	106.7	103.4	102.9	93.9	95.7	94.9	107.1	103.1	115.9	97.4	-12.8	-4.0	49.7
		21N01E27D001M	D	S	1946	109.7	103.9	106.6	110.4	108.1	104.4	95.2	94.7	95.9	103.3	96.3	111.0	105.7	-14.7	-7.0	47.0
		21N02E07C001M	I	I	1967	128.8	121.6	134.7	124.1	134.7	127.8	NM	NM	NM	NM	NM	128.8	122.9	NM		NM
		21N02E18C001M	M	D	2010				120.2	121.4	114.7	109.1	104.8	111.0	116.2	113.5	j	j		-2.7	75.6
		21N02E18C002M	M	I	2010				117.7	121.8	115.2	109.0	104.1	111.2	116.5	113.9	j	j		-2.6	75.2
		21N02E18C003M	M	S	2010				160.8	149.0	150.7	142.4	149.7	151.7	167.4	158.3	j	j		-9.0	30.8
		21N02E30L001M	D	S/I	1995	120.8	115.8	118.0	120.0	118.7	113.8	105.7	105.0	105.7	NM	110.6	126.3	109.8	-15.8		48.8

Well Type
D-Domestic, I-Irrigation
M-Monitoring, M/I-Municipal and Industrial
Well Depth
S-Shallow, I-Intermediate
D-Deep

Sub Basin	Sub-Inventory Unit	Monitoring Wells	Well Type	Well Depth	First Record	Spring 2008 Water Surface Elevation (WSE) (Elev. ft)	Spring 2009 Water Surface Elevation (WSE) (Elev. ft)	Spring 2010 Water Surface Elevation (WSE) (Elev. ft)	Spring 2011 Water Surface Elevation (WSE) (Elev. ft)	Spring 2012 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2013 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2014 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2015 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2016 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2017 Water Surface Elevation (WSE) (Elev. Ft)	Spring 2018 Water Surface Elevation (WSE) (Elev. Ft)	Spring BMO Stage 1 Alert Level (Elev. ft)	Spring BMO Stage 2 Alert Level (Elev. ft)	Elevation Above (+) or Below (-) Alert Stage 1 (ft)	Change Spring 2017 to Spring 2018 (ft)	Spring 2018 Depth to Water (ft)
						Groundwater Elevations													Analysis		
WEST BUTTE	Llano Seco	20N01E18L001M	M	D	2000	106.3	104.3	105.2	106.6	104.1	103.4	99.4	100.7	99.9	104.5	101.4	107.7	105.2	-6.3	-3.1	5.9
		20N01E18L002M	M	I	2001	103.0	102.4	102.6	104.3	102.1	101.8	101.0	101.1	102.3	103.9	101.3	102.9	100.2	-1.5	-2.6	6.0
		20N01E18L003M	M	S	2001	104.2	103.6	104.0	104.7	103.4	103.2	103.1	102.8	105.5	104.3	104.3	103.6	101.5	0.6	0.0	3.1
		20N01W04J001M	I	S	2008	82.9	82.8	82.8	91.1	82.9	82.1	81.8	81.5	86.1	NM	82.0	k	k			20.4
		20N01W11N002M	I	S	2008	96.9	96.6	97.4	101.7	95.8	94.4	95.9	96.3	97.5	NM	94.6	k	k			12.8
		21N01W35K002M	I	S/I	1994	102.4	102.2	103.0	107.5	100.9	100.5	99.7	101.0	103.9	107.5	99.3	94.9	80.9	4.4	-8.2	15.1
	M & T	21N01W11A001M	M	D	2010				121.2	119.8	118.8	113.1	114.0	115.6	122.5	115.5	l	l		-7.0	13.8
		21N01W11A002M	M	S	2010				117.0	119.2	115.1	114.5	113.9	122.0	120.2	115.5	l	l		-4.7	13.8
		21N01W11A003M	M	S	2010				116.7	119.8	114.9	114.4	113.9	122.6	119.8	115.7	l	l		-4.2	13.6
		21N01W13J001M	M	D	2012					115.7	114.2	108.6	109.1	110.9	117.5	110.3	l	l		-7.3	17.4
		21N01W13J002M	M	I	2012					115.8	114.5	109.1	109.7	111.7	118.1	110.6	l	l		-7.5	17.1
		21N01W13J003M	M	I	2012					116.0	114.7	109.5	110.2	112.3	118.6	111.0	l	l		-7.6	16.7
		21N01W24B001M	M	D	1995	115.7	113.0	114.4	114.9	113.0	111.9	106.7	107.4	108.9	115.2	108.0	117.8	108.5	-9.8	-7.2	19.1
		22N01E29R001M	I	I	1947	138.2	138.3	132.4	137.5	133.7	131.3	122.5	120.6	124.2	134.7	128.9	140.6	136.6	-11.8	-5.8	34.9
		22N01E32E004M	D	S	1992	127.1	125.5	124.6	126.6	126.7	125.4	117.4	117.5	119.8	129.4	123.0	130.9	117.8	-7.9	-6.4	27.9
VINA	Vina	22N01E09B001M	D	S	2001	144.9	140.7	141.0	145.0	142.6	138.0	131.5	131.6	130.6	137.9	137.2	146.0	138.2	-8.8	-0.7	41.1
		22N01E20K001M	D	S	1961	132.9	129.0	134.1	138.2	134.6	130.5	NM	121.7	125.6	136.5	132.3	132.3	127.2	0.0	-4.2	35.5
		23N01E29P002M	D	S/I	1990	156.1	152.3	152.5	155.9	152.6	150.2	NM	141.5	143.4	152.4	146.4	148.4	131.9	-2.0	-6.0	58.9
		23N01E33A001M	I	S/I	2001	154.6	151.4	150.5	152.6	151.5	149.5	144.6	142.2	141.7	144.3	144.2	155.3	144.1	-11.1	-0.1	108.1
		23N01W10E001M	I	I	2001	165.7	163.2	164.7	166.6	163.6	159.0	153.4	153.5	155.9	162.7	157.2	166.8	160.9	-9.6	-5.5	32.2
		23N01W10M001M	M	S	2001	165.5	164.5	165.2	167.8	163.3	166.0	156.0	155.6	158.4	166.1	158.8	168.4	162.6	-9.5	-7.3	28.6
		23N01W27L001M	D	S	1976	145.2	142.4	145.3	NM	142.7	142.7	136.3	139.9	140.8	149.2	138.9	137.1	114.8	1.8	-10.3	23.5
		23N01W36P001M	D	S	1959	142.1	138.5	139.6	143.5	137.3	137.3	134.5	132.4	130.5	144.7	140.5	134.8	128.3	5.7	-4.2	22.3
		23N02W25C001M	I	S/I	1967	139.1	139.3	140.5	144.2	136.1	137.7	133.9	136.3	136.4	149.0	137.7	136.3	133.0	1.4	-11.3	19.7
		23N01W25G001M	I	I	2007	148.4	150.0	150.7	134.5	149.8	149.0	141.2	141.0	142.3	150.4	145.0	m	m			35.4
		23N01W03H002M	M	I	2012					179.0	178.0	171.1	173.3	173.0	176.1	174.1	m	m		-2.0	42.7
		23N01W03H003M	M	I	2012					179.4	178.9	173.0	174.0	173.5	177.2	174.8	m	m		-2.5	42.1
		23N01W03H004M	M	S	2012					182.9	181.8	175.9	177.3	174.9	180.5	177.2	m	m		-3.3	39.7
		23N01W28M002M	M	D	2009		145.2	148.9	148.0	147.8	148.0	140.1	143.0	142.6	148.8	143.1	m	m		-5.7	15.9
		23N01W28M003M	M	D	2009		145.6	148.6	147.1	146.7	147.2	140.1	143.1	143.6	151.0	142.8	m	m		-8.2	16.2
		23N01W28M004M	M	S	2009		147.9	146.5	152.2	143.6	143.6	137.8	141.3	144.3	150.1	140.3	m	m		-9.8	18.7
		23N01W28M005M	M	S	2009		148.2	146.5	152.6	142.9	143.6	130.2	141.6	143.4	150.3	139.8	m	m		-10.5	19.2
		23N01W31M001M	M	D	2008		138.1	141.2	143.6	139.6	140.9	130.8	135.1	135.1	141.0	136.9	m	m		-4.1	17.9
		23N01W31M002M	M	I	2008		144.2	144.9	148.1	141.9	142.7	136.9	139.9	141.4	148.8	138.6	m	m		-10.2	16.2
		23N01W31M003M	M	S	2008		141.2	142.2	146.6	140.5	138.8	137.2	137.0	142.5	147.8	137.9	m	m		-9.9	16.9
		23N01W31M004M	M	S	2008		138.8	139.2	142.3	138.5	137.8	136.0	137.6	141.3	141.7	136.4	m	m		-5.3	18.4

* Indicates sub-inventory unit corresponding to an Irrigation District primarily served by surface water
Note: Red font indicates Questionable Measurement (QM), Orange highlight is Alert Stage 1, Red highlight is Alert Stage 2
a 18N01E35L001M monitoring well installed in 2005. Not yet enough data to establish alert levels
b 17N01E24A03-6 multi-completion well installed in 2007. Not yet enough data to establish alert levels
c 21N03E29J03 added to DWR monitoring network in 2007
d 20N02E08H03 added to DWR monitoring network in 2008
e 21N02E26E03-6 multi-completion monitoring well installed 2007
f 19N01E35B02-03 record begins in 2005. Not yet enough data to establish alert levels
g 19N02E07K02-4 and 19N02E13Q01-3 multi-completion wells with first measurement in 2006. 20N02E15H001 and 20N02E15H002 with start of record in 1995.
h 22N01E35E001, 22N02E30C002 and 20N01E02H003M added to the network in 2005, 2002, and 2001, respectively.
i 21N01E13L02-04 installed in 2012 and 21N02E18C01-03 in 2010
j 21N02E18C01-03 installed in 2010
k 20N01W04J001 and 20N01W11N002 first measured in 2008
l 21N01W11A01-03 and 21N01W13J01-03 installed in 2010 and 2012, respectively.
m 23N01W25G01 added to DWR monitoring network in 2007, 23N01W28M02-5 and 23N01W31M01-4 multi-completion monitoring wells installed 2008, and 23N01W03H02-4 installed 2012
** 23N01E18A001M discontinued

Depth Category
S- Shallow: indicates total well depth or screening interval is less than 200 feet below ground surface
I- Intermediate: total well depth or screening interval is 200-600 feet
S/I- Shallow/Intermediate: screened interval spans portions of the shallow and intermediate depth intervals
D- Deep: total well depth or screening interval is greater than 600 feet

Alert Stage Count

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Alert 1	26	28	25	22	23	19	22	20	15	14	17
Alert 2	0	6	3	0	4	15	21	25	25	11	19
Total Measured	104	115	112	119	128	127	119	126	123	123	121

Well Type
D-Domestic, I-Irrigation
M-Monitoring, M/I-Municipal and Industrial
Well Depth
S-Shallow, I-Intermediate
D-Deep

BMO Data Summary
Summer 2011 - 2018 Groundwater Elevations - CASGEM

Sub Basin	Revised Subinventory Unit	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Elevations										Analysis		
						Summer 2011 Average WSE (ft)	Summer 2012 Average WSE (ft)	Summer 2013 Average WSE (ft)	Summer 2014 Average WSE (ft)	Summer 2015 Average WSE (ft)	Summer 2016 Average WSE (ft)	Summer 2017 Average WSE (ft)	Spring 2018 (WSE) (ft)	July 2018 WSE (ft)	August 2018 WSE (ft)	2018 Summer Average WSE (ft)	Avg. Change Summer WSE 2017 to 2018 (ft)	Change 2018 Spring to Avg. 2018 Summer WSE (ft)
VINA	Vina North	23N01E29P002M	D	S/I	1990	145.6	139.4	128.0	138.7	133.3	132.4	139.7	146.4	126.8	135.2	131.0	-8.7	-15.4
		23N01W10E001M	I	I	2001	156.2	163.4	166.8	146.2	146.2	143.7	149.6	157.2	NM	145.6	NM	N/A	N/A
		23N01W10M001M	M	S	2001	158.6	148.8	148.4	145.4	147.1	147.9	152.2	158.8	150.7	148.4	149.5	-2.7	-9.3
		23N01W27L001M	D	S	1976	137.2	128.7	125.1	126.5	121.1	123.5	NA	138.9	125.2	121.5	123.3	N/A	-15.6
		23N01W36P001M	D	S	1959	131.6	112.4	113.2	109.6	108.4	108.6	119.5	140.5	115.4	110.3	112.8	-6.7	-27.7
		23N02W25C001M	I	S/I	1967	136.8	137.3	132.3	130.0	131.1	133.9	137.1	137.7	123.0	NM	123.0	-14.1	-14.7
		23N01W25G001M	I	I	2007	125.5	134.1	134.4	132.8	127.4	121.9	131.7	145.0	122.9	130.4	126.6	-5.1	-18.4
		23N01W03H002M	M	I	2012	NW	166.3	163.4	166.0	165.5	164.5	165.4	174.1	165.7	165.5	165.6	0.2	-8.5
		23N01W03H003M	M	I	2012	NW	168.3	166.0	162.4	166.6	166.1	168.4	174.8	167.8	166.6	167.2	-1.2	-7.5
		23N01W03H004M	M	S	2012	NW	178.3	175.8	172.9	172.4	173.8	178.2	177.2	175.4	173.6	174.5	-3.7	-2.7
		23N01W28M002M	M	D	2009	141.1	135.3	129.8	127.2	125.1	130.0	136.0	143.1	131.7	127.4	129.6	-6.5	-13.6
		23N01W28M003M	M	D	2009	137.9	131.7	127.4	124.9	124.6	128.6	135.2	142.8	130.2	127.8	129.0	-6.2	-13.9
		23N01W28M004M	M	S	2009	137.1	127.7	127.6	125.3	124.1	128.0	134.6	140.3	130.0	127.6	128.8	-5.8	-11.5
		23N01W28M005M	M	S	2009	138.2	130.8	128.9	126.4	127.0	129.4	135.6	139.8	131.3	128.4	129.8	-5.8	-10.0
		23N01W31M001M	M	D	2008	133.4	127.8	111.4	118.7	106.6	123.8	131.0	136.9	126.2	117.2	121.7	-9.4	-15.2
		23N01W31M002M	M	I	2008	129.0	122.1	117.8	112.7	117.1	117.6	126.1	138.6	114.9	116.5	115.7	-10.4	-22.9
		23N01W31M003M	M	S	2008	123.1	120.1	119.9	118.5	118.7	116.9	121.2	137.9	116.9	116.9	116.9	-4.3	-21.0
		23N01W31M004M	M	S	2008	136.5	134.2	133.7	132.2	132.0	133.0	135.5	136.4	134.1	133.2	133.6	-1.9	-2.8
	Vina Chico	22N01E09B001M	D	S	2001	141.7	129.6	126.7	125.8	126.2	126.0	134.5	137.2	128.0	128.5	128.3	-6.3	-8.9
		22N01E20K001M	D	S	1961	130.4	121.8	121.7	125.1	115.5	116.2	127.6	132.3	123.4	115.8	119.6	-8.0	-12.7
		23N01E33A001M	I	S/I	2001	147.8	144.1	141.7	138.9	136.8	136.5	141.2	144.2	141.3	138.2	139.8	-1.4	-4.4
		CWSCH01b	M&I	U	1988	NA	NA	NA	NA	NA	NA	NA	124.0	104.0	106.0	105.0	N/A	-19.0
		CWSCH02	M&I	U	1988	NA	NA	NA	NA	NA	NA	NA	126.0	96.0	113.0	104.5	N/A	-21.5
		CWSCH03	M&I	U	1988	NA	NA	NA	NA	NA	NA	NA	123.0	104.0	113.0	108.5	N/A	-14.5
		CWSCH04	M&I	U	1988	NA	NA	NA	NA	NA	NA	NA	130.0	104.0	107.0	105.5	N/A	-24.5
		CWSCH05	M&I	U	1988	NA	NA	NA	NA	NA	NA	NA	119.0	104.0	103.0	103.5	N/A	-15.5
		CWSCH06	M&I	U	1988	NA	NA	NA	NA	NA	NA	NA	128.0	90.0	109.0	99.5	N/A	-28.5
		CWSCH07	M&I	U	1991	NA	NA	NA	NA	NA	NA	NA	114.0	95.0	109.0	102.0	N/A	-12.0
		22N01E28J001M	M	I	1958	126.2	118.1	NM	118.1	116.9	115.5	124.6	132.8	121.7	118.5	120.1	-4.5	-12.7
		22N01E28J003M	M	I	1958	132.7	125.9	NM	122.4	120.4	120.9	130.0	136.5	127.8	124.7	126.3	-3.7	-10.2
		22N01E28J005M	M	D	1958	126.8	118.9	NM	114.2	114.8	119.0	125.2	128.6	120.8	117.6	119.2	-6.0	-9.4
		22N01E35E001M	I	S/I	2005	116.2	103.7	104.2	104.5	105.7	105.6	112.7	126.8	NM	107.0	107.0	-5.7	-19.9
		22N02E30C002M	M	S	2002	117.7	112.8	NM	111.8	NM	112.8	117.2	126.2	116.0	114.1	115.0	-2.2	-11.2
	Vina South	20N01E02H003M	M	S	2001	102.0	92.2	NM	87.1	81.8	86.0	94.2	100.5	92.5	87.0	89.8	-4.4	-10.7
		20N01E10C002M	I	S	1947	NM	NM	NM	94.0	86.3	95.2	101.5	104.2	85.9	92.9	89.4	-12.2	-14.8
		20N02E06Q001M	I	S/I	1947	112.7	101.4	99.2	98.5	92.5	96.6	105.2	112.5	92.5	95.5	94.0	-11.2	-18.5
		21N01E10B003M	I	I	1995	110.2	99.4	93.0	92.7	99.5	95.2	103.2	119.0	98.7	97.2	98.0	-5.2	-21.0
		21N01E13L002M	M	D	2012	NW	90.9	77.1	81.4	86.6	87.9	95.0	114.2	80.3	90.6	85.4	-9.6	-28.8
		21N01E13L003M	M	I	2012	NW	89.8	76.5	81.3	83.8	86.6	94.0	114.2	77.9	88.7	83.3	-10.7	-30.9
		21N01E13L004M	M	I	2012	NW	92.6	78.6	83.3	86.4	88.7	95.9	114.1	82.3	91.3	86.8	-9.1	-27.3
		21N01E25K001M	D	S	1993	104.1	NM	NM	83.8	83.5	85.7	95.8	103.6	93.5	88.6	91.1	-4.7	-12.6
		21N01E26K001M	I	I	1993	97.6	92.7	90.6	71.6	79.5	81.4	84.8	103.1	68.3	85.9	77.1	-7.7	-26.0
		21N01E27D001M	D	S	1946	102.0	91.4	88.6	82.1	80.2	81.5	91.3	96.3	NM	84.0	84.0	-7.3	-12.3
		21N02E07C001M	I	I	1967	131.6	115.2	133.0	107.1	134.8	135.3	122.7	NM	130.2	NM	130.2	7.5	N/A
		21N02E18C001M	M	D	2010	104.4	95.5	86.6	90.0	89.5	91.9	97.5	113.5	86.0	93.3	89.7	-7.9	-23.8
		21N02E18C002M	M	I	2010	105.1	95.5	87.9	90.7	89.7	91.3	97.6	113.9	86.2	94.0	90.1	-7.5	-23.8
		21N02E18C003M	M	S	2010	154.4	145.4	143.6	140.4	142.9	149.2	162.8	158.3	157.7	158.4	158.0	-4.8	-0.3
		21N02E30L001M	D	S/I	1995	110.1	98.7	93.3	92.6	90.2	92.4	99.1	110.6	94.5	93.1	93.8	-5.3	-16.8
		20N02E24C001M	M	S	1999	104.6	103.7	98.1	94.2	89.9	92.3	101.4	112.1	99.8	94.7	97.2	-4.1	-14.8
		20N02E24C002M	M	I	1999	104.6	103.8	98.1	94.3	90.0	92.4	101.3	111.6	100.0	94.9	97.4	-3.9	-14.1
		20N02E24C003M	M	I	1999	107.6	103.3	98.0	94.4	90.0	92.4	101.3	111.1	100.0	94.9	97.5	-3.8	-13.6
		20N03E31M001M	M	S	2001	101.5	98.6	96.3	93.9	89.0	92.5	100.1	114.7	NM	96.1	96.1	-4.0	-18.7
		20N03E33L001M	I	S	1999	97.2	94.6	94.4	91.1	89.0	91.0	96.6	117.5	89.4	89.1	89.3	-7.4	-28.3
		21N03E22C001M	D	S	2001	367.3	365.4	371.0	365.0	358.8	360.2	365.3	NM	NM	NM	N/A	N/A	N/A
		21N03E29J003M	D	S/I	2007	NM	NM	NM	NM	206.8	208.3	208.3	230.0	207.1	199.7	203.4	-4.8	N/A
		21N03E32B001M	I	S	1999	224.0	221.7	222.0	217.8	217.9	217.9	220.8	222.8	219.8	218.8	219.3	-1.5	-3.5
		20N02E08H003M	D	S	2008	119.7	111.2	109.3	106.2	100.7	107.0	108.6	116.2	98.7	105.1	101.9	-6.7	-14.3
		20N02E09G001M	M	S	2001	114.8	97.1	93.4	92.2	89.0	94.8	97.9	115.6	94.8	96.6	95.7	-2.2	-19.9
		20N02E09L001M	I	I	1953	110.4	96.8	94.2	98.6	88.5	100.7	99.1	118.0	82.3	99.8	91.1	-8.1	-27.0
		21N02E20P001M	I	S/I	1995	103.4	89.4	90.8	93.5	89.6	93.4	94.1	114.2	58.3	93.5	75.9	-18.2	-38.3
		21N02E26E003M	M	D	2007	112.0	102.5	95.4	98.8	100.8	97.7	106.4	115.5	105.2	100.0	102.6	-3.7	-12.8
		21N02E26E004M	M	I	2007	109.1	100.5	85.9	98.0	101.1	96.0	106.7	115.2	102.9	99.7	101.3	-5.4	-14.0
		21N02E26E005M	M	I	2007	106.3	97.8	90.0	95.6	99.9	94.1	106.0	114.3	100.0	97.8	98.9	-7.1	-15.4
		21N02E26E006M	M	S	2007	114.1	110.4	103.5	103.2	102.1	102.4	108.3	109.6	109.4	107.4	108.4	0.1	-1.3

Well Type
D-Domestic, I-Irrigation
M-Monitoring, M/I-Municipal and Industrial
Well Depth
S-Shallow, I-Intermediate
D-Deep

Sub Basin	Revised Subinventory Unit	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Elevations										Analysis		
						Summer 2011 Average WSE (ft)	Summer 2012 Average WSE (ft)	Summer 2013 Average WSE (ft)	Summer 2014 Average WSE (ft)	Summer 2015 Average WSE (ft)	Summer 2016 Average WSE (ft)	Summer 2017 Average WSE (ft)	Spring 2018 (WSE) (ft)	July 2018 WSE (ft)	August 2018 WSE (ft)	2018 Summer Average WSE (ft)	Avg. Change Summer WSE 2017 to 2018 (ft)	Change 2018 Spring to Avg. 2018 Summer WSE (ft)
BUTTE	Butte*	17N01E10A001M	D	S	1953	58.2	54.2	NM	59.6	35.0	58.4	58.3	58.9	59.1	59.6	59.4	1.1	0.5
		18N01E35L001M	M	D	2005	73.1	71.7	71.1	68.2	54.9	70.5	71.4	73.3	NM	69.9	69.9	-1.5	-3.4
		18N02E16F001M	I	S	1947	78.3	77.5	77.9	78.1	74.3	78.5	78.5	77.8	77.4	78.6	78.0	-0.5	0.2
		18N02E25M001M	I	S	1959	82.0	NM	80.6	80.3	79.3	79.9	79.4	***82.2***	80.5	NM	80.5	1.1	-1.7
		18N02E32H001M	D	S	2001	75.4	73.8	75.5	70.6	73.5	76.0	73.8	71.8	75.1	75.4	75.3	1.5	3.5
		17N02E14A001M	I	S	1947	77.8	77.0	76.6	76.9	76.0	79.3	77.6	79.7	76.8	77.1	76.9	-0.7	-2.8
		17N02E14H001M	D	S	2000	73.3	63.2	75.1	72.9	58.0	68.3	72.4	***77.6***	60.0	74.3	67.1	-5.3	-10.5
		17N03E16N001M	D	S	1953	72.3	66.3	71.7	68.0	NM	NM	NM	NM	66.3	NM	66.3	N/A	N/A
		17N01E17F001M	M	S	1992	52.3	51.7	51.6	47.1	45.1	50.9	51.7	56.0	48.6	51.2	49.9	-1.8	-6.1
		17N01E17F002M	M	I	1992	53.5	52.4	51.8	45.7	41.2	50.1	52.5	57.0	45.7	50.1	47.9	-4.6	-9.1
		17N01E17F003M	M	I	1992	54.2	53.3	52.5	44.6	38.9	50.3	53.4	58.0	44.7	50.0	47.3	-6.1	-10.6
		17N01E24A003M	M	D	2007	74.6	72.6	72.4	68.0	60.8	70.6	72.9	73.4	71.0	69.0	70.0	-2.9	-3.3
		17N01E24A004M	M	I	2007	51.6	52.7	47.3	47.7	42.1	51.6	52.8	62.6	51.7	41.4	46.5	-6.3	-16.1
		17N01E24A005M	M	I	2007	51.6	52.8	47.3	47.7	42.2	51.7	52.9	62.4	54.7	41.5	48.1	-4.8	-14.3
		17N01E24A006M	M	S	2007	66.3	66.7	66.3	64.8	65.0	66.7	65.6	68.3	65.4	66.1	65.8	0.2	-2.6
		17N02E19J001M	I	S/I	2000	64.3	61.4	61.8	53.7	61.2	65.3	64.3	66.8	64.5	65.1	64.8	0.5	-2.0
		18N01E13A002M	I	S/I	2001	77.2	76.5	76.7	76.5	55.0	76.5	76.7	75.2	76.7	76.8	76.8	0.1	1.6
		18N01E15D002M	D	S	1976	69.9	70.7	70.6	70.2	33.6	70.7	70.3	71.3	NM	71.1	71.1	0.8	-0.2
		19N01E27Q001M	M	I	1978	84.0	83.0	83.4	83.2	72.3	83.6	83.2	83.9	83.0	83.5	83.2	0.0	-0.6
		19N01E35B001M	M	S	2002	84.0	83.6	84.0	83.4	74.7	84.2	84.1	83.3	NM	83.7	83.7	-0.4	0.4
		19N01E35B002M	M	D	2005	90.7	89.2	88.8	87.5	74.4	88.1	89.7	90.5	NM	88.5	88.5	-1.2	-1.9
		19N01E35B003M	M	I	2005	85.2	84.1	84.2	83.3	67.6	84.0	84.3	85.2	NM	84.0	84.0	-0.4	-1.2
		19N02E15N002M	I	U	2000	103.1	101.9	103.5	101.6	99.7	103.2	103.0	103.6	101.8	102.6	102.2	-0.8	-1.3
		18N03E08B003M	I	S/I	2001	91.2	87.4	88.7	88.3	86.8	80.3	91.4	***99.8***	89.5	90.8	90.2	-1.3	-9.6
		18N03E21G001M	I	S	1953	88.1	85.0	84.2	80.1	82.3	83.5	89.2	90.6	82.8	83.7	83.2	-6.0	-7.3
		19N03E05N002M	D	S	1967	117.9	110.5	107.5	106.8	109.2	113.0	111.9	119.4	112.3	114.1	113.2	1.4	-6.2
		19N01E09Q001M	I	S	1991	89.7	89.0	NM	NM	NM	NM	90.0	88.9	89.2	NM	89.2	-0.8	0.3
		19N02E07K002M	M	I	2006	101.7	99.9	98.9	98.3	85.1	98.9	100.6	102.0	99.6	99.1	99.3	-1.2	-2.7
		19N02E07K003M	M	I	2006	100.7	100.1	100.3	100.3	92.3	100.5	100.5	100.4	99.9	100.2	100.1	-0.4	-0.3
		19N02E07K004M	M	S	2006	99.7	100.0	100.2	106.2	90.6	100.4	100.5	100.4	99.9	100.2	100.1	-0.4	-0.3
		19N02E13Q001M	M	S	2002	114.5	112.9	113.6	113.4	110.3	114.2	113.3	115.9	NM	113.9	113.9	0.6	-2.0
		19N02E13Q002M	M	I	2006	114.7	113.3	113.2	113.2	109.4	114.0	114.3	116.4	NM	113.7	113.7	-0.6	-2.7
		19N02E13Q003M	M	D	2006	115.0	113.6	113.2	113.4	109.2	114.1	114.7	116.7	NM	113.7	113.7	-1.0	-3.0
		20N01E18L001M	M	D	2000	101.2	96.4	93.5	93.0	78.4	93.7	97.7	***101.4***	NM	94.8	94.8	-2.9	-6.6
		20N01E18L002M	M	I	2001	100.8	97.9	97.6	96.3	89.9	97.3	98.5	101.3	NM	98.2	98.2	-0.3	-3.2
		20N01E18L003M	M	S	2001	103.3	101.0	101.8	99.3	104.3	103.8	103.5	104.3	NM	103.9	103.9	0.4	-0.4
		20N01E35C001M	D	S	1947	100.8	NM	NM	NM	98.2	100.1	NA	NM	99.0	99.9	99.4	N/A	N/A
		20N02E15H001M	M	S	1995	113.5	102.7	97.9	90.9	89.4	94.7	96.1	115.5	92.5	92.7	92.6	-3.6	-23.0
		20N02E15H002M	M	S	1995	134.3	132.4	123.7	117.6	116.7	118.4	124.4	121.6	NM	118.0	118.0	-6.4	-3.6
		20N02E16P001M	I	U	1990	117.1	NM	NM	103.2	88.8	100.0	102.5	***118.1***	99.1	106.7	102.9	0.4	-15.2
		20N02E28N001M	D	S/I	1947	117.4	116.5	115.8	116.1	116.0	117.3	116.4	118.7	116.8	117.5	117.2	0.8	-1.6
		21N01W23J001M	I	S	1941	107.6	107.4	106.5	102.0	102.8	103.5	106.2	***106.7***	103.4	103.7	103.5	-2.7	-3.2
		21N01W35K002M	I	S/I	1994	98.9	97.0	95.2	94.1	94.9	95.4	96.9	99.3	96.3	95.8	96.0	-0.8	-3.2
		20N01E18L001M	M	D	2000	101.2	96.4	93.5	93.0	78.4	93.7	97.7	***101.4***	NM	94.8	94.8	-2.9	-6.6
		20N01E18L002M	M	I	2001	100.8	97.9	97.6	96.3	89.9	97.3	98.5	*101.3*	NM	98.2	98.2	-0.3	-3.2
		20N01E18L003M	M	S	2001	103.3	101.0	101.8	99.3	104.3	103.8	103.5	104.3	NM	103.9	103.9	0.4	-0.4
		20N01W04J001M	I	S	2008	82.9	83.0	82.2	80.1	80.4	81.0	81.9	82.0	81.7	81.9	81.8	-0.1	-0.2
		20N01W11N002M	I	S	2008	95.7	93.1	93.5	91.4	91.6	92.1	93.0	94.6	90.4	91.9	91.1	-1.8	-3.4
		21N01W35K002M	I	S/I	1994	98.9	97.0	95.2	94.1	94.9	95.4	96.9	99.3	96.3	95.8	96.0	-0.8	-3.2
		21N01W11A001M	M	D	2010	108.2	107.5	104.2	102.8	99.2	104.1	111.6	115.5	108.5	106.1	107.3	-4.3	-8.2
		21N01W11A002M	M	S	2010	115.0	114.3	113.8	113.5	111.9	112.3	114.5	115.5	115.0	113.5	114.2	-0.3	-1.3
		21N01W11A003M	M	S	2010	115.8	115.8	115.5	114.5	113.5	114.2	115.6	115.7	115.8	115.6	115.7	0.1	0.0
		21N01W13J001M	M	D	2012	NW	101.5	97.8	96.3	92.5	97.0	103.9	110.3	100.3	98.8	99.6	-4.3	-10.7
		21N01W13J002M	M	I	2012	NW	103.1	101.3	97.1	95.0	98.6	105.1	110.6	100.6	99.4	100.0	-5.1	-10.6
		21N01W13J003M	M	I	2012	NW	104.9	97.2	87.9	96.4	100.2	106.4	111.0	90.2	91.8	91.0	-15.4	-20.0
		21N01W24B001M	M	D	1995	103.3	98.9	93.8	94.5	89.0	93.8	102.4	***108.0***	NM	94.4	94.4	-8.0	-13.6
		22N01E29R001M	I	I	1947	126.5	121.2	113.0	100.0	94.8	107.3	123.0	***128.9***	138.7	115.5	127.1	4.1	-1.7
		22N01E32E004M	D	S	1992	119.8	111.3	112.9	107.3	105.0	107.2	116.6	***123.0***	112.5	109.1	110.8	-5.8	-12.2
WYANDOTTE CREEK	Wyandotte Creek Oroville	CWS-01	M&I	U	1978	NA	NA	NA	NA	NA	NA	NA	135.0	NM	132.0	132.0	N/A	-3.0
		CWS-02	M&I	U	1978	NA	NA	NA	NA	NA	NA	NA	150.0	NM	148.0	148.0	N/A	-2.0
		CWS-03	M&I	U	1978	NA	NA	NA	NA	NA	NA	NA	168.0	NM	166.0	166.0	N/A	-2.0
		19N03E16Q001M	D	S	2000	140.0	137.5	137.4	137.7	139.4	140.0	140.1	149.9	138.3	139.3	138.8	-1.3	-11.1
	Wyandotte Creek South	17N03E03D001M	I	S	1947	73.0	71.0	69.8	67.9	70.8	72.8	75.2	***72.2***	66.4	71.3	68.8	-6.4	-3.4
		17N04E09N002M	I	S/I	2001	73.5	71.4	NM	59.1	NM	58.8	64.3	NM	NM	NM	N/A	N/A	N/A
		17N04E22B001M	D	S	1976	99.0	96.6	67.5	81.4	63.7	93.9	93.5	NM	NM	NM	N/A	N/A	N/A
		19N04E31F001M	D	S	2001	125.4	118.7	116.6	118.4	120.5	122.5	125.3	139.2	124.5	123.9	124.2	-1.1	-15.0

* Indicates subbasin area primarily served by surface water
Note: Red font indicates Questionable Measurement (QM)
NA- Not available, NM- No measurement, NW- New well

Depth Category
S- Shallow: indicates total well depth or screening interval is less than 200 feet below ground surface
I- Intermediate: total well depth or screening interval is 200-600 feet
S/I- Shallow/Intermediate: screened interval spans portions of the shallow and intermediate depth intervals
D- Deep: total well depth or screening interval is greater than 600 feet

Well Type
D-Domestic, I-Irrigation
M-Monitoring, M/I-Municipal and Industrial
Well Depth
S-Shallow, I-Intermediate
D-Deep

BMO Data Summary
Fall 2008-2018 Groundwater Elevations - CASGEM

Sub Basin	Revised Subinventory Unit	Monitoring Wells	Well Type	Well Depth	First Record	Groundwater Elevations: Fall 2008 Water Surface Elevation (WSE) (Elev. ft)	Fall 2009 Water Surface Elevation (WSE) (Elev. ft)	Fall 2010 Water Surface Elevation (WSE) (Elev. ft)	Fall 2011 Water Surface Elevation (WSE) (Elev. ft)	Fall 2012 Water Surface Elevation** (WSE) (Elev. ft)	Fall 2013 Water Surface Elevation (WSE) (Elev. Ft)	Fall 2014 Water Surface Elevation (WSE) (Elev. Ft)	Fall 2015 Water Surface Elevation (WSE) (Elev. Ft)	Fall 2016 Water Surface Elevation (WSE) (Elev. Ft)	Fall 2017 Water Surface Elevation (WSE) (Elev. Ft)	Fall 2018 Water Surface Elevation (WSE) (Elev. Ft)	Fall BMO Stage 1 Alert Level (Elev. ft)	Fall BMO Stage 2 Alert Level (Elev. ft)	Analysis: Elevation Above (+) or Below (-) Alert Stage 1 (ft)	Change Fall 2017 to Fall 2018 (ft)	Fall 2018 Depth to Water (ft)
VINA	Vina North	22N01E09B001M	D	S	2001	131.7	131.0	132.0	136.1	129.5	128.0	125.6	125.5	126.5	132.0	128.6	143.5	136.3	-14.9	-3.4	49.7
		22N01E20K001M	D	S	1961	121.5	121.0	124.6	129.1	120.7	118.3	NM	114.1	114.3	126.5	119.6	124.9	120.0	-5.3	-6.9	48.2
		23N01E29P002M	D	S/I	1990	143.8	138.5	141.9	144.2	140.6	NM	136.5	134.9	133.9	140.4	136.6	129.8	100.8	6.8	-3.8	68.7
		23N01E33A001M	I	S/I	2001	146.7	145.4	145.3	147.5	143.5	140.5	NM	136.3	136.9	140.2	138.6	149.3	136.3	-10.8	-1.7	113.8
		23N01W10E001M	I	I	2001	149.3	156.3	157.2	159.9	NM	NM	142.7	141.9	145.1	NM	151.7	152.6	144.2	-0.9		37.7
		23N01W10M001M	M	S	2001	153.6	155.6	157.1	159.9	NM	148.6	147.5	144.5	149.6	154.0	150.1	154.3	145.5	-4.2	-3.9	37.3
		23N01W27L001M	D	S	1976	140.3	133.4	135.3	137.4	130.7	NM	126.4	126.4	129.4	133.4	127.3	131.6	116.0	-4.3	-6.1	35.1
		23N01W36P001M	D	S	1959	122.8	124.7	125.9	129.8	120.7	118.7	117.5	116.8	119.6	125.2	119.9	128.9	124.1	-9.0	-5.3	42.9
		23N02W25C001M	I	S/I	1967	132.1	133.9	134.4	135.8	130.6	130.5	131.0	130.9	133.9	135.4	134.0	128.8	123.7	5.2	-1.4	23.4
		23N01W25G001M	I	I	2007	140.3	139.8	134.5	129.1	134.4	131.5	131.4	130.5	139.1	NM	133.7	k	k			46.7
		23N01W03H002M	M	I	2012					172.6	169.8	168.0	167.0	167.7	170.2	168.3	k	k		-2.0	48.6
		23N01W03H003M	M	I	2012					173.2	170.3	168.4	167.1	168.1	171.2	167.7	k	k		-3.5	49.2
		23N01W03H004M	M	S	2012					175.8	173.9	171.3	170.4	171.1	174.8	171.6	k	k		-3.2	45.3
		23N01W28M002M	M	D	2009		136.9	134.4	138.3	136.6	127.5	131.3	129.9	133.0	136.2	133.2	k	k		-3.0	25.8
		23N01W28M003M	M	D	2009		136.8	135.4	138.8	137.1	129.0	130.6	129.8	132.8	135.7	133.3	k	k		-2.4	25.8
		23N01W28M004M	M	S	2009		133.9	139.3	137.1	131.7	130.6	128.0	128.0	130.6	133.9	130.6	k	k		-3.3	28.5
		23N01W28M005M	M	S	2009		133.4	141.4	136.6	131.4	130.2	127.7	127.8	130.1	133.7	130.3	k	k		-3.5	28.8
		23N01W31M001M	M	D	2008	131.1	126.8	134.0	126.0	129.7	110.9	121.6	119.9	125.3	128.2	124.4	k	k		-3.8	30.4
		23N01W31M002M	M	I	2008	132.5	131.6	133.0	132.2	129.4	125.8	126.0	124.5	129.5	129.4	123.8	k	k		-5.6	31.0
		23N01W31M003M	M	S	2008	133.1	135.1	133.8	137.1	132.0	129.5	128.9	126.2	132.2	132.1	126.5	k	k		-5.6	28.3
		23N01W31M004M	M	S	2008	134.0	134.1	134.5	135.7	133.5	133.2	132.2	132.3	133.4	134.5	133.2	k	k		-1.3	21.5
	Vina Chico	CWSCH01b	M&I	U	1988	123.0	118.0	122.0	120.0	115.0	114.0	110.0	108.0	113.0	117.0	116.0	l	l	#VALUE!	-1.0	84.0
		CWSCH02	M&I	U	1988	117.0	123.0	130.0	132.0	86.0	113.0	112.0	111.0	112.0	111.0	115.0	103.0	63.0	12.0	4.0	68.0
		CWSCH03	M&I	U	1988	121.0	120.0	116.0	120.0	117.0	114.0	110.0	113.0	113.0	115.0	114.0	116.0	100.0	-2.0	-1.0	144.0
		CWSCH04	M&I	U	1988	107.0	91.0	NM	110.0	108.0	107.0	107.0	117.0	124.0	118.0	115.0	103.0	66.0	12.0	-3.0	97.0
		CWSCH05	M&I	U	1988	111.0	115.0	113.0	118.0	110.0	108.0	100.0	102.0	107.0	111.0	105.0	98.0	61.0	7.0	-6.0	110.0
		CWSCH06	M&I	U	1988	116.0	113.0	109.0	113.0	101.0	101.0	97.0	108.0	109.0	116.0	116.0	115.0	61.0	1.0	0.0	65.0
		CWSCH07	M&I	U	1991	111.0	106.0	110.0	114.0	105.0	103.0	101.0	105.0	105.0	110.0	114.0	103.0	80.0	11.0	4.0	156.0
		22N01E28J001M	M	I	1958	122.6	123.8	125.5	130.4	121.4	119.6	114.7	114.7	117.8	125.0	122.2	126.7	120.8	-4.5	-2.8	56.7
		22N01E28J003M	M	I	1958	126.5	128.0	129.7	135.0	126.7	124.7	119.8	118.2	121.0	129.4	126.8	129.1	123.7	-2.3	-2.6	51.5
		22N01E28J005M	M	D	1958	120.5	121.5	122.2	127.4	116.4	117.5	113.8	113.1	114.0	122.1	118.2	122.3	117.3	-4.1	-3.9	60.7
		22N01E35E001M	I	S/I	2005	116.3	116.0	116.0	122.4	112.5	110.8	107.5	107.5	NM	116.0	114.4	f	f		-1.6	67.9
		22N02E30C002M	M	S	2002	116.3	115.5	114.8	119.2	112.3	111.4	109.5	NM	113.4	116.0	115.9	f	f		0.0	127.7
	Vina South	20N02E24C001M	M	S	1999	112.2	111.5	110.7	114.9	109.8	105.0	99.3	95.8	98.1	105.1	101.1	113.6	108.8	-12.6	-4.0	56.7
		20N02E24C002M	M	I	1999	112.1	111.6	112.1	115.0	109.9	105.1	99.4	96.0	98.3	105.0	101.2	113.4	107.8	-12.3	-3.8	56.6
		20N02E24C003M	M	I	1999	112.1	111.5	110.9	114.9	109.9	105.2	99.4	96.1	98.8	105.0	101.2	113.5	107.9	-12.4	-3.8	56.6
		20N03E31M001M	M	S	2001	109.2	108.1	105.7	105.6	106.0	104.2	103.9	99.3	103.8	108.9	104.9	111.4	106.5	-6.5	-4.0	28.1
		20N03E33L001M	I	S	1999	116.8	115.4	115.2	114.8	112.6	109.6	110.1	108.3	108.9	111.9	111.1	116.7	113.3	-5.7	-0.9	40.3
		21N03E22C001M	D	S	2001	361.5	366.0	367.1	363.2	354.3	366.9	358.8	360.0	366.0	371.9	375.2	357.9	347.9	17.3	3.3	7.2
		21N03E29J003M	D	S/I	2007	NM	216.5	212.2	NM	NM	205.1	NM	217.6	NM	210.7	215.7	c	c		5.0	58.6
		21N03E32B001M	I	S	1999	218.8	218.1	218.3	222.1	218.3	224.1	216.1	215.8	215.6	217.9	216.9	218.6	215.3	-1.8	-1.1	21.6
		20N02E08H003M	D	S	2008	116.4	116.5	117.7	117.9	100.4	NM	109.9	NM	NM	110.0	110.7	d	d		0.7	21.6
		20N02E09G001M	M	S	2001	105.7	NM	108.8	113.6	100.6	103.8	98.3	90.6	95.7	103.9	98.5	108.9	97.5	-10.4	-5.4	50.3
		20N02E09L001M	I	I	1953	109.7	108.6	110.9	112.5	109.7	106.4	105.1	97.2	104.4	109.9	104.2	112.1	106.8	-7.9	-5.7	35.1
		21N02E20P001M	I	S/I	1995	111.9	111.6	106.4	114.1	106.4	99.0	98.2	94.1	95.9	106.3	100.2	108.7	87.7	-8.5	-6.1	67.9
		21N02E26E003M	M	D	2007	107.9	109.4	107.0	119.1	105.5	111.3	108.3	103.4	106.4	110.5	110.0	e	e		-0.5	72.3
		21N02E26E004M	M	I	2007	94.4	106.9	104.7	118.3	103.6	111.2	108.9	102.4	106.1	110.5	110.5	e	e		0.0	71.8
		21N02E26E005M	M	I	2007	98.8	104.2	101.7	117.0	100.7	110.3	108.1	100.9	105.0	110.0	109.7	e	e		-0.3	72.6
		21N02E26E006M	M	S	2007	108.9	108.0	107.6	113.5	107.1	105.5	104.6	102.7	102.6	107.0	107.0	e	e		0.0	75.3
		20N01E02H003M	M	S	2001	95.1	95.6	95.9	101.7	93.1	90.3	86.9	83.9	88.3	95.2	91.3	e	e		-3.9	41.1
		20N01E10C002M	I	S	1947	100.5	101.1	100.9	NM	96.0	94.4	94.4	90.1	94.7	100.7	94.6	101.5	97.6	-6.8	-6.1	32.8
		20N02E06Q001M	I	S/I	1947	109.5	108.3	108.1	113.9	106.8	103.9	102.1	95.9	100.4	108.0	104.7	106.2	101.2	-1.5	-3.3	32.9
		21N01E10B003M	I	I	1995	110.6	111.8	112.4	119.1	107.1	104.2	100.7	96.3	102.2	109.9	106.6	114.7	93.2	-8.2	-3.4	63.8
		21N01E13L002M	M	D	2012					102.2	98.7	95.7	90.6	96.1	105.0	102.2	g	g		-2.9	77.7
		21N01E13L003M	M	I	2012					102.1	98.9	95.8	90.9	96.0	105.3	102.2	g	g		-3.1	77.6
		21N01E13L004M	M	I	2012					102.4	99.1	95.8	91.4	96.2	105.5	102.3	g	g		-3.2	77.6
		21N01E25K001M	D	S	1993	98.5	96.9	98.8	103.9	NM	90.4	87.5	85.6	87.9	95.9	92.0	99.6	74.5	-7.6	-3.9	62.3
		21N01E26K001M	I	I	1993	92.9	85.6	98.2	92.9	88.1	86.8	78.5	84.5	79.1	88.3	85.0	95.9	72.3	-10.9	-3.3	67.8
		21N01E27D001M	D	S	1946	94.9	94.3	94.9	100.0	91.4	86.6	83.8	83.2	NM	94.5	89.0	97.1	90.9	-8.1	-5.5	54.3
		21N02E18C001M	M	D	2010				115.7	103.2	100.5	97.5	90.9	97.3	104.8	103.5	h	h		-1.2	85.5
		21N02E18C002M	M	I	2010				115.8	102.7	101.1	97.5	92.4	97.9	105.4	104.0	h	h		-1.5	85.1
		21N02E18C003M	M	S	2010				154.0	144.6	143.5	139.7	140.2	149.6	161.0	156.9	h	h		-4.2	32.2
		21N02E30L001M	D	S/I	1995	106.9	105.6	106.3	112.6	101.8	98.8	95.6	93.3	95.9	103.2	99.8	110.5	95.1	-10.7	-3.4	59.5
		17N01E10A001M	D	S	1953	52.9	55.3	55.2	57.0	NM	56.1	57.5	52.8	57.2	56.3	54.3	34.0	28.1	20.3	-2.0	11.0
		18N01E35L001M	M	D	2005	69.2	67.2	68.0	71.8	69.0	69.7	67.8	60.0	69.9	69.9	68.8	a	a		-1.1	1.2
		18N02E16F001M	I	S	1947	75.9	75.9	75.7	76.5	77.8	76.3	76.6	75.4	76.7	75.9	75.6	74.8	74.2	0.8	-0.3	6.7
		18N02E25M001M	I	S	1959	80.7	81.7	80.8	82.1	80.9	81.1	80.1	78.9	80.5	80.0	79.7	67.9	64.0	11.8	-0.3	9.6
		18N02E32H001M	D	S	2001	NM	NM	NM	73.7	71.8	71.6	71.6	71.6	71.9	71.9	72.0	70.1	68.0	1.9	0.1	6.3
		17N02E14A001M	I	S	1947	78.1	80.6	77.8	78.4	77.9	76.9	77.5	75.3	77.6	76.4	75.9	72.9	70.3	3.0	-0.5	8.9
		17N02E14H001M	D	S	2000	75.3	75.8	75.4	76.9	74.9	NM	74.5	65.9	74.0	67.1	68.8	66.0	54.3	2.8	1.7	17.5
		17N03E16N001M	D	S	1953	74.8	74.1	74.5	75.7	74.4	73.7	72.5	NM	NM	NM	NM	74.0	73.2			NM
		17N01E17F001M	M	S	1992	51.9	52.3	50.8	51.3	51.6	50.1	47.0	43.5	48.3	49.1	51.2	50.9	47.5	0.3	2.1	7.8
		17N01E17F002M	M	I	1992	50.6	51.0	48.9	49.8	51.7	47.2	44.2	38.2	44.9	46.1	47.2	51.1	47.4	-3.9	1.1	12.2
		17N01E17F003M	M	I	1992	50.0	50.0	47.6	48.8	51.3	46.6	42.7	35.3	44.0	45.7	45.4	51.0	47.0	-5.6	-0.3	14.0
		17N01E24A003M	M	D	2007	70.7	67.4	68.6	72.5	71.1	68.3	66.7	62.9	70.1	71.6	67.5	b	b		-4.1	5.4
		17N01E24A004M	M	I	2007	28.2	22.9	27.2	51.7	41.7	30.0	23.3	21.0	49.1	37.7	38.9	b	b		1.2	33.9
		17N01E24A005M	M	I	2007	28.5	23.1	27.4	51.7	41.8	29.9	23.3	20.9	49.1	37.7	38.9	b	b		1.2	34.0
		17N01E24A006M	M	S	2007	68.4	68.3	67.3	67.1	69.1	68.6	67.7	66.4	67.2	66.7	68.2	b	b		1.5	4.7
		17N02E19J001M	I	S/I	2000	NM	NM	66.1	67.2	NM	NM	NM	NM	66.7	NM	NM	62.8	55.7			NM

Well Type
D-Domestic, I-Irrigation
M-Monitoring, M/I-Municipal and Industrial
Well Depth
S-Shallow, I-Intermediate
D-Deep

BMO Data Summary
Fall 2008-2018 Groundwater Elevations - CASGEM

						Groundwater Elevations													Analysis		
Sub Basin	Revised Subinventory Unit	Monitoring Wells	Well Type	Well Depth	First Record	Fall 2008 Water Surface Elevation (WSE) (Elev. ft)	Fall 2009 Water Surface Elevation (WSE) (Elev. ft)	Fall 2010 Water Surface Elevation (WSE) (Elev. ft)	Fall 2011 Water Surface Elevation (WSE) (Elev. ft)	Fall 2012 Water Surface Elevation** (WSE) (Elev. ft)	Fall 2013 Water Surface Elevation (WSE) (Elev. Ft)	Fall 2014 Water Surface Elevation (WSE) (Elev. Ft)	Fall 2015 Water Surface Elevation (WSE) (Elev. Ft)	Fall 2016 Water Surface Elevation (WSE) (Elev. Ft)	Fall 2017 Water Surface Elevation (WSE) (Elev. Ft)	Fall 2018 Water Surface Elevation (WSE) (Elev. Ft)	Fall BMO Stage 1 Alert Level (Elev. ft)	Fall BMO Stage 2 Alert Level (Elev. ft)	Elevation Above (+) or Below (-) Alert Stage 1 (ft)	Change Fall 2017 to Fall 2018 (ft)	Fall 2018 Depth to Water (ft)
Butte	Butte*	18N01E13A002M	I	S/I	2001	75.6	75.2	74.3	74.7	74.3	74.6	75.7	72.1	74.8	74.6	74.6				0.0	4.7
		18N01E15D002M	D	S	1976	68.7	62.9	40.5	41.2	52.8	68.1	61.2	35.3	70.0	70.2	69.9				-0.3	2.5
		19N01E27Q001M	M	I	1978	83.1	82.6	82.2	83.1	81.2	82.7	83.0	76.8	82.1	82.2	81.8				-0.4	5.6
		19N01E35B001M	M	S	2002	83.6	83.4	81.7	82.2	81.5	82.0	83.6	80.1	81.8	82.0	82.5	No Fall BMO**			0.5	4.0
		19N01E35B002M	M	D	2005	88.8	88.3	88.6	89.9	88.3	88.3	87.1	81.9	87.8	88.9	87.6				-1.3	-1.1
		19N01E35B003M	M	I	2005	83.8	82.7	83.1	84.2	82.9	83.5	82.9	76.0	82.6	83.0	82.7				-0.2	3.8
		19N02E15N002M	I	U	2000	101.2	100.9	101.1	102.9	101.0	101.3	100.9	100.1	101.5	101.4	101.3				-0.1	6.0
		18N03E08B003M	I	S/I	2001	95.2	NM	89.6	99.0	97.3	96.4	94.6	94.8	96.8	97.4	87.2	91.7	83.8	-4.5	-10.2	25.1
		18N03E21G001M	I	S	1953	82.2	83.9	85.1	87.0	85.3	83.6	82.7	82.3	83.0	87.2	84.6	83.5	81.2	1.1	-2.6	21.7
		19N03E05N002M	D	S	1967	119.7	117.0	115.1	119.8	117.9	114.7	113.6	113.7	114.2	117.6	113.9	109.2	92.4	4.7	-3.7	28.4
		19N01E09Q001M	I	S	1991	88.5	89.1	85.7	86.8	86.5	87.0	NM	NM	NM	87.0	NM					NM
		19N02E07K002M	M	I	2006	98.7	99.6	99.8	101.5	99.8	99.5	98.2	91.8	99.2	100.0	99.0				-1.1	3.8
		19N02E07K003M	M	I	2006	96.3	98.4	98.4	99.4	98.2	97.7	98.1	96.1	99.4	98.2	98.1				-0.1	4.6
		19N02E07K004M	M	S	2006	95.7	98.4	98.5	99.5	98.3	98.2	99.3	95.4	99.2	98.3	98.1				-0.2	4.6
		19N02E13Q001M	M	S	2002	112.0	112.8	113.3	115.6	114.0	114.1	114.4	111.9	115.0	114.9	114.3				-0.6	5.6
		19N02E13Q002M	M	I	2006	113.2	113.3	114.1	115.9	114.5	114.3	114.7	112.3	115.4	115.3	114.5				-0.8	5.4
		19N02E13Q003M	M	D	2006	113.8	113.7	114.5	116.2	114.8	114.6	114.8	112.7	115.7	115.6	114.7				-0.8	5.2
		20N01E18L001M	M	D	2000	99.4	99.3	100.7	101.0	97.1	95.5	95.0	90.7	96.0	104.5	96.4	No Fall BMO**			-8.1	11.0
		20N01E18L002M	M	I	2001	99.0	99.5	99.8	100.3	97.9	97.3	97.5	94.9	97.7	98.7	98.0				-0.7	9.4
		20N01E18L003M	M	S	2001	101.3	102.0	102.4	102.9	100.7	100.4	100.2	99.3	101.0	101.2	100.9				-0.4	6.5
		20N01E35C001M	D	S	1947	99.3	99.7	98.1	99.0	97.8	NM	NM	NM	NM	NM	97.4					5.0
		20N02E15H001M	M	S	1995	110.4	106.9	111.4	112.7	108.8	NM	100.4	96.6	96.8	102.8	99.7				-3.1	44.4
		20N02E15H002M	M	S	1995	129.6	128.1	131.0	144.1	129.1	NM	116.8	115.3	116.3	121.1	117.0				-4.1	27.2
		20N02E16P001M	I	U	1990	108.2	107.5	NM	109.2	112.7	111.6	109.0	105.0	107.3	110.9	109.1				-1.8	22.7
		20N02E28N001M	D	S/I	1947	114.4	115.2	117.9	118.5	117.5	117.2	116.8	117.5	117.5	117.3	117.0				-0.3	6.4
		21N01W23J001M	I	S	1941	107.6	107.2	107.2	108.1	106.0	103.9	103.7	103.0	103.7	105.0	104.3	108.5	105.4	-4.2	-0.7	17.1
		21N01W35K002M	I	S/I	1994	97.5	97.7	97.8	98.8	96.7	95.4	96.4	96.0	96.7	97.2	96.9	97.5	95.5	-0.5	-0.3	17.5
		20N01E18L001M	M	D	2000	99.4	99.3	100.7	101.0	97.1	95.5	95.0	90.7	96.0	104.5	96.4	99.4	94.1	-3.1	-8.1	11.0
		20N01E18L002M	M	I	2001	99.0	99.5	99.8	100.3	97.9	97.3	97.5	94.9	97.7	98.7	98.0	99.3	96.3	-1.3	-0.7	9.4
		20N01E18L003M	M	S	2001	101.3	102.0	102.4	102.9	100.7	100.4	100.2	99.3	101.0	101.2	100.9	101.2	98.5	-0.4	-0.4	6.5
		20N01W04J001M	I	S	2008	81.18	80.98	81.28	81.58	80.98	80.98	80.58	81.0	81.1	81.6	81.3	i	i		-0.3	21.1
		20N01W11N002M	I	S	2008	93.17	92.97	92.47	93.77	93.27	92.17	93.27	91.7	92.2	92.7	92.3	i	i		-0.4	15.1
		21N01W35K002M	I	S/I	1994	97.5	97.7	97.8	98.8	96.7	95.4	96.4	96.0	96.7	97.2	96.9	97.5	95.5	-0.5	-0.3	17.5
		21N01W11A001M	M	D	2010				112.4	110.0	105.8	105.6	104.0	106.6	111.1	108.7	j	j		-2.4	20.6
		21N01W11A002M	M	S	2010				114.8	113.4	113.2	112.8	113.3	113.4	113.4	113.2	j	j		-0.2	16.1
		21N01W11A003M	M	S	2010				114.4	113.8	113.7	113.4	114.1	114.1	115.3	114.8	j	j		-0.5	14.5
		21N01W13J001M	M	D	2012					105.9	103.1	102.0	98.6	101.3	103.9	102.7	j	j		-1.2	24.9
		21N01W13J002M	M	I	2012					107.0	104.7	102.3	100.0	102.5	103.4	103.5	j	j		0.0	24.2
		21N01W13J003M	M	I	2012					107.7	105.7	103.4	101.1	103.2	103.8	104.1	j	j		0.3	23.6
		21N01W24B001M	M	D	1995	106.1	105.7	107.2	106.9	103.7	100.7	99.0	97.1	99.5	103.3	100.1	109.1	100.3	-9.0	-3.2	27.0
		22N01E29R001M	I	I	1947	118.1	119.3	123.0	127.4	118.3	115.9	90.2	110.1	113.4	121.9	118.0	118.6	109.4	-0.6	-3.9	45.7
		22N01E32E004M	D	S	1992	113.4	114.5	118.0	121.5	113.6	110.5	104.6	106.6	108.8	117.0	112.5	111.5	90.1	1.0	-4.5	38.4
WYANDOTTE CREEK	Wyandotte Creek Oroville	CWS-01	M&I	U	1978	101.0	132.0	131.0	131.0	124.0	130.0	120.0	134.0	134.0	124.0	129.0	82.0	31.0	47.0	5.0	31.0
		CWS-02	M&I	U	1978	146.0	143.0	146.0	148.0	146.0	144.0	148.0	140.0	140.0	148.0	149.0	98.0	43.0	51.0	1.0	29.0
		CWS-03	M&I	U	1978	163.0	165.0	164.0	164.0	161.0	163.0	149.0	165.0	165.0	161.0	163.0	123.0	78.0	40.0	2.0	32.0
		19N03E16Q001M	D	S	2000	137.4	138.0	138.4	139.3	138.8	137.6	139.3	139.4	140.0	NM	138.9	136.3	133.0	2.6		40.4
	Wyandotte Creek south	17N03E03D001M	I	S	1947	71.5	70.5	72.3	73.2	72.6	71.4	69.6	70.3	71.5	73.9	72.7	68.4	66.9	4.3	-1.2	24.6
		17N04E09N002M	I	S/I	2001	69.9	66.0	64.4	72.5	NM	66.7	53.6	52.4	53.7	65.2	66.7	69.1	60.3	-2.4	1.5	35.6
		17N04E22B001M	D	S	1976	88.4	85.4	95.1	100.4	98.2	95.7	84.3	93.2	94.8	NM	NM	81.3	76.3			NM
		19N04E31F001M	D	S	2001	122.1	123.2	122.5	123.9	120.3	108.0	121.1	120.8	121.6	124.0	122.6	120.0	114.6	2.6	-1.4	136.7

Note: Red font indicates Questionable Measurement (QM), Orange highlight is Alert Stage 1, Red higlight is Alert Stage 2

* Indicates sub-inventory unit corresponding to an Irrigation District primarily served by surface water

** Richvale and Western Canal use the Specific Depth Method which establishes alert levels for spring only (per Chapter 33A)

a 18N01E35L001M monitoring well installed in 2005. Not yet enough data to establish alert levels

b 17N01E24A03-6 multi-completion well installed in 2007. Not yet enough data to establish alert levels

c 21N03E29J03 added to DWR monitoring network in 2007

d 20N02E08H03 added to DWR monitoring network in 2008

e 21N02E26E03-6 multi-completion monitoring well installed 2007

f 22N01E35E001, 22N02E30C002 and 20N01E02H003M added to the network in 2005, 2002, and 2001, respectively.

g 21N01E13L02-04 installed in 2012 and 21N02E18C01-03 in 2010

h 21N02E18C01-03 installed in 2010

i 20N01W04J001 and 20N01W11N002 first measured in 2008

j 21N01W11A01-03 and 21N01W13J01-03 installed in 2010 and 2012, respectively.

k 23N01W25G01 added to DWR monitoring network in 2007, 23N01W28M02-5 and 23N01W31M01-4 multi-completion monitoring wells installed 2008, and 23N01W03H02-4 installed 2012

l CWS 01b replaced CWS 01 (unk. date) and does not have a BMO established

Depth Category

S- Shallow: indicates total well depth or screening interval is less than 200 feet below ground surface

I- Intermediate: total well depth or screening interval is 200-600 feet

S/I- Shallow/Intermediate: screened interval spans portions of the shallow and intermediate depth intervals

D- Deep: total well depth or screening interval is greater than 600 feet

Alert Stage Count

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Alert 1	0	0	0	0	0	0	0	0	0	0	23
Alert 2	0	0	0	0	0	0	0	0	0	0	13
Total Measured	0	0	0	0	0	0	0	0	0	0	36

Well Type
D-Domestic, I-Irrigation
M-Monitoring, M/I-Municipal and Industrial
Well Depth
S-Shallow, I-Intermediate
D-Deep

Groundwater Status Report

Appendix F

DWR Groundwater Level Contour and Change Maps

Available online: https://water.ca.gov/Programs/Groundwater-Management/Data-and-Tools

NOTES

Note 1: The groundwater level measurements that were used in generating the contours were taken by the Department of Water Resources and Local Cooperators between the dates of March 5th to April 17th, 2018.

Note 2: Groundwater elevations are based on national geodetic vertical datum 1988 (NGVD 88).

Note 3: Groundwater contours are based on groundwater level measurements taken from wells constructed that have screened intervals and well depths that are generally greater than 100 ft and less than 450 ft. This portion of the aquifer supplies more than 70% of all domestic, agriculture, and municipal wells.

Note 4: Groundwater elevations are based on the actual measured level of the hydrostatic level (piezometric surface) of the water at individual well locations. Contours are groundwater elevation estimates of the piezometric surface between wells. The accuracy of the estimated contour is directly related to the spacing and the distribution of nearby monitoring wells, the similarity of nearby monitoring well construction, and the local changes or similarities in aquifer characteristics.

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NORTHERN SACRAMENTO VALLEY GROUNDWATER ELEVATION MAP

Spring 2018

100 to 450 ft Well Depths

(Well depths greater than 100 ft and less than 450 ft deep bgs)

PLATE 1

Date: July 2018

BY: G. Gordon, PG 7811

Redding Basin

Subbasin Name	GWE Maximum Increase (ft)	GWE Maximum Decrease (ft)	GWE Average Change (ft)	Count
Anderson	NA	-7.9	-3.4	13
Bowman	0.1	-8.6	-2.2	6
Enterprise	NA	-5.5	-3.6	3
Millville	0.9	-5.8	-2.9	4
Rosewood	2.1	-5.6	-1.8	2
South Battle Creek	NA	NA	NA	0
Summary	2.1	-8.6	-2.8	28

NOTES

Note 1: A positive number indicates that groundwater elevations were higher in the current year than the previous year. A negative number indicates that groundwater elevations were lower in the current year than in the previous year.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths of 100 to 450 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations.Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

Northern Sacramento Basin

Subbasin Name	GWE Maximum Increase (ft)	GWE Maximum Decrease (ft)	GWE Average Change (ft)	Count
Antelope	NA	-14.0	-9.4	5
Bend	NA	-9.2	-9.2	1
Colusa	8.5	-22.4	-5.3	87
Corning	1.4	-17.0	-7.4	37
Dye Creek	NA	-0.3	-0.2	2
East Butte	2.3	-4.9	-0.8	19
Los Molinos	NA	-8.4	-5.2	3
Red Bluff	0.0	-11.6	-4.3	16
Sutter	2.0	-13.0	-4.9	16
Vina	NA	-11.3	-5.4	29
West Butte	NA	-9.6	-5.4	15
Wyandotte Creek	12.1	-4.9	2.9	4
Summary	12.1	-22.4	-4.6	234

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NORTHERN SACRAMENTO VALLEY CHANGE IN GROUNDWATER ELEVATION MAP SPRING 2017 TO SPRING 2018

100 to 450 ft WELL DEPTHS

(Well depths greater than 100 ft and less than 450 ft deep bgs)

PLATE 1C-A

Date: September 2018

BY: G. Gordon, PG 7811

http://www.water.ca.gov/groundwater/data_and_monitoring/northern_region/GroundwaterLevel/gw_level_monitoring.cfm

Redding Basin

Subbasin Name	GWE Maximum Increase (ft)	GWE Maximum Decrease (ft)	GWE Average Change (ft)	Count
Anderson	0.2	-7.5	-2.5	10
Bowman	NA	-10.2	-3.0	5
Enterprise	NA	-8.4	-4.7	3
Millville	NA	-6.9	-5.8	2
Rosewood	NA	-9.1	-6.8	2
South Battle Creek	NA	NA	NA	0
Summary	0.2	-10.2	-4.6	22

NOTES

Note 1: A positive number indicates that groundwater elevations were higher in the 2011. A negative number indicates that groundwater elevations were lower in the current year than in 2011.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths of 100 to 450 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations.Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

Northern Sacramento Basin Groundwater Subbasins

Subbasin Name	GWE Maximum Increase (ft)	GWE Maximum Decrease (ft)	GWE Average Change (ft)	Count
Antelope	NA	-5.7	-4.0	3
Bend	NA	NA	NA	0
Colusa	5.7	-46.9	-11.9	87
Corning	NA	-24.5	-14.1	30
Dye Creek	0.2	NA	0.2	1
East Butte	1.9	-9.6	-2.9	20
Los Molinos	NA	-4.7	-4.3	3
Red Bluff	NA	-19.2	-7.7	12
Sutter	4.7	-6.5	-2.9	7
Vina	NA	-11.9	-5.9	28
West Butte	NA	-14.1	-5.8	14
Wyandotte Creek	12.1	-10.3	-0.3	4
Summary	12.1	-46.9	-5.4	209

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NORTHERN SACRAMENTO VALLEY CHANGE IN GROUNDWATER ELEVATION MAP SPRING 2011 TO SPRING 2018

100 to 450 ft WELL DEPTHS

(Well depths greater than 100 ft and less than 450 ft deep bgs)

PLATE 1C-D

Date: August 2018

BY: G. Gordon, PG 7811

http://www.water.ca.gov/groundwater/data_and_monitoring/northern_region/GroundwaterLevel/gw_level_monitoring.cfm

Redding Basin

Subbasin Name	GWE Maximum Increase (ft)	GWE Maximum Decrease (ft)	GWE Average Change (ft)	Count
Anderson	3.0	-3.6	-0.4	11
Bowman	NA	-1.3	-0.7	4
Enterprise	2.2	-0.9	0.5	3
Millville	NA	-4.5	-1.5	4
Rosewood	NA	-5.1	-5.1	1
South Battle Creek	NA	NA	NA	0
Summary	3.0	-5.1	-1.4	23

NOTES

Note 1: A positive number indicates that groundwater elevations were higher in the current year than the previous year. A negative number indicates that groundwater elevations were lower in the current year than in the previous year.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths of 100 to 450 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations. Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

Northern Sacramento Basin

Subbasin Name	GWE Maximum Increase (ft)	GWE Maximum Decrease (ft)	GWE Average Change (ft)	Count
Antelope	NA	-8.2	-6.0	4
Bend	NA	NA	NA	0
Colusa	14.0	-24.1	-3.1	63
Corning	2.4	-10.9	-4.6	38
Dye Creek	NA	-0.1	-0.1	1
East Butte	1.0	-9.7	-2.3	17
Los Molinos	NA	-2.8	-2.8	1
Red Bluff	0.6	-19.1	-3.8	11
Sutter	NA	-12.2	-6.4	2
Vina	1.1	-19.7	-4.5	24
West Butte	5.6	-13.7	-2.2	16
Wyandotte Creek	NA	-1.9	-1.4	3
Summary	14.0	-24.1	-3.4	180

STATE OF CALIFORNIA
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NORTHERN SACRAMENTO VALLEY CHANGE IN GROUNDWATER ELEVATION MAP SUMMER 2017 TO SUMMER 2018

100 to 450 ft WELL DEPTHS

(Well depths greater than 100 ft and less than 450 ft deep bgs)

PLATE 1C-B

Date: September 2018

BY: G. Gordon, PG 7811

http://www.water.ca.gov/groundwater/data_and_monitoring/northern_region/GroundwaterLevel/gw_level_monitoring.cfm

Redding Basin

Subbasin Name	GWE Maximum Increase (ft)	GWE Maximum Decrease (ft)	GWE Average Change (ft)	Count
Anderson	1.6	-6.0	-1.4	11
Bowman	0.9	-2.1	-0.7	4
Enterprise	NA	-14.5	-6.2	3
Millville	NA	NA	NA	0
Rosewood	NA	-4.5	-2.8	2
South Battle Creek	NA	NA	NA	0
Summary	1.6	-14.5	-2.8	20

NOTES

Note 1: A positive number indicates that groundwater elevations were higher in the 2011. A negative number indicates that groundwater elevations were lower in the current year than in 2011.

Note 2: Statistics are based on the number of wells monitored within each subbasin.

Note 3: This map may not use all the color ranges shown in table above. Some wells may not be visible on map due to the close proximity to each other.

Note 4: Groundwater level changes are based on measurements taken from wells with depths of 100 to 450 ft. Measurements are taken during similar time periods each year.

Note 5: Change in groundwater elevations are based on the actual measured levels of the hydrostatic level (piezometric surface) of the groundwater at individual well locations.Contoured color ramping is interpolated from these measurements and should be considered approximate. The accuracy of the estimated contour is directly related to the timing of the measurements, spacing and the distribution of nearby monitoring wells, well construction, and aquifer characteristics.

Note 6: GW - Groundwater
GWE - Groundwater Elevation
bgs - below ground surface

Northern Sacramento Basin Groundwater Subbasins

Subbasin Name	GWE Maximum Increase (ft)	GWE Maximum Decrease (ft)	GWE Average Change (ft)	Count
Antelope	NA	-9.6	-7.5	3
Bend	NA	NA	NA	0
Colusa	22.4	-47.2	-10.9	64
Corning	NA	-29.1	-14.9	26
Dye Creek	0.3	NA	0.3	1
East Butte	1.1	-20.8	-5.3	17
Los Molinos	NA	-6.9	-6.9	1
Red Bluff	4.9	-18.6	-7.2	11
Sutter	NA	-13.0	-4.4	6
Vina	NA	-24.2	-9.2	23
West Butte	3.5	-18.0	-4.0	14
Wyandotte Creek	0.7	-9.0	-3.0	5
Summary	22.4	-47.2	-6.6	171

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NORTHERN SACRAMENTO VALLEY CHANGE IN GROUNDWATER ELEVATION MAP SUMMER 2011 TO SUMMER 2018

100 to 450 ft WELL DEPTHS

(Well depths greater than 100 ft and less than 450 ft deep bgs)

PLATE 2C-D

Date: September 2018

BY: G. Gordon, PG 7811

http://www.water.ca.gov/groundwater/data_and_monitoring/northern_region/GroundwaterLevel/gw_level_monitoring.cfm