



DEPARTMENT OF WATER RESOURCES

Northern Region

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GROUNDWATER LEVEL MONITORING REPORT SACRAMENTO VALLEY and REDDING GROUNDWATER BASINS CHANGE IN GROUNDWATER ELEVATIONS:

SUMMER 2008 TO SUMMER 2009 AND SUMMER 2006 TO SUMMER 2009

The Groundwater Level Monitoring Report summarizes summer 2006, 2008, and 2009 groundwater level measurements collected from wells in the northern Sacramento Valley by the Department of Water Resources (DWR) Northern District and DWR monitoring cooperators. Northern Sacramento Valley groundwater levels are measured up to four times a year as part of our ongoing data collection program. During 2009 groundwater levels are measured on a monthly basis from spring until fall due to the severe drought condition. Many of the wells have over 30 years of monitoring history, with the longest active monitoring well dating back to 1921, or 88 years. Groundwater level data provides valuable information regarding seasonal fluctuations and long-term changes in groundwater level trends over time. The groundwater level data presented in this report includes the Sacramento Valley and Redding groundwater basin portions of Butte, Colusa, Glenn, Tehama, and Shasta counties.

The groundwater level monitoring grid includes active and inactive wells that were drilled by different methods, with different designs, for different uses. Types of well use include domestic, irrigation, observation, and other (stock, unused, etc) wells. Wells may be constructed over discreet aquifer intervals or multiple aquifer zones. The total depth of monitoring grid wells ranges from 18 feet below ground surface (ft-bgs), to 1,380 ft-bgs; with screened intervals ranging from 8 to 1,310 ft-bgs. The wide variety of well uses and construction provides the opportunity to examine the groundwater level responses to seasonal and long-term changes in climate and land use over multiple aquifer zones.

Static groundwater level data from 379 monitoring wells were analyzed by well use and well depth for the August 2008 versus August 2009 and August 2006 versus August 2009 monitoring periods. According to the Sacramento Valley Water Year Index, 2006 was a relatively wet year, while 2008 and 2009 were both dry years. Wells that were pumping or had been recently pumped at the time of measurement were excluded from the analysis due to inherent uncertainties associated with pumping level data. It is important to note that the change in groundwater elevation data represents the individual annual change which occurred in one well over two monitoring periods. Daily and seasonal changes in groundwater levels are also occurring and are influenced by many factors, such as a nearby well pumping, changing land use, weather, precipitation, and surface water supply, among others.

Seasonal and long-term changes in groundwater levels in individual wells are best examined with hydrographs. Hydrographs for each of the monitoring wells can be obtained at DWR's Water Data Library: <http://www.water.ca.gov/waterdatalibrary/>. Regional evaluation of seasonal or long-term changes in groundwater levels are typically evaluated through

groundwater contour mapping. Annual groundwater elevation contours, along with copies of this report, are available online at DWR Northern District's website:
http://www.water.ca.gov/groundwater/data_and_monitoring/northern_region/GroundwaterLevel/gw_level_monitoring.cfm

Groundwater elevation is determined by subtracting the measured depth to groundwater in a well from the ground surface elevation, and is expressed as feet-mean sea level (ft-msl). The change in groundwater elevation was calculated by subtracting the summer 2008 and summer 2006 measurements from the March 2009 measurements for each of the monitoring wells. A change in groundwater level indicated by a positive number indicates that the groundwater level was higher in summer 2009 than it was in summer 2008 or summer 2006. A change in groundwater level indicated by a negative number indicates that the groundwater level was lower in summer 2009 than it was in summer 2008 or summer 2006.

The groundwater level data that were analyzed for this report are summarized below and are listed in Tables 1-4, and illustrated in Plates 1 through 8. Tables 1 and 2 show the change in groundwater elevation by well depth and well use, respectively from summer 2008 to summer 2009. Likewise, Tables 3 and 4 show the change in groundwater elevation by well depth and well use, respectively, from summer 2006 to summer 2009. Also provided are eight plates that show the locations of the wells by well depth, well type, and change in groundwater level from summer 2008 to summer 2009 and from summer 2006 to summer 2009. For each summer comparison, plates 1 and 5 show monitoring wells with depths ranging from 0 to 200 feet; Plates 2 and 6 show monitoring wells with depths ranging from 201 to 600 feet; and Plates 3 and 7 shows monitoring wells with depths ranging from 601 to 1,380 feet. Plates 4 and 8 show the locations of observation wells only, by well depth and by the change in groundwater level.

GENERAL SUMMARY:

- ✓ On average, groundwater levels in the northern Sacramento Valley and the Redding Basins were down by about 2 feet (-2 ft) from summer 2008 compared to summer 2009 and about 8 feet from summer 2006 compared to summer 2009.
- ✓ The greatest decrease in groundwater elevation from 2008 compared to 2009 was in an irrigation well in Tehama County that had a decline of about 28 feet. The greatest decrease in groundwater elevation from 2006 to 2009 occurred in an observation on the west side of the Sacramento Valley in Glenn County that had a decline of 56 feet.
- ✓ The greatest increase in groundwater elevation from 2008 to 2009 was in an irrigation well in Glenn County with an increase of about 12 feet. From 2006 to 2009, the greatest increase in groundwater elevation was in an irrigation well in the Redding Basin that increased about 20 feet.
- ✓ Groundwater levels were down, on average, in all well types:

2008-2009

▪ domestic wells:	1 foot (-1 ft)
▪ irrigation wells:	2 feet (-2 ft)
▪ observation wells:	2 feet (-2 ft)
▪ other well types:	1 foot (-1 ft)

2006-2009

- domestic wells: 5 feet (-5 ft)
- irrigation wells: 7 feet (-7 ft)
- observation wells: 7 feet (-7 ft)
- other well types: 7 feet (-7 ft)

✓ Groundwater levels were also down, on average, for all well depths:

2008-2009

- 0 to 200 feet deep: 1 foot (-1 ft)
- 201 feet and 600 feet deep: 2 feet (-2 ft)
- 601 and 1380 feet deep: 2 feet (-2 ft)
- unknown well depth: 3 feet (-3 ft)

2006-2009

- 0 to 200 feet deep: 6 feet (-6 ft)
- 201 feet and 600 feet deep: 6 feet (-6 ft)
- 601 and 1380 feet deep: 10 feet (-10 ft)
- unknown well depth: 7 feet (-7 ft)

✓ Looking at the average groundwater level decline by county:

2008-2009

Sacramento Valley Groundwater Basin

- Butte: 1 foot (-1 ft)
- Colusa: 2 feet (-2 ft)
- Glenn: 3 feet (-3 ft)
- Southern Tehama: 2 feet (-2 ft)

Redding Basin

- Northern Tehama/Shasta: 0 feet (-0 ft)

2006-2009

Sacramento Valley Groundwater Basin

- Butte: 6 feet (-6 ft)
- Colusa: 7 feet (-7 ft)
- Glenn: 12 feet (-12 ft)
- Southern Tehama: 6 feet (-6 ft)

Redding Basin

- Northern Tehama/Shasta: 1 foot (-1 ft)

FOLLOWING ARE THE TABLES AND PLATES SUMMARIZING THE GROUNDWATER LEVEL DATA COLLECTED:

TABLES

- Table 1. 2008-2009 Change in Groundwater Elevation by Well Depth
- Table 2. 2008-2009 Change in Groundwater Elevation by Well Use
- Table 3. 2006-2009 Change in Groundwater Elevation by Well Depth
- Table 4. 2006-2009 Change in Groundwater Elevation by Well Use

PLATES

- Plate 1. Sacramento Valley Change in Groundwater Elevation Map
Summer 2008 to Summer 2009
Monitoring Wells Up to 200 Feet in Depth
- Plate 2. Sacramento Valley Change in Groundwater Elevation Map
Summer 2008 to Summer 2009
Monitoring Wells 200 Feet to 600 Feet in Depth
- Plate 3. Sacramento Valley Change in Groundwater Elevation Map
Summer 2008 to Summer 2009
Monitoring Wells Over 600 Feet in Depth
- Plate 4. Sacramento Valley Change in Groundwater Elevation Map
Spring 2008 to Spring 2009
Dedicated Groundwater Observation Wells
- Plate 5. Sacramento Valley Change in Groundwater Elevation Map
Summer 2006 to Summer 2009
Monitoring Wells Up to 200 Feet in Depth
- Plate 6. Sacramento Valley Change in Groundwater Elevation Map
Summer 2006 to Summer 2009
Monitoring Wells 200 Feet to 600 Feet in Depth
- Plate 7. Sacramento Valley Change in Groundwater Elevation Map
Summer 2006 to Summer 2009
Monitoring Wells Over 600 Feet in Depth
- Plate 8. Sacramento Valley Change in Groundwater Elevation Map
Spring 2008 to Spring 2009
Dedicated Groundwater Observation Wells

DEPARTMENT OF WATER RESOURCES					
SUMMER GROUNDWATER ELEVATION MEASUREMENTS					
NORTHERN SACRAMENTO VALLEY & REDDING BASINS, CALIFORNIA					
CHANGE IN GROUNDWATER ELEVATION BY WELL DEPTH					
SUMMER 2008 to SUMMER 2009					
	All Well Depths	Well Depth			
		0 to 200 ft-bgs	201 to 600 ft-bgs	601 to 1,500 ft-bgs	Unknown
BUTTE					
Maximum Increase in GWE* (ft)	7.3	4.9	4.5	7.3	0
Maximum Decrease in GWE (ft)	-8.3	-5.1	-8.3	-7.5	-2.5
Average GWL Change (ft)	-0.7	-0.1	-1.1	-0.9	-1.7
Range of GWL Change (ft)	15.6	10.0	12.8	14.8	2.5
Number of Wells	96	42	36	15	3
COLUSA					
Maximum Increase in GWE* (ft)	3.1	2.4	3.1	0	--
Maximum Decrease in GWE (ft)	-17.5	-9.9	-17.5	-5.6	--
Average GWL Change (ft)	-2.3	-1	-3	-4.6	--
Range of GWL Change (ft)	20.6	12.3	20.6	5.6	--
Number of Wells	31	15	11	5	0
GLENN					
Maximum Increase in GWE* (ft)	12.4	11.2	12.4	0	1.8
Maximum Decrease in GWE (ft)	-25.2	-14.1	-25.2	-17.8	-7.1
Average GWL Change (ft)	-3.3	-2.4	-3.4	-5.8	-2.7
Range of GWL Change (ft)	37.6	25.3	37.6	17.8	8.9
Number of Wells	117	53	43	19	2
TEHAMA					
Maximum Increase in GWE* (ft)	5.7	4.4	5.7	1.9	0
Maximum Decrease in GWE (ft)	-27.6	-9.4	-27.6	-9.7	-4.9
Average GWL Change (ft)	-1.8	-0.9	-2.8	-1.5	-3.3
Range of GWL Change (ft)	33.3	13.8	33.3	11.6	4.9
Number of Wells	108	47	42	16	3
REDDING BASIN					
Maximum Increase in GWE* (ft)	6.2	5	6.2	1.6	--
Maximum Decrease in GWE (ft)	-7.3	-6	-7.3	0	--
Average GWL Change (ft)	-0.3	-0.8	0	1.6	--
Range of GWL Change (ft)	13.5	11.0	13.5	1.6	--
Number of Wells	27	13	13	1	0
TOTAL					
Maximum Increase in GWE* (ft)	12.4	11.2	12.4	7.3	1.8
Maximum Decrease in GWE (ft)	-27.6	-14.1	-27.6	-17.8	-7.1
Average GWL Change (ft)	-1.7	-1.0	-2.1	-2.2	-2.6
Range of GWL Change (ft)	40.0	25.3	40.0	25.1	8.9
Number of Wells	379	170	145	56	8
Note: A positive number indicates that groundwater levels were higher in 2009 than in 2008; a negative number indicates that groundwater levels were lower in 2009 than in March 2008.					
*GWE=Groundwater Elevation					

Table 1. 2008-2009 Change in Groundwater Level Elevation by Well Depth.

DEPARTMENT OF WATER RESOURCES					
SUMMER GROUNDWATER ELEVATION MEASUREMENTS					
NORTHERN SACRAMENTO VALLEY & REDDING BASINS, CALIFORNIA					
CHANGE IN GROUNDWATER ELEVATION BY WELL USE					
SUMMER 2008 to SUMMER 2009					
	All Well Depths	Well Use			
		Domestic	Irrigation	Observation	Other
BUTTE					
Maximum Increase in GWE* (ft)	7.3	4.9	7.3	2.7	3.6
Maximum Decrease in GWE (ft)	-8.3	-8.3	-6.5	-7.5	-3.4
Average GWL Change (ft)	-0.7	-0.2	0.3	-1.4	-0.8
Range of GWL Change (ft)	15.6	13.2	13.8	10.2	7.0
Number of Wells	96	20	23	43	10
COLUSA					
Maximum Increase in GWE* (ft)	3.1	2.4	3.1	0	0.3
Maximum Decrease in GWE (ft)	-17.5	-17.5	-9.9	-6.6	-0.6
Average GWL Change (ft)	-2.3	-1.2	-2.5	-3.9	-0.2
Range of GWL Change (ft)	20.6	19.9	13.0	6.6	0.9
Number of Wells	31	13	6	10	2
GLENN					
Maximum Increase in GWE* (ft)	12.4	11.2	12.4	10.9	0.5
Maximum Decrease in GWE (ft)	-25.2	-14.1	-25.2	-24.4	-10.9
Average GWL Change (ft)	-3.3	-1.9	-3	-3.8	-3.5
Range of GWL Change (ft)	37.6	25.3	37.6	35.3	11.4
Number of Wells	117	23	16	72	6
TEHAMA					
Maximum Increase in GWE* (ft)	5.7	4.4	5.7	2.6	0.8
Maximum Decrease in GWE (ft)	-27.6	-4.9	-27.6	-10.4	-4
Average GWL Change (ft)	-1.8	-0.9	-2.2	-2.3	-0.9
Range of GWL Change (ft)	33.3	9.3	33.3	13.0	4.8
Number of Wells	108	34	29	39	6
REDDING BASIN					
Maximum Increase in GWE* (ft)	6.2	1.3	0	5	6.2
Maximum Decrease in GWE (ft)	-7.3	-3.5	-1.2	-6	-7.3
Average GWL Change (ft)	-0.3	-0.8	-0.9	-0.1	0.2
Range of GWL Change (ft)	13.5	4.8	1.2	11.0	13.5
Number of Wells	27	4	5	13	5
TOTAL					
Maximum Increase in GWE* (ft)	12.4	11.2	12.4	10.9	6.2
Maximum Decrease in GWE (ft)	-27.6	-17.5	-27.6	-24.4	-10.9
Average GWL Change (ft)	-1.7	-1.0	-1.7	-2.3	-1.0
Range of GWL Change (ft)	40.0	28.7	40.0	35.3	17.1
Number of Wells	379	94	79	177	29
Note: A positive number indicates that groundwater levels were higher in 2009 than in 2008; a negative number indicates that groundwater levels were lower in 2009 than in March 2008.					
*GWE=Groundwater Elevation					

Table 2. 2008-2009 Change in Groundwater Level Elevation by Well Use.

DEPARTMENT OF WATER RESOURCES					
SUMMER GROUNDWATER ELEVATION MEASUREMENTS					
NORTHERN SACRAMENTO VALLEY & REDDING BASINS, CALIFORNIA					
CHANGE IN GROUNDWATER ELEVATION BY WELL DEPTH					
SUMMER 2006 to SUMMER 2009					
	All Well Depths	Well Depth			
		0 to 200 ft-bgs	201 to 600 ft-bgs	601 to 1,500 ft-bgs	Unknown
BUTTE					
Maximum Increase in GWE* (ft)	4.1	1.9	4.1	0.5	0
Maximum Decrease in GWE (ft)	-25.1	-25.1	-24	-16.2	-19
Average GWL Change (ft)	-5.8	-4.9	-6	-5.1	-13
Range of GWL Change (ft)	29.2	27.0	28.1	16.7	19.0
Number of Wells	75	35	27	9	4
COLUSA					
Maximum Increase in GWE* (ft)	2.1	0.9	2.1	0	--
Maximum Decrease in GWE (ft)	-43.8	-43.8	-24.1	-23.9	--
Average GWL Change (ft)	-7	-5.5	-7.3	-11	--
Range of GWL Change (ft)	45.9	44.7	26.2	23.9	--
Number of Wells	33	16	12	5	0
GLENN					
Maximum Increase in GWE* (ft)	14.3	14.3	5	0	0.2
Maximum Decrease in GWE (ft)	-56.1	-41	-37.7	-56.1	-8.1
Average GWL Change (ft)	-11.7	-8.3	-11.9	-25.5	-4
Range of GWL Change (ft)	70.4	55.3	42.7	56.1	8.3
Number of Wells	91	41	37	11	2
TEHAMA					
Maximum Increase in GWE* (ft)	3.6	2.8	3.6	0	0
Maximum Decrease in GWE (ft)	-27.4	-27.4	-27.2	-9	-5.7
Average GWL Change (ft)	-6.2	-6.3	-6.9	-4.9	-3.8
Range of GWL Change (ft)	31.0	30.2	30.8	9.0	5.7
Number of Wells	113	51	42	14	6
REDDING BASIN					
Maximum Increase in GWE* (ft)	19.8	0	19.8	0	--
Maximum Decrease in GWE (ft)	-7.8	-7.8	-7	-1.1	--
Average GWL Change (ft)	-0.9	-4.3	0.6	-1.1	--
Range of GWL Change (ft)	27.6	7.8	26.8	1.1	--
Number of Wells	14	4	9	1	0
TOTAL					
Maximum Increase in GWE* (ft)	19.8	14.3	19.8	0.5	0.2
Maximum Decrease in GWE (ft)	-56.1	-43.8	-37.7	-56.1	-19.0
Average GWL Change (ft)	-6.3	-5.9	-6.3	-9.5	-6.9
Range of GWL Change (ft)	75.9	58.1	57.5	56.6	19.2
Number of Wells	326	147	127	40	12
Note: A positive number indicates that groundwater levels were higher in 2009 than in 2006; a negative number indicates that groundwater levels were lower in 2009 than in 2006.					
*GWE=Groundwater Elevation					

Table 3. 2006-2009 Change in Groundwater Level Elevation by Well Depth.

DEPARTMENT OF WATER RESOURCES					
SUMMER GROUNDWATER ELEVATION MEASUREMENTS					
NORTHERN SACRAMENTO VALLEY & REDDING BASINS, CALIFORNIA					
CHANGE IN GROUNDWATER ELEVATION BY WELL USE					
SUMMER 2006 to SUMMER 2009					
	All Well Depths	Well Use			
		Domestic	Irrigation	Observation	Other
BUTTE					
Maximum Increase in GWE* (ft)	4.1	1.7	4.1	0.7	0
Maximum Decrease in GWE (ft)	-25.1	-25.1	-24	-16.2	-19
Average GWL Change (ft)	-5.8	-6.6	-5.6	-4.7	-8
Range of GWL Change (ft)	29.2	26.8	28.1	16.9	19.0
Number of Wells	75	18	20	29	8
COLUSA					
Maximum Increase in GWE* (ft)	2.1	0.9	2.1	0	0
Maximum Decrease in GWE (ft)	-43.8	-24.1	-43.8	-14.6	-7
Average GWL Change (ft)	-7	-4.8	-11.5	-8.2	-4.1
Range of GWL Change (ft)	45.9	25.0	45.9	14.6	7.0
Number of Wells	33	14	6	10	3
GLENN					
Maximum Increase in GWE* (ft)	14.3	5	0.2	14.3	0.1
Maximum Decrease in GWE (ft)	-56.1	-41	-37.7	-56.1	-33
Average GWL Change (ft)	-11.7	-8.3	-12.4	-12.9	-12.6
Range of GWL Change (ft)	70.4	46.0	37.9	70.4	33.1
Number of Wells	91	21	17	48	5
TEHAMA					
Maximum Increase in GWE* (ft)	3.6	3.6	2.4	2.8	0
Maximum Decrease in GWE (ft)	-27.4	-18.1	-27.4	-19.4	-16.8
Average GWL Change (ft)	-6.2	-5	-7.6	-6.1	-6.1
Range of GWL Change (ft)	31.0	21.7	29.8	22.2	16.8
Number of Wells	113	39	36	30	8
REDDING BASIN					
Maximum Increase in GWE* (ft)	19.8	4.4	19.8	0	0.9
Maximum Decrease in GWE (ft)	-7.8	-7.8	-4.9	-1.1	-7
Average GWL Change (ft)	-0.9	-2.4	1.5	-1.1	-2.4
Range of GWL Change (ft)	27.6	12.2	24.7	1.1	7.9
Number of Wells	14	4	5	1	4
TOTAL					
Maximum Increase in GWE* (ft)	19.8	5.0	19.8	14.3	0.9
Maximum Decrease in GWE (ft)	-56.1	-41.0	-43.8	-56.1	-33.0
Average GWL Change (ft)	-6.3	-5.4	-7.1	-6.6	-6.6
Range of GWL Change (ft)	75.9	46.0	63.6	70.4	33.9
Number of Wells	326	96	84	118	28
Note: A positive number indicates that groundwater levels were higher in 2009 than in 2006; a negative number indicates that groundwater levels were lower in 2009 than in 2006.					
*GWE=Groundwater Elevation					

Table 4. 2006-2009 Change in Groundwater Level Elevation by Well Use.