Update on Groundwater Conditions in the Oakley Fan Area, Idaho

IDAHO DEPARTMENT OF WATER RESOURCES

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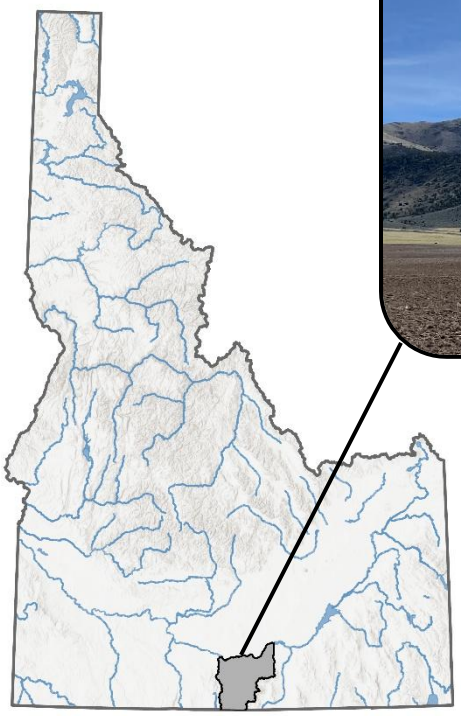

Open-File Report

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Introduction

The Oakley Fan area is located approximately 20 miles southeast of Twin Falls, Idaho (Figure 1). It contains four Critical Groundwater Areas: Artesian City (designated 1962), Cottonwood (designated 1962), Oakley-Kenyon (designated 1962), and West Oakley Fan (designated 1982). A Critical Groundwater Area (CGWA) is all or part of a groundwater basin that does not have sufficient groundwater to provide a reasonably safe supply for irrigation or other uses at the current or projected rates of withdrawal. IDWR's Director is granted the authority to designate Critical Groundwater Areas (CGWAs) and Groundwater Management Areas (GWMAs) under Idaho Code Title 42, Chapter 233a and 233b, respectively. The Oakley Fan Area overlaps with the southernmost boundary of the Eastern Snake Plain Aquifer Model (ESPAM).

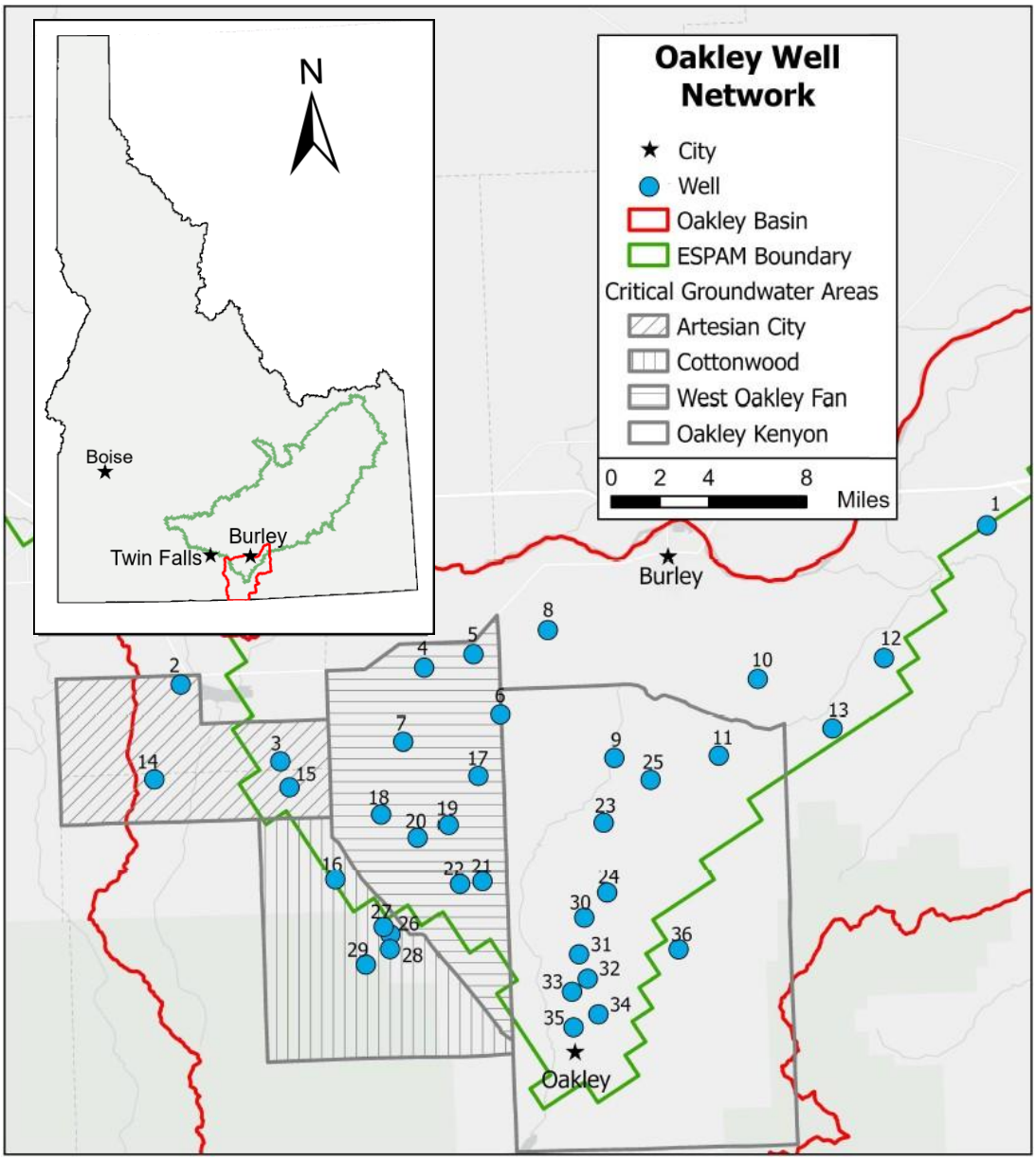

Figure 1: *The location of the Oakley Fan area and distribution of wells in the Oakley well network.*

IDWR has divided the state into over 50 administrative basins in order to coordinate water management activities. Each basin is assigned to one of the four IDWR regional offices (Northern, Eastern, Southern, and Western). The Oakley Fan area is in Basin 45 and is managed by the IDWR Southern Regional Office in Twin Falls.

A predominantly agricultural region, farmers in the Oakley Fan area steadily replaced flood irrigation over time in favor of more efficient sprinkler irrigation since the start of significant groundwater development in the mid-20th century. Due to declining groundwater levels, IDWR and the U.S. Geologic Survey (USGS) have both monitored groundwater levels in the area for several decades. The current groundwater monitoring network consists of 36 wells monitored by IDWR (Figure 1).

Previous technical reports and studies have summarized the geology, hydrology, and geography of the Oakley Fan Area (Crosthwaite, 1969; Piper, 1923; Bendixsen, 1994; Young and Newton, 1989). The purpose of this report is to provide an update and overview of the current groundwater-level trends in the Oakley Fan area.

Hydrogeology

The Oakley Fan area has a moderately complex geological history. The basin consists of rocks and formations spanning from the Paleozoic to the Tertiary. Marine Paleozoic sediments dominate the makeup of the mountain ranges in the area, especially to the east, where they have been uplifted due to tectonic activity (Piper, 1923). Within the fan itself, hydrogeologically significant deposits consist largely of tertiary and quaternary basin fill. The fill comprises a mix of alluvial, fluvial, lacustrine, and volcanic-derived materials. Beneath the basin fill the volcanic bedrock is interbedded with sedimentary units. In some areas this volcanic basin is overlain by lacustrine clays and sediments, as well as recent stream and alluvial fan deposits (Piper, 1923; Youngquist and Haegele, 1956).

Groundwater in the Oakley Fan Basin is mostly found within shallow unconsolidated alluvial deposits, the basalts of the Snake River group, and old silicic volcanic rocks at depth (Crosthwaite, 1969). Static water levels in the basin typically range from 40 ft to over 700 ft below the land surface.

Climate

The Oakley Fan area has a semi-arid climate typical of southern Idaho with cold winters and hot summers. The average annual precipitation is 11 inches, and the average annual snowfall is approximately 27 inches. The average annual low temperature is 19°F and typically occurs in January with average annual high temperatures averaging 87°F and generally occur in July (WRCC, 2025).

Calculating the Palmer Drought Severity Index (PDSI) can help us better understand historical climate trends and quantify the amount of moisture typically available in the region. The PDSI (Figure 2, Table 1) is an effective drought measurement tool that encompasses precipitation, temperature, evapotranspiration, and soil moisture (Rhee and Carbone, 2007). Positive values indicate wet periods and negative values indicate drought, with larger values indicating the severity of wet or dry periods. The PDSI analysis indicates the area is classified as being in

drought conditions approximately 34% of the time since 1950. Drought conditions appear to be increasing in frequency over time since 1950, occurring 43% of the time in the 2000-2025 period compared to 36% in the period from 1975-1999 and 20% from 1950-1974.

Table 1: *PDSI for the Oakley Fan Area since 1950 and in 25-year intervals.*

PDSI	PDSI Description	1950-1974	1975-1999	2000-2025	1950-2025
x ≤ -4	*extreme drought*	*0%*	*8%*	*4%*	*4%*
-4 < x ≤ -3	*severe drought*	*8%*	*16%*	*8%*	*11%*
-3 < x ≤ -2	*moderate drought*	*4%*	*8%*	*12%*	*8%*
-2 < x ≤ -1	*mild drought*	*8%*	*4%*	*19%*	*11%*
-1 < x < 1	*near normal*	*52%*	*12%*	*27%*	*30%*
1 ≤ x < 2	*mild wet spell*	*0%*	*24%*	*19%*	*15%*
2 ≤ x < 3	*moderate wet spell*	*12%*	*4%*	*8%*	*8%*
3 ≤ x < 4	*severe wet spell*	*4%*	*16%*	*4%*	*8%*
x ≥ 4	*extreme wet spell*	*12%*	*8%*	*0%*	*7%*

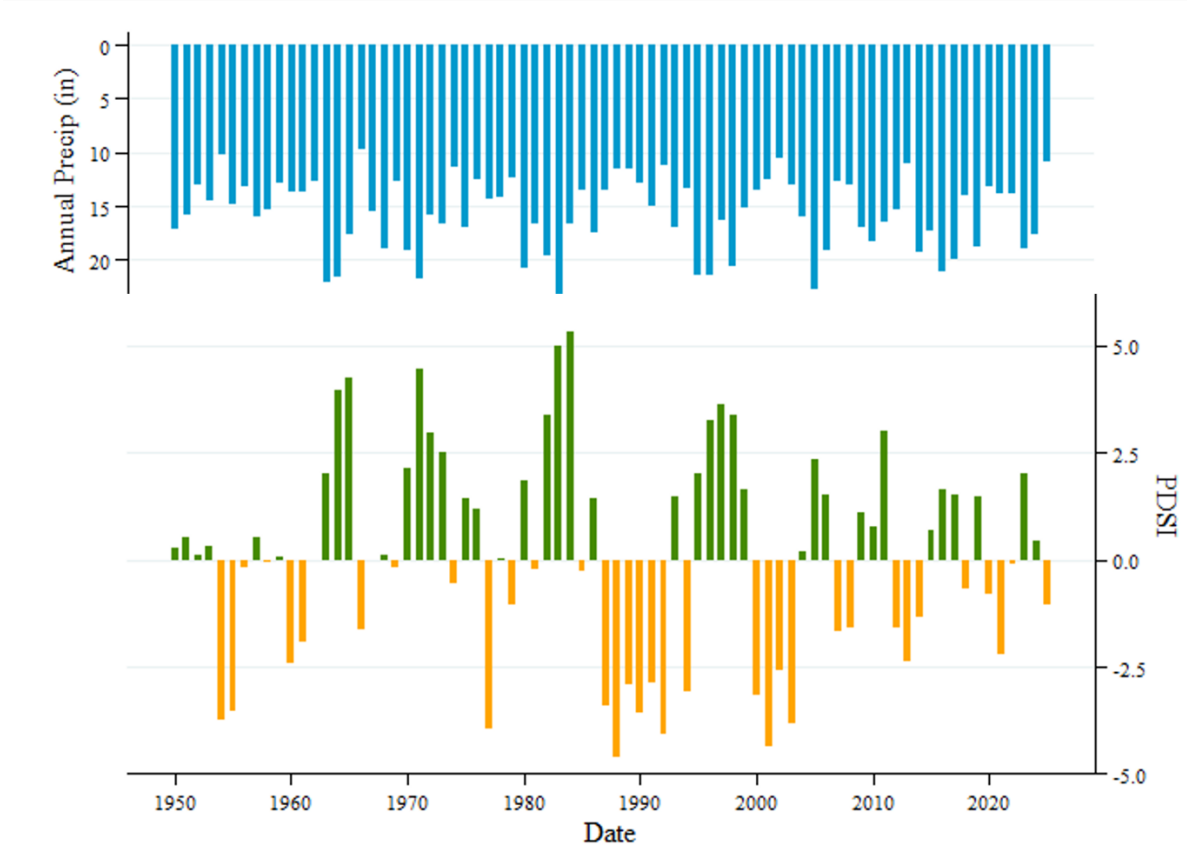

Figure 2: *The Palmer Drought Severity Index plotted alongside precipitation. Data obtained from NOAA's database for Cassia County, Idaho, which includes the Oakley Fan area.*

Monitoring Network Status

The Oakley Fan monitoring network contains 36 wells (Table 3) of which 19 are equipped with data loggers that record water levels every 12 hours. Sixteen wells are primarily used for irrigation, two for domestic use, one for stockwater, one is a commercial/industrial well, and two wells are used as injection wells. The remaining 14 wells are unused.

All wells are visited twice per year, once in the spring before the irrigation season starts, and once in the fall after irrigation season ends. During each visit, a manual depth to water measurement is made using a calibrated e-tape, and if a pressure transducer is installed, data are downloaded from the data logger. If a measurement is not possible during a visit, it will be revisited if time allows, otherwise the measurement is deferred to the following season.

Hydrographs for each well are available in Appendix A.

Table 2: *List of monitored wells in the Oakley Fan area.*

No	Station Name	Constructed Depth (ft)	Period of Record	Data Logger	CGWA
1	*10S 25E 21ABA1*	*200*	*1956-2025*	*Yes*	*NA*
2	*11S 19E 13BCA2*[1,2]	*954*	*2017-2024*	*No*	*Artesian City*
3	*11S 20E 33DAD1*	*680*	*1951-2025*	*Yes*	*Artesian City*
4	*11S 21E 09DDD1*	*810*	*2017-2022*	*No*	*West Oakley Fan*
5	*11S 21E 11DAA1*	*600*	*2010-2025*	*No*	*West Oakley Fan*
6	*11S 21E 25AAA1*	*965*	*1982-2025*	*No*	*West Oakley Fan*
7	*11S 21E 33BBB1*	*475*	*1981-2025*	*Yes*	*West Oakley Fan*
8	*11S 22E 04CBC2*	*656*	*2012-2025*	*Yes*	*NA*
9	*11S 22E 35DCC1*	*900*	*2012-2025*	*Yes*	*Oakley-Kenyon*
10	*11S 23E 14DDD1*	*69*	*1985-2025*	*No*	*NA*
11	*11S 23E 34CDC1*	*412*	*1962-2025*	*Yes*	*Oakley-Kenyon*
12	*11S 24E 14BDB1*	*1400*	*1991-2025*	*No*	*NA*
13	*11S 24E 28CCC1*	*435*	*2012-2025*	*No*	*NA*
14	*12S 19E 02BBC1*	*900*	*1951-2025*	*No*	*Artesian City*
15	*12S 20E 03CAC2*	*670*	*1995-2025*	*Yes*	*Artesian City*
16	*12S 20E 25CBB1*	*630*	*2003-2025*	*No*	*Cottonwood*
17	*12S 21E 02DAA1*	*936*	*1972-2025*	*Yes*	*West Oakley Fan*
18	*12S 21E 08CCC2*	*972*	*1997-2025*	*Yes*	*West Oakley Fan*
19	*12S 21E 15ACD1*	*1002*	*1981-2024*	*Yes*	*West Oakley Fan*
20	*12S 21E 16DCC1*	*260*	*1962-2025*	*Yes*	*West Oakley Fan*
21	*12S 21E 25CCC1*	*1870*	*1962-2025*	*No*	*West Oakley Fan*
22	*12S 21E 26CCD2*	*1719*	*1978-2025*	*Yes*	*West Oakley Fan*
23	*12S 22E 14CBB1*	*658*	*2017-2025*	*Yes*	*Oakley-Kenyon*
24	*12S 22E 35BCC1*	*810*	*1985-2025*	*Yes*	*Oakley-Kenyon*
25	*12S 23E 06DCC1*	*1280*	*1985-2025*	*No*	*Oakley-Kenyon*
26	*13S 21E 05CCD1*	*1000*	*1977-2025*	*No*	*Cottonwood*
27	*13S 21E 06DAD1*	*Unknown*	*1984-2025*	*Yes*	*Cottonwood*
28	*13S 21E 08CBA1*	*750*	*1982-2025*	*No*	*Cottonwood*
29	*13S 21E 18BBC1*	*850*	*1961-2025*	*Yes*	*Cottonwood*
30	*13S 22E 03BCC2*	*408*	*1962-2025*	*Yes*	*Oakley-Kenyon*
31	*13S 22E 09DDC1*	*360*	*1963-2025*	*No*	*Oakley-Kenyon*
32	*13S 22E 15CCC2*	*280*	*2012-2025*	*Yes*	*Oakley-Kenyon*
33	*13S 22E 21CAA1*[2]	*400*	*1997-2025*	*No*	*Oakley-Kenyon*
34	*13S 22E 27BDD2*	*290*	*2012-2025*	*Yes*	*Oakley-Kenyon*
35	*13S 22E 28CDD1*	*255*	*1972-2025*	*No*	*Oakley-Kenyon*
36	*13S 23E 08CDD1*	*287*	*1984-2024*	*No*	*Oakley-Kenyon*

Driller's first depth to water measurement is excluded from the period of record

[1]Unable to complete recent measurements due to well access

[2]Well was deepened during period of record

Water-Level Trends and Analysis

To better understand water-level trends in the Oakley Fan area, overall water-level changes were calculated (Table 3), and statistical analyses were performed (Table 4).

Changes in Water Levels

IDWR and the USGS have been measuring wells in the Oakley Fan area for several decades, with USGS records dating back to the 1950s at some wells. These records can be used to determine long-term trends in the region. To minimize the impact of large seasonal fluctuations, spring measurements (pre-irrigation season) were selected for comparison.

To calculate the overall change in water levels, the earliest spring measurement was compared to the 2025 spring measurement. In some cases, historic spring measurements were not recorded until several years after the well's monitoring record began. Spring measurements were selected on April 1 every year; if not available, the closest measurement was selected between March 1 and May 30 of that year.

Table 3 summarizes water-level changes for the period from 2001-2025, a more recent period from 2016-2025, and the overall period of record for each well. Of the 36 wells, 25 wells show an overall decline in water levels and nine wells show an increase. Two wells (Well 2 and 33) were deepened during their period of record and this analysis was not performed. For the period from 2001-2025, 15 wells show a decrease in water levels, seven wells show an increase, and 14 wells lack sufficient data for this analysis. The median change for the 2001-2025-period is a decline of 18.10 ft. For the period from 2016-2025, a total of 18 wells show a decrease in water levels, 15 wells show an increase, and three wells lack sufficient data for this analysis. The median change for this more recent period is a decline of 0.96 ft.

Table 3: *Water-level changes for the overall period of record, the period from 2001-2025, and the period from 2016-2025 for wells in the Oakley Fan monitoring network, grouped by CGWA.*

No	Station Name	Water-level change from 2016-2025 (ft)	Water-level change from 2001-2025 (ft)	Overall water-level change period of record	Overall water-level change (ft)
			Artesian City CGWA		
2	*11S 19E 13BCA2*	*NA*	*NA*	*2017-2024*	*NA*
3	*11S 20E 33DAD1*	*22.63*	*11.33*	*1951-2025*	*-140.32*
14	*12S 19E 02BBC1*	*-3.26*	*-72.53*	*1951-2025*	*-311.42*
15	*12S 20E 03CAC2*	*40.45*	*NA*	*1995-2025*	*-43.19*
			West Oakley Fan CGWA		
4	*11S 21E 09DDD1*	*NA*	*NA*	*2017-2022*	*12.25*
5	*11S 21E 11DAA1*	*3.53*	*NA*	*2010-2023*	*10.19*
6	*11S 21E 25AAA1*	*4.67*	*-11.51*	*1982-2025*	*-30.13*
7	*11S 21E 33BBB1*	*58.01*	*27.49*	*1981-2025*	*-16.58*
17	*12S 21E 02DAA1*	*75.03*	*52.04*	*1972-2025*	*2.36*
18	*12S 21E 08CCC2*	*71.71*	*NA*	*1997-2025*	*21.27*
19	*12S 21E 15ACD1*	*98.87*	*125.92*	*1981-2024*	*132.00*
20	*12S 21E 16DCC1*	*36.72*	*31.50*	*1962-2025*	*9.50*
21	*12S 21E 25CCC1*	*5.86*	*-64.22*	*1962-2025*	*-119.67*
22	*12S 21E 26CCD2*	*21.37*	*-26.28*	*1978-2025*	*-88.83*
			Cottonwood CGWA		
16	*12S 20E 25CBB1*	*-12.79*	*-39.39*	*2003-2025*	*-39.39*
26	*13S 21E 05CCD1*	*-13.20*	*-38.25*	*1977-2025*	*-148.45*
27	*13S 21E 06DAD1*	*-11.54*	*-45.62*	*1984-2025*	*-118.67*
28	*13S 21E 08CBA1*	*NA*	*NA*	*1982-2025*	*-120.17*
29	*13S 21E 18BBC1*	*-8.83*	*-58.96*	*1961-2025*	*-340.39*

No	Station Name	Water-level change from 2016-2025 (ft)	Water-level change from 2001-2025 (ft)	Overall water-level change period of record	Overall water-level change (ft)
			Oakley-Kenyon CGWA		
9	*11S 22E 35DCC1*	*-3.47*	*NA*	*2012-2025*	*-4.74*
11	*11S 23E 34CDC1*	*1.17*	*-11.15*	*1962-2025*	*-51.19*
23	*12S 22E 14CBB1*	*-5.20*	*NA*	*2017-2025*	*-5.20*
24	*12S 22E 35BCC1*	*-11.55*	*-51.71*	*1985-2025*	*-93.37*
25	*12S 23E 06DCC1*	*-4.97*	*-24.68*	*1985-2025*	*-54.65*
30	*13S 22E 03BCC2*	*-14.07*	*NA*	*1962-2025*	*64.24*
31	*13S 22E 09DDC1*	*-29.20*	*-80.85*	*1963-2025*	*-87.47*
32	*13S 22E 15CCC2*	*-58.77*	*NA*	*2012-2025*	*-99.38*
33	*13S 22E 21CAA1*	*NA*	*NA*	*1997-2025*	*NA*
34	*13S 22E 27BDD2*	*-15.02*	*NA*	*2012-2025*	*-25.81*
35	*13S 22E 28CDD1*	*-25.24*	*-106.14*	*1972-2025*	*-149.61*
36	*13S 23E 08CDD1*	*-0.77*	*-1.99*	*1984-2024*	*-4.00*
			Wells not part of a CGWA		
1	*10S 25E 21ABA1*	*-1.16*	*3.12*	*1956-2025*	*2.51*
8	*11S 22E 04CBC2*	*2.29*	*NA*	*2012-2025*	*-1.38*
10	*11S 23E 14DDD1*	*-2.65*	*-5.29*	*1985-2025*	*-10.01*
12	*11S 24E 14BDB1*	*12.11*	*45.60*	*1991-2025*	*59.81*
13	*11S 24E 28CCC1*	*0.51*	*NA*	*2012-2025*	*-2.53*
Median Change Across Entire Network		*-0.96*	*-18.10*		

NA values indicate an incomplete data set for some wells over the various periods of record. Water-level change was not calculated if there was a total of two or more years missing on either end of the period from 2016-2025 and more than a total of five or more years missing for the period from 2001-2025. For wells 2 and 33 the analysis was not completed due to the well being deepened during the period of analysis.

Statistical Analysis and Trends

While comparing water-level change between distinct historical and recent years can provide a snapshot of how water levels have changed over time, it may be misleading due to both short-term and long-term variability. To more accurately quantify and describe trends in the data, a statistical analysis was performed using the Mann-Kendall (MK) test. MK tests were performed using spring depth-to-water measurements for a recent 10-year period, a recent 25-year period, and overall period of record. For the 10-year and 25-year periods, the analysis was not performed for wells with less than 80% of the yearly data available. For the overall period of record, there was no screening threshold.

Two variables were recorded from the MK test for each well and used to assess trends. Kendall's p-value is a value that ranges from 0 to 1 and represents the statistical significance of the data. It is widely accepted that a p-value ≤0.05 is statistically significant since it meets the 95% confidence interval. A p-value >0.05 means that there is a lack of statistical significance and the trend cannot be considered different than zero. For this analysis a p-value ≤0.05 was used. The trend (positive for an increasing trend and negative for a decreasing trend) is calculated as the median of all pairwise slopes between data points. The value is in the same units as measured and represents the rate of change.

For the period of record, 22 of the 34 wells analyzed show trends that are statistically significant (Table 5). Of these 22 wells, 20 wells show a decreasing trend, and two wells show an increasing trend. For the period of 2001-2025, 15 of 21 wells analyzed show statistically significant trends. Of these 15 wells, 11 wells show a decreasing trend, and four wells show an increasing trend. For the period of 2016-2025, 15 of 33 wells analyzed show statistically significant trends. Of these 15 wells, 9 wells show a decreasing trend, and six wells show an increasing trend.

Analysis by CGWA for the recent 25-year period (Table 5), shows that the Cottonwood and Oakley-Kenyon CGWAs have no statistically significant wells with increasing groundwater trends. The other two CGWAs, however, show some increasing groundwater level trends with one well in Artesian City and two wells in West Oakley Fan showing statistically significant increasing trends.

Table 4: *Results of Mann-Kendall analysis for each well. Results that are statistically significant (p≤0.05) are highlighted.*

No	Station Name	10 YR period (2016 - 2025) statistics		25 YR period (2001 - 2025) statistics		Period of record statistics	
		p-value	trend (ft/year)	p-value	trend (ft/year)	p-value	trend (ft/year)
Artesian City CGWA							
2	11S 19E 13BCA2[1]	NA	NA	NA	NA	NA	NA
3	11S 20E 33DAD1	0.05	2.18	0.00	1.53	0.00	-2.11
14	12S 19E 02BBC1	0.18	-1.70	0.00	-3.45	0.00	-3.81
15	12S 20E 03CAC2	0.60	4.88	NA	NA	0.44	2.07
West Oakley Fan CGWA							
4	11S 21E 09DDD1	NA	NA	NA	NA	0.71	-0.58
5	11S 21E 11DAA1	0.22	0.99	NA	NA	0.92	0.13
6	11S 21E 25AAA1	0.28	0.40	0.00	-0.48	0.00	-1.02
7	11S 21E 33BBB1	0.00	7.49	0.12	1.21	0.00	-1.97
17	12S 21E 02DAA1	0.01	8.45	0.31	0.87	0.00	-1.92
18	12S 21E 08CCC2	0.02	7.30	NA	NA	0.01	6.85
19	12S 21E 15ACD1	0.06	19.96	0.01	6.87	0.22	1.62
20	12S 21E 16DCC1	0.01	2.42	0.00	1.46	0.01	-0.44
21	12S 21E 25CCC1	0.37	2.31	0.11	-1.06	0.00	-2.86
22	12S 21E 26CCD2	0.28	1.88	0.08	-1.09	0.00	-2.97
Cottonwood CGWA							
16	12S 20E 25CBB1	0.18	-2.77	NA	NA	0.00	-1.70
26	13S 21E 05CCD1	0.02	-2.99	0.00	-2.40	0.00	-5.85
27	13S 21E 06DAD1	0.01	-2.40	0.00	-2.00	0.00	-3.52
28	13S 21E 08CBA1	0.81	-1.75	NA	NA	0.07	-12.38
29	13S 21E 18BBC1	0.02	-1.79	0.00	-2.34	0.00	-3.25

No	Station Name	10 YR period (2016 - 2025) statistics		25 YR period (2001 - 2025) statistics		Period of record statistics	
		p-value	trend (ft/year)	p-value	trend (ft/year)	p-value	trend (ft/year)
Oakley-Kenyon CGWA							
9	*11S 22E 35DCC1*	*0.21*	*-0.40*	*NA*	*NA*	*0.25*	*-0.43*
11	*11S 23E 34CDC1*	*0.86*	*0.07*	*0.00*	*-0.39*	*0.00*	*-1.01*
23	*12S 22E 14CBB1*	*0.18*	*-0.98*	*NA*	*NA*	*0.18*	*-0.98*
24	*12S 22E 35BCC1*	*0.47*	*-1.45*	*0.00*	*-2.18*	*0.00*	*-1.85*
25	*12S 23E 06DCC1*	*0.47*	*-0.52*	*0.00*	*-1.00*	*0.00*	*-1.52*
30	*13S 22E 03BCC2*	*0.00*	*-2.13*	*NA*	*NA*	*0.10*	*3.50*
31	*13S 22E 09DDC1*	*0.00*	*-4.50*	*0.00*	*-3.17*	*0.00*	*-1.74*
32	*13S 22E 15CCC2*	*0.00*	*-6.39*	*NA*	*NA*	*0.00*	*-7.73*
33	*13S 22E 21CAA1*[1]	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
34	*13S 22E 27BDD2*	*0.01*	*-2.44*	*NA*	*NA*	*0.00*	*-2.06*
35	*13S 22E 28CDD1*	*0.01*	*-2.84*	*0.00*	*-3.67*	*0.00*	*-2.90*
36	*13S 23E 08CDD1*	*0.47*	*-0.41*	*0.76*	*-0.04*	*0.23*	*-0.09*
Wells not part of a CGWA							
1	*10S 25E 21ABA1*	*0.21*	*-0.99*	*0.13*	*0.25*	*0.18*	*0.16*
8	*11S 22E 04CBC2*	*0.47*	*0.39*	*NA*	*NA*	*0.84*	*-0.11*
10	*11S 23E 14DDD1*	*0.01*	*-0.57*	*0.00*	*-0.19*	*0.00*	*-0.17*
12	*11S 24E 14BDB1*	*0.00*	*1.08*	*0.00*	*1.94*	*0.00*	*1.95*
13	*11S 24E 28CCC1*	*0.92*	*0.10*	*NA*	*NA*	*0.73*	*-0.08*

NA values indicate that less than 80% of data is available for 10 and 25 yr statistics and a trend was not calculated. All available data was used for the period of record statistics.

[1]*Well was deepened at some point during the analysis period and trends could not be reliably calculated.*

Table 5: *Summary of Mann-Kendall test results for the recent 25-year period for wells in the Oakley Fan monitoring network.*

CGWA	***No. of wells with statistically significant increases (p≤0.05)***	***No. of wells with statistically significant decreases (p≤0.05)***	***No. of wells with statistically insignificant data (p>0.05)***
Artesian City	*1*	*1*	*2*
West Oakley Fan	*2*	*1*	*7*
Cottonwood	*0*	*3*	*2*
Oakley-Kenyon	*0*	*5*	*7*
Outside CGWA	*1*	*1*	*3*

Conclusion and Recommendations

The Oakley Fan area monitoring network contains a total of 36 wells, 19 of which are equipped with data loggers for daily continuous monitoring. Twenty-two wells have statistically significant water-level trends for the entire period of record; 20 wells show a trend of decreasing water levels, while two wells show a trend of increasing water levels. For the recent 25-year period, 15 wells show statistically significant trends; 11 of these wells indicate decreasing water-level trends, and four show increasing water-level trends. During this period, the Artesian City and West Oakley Fan CGWAs show a mix of statistically significant increasing and decreasing water-level trends, whereas statistically significant trends in the Cottonwood and Oakley-Kenyon CGWAs are exclusively declining. For the period of 2016-2025, 15 wells show statistically significant trends; nine of these wells show a trend of decreasing water levels, while six wells show a trend of increasing water levels. The data indicate that there is a general trend of decreasing water levels throughout the Oakley Fan area when looking at the entire period of record, though water levels have decreased more slowly during the period of 2001-2025, and continued to slow during the period of 2016-2025.

Continued water-level measurement of the Oakley Fan area is recommended. Several CGWAs have already been designated in this basin, and we continue to observe decreasing groundwater levels on a regional scale. Continued monitoring will assist water managers and water users alike with making informed decisions regarding water use and availability in the area.

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Appendix A – Hydrographs

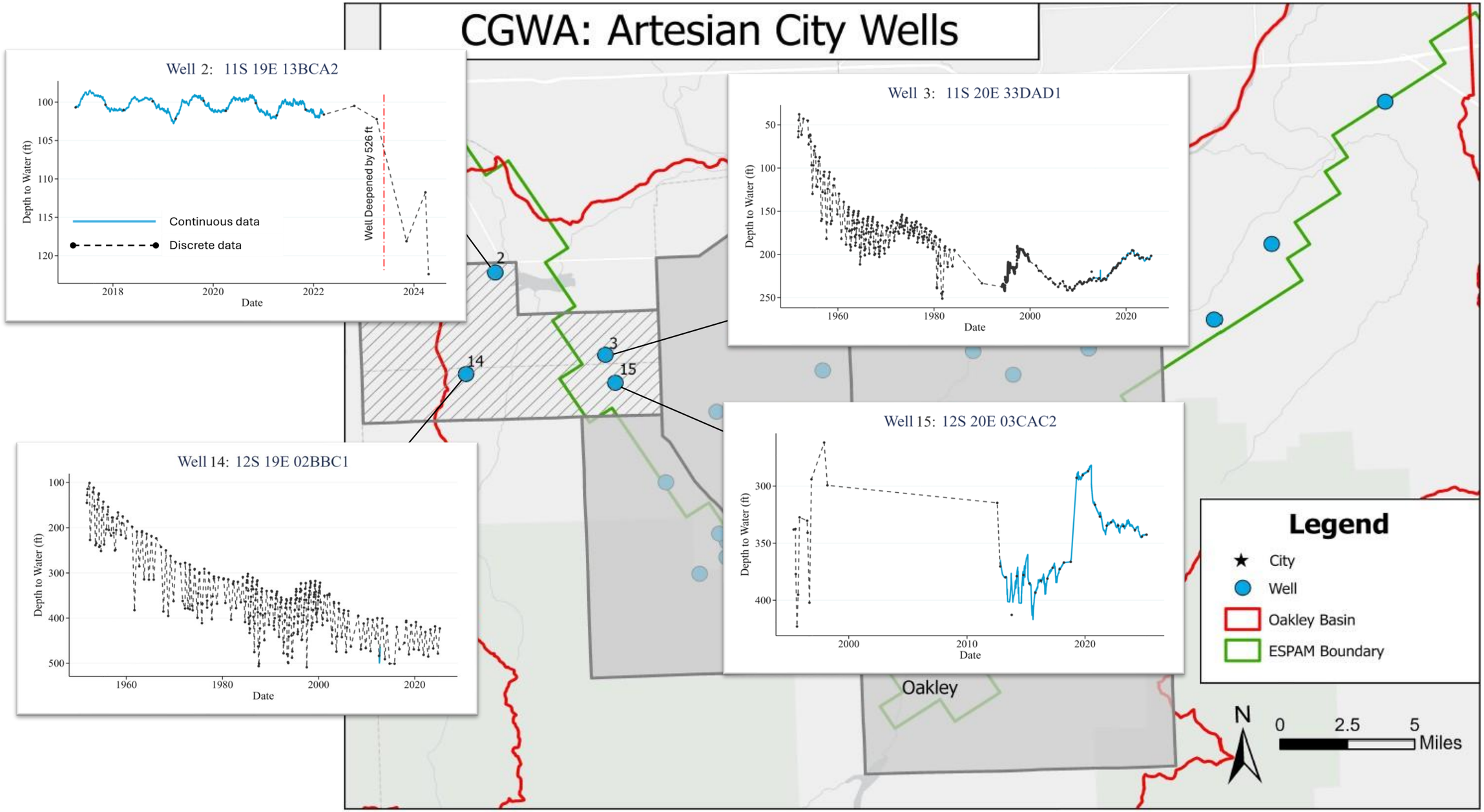

Figure A1: *Hydrographs of wells located in the Artesian City CGWA.*

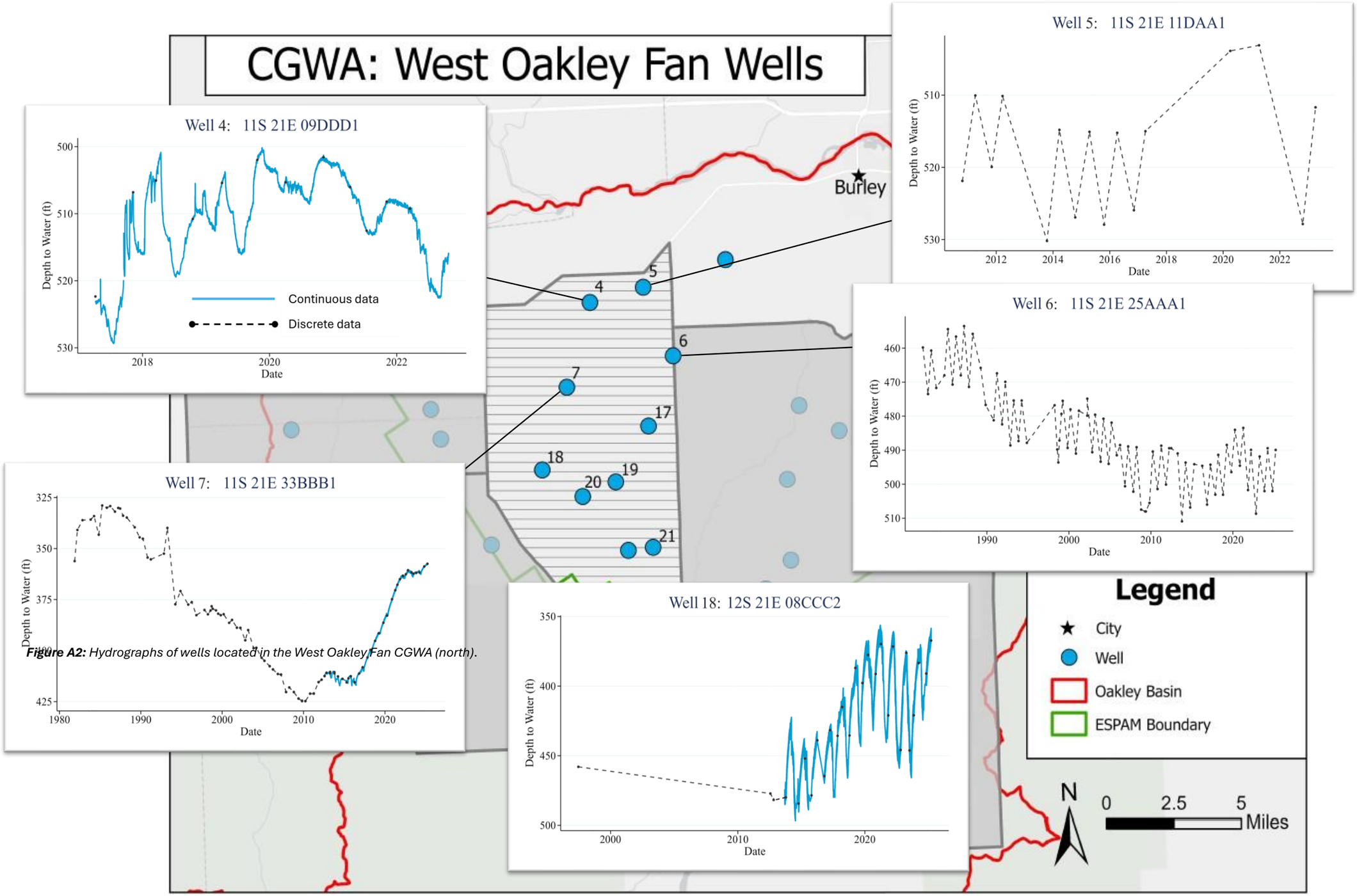

Figure A2: *Hydrographs of wells located in the West Oakley Fan CGWA (north).*

Figure A2: *Hydrographs of wells located in the West Oakley Fan CGWA (north).*

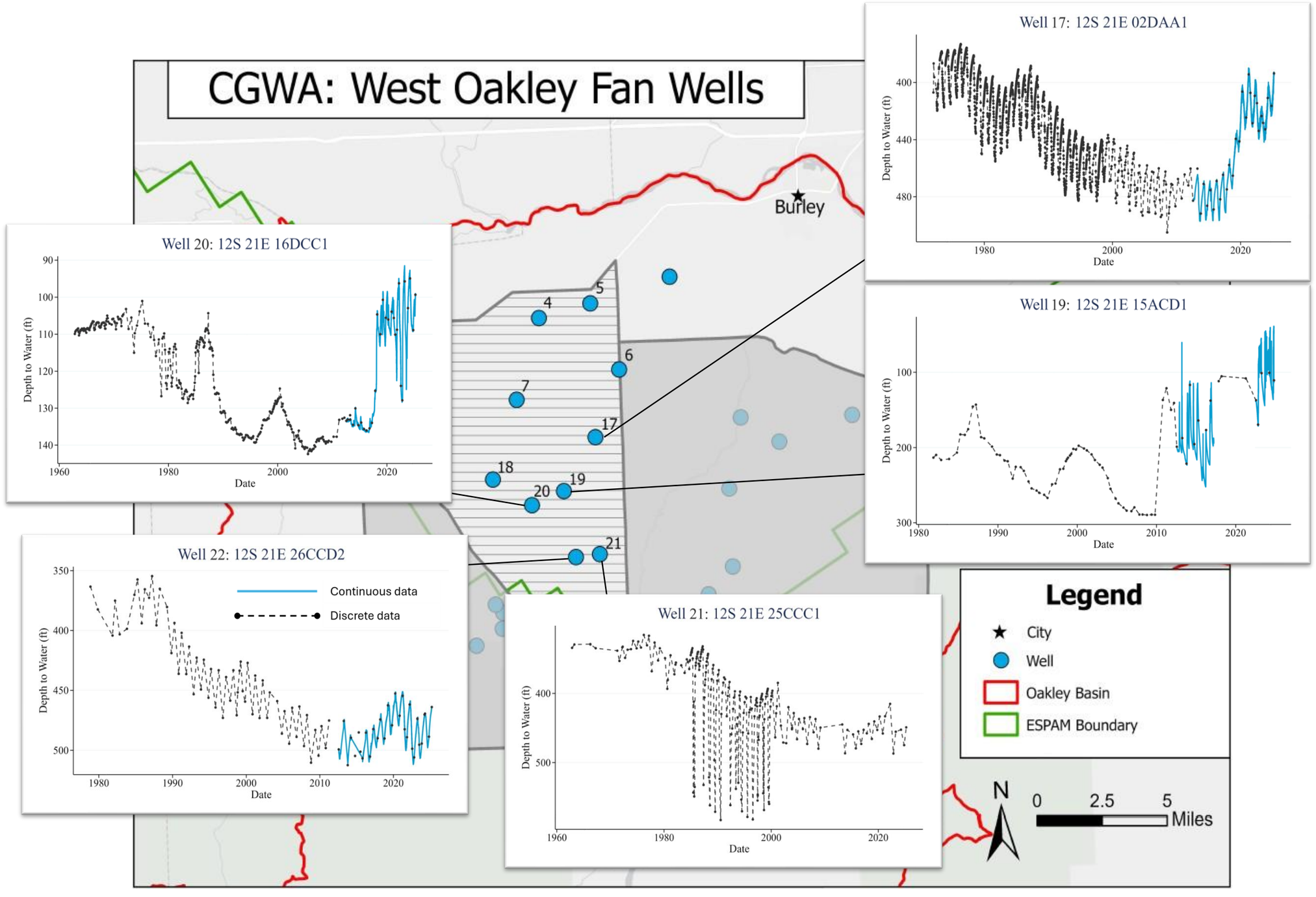

Figure A3: *Hydrographs of wells located in the West Oakley Fan CGWA (south).*

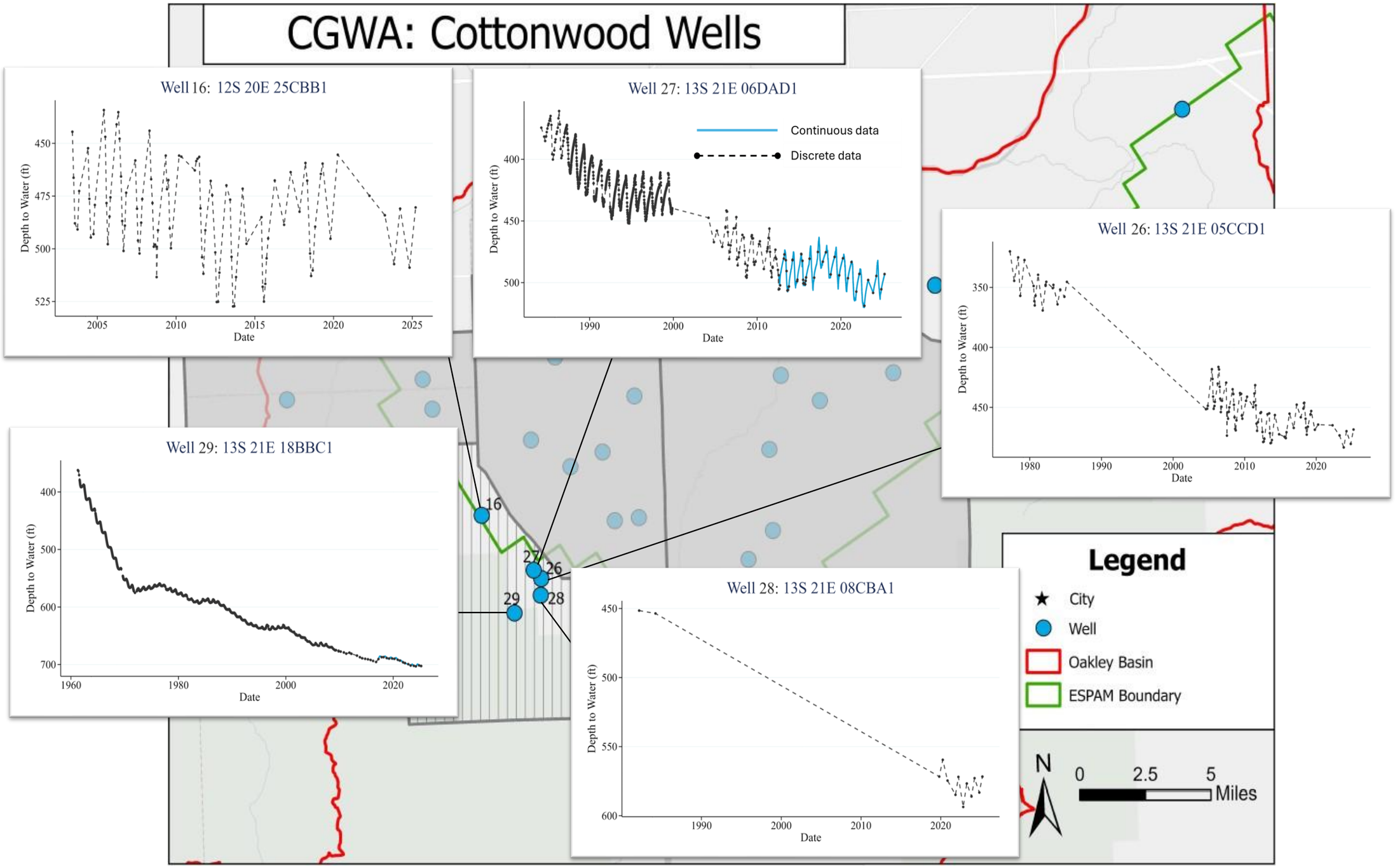

Figure A4: *Hydrographs of wells located in the Cottonwood CGWA.*

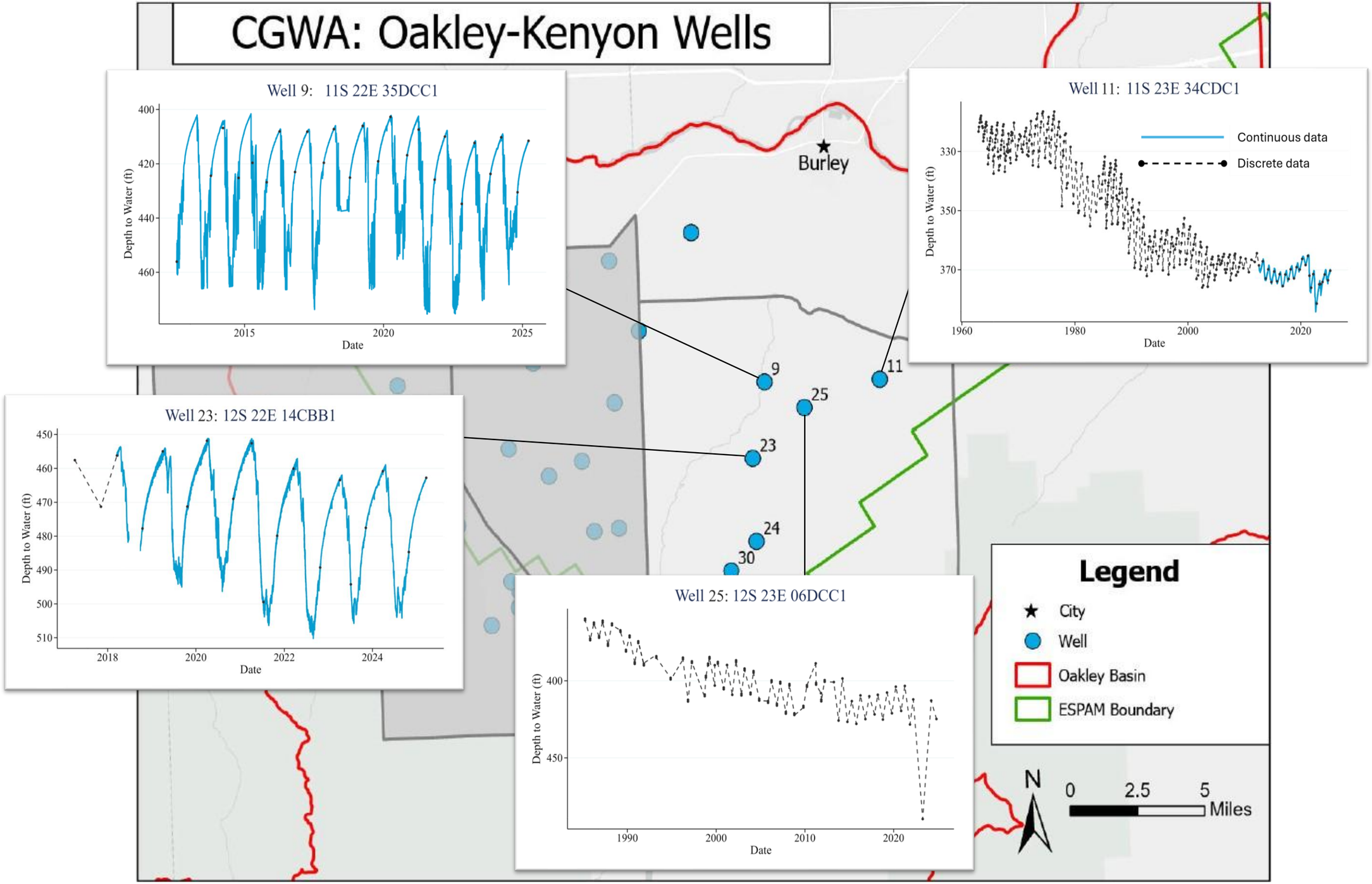

Figure A5: *Hydrographs of wells located in the Oakley-Kenyon CGWA (north)*

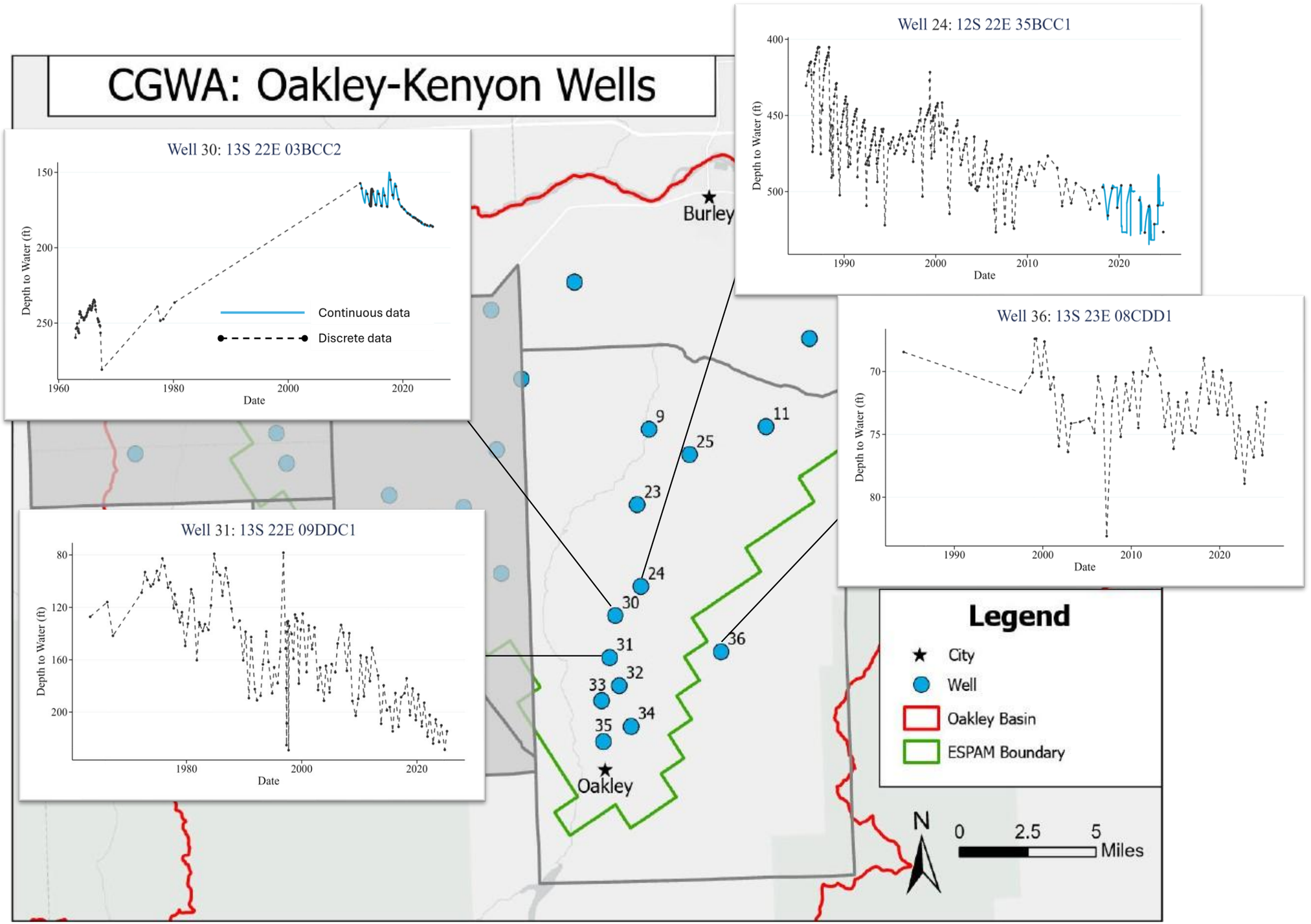

Figure A6: *Hydrographs of wells located in the Oakley-Kenyon CGWA (central).*

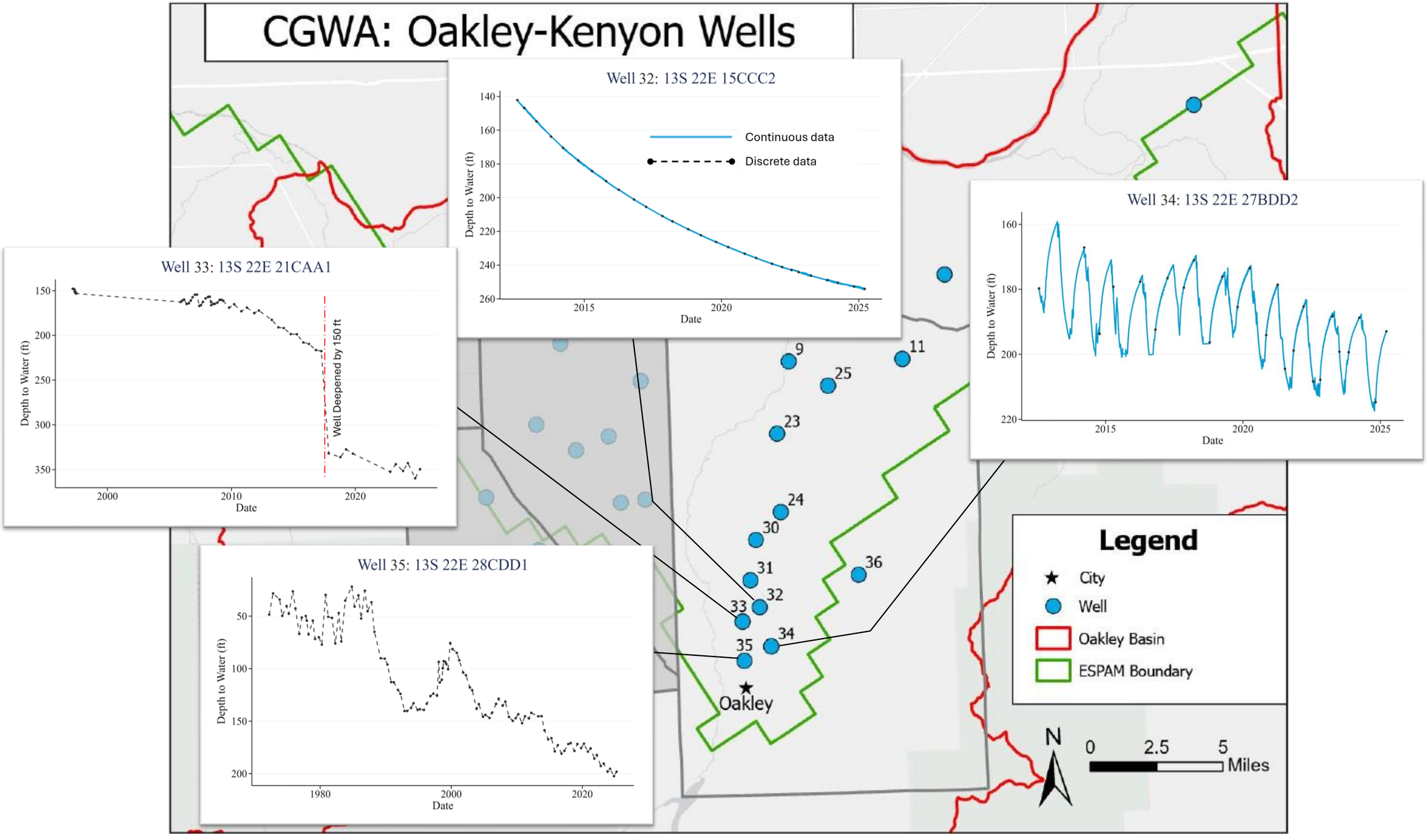

Figure A7: *Hydrographs of wells located in the Oakley-Kenyon CGWA (south).*

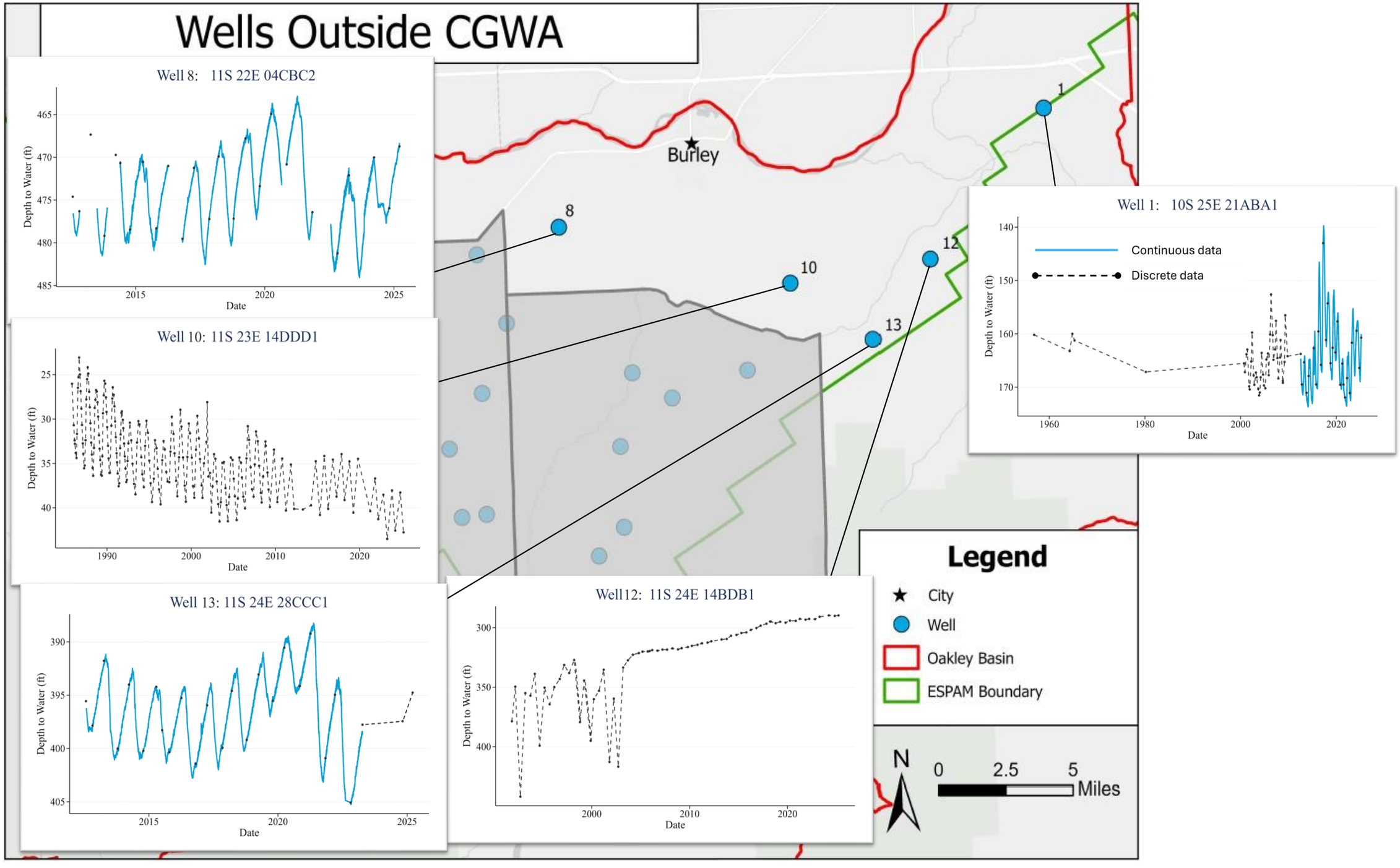

Figure A8: *Hydrographs of wells located outside of any CGWA.*