La Cienega Groundwater Level Monitoring, Santa Fe County, New Mexico: 2018 Summary of Findings

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AQUIFER MAPPING PROGRAM

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CONTENTS

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I. INTRODUCTION

As a follow up to hydrogeologic research performed by the New Mexico Bureau of Geology and Mineral Resources in recent years (summarized in Johnson, et al., 2016), a groundwater monitoring network was implemented around La Cienega, Santa Fe County, New Mexico in the fall of 2015.The primary aquifer in La Cienega is within the Ancha Formation, overlying the Tesuque Formation. The Ancha Formation aquifer exists as buried valleys of coarse sediments that are highly transmissive (Figure 1). Figure 2 shows the locations of the current wells in the monitoring network, with symbols color coded to the formation in which the wells are completed.

Previous hydrogeologic research by Johnson, et al. (2016) indicates that the groundwater in this region is highly susceptible to regional influences such as pumping, drought, and land use changes. The groundwater levels in many wells in the primary aquifer around La Cienega have steadily dropped since the 1970s (Figure 3).

Groundwater level monitoring provides an essential tool in groundwater management. The data are used in development of more accurate groundwater models, and can help with protection of groundwater resources. Measurements of changing groundwater levels also directly reflect changes in groundwater storage.

The monitoring network that was established in 2015 was composed of two overlapping groups; 23 wells that would be measured every six months and 14 wells that had been measured approximately 10 years prior. The initial sampling schedule and distribution was useful to confirm the seasonal trends experienced throughout the area. The twice annual monitoring frequency was intended to reflect the local seasonal highs (April) and lows (October), relating to the growing season impact on the water table. The grouping of wells that had

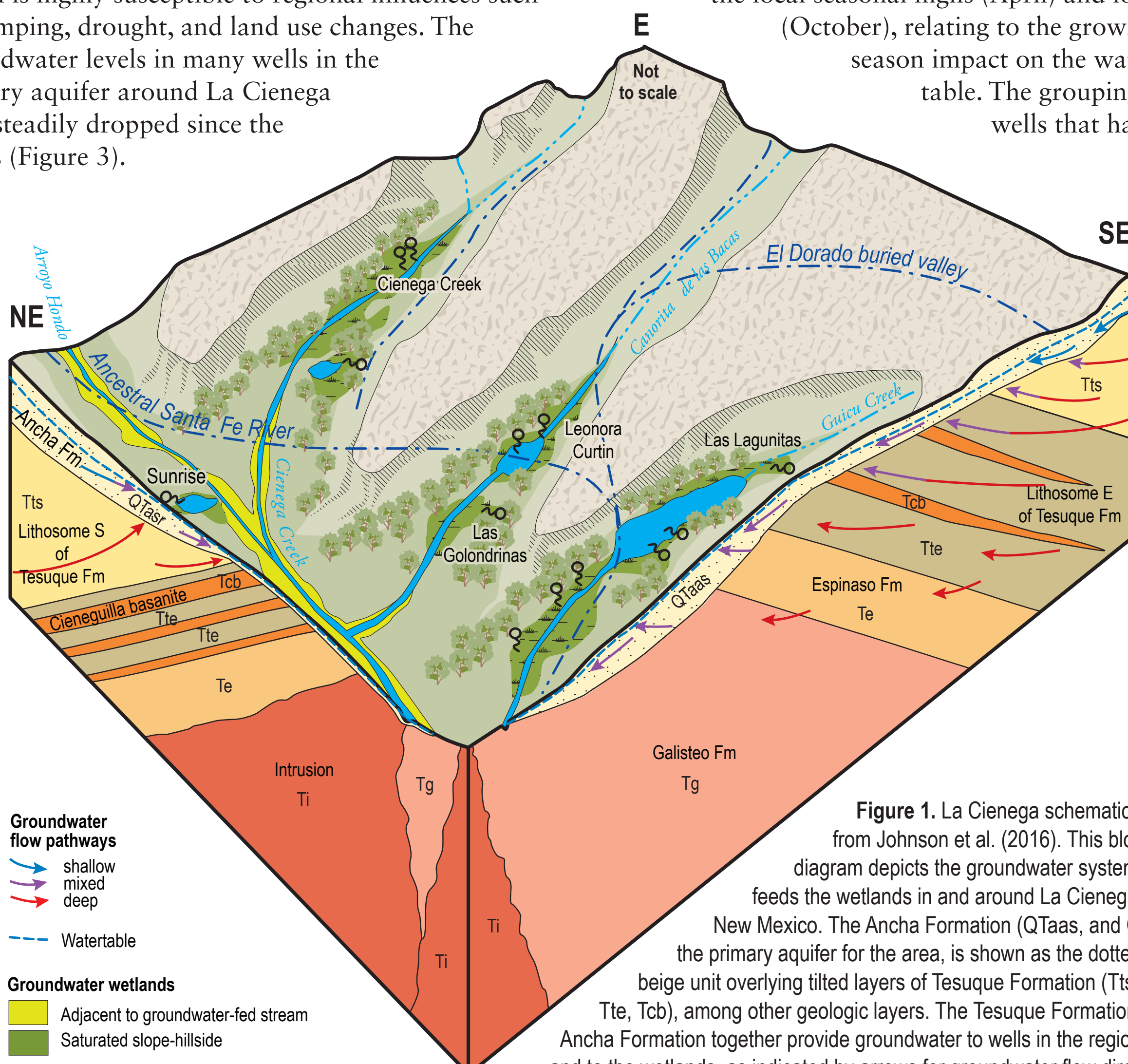

Figure 1. La Cienega schematic model from Johnson et al. (2016). This block diagram depicts the groundwater system that feeds the wetlands in and around La Cienega, New Mexico. The Ancha Formation (QTaas, and QTasr), the primary aquifer for the area, is shown as the dotted beige unit overlying tilted layers of Tesuque Formation (Tts, Tte, Tcb), among other geologic layers. The Tesuque Formation and Ancha Formation together provide groundwater to wells in the region and to the wetlands, as indicated by arrows for groundwater flow directions.

previously been measured 10 years prior was intended to capture long term trends affecting the local aquifers.

From 2015–2017, the monitoring network was measured six times, twice annually. The network was adjusted in the spring of 2018 and moving forward we are restructuring our long-term monitoring plan to more efficiently monitor the groundwater network, while still collecting valuable, useable data. Moving forward, we plan to measure the monitoring network of wells once every year in late spring. Based on the results of the previous 3 years of monitoring, this sampling period represents the maximum groundwater level, at its highest point. In addition to changing the monitoring frequency we also expanded the spatial coverage of the monitoring network to both the north and south, which now includes 41 wells. This report is a brief summary of 2018 groundwater level monitoring activities in La Cienega.

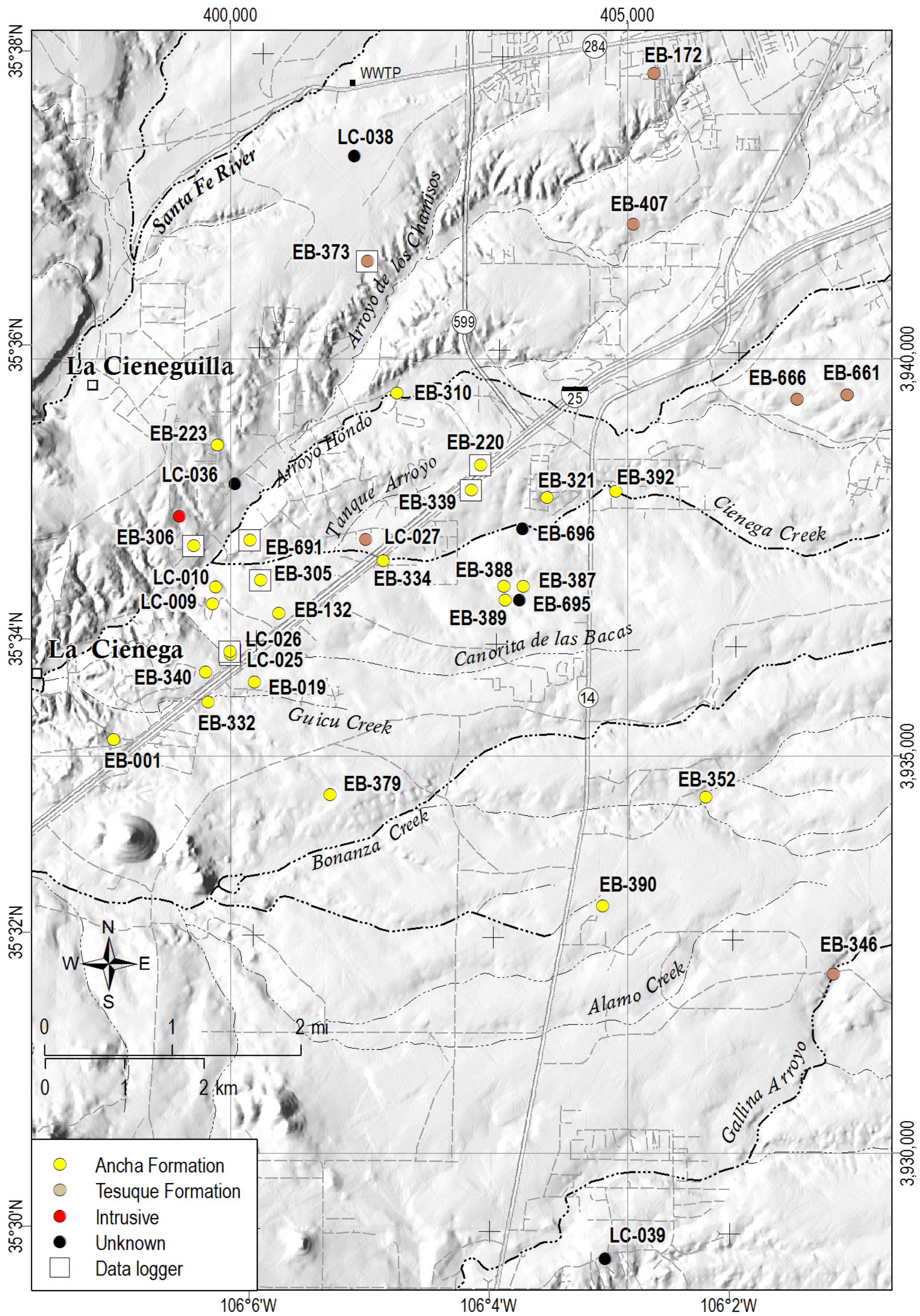

Figure 2. Location of wells monitored for this project. Well points are color coded with the primary aquifer producing water. Most wells in this study are providing groundwater from the Ancha Formation, with a few on the margins of the study that produce water from the Tesuque Formation. In this region, groundwater is generally flowing toward the southwest.

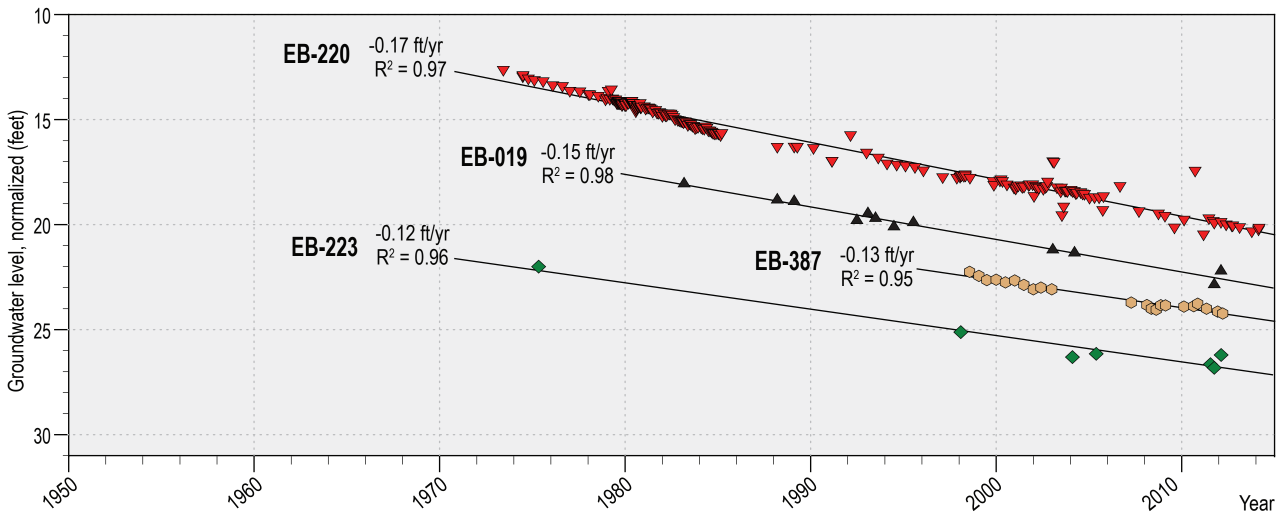

Figure 3. Modified figure from Johnson et al. (2016) that shows decline in groundwater hydrographs from shallow wells in the La Cienega over the past several decades. Water level changes from shallow wells in La Cienega over the past several decades. The rate of groundwater decline (ft/yr) is the slope of the regression line.

II. METHODS

In April of 2018, the monitoring network for La Cienega was expanded from 22 wells measured twice annually, to 41 wells measured once per year (Figure 2, Table 1). The additional wells added to the monitoring network were selected because they have been measured previously. As result, these wells have a baseline water level so that we can monitor changes going forward. The new wells also serve to expand the spatial coverage of the monitoring network to both the north and south.

Table 1. Inventory of wells that are part of the annual monitoring network, including location information and well construction. MP = Measuring point ("-" = below ground). NA = no data available.

Site ID	Elevation (ft)	UTM easting NAD83	UTM northing NAD83	Well depth (ft)	MP height (ft)	Screen top (ft)	Screen bottom (ft)	Formation
EB-001	6068.46	398529	3935208	221	0.5	47	221	Ancha Formation
EB-019	6139.64	400304	3935932	80	1	50	80	Ancha Formation
EB-132	6173.97	400609	3936794	135	-6.2	60	90	Ancha Formation
EB-172	6459.06	405330	3943594	493	0.9	353	470	Tesuque Formation
EB-220	6259.80	403153	3938661	161	0.65	125	161	Ancha Formation
EB-223	6157.07	399840	3938918	100	0	40	95	Ancha Formation
EB-305	6121.22	400377	3937211	75	2	20	75	Ancha Formation
EB-306	6086.80	399537	3937647	43	1.8			Ancha Formation
EB-308	6140.71	399358	3938016	103	2.6	73	103	Intrusive
EB-310	6176.03	402100	3939571	307	2.2	47	267	Ancha Formation
EB-321	6261.60	403986	3938251	180	0.5	140	180	Ancha Formation
EB-332	6089.35	399720	3935678	160	0.45	80	140	Ancha Formation
EB-334	6146.70	401921	3937456	140	1.5	60	120	Ancha Formation
EB-339	6263.08	403035	3938347	200	2.09	160	200	Ancha Formation
EB-340	6136.16	399686	3936057	155	0.8			Ancha Formation
EB-346	6340.75	407590	3932255	366	0.52	185	365	Tesuque Formation
EB-352	6292.49	405988	3934482	152	1.29			Ancha Formation
EB-373	6262.32	401729	3941231	300	0.6			Tesuque Formation
EB-379	6213.16	401253	3934512	227	0.67	137	227	Ancha Formation
EB-387	6225.99	403690	3937134	115	1.24			Ancha Formation
EB-388	6214.53	403442	3937136	91	1.43			Ancha Formation
EB-389	6234.58	403458	3936959	121	1.98			Ancha Formation
EB-390	6302.83	404686	3933111	500	1.7	200	460	Ancha Formation
EB-392	6262.84	404853	3938331	220	1.73	160	200	Ancha Formation
EB-407	6369.66	405069	3941697	247	0.5			Tesuque Formation
EB-661	6482.50	407765	3939546	620	2.75	580	620	Tesuque Formation
EB-662	6482.50	407765	3939546	1140	2.74	1020	1140	Tesuque Formation
EB-663	6482.50	407765	3939546	1580	2.79	1500	1580	Tesuque Formation
EB-666	6418.00	407135	3939493	450	2.77	430	450	Tesuque Formation
EB-667	6418.00	407135	3939493	1400	2.98	680	1360	Tesuque Formation
EB-691	6113.37	400249	3937717	180	1.75			Ancha Formation
EB-695	6242.70	403641	3936964	125	1.89			Unknown
EB-696	6216.32	403679	3937857	117	2.51			Unknown
LC-009	6084.88	399771	3936914	180	0.5			Ancha Formation
LC-010	6101.43	399811	3937131	180	0.9	160	180	Ancha Formation
LC-025	6086.69	400000	3936280	18	-0.35			Ancha Formation
LC-026	6086.25	399995	3936316	8	-0.5			Ancha Formation
LC-027	6155.19	401705	3937727	102	-7.7			Tesuque Formation
LC-036	6111.50	400055	3938426		-6.1			Unknown
LC-038	6323.20	401562	3942555	186	1.93	166	186	Unknown
LC-039	6231.00	404716	3928667	295	-6.32	215	275	Unknown

For the purpose of this monitoring project, groundwater level measurements are made using existing domestic wells (with pumps), and open/unused wells (without pumps). For domestic wells, water level measurements were made after the well had been off for at least 1 hour. Water levels were measured following U.S. Geological Survey protocols for a steel tape measurement device with repeat measurements to within 0.02 feet. Open wells were measured using an electronic sounder probe, also with repeated measurements within 0.02 feet. All measurements reported are in units of feet, and are reported from below ground surface (bgs). Manual water level measurements from wells in the monitoring network are provided with this report in Table 2. Hydrographs showing the water level measurements over time are found in the Appendix 1.

Table 2. Wells in La Cienega Area and manual water level measurements collected during three measurement periods; 2004–2006, spring 2015, and spring 2018. Depth to water is ft below land surface.

			2004–2006		2015		2018	
Site ID	**UTM easting NAD83**	**UTM northing NAD83**	**Date measured**	**Depth to water (ft)**	**Date measured**	**Depth to water (ft)**	**Date measured**	**Depth to water (ft)**
EB-001	398529	3935208	1/9/04	48.41	4/14/15	48.03	4/9/18	48.03
EB-016	406470	3940387	3/24/04	228.06	2/11/15	228.04		
EB-019	400304	3935932	3/23/04	43.34	4/14/15	44.46	4/10/18	44.51
EB-102	402734	3934466	3/31/04	60.35	2/18/15	62.07		
EB-115	405319	3939633	3/14/06	215.06	2/11/15	215.77		
EB-132	400609	3936794	2/10/04	67.56	4/14/15	68.3	4/10/18	68.39
EB-171	406350	3944331	3/31/05	347.26	2/20/15	344.53		
EB-172	405330	3943594	3/31/05	305			4/11/18	303.1
EB-218	406118	3941215	3/25/04	264.03	2/11/15	232.12		
EB-220	403153	3938661	3/18/04	131.39	2/11/15	133.15	4/9/18	132.85
EB-222	404457	3937957	2/11/04	131.32	2/11/15	132.1		
EB-223	399840	3938918	2/11/04	46.31	4/14/15	45.42	4/9/18	45.31
EB-240	406983	3946736	5/12/05	435.49	2/17/15	437.12		
EB-243	408912	3946594	4/6/05	87.42	2/20/15	90.87		
EB-245	412838	3946969	3/17/04	224.42	3/23/15	221.75		
EB-246	412838	3946969	3/17/04	300.76	3/23/15	296.35		
EB-305	400377	3937211	1/9/04	22.17	4/13/15	22.78	4/9/18	22.78
EB-306	399537	3937647	2/10/04	19.4	3/16/15	18.97	4/9/18	18.72
EB-308	399358	3938016	2/11/04	52.54	4/16/15	52.22	4/9/18	51.97
EB-309	399896	3939990	2/11/04	106.5	4/16/15	104.76		
EB-310	402100	3939571	2/11/04	38.07	4/16/15	37.49	4/9/18	37.27
EB-315	400028	3937110	2/10/04	19.91	4/14/15	20.47		
EB-321	403986	3938251	2/20/04	132.89	4/13/15	132.17	4/10/18	132.1
EB-332	399720	3935678	2/21/04	30	4/14/15	8.83	4/10/18	8.75
EB-334	401921	3937456	2/27/04	38.42	4/13/15	39.65	4/10/18	39.63
EB-336	403199	3944575	5/14/04	209.57	3/23/15	208.83		
EB-337	403199	3944575	5/14/04	203.87	3/23/15	201.21		
EB-338	403199	3944575	5/14/04	185.47	3/23/15	186.77		
EB-339	403035	3938347	4/29/04	136.53	4/14/15	137.72	4/9/18	137.6
EB-340	399686	3936057	4/29/04	51.53	4/14/15	52.41	4/9/18	52.4
EB-346	407590	3932255	6/3/04	151.77			5/4/18	132.37
EB-352	405988	3934482	7/14/04	138.1	4/13/15	141.58	5/4/18	140.76
EB-373	401729	3941231	6/18/04	127.1	3/16/15	116.38	4/10/18	116.3
EB-379	401253	3934512	6/24/04	101.77	4/13/15	103.15	4/11/18	103.33
EB-387	403690	3937134	4/12/07	98.47	4/13/15	98.95	4/9/18	98.87
EB-388	403442	3937136	4/12/07	88.95	4/13/15	88.99	4/9/18	88.92
EB-389	403458	3936959	4/12/07	107.94	4/13/15	108.39	4/9/18	108.31
EB-390	404686	3933111	7/1/04	157.85			4/10/18	160.7
EB-392	404853	3938331	7/15/04	125.21	4/13/15	125.26	4/9/18	125.21
EB-407	405069	3941697	3/23/04	217.6	4/14/15	214.98	4/10/18	213.57
EB-607	405006	3936039	3/28/06	198.65	3/26/15	200.18		
EB-661	407765	3939546	8/24/06	291.45	4/13/15	292.07	5/4/18	292.56
EB-662	407765	3939546	8/24/06	290.7	4/13/15	290.58	5/4/18	290.78
EB-663	407765	3939546	8/24/06	286.71	4/13/15	282.67	5/4/18	280.05
EB-666	407135	3939493	8/24/06	231.53	4/13/15	237.62	5/4/18	235.21
EB-667	407135	3939493	8/24/06	246.62	4/13/15	245.2	5/4/18	245.55
EB-691	400249	3937717			3/16/15	23.21	4/10/18	23.1
EB-695	403641	3936964			4/13/15	110.54	4/9/18	110.43
EB-696	403679	3937857	4/12/07	89.75	4/13/15	91.55	4/9/18	91.57
LC-009	399771	3936914			4/14/15	15.79	4/9/18	16.07
LC-010	399811	3937131			4/14/15	16.1	4/9/18	16.05
LC-025	400000	3936280			3/16/15	7.87	4/9/18	7.97
LC-026	399995	3936316			3/16/15	8.02	4/9/18	6.44
LC-027	401705	3937727					4/10/18	40.57
LC-036	400055	3938426			4/14/15	11.24	4/9/18	11.44
LC-038	401562	3942555					4/9/18	171.18
LC-039	404716	3928667					4/10/18	137.76

Pressure transducers monitoring continuous changes in groundwater levels have been deployed in several wells since 2011 (EB-220, -306, LC-025, -026) (Table 3). Additional sites were instrumented in 2014 and 2015 (EB-305, -373, -339, -691). These instruments are VanEssen brand (Divers), and provide pressure readings, which are converted to water level measurements collected every 12 hours. These are lengthy data records, and are available upon request. Images produced from these records are discussed below. As these instruments age and reach the end of their lifetime, the data loggers will begin to fail, this has occurred in wells EB-339, EB-306, and LC-026.

Table 3. Point locations with continuous data recorders, and date of installation. See Figure 2 for locations.

Site ID	Date installed	Notes
EB-220	10/4/11	Running
EB-305	6/4/15	Running
EB-306	10/6/11	Running
EB-339	6/1/15	Lost from well
EB-373	10/2/12	Running
EB-691	5/27/14	Running
LC-025	10/4/11	Running
LC-026	10/4/11	Instrument failed

III. RESULTS

Continuous Data Records

As noted in Table 3, there were originally eight locations with pressure transducers monitoring groundwater level changes every 12 hours, there are 5 remaining presently. If more of the data loggers malfunction, they will be removed from the data logger network and shifted to manually measured sites. These records are displayed in Figures 4–9. Locations of these wells are shown on Figure 2.

LC-025 is a shallow monitoring well that is 18 feet deep, and completed in the shallow Ancha Formation (Figure 1–2). The hydrograph shows a distinct seasonal fluctuation related to the growing season that is seen in numerous wells in the area, varying by ~4 feet (Figure 4). Water levels begin to recover after plants go dormant later in the fall, typically by mid-November. This well sees rapid recharge as noted in late 2013, where water levels rose 6 ft following a large storm event.

EB-373 is 300 feet deep, located near the Santa Fe airport, and is completed in the Tesuque Formation (Figure 2). This is the only well with a consistent upward trend in the groundwater level (Figure 5) since the well was instrumented in late 2012. Wells in the area of the Santa Fe Airport were shut down in the mid-1990s, as the airport was connected to City of Santa Fe water supply, which may be influencing the water level rise in the well. From 2012, when a pressure transducer was first deployed in the well, through mid-2016, water levels were coming up at approximately 0.4 ft/yr. Since 2016, water level changes have remained steady. Where previously there was no noticeable seasonality to the water level trend there is now a very slight seasonality to the water level fluctuation, likely due to the depth of the well.

EB-306 is a 43 foot deep well that is completed in the Ancha Formation (Figure 2). The water level time series recorded in this well shows a distinct

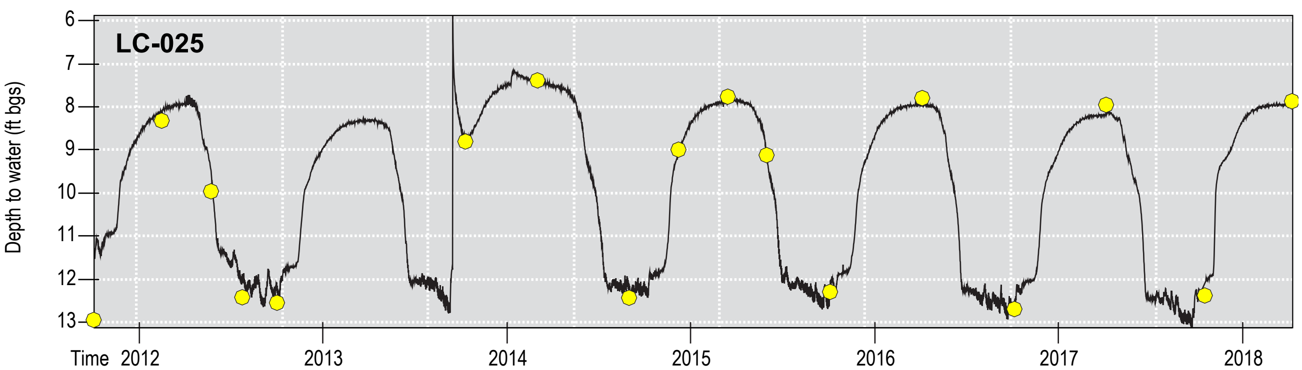

Figure 4. LC-025 is a shallow, 18 foot deep monitoring well, completed in the Ancha Formation. The spike in water level that occurs in September 2013 coincides with a significant precipitation event.

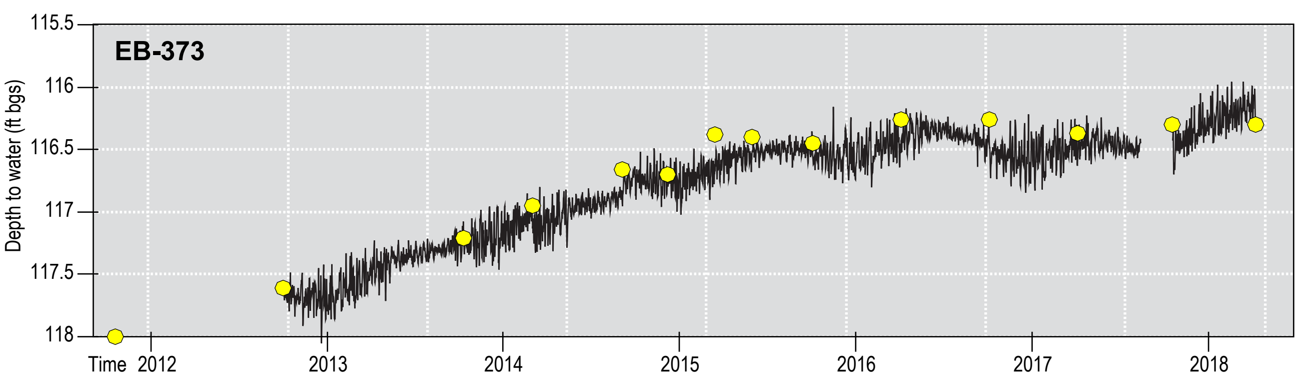

Figure 5. EB-373 is 300 ft deep, located near the Santa Fe airport, and completed in the Tesuque Formation.

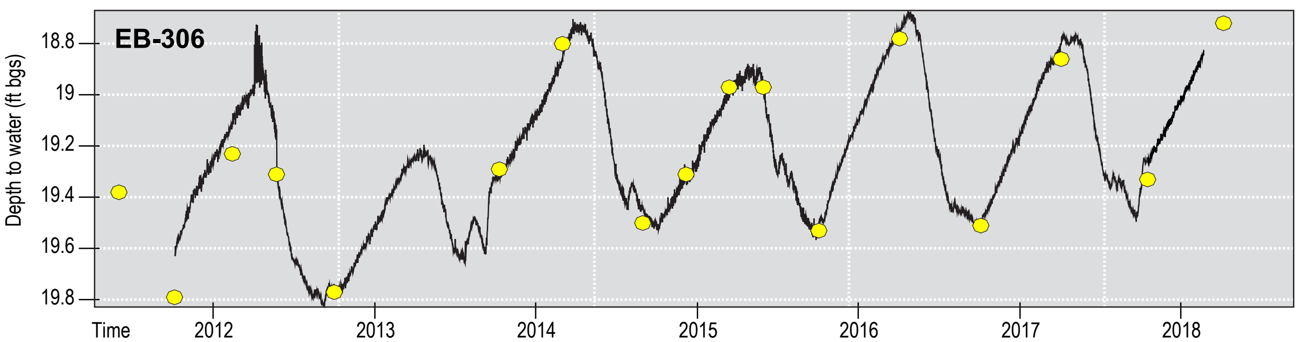

Figure 6. EB-306 is a 43 ft deep well completed in the Ancha Formation.

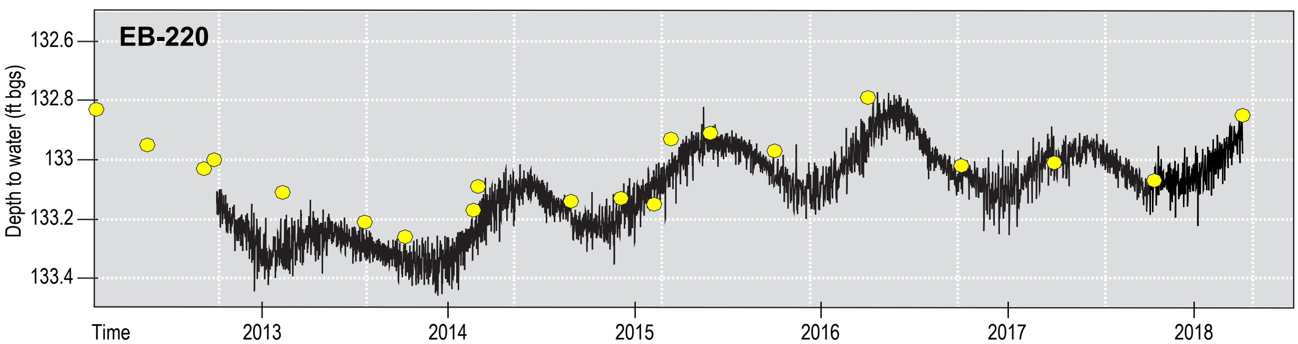

Figure 7. EB-220 is a well completed in the Ancha Formation, with a total depth of 161 ft.

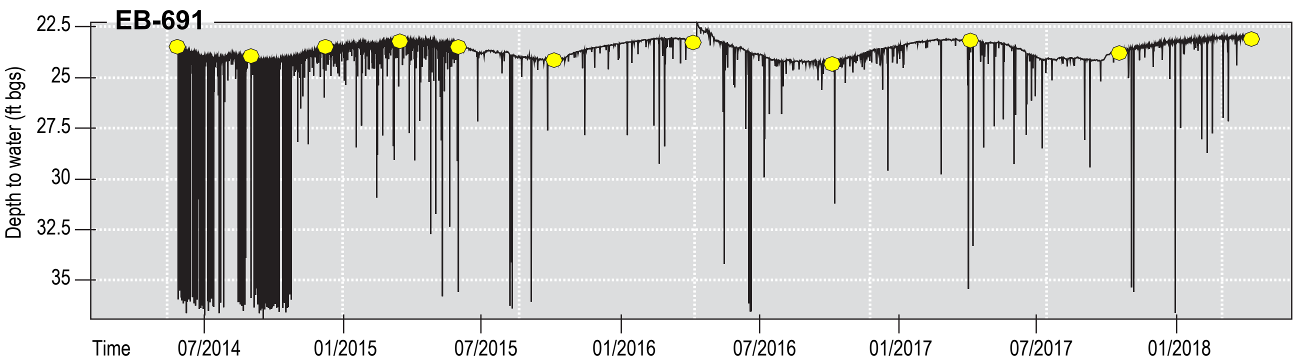

Figure 8. EB-691 is a 180-foot pumping well completed in the Ancha Formation. Water levels measured when the well was pumping are dramatically lower than the static water level, with water levels reaching 36 ft below land surface. The overall trend in the static water level of this well, indicated by the blue line of points, shows that this well reflects a seasonal fluctuation of approximately 1 ft.

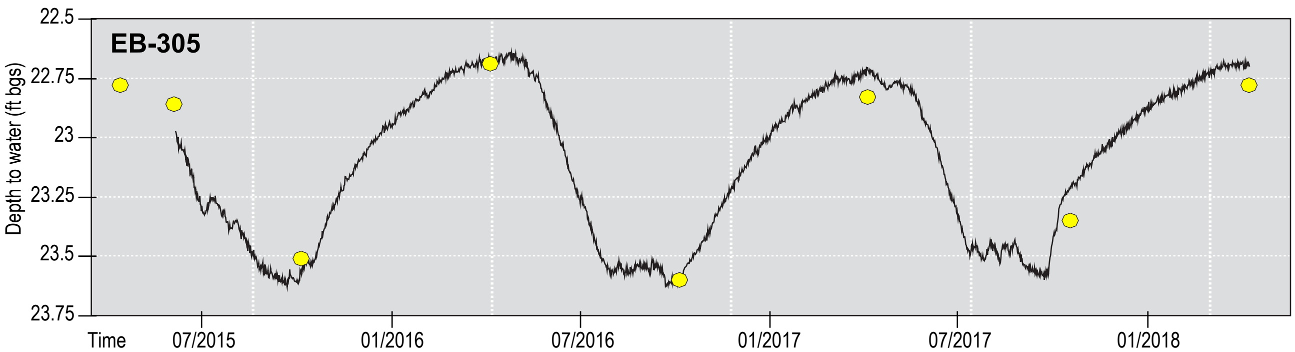

Figure 9. EB-305 is a 75 ft deep well completed in the Ancha Formation. Installed in June 2015.

seasonal fluctuation in the shallow water table likely related to evapotranspiration (Figure 6). The winter recovery, following the growing season generally occurs at the end of September and since 2014 water levels have returned to approximately 18.8 feet below land surface. Once the growing period begins in late spring/early summer, the groundwater levels drop approximately 0.8 feet.

EB-220 is a well completed in the Ancha Formation, with a total depth of 161 feet (Figure 2). This well has a long record of decline since the 1970s, on the order of roughly 0.2 ft/yr (Johnson et al., 2016). Beginning in 2013, the water level appears to have begun to recover. The peak winter water level between 2013 and 2016 were consistently 0.1 feet higher each year (Figure 7). From 2017–2018 data, however, we observe a slight change. The winter high in 2017 was 0.1 feet lower than the previous year.

This well also shows a muted water level response to seasonal changes; typically rising and falling approximately 0.25 feet. The seasonal fluctuation in this well is different from other wells in the area that respond quickly to the growing season. The signal in this well appears to be more muted or offset, likely related to the greater depth of the well and groundwater level. Typically the water level in this well does not fully recover until June, and doesn't full decline until early January.

EB-691 is a 180 foot deep pumping well completed in the Ancha Formation (Figure 2). Records of water levels measured when the well was pumping are shown by the dips in water levels (longer vertical lines), with water levels reaching 36 feet below land surface (Figure 8). The overall trend in the static water level of this well, as indicated by the level that the water level recovers to after pumping, shows that this well has a seasonal fluctuation of approximately 1 foot. Static water levels are close to 23 feet below land surface in the winter months, and approximately 24 feet below land surface during summer months.

EB-305 is a 75 foot deep well completed in the Ancha Formation. The overall trend of water level change in this well reflects the seasonal decline common in other shallow Ancha Formation wells in the region; rising and falling one foot between summer and winter seasons (Figure 9). A previous water level measurement from this well in January 2004 was 22.1 feet below land surface. This well has seasonal fluctuations, but there has been a long term decline in the overall water level at this well since it was measured in 2004. At present the well appears to be stable; recovering to approximately the same levels in the spring and decreasing to same levels in the fall.

Long-term Trends

La Cienega area water levels have been monitored over the past several decades (Figure 10). Most wells in the monitoring network have records dating back

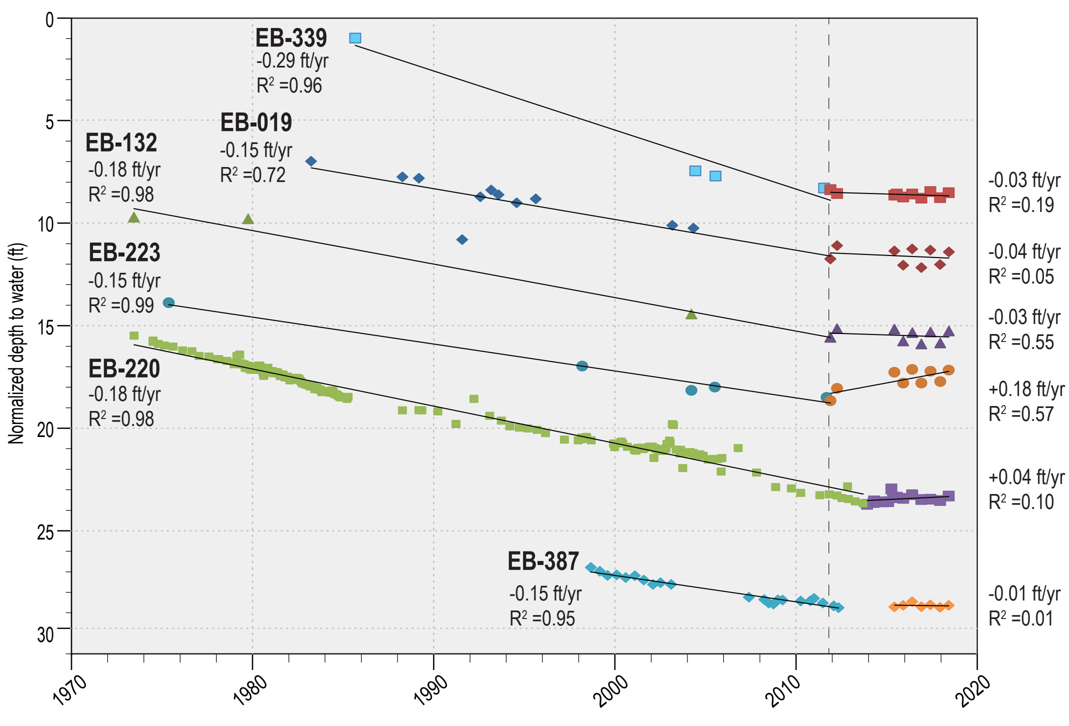

Figure 10. Groundwater hydrographs from four wells in the study area that show significant decline for several decades; between 0.29 and 0.15 ft per year. Starting in 2012 the rate of decline was significantly reduced in these wells; between 0.04 ft decline and 0.15 ft per year of recovery.

10 or more years. As was noted by Johnson et al. (2016), since the 1950s when some of the wells were first measured, water levels have been declining, between 0.12 and 0.23 ft/yr. On the hydrographs that were presented in Johnson et al. (2016) it was noted, however, that at the very end of the data collection period, early 2014, that there did appear to be a slight rise in water levels (Figure 3). With the continued collection of data over the past three years the previously published hydrographs have been updated. Starting between 2010 and 2013, there has been reduction in water level declines in most wells in the La Cienega area, and in some cases, water levels are now stable or rising (Figure 10).

In order to detect long term spatial changes, the modified monitoring network that was measured in 2018 mostly included wells that had previously been measured in the mid 2000s, in 2012, and again in 2015. We compared water levels from similar seasons (where possible) in 2004–2007 to measurements made during 2012, 2015 and again in 2018. To normalize changes in water levels between measurement periods, we calculated the feet of change per year over a given time period.

From analyzing the water level change maps we found a spatial trend in the long term water level data. Water levels northwest of the Cienega Creek and Arroyo Hondo, were found to be recovering (rising) from 2004 to present. The median change in water level per year in the NW region was close to neutral, 0.02 ft/yr, between 2004 and 2015. Between 2015 and 2018 water levels in began to increase, closer to 0.1 ft/year (Figure 11, 12).

To the southeast, however, water levels declined from 2004 to 2015 were close to -0.1 ft/yr, (Figure 11). Since 2015, water levels in the southeastern

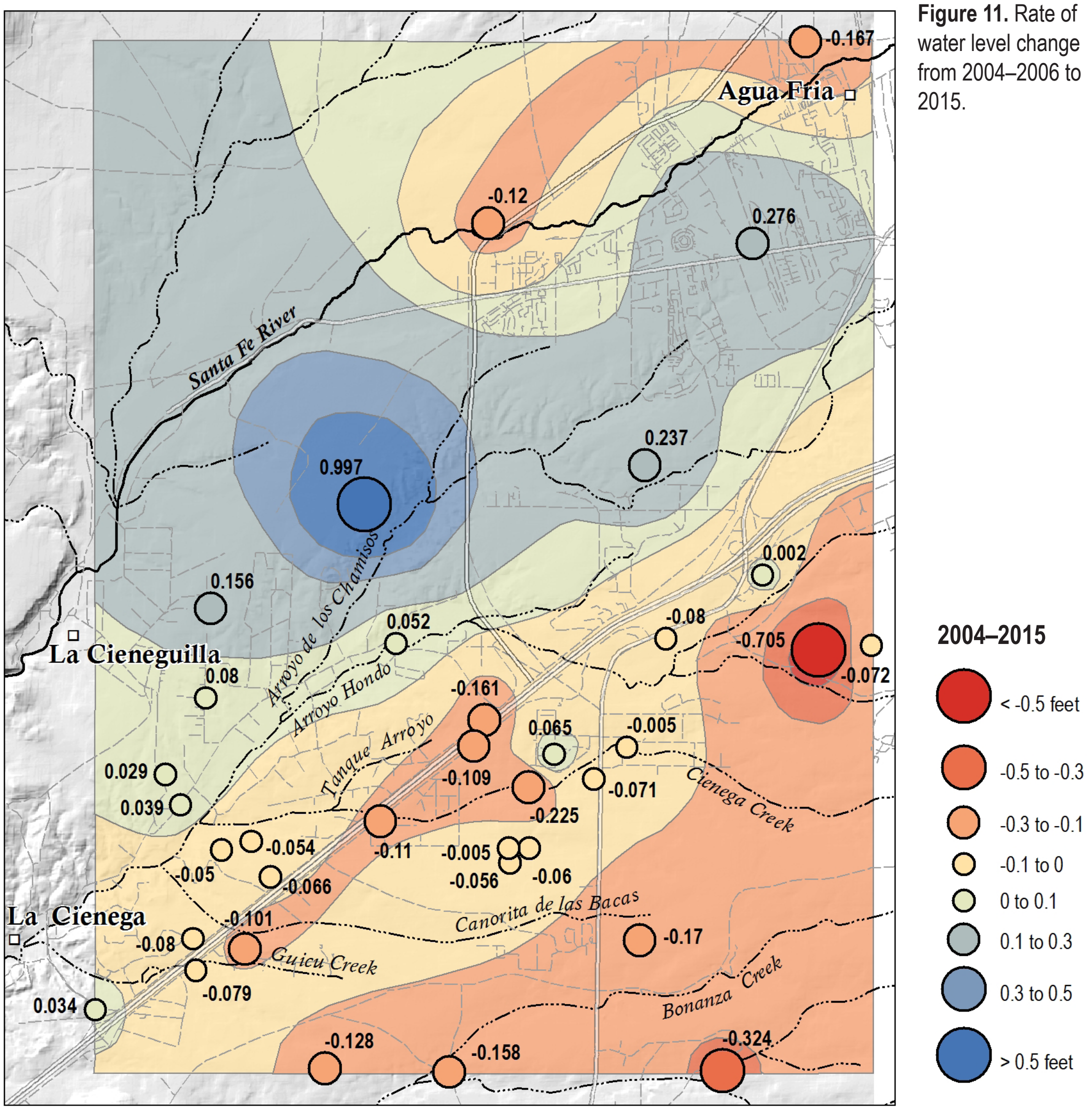

Figure 11. Rate of water level change from 2004–2006 to 2015.

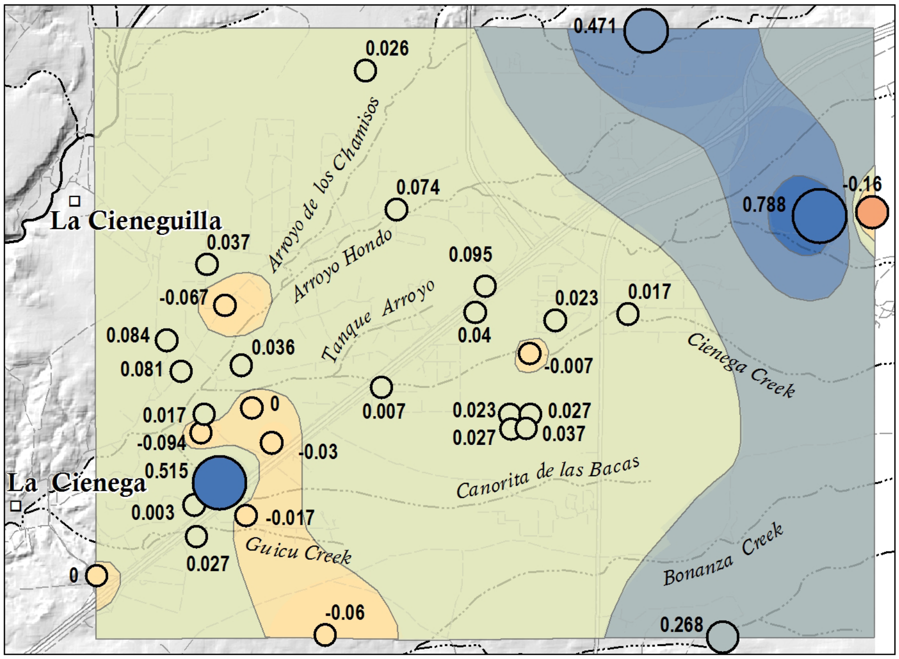

Figure 12. Rate of water level change from 2015 to 2018.

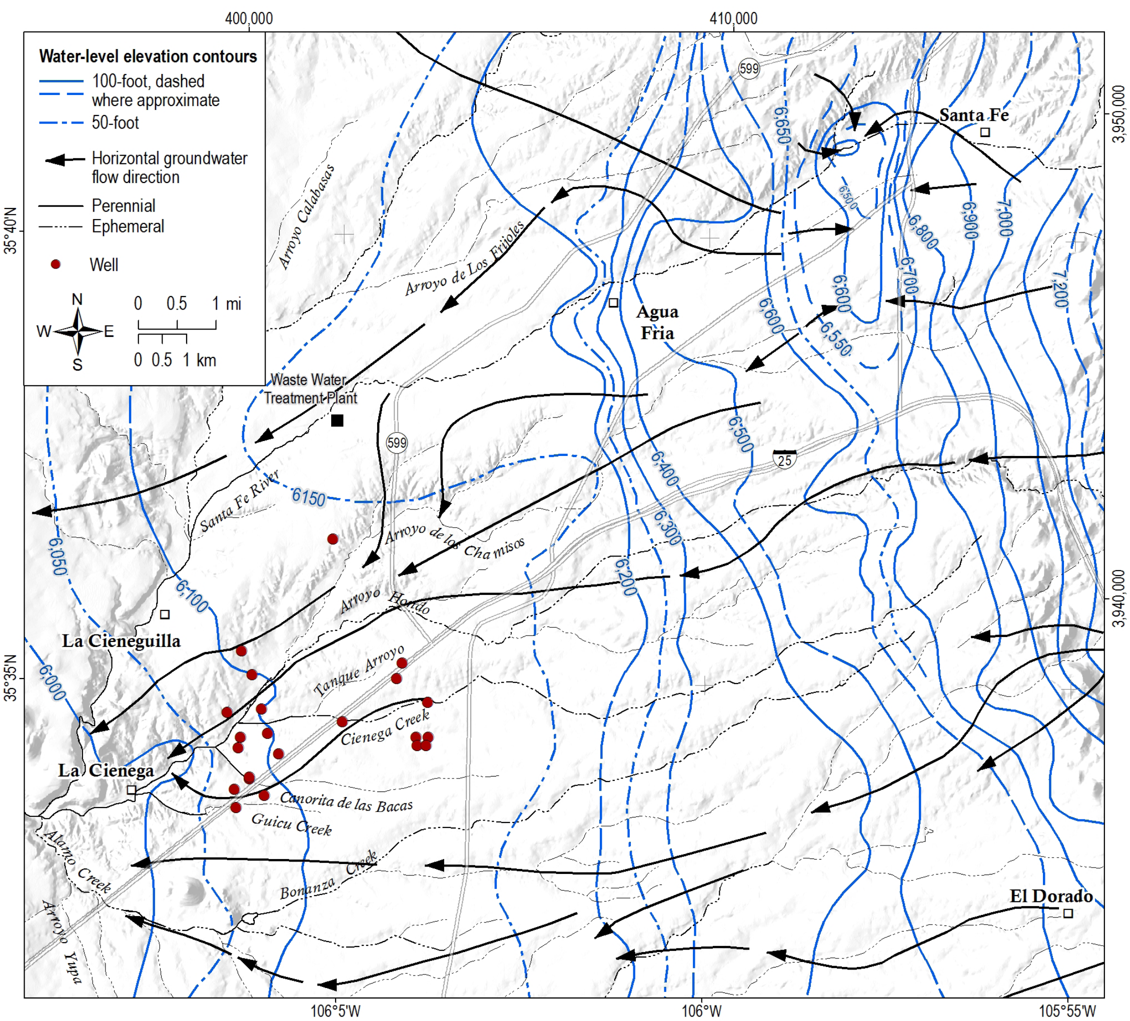

Figure 13. Groundwater map of 2012 water-table conditions in La Cienega and up-gradient areas. Groundwater flow is shown by the dark arrows that are drawn perpendicular to groundwater contours, Johnson et al. (2016).

portion of the study area have remained fairly neutral, even showing some signs of recovering with median rate of 0.02 ft/yr (Figure 12).

Based on 2012 water level data, groundwater flow paths in area were drawn based on groundwater flow contours (Johnson et al., 2016) (Figure 13). The water level contours indicate that La Cienega is located at the termination of several flow paths (Johnson et al., 2016). These flow paths originate from both the City of Santa Fe to the northeast and Eldorado to the east. Regional land and water use changes in the region upgradient likely impact changes we observe in La Cienega.

Discussion of Other Regional Datasets

Within the hydrologically up-gradient proximity to La Cienega, the U.S. Geological Survey maintains continuous data recorders in several nested piezometer well sets; Jail Well, NMOSE County and NMOSE Fairgrounds (Figure 14). Nested piezometers consist of groups of three wells that are drilled within close proximity to each other. Each well that is part of the nested piezometer grouping is completed at different depths; a shallow, a middle, and a deep well. This allows for analysis of the vertical gradient in an aquifer; the measure of groundwater flow in the 'Z' direction, up or down. The shallowest of these wells can be compared to the sites monitored in La Cienega. The results in the figures below show that regional groundwater levels in the Tesuque Formation aquifer are largely declining, with small seasonal rises superimposed on the overall downward trend (Figures 15–18). While the majority of the wells in La Cienega are screened in the Ancha Formation, the underlying Tesuque Formation is hydrologically connected to the Ancha in this area (Johnson et al., 2016), so tracking trends in both formations is essential.

The "Jail Well shallow piezometer" is 340 feet deep, and is completed in the Ancha Formation and Tesuque Formation aquifers. This well shows a groundwater decline from 2006 to 2014 of roughly 0.23 ft/yr (Figure 15). From 2014–2018, water levels have remained steady. The "Jail Well middle piezometer" is 640 feet deep, and was completed in the Tesuque Formation aquifer. It had consistent groundwater decline since 2009, approximately 0.4 ft/yr (Figure 16). This set of nested piezometers shows an upward vertical gradient of 0.13.

The "NMOSE County shallow piezometer" is 460 feet deep and was completed in the Tesuque Formation aquifer (Figure 14). It has a continuous decline from 2006 to 2018, dropping approximately 0.27 ft/yr (Figure 17). This set of nested piezometers shows a slightly downward vertical gradient of 0.01. The "NMOSE Fairgrounds shallow piezometer" is 540 feet deep, completed in the Tesuque Formation aquifer (Figure 14). This well has a consistent groundwater decline of approximately 0.3 ft/yr (Figure 18). This set of nested piezometers shows a slightly downward vertical gradient of 0.04.

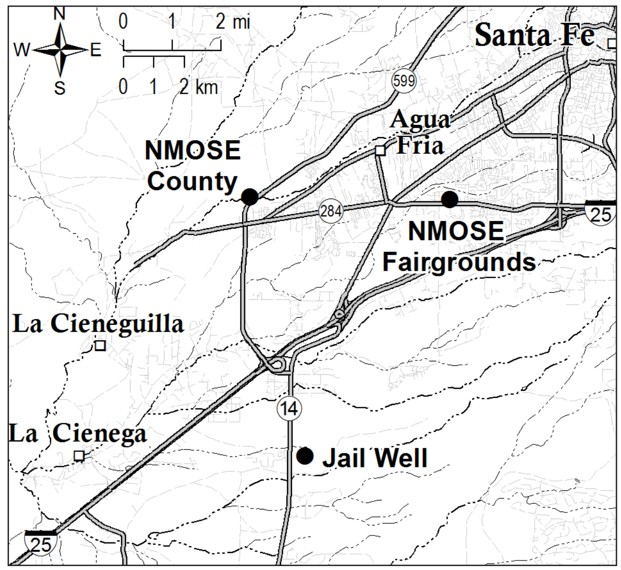

Figure 14. Map showing location of U.S. Geological Survey piezometer well sets. Wells discussed here include Jail Well, NMOSE County, and NMOSE Fairgrounds.

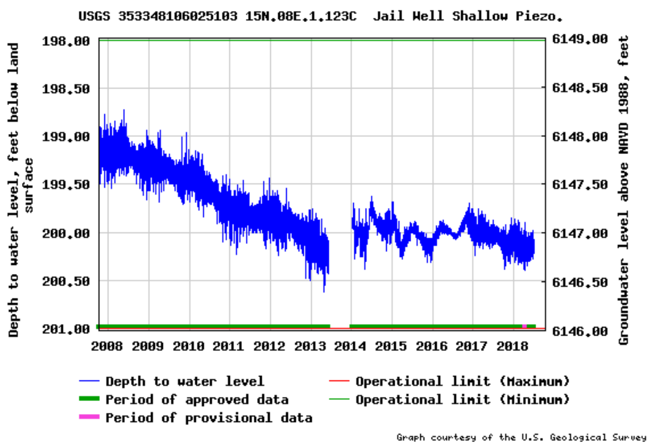

Figure 15. Jail well shallow piezometer. This well is 340 feet deep, completed in the bottom of the Ancha Formation and Tesuque Formation aquifers.

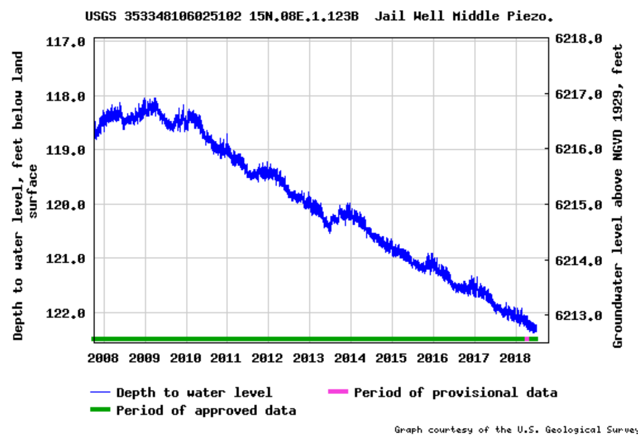

Figure 16. Jail well middle piezometer. This well is 640 feet deep, completed in the Tesuque Formation aquifer.

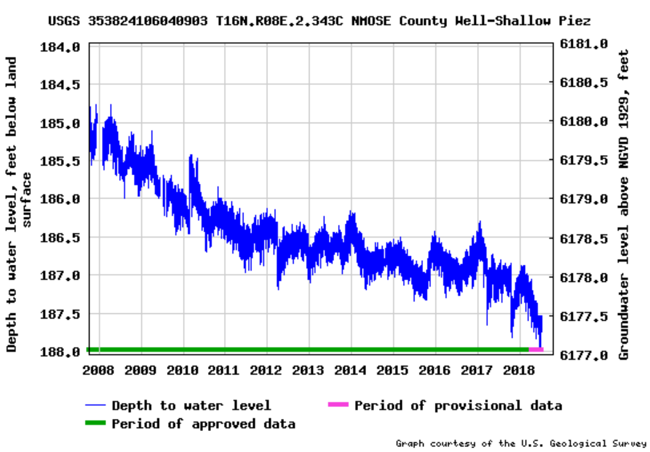

Figure 17. NMOSE County shallow piezometer. This well is 460 feet deep, completed in the Tesuque Formation aquifer.

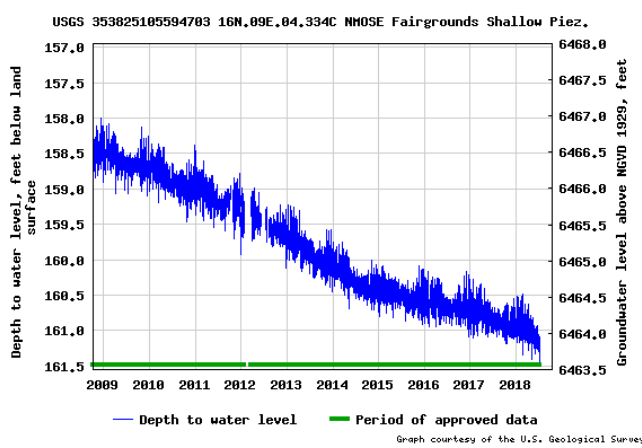

Figure 18. NMOSE Fairgrounds shallow piezometer. This well is 540 feet deep, completed in the Tesuque Formation aquifer.

IV. CONCLUSIONS

Results of this monitoring project in La Cienega highlight the importance of continued monitoring of groundwater levels in the region. The complexity of the groundwater system in and around La Cienega is indicated by the variety of results. As previous work (Johnson et al., 2016) and deeper groundwater monitoring sites in the Tesuque and Ancha Formation aquifers (i.e. USGS piezometers) have shown, there has been an overall trend of declining groundwater levels around La Cienega. Many of these declining trends have been ongoing since the 1970s. Superimposed on this trend, we also observe shallow groundwater fluctuations on a daily and seasonal time scale. Interestingly, in several of the shallow wells measured in this project that have extended water level records, we see a trend toward reduced declines (i.e. EB-132) and even some recovery that started in the early 2010s (i.e. EB-223) (Appendix 1). We also see small rises in the Tesuque Formation aquifer at the Santa Fe Airport well (EB-373) (Appendix 1). This contradicts the NMOSE County shallow piezometer, which is also completed in the Tesuque Formation (though it is screened 260 feet deeper than EB-373 at the airport). At the NMOSE County shallow piezometer, the water level has dropped 3 feet since 2007. Measures to reduce the amount of groundwater pumping from the Ancha and Tesuque Formation aquifers, maintaining Santa Fe River flows, and other water conservation practices may be responsible for the observed slowing and changing rates of groundwater decline.

References

Johnson, P., Koning, D., Timmons, S., Felix, B., 2016, Geology and Hydrology of Groundwater-Fed Springs and Wetlands at La Cienega, Santa Fe County, New Mexico: New Mexico Bureau of Geology, Bulletin 161.

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