

Review of Boise Front Low Temperature Geothermal Monitoring Data for Water Year 2017 (October 1, 2016 – September 30, 2017)

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

January 11, 2018

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 2017 (WY17) was 828.5 million gallons (mgal). This amount was 70.2 mgal more than the total gross withdrawal in Water Year 2016 (WY16). The net withdrawal for WY17 was 265.7 mgal, which was 4.9 mgal less than the net withdrawal in WY16. All four of the systems had increases in gross withdrawals in WY17, with the City of Boise system having the largest increase (62.6 mgal). The individual increases for the other three systems were all less than 4 mgal. About 68% of the water withdrawn in WY17 was re-injected, which is an increase of about 4% from WY16.

Water level maximums and minimums decreased slightly in WY17. The maximum value for the BLM well decreased 0.6 foot, and the minimum value decreased 3.7 feet. The maximum and minimum values for the Kanta well decreased 0.6 feet and 2.7 feet, respectively, from WY16 to WY17.

In general, the maximum water level values for the Boise Warm Springs Water District (BWSWD) East and West wells declined 3 feet from WY16 to WY17. This observation is based on readings that were taken when one of the wells was pumping. However, a few readings were recorded in WY16 and WY17 when the wells were not being pumped for short (25 – 30 hours) time periods. During these times, water from the wells flowed over the top of the well casings. There is currently no way to determine how much pressure is present in the wells when they are artesian flowing. The BWSWD #3 had the same maximum water level in WY17 as in WY16. The minimum values for the East and West wells were 9 feet higher in WY17, and the minimum value for the #3 well was 2 feet higher.

The maximum water temperature for the State of Idaho Capitol Mall Production well, as determined on a monthly basis, was 0.2 degrees Fahrenheit (°F) lower in WY17 than in WY16. The average of the monthly values was less than 0.1°F different in WY17. The maximum temperature for BWSWD was 1°F higher in WY17; however, this is based on a single reading in 2017 that was 1°F higher than all the rest of the maximum readings. The City of Boise's maximum water temperature was about 0.2°F higher in WY17.

Withdrawals and Re-Injection

In WY17, gross and net withdrawals from the four Downtown Boise-East Boise district heating systems were 828.5 mgal and 265.7 mgal, respectively (Table 1 and Figure 1). Gross withdrawal was 70.2 mgal more in WY17 than in the previous water year (+9%). Net withdrawal was 4.9 mgal less in WY17 than in WY16 (-2%). About 68 of the fluids were re-injected, which is 4% more than in WY16. All four of the systems had increases in gross withdrawals in WY17, with the City of Boise system having the largest increase (62.6 mgal). The increases for the other three systems were all less than 4 mgal.

Table 1. Withdrawals¹ from the four district geothermal heating systems in the Downtown Boise-East Boise areas for Water Year 2017 (October 1, 2016 through September 30, 2017).

System	Gross Withdrawals ¹ for WY17 (million gallons) and percent change from WY16 to WY17	Net Withdrawals ² for WY17 (million gallons) and percent change from WY16 to WY17
Boise Warm Springs Water District	246.6 (+1%)	246.6 (+1%)
State of Idaho Capitol Mall	91.0 (+2%)	0 (NC ³)
City of Boise	290.6 (+27%)	19.2 (-27%)
Veterans Administration	200.3 (+2%)	0 (NC ³)
Total	828.5 (+9%)	265.7 (-2%)

¹These 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.

²Net Withdrawals equal Gross Withdrawals minus Injection amounts. ³NC = No change.

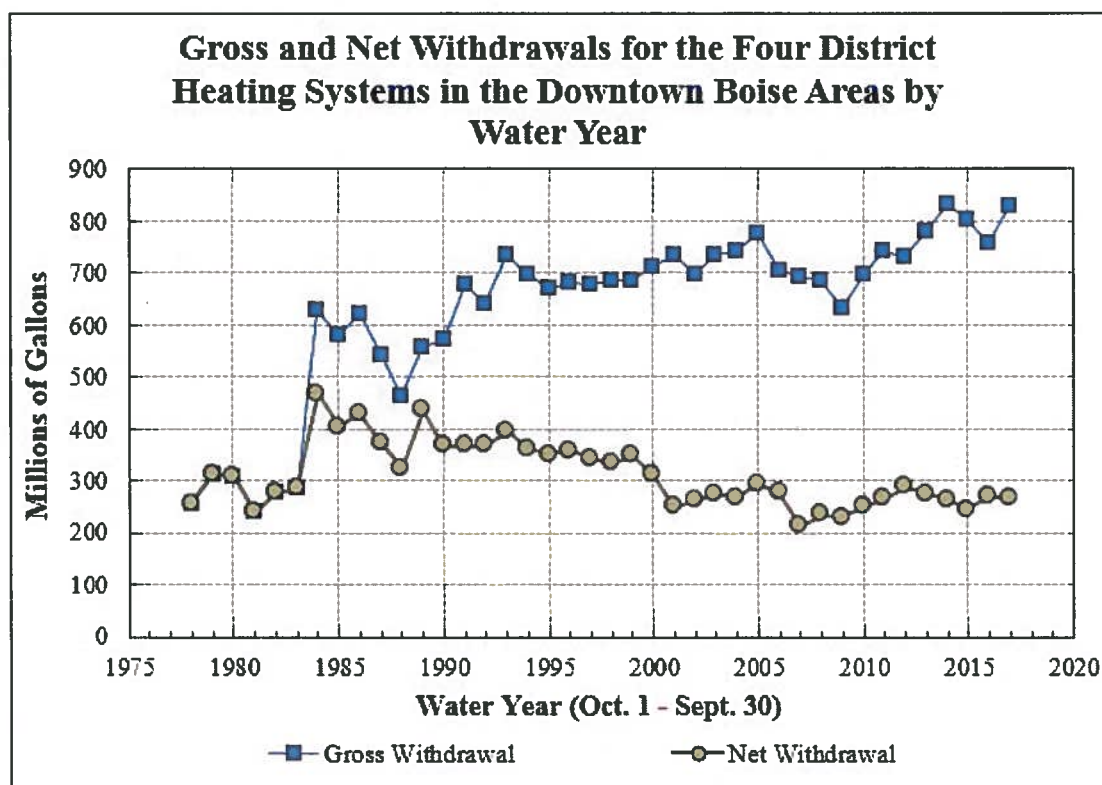


Figure 1. Gross and net withdrawals for the four district heating systems in the Downtown Boise – East Boise area for water years 1978 through 2017.

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

The BLM well, which is located near the City of Boise, Capitol Mall and VA wellfields, had a decrease of 0.6 feet in the maximum water level from WY16 to WY17, and a decrease of 3.7 feet in the minimum water level (Figure 2). The total decreases in the maximum and minimum values over the last two water years were 1.5 feet and 4.9 feet, respectively.

The Kanta well showed similar trends (Figure 3), with the maximum value decreasing 0.6 feet from WY16 to WY17, and the minimum value decreasing 2.7 feet in WY17. The total decreases in the maximum and minimum values over the last two water years were 1.6 feet and 4.1 feet, respectively.

The BSWD East and West wells had interesting water level data. Both wells had single readings of “zero” feet below their measuring points in WY16 and WY17 (Figures 4 and 5). According to the BSWD manager, “zero” was recorded when the wells were artesian flowing (i.e., water was flowing over the casing tops). The “zero” readings occurred when the pumps in the wells were not in operation for short (25 – 30 hours) time periods. All of the preceding and succeeding measurements, when the pump in at least one of the wells was operating, were significantly lower (3 to 14 feet below the casing tops). It is currently not possible to determine how much artesian pressure is in the wells when the water is flowing over the casing tops. If the wells could be shut in, then pressures could be recorded. However, that cannot be accomplished at this time. In the future, the BSWD manager is going to record “zero” when the water level is exactly at the top of the casing, and “+1” when the water is flowing over the casing top. If the zero readings are ignored, then both wells experienced decreases of 3 feet in the maximum water levels in WY17. The BSWD #3 well had no change in the maximum water level in WY17. The minimum values for the East and West wells were 9 feet higher in WY17. The minimum value for the BSWD #3 well was 2 feet higher in WY17.

The BGL #1 well continued to have unusually high values for the manual measurements, which were noted in last year’s report (Figure 6). The trends for the transducer measurements were similar to the BLM and Kanta wells with the maximum level being 0.7 feet lower in WY17, and the minimum level being at least 3.2 feet lower in WY17. The Harris Ranch wells have decreased 1.0 feet and 1.6 feet over the last two years (Figure 7).

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

The maximum water temperature¹ for the State of Idaho Capitol Mall Production well was slightly lower in WY17, down 0.2°F from WY16 (Figure 8). The average of the maximum monthly values in WY17 was 0.03°F higher in WY17 (Figure 9). The maximum temperature for BSWD was 1°F higher in WY17 (Figure 10); however, this is based on a single reading in 2017 that was 1°F higher than all the rest of the maximum readings. The City of Boise’s maximum water temperature was about 0.2°F higher in WY17 (Figure 11).

¹Readings that are preceded by 8 hours of discharge rates over 300 gallons per minute are valid for using in this analysis.

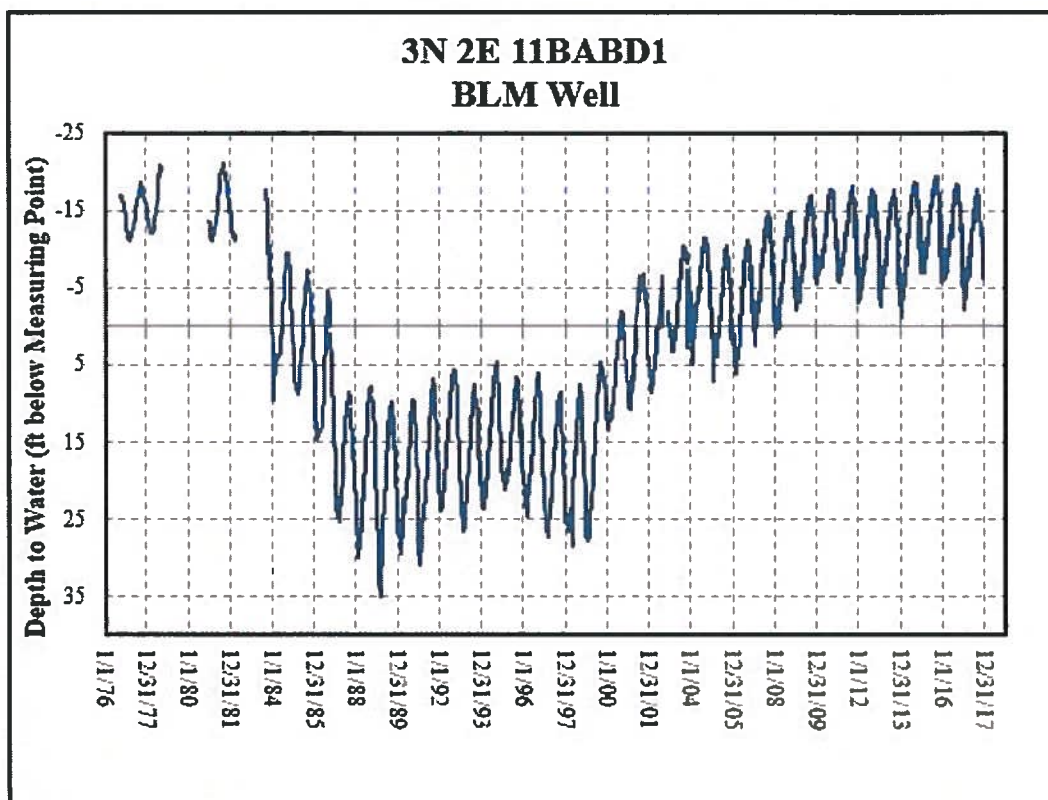


Figure 2. Water level hydrograph for the BLM well.

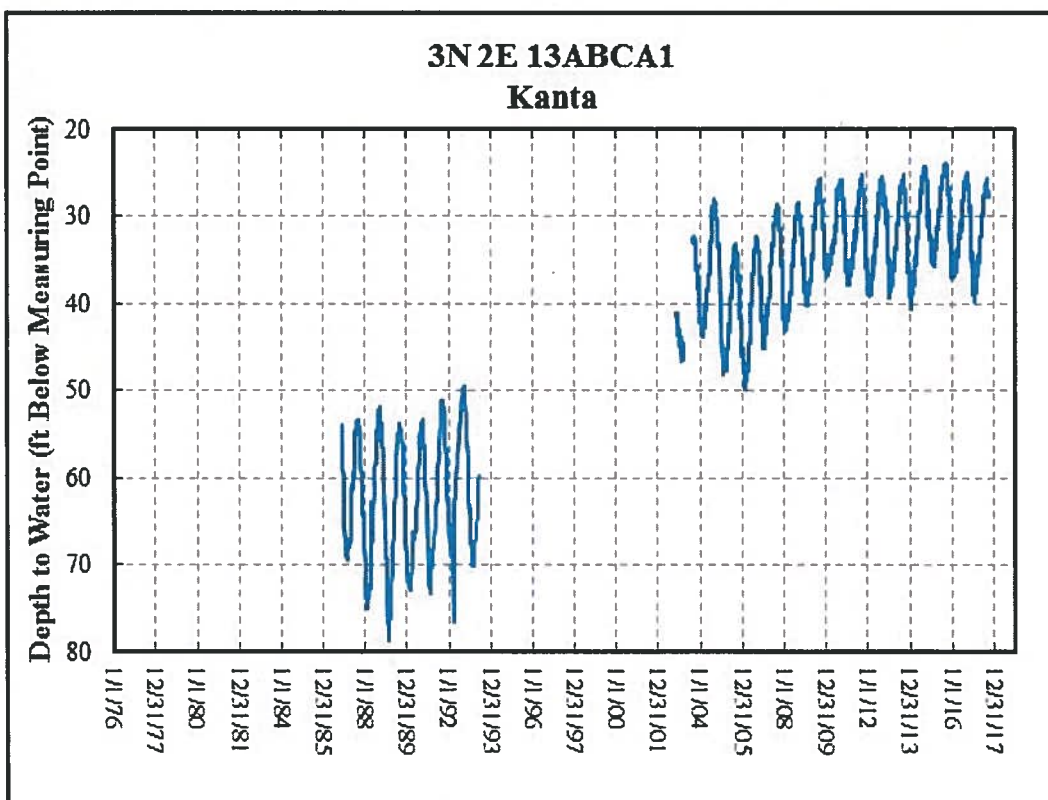


Figure 3. Water level hydrograph for the Kanta well.

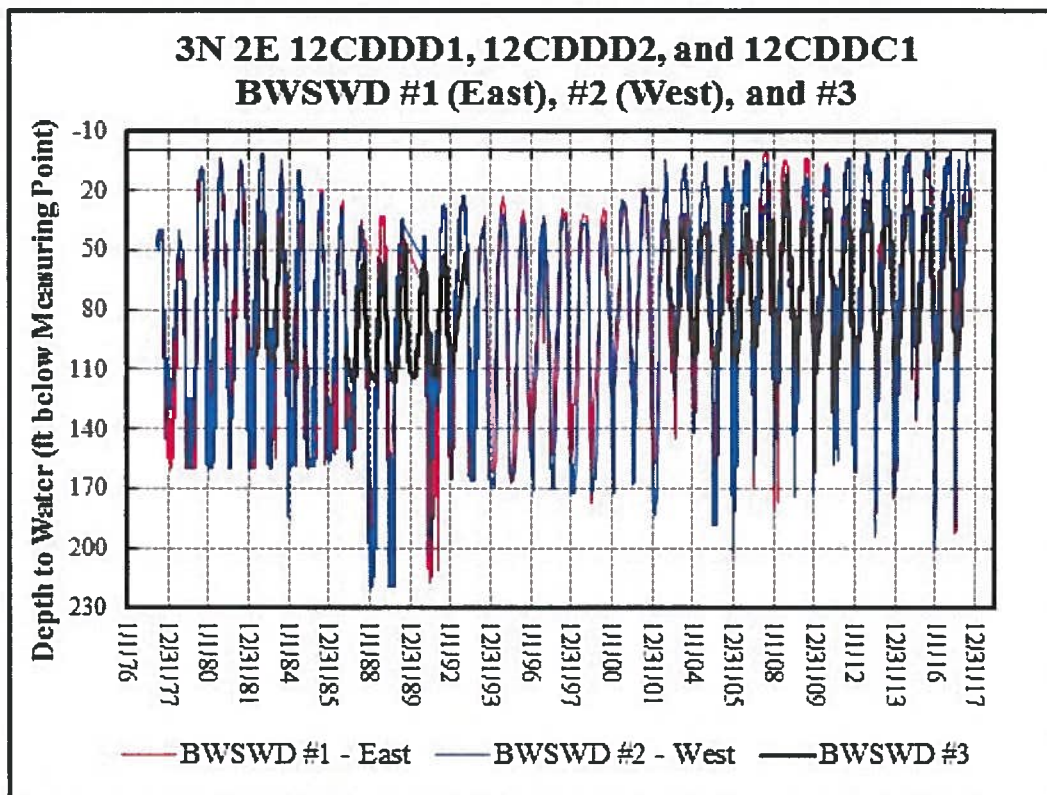


Figure 4. Water level hydrographs for the Boise Warm Springs Water District (BWSWD) wells.

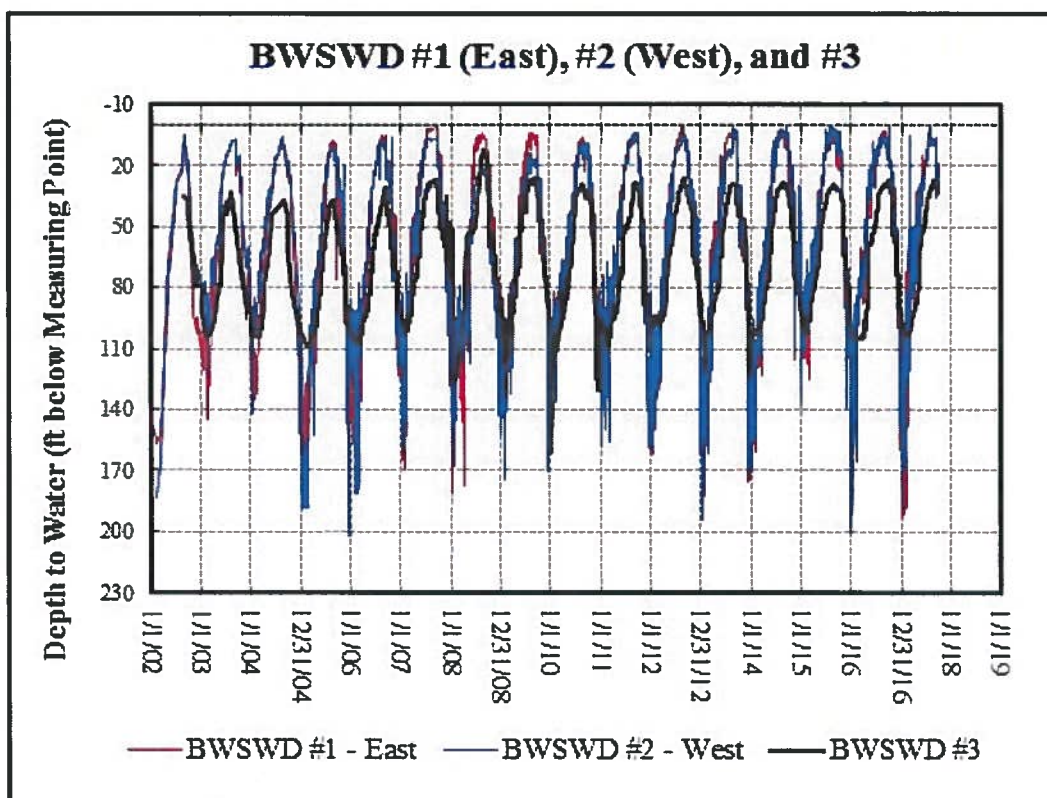


Figure 5. Water level hydrographs for the Boise Warm Springs Water District (BWSWD) wells, January 2002 to September 2017.

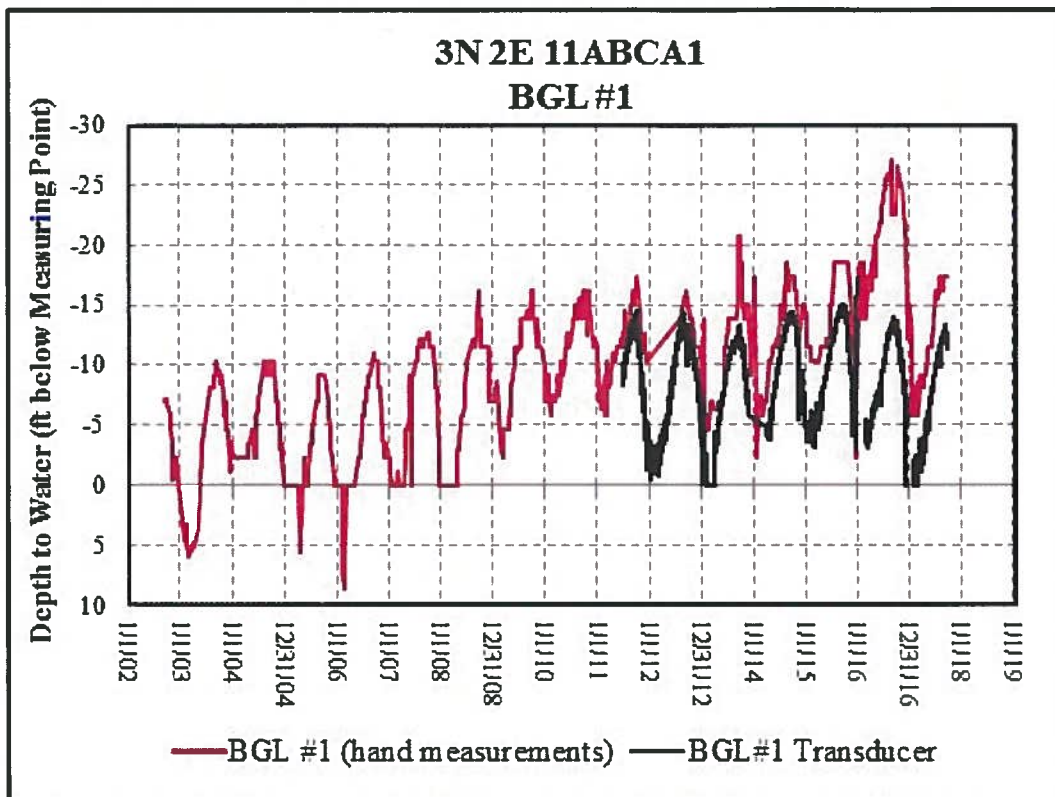


Figure 6. Water level hydrographs for the City of Boise's BGL #1 well.

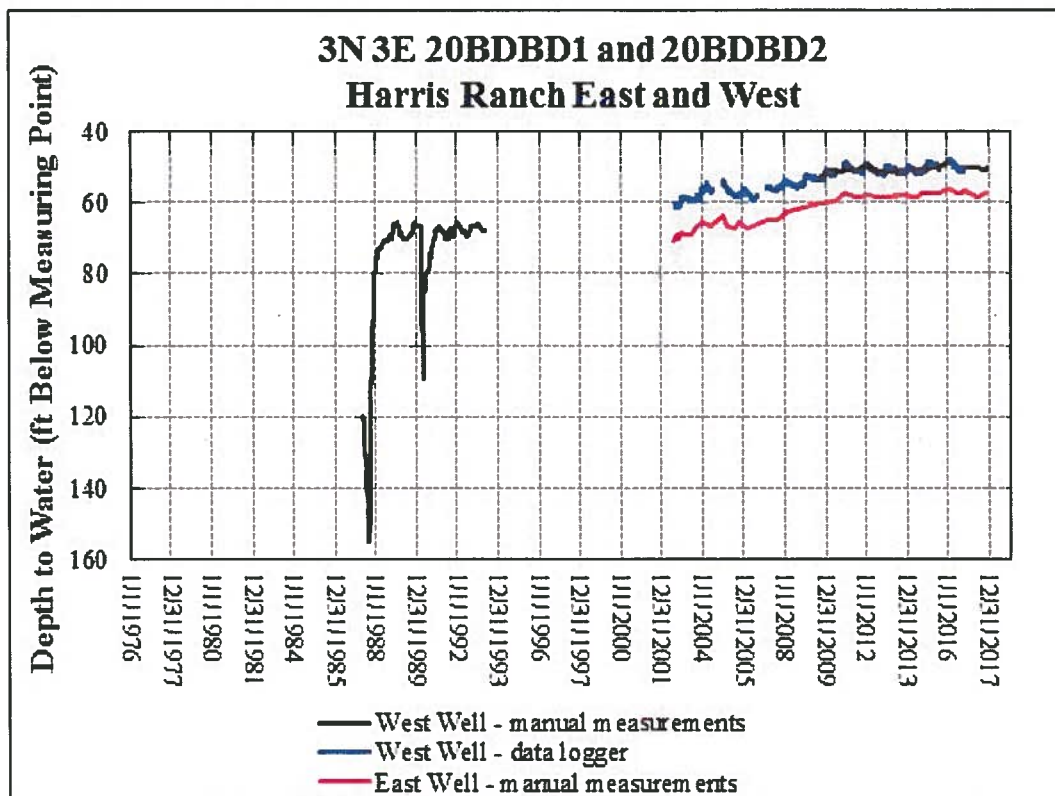


Figure 7. Water level hydrographs for the Harris Ranch wells.

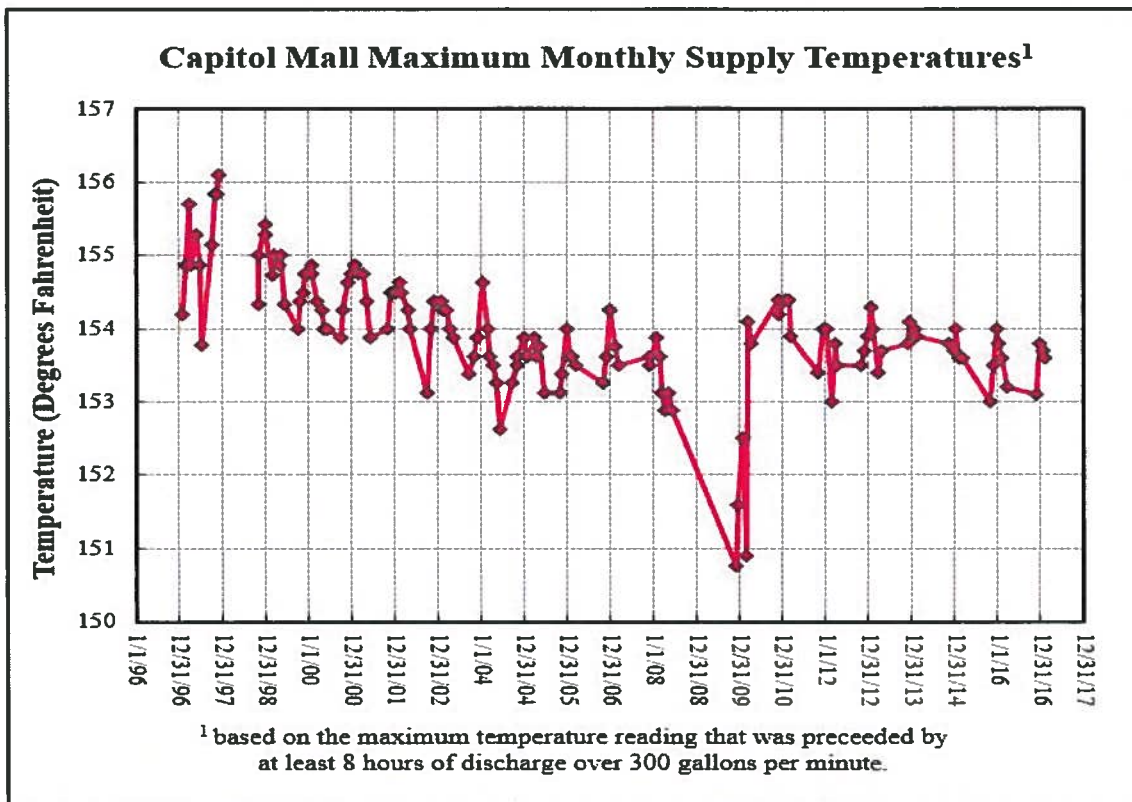


Figure 8. Monthly maximum supply water temperatures for the Capitol Mall geothermal system.

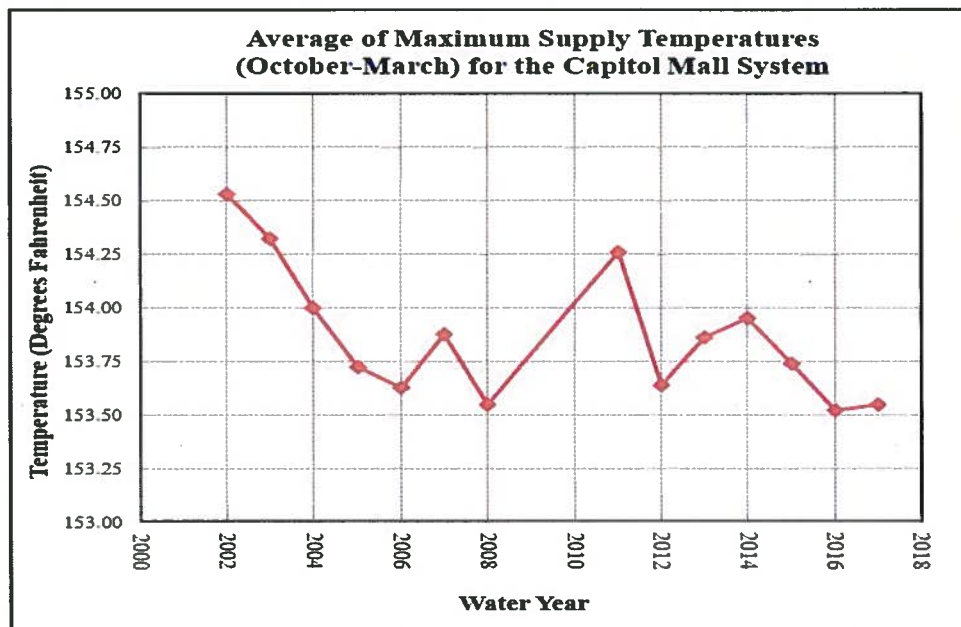


Figure 9. Average of the Capitol Mall maximum supply water temperatures for the October-March time periods for Water Years 2002 through 2017 (In some water years, data that met the requirements for analyses were available for six months (October through March); in other years, fewer than six months had temperature data that met the requirements).

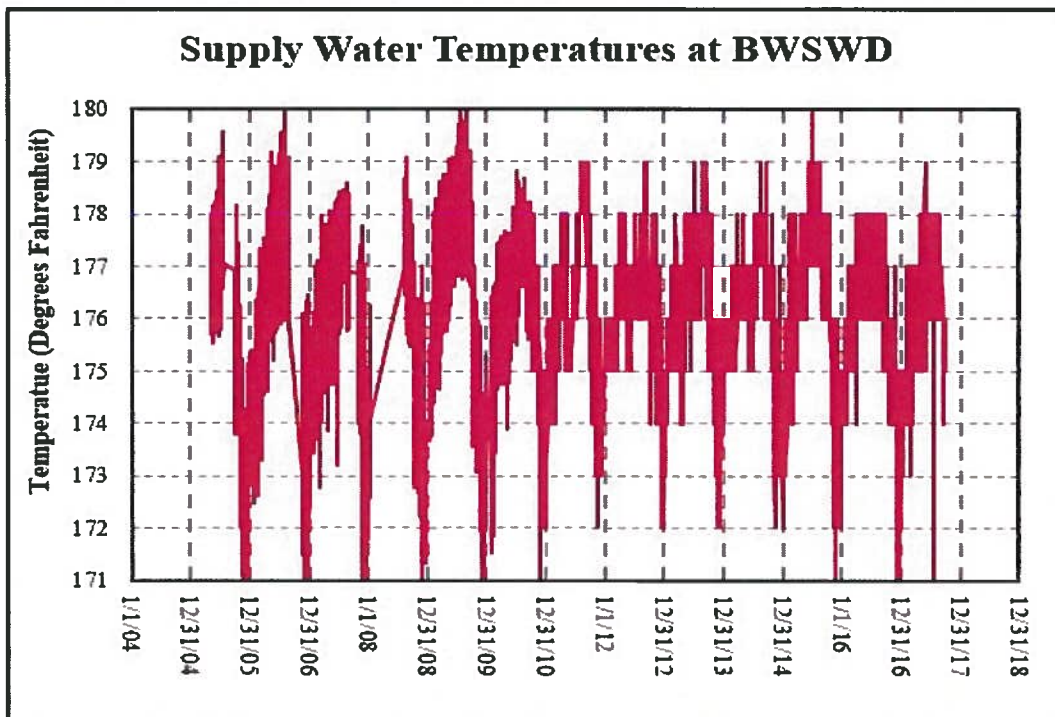


Figure 10. Supply water temperatures for the Boise Warm Springs Water District.

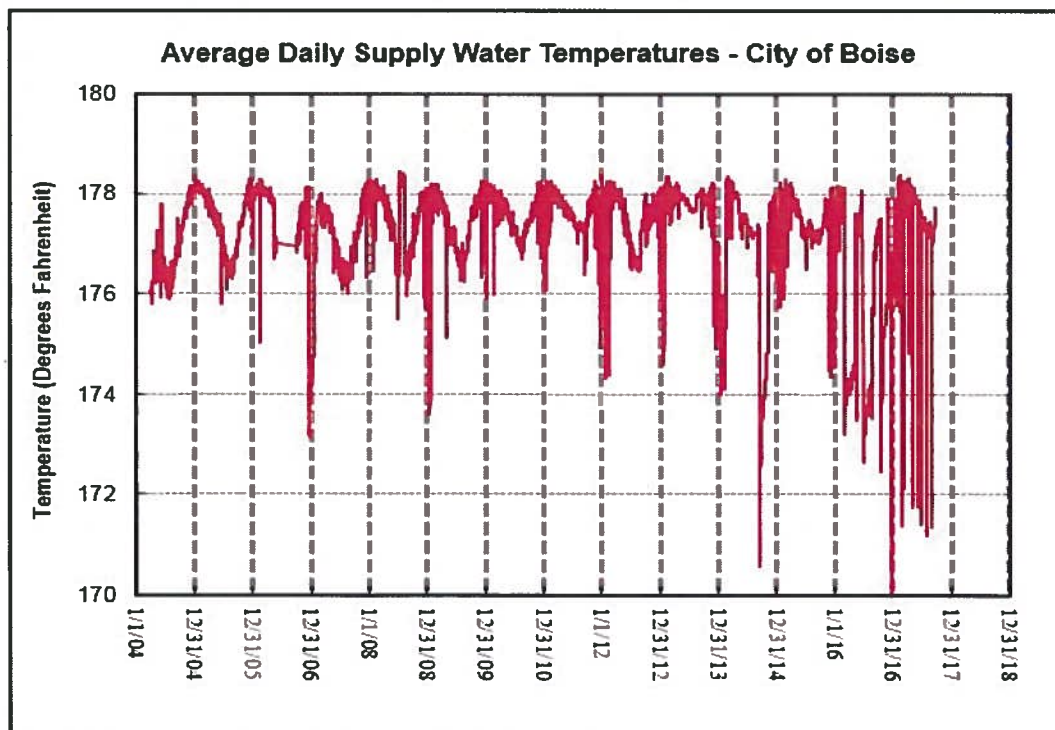


Figure 11. Supply water temperatures for the City of Boise's geothermal system. This graph is based on the daily average of the hourly readings. Readings less than 170°F were omitted from the analysis.