ADDENDUM TO
NORTHWEST WELL AND CITY WELL FIELD GROUNDWATER MONITORING REPORT RG-68302, RG-81092, AND RG-1113 THRU RG-1118 COMBINED DECEMBER 2019

prepared by

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prepared for

CITY OF SANTA FE
Water Division
New Mexico

and

NEW MEXICO OFFICE OF THE STATE ENGINEER
District VI Office
Santa Fe, New Mexico

DECEMBER 6, 2019

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1.0 INTRODUCTION

As recommended in the report titled *Northwest Well and City Well Field Groundwater Monitoring Report, RG-68302, RG-81092, and RG-1113 thru RG-1118 Combined* (monitoring report; JSAI, 2019) submitted to the New Mexico Office of the State Engineer (NMOSE) in March 2019, this addendum has been prepared to incorporate data collected at the three domestic Group A wells in the Tano Road area (Fig. 1) that have now been equipped with transducers. As recommended, this addendum presents data tables, hydrographs, and maps incorporating the newly-collected data, and a narrative describing water-level trends and changes for these additional three Group A wells.

This addendum also provides documentation of the sounding tube and transducer installation at the three wells, and addresses comments on the monitoring report provided in the April 25, 2019 memorandum from Reid Bandeen, PG, for Tano Road Association (Bandeen, 2019).

This addendum has been prepared at this time, incorporating water-level data downloaded through end-of-June 2019, at the request of Reid Bandeen, PG, and Tano Road Association. The wells are on a semi-annual monitoring schedule, and the next data collection event will occur in January 2020.

The work to install sounding tubes in Group A wells was completed near the end of May 2019. The work included site access, pump removal, installation of sounding tube with pump re-install, and installation of transducer in sounding tube.

Details regarding the monitoring program wells can be referenced from the March 2019 report (JSAI, 2019). Well locations are shown on Figure 1, and Tables 1 and 2 present the monitoring program wells.

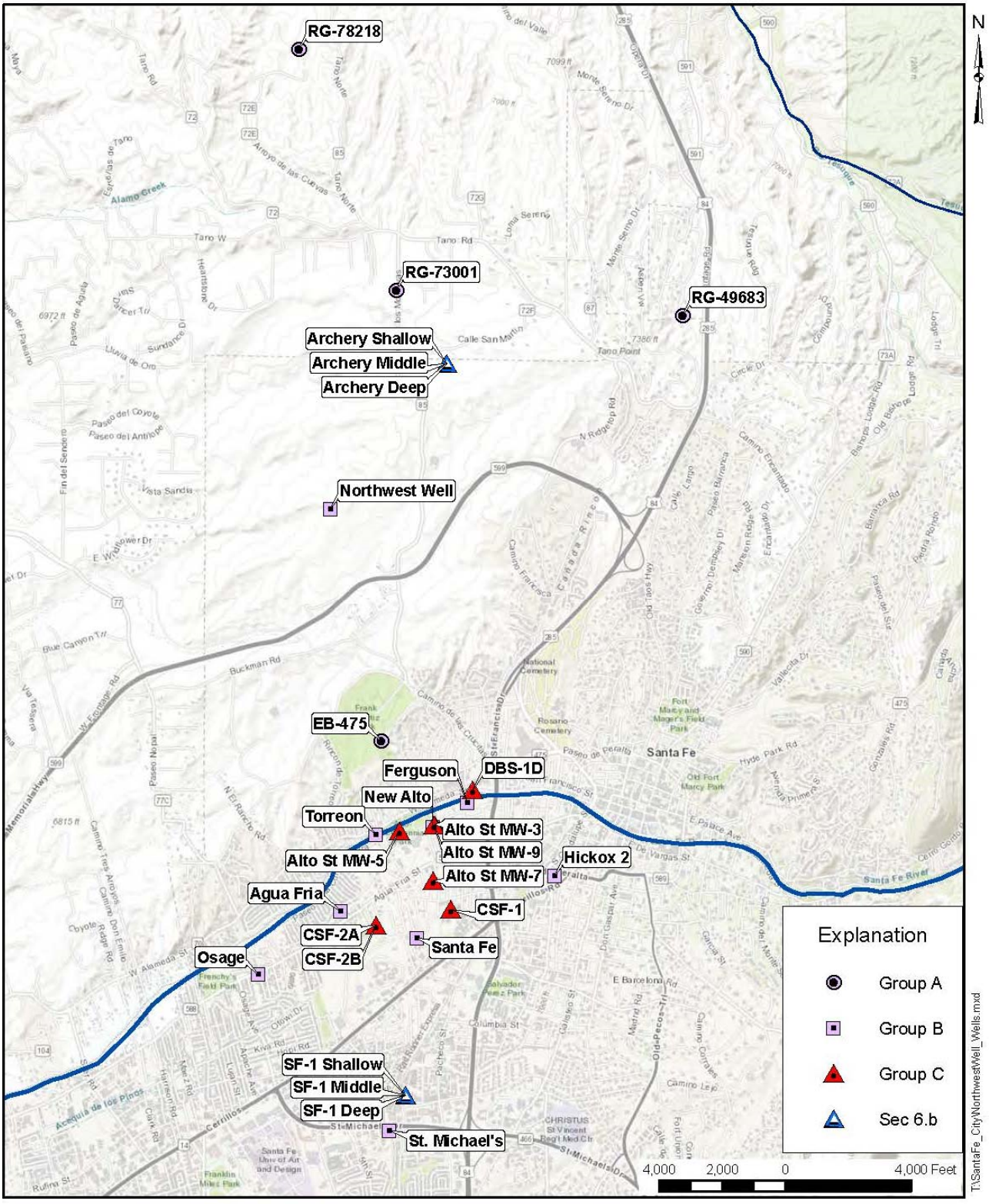

Figure 1. Map showing Northwest Well and City Well Field area water-level monitoring network, Santa Fe, New Mexico.

Table 1. Northwest Well and City Well Field Monitoring Program requirements

monitoring group	NMOSE ID	other ID (NMBGMR/ USGS, if any)	name	monitoring frequency	comments and status
A		EB-475	Ortiz 1	hourly	
A	RG-49683	EB-080	RG-49683	hourly	“east” well
A	RG-73001		RG-73001	hourly	“north, intermediate” well
A	RG-78218	EB-275	RG-78218	hourly	“north, distant” well
B	RG-1118		Agua Fria	quarterly*	
B	RG-1116		Ferguson	quarterly*	
B	RG-1114	EB-123	Hickox No. 2	quarterly*	
B	RG-1113	EB-276	New Alto	quarterly*	
B	RG-304-S		Osage	quarterly*	
B	RG-1117		Santa Fe	quarterly*	
B	RG-304		St. Michael's	quarterly*	
B	RG-1115		Torreon	quarterly*	
C		EB-279	Alto St MW-3	semi-annual	
C			Alto St MW-5	semi-annual	
C			Alto St MW-7	semi-annual	
C			Alto St MW-9	semi-annual	
C			CSF-1	semi-annual	
C			CSF-2(A)	semi-annual	
C			CSF-2(B)	semi-annual	
C			DBS-1D	semi-annual	
permit well	RG-68302		Northwest Well	quarterly*	
Section 6.b		354321105573701	Archery Deep piez	daily**	
Section 6.b		354321105573702	Archery Middle piez	daily**	
Section 6.b		354321105573703	Archery Shallow piez	daily**	
Section 6.b		353945105574501	SF-1 Deep piez	daily**	
Section 6.b		353945105574502	SF-1 Middle piez	daily**	
Section 6.b		353945105574503	SF-1 Shallow piez	daily**	

* quarterly manual measurements required; wells equipped with transducers recording hourly measurements
** daily measurements available from U.S. Geological Survey database
NMOSE - New Mexico Office of the State Engineer
USGS - U.S. Geological Survey
NMBGMR - New Mexico Bureau of Geology and Mineral Resources
piez. - piezometer

Table 2. Summary of elevation, total depth, and depth to top and bottom of screen for Northwest Well and City Well Field Monitoring Program wells

monitoring group	well	land surface elevation, ft amsl	total well depth, ft bgl	screen interval(s), ft bgl
A	Ortiz 1	6,999.03	460	350 to 460
A	RG-49683	7,178.50	600	400 to 600
A	RG-73001	7,160.00	805	665 to 685; 705 to 725; 745 to 765; 785 to 805
A	RG-78218	6,810.00	1,000	720 to 740; 780 to 800; 840 to 860; 900 to 920; 960 to 980
B	Agua Fria	6,797.65	740	201 to 740
B	Ferguson	6,877.00	750	175 to 746
B	Hickox No. 2	6,965.00	860	400 to 840
B	New Alto	6,861.40	725	226 to 720
B	Osage	6,750.00	770	210 to 760
B	Santa Fe	6,871.60	725	200 to 723
B	St. Michael's	6,853.45	795	380 to 780
B	Torreon	6,828.00	1,230	365 to 1,230
C	Alto MW-3	6,873.90	415	395 to 415
C	Alto MW-5	6,842.80	235	195 to 235
C	Alto MW-7	6,892.70	520	500 to 520
C	Alto MW-9	6,873.90	160	100 to 160
C	CSF-1	6,913.00	284	259 to 284
C	CSF-2(A)	6,858.00	554	534 to 554
C	CSF-2(B)	6,858.00	668	648 to 658
C	DBS-1D	6,885.73	*282*	267 to 282
permit well	Northwest Well	7,124.00	2,000	500 to 960; 1,000 to 1,980
Section 6.b	Archery Deep piez	7,223.00	1,100	1,080 to 1,090
Section 6.b	Archery Middle piez	7,223.00	920	900 to 910
Section 6.b	Archery Shallow piez	7,223.00	655	505 to 655
Section 6.b	SF-1 Deep piez	6,880.00	1,952	1,917 to 1,922
Section 6.b	SF-1 Middle piez	6,880.00	1,060	1,025 to 1,030
Section 6.b	SF-1 Shallow piez	6,880.00	780	669 to 674

ft amsl - feet above mean sea level
ft bgl - feet below ground level
italics - inferred total depth

2.0 SOUNDING TUBE AND TRANSDUCER INSTALLATION IN TANO ROAD AREA "GROUP A" DOMESTIC WELLS

John Shomaker and Associates, Inc. (JSAI) supervised the installation of sounding tubes and transducers in three domestic wells in the Tano Road Area as part of the Northwest Well and City Well Field Water-Level Monitoring Program (also referred to as "Group A" wells). Sounding tube installation was performed by Kuckelman Pump Service (KPS) and supervised by JSAI, and transducers were installed by JSAI.

The three wells for which access was gained for installation of sounding tubes and transducers, and monitoring of water levels were RG-78218, RG-73001, and RG-49683. The following is a summary of the work that was performed at each well in order to install the sounding tubes and transducers.

2.1 RG-78218

RG-78218 is located about 2.7 miles north of the Northwest Well. All work was performed on the well on May 21, 2019. The following work was performed:

- Tag water level at approximately 170 feet below ground level (ft bgl), and set up plumbing to perform short pump test before removal of pump
- Short pump test performed: Q/s = 1.3 gallons per minute per foot of drawdown (gpm/ft); water clarity: clear
- Take bacteriological sample: results were negative (no total coliform or e. coli present)
- Disinfect well and circulate water until chlorine concentration is ~50 parts per million (ppm)
- Remove pump and place on plastic
- Reinstall pump with 500 ft of 1-in. inside diameter PVC sounding tube
- Purge 4,485 gallons of water from well, chlorine concentration: 1 ppm; water clarity: clear
- Take bacteriological sample: results were negative
- Install transducer near bottom of sounding tube
- Clean up site and return to original condition

The transducer has been logging since installation and the results are presented in Figure 2.

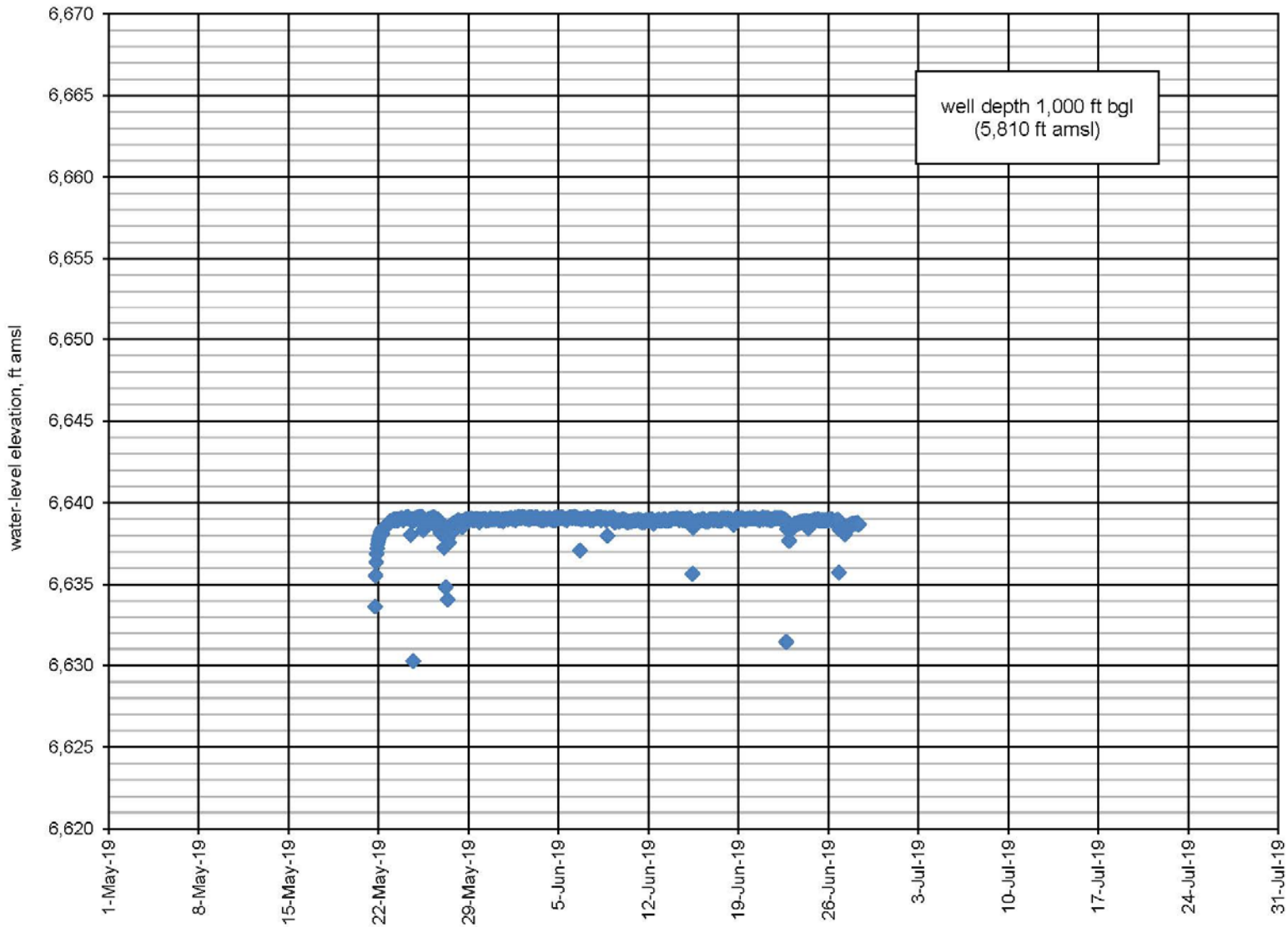

Figure 2. Transducer-measured water-level elevations for Group A well RG-78218, Northwest Well and City Well Field Monitoring Program, Santa Fe, New Mexico.

2.2 RG-73001

RG-73001 is located about 1.3 miles north-northeast of the Northwest Well. All work was performed on the well on May 22, 2019. The following work was performed:

- Tag water level at approximately 502 ft bgl, and set up plumbing to perform short pump test before removal of pump
- Short pump test performed: Q/s = 1.2 gpm/ft; water clarity: clear
- Take bacteriological sample: results were negative (no total coliform or e. coli present)
- Disinfect well and circulate water until chlorine concentration is ~50 ppm
- Remove pump and place on plastic
- Reinstall pump with 740 ft of 1-in. inside diameter PVC sounding tube
- Purge 950 gallons of water from well, chlorine concentration: 1 ppm; water clarity: clear
- Take bacteriological sample: results were negative
- Install transducer to 720 ft bgl inside sounding tube
- Clean up site and return to original condition

The transducer has been logging since installation and the results are presented in Figure 3.

2.3 RG-49683

RG-49683 is located about 2.4 miles east-northeast of the Northwest Well. All work was performed on the well on May 23, 2019. The following work was performed:

- Tag water level at approximately 296 ft bgl, and set up plumbing to perform short pump test before removal of pump
- Short pump test performed: Q/s = 1.3 gpm/ft; water clarity: clear with reddish scale or sediment particles suspended in water
- Take bacteriological sample: results were negative (no total coliform or e. coli present)
- Disinfect well and circulate water until chlorine concentration is ~50 ppm
- Remove pump and place on plastic
- Take pump to KPS shop for testing, clean out pump, restore to pumping condition
- Reinstall pump with 500 ft of 1-in. inside diameter PVC sounding tube
- Purge 1,419 gallons of water from well, chlorine concentration: 1 ppm; water clarity: clear
- Take bacteriological sample: results were negative
- Install transducer to 500 ft bgl inside sounding tube
- Clean up site and return to original condition

The transducer has been logging since installation and the results are presented in Figure 4.

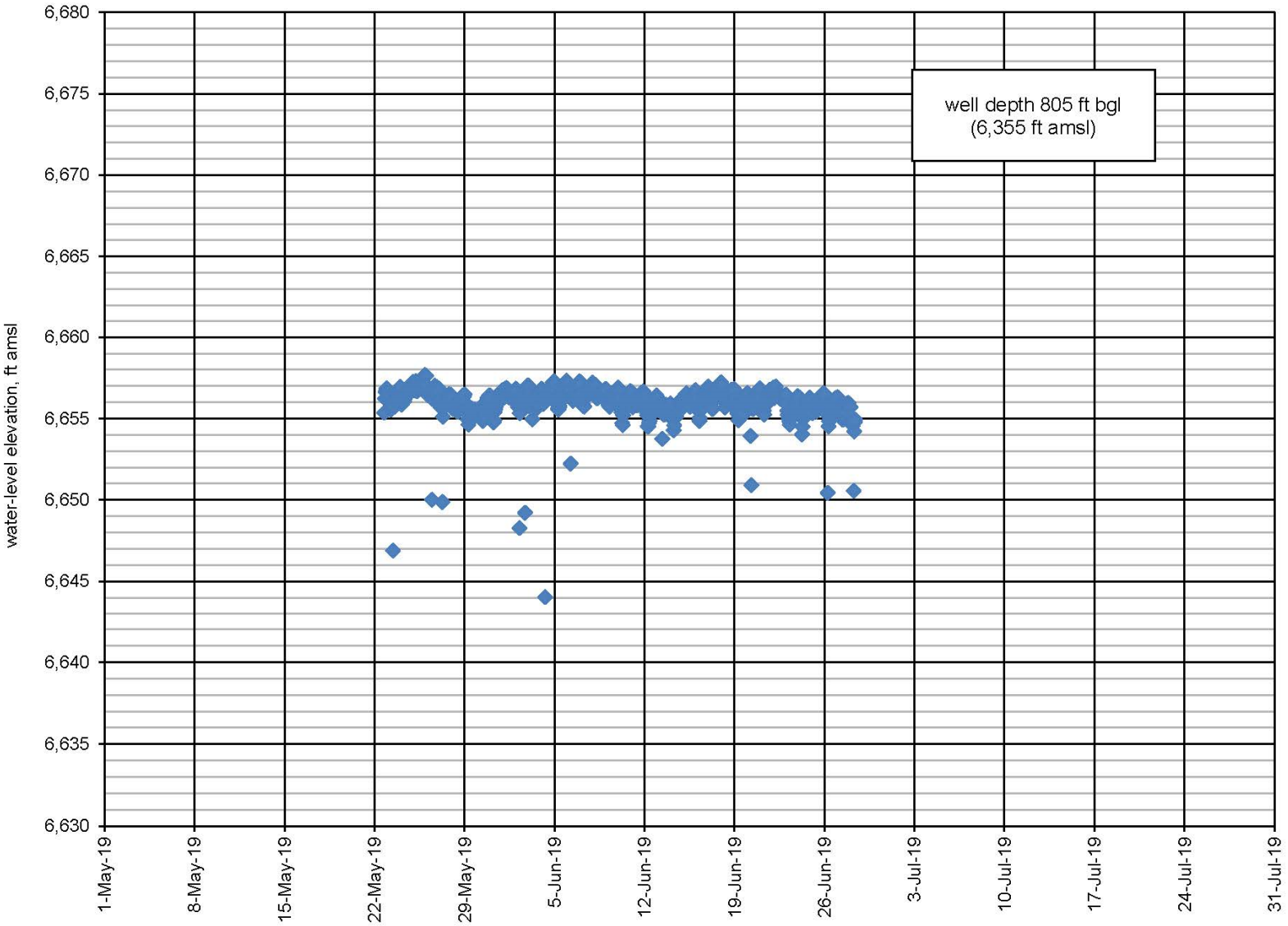

Figure 3. Transducer-measured water-level elevations for Group A well RG-73001, Northwest Well and City Well Field Monitoring Program, Santa Fe, New Mexico.

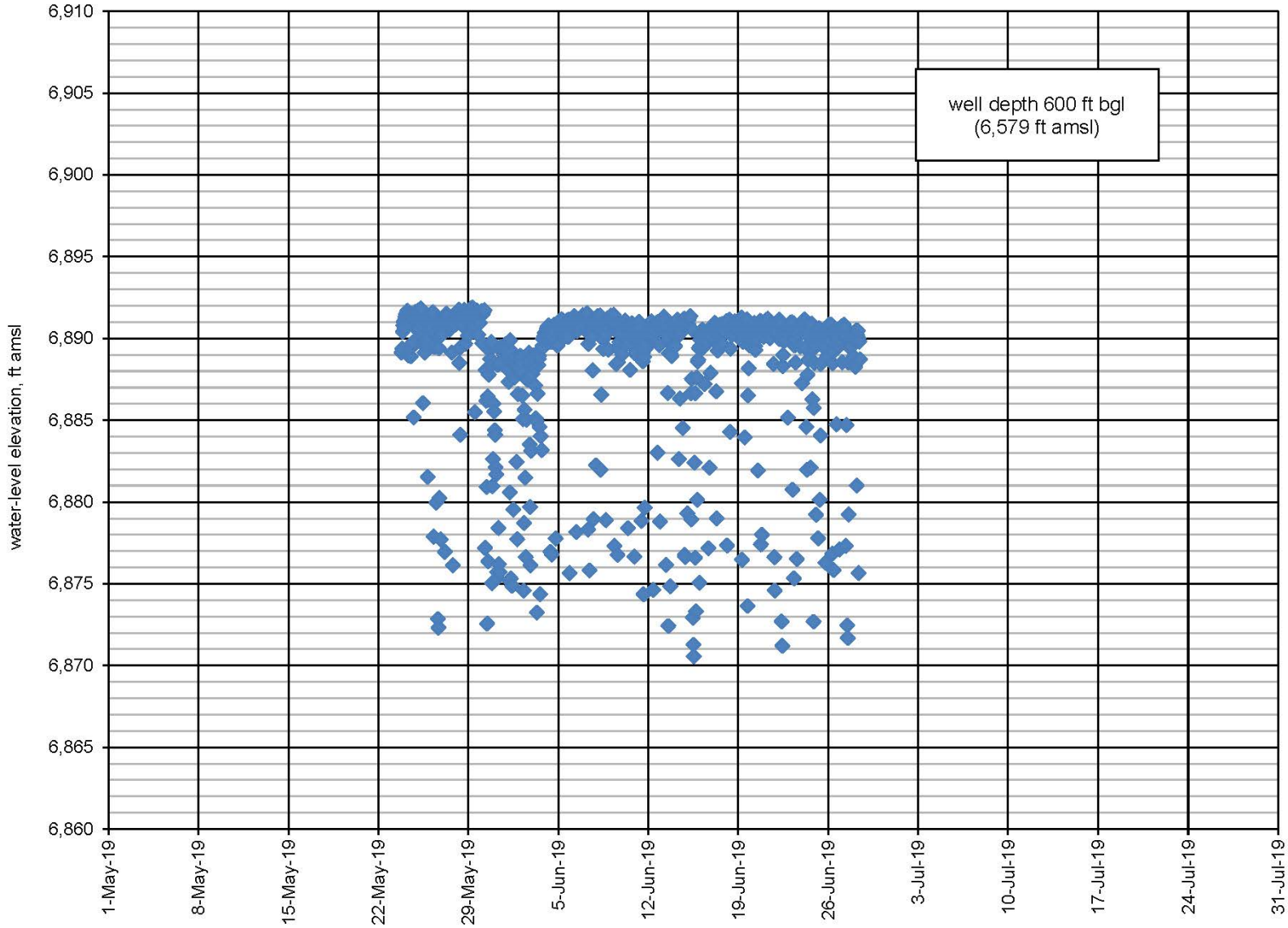

Figure 4. Transducer-measured water-level elevations for Group A well RG-49683, Northwest Well and City Well Field Monitoring Program, Santa Fe, New Mexico.

3.0 ANALYSIS OF WATER-LEVEL DATA

Monthly diversions from the Northwest Well for 2019 to-date are presented in Table 3. Total pumping for the Northwest Well was 4.4 acre-feet in May 2019, and zero in June 2019. Figure 5 presents recent transducer-recorded water levels for the Northwest Well. The Northwest Well was not pumping during the period of transducer-measured water-level monitoring of Group A wells between late May and late June 2019.

3.1 RG-78218 Water Levels

Figure 2 presents transducer-measured water-level data for RG-78218. Initial water levels recorded by the transducer at RG-78218 appear to reflect water-level recovery following the short pump test performed at the well. Subsequently, non-pumping water levels remained relatively stable at about 171 ft below top of sounding tube (water-level elevation 6,639 ft amsl). Pumping water levels from extended pumping periods were recorded relatively infrequently, with maximum pumping water levels up to 180 ft below top of sounding tube (water-level elevation 6,630 ft amsl). No significant short-term trends in the water-level data are observed from Figure 3. The Northwest Well was not pumped during this period of time.

3.2 RG-73001 Water Levels

Figure 3 presents transducer-measured water-level data for RG-73001. Non-pumping water levels fluctuated by several feet with an overall decline of about 1 ft, from 503 ft below top of sounding tube (water-level elevation 6,657 ft amsl) to 504 ft below top of sounding tube (water-level elevation 6,656 ft amsl) between late May and late June 2019. Pumping water levels from extended pumping periods were recorded relatively infrequently, with maximum pumping water levels up to 516 ft below top of sounding tube (water-level elevation 6,644 ft amsl). More data are needed to determine whether the observed overall decline is representative of a seasonal or long-term trend at this well. The Northwest Well was not pumped during this period of time.

Table 3. Monthly diversions from the Northwest Well (RG-68302) for 2019 to-date

month	diversion, acre-feet
January 2019	21.8
February 2019	0
March 2019	23.0
April 2019	40.8
May 2019	4.4
June 2019	0
July 2019	17.6
August 2019	0
September 2019	0

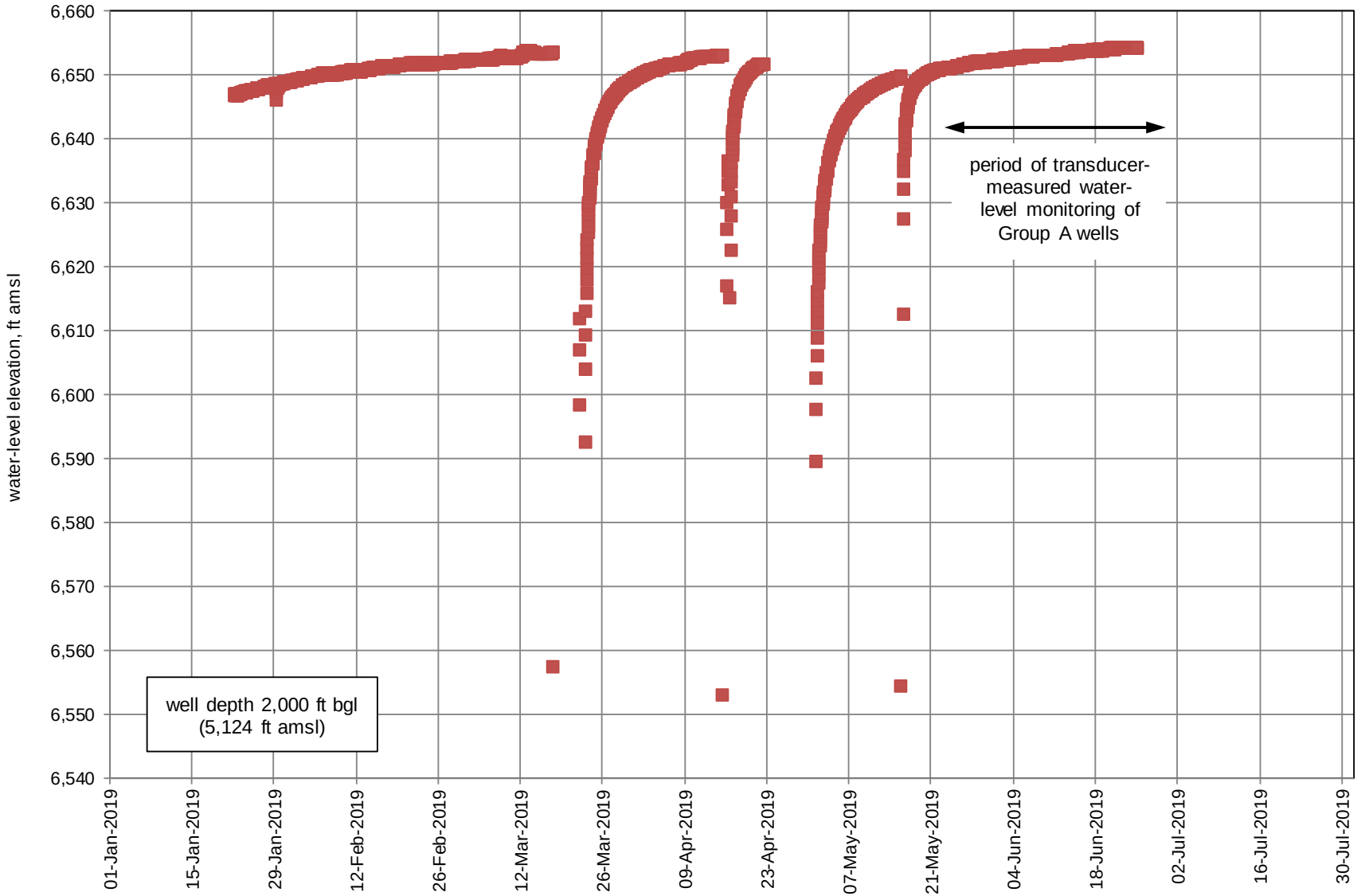

Figure 5. Transducer-measured water-level elevations for the Northwest Well, Santa Fe, New Mexico.

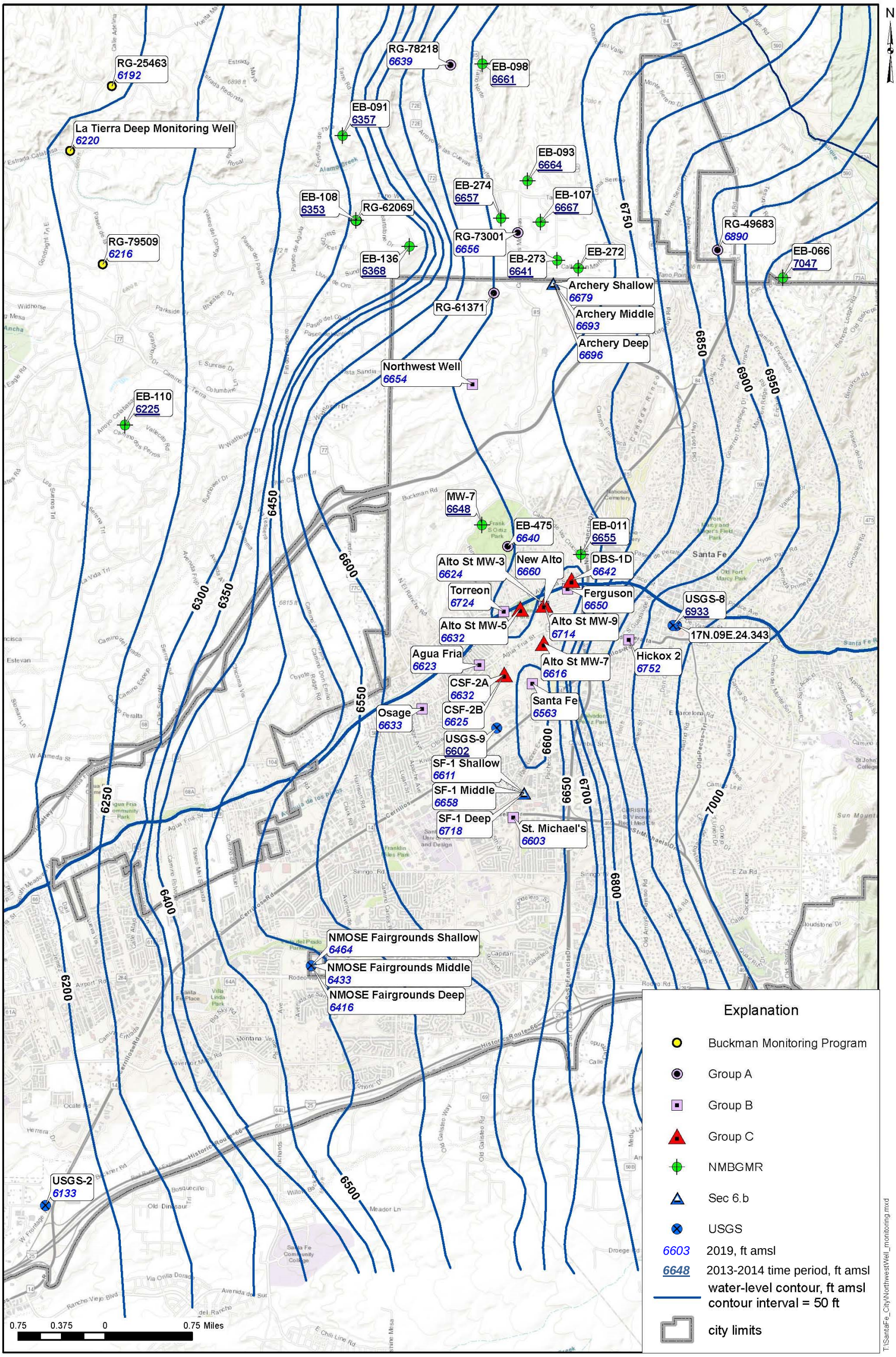

Figure 6. Map showing water-level elevation contours for Northwest Well and City Well Field area representing current conditions, Santa Fe, New Mexico.

3.3 RG-49683 Water Levels

Figure 4 presents transducer-measured water-level data for RG-49683. Non-pumping water levels remained relatively stable at about 287 ft below top of sounding tube (water-level elevation 6,891.5 ft amsl) for the first week following sounding tube and transducer installation. This period was followed by a week with lower non-pumping water levels of about 289.5 ft below top of sounding tube (water-level elevation 6,889 ft amsl). Then, non-pumping water levels appeared to recover over a several-day period to about 287.5 ft below top of sounding tube. The remainder of the non-pumping water-level dataset shows an overall decline of about 1 ft, from 287.5 ft below top of sounding tube (water-level elevation 6,891 ft amsl) to 288.5 ft below top of sounding tube (water-level elevation 6,890 ft amsl) in June 2019.

Maximum pumping water levels were up to 308 ft below top of sounding tube (water-level elevation 6,870.5 ft amsl).

The reason for the 1-week period of lower non-pumping water levels in late May and early June is unclear; the Northwest Well was not pumping during this time period. It appears that pumping water levels were recorded more frequently at RG-49683 during this period, and it is possible that some part-time residents that use this shared domestic well may have arrived for a week-long stay, resulting in more frequent pumping and higher water use. RG-49683 is also within relatively close proximity to Santa Fe Opera and Tesuque Casino water-supply wells (about 2.3 miles). Although Santa Fe Opera permitted allowable diversions amount to about 50 acre-feet per year (ac-ft/yr), their water use is likely concentrated during the summer months. Current use from the supply well for the recently constructed Tesuque Casino is not known.

More data are needed to determine whether the observed overall decline of 1 ft in June is representative of a seasonal or long-term trend at this well.

4.0 RESPONSES TO COMMENTS MADE ON BEHALF OF TANO ROAD ASSOCIATION

This section addresses comments on the monitoring report provided in the April 25, 2019 memorandum from Reid Bandeen, PG, for Tano Road Association (Bandeen, 2019). It is organized according to the sections in the Bandeen (2019) memo.

Comment 1: NW Well application background and reporting requirements

As proposed in the Bandeen (2019) memo, the following text will be incorporated into Section 1.1 of the monitoring report going forward:

The Northwest Well (New Mexico Office of the State Engineer (NMOSE) well no. RG-68302)) was drilled and constructed in 1998. The City filed an application with NMOSE in 1999 to make the well supplemental to NMOSE well nos. RG-1113 through RG-1118 (City Well Field). The application was protested and a settlement was reached among the parties in which a temporary permit was issued in 2002. The temporary permit allowed a diversion of up to 900 ac-ft/yr from RG-68302, provided that the total diversion from all wells was limited to 3,507 ac-ft/yr during the 10-year temporary permit. Alternatively, the City could pump up to 4,865 ac-ft/yr in 1 year if the City did not use the Northwest Well.

In 2011, before the temporary permit expired, the City filed an application with NMOSE to permanently combine the Northwest Well with the City Well Field and the groundwater remediation well at the Santa Fe Generating site (NMOSE well no. RG-81092). The 2011 application was protested by various individuals and entities, including the Tano Road Association, but settled through mediation with all parties. The NMOSE issued the Northwest Well-City Well Field Permit in 2018 with conditions limiting pumping and requiring water-level monitoring as specified in Exhibit 1 of the Permit.

As proposed in the Bandeen (2019) memo, the following requirements of Paragraph 6.b of Exhibit 1, the Permit will be incorporated into Section 1.3 of the monitoring report going forward:

- Data tables and hydrographs based on water-level data of good quality that are published in and reasonably available from a recognized monitoring database, and which are for wells within 3 miles of the Alto, Hickox, Torreon, Ferguson, Santa Fe, Agua Fria, and Northwest Wells.

Comment 2: City claims compliance with the NW Well permit monitoring plan, albeit without inclusion of current TRA well monitoring data

This addendum incorporates the three domestic Group A wells in the Tano Road area into the monitoring report, now that the wells have been equipped with transducers. These wells will be included in the monitoring reports, as required, going forward.

Comment 3: City interpretation of baseline and current ground water levels and trends continues to be a point of disagreement and are partially in error.

Issues related to monitoring report figure 2, a map showing water-level elevation contours representing 2014 conditions, were addressed in detail in section 3.1.1 of the monitoring report (JSAI, 2019).

Monitoring report figure 3, a map showing water-level elevation contours representing current conditions, was prepared based on available data. Data used to prepare the map were included in appendix E of the monitoring report. An updated version of the map is provided as Figure 6 in this addendum, incorporating the new data for the three domestic Group A wells in the Tano Road area, and the Northwest Well. Figure 6 also notes the water levels that are representative of the 2013-2014 time period (in the case that more recent data were not available). All other water-level data presented on the map are from 2019.

Comment 4: Suspect water-level data reported for NW Well

Improved data QAQC implemented with the monitoring plan in January 2019 brings a higher level of confidence to the water-level dataset for the Northwest Well from January 2019 to present. Water-level data collected at the Northwest Well in 2017 and 2018 are also in-line with the 2019 data.

Comment 5: Discrepancies in OSE and City stream impact projections

These comments do not pertain to the monitoring report and should be addressed separately.

Comment 6: Additional issues of concern

The information on screen intervals for the Archery piezometers has been added to Table 2, above. This addition will be made to the monitoring reports going forward, in the appropriate tables and appendices.

As proposed in the Bandeen (2019) memo, the text of the monitoring report should be amended going forward to clarify that the well owners for the three domestic Group A wells in the Tano Road area did not agree to installation of water meters on the access agreements.

5.0 REFERENCES

Bandeen, R., 2019, OSE File No. RG-81092, RG-68302, and RG-1113 thru 1118 Combined; Comments regarding City of Santa Fe Northwest Well and City Well Field Monitoring Report (the Report), Dated March 2019: memo from Reid Bandeen, PG, for Tano Road Association, to Ramona Martinez, Northern Rio Grande Basin Manager, Water Rights Division, NMOSE, January 24, 2019, 5 p. plus attachment.

[JSAI] John Shomaker & Associates, Inc., 2009, Buckman Monitoring Program well and well permit survey: consultant's letter report to Claudia Borchert, City of Santa Fe Water Division, March 13, 2009, 4 p. plus map and CD containing well and well permit survey, database letter report, and index maps.

[JSAI] John Shomaker & Associates, Inc., 2018, Buckman Wells 10-13 (RG-20516-S-10 through S-13) monitoring program 5th biennial report, February 2018: consultant's report prepared for City of Santa Fe Water Division, February 26, 2018: 30 p. plus figures and appendices.

[JSAI] John Shomaker & Associates, Inc., 2019, Northwest Well and City Well Field groundwater monitoring report, RG-68302, RG-81092, and RG-1113 thru RG-1118 Combined, consultant's report prepared for City of Santa Fe Water Division, March 29, 2019: 15 p. plus figures and appendices.