GROUNDWATER STATUS REPORT

Prepared for

BUTTE COUNTY WATER COMMISSION

by

BUTTE BASIN WATER USERS ASSOCIATION

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FOREWORD

In November 1996, the voters in Butte County voted in "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 that the Butte Basin Water Users Association prepare a groundwater status report based upon the data gathered and analyzed pursuant to Section 3.02 – "Groundwater Monitoring". The Groundwater Status Report is in response to this requirement. This report was prepared by the Butte County Department of Water and Resource Conservation with assistance from Department of Water Resources (DWR), Northern District.

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. The purpose of this report is to summarize groundwater level and land subsidence data collected by Butte County and DWR up to and through October 2008. The report presents locations of wells and extensometers, information related to groundwater level trends, historical precipitation information and hydrographs depicting groundwater levels over time. This report is intended to serve as an accompanying document to the annual Basin Management Objectives (BMO). Together, these documents will provide a comprehensive reference for understanding groundwater level trends, and associated aquifer conditions in Butte County.

All past versions of this report and the BMO document are available for review at the Butte County Department of Water and Resource Conservation website at http://www.buttecounty.net/waterandresource/ .

Michael Pembroke, Chairman
Butte Basin Water Users Association

February 20, 2009

INTRODUCTION

This report is a compilation of information related to the basin monitoring activities in Butte County and includes groundwater hydrographs from "key wells" within each hydrologic sub-area. Groundwater hydrographs for the other wells monitored in the County are available through the Butte County BMO Information Center website at http://gis.buttecounty.net/bmoic3/GIS/Default.asp?loadfile=map.asp&county=. This report is meant to be used as an accompanying document to the annual Butte County Basin Management Objectives and other technical documents prepared for the Department of Water and Resource Conservation for the continued management of the groundwater in Butte County. These documents are available for viewing or download from the Department's website. http://www.buttecounty.net/waterandresource/

This report was prepared by the Department of Water and Resource Conservation with assistance from the Department of Water Resources, Northern District Groundwater Section under the request for local assistance by the Butte Basin Water Users Association (BBWUA). The document was reviewed and approved by both the BBWUA and Water Commission Technical Advisory Committees prior to circulation. Much of the background material for this report consists of updated excerpts taken from the 2005 Butte County Groundwater Inventory Analysis report prepared by the Department of Water Resources, Northern District. This was done to achieve a level of consistency between the findings of the BBWUA, and those of the Butte County Water Inventory and Analysis report which was prepared cooperatively by Butte County Department of Water and Resource Conservation, Camp, Dresser and McKee, Inc., and the Department of Water Resources in March 2001.

SUMMARY

California is experiencing drought conditions after two years of low precipitation, very little snowmelt runoff, a historically dry spring in 2008 and the largest court-ordered restrictions on water deliveries through state and federal Delta pumps to protect the threatened Delta smelt. Those rules were expected to reduce water deliveries by as much as 30 percent, one of the largest court-ordered cutbacks in the history of the projects. California had the fourth driest June and driest March-June in the 1895-2008 record[1]. On June 4, 2008 the Governor formally declared a statewide drought and took administrative actions to promote conservation, promote moving water to critical areas, increase fire protection and assess impacts to communities and agriculture. Statewide, 21 agencies have implemented some form of mandatory water rationing, and 61 agencies around the state have implemented some form of voluntary conservation program. Although Butte County may be experiencing lesser effects of the drought than other parts of the state, the situation warrants consideration of early action measures consistent with the Drought Preparedness and Mitigation Plan, as continued drought conditions will certainly pose imminent risk.

[1] http://www.ncdc.noaa.gov/oa/climate/research/2008/jun/us-drought.html

The Butte County Drought Preparedness and Mitigation Plan was adopted by the Board of Supervisors in 2005 by way of Resolution 04-200. A key element of the Plan was the creation of the Drought Task Force (DTF). The DTF is chaired by the Director of the Department of Water and Resource Conservation and includes one representative from the Butte County Departments of Emergency Services, Public Works, Administration, Agricultural Commissioner, Environmental Health as well as the Chair of the Water Commission. In addition to those Departments, the DTF includes representatives from the Butte Basin Water User's Association, the UC Cooperative Extension/Butte County Farm Advisor, California Department of Forestry and Fire Protection/Butte County Fire, Natural Resource Conservation Service and the Butte County Resource Conservation District.

The DTF met throughout 2008 to review the most current groundwater monitoring data, reservoir levels, and to assess the overall drought impacts at the state and local levels. The documents presented to the group are posted on the Department website http://www.buttecounty.net/waterandresource/drought_info.htm. In 2008, the snow-pack and precipitation began to meet normal annual levels. However, the effect of a historic dry spring severely reduced the annual runoff. Lake Oroville experienced its lowest carryover volume since 1977, and preliminary reports indicate that the 2009 water year will likely be dry and, in order for reservoir levels to recover, the state would need to receive 95% of average precipitation next year.

The precipitation measured at the Western Canal Water District Climatological Observation Station for the 2008 water year was only slightly greater than the previous year. Since 1960, only 1977, 1972, 1994, 2007, 1990 and 1976 had less precipitation. The total historical average for this station (beginning in 1921) is 20.54 inches. Over the past ten years the average annual precipitation is 20.38 inches. The total precipitation for the 2008 water year was 13.08 inches.

A summary of the status of Butte County groundwater, based upon the 2008 groundwater level monitoring is provided below.

- Review of groundwater level trends indicates:
    1) Three key wells, one each in the Biggs-West Gridley Sub-Area, Richvale Sub-Area, and Western Canal Sub-Area, show no declining trend.
    2) Ten wells along the eastern edge of the valley portion of the county and within the Chico Urban Area show what appears to be declining water levels ranging from less than 5 feet to more than 20 feet, and with the below average precipitation during water years 2007 and 2008 they continued to decline.
    3) Areas east of Durham (well 21N02E26F001M) and within Chico (well 22N02E18N001M), experienced the most significant declining trends, with groundwater levels averaging approximately 20 feet below the previous highs recorded in the mid-1980s.

- The Butte County Department of Water and Resource Conservation (DW&RC) sampled wells within the county during the month of August for the groundwater quality trend monitoring program. This year we added wells in the Thermalito and Llano Seco sub-inventory units, bringing the total number of wells in the monitoring grid to thirteen. As required by Chapter 33A, the parameters monitored were temperature, pH, Electrical Conductivity. Total Dissolved Solids were also recorded. These parameters encompass the basic characteristics to consider when evaluating water for evidence of saline intrusion.

  This was the seventh season of data collection, and at this time we do not have sufficient information to make valid assumptions regarding any trends in water quality changes. Overall, the results of the water quality sampling indicate that groundwater in the basin is of high-quality, free of saline intrusion and is in good health.

- Subsidence is monitored by repeated land surveys and by use of scientific instruments called extensometers. These instruments are capable of detecting changes in land surface elevation to about 1/100th of an inch. DWR Northern District has installed and operates seven extensometers in the northern Sacramento Valley: five in Butte County and two in Glenn County. No land subsidence was detected in Butte County from an evaluation of the extensometer records in the Western Canal, M&T, California Water Service, Richvale, and Biggs-West Gridley sub-areas.

Monitoring Frequency and Period of Record

According to Chapter 33A-9 of the Butte County Code, at a minimum, groundwater elevations shall be monitored four (4) times during the year: one measurement prior to the irrigation season in March, two measurements during peak groundwater use in July and August, and one measurement following irrigation season in October. DWR and the Department of Water and Resource Conservation split the monitoring duties, with DWR taking the March and October measurements and DW&RC taking the July and August measurements. Chapter 33A-9 further states that the frequency for groundwater quality monitoring shall be at a minimum of once a year during peak groundwater use (July or August) for the constituents of temperature, pH and electrical conductivity. Monitoring frequency for land subsidence shall be conducted on a continuous basis through the use of extensometers.

Groundwater Level Monitoring

Groundwater level monitoring in the Sacramento Valley portion of Butte County is currently being conducted by several private and public agencies. Historically, the Department of Water Resources has maintained the most comprehensive, long-term groundwater level monitoring grid, with approximately 212 different wells monitored over the last 50 years in the Sacramento Valley portion of Butte County. Within this period of time, the annual size of the monitoring grid has fluctuated from as few as 50 wells, to as many as 180 wells, depending upon the activity of special studies in the area. Until 1989, the majority of these wells were measured semi-annually, during the spring and fall. Beginning in 1990, the frequency of groundwater level monitoring was increased to monthly, before returning to a semi-annual measurement in 1995. In 1997, the Butte County Department of Water and Resource Conservation, in cooperation with the Department of Water Resources, began to expand the number and frequency of groundwater level monitoring in the valley portion of Butte County. Currently 107 wells are monitored in Butte County. These wells consist of a mixture of domestic and irrigation wells, along with dedicated observation wells. Two new multi-completion observation wells were installed in Butte County, one in the Butte Sink and one in the Pentz sub-areas, during 2007, and in 2008, two multi-completion wells were installed in the Vina Inventory Unit. Data collected at these new wells is available from both the DWR and DW&RC websites. Approximately 43 of the 115 wells are equipped with data loggers to continuously monitor and record changes in groundwater levels. The remaining wells are measured by hand four times per-year, during January, March, August and October. The locations of wells monitored in Butte County are shown in Appendix A The DWR Northern District maintains an electronic database of groundwater level measurements for Northern California. The database contains over 100,000 individual groundwater level measurements, some dating back to the early 1930's. Butte County also hosts an online groundwater management tool known as the BMOIC, or Basin Management Objective Center The data generated on either of these websites can be printed in varying formats. You can access the DWR site at: http://wdl.water.ca.gov/. The Butte County site may be viewed from the Departments' main site, or by going directly to http://gis.buttecounty.net/bmoic3/GIS/Default.asp?loadfile=map.asp&county=.

In addition to the groundwater level monitoring conducted by Butte County and the Department of Water Resources, California Water Service Company currently measures monthly groundwater levels in approximately 60 municipal groundwater supply wells in the Chico Urban area. California Water Service wells are typically deep wells that draw from the Tuscan Formation aquifer system. The US Bureau of Reclamation and US Geological Survey are not currently measuring groundwater levels in Butte County, but both agencies have monitored wells in the past.

Groundwater Quality Trend Monitoring

The Butte County Groundwater Quality Trend Monitoring Program, in place since 2001, has annually recorded measurements for temperature, pH, and EC on ten wells throughout the county. The County's groundwater monitoring program is a work in progress and requires expansion to adequately cover the entire basin geographically prior to considering additional constituents. The data collected each July/August at the peak of irrigation season is building a foundation that serves to establish baseline levels across the county so that any future changes in water quality can be detected and further investigation and monitoring can subsequently be developed.

Land Subsidence

The locations of the five extensometers that measure land subsidence within the County are shown on the 2008 monitoring network map in Appendix A. These extensometers were installed during 1999 and 2003, and continuously monitor for subsidence. Records from these extensometers are available by contacting the Department of Water Resources Northern District or on the Northern District web page (http://www.nd.water.ca.gov/Data/Extensometers/index.cfm). To date, no land subsidence has been recorded in Butte County.

The DWR is engaged in an ongoing program with northern Sacramento Valley counties to improve data collection and understanding of the aquifer system. The Department of Water Resources (DWR) and participating local, state, and federal agencies worked through the months of April and May 2008 to establish a Global Positioning System (GPS) geodetic control network in the Sacramento Valley. The Sacramento Valley GPS network incorporates existing GPS networks and monuments to create a regional network that covers part or all of Colusa, Sutter, Glenn, Butte, Yolo, Yuba, Tehama, and Placer Counties.

Over the past decade, GPS surveying techniques have proven to be so efficient and accurate that they are now routinely used in place of classical line-of-sight surveying methods for establishing horizontal control. The monitoring of land surface elevations will allow for measurement of any potential land subsidence. Since subsidence tends to occur in small increments during dry years with increased groundwater pumping,

the network will be designed and the baseline GPS survey will be conducted in accordance with National Geodetic Survey standards for 2 centimeter (cm) accuracy.

WELL NUMBERING SYSTEMS

Locations of Butte County monitoring wells, including continuously monitored wells and extensometers, are shown in Appendix A. The well locations are approximate, but are estimated to be within 500 feet. The monitoring wells are numbered using the State Well Numbering System. The State Well Numbering System identifies each well by its location according to the township, range, section, and tract system. The figure below illustrates how a State Well Number (SWN) is assigned.

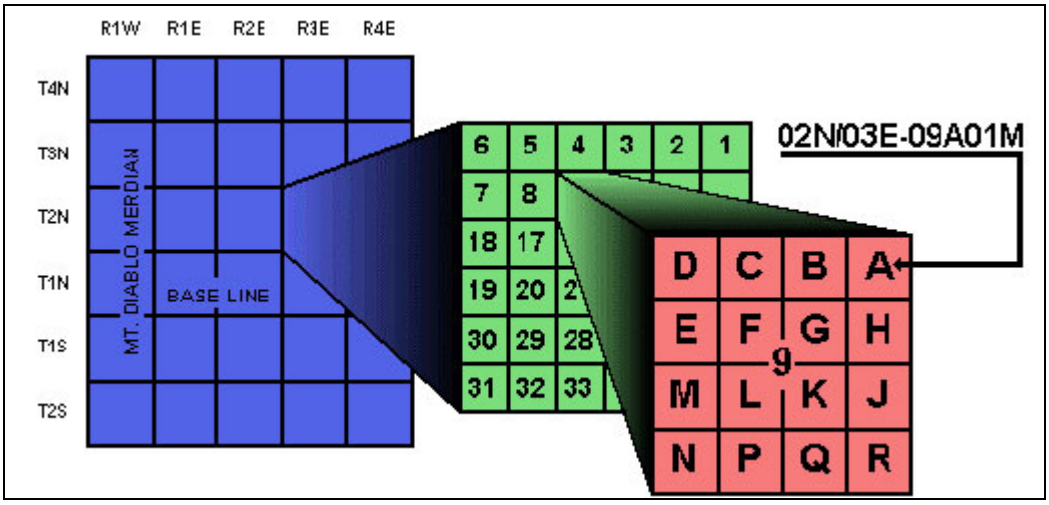

Figure A – State Well Number System Schematic

HYDROLOGIC CONDITIONS

Water agencies such as the Department of Water Resources or the US Geological Survey often report hydrologic data on a water year basis, or the 12-month period from October through September. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. For example, "Water year 2008" means October 1, 2007 through September 30, 2008.

California Water Year 2008 was a critically dry year statewide, and it will take a significantly above average rainfall season to alleviate current drought conditions. For the 8-Station Index, Water Year 2008 was the 15th driest year out of 88 years of record. The Spring of 2008 turned out to be extremely dry. The Water Year 2008 combined March through June total precipitation was only 3.4 inches, the driest on record (since 1921). The 2-year combined total precipitation for Water Years 2007 (37.2 inches) and 2008 (34.9 inches) was 72.1 inches, the ninth driest 2-year period on record.

As of December 31, 2008, statewide hydrologic conditions were as follows: precipitation, 90 percent of average to date; runoff, 40 percent of average to date; and reservoir storage, 70 percent of average for the date. The snowpack was at about 75 percent of its average value for the date. Sacramento River unimpaired runoff observed through December 31, 2008 was about 1.4 million acre-feet (MAF), which is about 44 percent of average. (On December 31, 2007, the observed Sacramento River unimpaired runoff through that date was about 1.5 MAF or about 47 percent of average.) For the month of December 2008 as a whole, rainfall for was generally below normal in the northern two-thirds of California and wetter than normal in the southern one-third. To make the drought conditions very clear, it was the lowest end-of-December storage for the Lake Oroville reservoir, at 981 Thousand Acre Feet, beating 1990's 987 TAF.[2]

The average of eight precipitation stations serves as a wetness index for the Sacramento River hydrologic region. It 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 our water supply. The eight stations are: Blue Canyon, Brush Creek Ranger Station, Mineral, Mount Shasta City, Pacific House, Quincy Ranger Station, Shasta Dam, and Sierraville Ranger Station. The 8-Station Index recorded 34.9" of rain this water year. Compared to the normal annual rainfall of approximately 50.0", Water Year 2008 is the 15th driest year out of 88 years of record. Spring 2008 was extremely dry with only 3.5" of rainfall between March and September, making it the driest seven-month period on California record.[3] [4]

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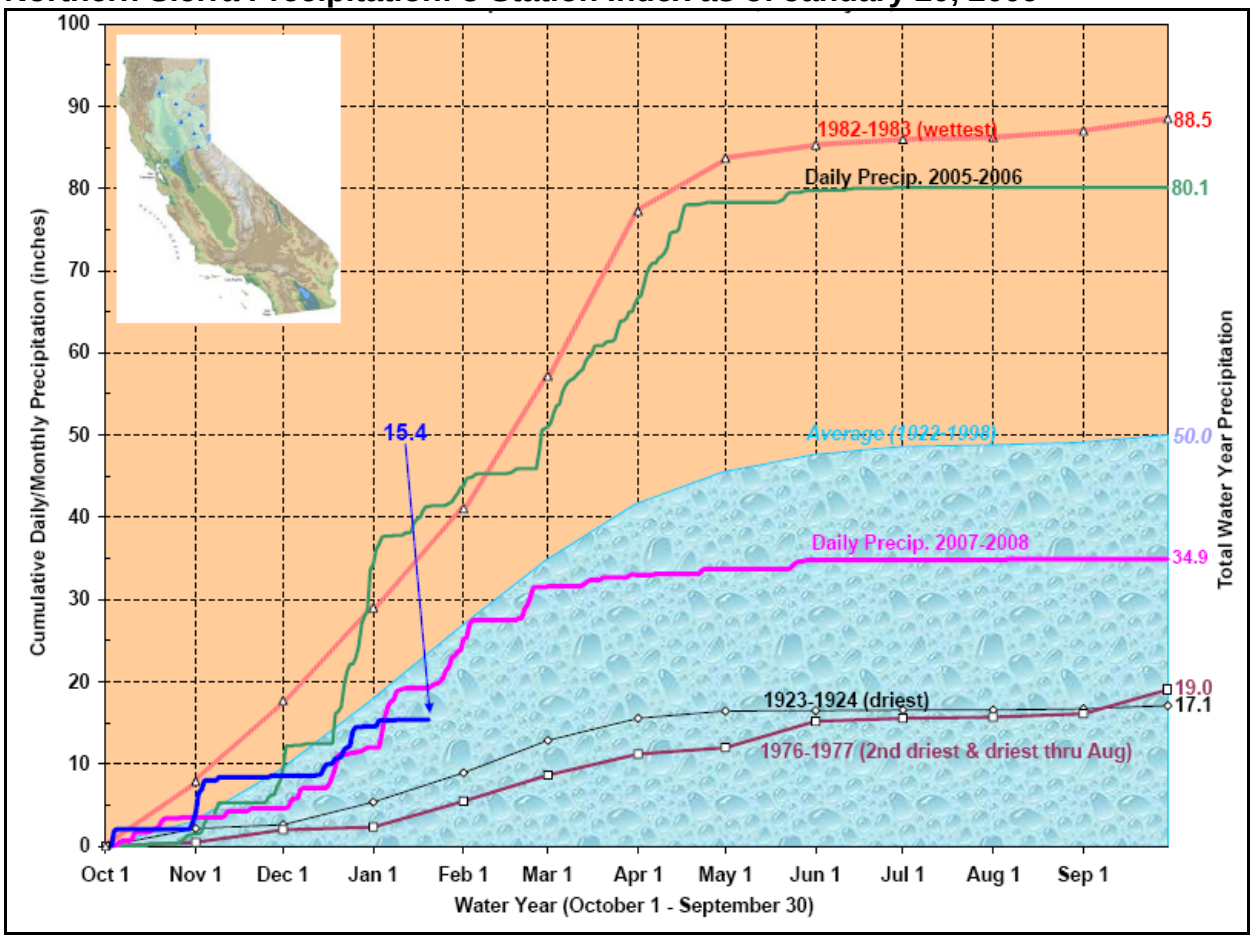
[2] http://www.water.ca.gov/floodmgmt/hafoo/hb/csm/docs/Monthly_Weather_Summary_122008.pdf

[3] http://cdec.water.ca.gov/cgi-progs/snow/PLOT_ESI

[4] http://www.water.ca.gov/floodmgmt/hafoo/hb/csm/docs/Monthly_Weather_Summary_102008.pdf
http://cdec.water.ca.gov/cgi-progs/snow/PLOT_ESI

On January 8, 2009, the Northern Sierra 8-station Precipitation Index had accumulated a seasonal total of 15.3 inches, which is 77% of the seasonal average to date and 31% of an average Water Year (50.0 inches). During December 2008, the 8-Station Index received 6.0 inches, about 71% of average. Last year at this time, the 8-Station Index had 17.8 inches for the seasonal total. January started out dry, with approximately two-thirds of the rainy season to go.

Northern Sierra Precipitation: 8-Station Index as of January 20, 2009



Water year classification systems provide a means to assess the amount of water originating in a basin. Because water year classification systems are useful in water planning and management, they 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 as part of SWRCB's Bay-Delta regulatory activities. 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 water year types. The Sacramento Valley 40-30-30 Index is computed as a weighted average of the current water year's

April-July unimpaired runoff forecast (40 percent), the current water year's October-March unimpaired runoff forecast (30 percent), and the previous water year's index (30 percent). A cap of 10 maf is put on the previous year's index to account for required flood control reservoir releases during wet years. Unimpaired runoff (calculated in the 40-30-30 Index as the sum of Sacramento River flow above Bend Bridge near Red Bluff, Feather River inflow to Oroville, Yuba River flow at Smartville, and American River inflow to Folsom) is the river production unaltered by water diversions, storage, exports, or imports.

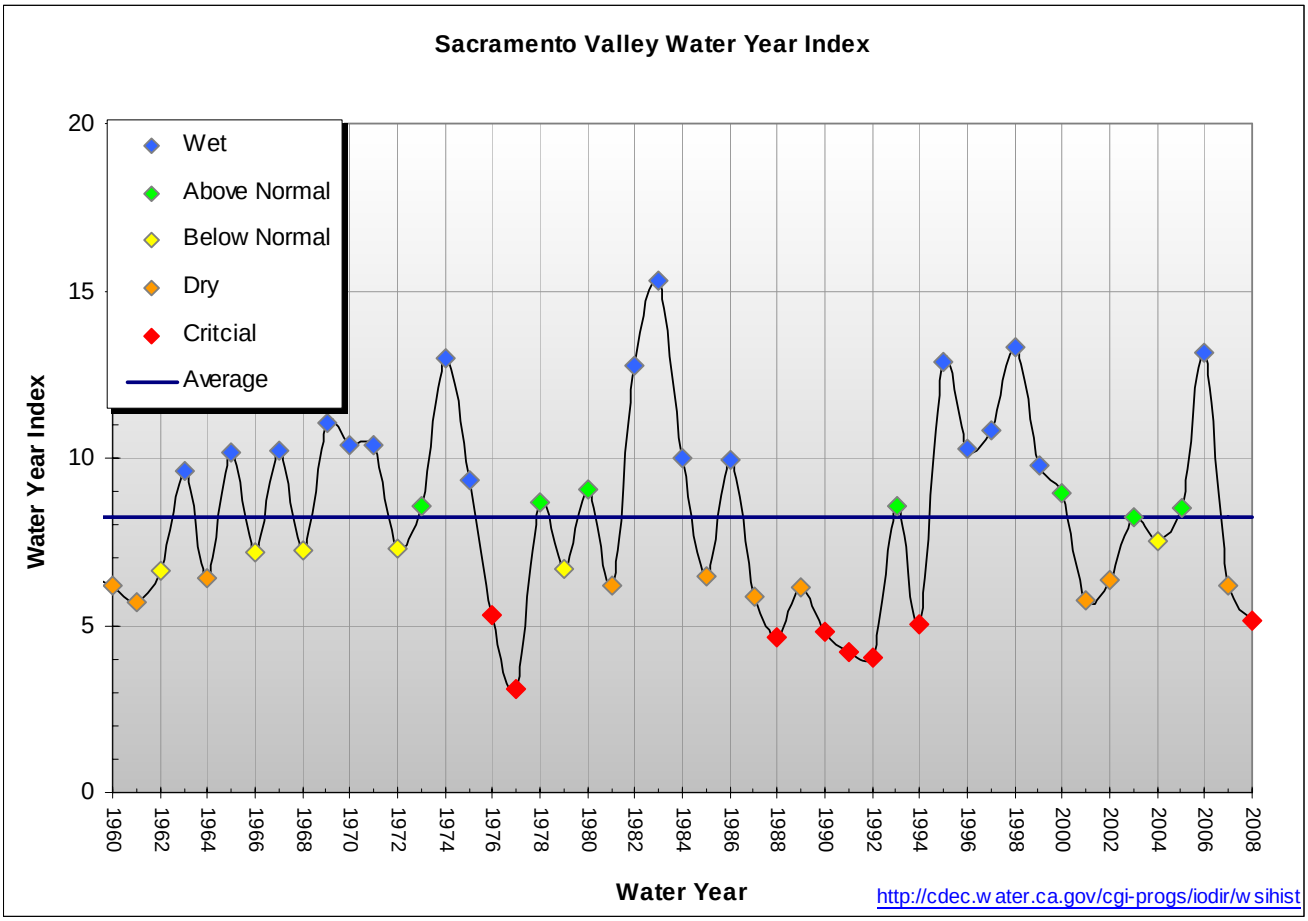
This index is used to determine the Sacramento Valley water year type as implemented in SWRCB D-1641. Year types are set by first of month forecasts beginning in February. Final determination is based on the May 1 50% exceedence forecast.

Sacramento Valley Water Year Hydrologic Classification:

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[5]

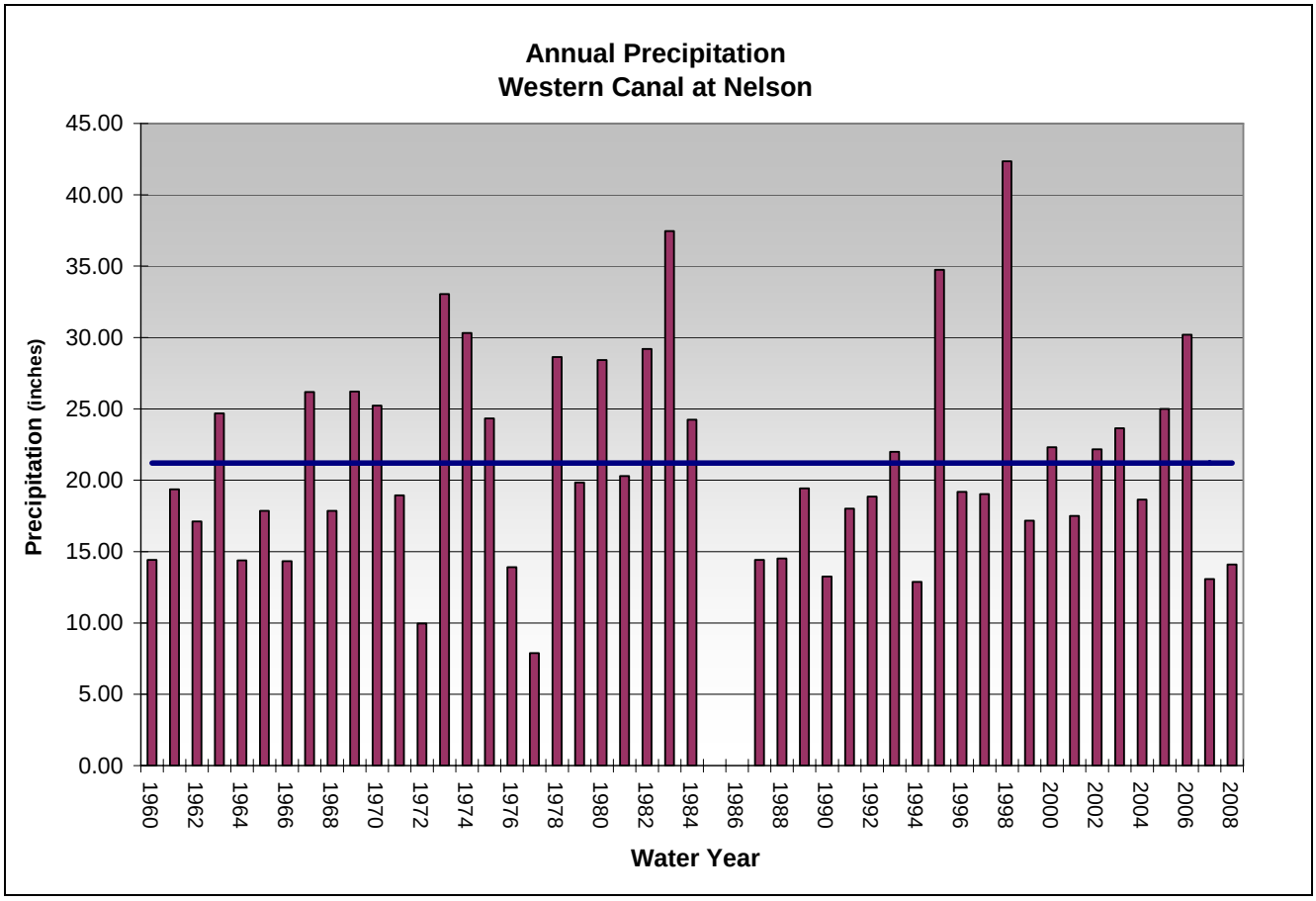
[5] http://watersupplyconditions.water.ca.gov/hydrologic.cfm

The next figure represents forty-nine years of hydrologic classifications for the Sacramento Valley covering the water years of 1960 through 2008.[6]



[6] http://cdec.water.ca.gov/cgi-progs/iodir/wsihist

Precipitation for the water year ending September 30, 2008 at the Western Canal Water District's Climatological Observation Station totaled 14.10 inches, which is 7.11 inches below the 48-year average of 21.21 inches. The figure below represents the total annual precipitation at the Western Canal Station for the 48-year period of water years 1960 through 2008. In the past ten years, five of the years have measured below the 48 year average, and in the 48-year period, over half of the years fall below the average.



Evapotranspiration

What is CIMIS? CIMIS is an acronym for California Irrigation Management Information System, a program unit in the Office of Water Use Efficiency (OWUE), Department of Water Resources (DWR). CIMIS is an Integrated network of over 125 automated active weather stations located throughout California. Hourly, daily and monthly data are available. The CIMIS station located in Butte County is Station # 12 Durham. [7]

ET Overview

Evapotranspiration (ET) is the loss of water to the atmosphere by the combined processes of evaporation (from soil and plant surfaces) and transpiration (through plant tissues). It is an indicator of how much water your crops, lawn, garden, and trees need for healthy growth and productivity.

Accurate estimates of ET are needed in many circumstances. In agriculture for example, estimates of ET are necessary for irrigation system design, irrigation scheduling, water deliveries, and planning field operations.

For ET to take place, the following conditions have to be met. First, water has to be present at the surface and in the soil profile. Second, there must be some form of energy to convert the liquid water into a water vapor. Third, there must be a mechanism to transport the water vapor away from the evaporating surface.

Precipitation and irrigation are the two primary sources of water that plants use. Plant leaves and soil surfaces temporarily retain some part of the water applied to a field. This part is readily available for evaporation. The remaining part infiltrates into the soil where plants extract the infiltrated water through their roots and transport it up to their leaves during photosynthesis, a process by which plants produce glucose (sugar). In addition to water, plants also need carbon dioxide (CO2) and light for photosynthesis. The light comes from the sun and CO2 comes from the atmosphere. In order to take in CO2 from the atmosphere, plants open their stomates, the microscopic pores on plant leaf surfaces. It is during this process that they lose water to the atmosphere. This water loss is known as transpiration.

As mentioned earlier, the conversion of liquid water into water vapor requires large amounts of energy (about 540 Calories per gram of water at a temperature of 100 °C/212 °F). This energy is provided by the sun in the form of solar energy. The solar energy is absorbed by water molecules and converted to latent heat energy, the energy that is tied up in vapor molecules. The water vapor thus produced escapes to the atmosphere because of a vapor pressure gradient between the surface and atmosphere. Once in the atmosphere, it is taken further away from the surface by wind (or other mechanisms), creating more gradient between the evaporating or transpiring surface and the air above it. This process continues as long as the three conditions mentioned above are present.

[7] http://wwwcimis.water.ca.gov/cimis/welcome.jsp

Evapotranspiration is a process that occurs year round through any type of green plant, weeds, lawns, shrubs, or agricultural crops. If we have a normal rainfall year the rainfall between October and about the end of March usually exceeds the ET requirements of growing plants and the soil remains fully moist and able to supply plants water needs without supplemental irrigation. During drought conditions plants use up this soil moisture and additional irrigation may be needed during abnormal times of the year. For example, January 2006 had no recorded rainfall. Many orchards and landscapes needed supplemental irrigation at that time to meet the plants ET requirements once the soil moisture was depleted. Such events put additional demands on our groundwater system at the same time that drought conditions reduce groundwater recharge. The net result is that groundwater levels may decline more significantly during these temporary conditions. Recovery has been demonstrated previously when conditions return to normal.

SURFACE WATER DELIVERIES

Surface water is an important component to aquifer recharge in the Butte Basin. During the 2008 water year 1,073,248 acre-feet of water were delivered to Western Canal Water District and the Joint Water District Board. The 2008 water deliveries were nearly 69,000 acre-feet less than what was delivered in 2007. In the 1991 and 1992 water years, surface water deliveries were curtailed by 25% for Western Canal Water District, and 50% for the Joint Water District Board.

There have been increasingly greater late season water demands since the Rice Straw Burning Reduction Act of 1991 was passed in response to public concern over the effects of agricultural burning. The below numbers indicate a steady increase as local farm owners and managers worked to phase out rice straw burning and turned to winter flooding of rice fields to assist in decomposition of waste rice straw. This winter flooding also has proven an invaluable source of winter habitat for millions of migratory birds and other wetland-dependent species. California duck populations have increased significantly since this new management practice began. In 2008 alone, at least 25,000 acre feet of water were supplied to wildlife refuges that are within the Joint district boundaries. Western Canal and the Joint districts participated in the 2008 Crop Idling Water Transfer Program in order to aid in supplying water to other State Water Project contractors during the drought. The districts made up the transferred water by idling cropland. Western Canal idled 4,516.9 acres of rice totaling 14,905 acre/ft and the Joint districts idled 9,281 acres, or 30,627 acre/ft of water. It is to be noted, however, that these idling programs were not part of the 2009 Drought Water Bank process.

Summarized below are the deliveries in acre-feet to Western Canal Water District and the Joint Water District Board for the water years 1991 to 2008.

Water Year	Western Canal Water District	Joint Water District Board	TOTAL
1991	185,273	344,768	529,915
1992	198,797	349,036	547,631
1993	216,521	515,292	729,827
1994	224,768	586,622	811,377
1995	210,110	568,481	778,598
1996	257,195	615,004	872,187
1997	272,003	658,540	934,214
1998	229,528	590,727	820,248
1999	293,364	690,847	984,248
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

GROUNDWATER LEVEL TRENDS

Groundwater levels typically fluctuate seasonally and from year to year. Seasonal fluctuation of groundwater levels occur in response to recharge and extraction or natural discharge. Precipitation, applied irrigation water, local creeks and rivers, and Thermalito Afterbay all recharge groundwater in Butte County. Levels are usually highest in the spring and lowest during the irrigation season in the summer months.

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 amount of water recharged then groundwater levels will 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 climatic cycles.

The seasonal and long-term changes in groundwater levels are determined using water level measurements in wells included in the monitoring network. This data are typically depicted on hydrographs, which are graphical plots of the water level measurement history. Prior to 1997, data points for each of the hydrographs in Butte

County generally consisted of two measurements per year. Since 1997, four level measurements are recorded each year. The addition of these summer measurements gives the hydrographs the appearance of greater fluctuation.

Described below, by sub-area unit, are groundwater level assessments for key wells. Each sub-area assessment includes a discussion of the land use, the historical trend in groundwater levels, and a 2008 update describing recent trends and pertinent findings. The key wells were chosen as being representative of groundwater level conditions within each sub-area. It should be noted that the sub-areas are consistent with the sub-inventory units used in the 2001 Butte County Water Inventory and Analysis report and the annual BMO document.

When reviewing the hydrographs for the key wells, it is important to note that the solid points indicate a static groundwater level measurement while enlarged, red symbols indicate a measurement that has been qualified as questionable. The Department of Water Resources assigns a numerical code to all questionable groundwater level measurements in an effort to help increase the accuracy of data analysis. Questionable measurement codes are used to differentiate between static versus pumping groundwater level measurements, identify if nearby wells are in operation during the measurement, or note that other conditions were present that could impact the accuracy of the measurement. A questionable measurement code key is shown on each hydrograph.

The accuracy of the groundwater level measurement is 0.1 feet. The accuracy of the well elevation is dependent on the source of the information. Some of the well elevations have been surveyed, but in the majority of cases the well elevation was estimated from its location on a USGS topographic map. The elevation accuracy is typically considered to be within 1 USGS topographic map contour interval. As a result the accuracy of the elevation should be considered to be between 5 and 20 feet.

When interpreting short-term changes in groundwater levels, care should be used to compare only those measurements taken during similar times of the year. To facilitate this, the graphs in this report have been color-coded by season of measurement. Blue points indicate measurements that were taken in March, April or May (spring). Green points represent measurements that were taken in June, July, or August (summer). Black points represent measurements taken in September, October, or November (fall). Discontinuities or breaks in a hydrograph represent missing measurements.

When using a hydrograph to evaluate long-term groundwater level data, comparison of the spring measurements is usually recommended. When evaluating spring to spring trends it is also important to consider that, although the measurement was taken in the spring, it may not truly represent the highest water level for the year due to various factors such as timing of spring precipitation and the beginning of

agricultural pumping in the area. Following is the list of the key wells presented in this report:

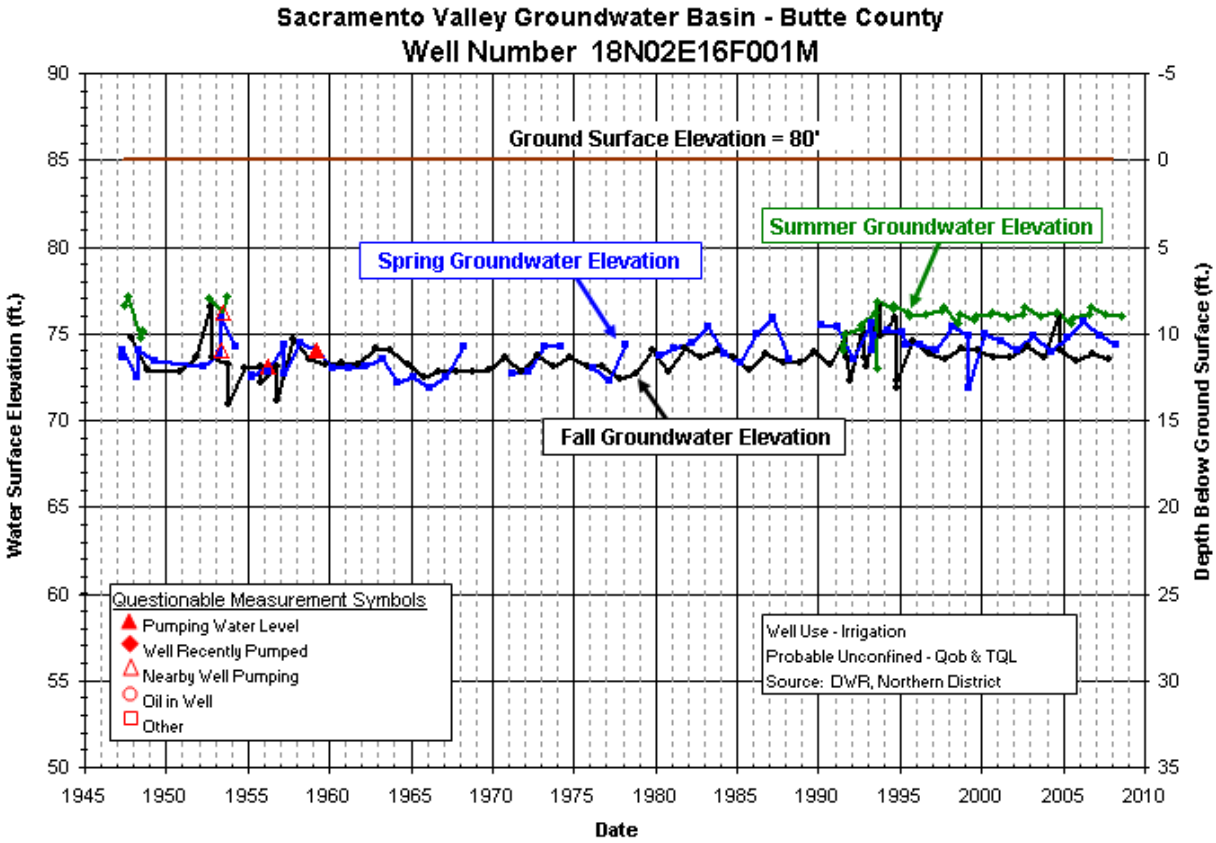
- ***Biggs-West Gridley Sub-Area*** (Well Number 18N/02E-16F001M)
- ***Butte Sub-Area*** (Well Number 17N/03E-16N001M)
- ***Butte Sink Sub-Area*** (Well Number 17N/01E-17F001M)
- ***California Water Service (Chico) Sub-Area*** (Well Numbers 22N02E18N001M & 22N01E26L002M)
- ***Cherokee Sub-Area*** (Well Numbers 20N/02E-13E002M & 20N/02E-24C002M)
- ***Durham-Dayton Sub-Area*** (Well Number 20N/02E-06Q001M)
- ***Esquon Sub-Area*** (Well Number 20N/02E-09L001M)
- ***Llano Seco Sub-Area*** (Well Numbers 20N/01W-26H002 & 20N/01E-18L002M)
- ***M & T Sub-Area*** (Well Number 22N/01E-29R001M)
- ***North Yuba Sub-Area*** (Well Number 17N/03E-03D001M)
- ***Pentz Sub-Area*** (Well Number 21N/02E-26F001M)
- ***Richvale Sub-Area*** (Well Numbers 19N/01E-28R001M & 19N/01E-35B001M)
- ***Thermalito Sub-Area*** (Well Number 18N/03E-21G001M)
- ***Vina Sub-Area*** (Well Number 23N/01W-09E001M)
- ***Western Canal Sub-Area*** (Well Number 20N/01E-35C001M)

BIGGS-WEST GRIDLEY SUB-AREA

The figure below is a hydrograph for well 18N/02E16F001M, in the north-central portion of the Biggs-West Gridley Sub-area. The area surrounding this well is characterized as rural agricultural. Agricultural cultivation in this area consists primarily of rice production supported by a combination of surface and groundwater. The well is an active irrigation well constructed in the upper portion of the aquifer, with a groundwater level measurement record dating back to the late 1940s. Groundwater levels in this well were monitored on a semi-annual basis until 1991, on a monthly basis from 1991 to about 1994 and are currently being monitored four times a year in March, July, August and October.

Historical Trend

The figure shows that the spring to fall fluctuation of groundwater levels in the unconfined portion of the aquifer system averages only 1 to 2 feet during years of normal precipitation and years of drought. Close examination of the spring to summer fluctuations indicate that groundwater levels rise during the summer months as the upper aquifer recharges due to flood irrigation for rice production. Long-term comparison of spring-to-spring groundwater levels shows almost no change in groundwater levels associated with the 1976-77, 1987-92 and or 1994 drought periods. Further long-term analysis of spring-to-spring groundwater levels indicates that there has been an increase of about 2 feet in groundwater levels since the late 1940s.



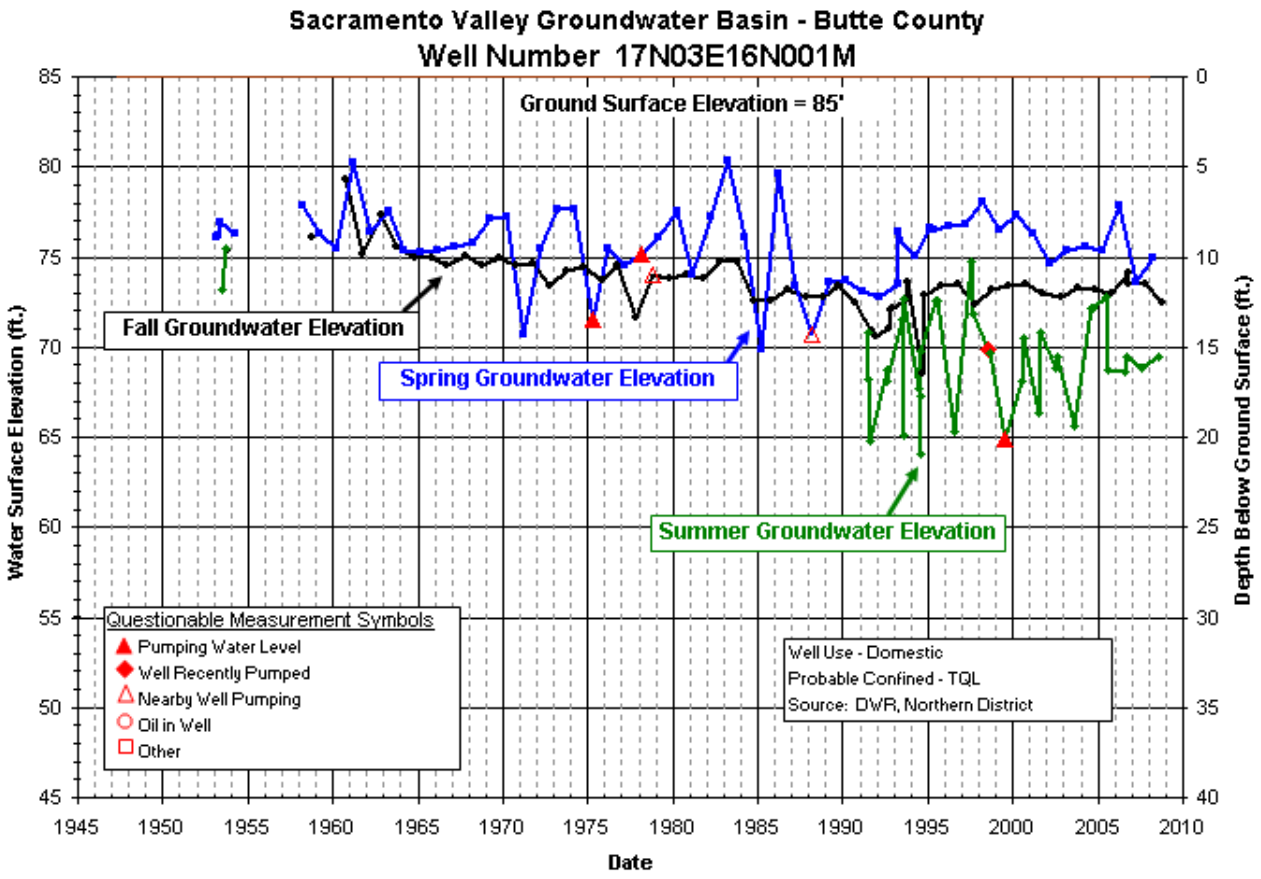
2008 Update - Water elevations have been monitored since 1947 at this location and the historical averages, including 2008 data, are; Spring=74 feet and Fall=73 feet. No recent trends or points of concern were observed for 2008. Water levels remain consistent with historical levels, with both Spring and Fall measurements remaining above the historical average.

BUTTE SUB-AREA

The figure below is a hydrograph for well 17N/03E16N001M, in the southeastern portion of the Butte Sub-area. The area surrounding this well is characterized as rural agricultural. Agricultural cultivation in this area consists primarily of orchard crops supported by groundwater. The well is an active domestic well constructed over the upper and middle portions of the aquifer, with a groundwater level measurement record dating back to the mid-1950s. The groundwater levels in this well were monitored on a semi-annual basis until approximately 1991, on a monthly basis from approximately 1991 to 1995, and are currently monitored four times a year during March, July, August and October.

Historical Trend

The figure shows that the spring to fall fluctuation of groundwater levels in the unconfined portion of the aquifer system averages only 3 to 6 feet during years of normal precipitation and 1 to 3 feet during years of drought. Long-term comparisons of spring-to-spring groundwater levels shows a small decline in spring groundwater levels associated with the 1976-77, 1987-92 and or 1994 drought periods., followed by recovery to normal levels. Further long-term analysis of spring-to-spring groundwater levels indicates very little change in spring groundwater levels since the 1950s. Fall groundwater levels have declined approximately 3 feet over the period of record.



2008 Update - Water elevations have been monitored since 1953 at this location and the historical averages, including 2008 data, are; Spring=76 feet and Fall=74 feet. There does not appear to be any long term trends in the spring groundwater levels. There does appear to be decline in the fall groundwater levels over the period of record of about 3 feet. 2008 Spring and Fall measurements are roughly one foot below the respective historical averages.

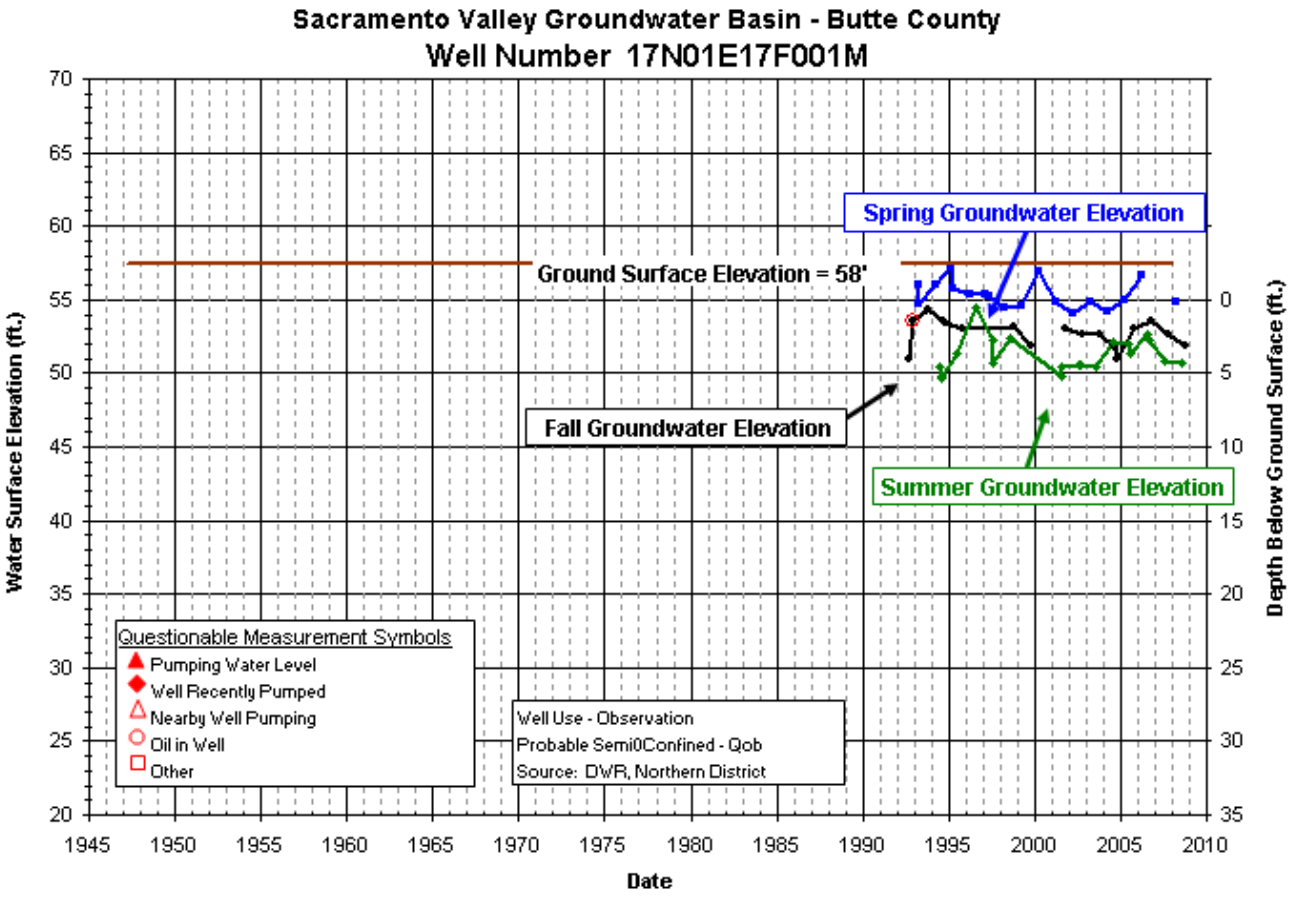
BUTTE SINK SUB-AREA

The figure below is a hydrograph for well 17N/01E17F001M, in the northwestern portion of the Butte Sink Sub-area. The land use surrounding this well is characterized as native riparian and agricultural. Agricultural cultivation in this area consists of rice production supported primarily by surface water. Surface water is also used as the primary source for flooding of native riparian land for waterfowl habitat. This well is a dedicated monitoring well constructed in the upper to middle portions of the aquifer, with a groundwater level measurement record dating back to 1992. The groundwater levels in this well were monitored on a monthly basis from 1992 to 1995,

and are currently monitored four times a year during March, July, August and October.

Historical Trend

The figure shows that the spring to summer fluctuation of groundwater levels in the unconfined portion of the aquifer system averages only 3 to 5 feet during years of normal precipitation. Monitoring in this well began during the 1987-92 and 1994 drought period so it is not possible to fully determine the impact of this drought period on the water level in this well. All groundwater level measurements (spring, summer, and fall) have been within 8 feet of the ground surface. Further long-term analysis of spring-to-spring groundwater levels is not possible due to the short monitoring history.



2008 Update - Water elevations have been monitored since 1992 at this location and the historical averages, including 2008 data, remain at; Spring=55 feet and Fall=53 feet. There limited period of record and number of measurements makes is difficult to determine trends in spring or fall groundwater levels at this time.

CALIFORNIA WATER SERVICE (CHICO) SUB-AREA

Groundwater hydrographs for the California Water Service monitoring wells were developed using static groundwater level data, provided by California Water Service Company. Although the groundwater level measurements presented in the California Water Service hydrographs were collected when the wells were not pumping (static groundwater levels), it should be noted that the effects from the recent pumping of these production wells could result in groundwater level readings that are deeper than stable static conditions. Hydrographs from two representative wells in the California Water Service Sub-area are shown below.

Historical Trend

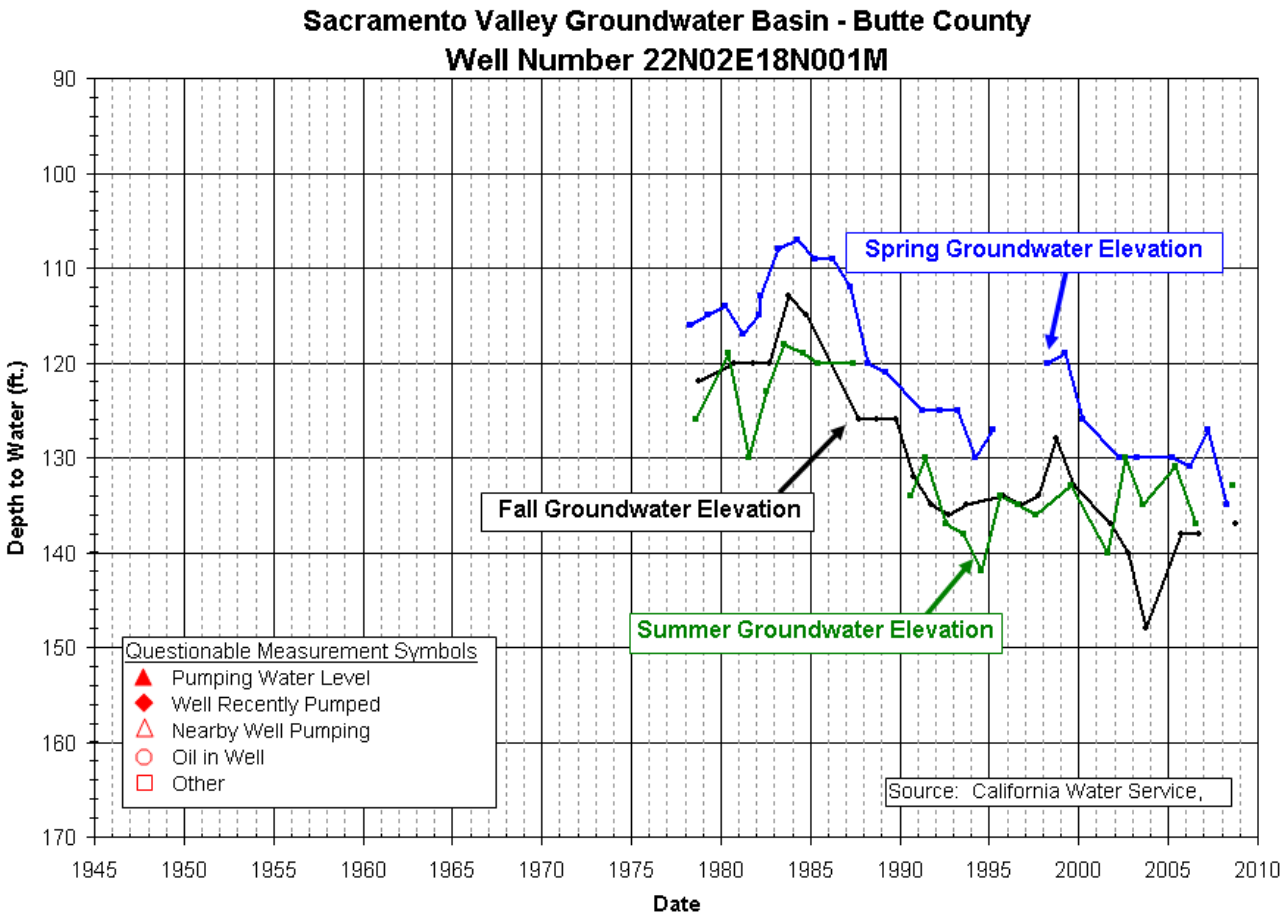
Overall analysis of the seasonal fluctuation of groundwater levels in all of the California Water Service wells with available data indicates a rather consistent seasonal fluctuation (spring to fall) of 8 to 20 feet during normal years. Analysis of seasonal groundwater levels during drought years shows a wide range of fluctuation depending upon the individual well. Many wells show little or no seasonal change between wet, normal and dry years, while other wells show large differences. The wide range of response to seasonal change in normal versus drought years is likely due to the wide range of operational scenarios that can be imposed upon these municipal wells.

Overall analysis of these hydrographs indicate that groundwater levels in the California Water Sub-area have declined an average of 13 feet between 1978 and 2008, with most of the decline occurring during the 1987-92 and 1994 drought periods.

The long-term trend of groundwater levels decline in the California Water Sub-area, tends to fluctuate based on the residential development and subsequent increase in demand. In municipal service areas it is typical for groundwater levels to experience an initial drop as the demand increases or drought conditions occur. After the initial decline, if demand remains consistent, groundwater levels will commonly reach a new equilibrium, thereby limiting further declines in groundwater levels.

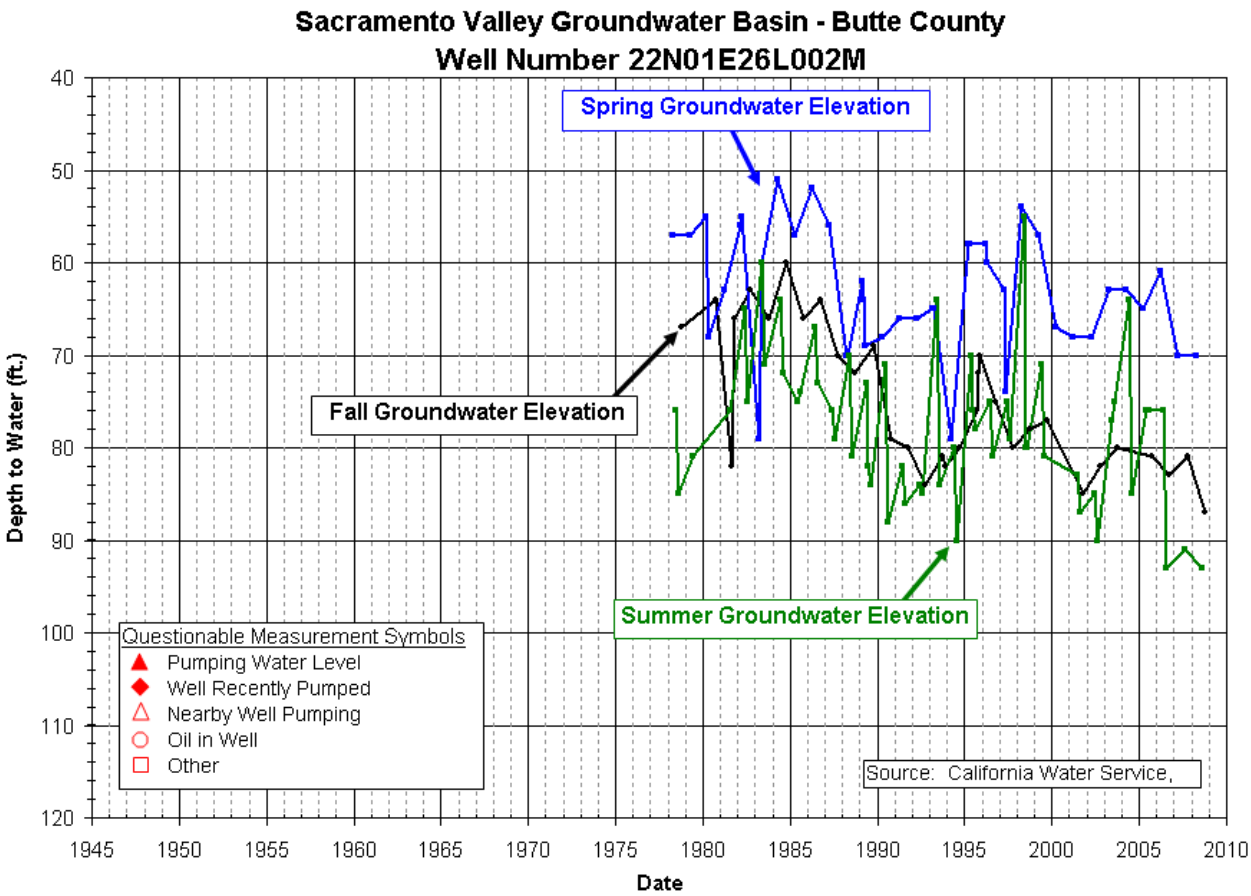
The hydrograph for well 22N02E18N001M demonstrates this relationship between demand and precipitation. It shows an increase in groundwater levels during the 1995-2000 period. This period was characterized by higher than normal precipitation and moderate increases in residential development. Normal precipitation and rapidly increasing development during the 2000-2006 period appears to contribute to declining water levels measured during this period of time.

The two hydrographs presented below include all data available at the time this report was prepared. They are included to demonstrate the general findings presented previously and to continue the evaluation of groundwater level trends in the Chico urban area. Well 22N02E18N001M is located in the northeastern portion of the California Water Service area and well 22N01E26L002M is located just southwest of the center of the California Water Service area.



Please note that Cal Water measurements are shown as depth to water .

2008 Update - Water elevations have been monitored since 1978 at this location and the historical depth to water averages, including 2008 data, are; Spring=121 feet and Fall=130 feet. The spring 2008 water level was 8 feet lower than the previous spring measurement, however the fall measurement was 1 foot higher than the last recorded measurement in 2006. Water levels recorded in the past five years represent a decline of approximately 25 feet from historical high water levels recorded in the mid-1990s.

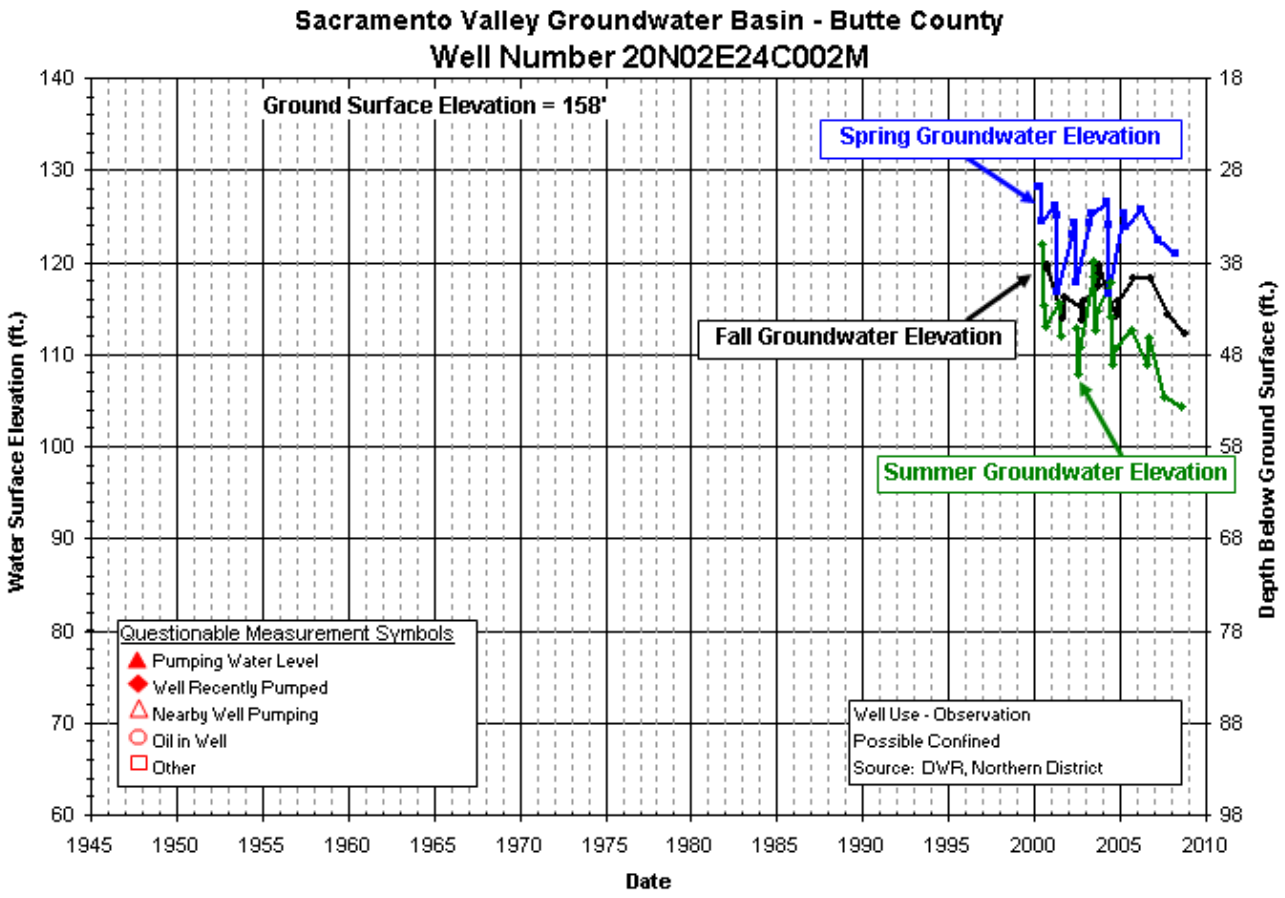


Please note that Cal Water measurements are shown as depth to water .

2008 Update - Water elevations have been monitored since 1978 at this location and the historical depth to water averages, including 2008 data, are; Spring=63 feet and Fall=75 feet. The spring 2008 water level was exactly the same as the previous spring measurement making the spring 2007 and 2008 depth to groundwater the lowest levels in the last ten years. Fall water level measurements have continued to decline since about 1985. Currently that decline is approximately 21 feet from the historical high level in 1984, and the fall 2008 measurement was six feet lower than the 2007 measurement, and setting a new historic fall low.

CHEROKEE SUB-AREA

The key well 20N/02E-24C002M is part of a dedicated, multi-completion monitoring well set that was installed during 1999. The well is in the west central portion of the sub-area south of the initial key well. Measurements in this well represent groundwater conditions between 336 to 377 feet in the semi-confined portion of the Lower Tuscan aquifer system.



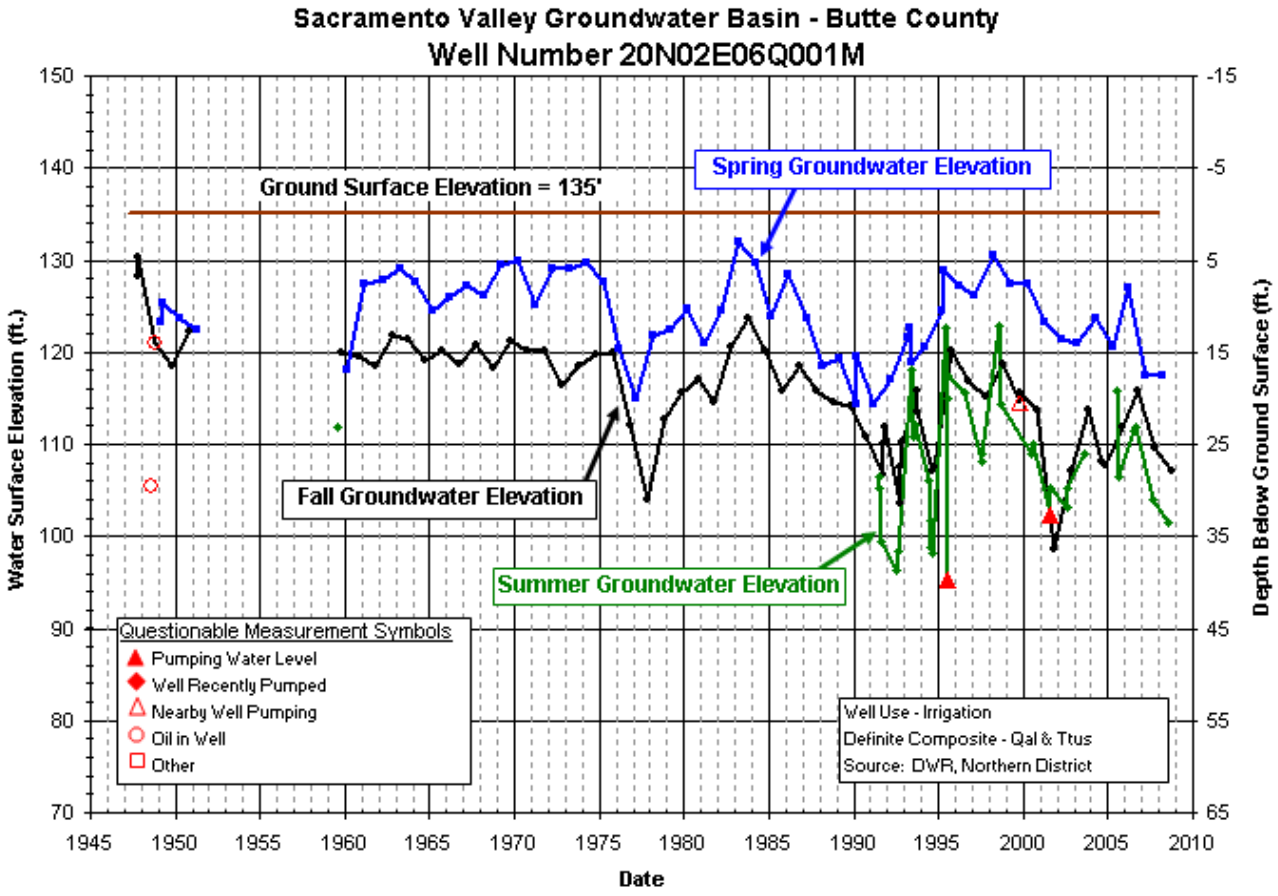
2008 Update - Water elevations have been monitored since 2000 at this location and the historical averages, including 2008 data, are; Spring=124 feet and Fall=117 feet. The short period of record for this well makes analysis of trends difficult, but spring groundwater levels have declined slightly (approximately 2.5 feet), but consistently since the spring of 2000, and the fall 2008 groundwater level measurement is the lowest on record.

DURHAM-DAYTON SUB-AREA

The figure below is a hydrograph for well 20N/02E06Q001M, located about two miles south of Durham. This area marks a change in agricultural water uses from groundwater to the north and surface water use to the south. The well is a deep irrigation well with shallow casing, and a groundwater level measurement record dating back to the late-1940s. Groundwater levels in this well represent a mixture of the unconfined and confined portions of the aquifer system. The groundwater levels in this well were monitored on a semi-annual basis until 1991, on a monthly basis from 1991 to about 1994, and are currently being monitored four times a year during March, July, August and October.

Historical Trend

The figure shows a seasonal fluctuation (spring to fall) in groundwater levels of about 10 to 15 feet during years of normal precipitation and less than 5 feet during years of drought. Long-term comparison of spring-to-spring groundwater levels shows a decline of approximately 15 feet associated with the 1976-77, 1987-92 and or 1994 drought periods. Overall comparison of spring to spring groundwater levels associated with this composite portion of the aquifer system indicates that there was little change in spring groundwater levels until 2000. Since 2000 spring groundwater levels have declined approximately 10 feet.



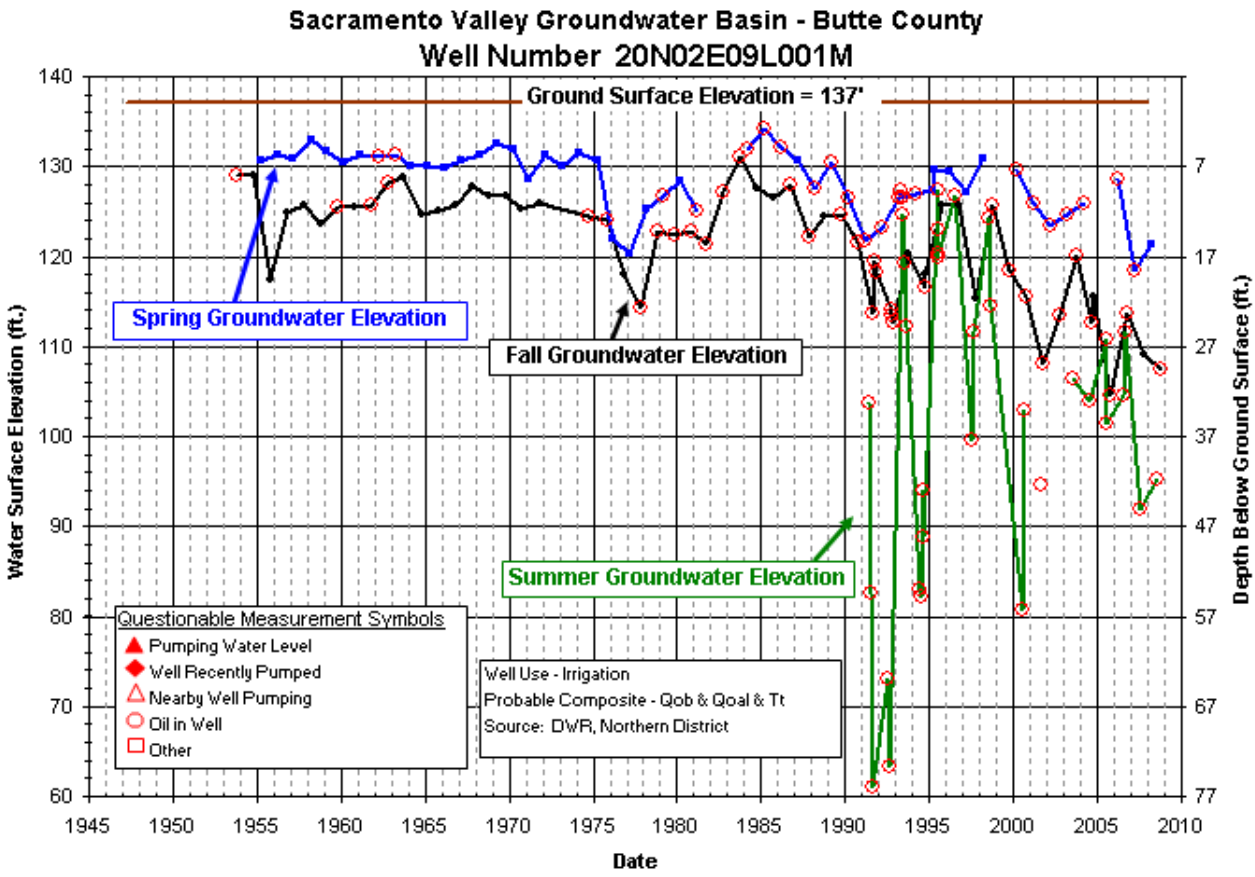
2008 Update - Water elevations have been monitored since 1947 at this location and the historical averages, including 2008 data, are; Spring=124 feet and Fall=115 feet. The spring 2008 groundwater level measurement was the lowest measurement since March 1992, at seven feet below the historic average, and supports previous indications of a continued decline since 2000. The fall measurements indicate a decline in fall groundwater levels since 1999 of about five feet.

ESQUON SUB-AREA

The figure below is a hydrograph for an active irrigation well 20N/02E09L001M, in the southern portion of the Esquon Sub-area. The area surrounding the well consists primarily of rice production using both surface and groundwater. The well is a deep irrigation well with shallow casing, and a groundwater level measurement record dating back to the 1950s. Groundwater levels in this well represent a mixture of the unconfined and confined portions of the aquifer system. The groundwater levels in this well were monitored on a semi-annual basis until 1991, on a monthly basis from 1991 to about 1994, and are currently being monitored four times a year during March, July, August and October.

Historical Trend

The figure shows that the historical spring to fall fluctuation in groundwater levels averages 3 to 8 feet during years of normal precipitation and drought periods. Long-term comparison of spring-to-spring groundwater levels shows about a 10 foot decline in groundwater levels associated with the 1976-77 drought, followed by a similar decline between 1990 and 1994, perhaps associated with the 1987-92 and 1994 drought periods. Groundwater levels in this well appear to recover from the 1987-94 drought to groundwater levels similar to those of the early 1980s. However, further long-term analysis of spring-to-spring groundwater levels indicates about a 5-foot decline in groundwater levels since the late 1950s.



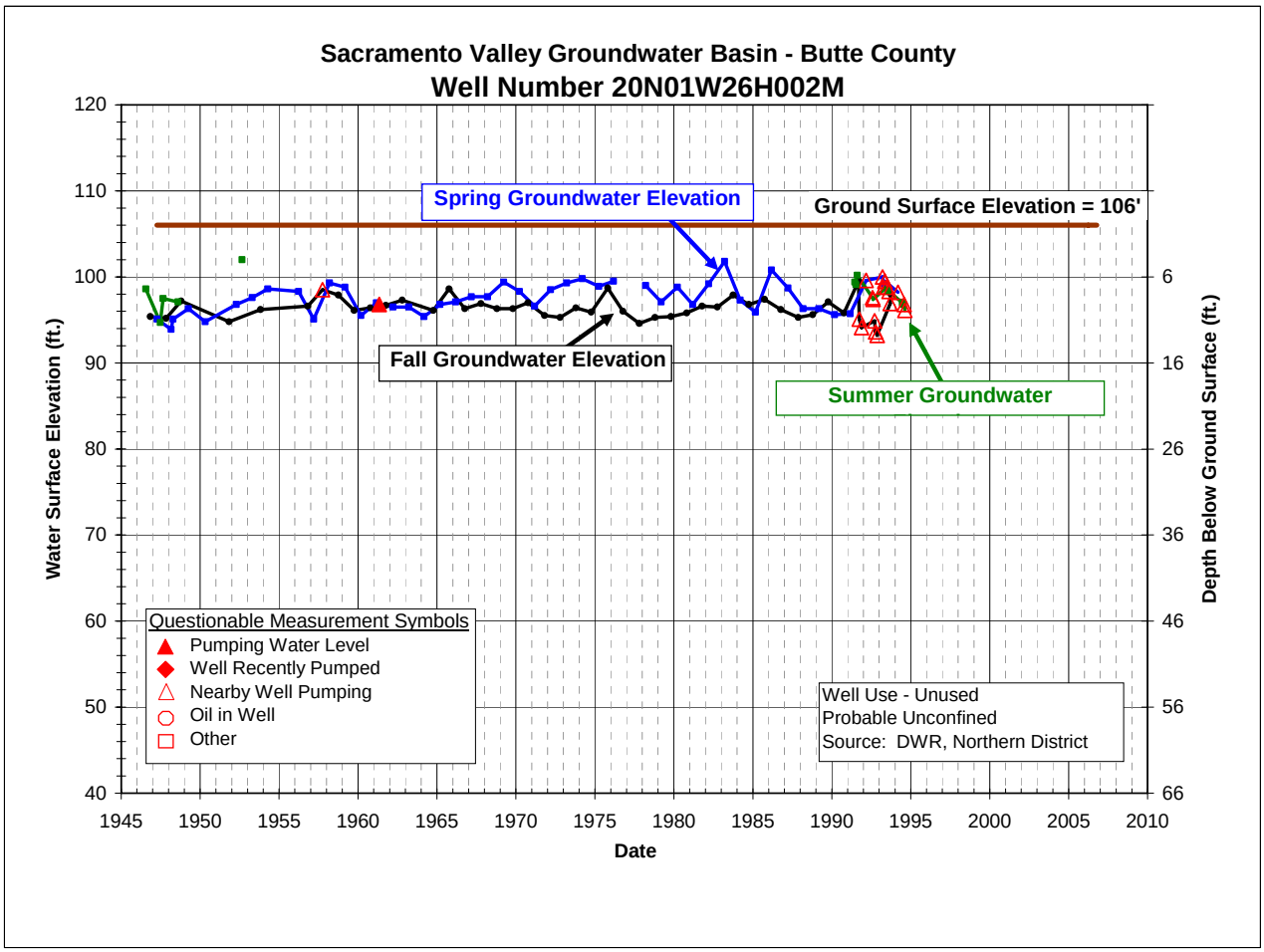
2008 Update - Water elevations have been monitored since 1953 at this location and the historical averages, including 2008 data, are; Spring=128 feet and Fall=121 feet. The spring 2008 groundwater level measurement was approximately three feet higher than the 2007 measurement, however is was still four feet lower than the average of the previous ten spring measurements. Fall groundwater levels are approximately nine feet lower than the averages of those measured during either of the previous drought periods on the hydrograph. At this time it appears that there may be a downward trend in groundwater levels in this well.

LLANO SECO SUB-AREA

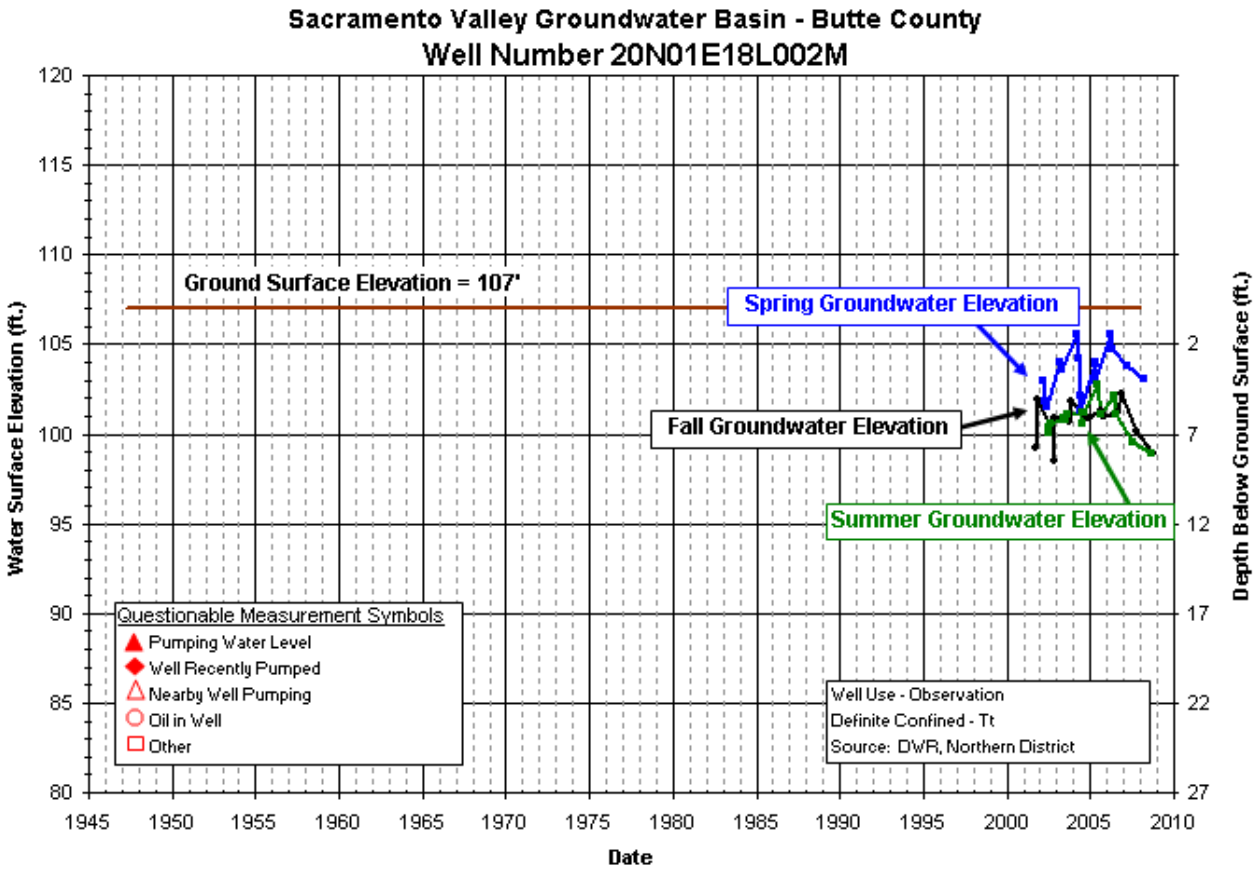
The figure below is a hydrograph for well 20N/01W26H002M, located in the southern portion of the Llano Seco Sub-area. The area surrounding this well is characterized by rural agricultural land use, supported primarily by the application of surface water. This well is an unused irrigation well constructed in the unconfined portion of the aquifer system, with a groundwater level measurement record dating back to the early 1940s. The groundwater levels in this well were monitored on a semi-annual basis until 1991 and on a monthly basis from 1991 to about 1994, when monitoring of this well was discontinued.

Historical Trend

The figure shows that the average seasonal fluctuation (spring to fall) in groundwater levels was about 1 to 5 feet during normal and drought years. Long-term comparison of spring-to-spring groundwater levels show little, if any, decline in groundwater levels associated with the 1976-77, 1987-92 and 1994 drought periods. Overall comparison of spring-to-spring groundwater levels from 19476 to 1993 showed very little change in the unconfined aquifer system within this portion of the Llano Seco Sub-area.



Groundwater level monitoring was discontinued in this well in 1994. Well 20N/01E-18L002M was chosen to replace the original key well in the Llano Seco Sub-area. This new well is part of a dedicated, multi-completion monitoring well set that was installed during 2001. The well is along the eastern margin of the sub-area, due east from the original key well. Measurements in this well represent groundwater conditions between 510-560 feet in the confined portion of the Upper Tuscan aquifer system. This well data is also utilized by the Western Canal sub-area in the BMO document.



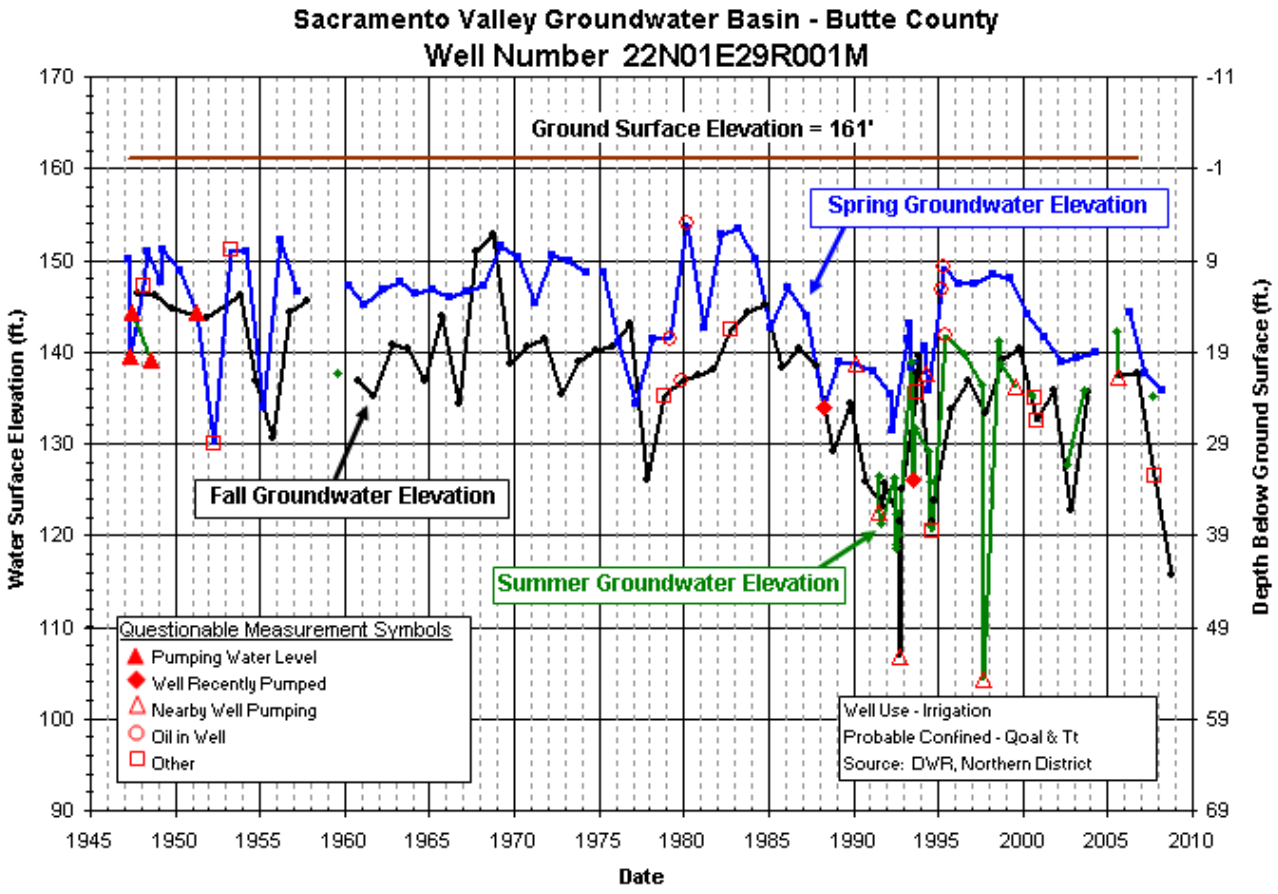
2008 Update - Water elevations have been monitored since 2001 at this location and the historical averages, including 2008 data, are; Spring=103 feet and Fall=101 feet. The spring 2008 groundwater level measurement was almost two feet lower than previous spring measurements. The fall measurement was the second lowest on record after 2002. The limited period of record for this well makes trend analysis difficult, but the available data do not indicate any trends in groundwater levels in this well.

M & T SUB-AREA

The figure below is a hydrograph for well 22N/01E29R001M, located just south of Big Chico Creek in the northern portion of the M&T Sub-area. The well is surrounded by agricultural orchard production, supported by groundwater extraction. This well is an inactive irrigation well of intermediate depth, with a groundwater level measurement record dating back to the late-1940s. Groundwater levels in this well represent the confined portion of the aquifer. The groundwater levels in this well were monitored on a semi-annual basis until 1991, on a monthly basis from 1991 to about 1994, and are currently being monitored four times a year during March, July, August and October.

Historical Trends

The figure shows that the average seasonal fluctuation (spring to fall) in groundwater levels is about 5 to 10 feet during years of normal precipitation and about 5 or less feet during years of drought. Long-term comparison of spring-to-spring groundwater levels shows a decline of about 10 to 15 feet in groundwater levels associated with the 1976-77 drought, followed by a decline of about 15 to 20 feet associated with the 1987-92 and 1994 drought periods. Overall comparison of spring to spring groundwater levels associated with this confined portion of the aquifer system indicates that there was little change in spring groundwater levels until 2000. Spring groundwater levels have declined about 8 feet since 2000.



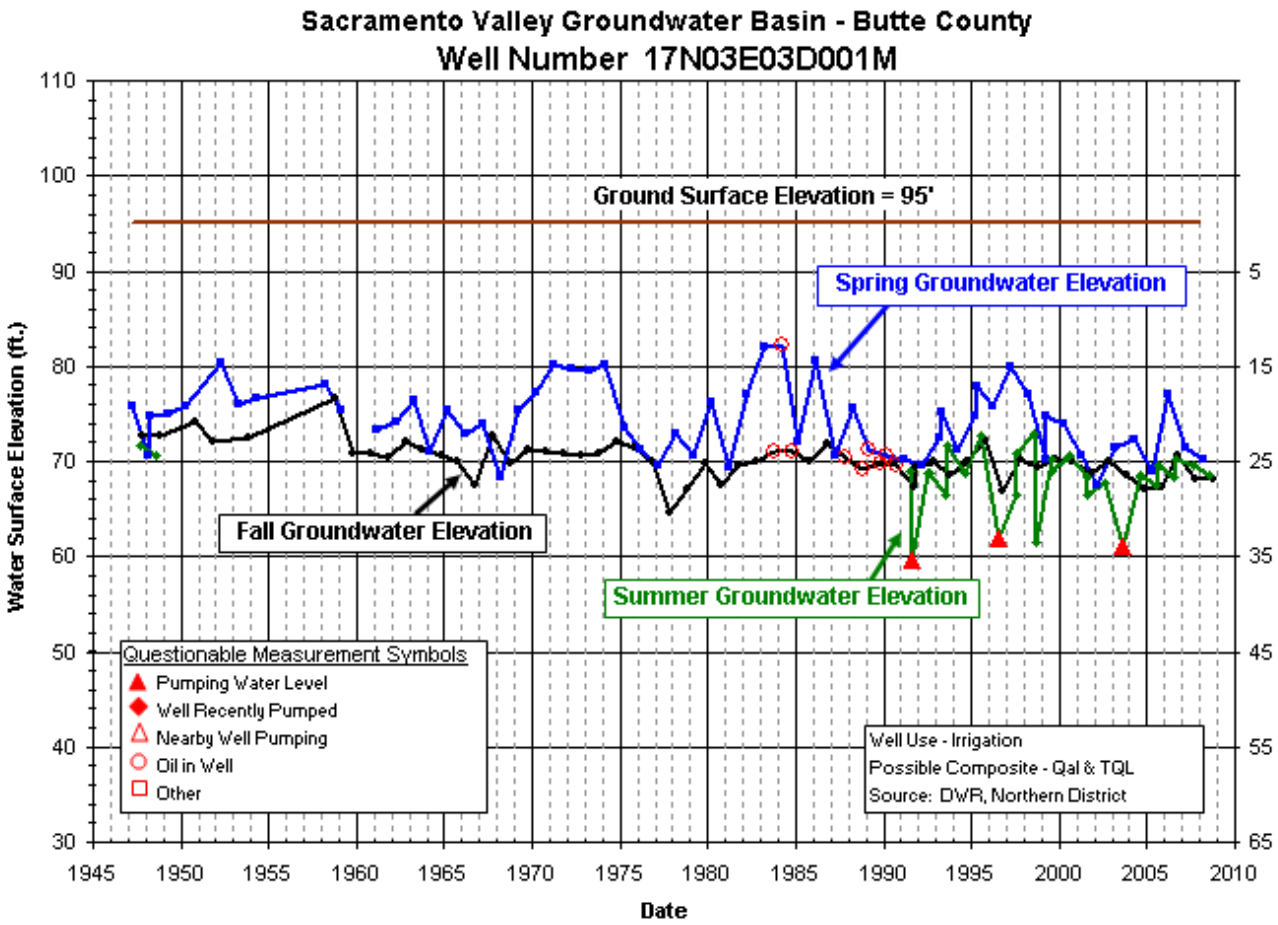
2008 Update - Water elevations have been monitored since 1947 at this location and the historical averages, including 2008 data, are; Spring=144 feet and Fall=136 feet. The spring 2008 groundwater level measurement is exactly the same as the measurement taken in 1994, tying as the second lowest recorded spring measurement behind the lowest taken in 1992. Fall groundwater levels have also declined a similar amount during the same period with the 2008 measurement twenty feet below the historic fall average, making it the second lowest recorded fall measurement since 1992.

NORTH YUBA SUB-AREA

The figure below is a hydrograph for well 17N/03E03D001M, located in the western portion of the North Yuba Sub-area. The area surrounding the well is characterized by rural, agricultural land use supported by the application of both surface and groundwater. The well is an active irrigation well drawing water from the upper and middle portions of the aquifer system, with a groundwater level measurement record dating back to the late 1940s. The groundwater level in this well was monitored on a semi-annual basis until 1991, on a monthly basis from 1991 to approximately 1995, and is currently being measured four times per year, March, July, August and October.

Historical Trend

The figure shows that the seasonal fluctuation (spring to fall) in groundwater levels is about 5 to 15 feet during years of average precipitation and less than 5 feet during years of drought. Long-term comparison of spring-to-spring groundwater levels shows about a 10-foot decline in spring groundwater levels associated with 1976-77, 1987-92 and 1994 drought periods and the period of 2001-05. Fall groundwater levels remain particularly consistent even during years of below average precipitation. This is likely due to the well's close proximity to the Feather River. Although spring groundwater levels have remained within 10-12 feet of historical high levels, the majority of measurements in the past 6 years have been closer to historical lows.



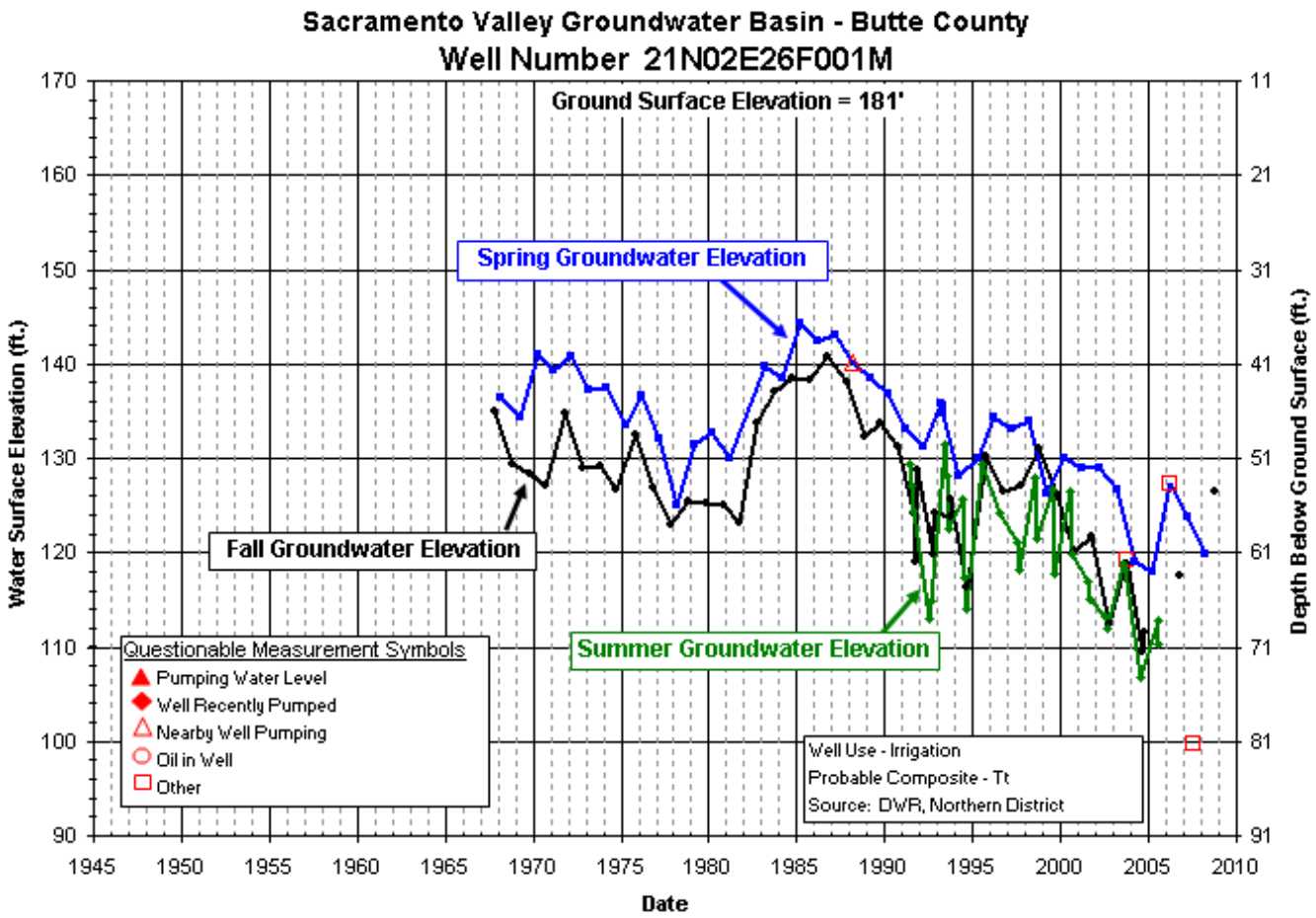
2008 Update - Water elevations have been monitored since 1947 at this location and the historical averages, including 2008 data, are; Spring=74 feet and Fall=70 feet. The spring 2008 groundwater elevation was four feet below the average historical spring groundwater elevations. There appears to be a decline in fall measurements beginning in 2001.

PENTZ SUB-AREA

The figure below is a hydrograph for an active irrigation well 21N/02E26F001M, just west of Highway 99E, near the intersection of Durham-Pentz Road and Oro-Chico Highway. Within a two-mile radius of the well, groundwater is used to support agricultural production of orchard and row crops, and small-scale industrial uses associated with a beverage distribution plant. The well is a deep irrigation well with shallow casing, and a groundwater level measurement record dating back to the mid-1960s. Groundwater levels in this well represent a mixture of the unconfined and confined portions of the aquifer system. The groundwater levels in this well were monitored on a semi-annual basis (spring and fall) until 1991, on a monthly basis from 1991 to about 1994, and are currently being monitored four times a year during March, July, August and October.

Historical Trend

The figure shows that the average seasonal fluctuation (spring to fall) in groundwater levels averages about 3 to 10 feet during years of normal precipitation and approximately 3 to 5 feet during years of drought. Long-term comparison of spring-to-spring groundwater levels shows a decline in groundwater levels during the period of 1971-1981, perhaps associated with the 1976-77 drought. Since a groundwater elevation high of approximately 145 feet in 1985 the measured groundwater levels in this well have continued to decline. Recent groundwater level measurements indicate that the groundwater elevation in this well is approximately 15-25 feet lower than the historical high in 1985.



2008 Update - Water elevations have been monitored since 1967 at this location and the historical averages, including 2008 data, are; Spring=133 feet and Fall=126 feet. Since 1985 spring groundwater levels in this well have been declining, and the spring 2008 measurement remained ten feet below historical high levels and continues the downward trend on the hydrograph. The long-term trend of decline observed in this well was such a point of concern it prompted the drilling of a new monitoring well to evaluate the potential causes for the decline. DWR installed a new dedicated monitoring well near this existing key well in August 2008. This newly constructed

well will provide much needed groundwater level data for this area, and summary results will be printed in the next groundwater status report. This well was constructed as a quadruple completion well which means that the bore hole contains four casings isolated in separate geologic strata that allows for monitoring the levels of the water contained in the respective aquifers systems.

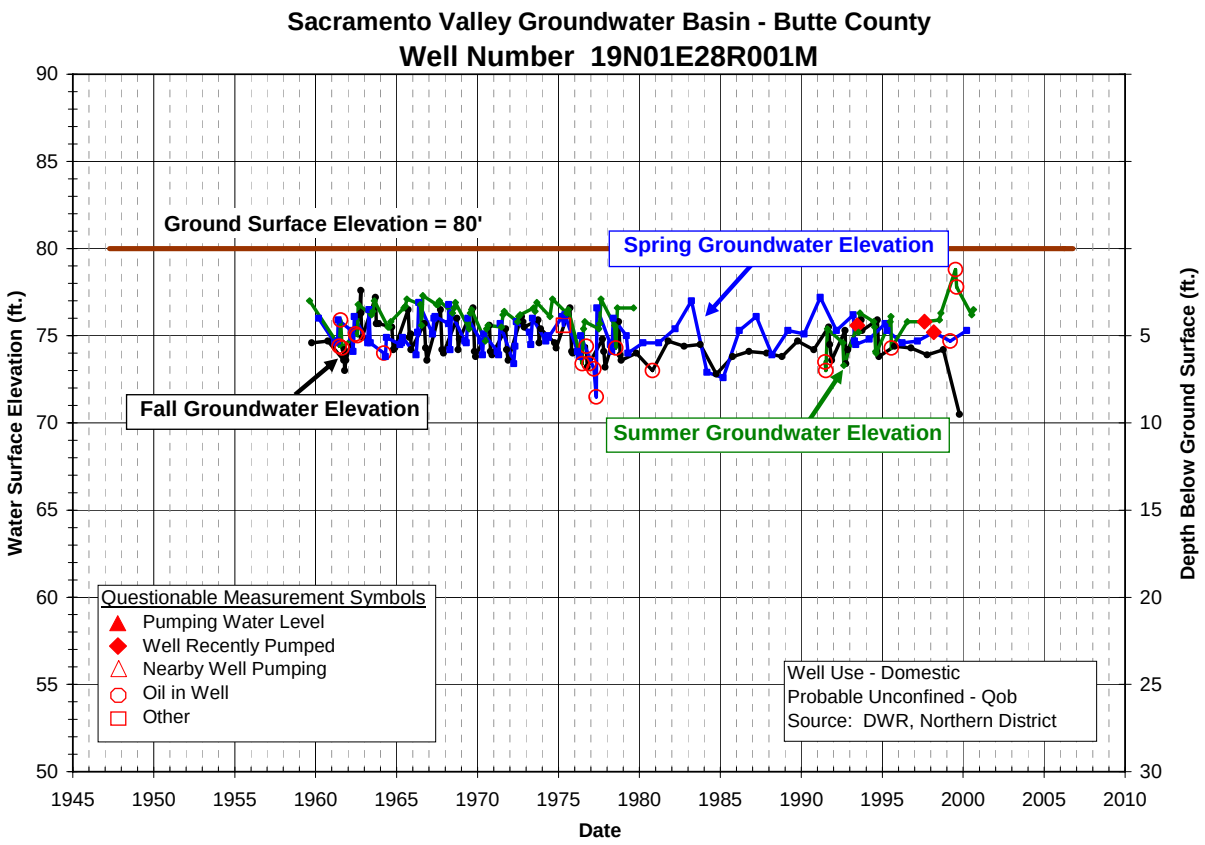
RICHVALE SUB-AREA

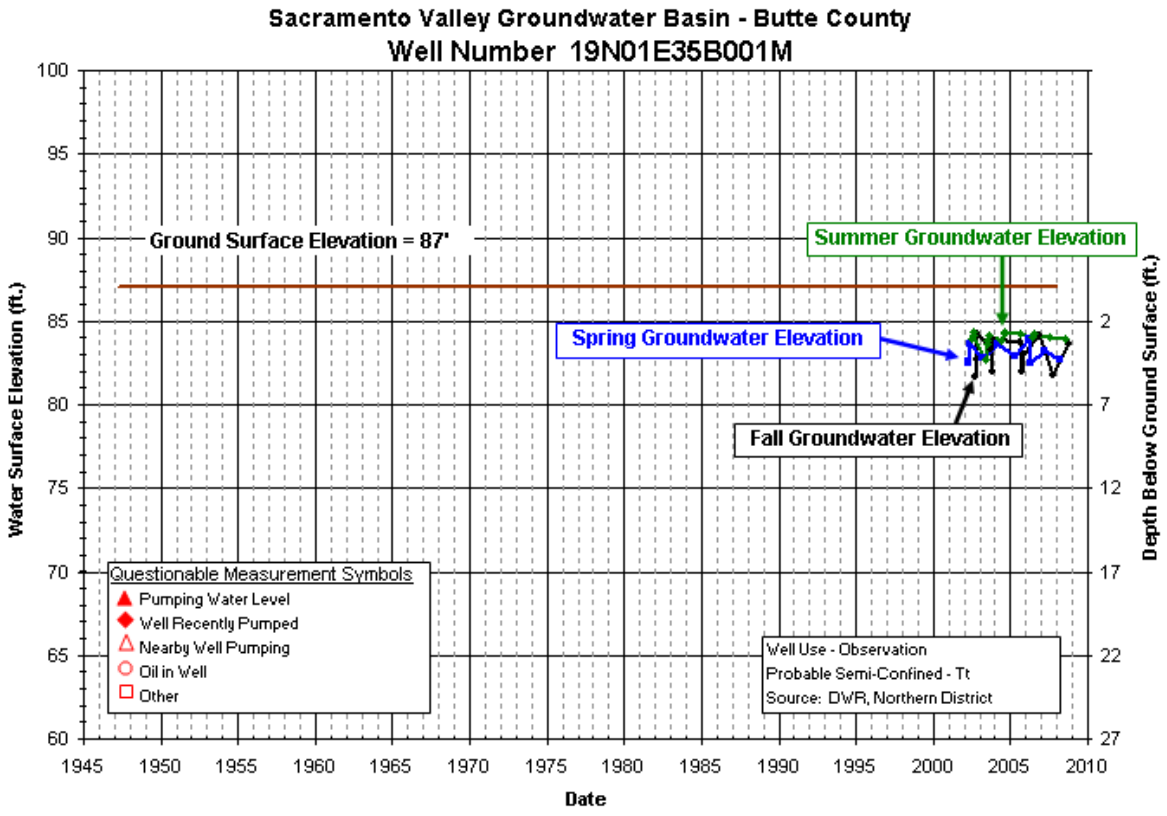
The figure below is a hydrograph for well 19N/01E28R001M, located in the western portion of the Richvale Sub-area. The area surrounding this well is characterized as rural agricultural. Agricultural cultivation in this area consists of rice production supported by surface water in normal years and a combination of surface and groundwater in drought years. The well is an active domestic well constructed in the upper portion of the aquifer, with a groundwater level measurement record dating back to the late-1950s. Groundwater levels in this well were monitored on a monthly basis from 1959 to 1979, on a semi-annual basis (spring and fall) from 1979 to 1991 and on a monthly basis again from 1991 to about 1994, and on a semi-annual basis until measurements were discontinued in 2000.

Historical Trend

The figure shows that the spring to fall fluctuation of groundwater levels in the unconfined portion of the aquifer system averages only 1 to 3 feet during years of normal precipitation and the same during years of drought. Summer groundwater level monitoring indicates that the upper aquifer recharges during summer months due to flood irrigation for rice production producing groundwater level measurements that are higher in the summer than in either the spring or fall Long-term comparison of spring-to-spring groundwater levels show almost no change in groundwater levels associated with either the 1976-77, 1987-92 and 1994 drought periods. Further long-term analysis of spring-to-spring groundwater levels indicates very little change in groundwater levels since the late 1950s.

Well 19N/01E-35B001 was chosen to replace 19N/01E-28R001M as a key well in the Richvale Sub-area. This is a new dedicated monitoring well that was installed by Butte County during 2001. This well is in the west central portion of the sub-area, east of the original key well. Measurements in this well represent groundwater conditions at a depth of 95-200 feet, in the semi-confined portion of the Upper Tuscan aquifer system.


Sacramento Valley Groundwater Basin - Butte County
Well Number 19N01E28R001M
Ground Surface Elevation = 80'
Spring Groundwater Elevation
Fall Groundwater Elevation
Summer Groundwater Elevation
Water Surface Elevation (ft.)
Depth Below Ground Surface (ft.)
Date
Questionable Measurement Symbols
Pumping Water Level
Well Recently Pumped
Nearby Well Pumping
Oil in Well
Other
Well Use - Domestic
Probable Unconfined - Qob
Source: DWR, Northern District


Sacramento Valley Groundwater Basin - Butte County
Well Number 19N01E35B001M
Ground Surface Elevation = 87'
Summer Groundwater Elevation
Spring Groundwater Elevation
Fall Groundwater Elevation
Water Surface Elevation (ft.)
Depth Below Ground Surface (ft.)
Date
Questionable Measurement Symbols
Pumping Water Level
Well Recently Pumped
Nearby Well Pumping
Oil in Well
Other
Well Use - Observation
Probable Semi-Confined - Tt
Source: DWR, Northern District

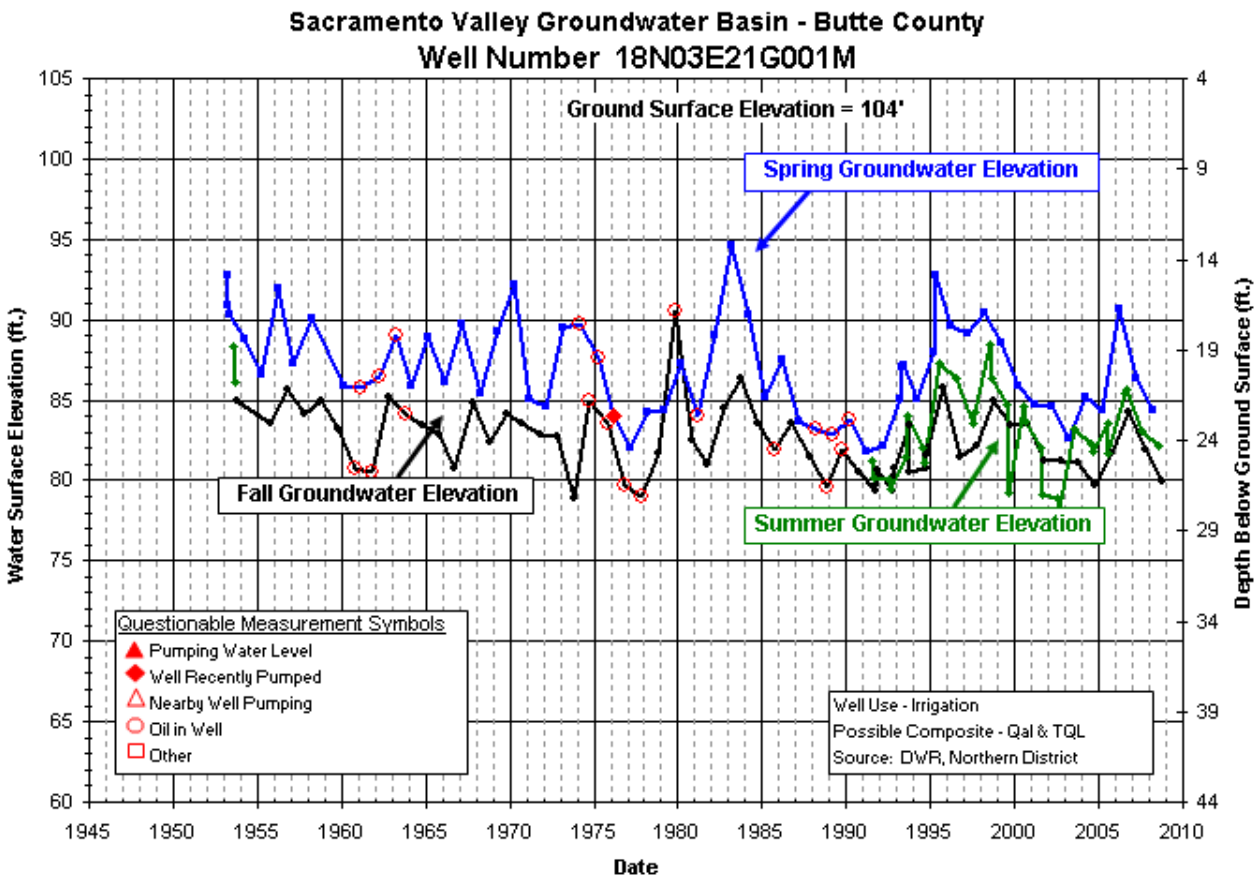
2008 Update - Water elevations have been monitored since 2002 at this location and the historical averages, including 2008 data, are; Spring=83 feet and Fall=83 feet. An evaluation of data from both key wells reveals that groundwater levels have changed very little since about 1960. Water levels remain consistent with historical levels.

THERMALITO SUB-AREA

The figure below is a hydrograph for well 18N/03E21G001M, located in the southern portion of the Thermalito Sub-area, approximately one-mile west of the Feather River. The area surrounding this well is characterized as rural agricultural. Agricultural cultivation in this area consists of orchard crops supported primarily by groundwater extraction. This well is an active irrigation well producing groundwater from the shallow to intermediate portion of the aquifer system. The groundwater level measurement record dates back to the late 1940s. Groundwater levels in this well were monitored on a semi-annual basis until 1991, on a monthly basis from 1991 to about 1994, and are currently being monitored four times a year during March, July, August and October.

Historical Trend

The figure shows that the seasonal fluctuation (spring to fall) in groundwater levels is about 3 to 8 feet during years of average precipitation and less than 3 to 5 feet during years of drought. Long-term comparison of spring-to-spring groundwater levels shows about an 8-foot decline in spring groundwater levels associated with 1976-77, 1987-92 and 1994 drought periods and also during the period of 2001-05. Fall groundwater levels also fluctuate with annual precipitation, declining approximately 3-5 feet during the same drought periods. Although spring groundwater levels have remained within 5-8 feet of historical high levels the majority of measurements in the past 6 years have been closer to historical lows.



2008 Update - Water elevations have been monitored since 1953 at this location and the historical averages, including 2008 data, are; Spring=87 feet and Fall=82 feet. The spring 2008 groundwater elevation is comparable to average historical spring groundwater elevations, though it is three feet lower than the historical average. The fall measurement is almost identical to that taken in 2004, and is two feet lower than the average.

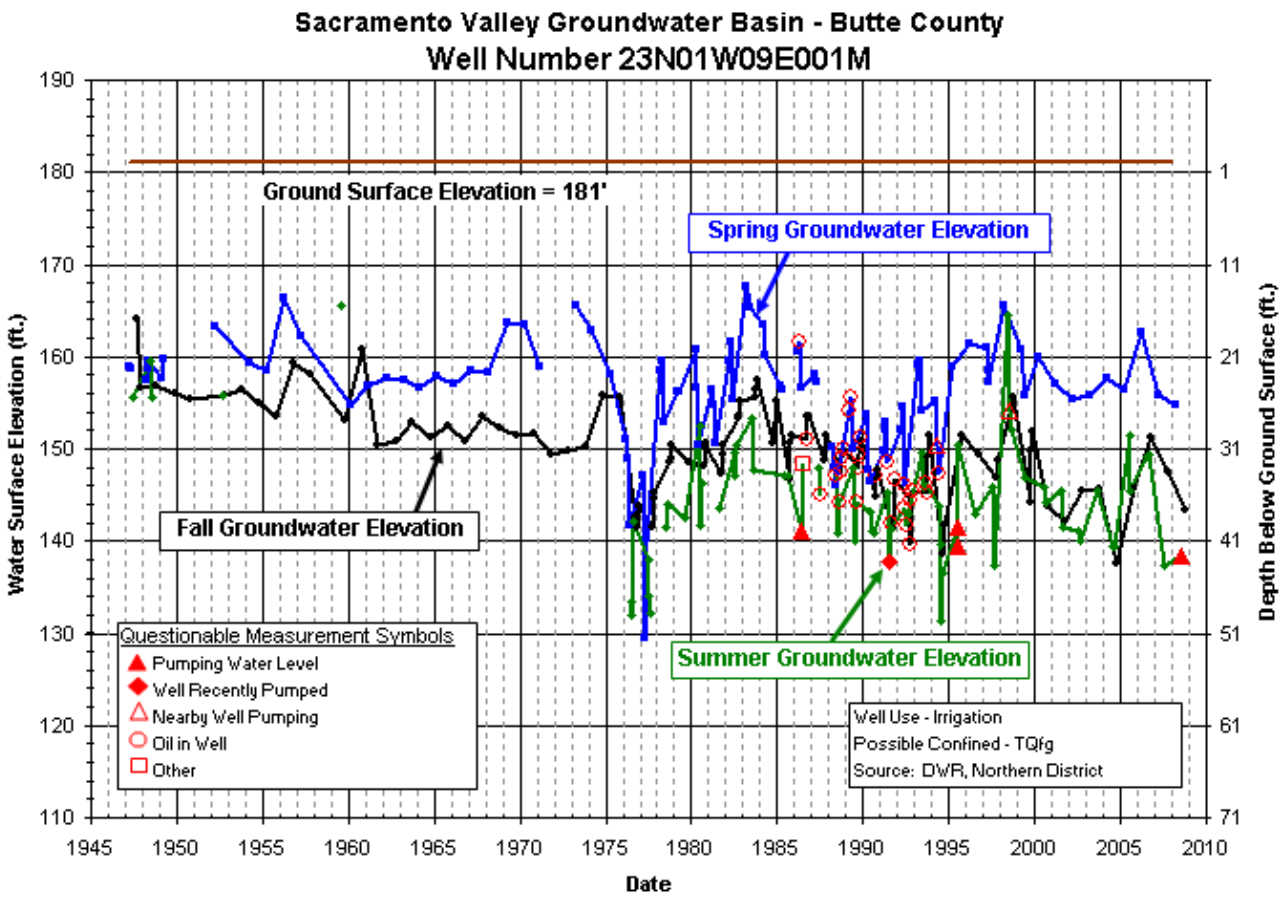
VINA SUB-AREA

The figure below is a hydrograph for well 23N/01W09E001M, in the northern Vina Sub-area. The area surrounding this well is characterized by rural, agricultural land use supported by groundwater. This well is an irrigation well constructed in the confined portion of the aquifer system, with a groundwater level measurement record dating back to the mid-1940s. The groundwater levels in this well were monitored on a semi-annual basis until the mid-1970s, on a monthly basis from the mid-1970s to 1996, and are currently monitored four times a year during March, July, August and October.

Historical Trend

The figure shows a seasonal fluctuation (spring to fall) in groundwater levels of about 5 to 15 feet during years of normal precipitation and less than 5 feet during years of

drought. Long-term comparison of spring-to-spring groundwater levels shows a decline of approximately 30 feet associated with the 1976-77 and approximately 10 to 12 feet associated with the 1987-92 and 1994 drought periods drought period. Overall comparison of spring to spring groundwater levels associated with this confined portion of the aquifer system indicates that there has been little change in the spring groundwater levels since the late 1940's. Long term comparison of fall groundwater levels does indicate that the fall groundwater level has declined 5 to 10 feet over the period of record.



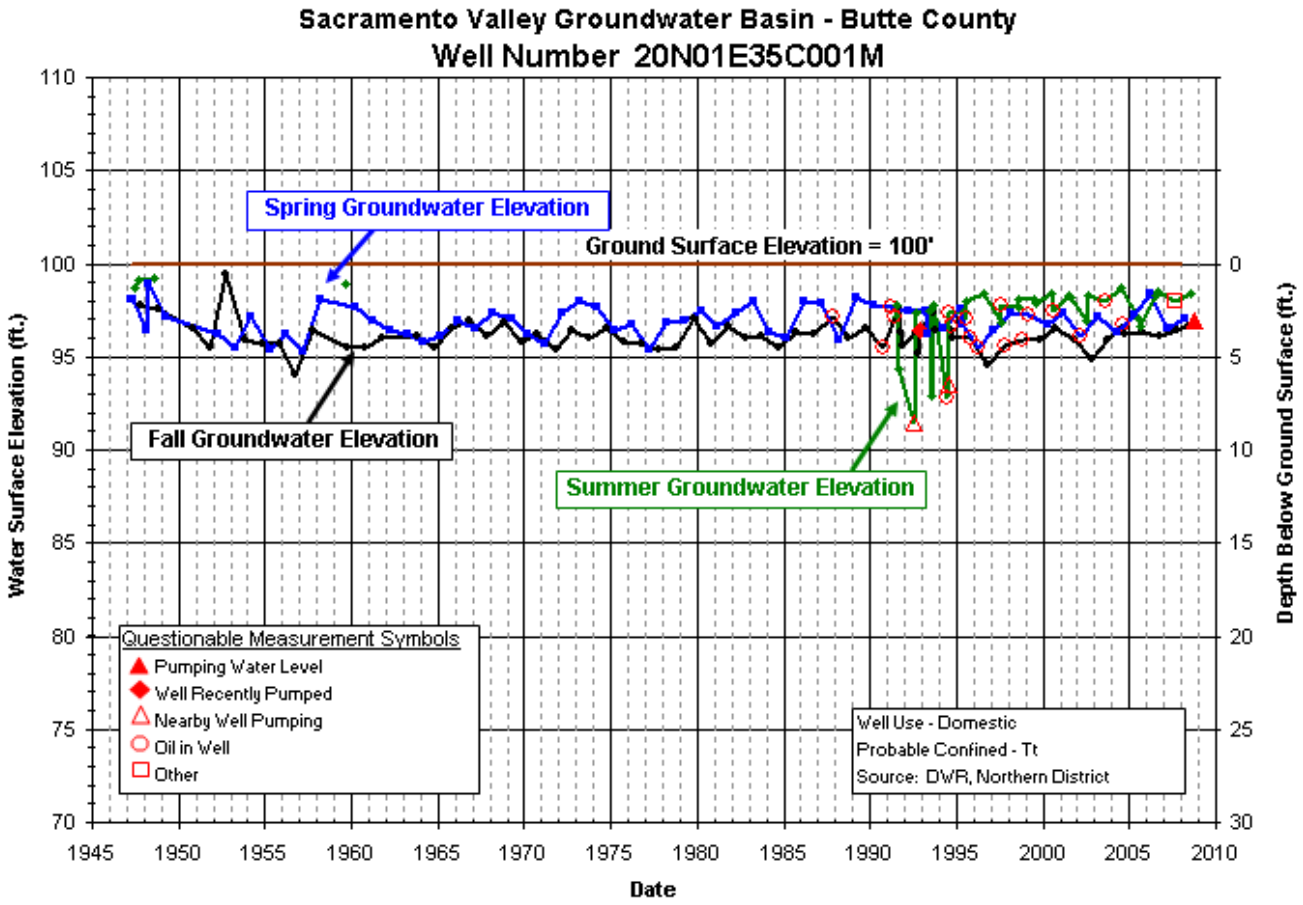
<u>2008 Update</u> - Water elevations have been monitored since 1947 at this location and the historical averages, including 2008 data, are; Spring=156 feet and Fall=150 feet. The spring 2008 groundwater level measurement was the lowest recorded since 1994. The fall 2008 measurement is higher than the measurements taken in 1994, but lower than the measurement taken in 1977, and remains several feet below historical measurements.

WESTERN CANAL SUB-AREA

The figure below is a hydrograph for an active domestic well 20N/01E35C001M, in the central portion of the Western Canal Sub-area. The area surrounding this well is characterized as rural agricultural. Agricultural cultivation in this area consists of rice production supported by surface water in normal years and a combination of surface and groundwater in drought years. The well is constructed in the uppermost aquifer system. The groundwater level measurement for this well record dates back to the mid-1960s. Groundwater levels in this well were monitored on a semi-annual basis until 1991, and on a monthly basis from 1991 to about 1994, and are currently being monitored four times a year during March, July, August and October.

Historical Trend

The figure shows that the spring to fall fluctuation in groundwater levels averages less than 3 feet during years of normal precipitation and the same during years of drought. Summer groundwater level monitoring indicates that the upper aquifer recharges during summer months due to flood irrigation for rice production producing groundwater level measurements that are higher in the summer than in either the spring or fall. Long-term comparisons of spring-to-spring groundwater levels show almost no change associated with the 1976-77, 1987-92 and 1994 drought periods. Further long-term analysis of spring-to-spring groundwater levels indicates very little change since the late 1940s.



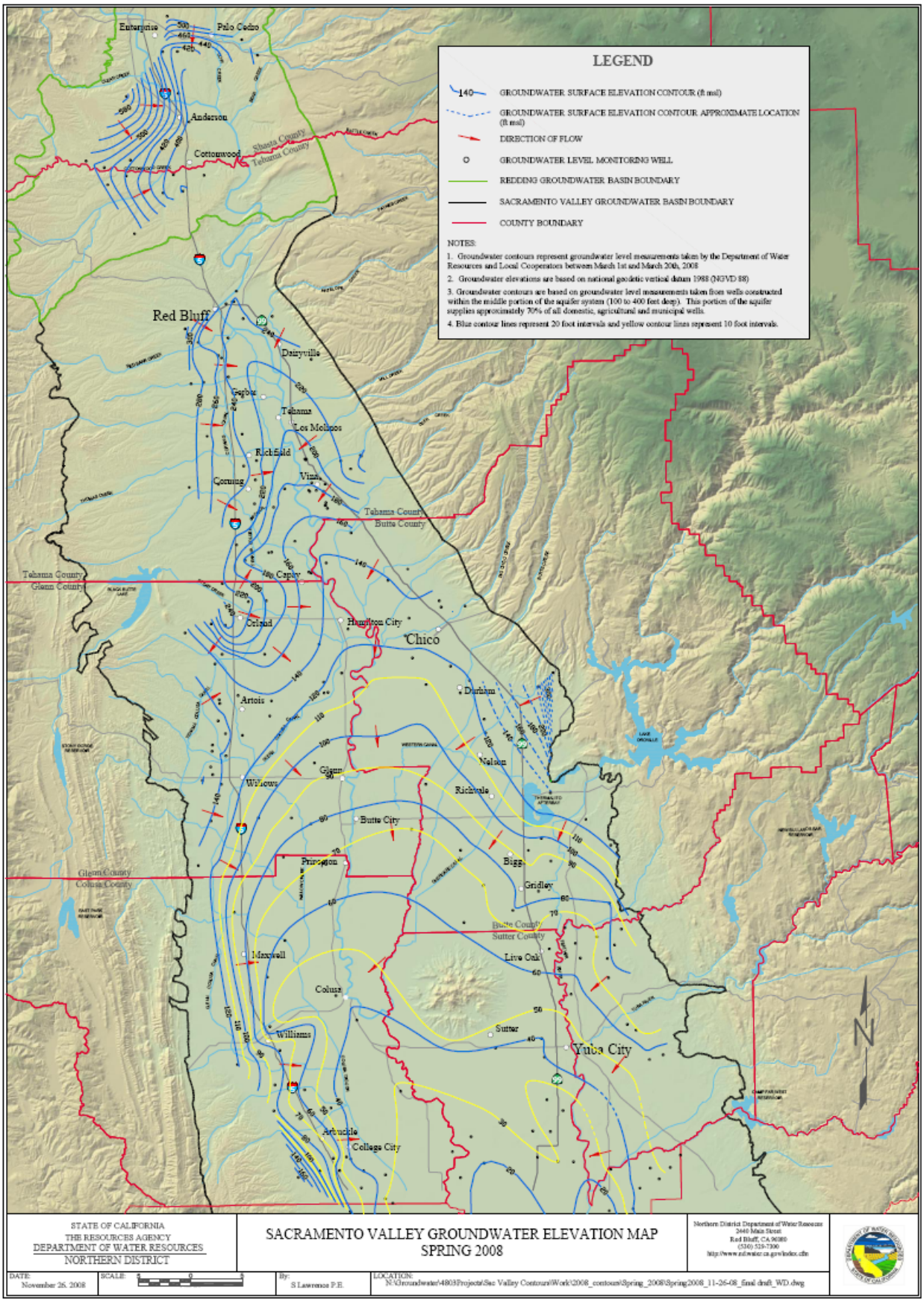
2008 Update - Water elevations have been monitored since 1947 at this location and the historical averages, including 2008 data, are; Spring=97 feet and Fall=96 feet. No recent trends or points of concern were observed for 2008. Water levels remain consistent with historical levels.

GROUNDWATER CONTOUR MAPS

Groundwater level data can be used to develop groundwater elevation and change in groundwater elevation contour maps. Using this method, groundwater level measurements taken in individual wells can be combined to examine the groundwater levels in the aquifer system on a larger, more regional scale. Groundwater elevation contours represent lines of equal groundwater elevation and provide a snap-shot of groundwater conditions during a particular monitoring period. Similar to topographic contours, the pattern and spacing of groundwater elevations contours can be used to help estimate the direction and gradient of groundwater movement. 2008 Groundwater contours were constructed using groundwater level measurements taken by the Department of Water Resources and local cooperators.

Groundwater contours are based on groundwater level measurements taken from wells constructed within the middle portion of the aquifer system (100 to 400 feet deep). This portion of the aquifer supplies approximately 70% of all domestic, agricultural and municipal wells, and represents a mixture of confined and unconfined aquifers. Due to the potential variation in groundwater levels between the confined and unconfined aquifer systems, care should be taken when using the contour maps to interpret groundwater occurrence, movement, and changes in storage at a local scale. These groundwater elevation contour maps were developed using groundwater level data from Butte, Glenn, Colusa, Tehama, Sutter, and Yuba counties.

Spring Groundwater Elevation Contour Map – Spring 2008 groundwater elevation contours for Butte County show that groundwater is highest in the northern and eastern portions of the valley and that the range is from 380 to 60 feet above sea level. There appears to be a subtle trough along the Sacramento River in the northern part of the county, which indicates that groundwater is likely being discharged into the river in this area There appears to be a mild groundwater mound southwest of the Thermalito Afterbay. The red arrows indicate the approximate groundwater flow direction based on the groundwater elevation contours.


LEGEND
GROUNDWATER SURFACE ELEVATION CONTOUR (ft msl)
GROUNDWATER SURFACE ELEVATION CONTOUR APPROXIMATE LOCATION (ft msl)
DIRECTION OF FLOW
GROUNDWATER LEVEL MONITORING WELL
REDDING GROUNDWATER BASIN BOUNDARY
SACRAMENTO VALLEY GROUNDWATER BASIN BOUNDARY
COUNTY BOUNDARY
NOTES:
1. Groundwater contours represent groundwater level measurements taken by the Department of Water Resources and Local Cooperators between March 1st and March 20th, 2008
2. Groundwater elevations are based on national geodetic vertical datum 1988 (NGVD 88)
3. Groundwater contours are based on groundwater level measurements taken from wells constructed within the middle portion of the aquifer system (100 to 400 feet deep). This portion of the aquifer supplies approximately 70% of all domestic, agricultural and municipal wells.
4. Blue contour lines represent 20 foot intervals and yellow contour lines represent 10 foot intervals.
Enterprise
Palo Cedro
Anderson
Cottonwood
Shasta County
Tehama County
Red Bluff
Dairyville
Gerber
Tehama
Los Molinos
Richfield
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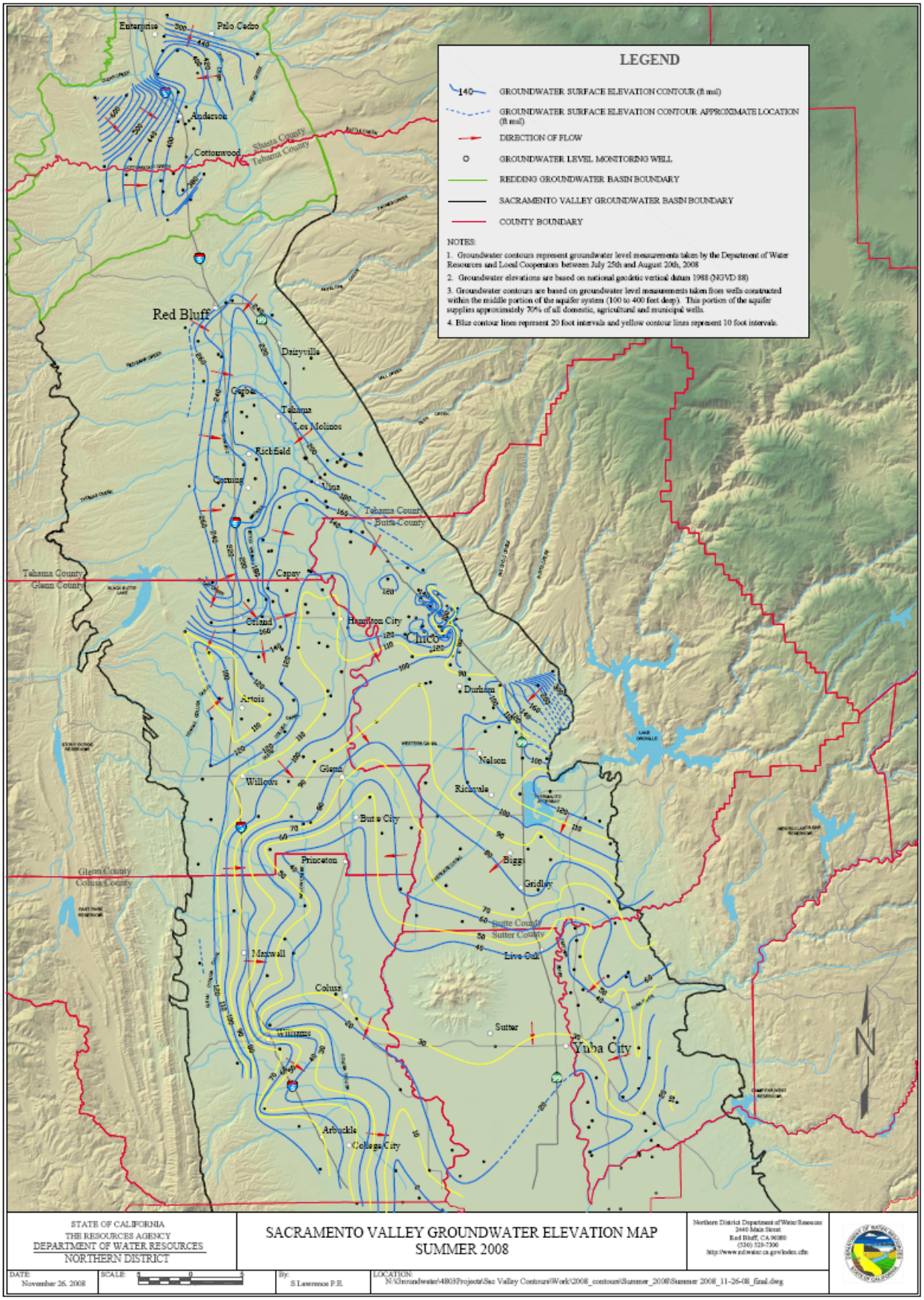
Yuba City
Arbuckle
College City
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
NORTHERN DISTRICT
SACRAMENTO VALLEY GROUNDWATER ELEVATION MAP
SPRING 2008
Northern District Department of Water Resources
2440 Main Street
Red Bluff, CA 96080
(530) 529-7300
http://www.ndwater.ca.gov/index.cfm
DATE
November 26, 2008
SCALE
By:
S Lawrence P.E.
LOCATION:
N:\Groundwater\4803\Projects\Sac Valley Contours\Work\2008_contours\Spring_2008\Spring2008_11-26-08_final draft_WD.dwg

Summer Groundwater Elevation Contour Map – Summer 2008 groundwater elevation contours for Butte County show that groundwater is highest in the northwestern portion of the county and lowest in the southwestern portion of the county. It ranges from a high of approximately 350 feet above sea level to approximately 50 feet above sea level. It appears that the groundwater "troughs" noted in the Spring 2008 groundwater elevation contours along both the Sacramento River and Butte Creek have shifted to the west. The results are two significant troughs, one located in Glenn County between Hamilton City and Orland and the other running approximately southwest from Chico in the north and extending into Glenn County to the southwest. The groundwater mound southwest of the Thermalito Afterbay, that was noted in the spring, is still present, but a mild trough can now be seen nearly directly south of the Thermalito Afterbay. The red arrows indicate the approximate groundwater flow direction based on the groundwater elevation contours. As a result of the southwest-trending trough, groundwater flow directions that were generally to the south or southwest in spring appear to be west and southeast.


LEGEND
GROUNDWATER SURFACE ELEVATION CONTOUR (ft msl)
GROUNDWATER SURFACE ELEVATION CONTOUR APPROXIMATE LOCATION (ft msl)
DIRECTION OF FLOW
GROUNDWATER LEVEL MONITORING WELL
REDDING GROUNDWATER BASIN BOUNDARY
SACRAMENTO VALLEY GROUNDWATER BASIN BOUNDARY
COUNTY BOUNDARY
NOTES:
1. Groundwater contours represent groundwater level measurements taken by the Department of Water Resources and Local Cooperators between July 25th and August 20th, 2008
2. Groundwater elevations are based on national geodetic vertical datum 1988 (NGVD 88)
3. Groundwater contours are based on groundwater level measurements taken from wells constructed within the middle portion of the aquifer system (100 to 400 feet deep). This portion of the aquifer supplies approximately 70% of all domestic, agricultural and municipal wells.
4. Blue contour lines represent 20 foot intervals and yellow contour lines represent 10 foot intervals.
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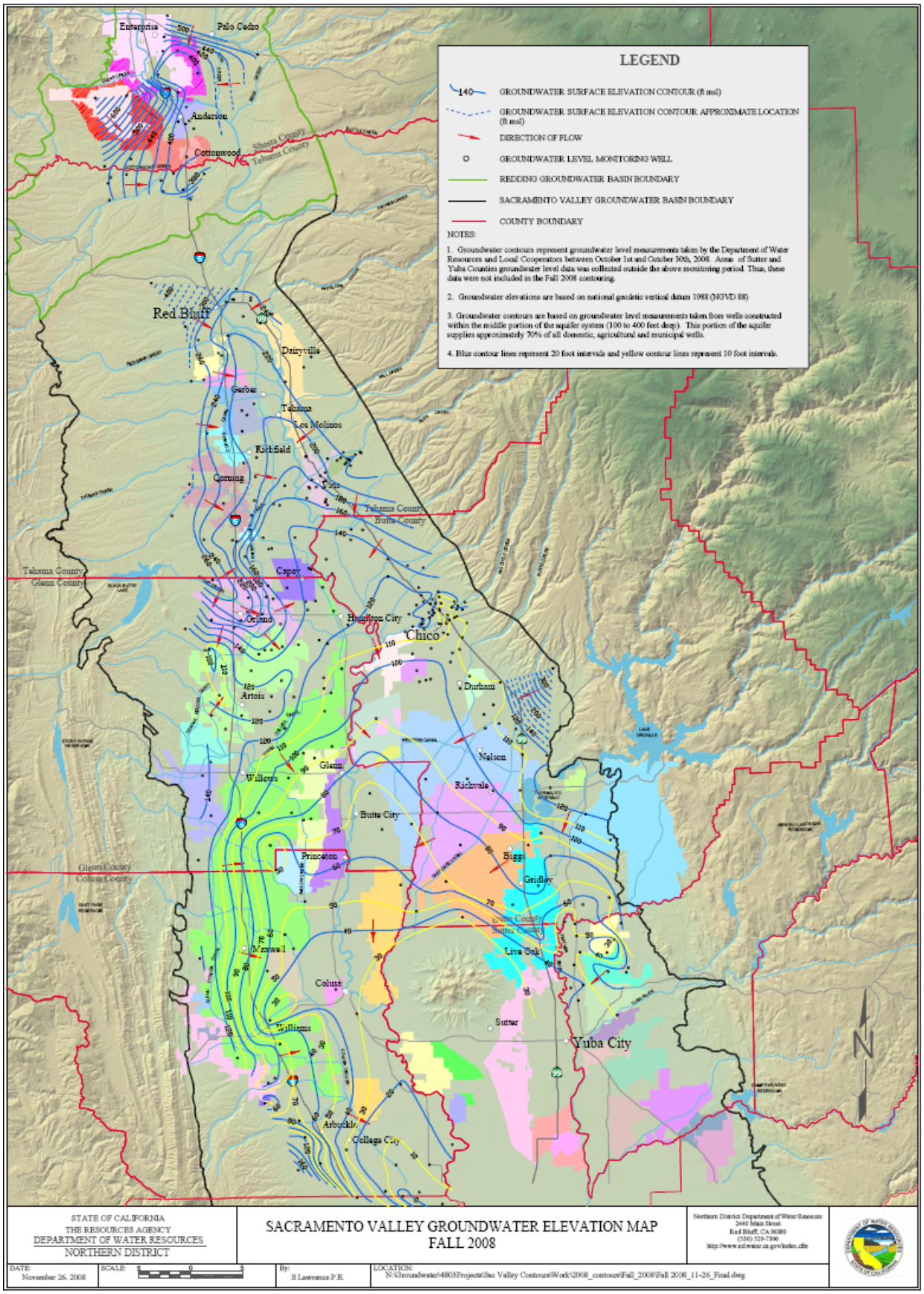
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
NORTHERN DISTRICT
SACRAMENTO VALLEY GROUNDWATER ELEVATION MAP
SUMMER 2008
Northern District Department of Water Resources
2440 Main Street
Red Bluff, CA 96080
(530) 529-7300
http://www.nd.water.ca.gov/index.cfm
DATE:
November 26, 2008
SCALE:
By:
S Lawrence P.E.
LOCATION:
N:\Groundwater\4803\Projects\Sac Valley Contours\Work\2008_contours\Summer_2008\Summer 2008_11-26-08_final.dwg

Fall Groundwater Elevation Contour Map – Fall 2008 groundwater level contours for Butte County show that groundwater is highest in the northern and eastern portions of the county and lowest in the southwest portion of the county. It ranges from a high of 352 feet above sea level to a low of 30 feet above sea level. It appears that there are two groundwater troughs, one along the Sacramento River in the northern part of the county and one southwest of Chico. There is also a groundwater mound south of the Thermalito Afterbay. The red arrows indicate the approximate groundwater flow direction based on the groundwater elevation contours.


LEGEND
140 GROUNDWATER SURFACE ELEVATION CONTOUR (ft msl)
GROUNDWATER SURFACE ELEVATION CONTOUR APPROXIMATE LOCATION (ft msl)
DIRECTION OF FLOW
GROUNDWATER LEVEL MONITORING WELL
REDDING GROUNDWATER BASIN BOUNDARY
SACRAMENTO VALLEY GROUNDWATER BASIN BOUNDARY
COUNTY BOUNDARY
NOTES:
1. Groundwater contours represent groundwater level measurements taken by the Department of Water Resources and Local Cooperators between October 1st and October 30th, 2008. Areas of Sutter and Yuba Counties groundwater level data was collected outside the above monitoring period. Thus, these data were not included in the Fall 2008 contouring.
2. Groundwater elevations are based on national geodetic vertical datum 1988 (NGVD 88)
3. Groundwater contours are based on groundwater level measurements taken from wells constructed within the middle portion of the aquifer system (100 to 400 feet deep). This portion of the aquifer supplies approximately 70% of all domestic, agricultural and municipal wells.
4. Blue contour lines represent 20 foot intervals and yellow contour lines represent 10 foot intervals.
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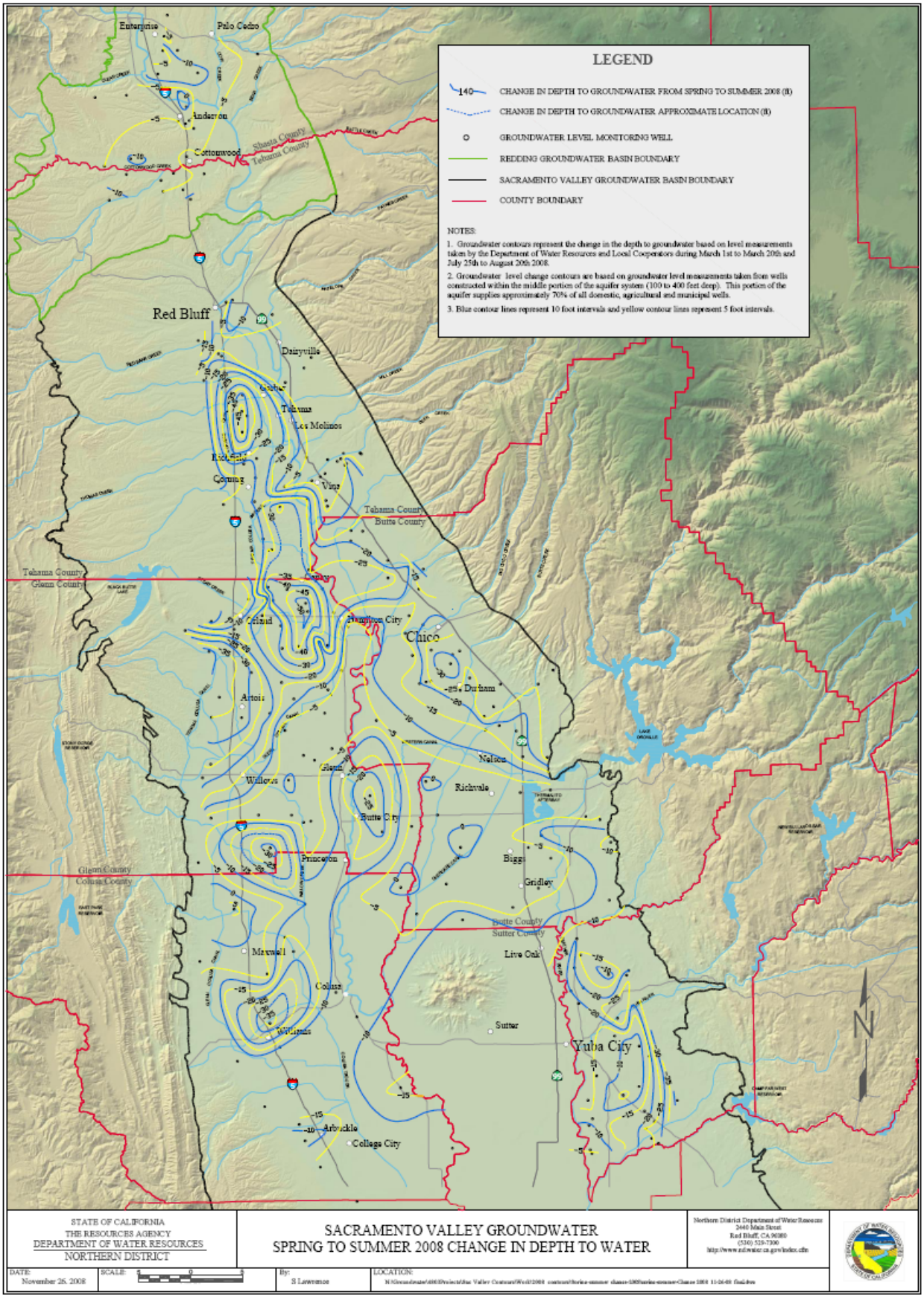
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
NORTHERN DISTRICT
SACRAMENTO VALLEY GROUNDWATER ELEVATION MAP
FALL 2008
Northern District Department of Water Resources
2440 Main Street
Red Bluff, CA 96080
(530) 529-7300
http://www.ndwater.ca.gov/index.cfm
DATE: November 26, 2008
SCALE:
By: S Lawrence P.E.
LOCATION: N:\Groundwater\4803\Projects\Sac Valley Contours\Work\2008_contours\Fall_2008\Fall 2008_11-26_Final.dwg

Spring-to-Summer Groundwater Elevation Change Contour Map. – The spring to summer change map depicts the difference between the groundwater elevations measured in spring and summer (July-August) of 2008. The contour lines on this map do not indicate elevation, only the change in elevation between the two measurements. The general, county-wide summer decline ranges between 0 feet in the southwestern portion of the county to between 25 and 30 feet in the eastern edge of the valley floor. With the exception of localized areas, the groundwater declines are generally greater along the eastern edge of the valley floor and least in the Butte Basin region. Localized areas of detectable decline in groundwater levels can be seen between Chico and Durham, southeast of Durham, and southeast of the Thermalito Afterbay. There are several areas of detectable groundwater level decline that are located outside of Butte County, which may influence groundwater levels in nearby areas of Butte County. These areas of decline can be seen in the private pumping areas southwest of Butte City and south of Capay, between Hamilton City and Orland.


LEGEND
140 CHANGE IN DEPTH TO GROUNDWATER FROM SPRING TO SUMMER 2008 (ft)
CHANGE IN DEPTH TO GROUNDWATER APPROXIMATE LOCATION (ft)
GROUNDWATER LEVEL MONITORING WELL
REDDING GROUNDWATER BASIN BOUNDARY
SACRAMENTO VALLEY GROUNDWATER BASIN BOUNDARY
COUNTY BOUNDARY
NOTES:
1. Groundwater contours represent the change in the depth to groundwater based on level measurements taken by the Department of Water Resources and Local Cooperators during March 1st to March 20th and July 25th to August 20th 2008.
2. Groundwater level change contours are based on groundwater level measurements taken from wells constructed within the middle portion of the aquifer system (100 to 400 feet deep). This portion of the aquifer supplies approximately 70% of all domestic, agricultural and municipal wells.
3. Blue contour lines represent 10 foot intervals and yellow contour lines represent 5 foot intervals.
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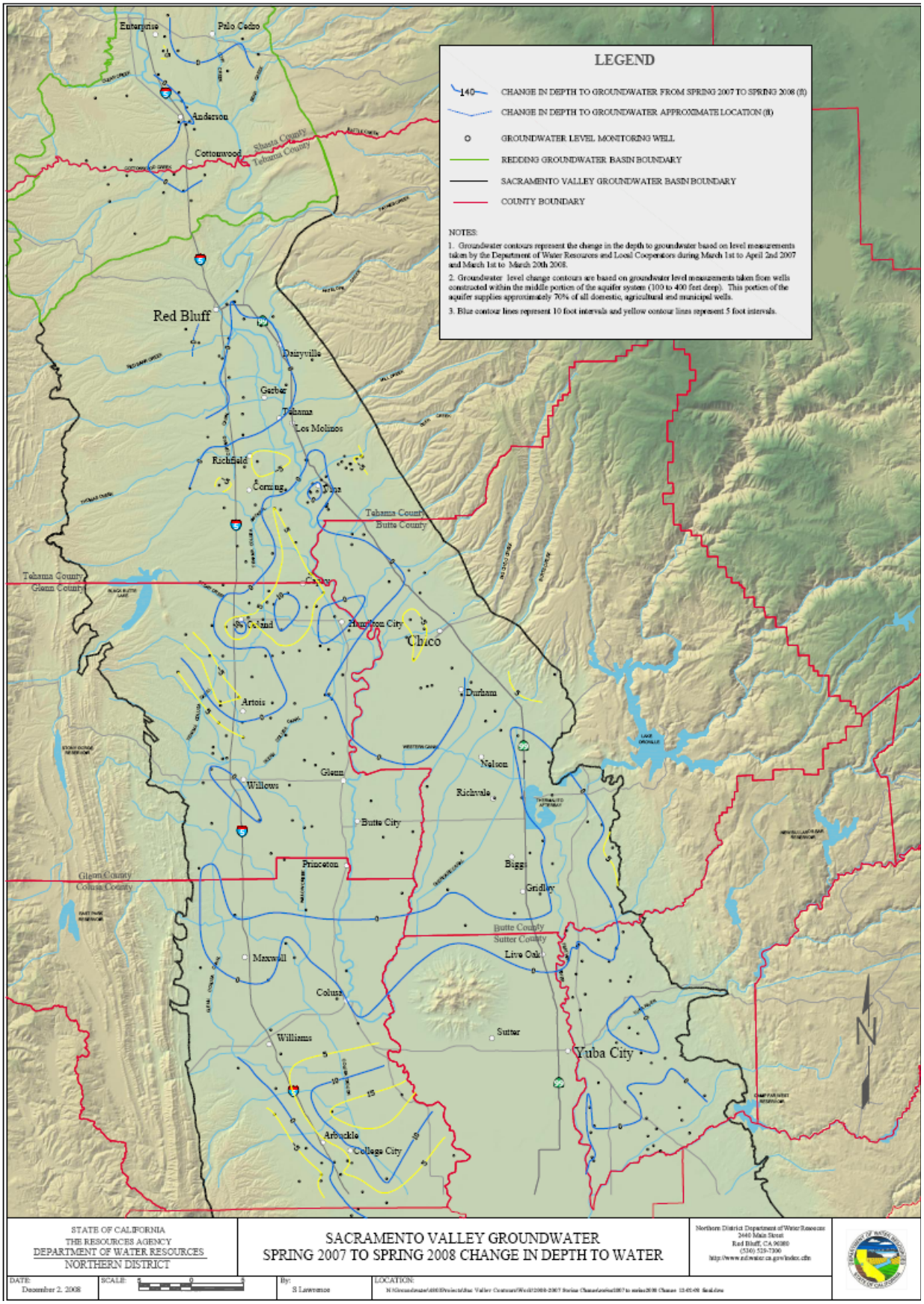
DEPARTMENT OF WATER RESOURCES
NORTHERN DISTRICT
SACRAMENTO VALLEY GROUNDWATER
SPRING TO SUMMER 2008 CHANGE IN DEPTH TO WATER
Northern District Department of Water Resources
2440 Main Street
Red Bluff, CA 96080
(530) 529-7300
http://www.ndwater.ca.gov/index.cfm
DATE:
November 26, 2008
SCALE:
By:
S Lawrence
LOCATION:

Spring 2007 to Spring 2008 Groundwater Elevation Change Contour Map – This groundwater elevation change contour map depicts the difference between the spring 2007 and spring 2008 groundwater levels. The contour lines on this map do not indicate elevation, only the change in elevation between the two measurements. In general, spring 2008 groundwater levels were between 0 and 5 feet lower than in spring of 2007, with some areas of the eastern edge of the valley floor showing an increase of 5 feet. The lack of a greater decrease in elevations around areas of northeast of Chico, Chico Urban Area, Durham, southeast of the Thermalito Afterbay, and south of Gridley is a good thing in light of hydrologic conditions, as the 2007 water year did see significant decreases over 2006.


LEGEND
140 CHANGE IN DEPTH TO GROUNDWATER FROM SPRING 2007 TO SPRING 2008 (ft)
CHANGE IN DEPTH TO GROUNDWATER APPROXIMATE LOCATION (ft)
GROUNDWATER LEVEL MONITORING WELL
REDDING GROUNDWATER BASIN BOUNDARY
SACRAMENTO VALLEY GROUNDWATER BASIN BOUNDARY
COUNTY BOUNDARY
NOTES:
1. Groundwater contours represent the change in the depth to groundwater based on level measurements taken by the Department of Water Resources and Local Cooperators during March 1st to April 2nd 2007 and March 1st to March 20th 2008.
2. Groundwater level change contours are based on groundwater level measurements taken from wells constructed within the middle portion of the aquifer system (100 to 400 feet deep). This portion of the aquifer supplies approximately 70% of all domestic, agricultural and municipal wells.
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SACRAMENTO VALLEY GROUNDWATER
SPRING 2007 TO SPRING 2008 CHANGE IN DEPTH TO WATER
Northern District Department of Water Resources
3440 Main Street
Red Bluff, CA 96080
(530) 529-7300
http://www.ndwater.ca.gov/index.cfm
DATE:
December 2, 2008
SCALE:
By:
S Lawrence
LOCATION:

BASIN MANAGEMENT OBJECTIVES

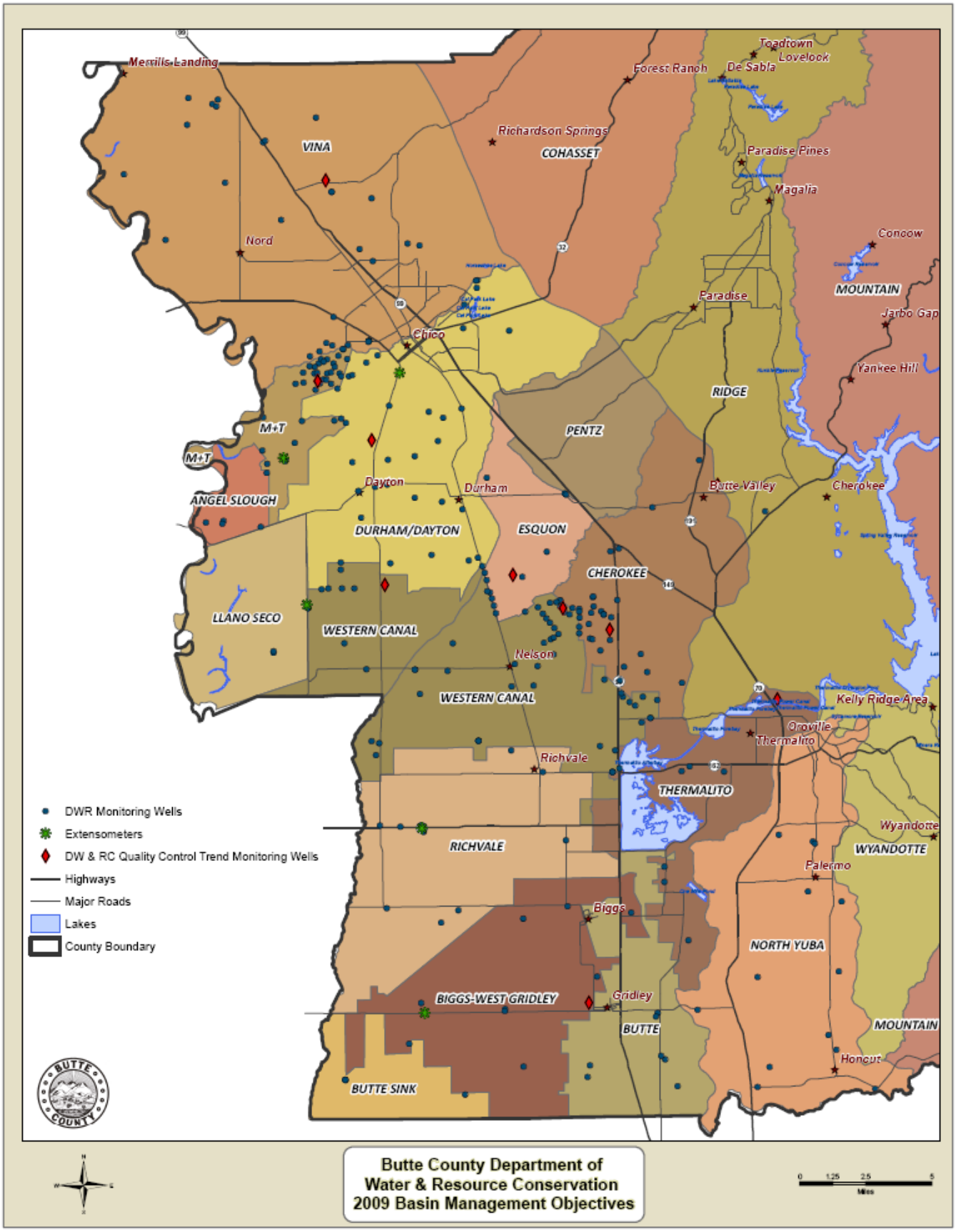
The Basin Management Objective, or BMO, concept was developed to overcome many of the usual problems of defining safe yield and overdraft in the Sacramento Valley. The California State Department of Water Resources (DWR), Northern District Groundwater Section formulated the concept while assisting Glenn County in developing their groundwater management ordinance. This concept was utilized in Butte County as well. The BMO concept defines acceptable groundwater levels, groundwater quality, and land subsidence conditions required to meet management objectives.

The BMO concept was incorporated into California Water Code §10750 et. seq., allowing for local development of AB 3030 Groundwater Management Plans. Effective January 1, 2003, BMOs are one of the mandatory components in an overall groundwater management plan required to receive grant funding from DWR for groundwater related studies, construction of groundwater projects, or groundwater quality projects. 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) to define acceptable groundwater elevations, groundwater quality, and land subsidence. Please refer to Appendix B to review the Ordinance in its entirety.

The established BMOs for each of the 16 sub-inventory units show how the cumulative monitoring efforts and historical data come together to help stakeholders determine the most appropriate alert level for groundwater levels, groundwater quality and land subsidence in each respective sub-inventory unit.

THE SACRAMENTO VALLEY BASIN

The major groundwater bearing aquifers in Butte County lie within the larger Sacramento Valley groundwater basin. The Sacramento Valley groundwater basin extends south from Red Bluff to the Sacramento-San Joaquin Delta and is bordered by the Coast Range to the west and the Cascade Range and Sierra Nevada to the east. It covers an area of 4,900 square miles. Within Butte County, the Sacramento Valley Region includes the East Butte, Foothill, Mountain, North Yuba, Vina, and West Butte Inventory Units. In Butte County, the Inventory Units of the Sacramento Valley Basin are further divided into 16 sub-inventory units shown in the figure below.


Merrills Landing
Toadtown
Lovelock
Forest Ranch
De Sabla
Richardson Springs
COHASSET
VINA
Paradise Pines
Magalia
Nord
Concow
MOUNTAIN
Paradise
Jarbo Gap
Chico
Yankee Hill
RIDGE
M+T
PENTZ
M+T
Dayton
Durham
Butte Valley
Cherokee
ANGEL SLOUGH
DURHAM/DAYTON
ESQUON
CHEROKEE
LLANO SECO
WESTERN CANAL
Nelson
WESTERN CANAL
Kelly Ridge Area
Oroville
Thermalito
Richvale
THERMALITO
Wyandotte
RICHVALE
WYANDOTTE
Palermo
Biggs
NORTH YUBA
BIGGS-WEST GRIDLEY
Gridley
BUTTE
MOUNTAIN
Honcut
BUTTE SINK
DWR Monitoring Wells
Extensometers
DW & RC Quality Control Trend Monitoring Wells
Highways
Major Roads
Lakes
County Boundary
BUTTE COUNTY
Butte County Department of
Water & Resource Conservation
2009 Basin Management Objectives
0 1.25 2.5 5
Miles

Groundwater Level Alert Stage Development Methods –
There are various methods for determining the groundwater level Alert Stages. These methods shown are typically applying different methods of statistical analysis to monitoring well records. There is no one defined method that should take precedence over another, however, some methods may be preferable based on variability of the data, simplicity, operating procedures and historical knowledge, or availability of data.

Butte County Department of Water and Resource Conservation contracted with the consulting firm Camp Dresser McKee to prepare comprehensive Development Packets for each sub-inventory unit. Groundwater level monitoring wells within each of the BMO sub-inventory units were identified. For each of the wells identified, historic groundwater level measurements were obtained using DWR's groundwater level website (http://wdl.water.ca.gov/gw/) and from municipal water suppliers. The methodologies used to calculate alert levels for Butte County sub-inventory units are described below.

Method 1 – 20% of Range and Lowest Record (Cherokee, Thermalito)
The average and range (the difference between the highest and lowest measurement) was calculated using the historic season of measurement level data for the key wells identified. The Stage 1 & 2 alert level is set at the average groundwater level of the data minus 20% of the range. The Stage 3 alert level is set at the lowest measurement on record for the key well during the season of measurement.

Method 2 – Specific Depth (Butte, Llano Seco, M&T, North Yuba, Western Canal)
An average was calculated using the historic Spring level measurement data for the key wells identified. The Stage 1 & 2 alert level is set at the average of the Spring data minus five feet. The Stage 3 alert level is set at the average of the Spring data minus ten feet. For M&T, the specific depth was set according to historical expertise and knowledge of levels that could potentially be problematic within the sub-inventory unit.

Method 3 – Specific Depth and Lowest Record (Angel Slough, Esquon, Pentz)
An average was calculated using the historic Spring level measurement data for the key wells identified. The Stage 1 & 2 alert level is set at the mid point between the average of the Spring level measurement and the Historic Low on record for the key well. The Stage 3 alert level is set at the lowest measurement on record for the key well during the season of measurement.

Method 4 – Standard Deviation and Lowest Record (Butte Sink, Biggs/West Gridley)
An average was calculated using the historic level measurement data for the key wells identified. The Stage 1 & 2 alert level is set at the average groundwater level of

the data minus one standard deviation for the key well identified. The Stage 3 alert level is set at the lowest measurement on record for the key well during the season of measurement.

Method 5 – Standard Deviation and Two Standard Deviations (Chico Urban Area, Durham/Dayton, Vina)
An average was calculated using the historic Spring (and Fall for Chico and Durham) level measurement data for the key wells identified. The Stage 1 & 2 alert level is set at the average groundwater level of the data minus one standard deviation for the key well identified. The Stage 3 alert level is set at the average groundwater level of the data minus two standard deviations for the key well identified.

LEVEL MONITORING COMPLIANCE

This spreadsheet example is taken from the Spring 2008 groundwater level summary to the Water Commission's Technical Advisory Committee (TAC). Shown is a comparison of the groundwater elevations taken and the established Stage 1 and Stage 3 Alert Levels.

BMO Data Summary
Fall 2008 LEVELS

Sub Basin	Sub-Inventory Unit	Monitoring Wells	Well Type	Groundwater Elevations			Analysis			
				Fall 2008 BMO Stage 1/2 Alert Level (Elev. ft)	Fall 2008 BMO Stage 3 Alert Level (Elev. ft)	Fall 2008 Water Surface Elevation (WSE) (Elev. ft)	Elevation Above or Below Alert Level (ft)	% change between Alert Level and Fall WSE	Fall Historic Low	Previous Historic Low Ft/Yr
EAST BUTTE	Butte Sink	17N01E17F01	M	51.76	50.92	51.90	0.14	%		
		17N01E17F02	***M***	***51.70***	***51.60***	***50.60***	***-1.10***	***-2%***	Yes	51.06 / 1994
		17N01E17F03	***M***	***51.52***	***50.97***	***50.00***	***-1.52***	***-3%***	Yes	50.96 / 1994
		17N02E19J01	I	61.10	60.50	NM-pumping				
	Esquon	***20N02E09G01***	***M***	***114.34***	***114.74***	***105.70***	***-8.64***	***-8%***	Yes	106.58 / 2002
		20N02E09L01	***I***	***113.35***	***104.50***	***107.40***	***-5.95***	***-5%***	No	104.5 / 2005
		21N02E20P01	***I***	***112.47***	***106.60***	***109.60***	***-2.87***	***-3%***	No	106.6 / 2002
	Pentz	21N02E26F01	I	119.60	111.50	NM				
	Richvale	18N01E13A02	I	68.08	63.08	73.30	5.22	8%		
		18N01E15D02	D	61.14	56.14	66.40	5.26	9%		
		19N01E27Q01	M	75.06	70.06	80.70	5.64	8%		
		19N01E35B01	M	77.30	72.30	83.90	6.60	9%		
		19N02E15N02	I	94.81	89.81	98.90	4.09	4%		
NORTH YUBA	North Yuba	***CWS-01***	***M&I***	***122.11***	***117.11***	***101.00***	***-21.11***	***-17%***	No	82 /2006
		CWS-02	M&I	136.74	131.74	146.00	9.26	7%		
		CWS-03	M&I	158.30	153.30	163.00	4.70	3%		
		17N03E03D01	I	65.16	60.16	69.20	4.04	6%		
		19N04E31F01	D	115.06	110.06	119.80	4.74	4%		

Chapter 33A §13 defines how the TAC is to investigate and report on identified or alleged non-compliance. First, the BMOs must be established and approved by the Board of Supervisors in order for there to be a review. Upon reviewing the pertinent hydrologic data, the TAC is to recommend actions to resolve the BMO non-compliance to Water and Resource Conservation staff, the WAC, and the Water Commission. Groundwater management action for an Alert Stage 1 non-compliance, as currently defined in the 2008 BMO document, is informational only. Stage 3 Alert protocol requires a more in depth review of potential influencing factors.

The TAC directed staff to contact the Water Advisory Committee (WAC) Representatives in the sub-inventory units that had reached an Alert Stage to gather data on how the low rainfall totals may have affected ag practices and in turn, groundwater levels. The TAC further investigated the Alert stages by reviewing data on the surrounding wells and reviewing common irrigation practices within the affected sub-inventory units.

Due to the fact that the winter season of 2007/2008 produced less than half of the average rainfall totals, the groundwater levels reflected a lowering throughout the basin. Similar situations existed in Colusa, Glenn and Tehama Counties. Many of the wells that were classified in the Stage 1 Alert were at, or less than one percent different from the established Alert level. The TAC ultimately concluded that the WAC and Water Commission should be made aware of the non-compliance, but keep in mind the precipitation deficiency of the 2008 water year when reviewing the hydrographs or tabular data. For the wells that were in a Stage 3 Alert Level, staff was directed to re-evaluate the chosen methodologies for setting the Alert Levels. Discussions with the sub-inventory WAC Representatives were conducted in order to gain further information on ag practices during the period of low rainfall. Staff also coordinated with sub-inventory representatives and the WAC on how best to proceed with gathering additional data to review with the TAC.

The TAC will annually review wells selected as BMO reference wells and the methodologies selected for establishing Alert Levels prior to the submission of the document to the Board of Supervisors. It is critical that there is a Quality Control and Quality Assurance confidence in both the historical data available and the manner in which it is evaluated in the context of the BMO process.

BUTTE COUNTY BMO COMPLIANCE EVALUATION PROCEDURE

The groundwater surface elevation at each monitoring well will be compared against the corresponding hydrographs and the defined Alert Stage for each sub-inventory unit to determine if the groundwater surface elevations are above or below specific alert trigger levels. The Butte County Water Commission's Technical Advisory Committee will convene following the stated measurement period, determine compliance with the BMO, and then report the results of the evaluation to the Butte County Water Advisory Committee and Water Commission.

Ground Water Management Actions –

Alert Stage 1. Groundwater management actions to be undertaken following a Stage 1 noncompliance shall be informational. The Butte County Water Advisory Committee (WAC) and Water Commission (WC) will be advised of the noncompliance.

Alert Stage 2. Groundwater management actions to be undertaken following a Stage 2 noncompliance shall be investigational. Upon identification of the Stage 2 noncompliance, the noncompliance will be reported to the WAC and the WC. Following review and concurrence, the WAC shall direct the TAC to initiate an

investigation to determine the cause(s) of the noncompliance and make recommendations as to how to correct the noncompliance. The TAC shall report their findings and recommendations back to the WAC and WC within 30 days.

Alert Stage 3. Groundwater management actions to be undertaken following a Stage 3 noncompliance shall be actionable. Upon identification of the Stage 3 noncompliance, the noncompliance will be reported to the WAC and the WC. Following review and concurrence, the WAC shall direct the TAC to initiate an investigation to determine the cause(s) of the noncompliance and make recommendations as to how to correct the noncompliance. The TAC shall report their findings and recommendations back to the WAC and WC within 30 days. The WAC will then work with the local stakeholders in the sub-inventory unit to implement needed water management activities necessary to correct the problem. Such water management activities shall include, but not limited to, voluntary water conservation measures, redistribution of groundwater extraction, reduction of groundwater extraction, and/or other measure(s) identified and approved by the WAC, WC, and the Butte County Board of Supervisors.

Butte County Groundwater Quality Trend Monitoring Program

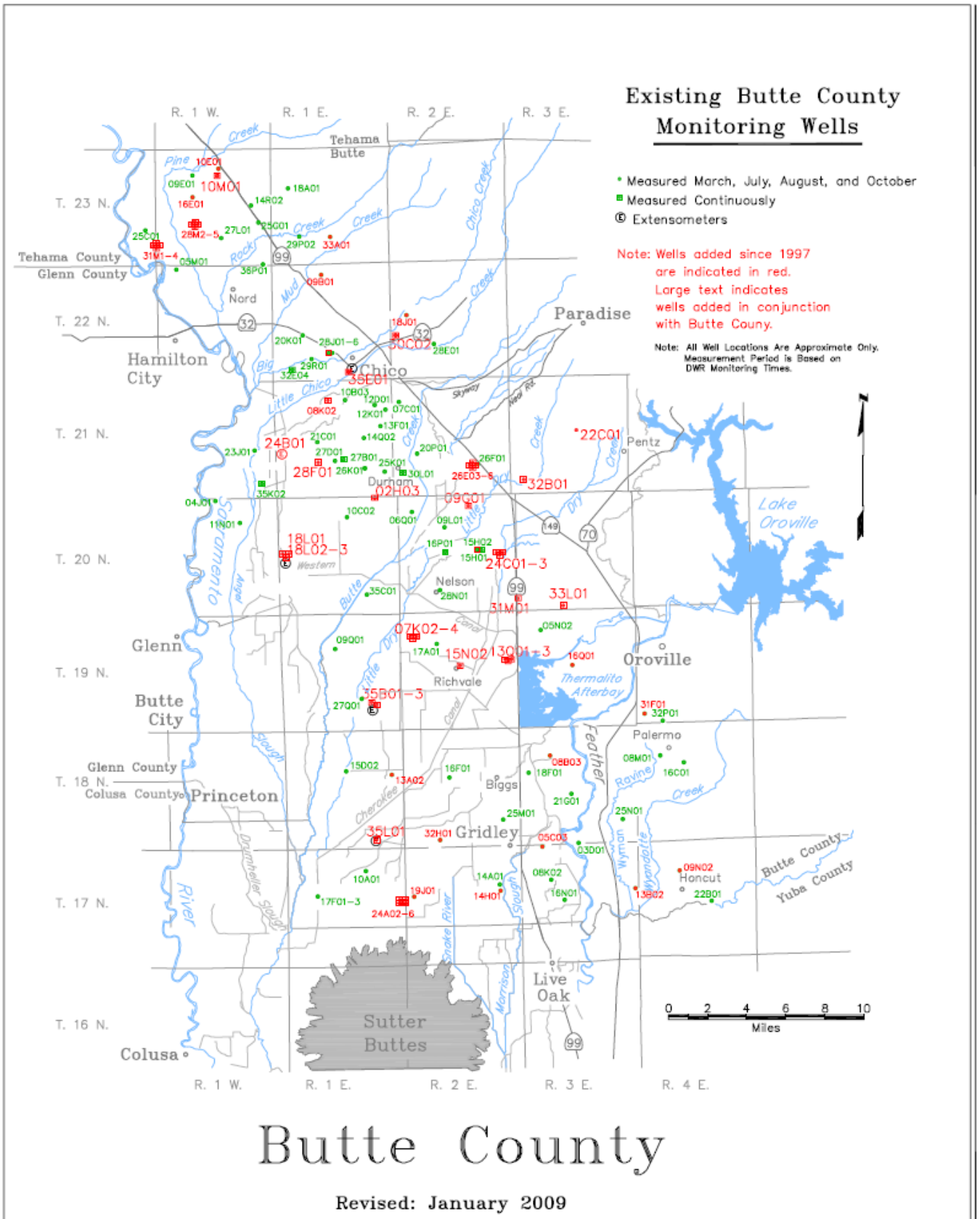
As stated in Chap 33A, the parameters to be monitored are temperature, pH and electrical conductivity. These three parameters do not fully characterize the quality of local groundwater nor do they provide enough information to ensure that water is safe to drink. Yet, they do encompass the basic characteristics to consider when evaluating water for evidence of saline intrusion. This monitoring program is not designed to characterize or focus on sites where groundwater has become contaminated due to pollutants, nor can it identify specific sources of pollution. However, it does provide valuable information on baseline water quality conditions before groundwater resources are further developed and to characterize water quality trends basin-wide in Butte County. Water quality trend monitoring samples are taken during the height of the irrigation season in late July or early August, and the data is evaluated by the Technical Advisory Committee each shortly thereafter.

LAND SUBSIDENCE

The locations of the five extensometers that measure land subsidence within the County are shown in Figure E. These extensometers were installed during 1999 and 2003. Records from these extensometers are available by contacting the Department of Water Resources Northern District or on the Northern District web page (http://www.nd.water.ca.gov/Data/Extensometers/index.cfm). Land subsidence data is recorded continuously and is evaluated by the Technical Advisory Committee each Spring. To date, no land subsidence has been recorded in Butte County.

APPENDIX A

Butte County Monitoring Well Network



Butte County

Revised: January 2009

N:\Groundwater\4803Projects\ButteCounty\AutoCAD\Monitoring Grid Maps

APPENDIX B

Butte County Groundwater Conservation Ordinance
Chapter 33

Chapter 33

GROUNDWATER CONSERVATION*

Sections:

33-1	**Purposes.**
33-2	**Definitions.**
33-3	**Groundwater planning process.**
33-4	**Groundwater monitoring.**
33-5	**Permit required for groundwater extraction for use outside county.**
33-6	**Permit required for groundwater substitute pumping.**
33-7	**Exemptions.**
33-8	**Application for a permit.**
33-9	**Procedures for processing.**
33-10	**Public review concerning issuance of permit.**
33-11	**Granting of permit.**
33-12	**Appeal of granting or denial of a permit.**
33-13	**Challenge to approved permit.**
33-14	**Duration of permit.**
33-15	**Limitation of permit.**
33-16	**Inspection.**
33-17	**Civil penalty.**
33-18	**Amendment.**
33-19	**Severability.**

***Editor's note**—Ord. No. 3303-A, § 7.01, adopted Dec. 10, 1996, repealed former Ch. 33, §§ 33-1—33-8, of the Code, which pertained to groundwater conservation and derived from Ord. No. 1859 § 1, adopted Aug. 23, 1977. Ord. No. 3303-A, §§ 1.01, 2.01, 3.01, 3.02, 4.01—4.11, 5.01, 6.01, 9.01, enacted new provisions which have been included herein as a new Ch. 33, §§ 33-1—33-18, at the direction of the county.

Cross references—Grading and mining, Ch. 13; code enforcement policies and procedures, Ch. 41.

33-1 Purposes.

The people of the county hereby find and declare:

(a) The groundwater underlying Butte County provides the people and lands of Butte County with water for agricultural, domestic, municipal, and other purposes.

(b) 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.

(c) It is essential for the protection of the health, welfare, and safety of the residents of the county, and the public benefit of the state, that the groundwater resources of Butte County be protected from harm resulting from both the extraction of groundwater for use on lands outside the county and the substitution of groundwater for surface water transferred outside the county.

(d) The county seeks to foster prudent water management practices to avoid significant environmental, social, and economic impacts. It is therefore essential for the protection of the county's important groundwater resources that the county require a permit to extract groundwater for use outside the county and for the substitution of groundwater for surface water that has been used in the county and is now voluntarily transferred outside the county, to protect against groundwater overdraft and to insure that the safe yield of the groundwater aquifers and subbasins are not exceeded. This chapter is not intended to regulate groundwater in any other way.

(e) In adopting this chapter, the county in no way intends to limit public entities' management of groundwater in accordance with the Groundwater Management Act and any other applicable laws.

(f) Butte County is the county and watershed of origin for much of the groundwater and surface water within the county. The availability of groundwater underlying the county for consumptive uses within the county is inextricably linked to the use of surface water. Increased groundwater pumping within the county which directly results from a transfer of surface water from the county causes a net loss of water resources for consumptive purposes within the county and can have significant adverse impacts on the health, welfare, and safety of the residents of the county. The county does not intend that this chapter invade the province of the Legislature by regulating surface water transfers. The county intends to exercise its police power to require a transferor who will pump amounts of groundwater or cause amounts of groundwater to be pumped to mitigate the potential adverse impacts from any additional groundwater pumping related to the surface water transfer. (Ord. No. 3303-A, § 1.01, 12-10-96; Ord. No. 3542, § 1, 8-10-99)

33-2 Definitions.

The definitions set out in this section shall apply to this chapter.

(a) "Aquifer" means a geologic formation that stores, transmits and yields significant quantities of water to wells and springs.

(b) "Association" means the Butte Basin Water Users Association.

(c) "Board" means the board of supervisors of Butte County.

(d) "Commission" means the Butte County Water Commission, which shall be a nine (9) person commission appointed by the board. The commission shall include one (1) member representing each board district and nominated for appointment by the county supervisor duly elected to represent that district and four (4) members at large of which two (2) are landowners of property served by district water and two (2) are landowners served by private wells.

(e) "County" means the County of Butte.

(f) "District" means a district wholly or in part located within the boundaries of the county, which is a purveyor of water for agricultural, domestic, or municipal use.

(g) "Department" shall mean the Butte County Department of Water and Resource Conservation.

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

(i) "Groundwater Management Act" means Water Code Sections 10750 et seq.

(j) "Hydraulic gradient" means the slope of the water table.

(k) "Hydrology" means the origin, distribution, and circulation of water through precipitation, stream flow, infiltration, groundwater storage, and evaporation.

(l) "Overdraft" means the condition of an aquifer where the amount of water withdrawn by pumping exceeds the amount of water replenishing the aquifer over the water year and also the point at which extractions from the aquifer exceed its safe yield plus any temporary surplus.

(m) "Percolation" means the movement of water through the soil to the groundwater table.

(n) "Permeability" means the capability of the soil or another geologic formation to transmit water.

(o) "Piezometric surface" means the surface to which the water in a confined aquifer will rise.

(p) "Porosity" means voids or open spaces in alluvium and rocks that can be filled with water.

(q) "Recharge" means flow to groundwater storage from precipitation, irrigation, infiltration from streams, spreading basins and other sources of water.

(r) "Safe yield" means the maximum quantity of water which can be withdrawn annually from an aquifer under a given set of conditions without causing overdraft or adverse water quality conditions.

(s) "Saline intrusion" means the movement of salt water into fresh water aquifers.

(t) "Specific capacity" means the volume of water pumped from a well in gallons per minute per foot of drawn down.

(u) "Spreading water" means discharging native or imported water to a permeable area for the purpose of allowing it to percolate to the zone of saturation. Spreading, artificial recharge and replenishment all refer to operations used to place water in a groundwater table.

(v) "Subbasin" means one (1) of the four (4) subbasins within the county, including the East Butte, Palermo, Vina, and West Butte subbasins defined by the California Department of Water Resources.

(w) "Technical advisory committee" means a seven (7) person committee nominated by the commission and appointed by the board. They each must have substantial expertise in water management or hydrology.

(x) "Transmissivity" means the rate of flow of water through an aquifer.

(y) "Water table" means the surface or level where groundwater is encountered in a well in an unconfined aquifer.

(z) "Water year" means the year beginning February 1 and ending the last day of the following January.

(aa) "Zone of saturation" means the area below the water table in which the soil is completely saturated with groundwater. (Ord. No. 3303-A, § 2.01, 12-10-96; Ord. No. 3329, §§ 1, 2, 5, 5-13-97; Ord. No. 3505, § 1, 4-13-99)

33-3 Groundwater planning process.

The association, unless otherwise designated by the water commission, shall present the reports described in this section to the department by February 21 of each year. These reports shall guide groundwater planning within county and shall be considered in accordance with section 33-9.

(a) A groundwater status report based upon the data gathered and analyzed pursuant to section 33-4.

(b) Using groundwater data for at least the prior twenty (20) years, a report that analyzes the amount of groundwater pumping that can occur during the water year within each county subbasin without exceeding the safe yield of each subbasin. (Ord. No. 3303-A, § 3.01, 12-10-96; Ord. No. 3641, § 1, 10-10-2000)

33-4 Groundwater monitoring.

(a) The water commission through the department, in cooperation with the technical advisory committee, the association, the California Department of Water Resources

and the regional water quality control board, shall develop and coordinate a county-wide groundwater monitoring program.

(b) Specific monitoring wells shall be identified. Permission to enter the property on which each well is located and to take groundwater level measurement shall be obtained voluntarily from the well owner. If permission cannot be obtained, then another well shall be selected.

(c) 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.

(d) Each district and city within the county shall be requested to submit copies of all its groundwater monitoring reports to the department as such reports are completed but not later than December 1 of each year. The department shall also encourage individuals to voluntarily provide any available groundwater data. (Ord. No. 3303-A, § 3.02, 12-10-96; Ord. No. 3455, § 1, 10-27-98)

33-5 Permit required for groundwater extraction for use outside county.

It shall be unlawful to extract groundwater underlying county for use of that groundwater so extracted, outside county without first obtaining a permit as provided in this chapter. A permit is not required pursuant to this section if the groundwater is used within the boundaries of either a district or on a contiguous parcel of any property owner which is in part located within county and in part in another county, where such extraction quantities and use are consistent with historical practices of the district or the property owner. The groundwater extractor shall have the burden of supporting an assertion of an historical practice with competent evidence. (Ord. No. 3303-A, § 4.01, 12-10-96)

33-6 Permit required for groundwater substitute pumping.

It shall be unlawful to extract groundwater underlying county for use on a parcel or parcels of land within the county in substitution for surface water which would otherwise be used to serve the parcel or parcels and which surface water is proposed to be transferred for use outside county, without first obtaining a permit as provided in this chapter. A permit is not required pursuant to this section if changed cropping patterns render the use of surface water infeasible or if the transferred surface water is used within the boundaries of either a district or on a contiguous parcel of any property owner which is in part located within county and in part in another county, where such quantity and use are consistent with historical practices of the district or the property owner. The transferor shall have the burden of supporting an assertion of infeasibility or an historical practice with competent evidence. (Ord. No. 3303-A, § 4.02, 12-10-96; Ord. No. 3542, § 1, 8-10-99)

33-7 Exemptions.

This chapter shall not apply to the temporary extraction of groundwater to prevent the flooding of lands or to prevent the saturation of the root zone of farm land. (Ord. No. 3303-A, § 4.03, 12-10-96)

33-8 Application for a permit.

An application for a permit pursuant to this chapter shall be filed with the department on forms provided by the department and shall contain all information required by the department. The department shall require the following information in an application for a permit under section 33-6.

(a) Name, address, telephone number, and fax number (if any) of the applicant.

(b) The amount of surface water available to the land and the amount proposed to be transferred, the transfer period, the physical source of the surface water to be transferred, the applicable surface water right held by the applicant, and the name, address, telephone number, and fax number (if any) of the proposed transferee.

(c) A list of all parcels of land where surface water deliveries are to be reduced.

(d) A list of wells, including the maximum engineered pumping capacity of each well's pump and motor, which are proposed to participate in the groundwater substitute pumping program and their location.

(e) A list of all wells located within the well spacing requirements of the wells listed under subsection (d) of this section along with certification that the owners of such wells have received notice of the application. The well spacing requirements are set forth in section 23B-5b of this code.

(f) A map showing the location of all parcels and wells identified under subsections (c), (d) and (e) of this section.

(g) A groundwater hydrology report paid for or otherwise provided by the applicant identifying adverse impacts on wells listed in subsection (e) and any other agricultural well likely to experience significant adverse impacts. The report shall be prepared by a qualified groundwater hydrologist or licensed professional civil or agricultural engineer.

(h) A description of the proposed monitoring program and the pumping curtailment.

(i) A description of the proposed mitigation program for any identified third party impacts, which may specify a dollar amount held in a trust account to satisfy potential third party claims.

(j) Such additional information as required by the department.

Concurrently, a request for environmental review shall be filed as required by applicable county CEQA guidelines. The application for a permit and request for environmental review shall be accompanied by the required fees established by the board, which shall be reviewed by the board not less than every two (2) years. (Ord. No. 3303-A, § 4.04, 12-10-96)

33-9 Procedures for processing.

(a) Within ten (10) calendar days of filing of the permit application, the department shall provide public notice by publication in a newspaper of general circulation in Butte County, and posting at the courthouse at Oroville and the department office in Chico that an application has been filed, shall send a copy of the notice to all districts and cities within the county and to any interested party who has made a written request to the department for such notice within the last twenty-four (24) calendar months. The department shall review the application to determine whether it is complete for purposes of proceeding under the county guidelines adopted pursuant to the California Environmental Quality Act requirements.

(b) The department shall review the most current reports provided pursuant to section 33-3. The department shall review the matter of the application with the technical advisory committee and may also review the matter of the application with the affected county departments, with the staff of the state department of water resources, with the staff of the Regional Water Quality Control Board—Central Valley Region, and with any interested district within whose boundary the proposed activity will occur. If the applicant is applying to pump groundwater from within the boundaries of a district or city which has adopted a groundwater management plan pursuant to the groundwater management act, the department shall consider a groundwater management plan or any other relevant information provided by the district or city. Any interested person or agency may provide comments relevant to the matter of the extraction of groundwater. Comments shall be submitted within thirty (30) days of the date of mailing the notice of filing the permit application.

(c) The environmental review shall be undertaken in accordance with the California Environmental Quality Act and county guidelines. All costs of the environmental review shall be the responsibility of applicant.

(d) Upon completion of the environmental review, the department shall submit the following documents to the commission: the application, all comments received, the environmental documentation, the most current reports submitted pursuant to section 33-3, the retained expert's report (if applicable), and the department's written report. (Ord. No. 3303-A, § 4.05, 12-10-96)

33-10 Public review concerning issuance of permit.

(a) Upon receipt of the documents described in 33-9(d), the commission shall immediately set a public review on the issuance of the permit which shall be noticed pursuant to Government Code section 6061 and may not be held within fifteen (15) days nor more than thirty (30) days of the time that the commission receives the report from the department.

(b) Formal rules of evidence shall not apply to the public review of the application, but the commission may establish such rules as will enable the expeditious presentation of the matter and relevant information thereto. At the commission review, the applicant shall be entitled to present any oral or documentary evidence relevant to the application, and the applicant shall have the burden of proof of establishing the facts necessary for the commission to make the required findings. The commission may request any additional information it deems necessary for its decision. The commission shall also hear relevant evidence presented by other interested persons and entities, the department, other county staff, the association, and the public. The commission shall consider all effects that the granting of the permit application would have on the subbasin and affected aquifer including, but not limited to, the hydraulic gradient, hydrology; percolation, permeability, piezometric surface, porosity, recharge, safe yield, salt water intrusion, specific capacity, spreading water, transmissivity, water table and zone of saturation. (Ord. No. 3303-A, § 4.06, 12-10-96)

33-11 Granting of permit.

A permit shall be granted pursuant to sections 33-5 and 33-6 only if the commission finds and determines that the extraction will not:

(a) Cause or increase an overdraft of the groundwater underlying the county;

(b) Bring about or increase salt water intrusion;

(c) Exceed the safe yield of the aquifer or subbasins underlying the county;

(d) Result in uncompensated injury to overlying groundwater users or other water users; or

(e) Cause subsidence.

In granting a permit, the commission shall impose appropriate conditions upon the permit to satisfy the above findings, and may impose other conditions that it deems necessary for the health, safety and welfare of the people of the county. Conditions in the permit may include, but are not limited to, requiring metering of the wells under the permit, both short-term and annual pumping limits, prescribed groundwater levels at which groundwater pumping must cease, and additional requirements for observation and/or monitoring wells.

In denying a permit, the commission shall make specific findings in any of the subsections (a) through (e) to support its decision.

The decision of the commission relating to section 33-5 shall be made upon an affirmative vote of six (6) members of the commission and relating to section 33-6 shall be made upon an affirmative vote of a majority of the quorum present. Such decisions may be appealed in accordance with section 33-12 or 33-13. (Ord. No. 3303-A, § 4.07, 12-10-96)

33-12 Appeal of granting or denial of a permit.

The applicant or any interested party or public entity may appeal the decision of the commission by filing a written request with the clerk of the board within thirty (30) days of issuance of the decision. The clerk shall set a time for review by the board within twenty (20) days of receipt of the request for appeal. Notice of appeal shall be given to the commission, the permittee, appellant, as well as to the districts and cities within the county, and to interested parties who have requested notice of such appeals within the last twenty-four (24) months. The board shall hear the appeal as to those disputed matters which were heard by the commission and which are specifically set out in the appeal request. The standard of review shall require that substantial evidence be presented to prevail on an issue. The appeal before the board shall not be conducted with formal rules of evidence but under such rules as set by the board for the expeditious presentation of the matter and relevant information pertaining thereto by the appellant and by those opposed to the reversal of the commission decision. The decision of a majority of the board shall be the final decision in the matter. (Ord. No. 3303-A, § 4.08, 12-10-96; Ord. No. 3542, § 1, 8-10-99)

33-13 Challenge to approved permit.

(a) Any interested party or public entity may challenge the continuation of the permit during the term of the permit when any of the following information exists:

(1) There is a violation of the conditions of the permit;

(2) Extraction of groundwater pursuant to the permit:

a. Causes or increases an overdraft in the basin; or

b. Brings about or increases salt water intrusion, or

c. Exceeds the safe yield of the subbasin(s), or

d. Results in uncompensated injury to overlying groundwater users or other water users, or

e. Causes subsidence.

(b) A challenge pursuant to this section is commenced by filing a written request with the department which alleges any one (1) of the above situations and generally described the supporting facts for such allegation. If the department determines that the supporting facts make a prima facie showing of one (1) of the above categories, the department shall within ten (10) days of the receipt of such challenge, give notice of the challenge to the commission, the permittee, appellant, to any interested party who filed a written request for such notice within the past twenty-four (24) months, and also to districts and cities within the county. A commission review shall be held on the matter following the procedure set out in section 33-11. The commission's decision may be to deny the challenge, grant the challenge and terminate the permit, or to establish modified conditions to the permit.

(c) The standard for review shall be substantial evidence.

(d) Any interested party or public entity may challenge the issuance of a permit by the commission on the basis that the permit was not issued in accordance with the procedural requirements of this chapter by filing an appeal in the same manner and within the same time period specified in section 33-12. The requirements of section 33-12 shall govern appeals filed pursuant to this subsection. (Ord. No. 3303-A, § 4.09, 12-10-96; Ord. No. 3542, § 1, 8-10-99)

33-14 Duration of permit.

All permits shall be valid for a three-year term unless the commission finds that a shorter term is required by the findings in section 33-11(a) through (e). For the purpose of calculation, the water year in which the permit is granted shall not be counted in determining the three (3) year time period if less than four (4) months remains in the then water year. Provided, however, nothing contained in this chapter nor in the conditions of the permit shall be

construed to give permittee an exclusive right to groundwater. (Ord. No. 3303-A, § 4.10, 12-10-96)

33-15 Limitation of permit.

The permit process in this chapter is not to be construed as a grant of any right or entitlement but rather the permit evidences that the health, welfare, and safety of the residents of the county will not be harmed by the extraction of groundwater for use outside the county or the substitution of groundwater for surface water that has been transferred outside county. The permit in no way exempts, supersedes, or replaces any other provisions of federal, state, and local laws and regulations including but not limited to Water Code Section 1220, the Groundwater Management Act, and any actions provided for in California groundwater law, well drilling and maintenance in accordance with Chapter 23B of the Butte County Code, or building permit requirements. (Ord. No. 3303-A, § 4.11, 12-10-96)

33-16 Inspection.

The department, with good cause, may at any and all reasonable times enter any and all places, property, enclosures and structures, where a well is located, for the purposes of making examinations and investigations to determine whether any provision of this chapter is being violated. (Ord. No. 3303-A, § 5.01, 12-10-96)

33-17 Civil penalty.

The county may elect to proceed with a civil action against a violator, including seeking injunctive relief. Any person who or entity which violates this chapter shall be subject to fines of up to five thousand dollars ($5,000.00) per separate violation. A person or entity shall be deemed to have committed separate violations for each and every day or portion thereof during which any such violation is committed, continued or permitted as well as for each and every separate groundwater well with which any such violation is committed, continued, or permitted. (Ord. No. 3303-A, § 5.01, 12-10-96)

33-18 Amendment.

The board may amend this chapter or any of its provisions following a properly noticed public hearing. The clerk shall publish notice of such hearing as provided in Section 6066 of the Government Code, prior to the date set for hearing, in a newspaper of general circulation printed and published in the county. (Ord. No. 3303-A, § 9.01, 12-10-96; Ord. No. 3329, § 3, 6-13-97)

33.19 Severability.

If any provision of this chapter or the application thereof to any person or circumstances is for any reason held to be invalid by a court of competent jurisdiction, such provision shall be deemed severable, and the invalidity thereof shall not affect the remaining provisions or other applications of the chapter which can be given effect without the invalid provision or application thereof. (Ord. No. 3542, § 1, 8-10-99)

APPENDIX C

Butte County Groundwater Management Ordinance
Chapter 33A

Chapter 33A

GROUNDWATER MANAGEMENT

Sections:

33A-1	**Legislative intent.**
33A-2	**Definitions.**
33A-3	**Actions.**
33A-4	**Water Advisory Committee.**
33A-5	**Appointments.**
33A-6	**Basin management objectives.**
33A-7	**Monitoring BMO compliance.**
33A-8	**Monitoring networks.**
33A-9	**Monitoring frequency.**
33A-10	**Changes in monitoring.**
33A-11	**Monitoring protocol.**
33A-12	**Review of technical data.**
33A-13	**Action by Technical Advisory Committee.**
33A-14	**Action by Water Advisory Committee.**

33A-1 Legislative intent.

a. The Board finds that the protection of the groundwater resource for beneficial use within the County is of major concern to the residents of the county for the protection of their health, welfare and safety. The Board further declares that the beneficial use and maintenance of groundwater and protection of recharge zones is of critical importance to the economy and environment of the County.

b. The Board intends to ensure the continued sustainability of groundwater quantity and quality within the county.

c. The Board intends to protect groundwater quality and prevent land subsidence.

d. The Board does not hereby intend to regulate, outside of Chapter 33, the use of groundwater; unless established Basin Management Objectives are exceeded. Absent emergency circumstances, as determined by the Board of Supervisors, the Board shall not consider changing any established basin management objective until one (1) year has elapsed from the date of the establishment or Board approved change to such Basin Management Objective.

e. It is essential for information gathering and management purposes that the County maintain a monitoring program addressing groundwater elevations, groundwater quality and land subsidence.

f. In adopting the groundwater management ordinance codified in this chapter, the Board does not intend to limit other means of managing groundwater within the county authorized elsewhere in statute or ordinance, and intends to work cooperatively with local entities and the general public to further develop and implement joint groundwater management practices.

g. The lack of groundwater management may have the following negative impacts, including, but not limited to:

1. Lowering of groundwater levels leading to increased energy consumption, a potential decrease in stream flows, the increased cost of deepening existing wells and the prospect that new wells shall need to be deeper and more costly than would otherwise be required;

2. Damage to public roads, bridges, subterranean infrastructure, canals and other structures caused by land subsidence at substantial cost to the public;

3. Depleting surface and subsurface flows leading to the potential loss of wildlife and critical terrestrial and wetland habitat;

4. Degradation of groundwater quality;

5. A degradation of property values and injury to agricultural lands in Butte County.

h. It is the purpose and intent of this chapter to establish and effective policy concerning groundwater that will assure that the overall economy and environment of the county is protected. Through the adoption of this Chapter, the Board of Supervisors seeks to protect the health, safety and welfare of County residents and the general public.

i. The Board does not intend, in adopting this chapter, to determine whether any groundwater in storage above established Basin Management Objectives is surplus groundwater, to define surplus groundwater, or to impose fees, assessments, charges or taxes upon County residents and/or business owners. (Ord. No. 3869, § 1 (part), 2-10-04)

33A-2 Definitions.

a. "Aquifer" means a geologic formation that may store, transmit and yield significant quantities of groundwater to wells and springs.

b. "Basin Management Objectives (BMO)" means groundwater elevations, groundwater quality and land subsidence criteria adopted by the Board of Supervisors for the management of the Butte County groundwater resource under the provisions of this chapter.

c. "Board" means the Board of Supervisors of Butte County.

d. "Commission" means the Butte County Water Commission.

e. "County" means County of Butte.

f. "District" means any purveyor of water wholly or partly within the boundaries of the county that provides water for agricultural, domestic, municipal or industrial use.

g. "Department" means the Butte County Department of Water and Resource Conservation.

h. "Extensometer" means an instrument for measuring land subsidence.

i. "Groundwater" means all water beneath the surface of the earth below the zone of saturation, but does not include water which flows in known and definite subsurface channels, as set forth in the case of Los Angeles v. Pomeroy (1899) 124 Cal. 597.

j. "Groundwater Management Plan" means a plan prepared pursuant to the California Groundwater Management Act (commencing with Water Code Section 10750 et seq.).

k. "Land Subsidence" means the permanent lowering of the ground surface caused by the inelastic consolidation of clay beds in the aquifer system.

l. "Recharge" means flow to groundwater storage from precipitation, irrigation, infiltration from streams, spreading basins and other sources of water.

m. "Technical Advisory Committee" means the seven (7) person committee nominated by the Water Commission and appointed by the Board as defined under Chapter 33.

n. "Water Advisory Committee" (WAC) means an advisory body appointed by the Board. (Ord. No. 3869, § 1 (part), 2-10-04)

33A-3 Actions.

a. Upon approval by the Board, Basin Management Objectives shall be used to establish criteria for:

1. Groundwater elevations;
2. Groundwater quality; and
3. Land subsidence.

b. Compliance with the BMO shall be determined by evaluation of data collected from the groundwater level, groundwater quality and land subsidence monitoring networks established within each sub-inventory unit by the local stakeholders. Evaluation of these data shall be the only basis for determining compliance with the BMO. It is the intent that the BMO levels be chosen to assure that the overall economy and environment of each sub-inventory unit within County is protected. (Ord. No. 3869, § 1 (part), 2-10-04)

33A-4 Water Advisory Committee.

a. The Water Advisory Committee (WAC) shall be appointed by the Board. The WAC shall be an advisory committee comprised of area-specific members, with one member appointed from each defined sub-inventory unit within the Sacramento Valley Groundwater Basin portion of the county, and one each from the Foothill and Mountain inventory units, as defined in the 2001 Butte County Water Inventory/Analysis report. Additional at-large members shall be appointed, one from each incorporated municipality in the County: Chico, Oroville, Paradise, Gridley and Biggs, one from the agricultural community, one from the environmental community and one from each organized watershed group in the county. The operation of the Water Advisory Committee shall be governed by by-laws approved by the Board of Supervisors.

b. Sub-inventory Units.

1. Vina;
2. M&T;
3. Llano Seco;
4. Durham/Dayton;
5. Western Canal;
6. Pentz;
7. Esquon;
8. Cherokee;
9. Richvale;
10. Thermalito;
11. Biggs-West Gridley;
12. Butte Sink;
13. Butte;
14. North Yuba;
15. Angel Slough;
16. Chico Urban Area.

c. The local representatives of each sub-inventory unit shall be solely responsible for the development of the Basin Management Objective for their sub-inventory unit.

d. Sub-inventory units may be added, modified or changed as deemed necessary by the stakeholders within the sub-inventory unit. All modifications and changes shall be reviewed by the WAC and approved by the Board. (Ord. No. 3869, § 1 (part), 2-10-04)

33A-5 Appointments.

a. The Board shall consider all nominations for appointment to the Water Advisory Committee that meet the following criteria:

1. Candidates who reside, own property or have their principle place of business within the sub-inventory unit or entity which they would represent and are willing to serve in a voluntary capacity; and
2. Candidates nominated by the citizens of the sub-inventory unit.

b. Members of the WAC shall serve a four (4) year term. Terms shall be staggered by lot for two (2) years at

the onset and open to reappointment for consecutive terms. (Ord. No. 3869, § 1 (part), 2-10-04)

33A-6 Basin management objectives.

a. Determination of the BMO. The process instituting the BMO within each sub-inventory unit shall be established within one (1) year following approval of the ordinance codified in this chapter and incorporated into this chapter by reference. The individual sub-inventory unit BMO shall be initially established and re-established annually through input from the sub-inventory unit stakeholders. The individual BMO shall be approved by the Board at the first regular meeting of the Board in April of each year. The Board's approval of the BMO shall be based on:

1. Local sub-inventory unit stakeholder input;

2. The recommendation of the Water Advisory Committee and the Water Commission; and

3. Monitoring data and existing conditions of the aquifer system.

b. It is the intent of this chapter that there be one (1) countywide adaptive management plan, incorporating all specific BMO determinations for the individual sub-inventory units.

c. It is the intent of the Board in adopting this chapter that groundwater management practices based on the established BMO criteria for one (1) sub-inventory unit shall not result in exceeding the established BMO criteria in any other sub-inventory unit.

d. In the event that sub-inventory unit stakeholders do not initially establish or re-establish BMO criteria for their sub-inventory unit, the Water Advisory Committee shall establish BMO criteria for the sub-inventory unit and submit it to the Water Commission and the Board of Supervisors for approval. (Ord. No. 3869, § 1 (part), 2-10-04)

33A-7 Monitoring BMO compliance.

a. Monitoring programs designed to detect changes to groundwater elevations, groundwater quality and land subsidence are the key to proper assignment of, and compliance with, the BMO. The monitoring programs shall measure select wells, identified by the local sub-inventory unit stakeholders, to determine changes in groundwater elevation and changes in groundwater quality and land subsidence. The County shall make available all groundwater monitoring data through the Department website in a timely manner. (Ord. No. 3869, § 1 (part), 2-10-04)

33A-8 Monitoring networks.

a. The monitoring networks used in the development of, and compliance with, the BMO may include as many of the following as are feasible: selected domestic and irrigation wells from water districts, private owners, municipal and industrial water suppliers and dedicated monitoring wells. Individual sub-inventory unit stakeholders may monitor additional wells for compliance with the BMO. Participation in monitoring activities by private landowners shall be on a voluntary basis.

b. Additional monitoring wells may be installed and monitored by the local stakeholders for BMO compliance. (Ord. No. 3869, § 1 (part), 2-10-04)

33A-9 Monitoring frequency.

a. Monitoring Frequency for Groundwater Elevations. At a minimum, groundwater elevations shall be monitored four (4) times during the year: one (1) measurement prior to the irrigation season in March, two (2) measurements during peak groundwater use in July and August, and one (1) measurement following irrigation season in October. All monitoring data collected by stakeholders shall be submitted to the Department within thirty (30) days of collection.

1. Monitoring Frequency for Groundwater Quality. The frequency of groundwater quality monitoring shall be at a minimum of once a year during peak groundwater use (July or August). The following minimum groundwater quality measurements shall be taken:

A. Groundwater temperature;

B. Groundwater pH; and

C. Groundwater electrical conductivity.

2. Within each sub-inventory unity, increased frequency and location of groundwater quality monitoring and monitoring constituents may be determined and conducted by the local stakeholders. All monitoring data collected by stakeholders shall be submitted to the Department within thirty (30) days of collection.

b. Monitoring Frequency for Land Subsidence. Land subsidence monitoring shall be conducted on a continuous basis through the use of extensometers. Land subsidence may also be monitored by resurveying existing benchmarks in the sub-inventory unit area at a frequency determined by the local stakeholders. All monitoring data collected by stakeholders shall be submitted to the Department within thirty (30) days of collection. (Ord. No. 3869, § 1 (part), 2-10-04)

33A-10 Changes in monitoring.

a. Changes in Monitoring Frequency. If evaluation of the groundwater elevation, groundwater quality or land subsidence data indicate a need for greater monitoring frequency, the local stakeholders may make changes to the monitoring schedule once per calendar year. Such changes,

if made, shall be submitted to the Department by April 1 of each year.

b. Changes in Monitoring Network. If evaluation of the groundwater elevation, groundwater quality standards or land subsidence criteria data indicates a need for a greater number of monitoring wells or survey monuments, the local stakeholders may make changes to their monitoring network once per calendar year. Such changes, if made, shall be submitted to the Department by April 1 of each year. (Ord. No. 3869, § 1 (part), 2-10-04)

33A-11 Monitoring protocol.

a. All data shall be collected and recorded through methods generally accepted in the applicable scientific field. (Ord. No. 3869, § 1 (part), 2-10-04)

33A-12 Review of technical data.

a. Standard methods for review and analysis of the collected data shall be established by the Water Advisory Committee. Such data shall be reviewed by the Technical Advisory Committee and reported to the Water Commission and the Board annually pursuant to established protocol.

b. During the irrigation season, the Technical Advisory Committee shall review and analyze data for compliance with the current BMO. During the non-irrigation season, the focus shall be on review of BMO compliance for the previous irrigation season and development of new BMO criteria for the following year, if necessary. New BMO criteria shall be developed by sub-inventory unit stakeholders and presented at the first regular meeting of the Board in April of each year.

1. The Department shall establish methods for data collection, storage and dissemination. Methods for collecting groundwater elevations, groundwater quality and land subsidence shall follow established quality assurance and quality control guidelines.

2. The Department shall disseminate the monitoring data through public presentations and through Internet access on the Department website. At a minimum, the Department shall publicly present findings from the monitoring program on an annual basis to the Board of Supervisors. (Ord. No. 3869, § 1 (part), 2-10-04)

33A-13 Action by Technical Advisory Committee.

a. All BMO noncompliance issues shall be resolved through a collaborative process at the sub-inventory unit level, if at all possible. However, in the event that an area of BMO noncompliance is identified to the Department, the Technical Advisory Committee shall investigate and report to the Water Advisory Committee and Water Commission the areal extent and magnitude of the noncompliance. This information shall also be released to the public. This report shall be made in a timely manner not to exceed fourteen (14) days from the time that BMO noncompliance was identified. The Technical Advisory Committee shall not investigate and report any alleged or identified noncompliance in any area until Basin Management Objectives have been approved by the Board of Supervisors in all sub-inventory units within the area allegedly affected.

b. The Technical Advisory Committee shall then collect all available pertinent hydrologic data and investigate possible causes for the BMO noncompliance. The Technical Advisory Committee shall recommend actions to resolve the BMO noncompliance to the Water Advisory Committee, Water Commission and the Department. The initial Technical Advisory Committee recommendations shall be made in a timely manner not to exceed thirty (30) days from the time at which BMO noncompliance was reported. The Technical Advisory Committee shall first make recommendations that focus on resolving the BMO noncompliance through negotiations with all parties in the impacted/impacting area(s). (Ord. No. 3869, § 1 (part), 2-10-04)

33A-14 Action by Water Advisory Committee.

a. If the noncompliance cannot be resolved through a collaborative process at the sub-inventory unit level or through the review and recommendations of the Technical Advisory Committee and if negotiations with parties in the impacted area do not result in a timely and positive action to re-establish BMO compliance within five (5) days, the Water Advisory Committee may recommend a plan to the Water Commission to modify, reduce or terminate groundwater extraction in the impacted/impacting area(s). This action shall only be taken on the recommendation of the Water Advisory Committee after a thorough technical review of the data. (Ord. No. 3869, § 1 (part), 2-10-04)