# Review of Boise Front Low Temperature Geothermal Monitoring Data for Water Year 2015 (October 1, 2014 – September 30, 2015)

**Kenneth W. Neely, Technical Hydrogeologist**
**Idaho Department of Water Resources (IDWR)**

**February 17, 2016**

## EXECUTIVE SUMMARY

The total gross withdrawal from the four district heating systems in the Downtown Boise-East Boise area of the Boise Front Low Temperature Geothermal Resources Ground Water Management Area in Water Year 2015 (WY15) was 801.4 million gallons (mgal). This amount was 31.4 mgal less than the total gross withdrawal in Water Year 2014 (WY14). The net withdrawal for WY15 was 244.2 mgal, which was 19.2 mgal less than the net withdrawal in WY14. The Boise Warm Springs Water District, the City of Boise, and the State of Idaho Capitol Mall systems all had decreases in gross withdrawals in WY15. The Veterans Administration had an increase in gross withdrawals. About 70% of the water withdrawn in WY15 was re-injected, which is an increase of about 2% from WY14.

Water level maximums and minimums increased slightly in WY15. The maximum value for the BLM well increased 0.6 foot, and the minimum value increased 6 feet. Water level trends in the Kanta and Boise Warm Springs Water District wells were similar to the BLM well.

The maximum water temperatures for the State of Idaho Capitol Mall Production well, as determined on a monthly basis, were 0.1 degrees Fahrenheit lower in WY15 than in WY14. The maximum and minimum temperatures for BWSWD were essentially the same in WY15 as they were in WY14, and the City of Boise's maximum water temperature was slightly lower in WY15.

The total withdrawal of low temperature geothermal water in Stewart Gulch Ground Water District 63-S (GWD63-S) in WY15 was 190.3 mgal, which was 23.4 mgal more than in WY14. This equated to an increase of 14%. The increase in withdrawals was primarily related to the Terteling Ranch Windsock well. Overall, ground water levels in GWD63-S wells showed a slight decreasing trend in WY15. Both the Edwards well and the TTCI Tiegs well had maximum water levels that were about two feet lower in WY15 than in WY 14. The Quail Hollow Upper well had a decrease of about four feet in the maximum water level. The Quail Hollow Lower well did not have a change in the maximum water level.

[1]For flowing wells, pressure readings were converted to feet by multiplying each value by 2.31. The converted readings were then referenced to the measuring points by multiplying by -1. Thus, flowing wells have negative water level values since the Y ordinate is plotted as "Feet below measuring point".

# DOWNTOWN BOISE-EAST BOISE

## Withdrawals and Re-Injection

In WY15, gross and net withdrawals from the four Downtown Boise-East Boise district heating systems were 801.4 mgal and 244.2 mgal, respectively (Table 1 and Figure 1). Gross withdrawal was 31.4 mgal less in WY15 than in the previous water year. Net withdrawal was 19.2 mgal less in WY15 than in WY14. Gross withdrawal was 4% less in WY15 and net withdrawal was 7% less in WY15, than their respective amounts in WY14. About 70% of the fluids were re-injected, which is 2% more than in WY14. Three of the four district heating systems had decreases in gross withdrawals in WY15. The Veterans Administration heating system had an increase in the gross withdrawal.

**Table 1.** Withdrawals[1] from the four district geothermal heating systems in the Downtown Boise-East Boise areas for Water Year 2015 (October 1, 2014 through September 30, 2015).

| System | Gross Withdrawals[1] for WY15 (million gallons) and percent change from WY14 to WY15 | Net Withdrawals[2] for WY15 (million gallons) and percent change from WY14 to WY15 |
|---|---|---|
| Boise Warm Springs Water District | 230.5 (-6%) | 230.5 (-6%) |
| State of Idaho Capitol Mall | 87.1 (-19%) | 0 (NC[3]) |
| City of Boise | 245.1 (-11%) | 13.7 (-29%) |
| Veterans Administration | 238.7 (+16%) | 0 (NC[3]) |
| **Total** | **801.4 (-4%)** | **244.2 (-7%)** |

[1]These numbers contain some degree of uncertainty which is typically associated with measurement equipment and methods. Therefore, the amounts are being reported in millions with one decimal place.
[2]Net Withdrawals equal Gross Withdrawals minus Injection amounts. [3]NC = No change.

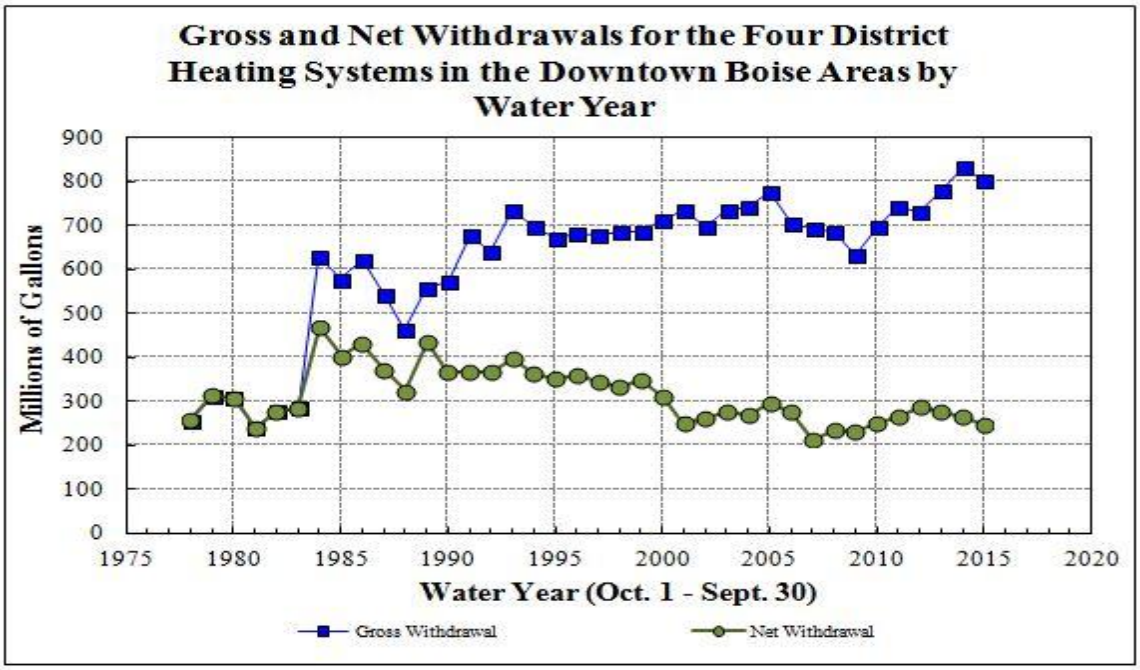


**Figure 1.** Gross and net withdrawals for the four district heating systems in the downtown Boise area for water years 1978 through 2015.

## Water Levels in the BLM, Kanta, BWSWD, City of Boise, and Harris Ranch Wells

The BLM well, which is located near the City of Boise, Capitol Mall and VA wellfields, had an increase of 0.6 feet in the maximum water level from WY14 to WY15 (Figure 2). The minimum water level increased about 6 feet in WY15. The Kanta well, the BWSWD East, West and #3 wells, and the BGL #1 well all showed similar water level trends as the BLM well (Figures 3-6). The Harris Ranch wells continued to show a very slight increasing water level trend (Figure 7).

## Water Supply Temperatures for the Capitol Mall, BWSWD and City of Boise.

The maximum water temperature[1] for the State of Idaho Capitol Mall Production well was 0.1 degrees Fahrenheit (°F) lower in WY15 than in WY14 (Figure 8). Some individual monthly readings were also slightly lower in WY15. Thus, the average of the maximum monthly values in WY15 was about 0.2°F lower than in WY14 (Figure 9). The maximum and minimum temperatures for BWSWD were essentially the same in WY15 as they were in WY14, except for one reading in July 2015 which was 1°F higher than the preceding and succeeding readings (Figure 10). The City of Boise's maximum water temperature was slightly lower in WY15 (Figure 11).

[1]Readings that are preceded by 8 hours of discharge rates over 300 gallons per minute are valid for considering as maximum values. Analysis is done on a monthly basis.

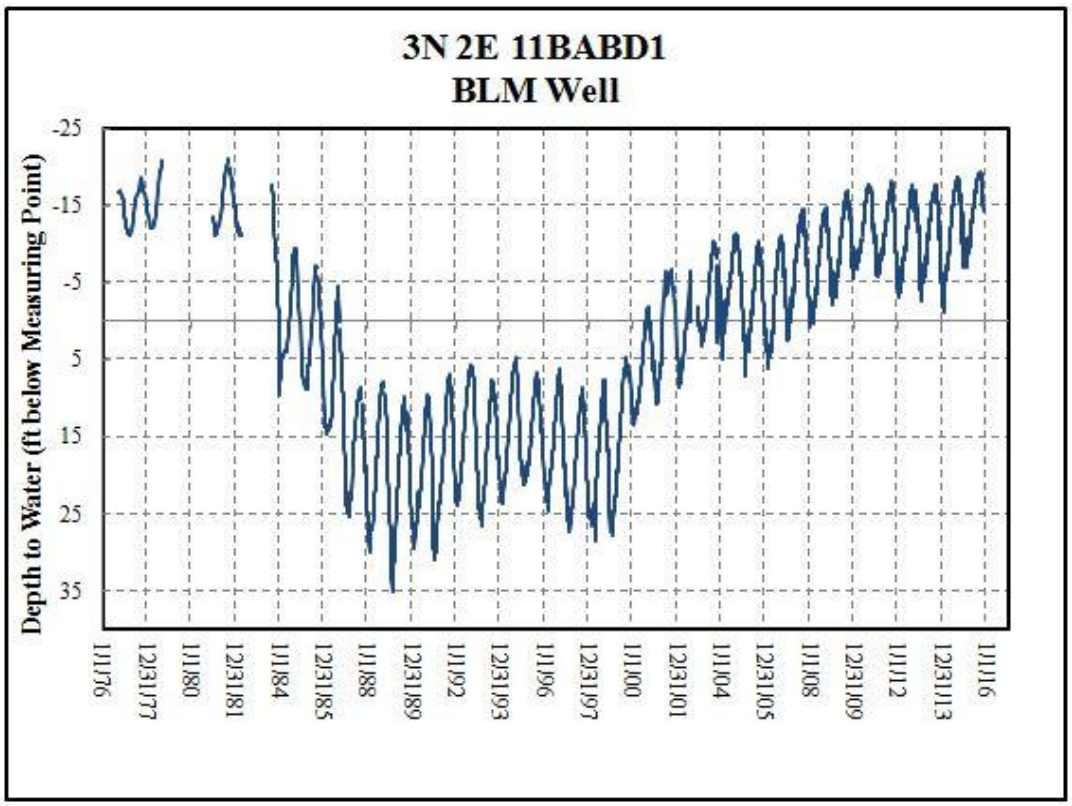


**Figure 2.** Water level hydrograph for the BLM well.

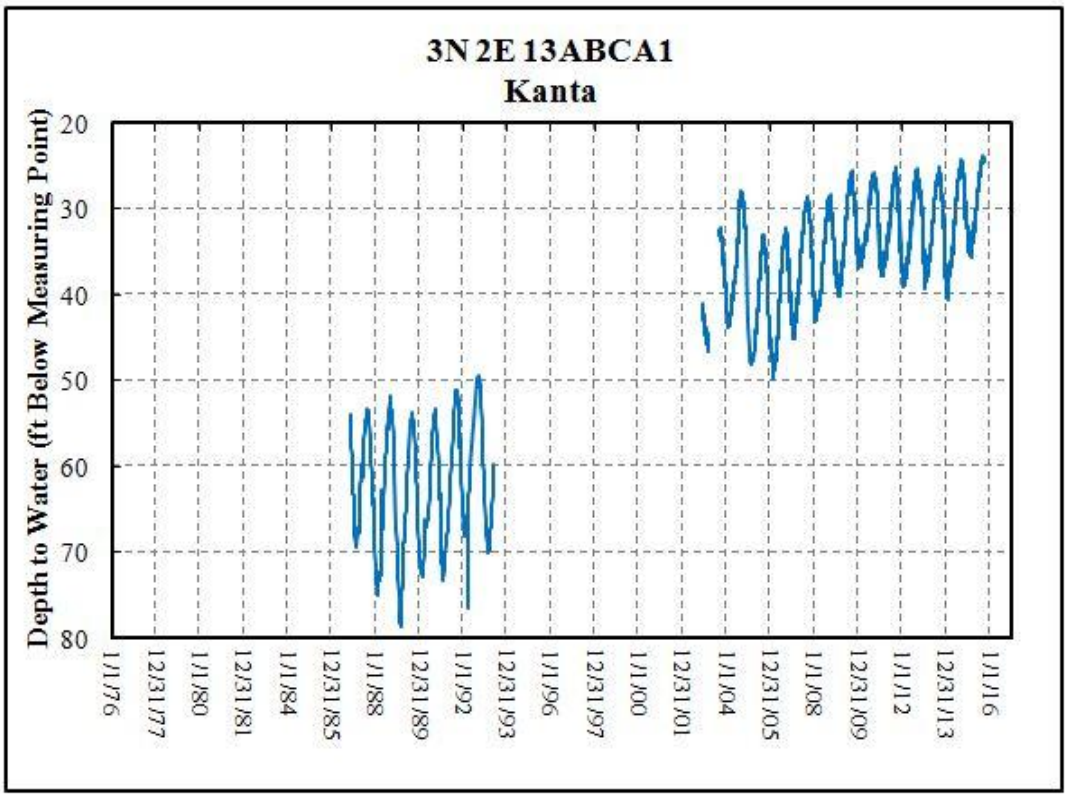


**Figure 3.** Water level hydrograph for the Kanta well.

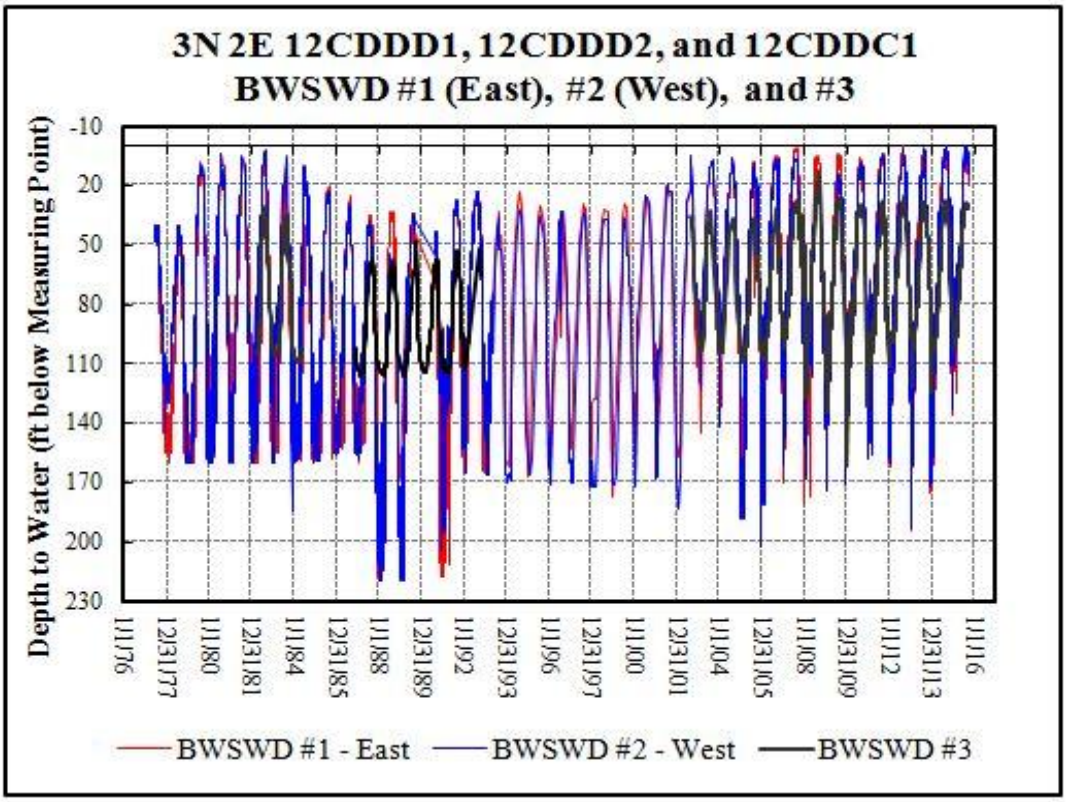


**Figure 4.** Water level hydrographs for the Boise Warm Springs Water District (BWSWD) wells.

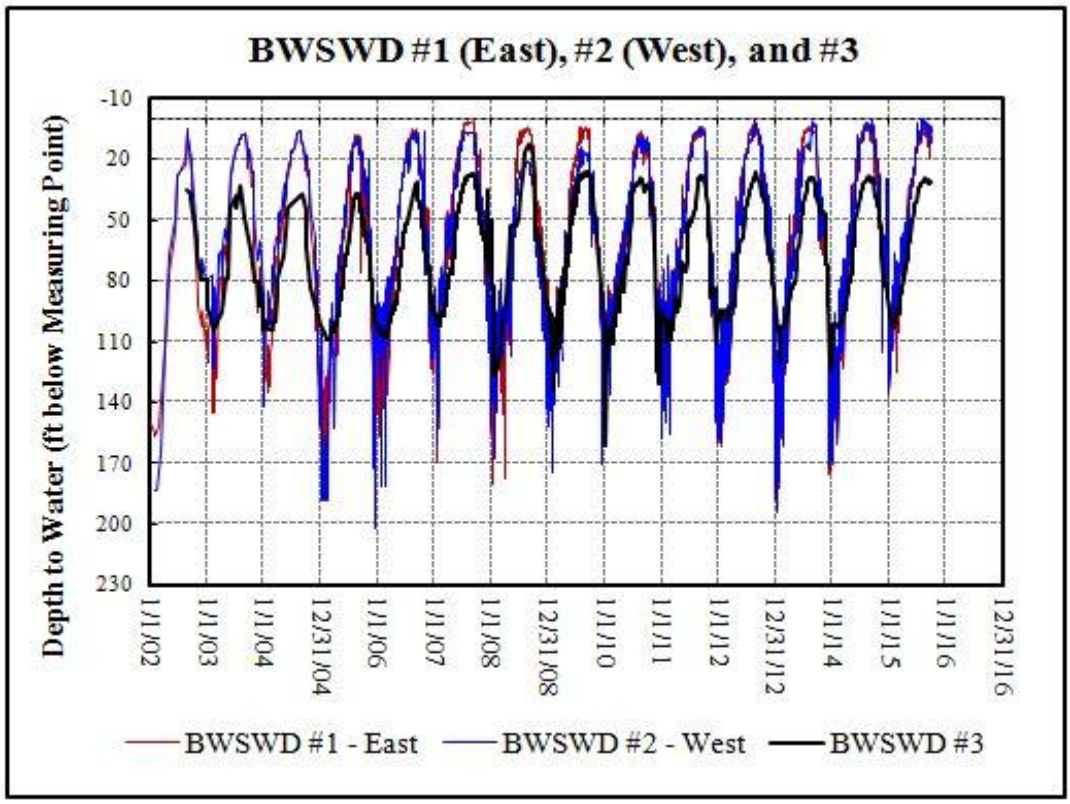


**Figure 5.** Water level hydrographs for the Boise Warm Springs Water District (BWSWD) wells, January 2002 to September 2015.

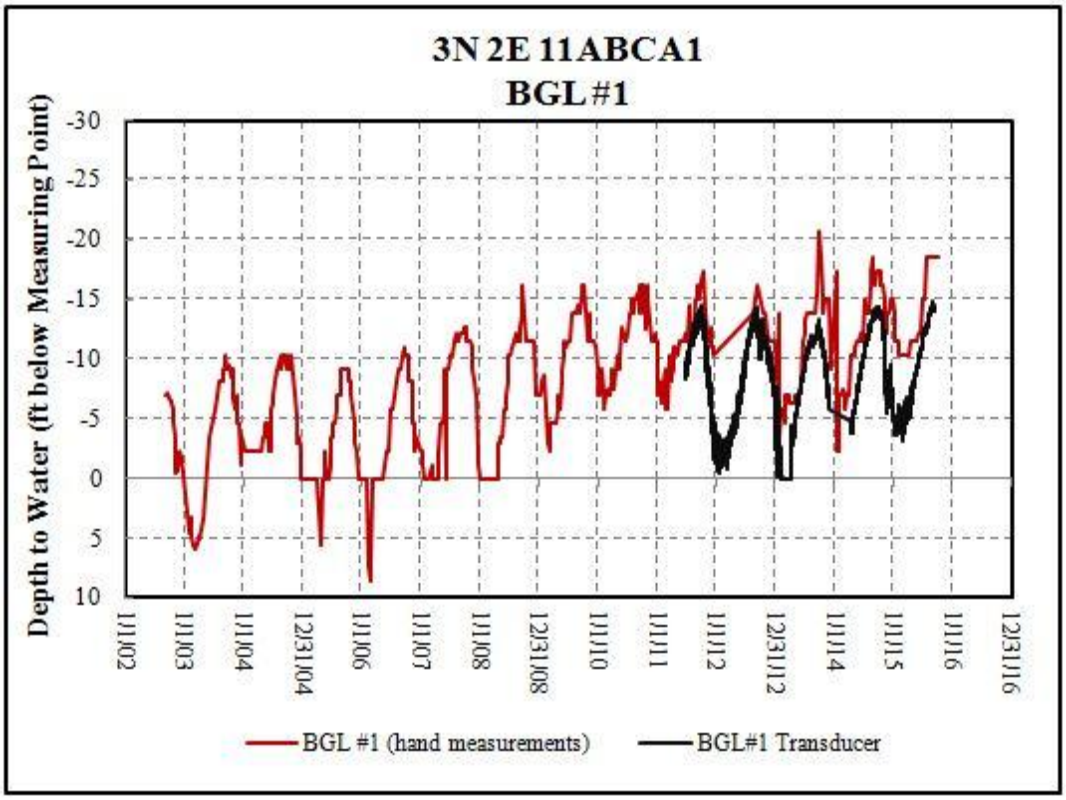


**Figure 6.** Water level hydrographs for the City of Boise's BGL #1 well.

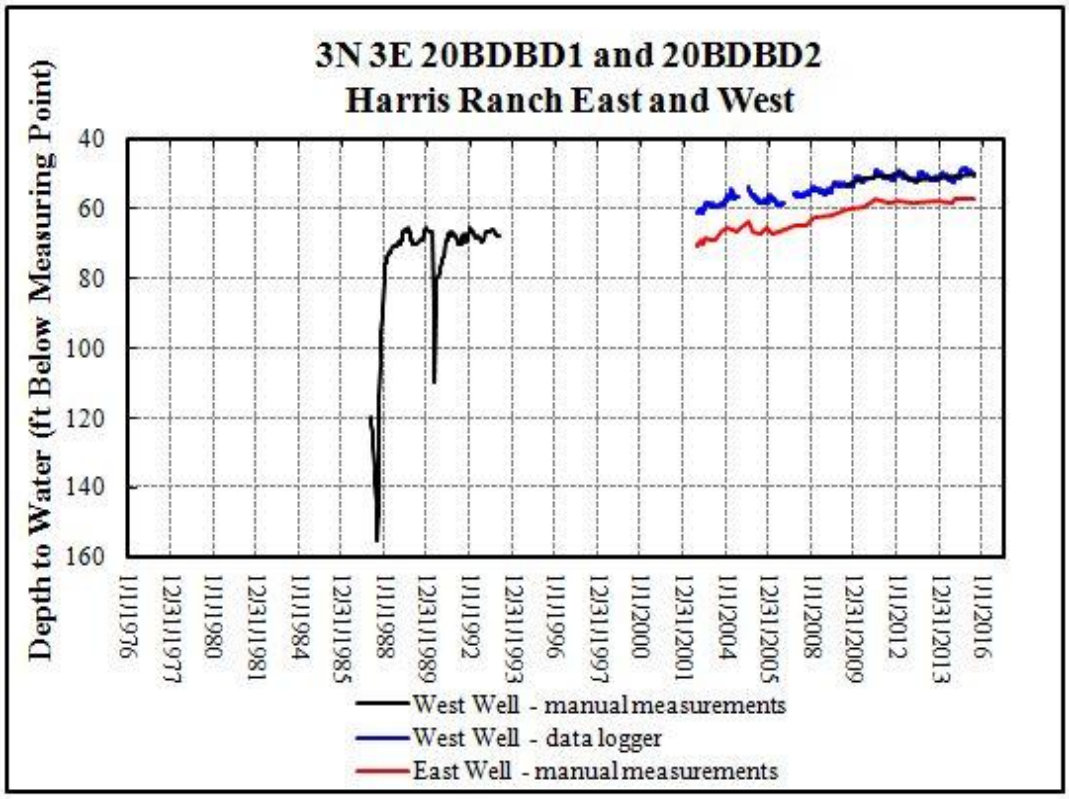


**Figure 7.** Water level hydrographs for the Harris Ranch wells.

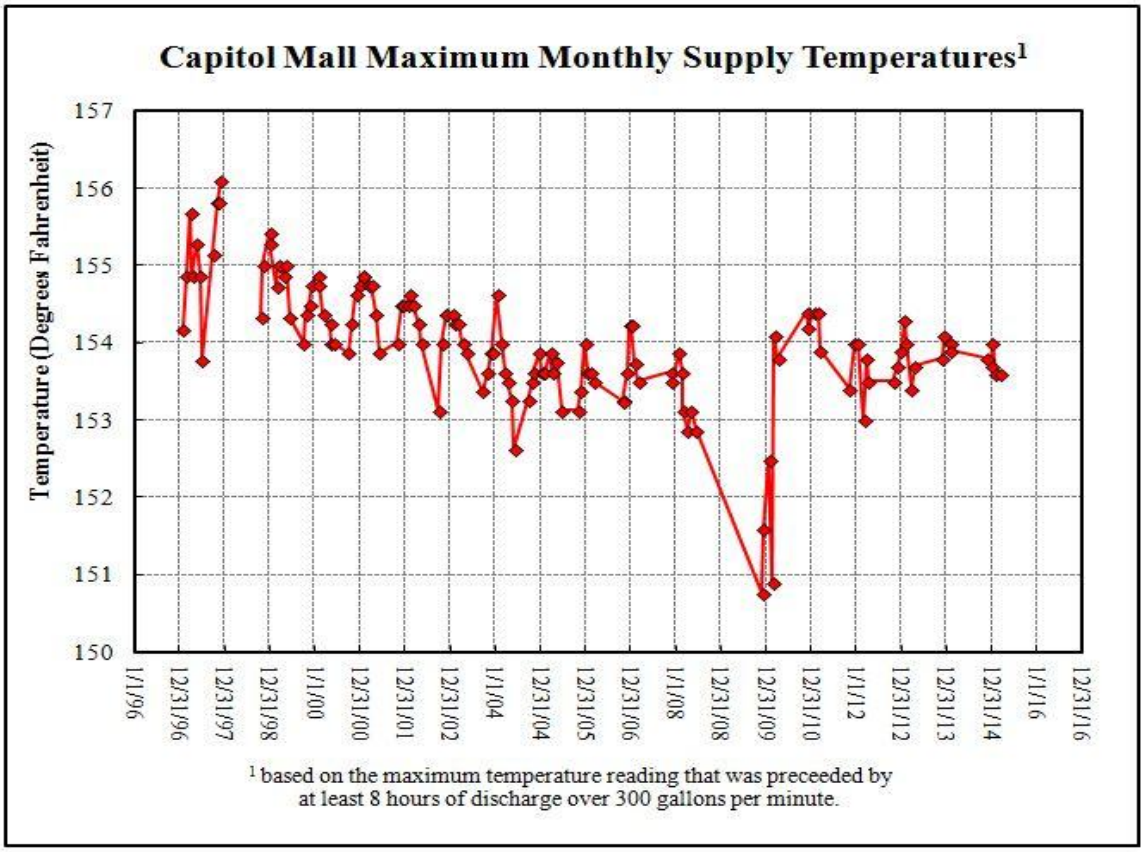


**Figure 8.** Monthly maximum supply water temperatures for the Capitol Mall geothermal system.

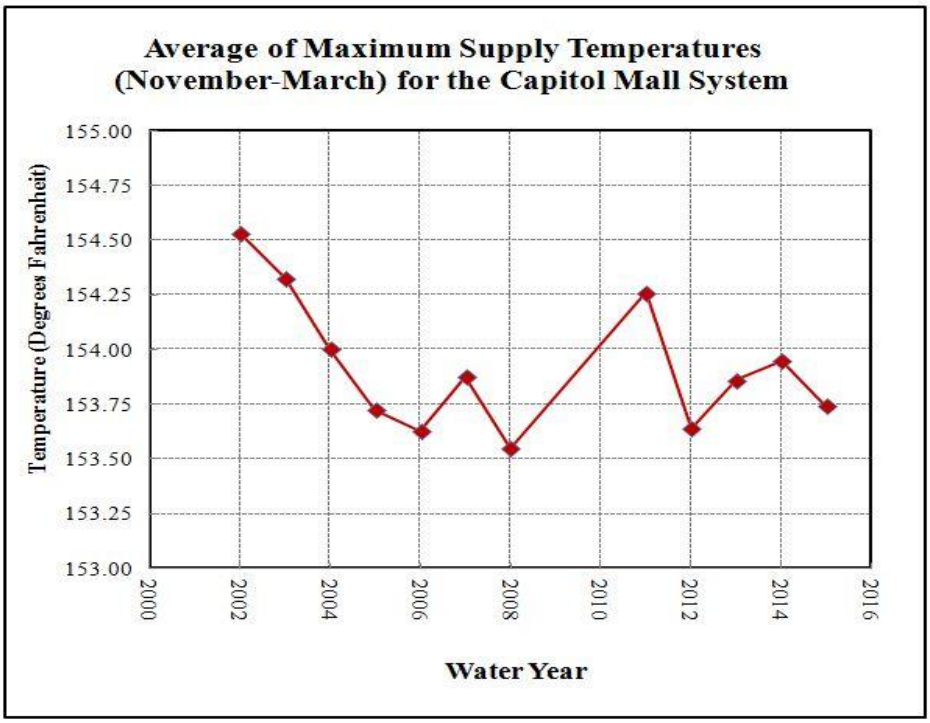


**Figure 9.** Average of the Capitol Mall maximum supply water temperatures for the November-March time periods for Water Years 2002 through 2015.

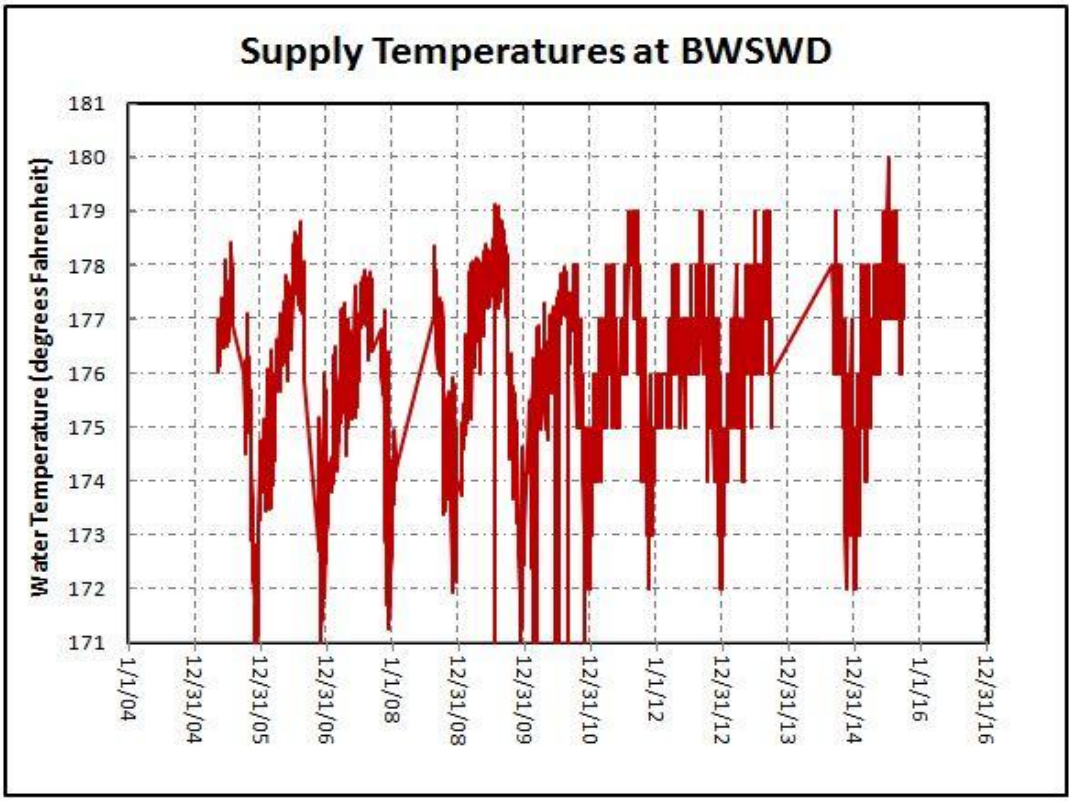


**Figure 10.** Supply water temperatures for the Boise Warm Springs Water District.

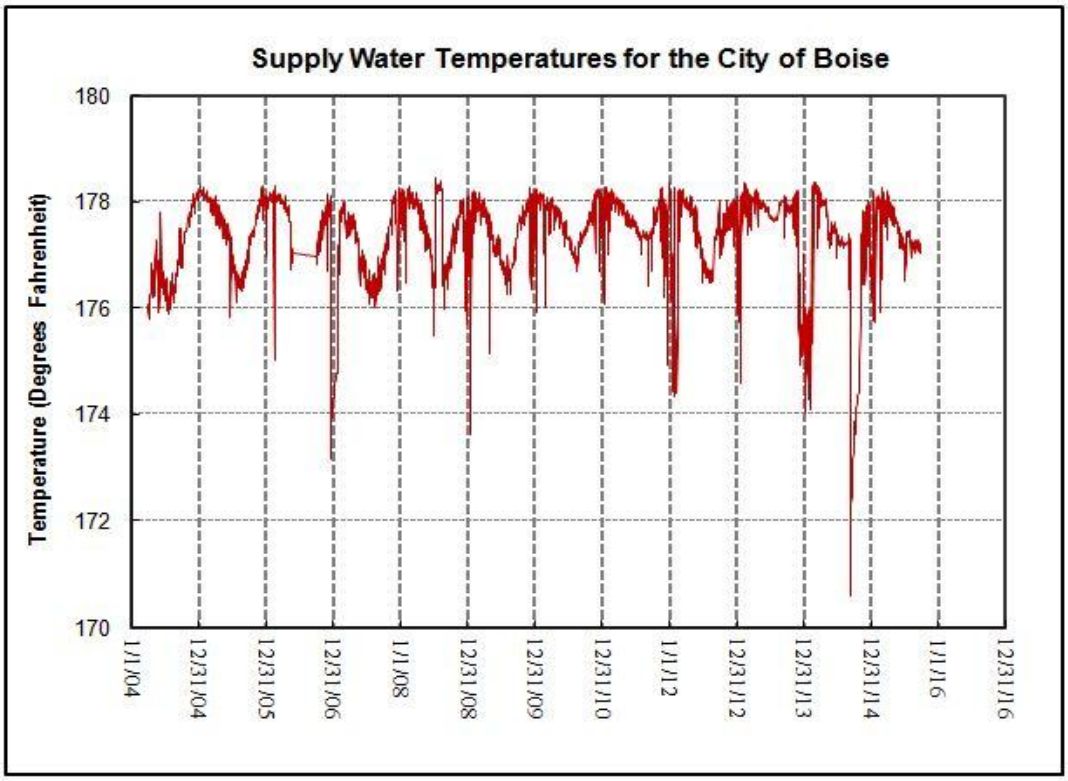


**Figure 11.** Supply water temperatures for the City of Boise's geothermal system. Readings less than 170 degrees Fahrenheit were removed from the dataset.

**Withdrawals**

The total withdrawal of low temperature geothermal water in GWD63-S in WY15 was 190.3 mgal (Figure 12). This amount is 23.4 mgal more than the withdrawal in WY14, which is a 14% increase (Table 4). This increase is mainly attributable to the Terteling Ranch Windsock well in WY15.

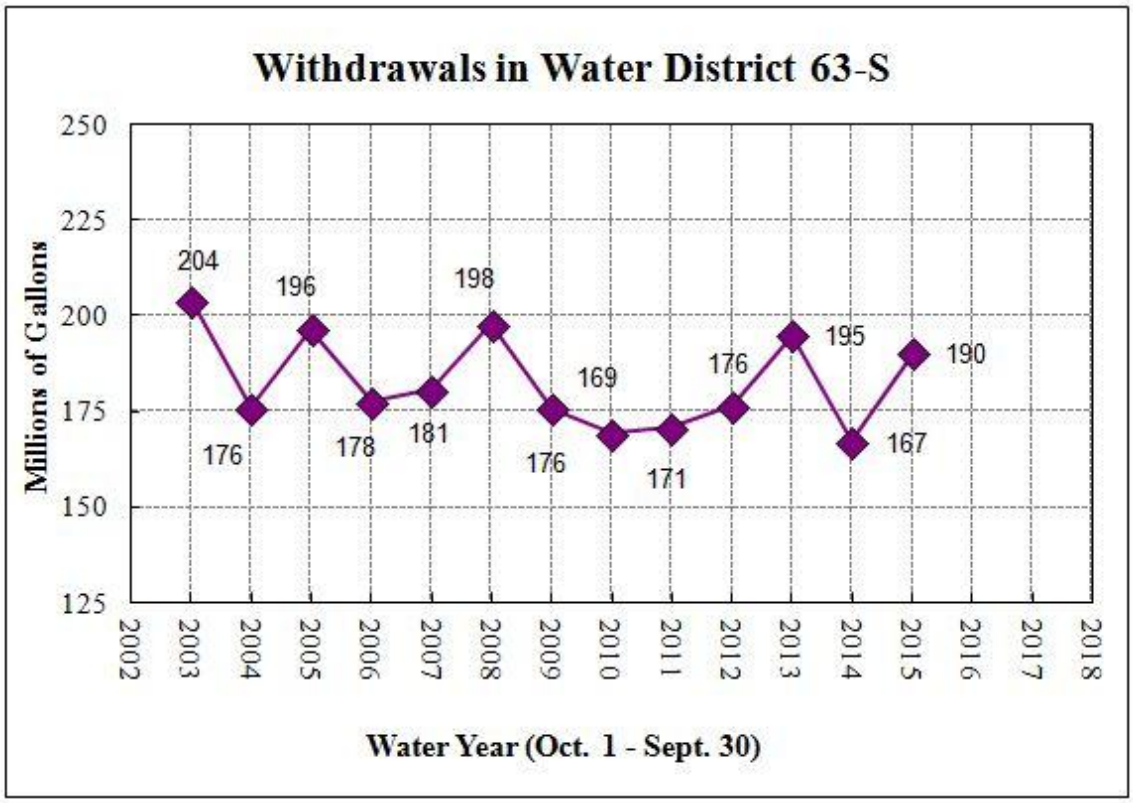


**Figure 12.** Geothermal withdrawals in Stewart Gulch Water District 63-S for Water Years 2003-2015.

**Table 4.** Withdrawals[1] from Stewart Gulch Ground Water District 63-S geothermal wells for Water Year 2015 (October 1, 2014 through September 30, 2015).

| Well | Withdrawals in WY15 (millions of gallons) | Change from WY14 (millions of gallons) | Percent Change from WY14 |
|---|---|---|---|
| TTCI Tiegs (Triangle) | 0 | 0 | 0 |
| TTCI Silkey (Shed) | 19.4 | -0.4 | -2% |
| TTCI House (Office) | 3.1 | -0.3 | -10% |
| Edwards Greenhouse | 48.7 | +0.4 | +1% |
| Terteling Ranch Windsock | 90.4 | +24.9 | +38% |
| Terteling Ranch Pool | 18.0 | -3.0 | -14% |
| Quail Hollow (Tee Ltd) Upper | <0.1 | -1.2 | NC |
| Quail Hollow (Nibbler) Lower | 4.6 | +2.7 | +146% |
| Niznik (Whitehead) | 6.1 | +0.3 | +5% |
| **Total** | **190.3** | **+23.4** | **+14.0%** |

[1]These numbers contain some degree of uncertainty which is typically associated with measurement equipment and methods. Therefore, the amounts are being reported in millions with one decimal place.
NC = Not Calculated because the number would be so large that it would not be of value to report.

The ownerships and locations of the wells allow them to be grouped into withdrawal centers, which is a useful approach for summarizing the withdrawals in these localized areas within the District. Table 5 shows the three centers and the changes in withdrawals.

**Table 5.** Three withdrawal centers in GWD63-S and changes from WY14 to WY15.

| Withdrawal Center | Number of Wells | Numerical change from WY14 to WY15 | Percentage change from WY14 to WY15 |
|---|---|---|---|
| Edwards Greenhouse, Terteling Garden Center, Niznik | 5 (4 in use; 1 unused) | 0 mgal | 0% |
| Quail Hollow | 2 | +2.7 mgal | +146% |
| Terteling Ranch | 2 | +21.9 mgal | +25% |

**Water Levels**

Four wells are currently monitored for water levels by their owners: Tiegs, Edwards, Quail Hollow Lower, and Quail Hollow Upper. Overall, ground water levels in GWD63-S wells showed a slight decreasing trend in WY15. Both the Edwards well and the TTCI Tiegs well had maximum water levels that were about two feet lower in WY15 than in WY 14 (Figures 13 and 14). The minimum water levels in the Tiegs and Edwards wells were 1.0 feet and 2.3 feet higher in WY15, respectively. The Quail Hollow Upper well had a decrease of about four feet in the maximum water level (Figure 15). The Quail Hollow Lower well did not have a change in the maximum water level (Figure 16). The minimum level in the Quail Hollow Upper well was 2.8 feet higher, while the minimum level in the Quail Hollow Lower well was essentially unchanged.

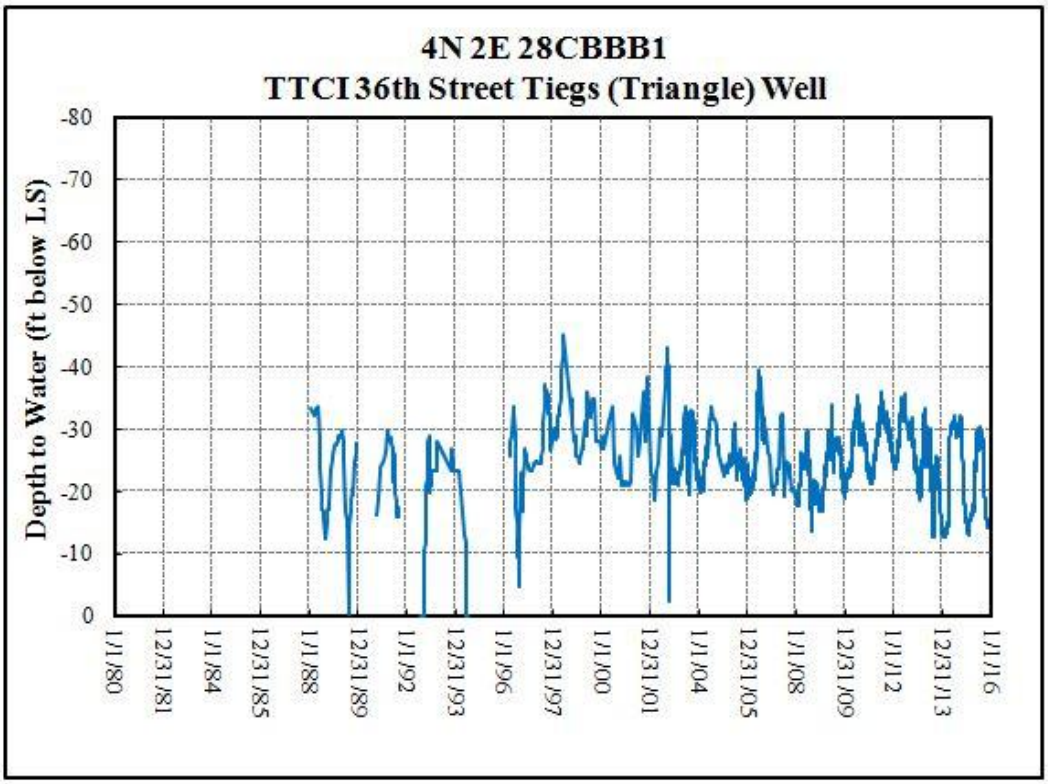


**Figure 13.** Water level hydrograph for the TTCI 36th Street Tiegs (Triangle) well.

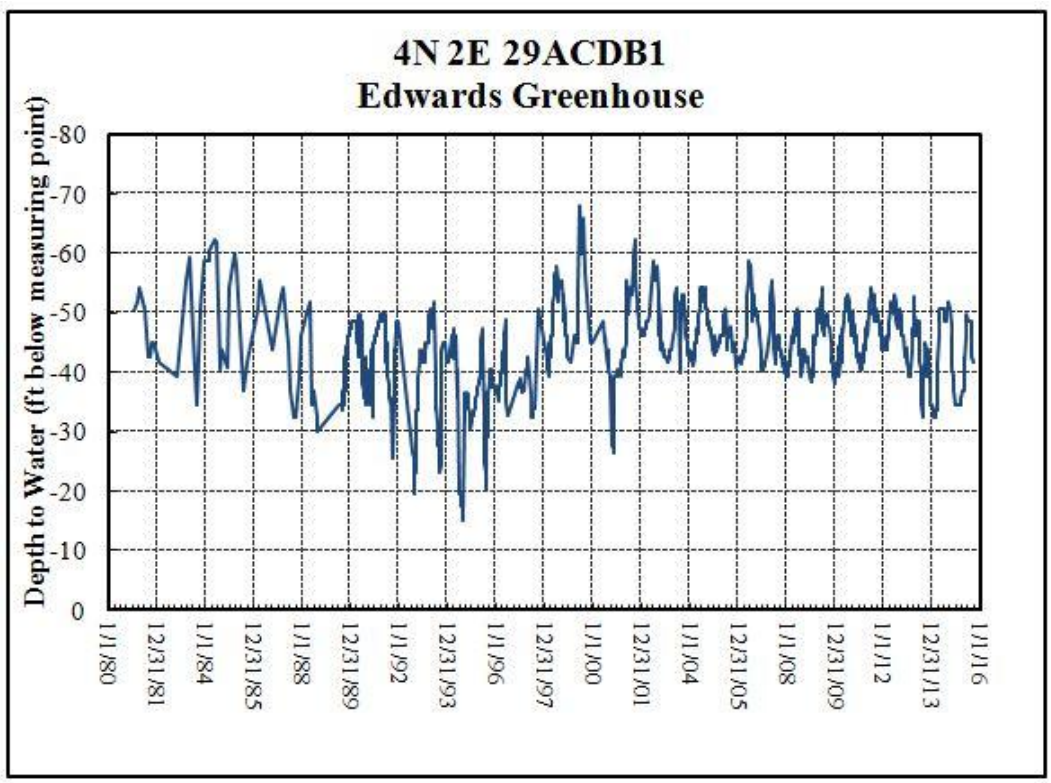


**Figure 14.** Water level hydrograph for the Edwards Greenhous well.

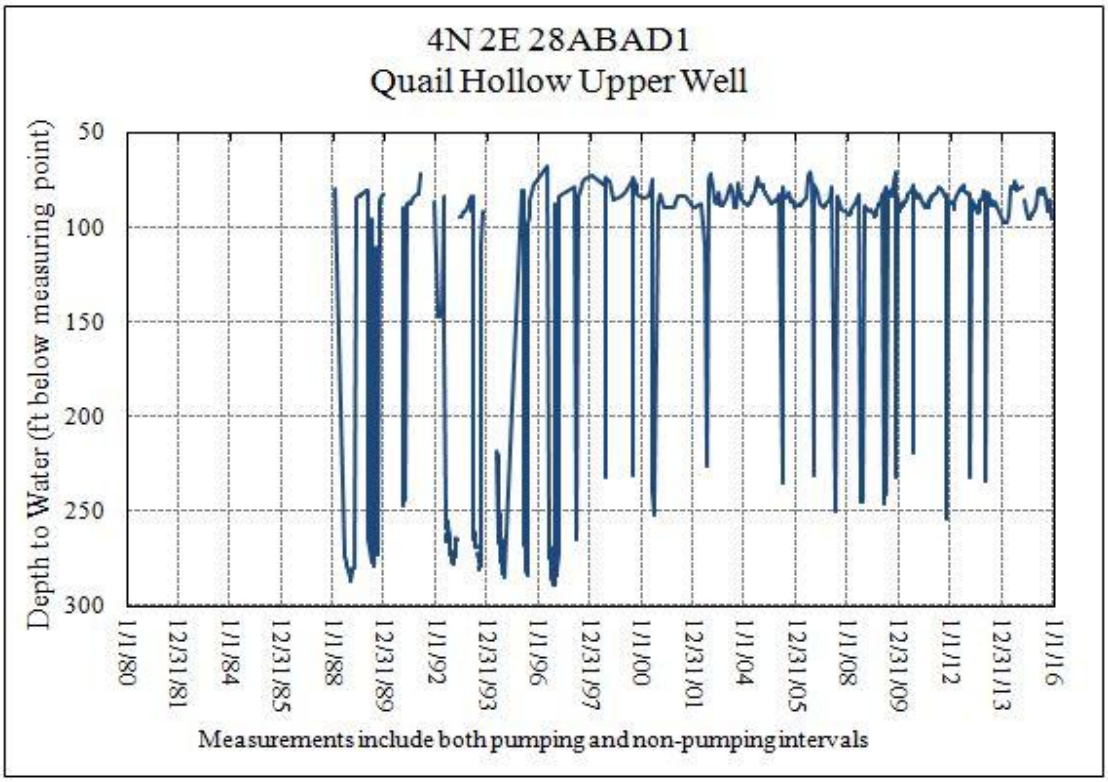


**Figure 15.** Water level hydrograph for the Quail Hollow Upper well.

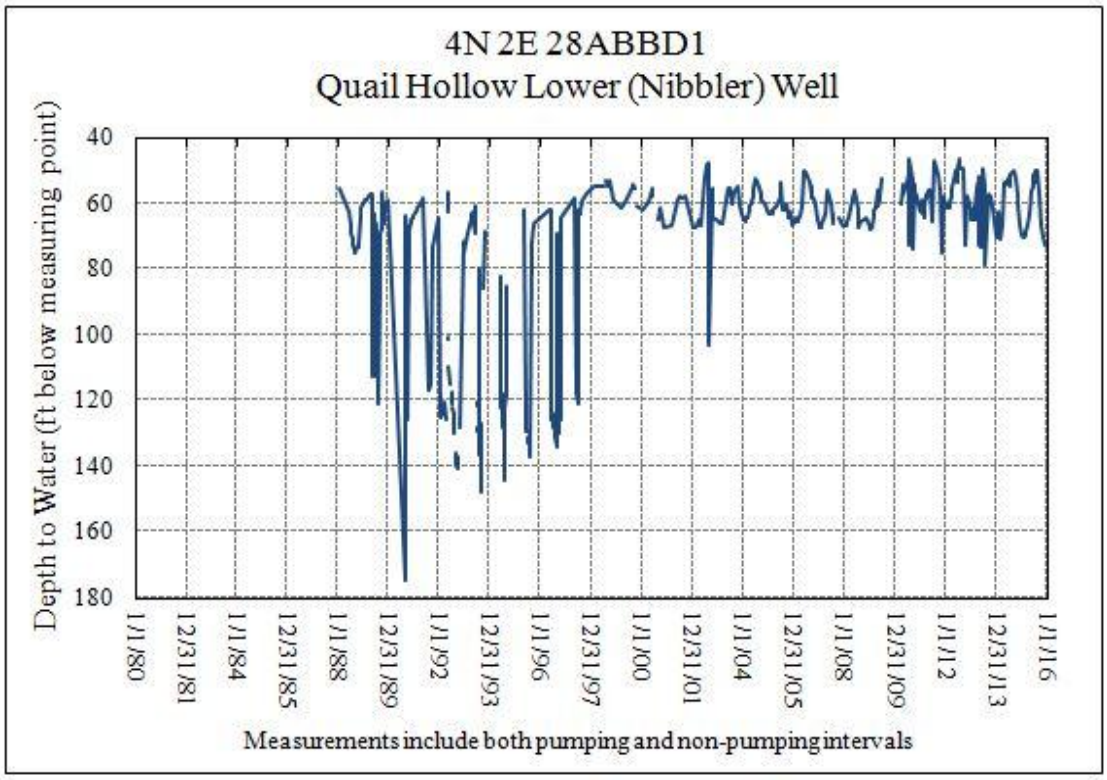


**Figure 16.** Water level hydrograph for the Quail Hollow Lower well.