



Residential Well Monitoring and New City Well No. 13

City of Warrenville
January 2024



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1 Executive Summary

In response to increasing demands for drinking water, the City of Warrenville drilled its fifth public water supply well to a depth of 354 feet at the site of 30W121 Estes Street in the Fall of 2023. The well is expected to be pumped at approximately 700 gallons per minute and used in combination with the City's other wells so that, on average, it is pumped one out of every five days.

There are approximately 25 private residential water wells with depths ranging from 100 to 200 feet below ground surface along Estes Street between Barkley Avenue and Briggs Street, and along Briggs Street between Route 56 / Butterfield Road and Estes Street. In response to residents' concerns regarding the potential impact of the City's new well on their neighboring residential wells, the City conducted a ground water investigation. The investigation included measuring water levels in twelve of these nearby residential wells in the timeframes before, during, and after the recent 29-hour pumping test of Well 13. During this pumping test, water was drawn from Well 13 at rates ranging from 700 to 995 gallons per minute in order to gauge both the properties of the aquifer and the pumping effects on the twelve residential wells.

The results of the investigation show that pumping Well 13 under normal operating conditions will lower water levels in the nearby residential wells by no more than 5 feet. This leads to the conclusion that the residential wells in the vicinity of Well 13 will not be negatively impacted by the normal operation of Well 13.

2 Background

The City's drilling contractor, Municipal Well & Pump, drilled Well 13 to a total depth of 354 feet between August 25 and September 14, 2023. The City plans to bring Well 13 online in 2026 and pump it at approximately 700 gallons per minute (gpm). The pumping rates and depths of Well 13 and the City's other active drinking water supply wells are presented in Table 1.

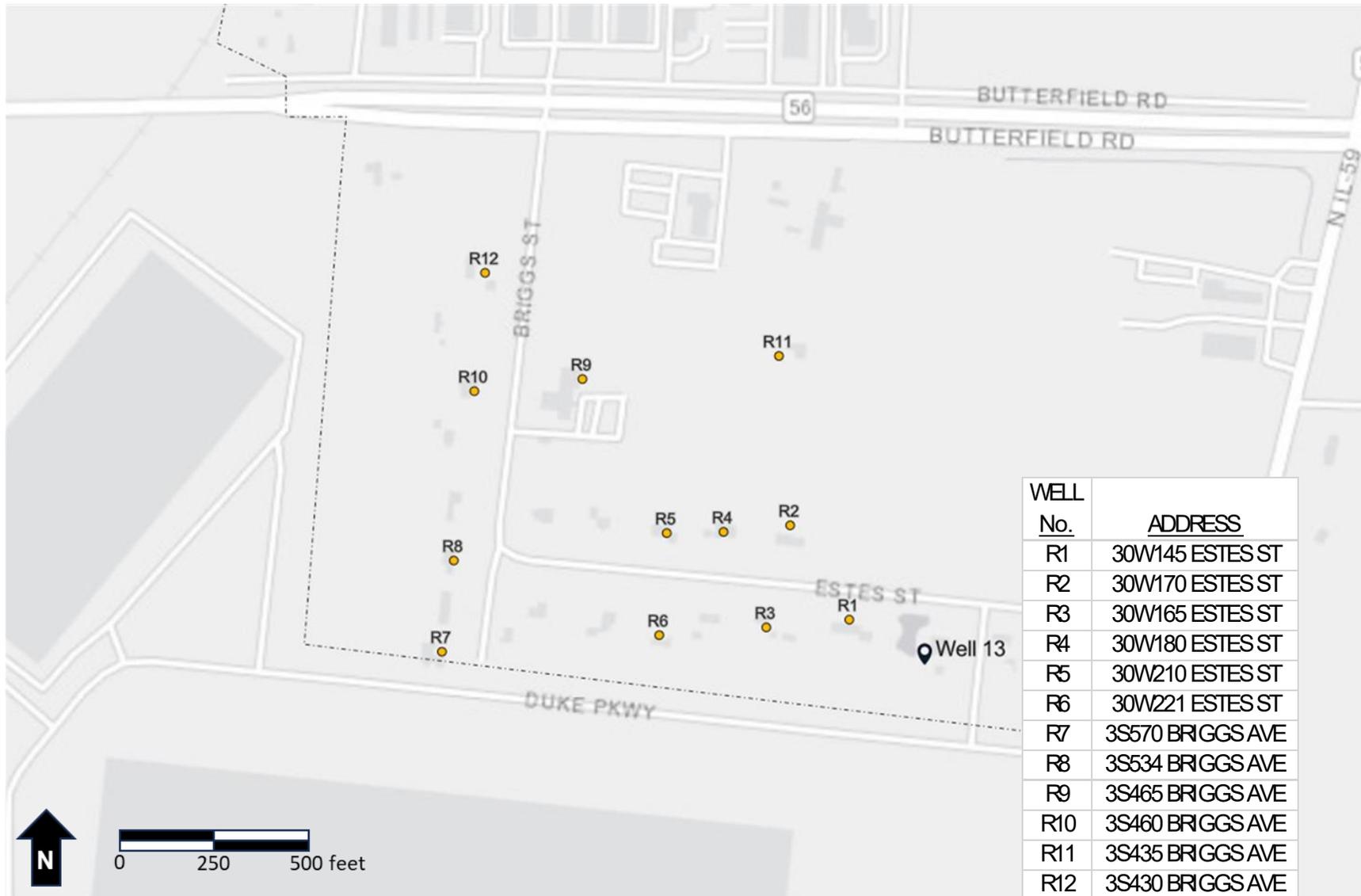
Table 1. City of Warrenville Water Supply Well Summary

Well No.	Pumping Rate (gpm)	Depth (feet)
9	600	354
10	700	368
11	500	350
12	750	320
13	700*	354

*Well 13 pumping rate is estimated based on pumping tests described in this report.

Note: The depth of the residential wells in the Well 13 area is typically 100 to 200 feet.

Exhibit 1. – Location of City of Warrenville Public Water Supply Well 13 and Nearby Residential Wells



3 Data Collection

The City and its consulting engineer, Engineering Enterprises, Inc. (EEI), gathered residential well information and collected water levels in the wells before, during, and after the pumping test of Well 13.

Through reviewing publicly available well data, communicating with local well contractors, and receiving information from residents, it is apparent that most private wells are between 100 and 200 feet deep, approximately 6-inches in diameter, and have pumps set at approximately 60 to 80 feet below-grade. The most pertinent information is residents' pump settings because this information determines how sensitive the residential wells are to ground water level changes.

Twelve households along Estes Street between Barkley Avenue and Briggs Street, and Briggs Street between Route 56 / Butterfield Road and Estes Street with private wells on their properties signed the Access Agreement to allow the City to collect water level readings in the residential wells from August to November 2023. These properties' private wells range from 220 to 1,555 feet from Well 13. Water levels were measured using the City's electronic water level meter. A bleach disinfectant solution was used on the meter before and after each level measurement.

Non-pumping water levels (e.g. Well 13 was not being pumped at this time) were recorded at all twelve wells on August 31, 2023. During the last two days of drilling, September 13 and 14, 2023, water level measurements were taken at three of the twelve houses which were representative of wells closest, mid-distance, and furthest from Well 13.

On October 25, 2023, a 29-hour pumping test of the well was initiated. The primary purpose of the pumping test was to assess the well's pumping capabilities. The pumping test began at 9:30 AM on October 25th and finished at 2:30 PM on October 26th. During this 29-hour period, the City monitored the water levels in the twelve residential wells. Due to the time it took to complete a full round of water level measurements, only 5 private well's levels were sampled every hour. These 5 wells, referred to as the primary wells, represent the closest, mid-distance, and furthest wells from Well 13. All twelve houses were measured once every 6 hours during this pumping period.

After the pump in Well 13 was shut off on the afternoon of October 26th, the City collected water level readings from all twelve residential wells. Recovery water levels were taken approximately 30 and 90 minutes from the time the pump was shut off. Table 2 presents a summary of the dates and times in which water levels were collected during the investigation.

4 Data Analysis

Water level data and Well 13 pumping rate information were processed by graphing the information in a manner that lends itself to standard pumping test data interpretation techniques. Appendix A presents all the water level data collected from residential wells as part of the investigation.

Exhibit 2 presents a graph of drawdown for the primary residential wells during pumping (elapsed time from 0 to 1,730 minutes) and after pumping stopped (elapsed time from 1,730 to 2,820 minutes). Exhibit 3 is a similar graph for the secondary wells. The graphs show that drawdown in the residential wells begins to decline within minutes after pumping at Well 13 is initiated. The rate of drawdown is steep during the first 60 minutes of pumping and the rate lessens afterward. The flattening of the drawdown curves indicates that the water levels in the wells are beginning to stabilize. When the pumping rate is increased after 1,170 minutes, the drawdown rate increases as well. This is particularly noticeable in the well at 30W145 Estes, which is the well closest to the pumping well. At about 1,500 minutes after pumping began drawdown begins to stabilize again until the pumping of Well 13 stops and the water levels quickly begin to recover (i.e. drawdown decreases).

5 Data Interpretation

The relationship between pumping rate, drawdown as a function of time, and distance from the pumping well can be used to interpret the hydraulic properties of the geologic materials in the vicinity of the pumping well. Exhibit 4 presents concentric circles with various levels of shading which correspond to the range of observed drawdowns. The darkest shading covers the area where drawdowns of 4.5 feet or greater were observed. The mid-level shading represents the area where drawdowns of 4 to 4.5 feet were observed, and the lightest shading corresponds to areas where drawdowns of 3.5 to 4 feet were observed.

All of the monitored residential wells conform to this interpretation except for Well R11, located at 3S435 Briggs Avenue. Based on drawdowns in the other wells, drawdowns in Well R11 would be expected to be between 3.5 and 4 feet. However, the observed drawdown in Well R11 is 5.0 feet. It may be that Well R11 is hydraulically connected to Well 13 in a way the other wells are not, perhaps by fractures common to both wells. It could also be that this well is deeper than the other wells and the lower transmissibility of the deeper geologic formations result in greater drawdown. However, the depth of the Well R11 is unknown at this time.

Regardless of the reason for Well R11 exhibiting unique drawdown as compared to the other wells, it can be stated with certainty that pumping Well 13 at the expected rate of 700 gpm will not draw down water levels in the nearby residential wells by more than 5 feet.

Exhibit 2. – Graph of Drawdown (Primary Residential Wells) and Pumping Rate of Well 13

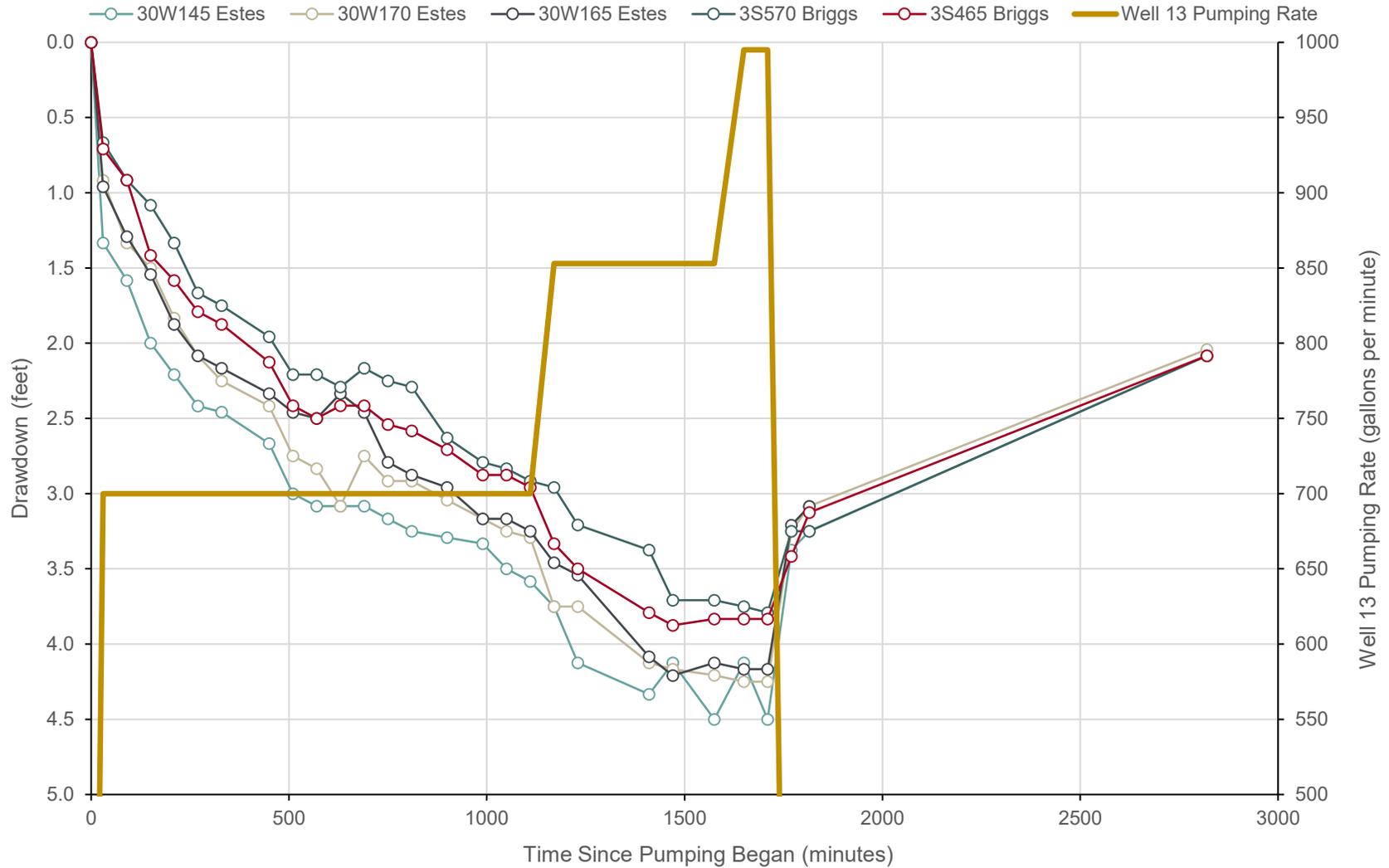
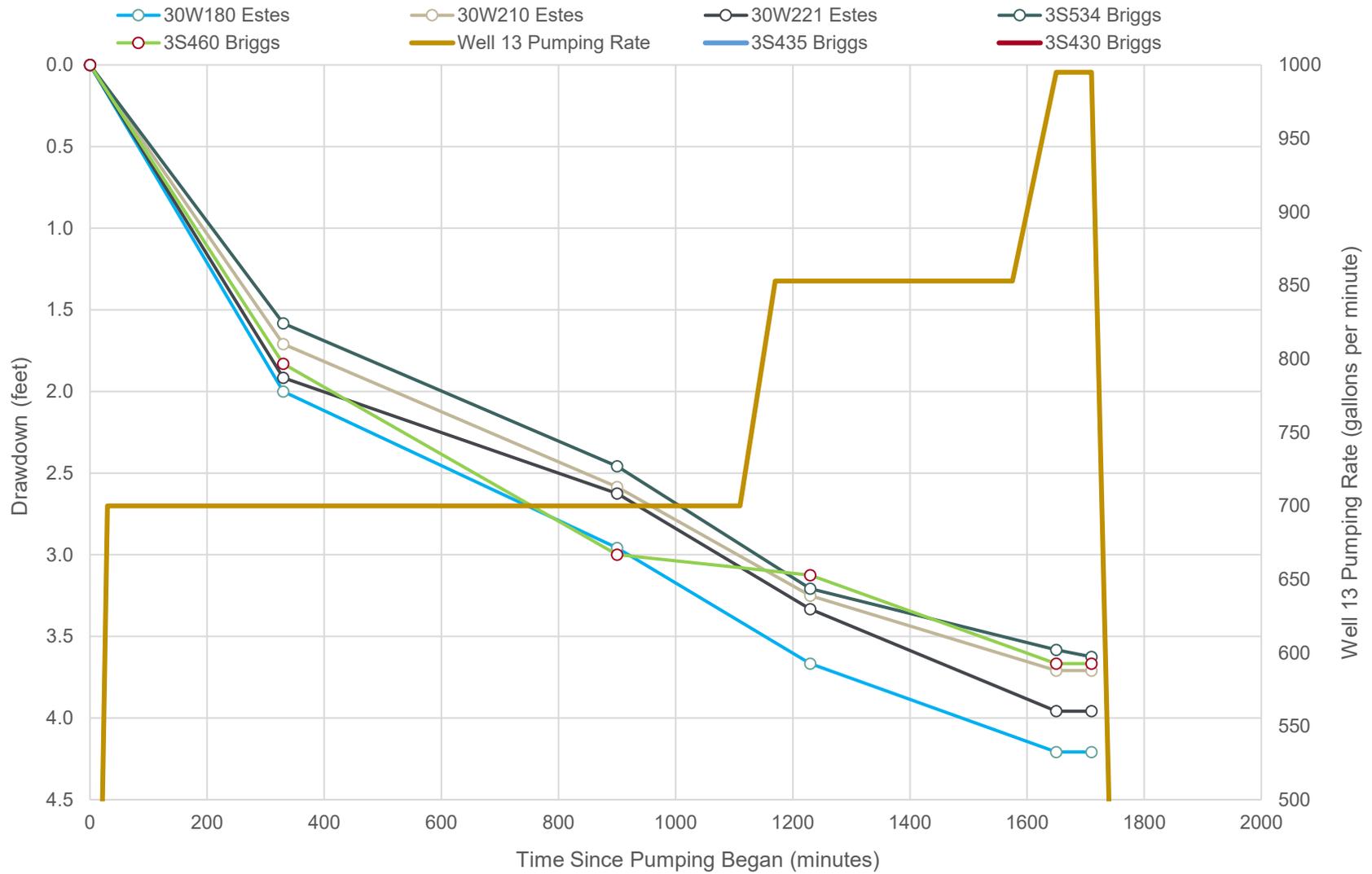


Exhibit 3. – Graph of Drawdown (Secondary Residential Wells) and Pumping Rate of Well 13



6 Conclusion

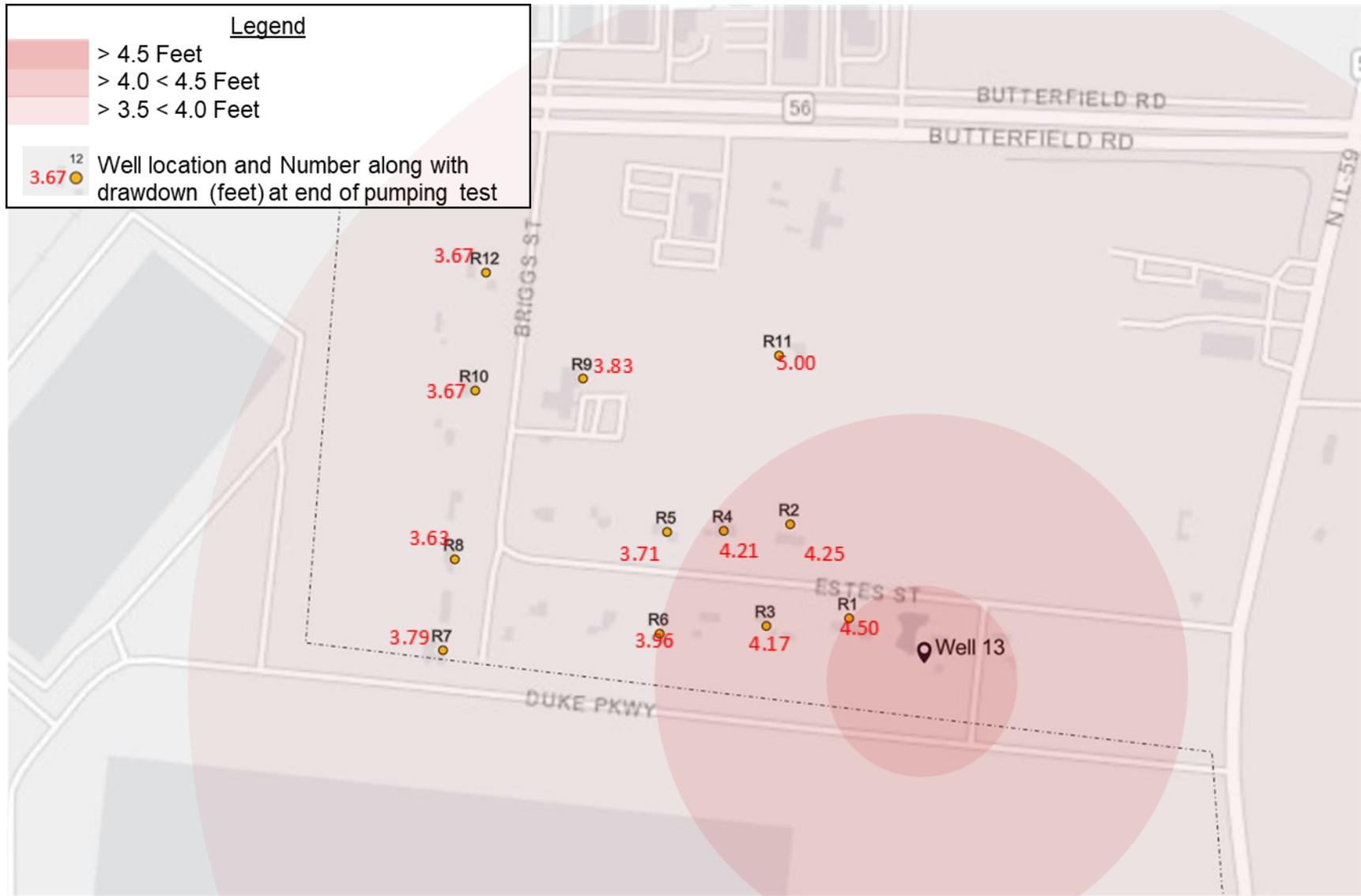
The interpretation of data collected as part of the investigation into the potential impact of Well 13 on nearby residential wells indicates no significant differences in the local geologic and hydrologic conditions from those typically found in DuPage County. The aquifers tapped by the residential wells and Well 13 can produce over 700 gpm from Well 13 under normal operating conditions without lowering the water levels in the nearby residential wells by more than 5 feet. As a result, there is currently no compelling reason to mitigate the effects of pumping Well 13 on the residential wells. The City does plan to monitor water levels at least quarterly to ensure that these conclusions remain valid over the long term.

7 Supporting References

Walton, W. C. 1960. Leaky artesian aquifer conditions in Illinois. Illinois State Water Survey Report of Investigation 39.

Zeisel, A. J., W. C. Walton, R. T. Sasman, and T. A. Prickett. 1962. Ground-water Resources of DuPage County, Illinois. Illinois State Water Survey and Geological Survey Cooperative Ground-Water Report.

Exhibit 4. – Drawdown at the End of the Pumping Test, October 26, 2023 @1330



APPENDIX A

Water Level Data from Residential Wells

Well Information				Original Readings												
Order	Address	Stick-Up* (feet)	Ground Elev.** (ft. asl)	31-Aug		13-Sep		14-Sep		7:45		9:30		10:30		11
				DTW^	ELV^^	DTW	ELV	DTW	ELV	DTW	ELV	DTW	ELV	DTW	ELV	DTW
1	30W145 Estes	1.25	720	42.33	678.92	43.25	678.00	44.08	677.17	41.00	680.25	42.33	678.92	42.58	678.67	43.00
2	30W170 Estes	0.88	719	40.42	679.46					39.25	680.63	40.17	679.71	40.58	679.29	40.75
3	30W165 Estes	0.67	718	41.42	677.25					40.21	678.46	41.17	677.50	41.50	677.17	41.75
4	30W180 Estes	0.58	719	40.00	679.58					39.79	679.79					
5	30W210 Estes	1.50	716	39.42	678.08					38.08	679.42					
6	30W221 Estes	1.08	719	41.50	678.58					40.17	679.92					
7	3S570 Briggs	0.88	716	40.00	676.88	40.50	676.38	41.33	675.54	38.42	678.46	39.08	677.79	39.33	677.54	39.50
8	3S534 Briggs	0.42	717	40.58	676.83					39.17	678.25					
9	3S465 Briggs	0.50	720	40.17	680.33	43.00	677.50	43.71	676.79	40.67	679.83	41.38	679.13	41.58	678.92	42.08
10	3S460 Briggs	0.63	721	45.17	676.46					43.50	678.13					
11	3S435 Briggs	1.15	718	42.21	676.94					40.42	678.73					
12	3S430 Briggs	0.38	723	45.33	678.04					43.67	679.71					
	Well 13 Pumping Rate (gpm):			0	0	180	180	240	240	0	0	700	700	700	700	700

Stick-up* = Distance in feet from ground level to top of well casing
Ground Elev.** = Elevation in feet above sea level of the ground at the well.
DTW^ = Depth to Water in the well measured in feet below top of casing.
ELV^^ = Elevation of water level in the well in feet above sea level (Ground Elevation + Stick-Up - Depth to Water).
Highlighted values indicate residences monitored hourly during pumping test.

Well Information				Pumping Test Readings, 10/25/23												
Order	Address	Stick-Up* (feet)	Ground Elev.** (ft. asl)	11:30	12:30		13:30		14:30		16:30		17:30		18:30	
				ELV	DTW	ELV	DTW	ELV	DTW	ELV	DTW	ELV	DTW	ELV	DTW	ELV
1	30W145 Estes	1.25	720	678.25	43.21	678.04	43.42	677.83	43.46	677.79	43.67	677.58	44.00	677.25	44.08	677.17
2	30W170 Estes	0.88	719	679.13	41.08	678.79	41.33	678.54	41.50	678.38	41.67	678.21	42.00	677.88	42.08	677.79
3	30W165 Estes	0.67	718	676.92	42.08	676.58	42.29	676.37	42.38	676.29	42.54	676.12	42.67	676.00	42.71	675.96
4	30W180 Estes	0.58	719						41.79	677.79						
5	30W210 Estes	1.50	716						39.79	677.71						
6	30W221 Estes	1.08	719						42.08	678.00						
7	3S570 Briggs	0.88	716	677.38	39.75	677.13	40.08	676.79	40.17	676.71	40.38	676.50	40.63	676.25	40.63	676.25
8	3S534 Briggs	0.42	717						40.75	676.67						
9	3S465 Briggs	0.50	720	678.42	42.25	678.25	42.46	678.04	42.54	677.96	42.79	677.71	43.08	677.42	43.17	677.33
10	3S460 Briggs	0.63	721						45.33	676.30						
11	3S435 Briggs	1.15	718						43.46	675.69						
12	3S430 Briggs	0.38	723						45.50	677.88						
	Well 13 Pumping Rate (gpm):			700	700	700	700	700	700	700	700	700	700	700	700	700

Stick-up* = Distance in feet from ground level to top of well casing
Ground Elev.** = Elevation in feet above sea level of the ground at the well.
DTW^ = Depth to Water in the well measured in feet below top of casing.
ELV^^ = Elevation of water level in the well in feet above sea level (Ground Elevation + Stick-Up - Depth to Water).
Highlighted values indicate residences monitored hourly during pumping test.

Well Information																
Order	Address	Stick-Up* (feet)	Ground Elev.** (ft. asl)	19:30		20:30		21:30		22:30		0:00		1:30		2:
				DTW	ELV	DTW										
1	30W145 Estes	1.25	720	44.08	677.17	44.08	677.17	44.17	677.08	44.25	677.00	44.29	676.96	44.33	676.92	44.50
2	30W170 Estes	0.88	719	42.33	677.54	42.00	677.88	42.17	677.71	42.17	677.71	42.29	677.58	42.42	677.46	42.50
3	30W165 Estes	0.67	718	42.54	676.12	42.67	676.00	43.00	675.67	43.08	675.58	43.17	675.50	43.38	675.29	43.38
4	30W180 Estes	0.58	719									42.75	676.83			
5	30W210 Estes	1.50	716									40.67	676.83			
6	30W221 Estes	1.08	719									42.79	677.29			
7	3S570 Briggs	0.88	716	40.71	676.17	40.58	676.29	40.67	676.21	40.71	676.17	41.05	675.83	41.21	675.67	41.25
8	3S534 Briggs	0.42	717									41.63	675.79			
9	3S465 Briggs	0.50	720	43.08	677.42	43.08	677.42	43.21	677.29	43.25	677.25	43.38	677.13	43.54	676.96	43.54
10	3S460 Briggs	0.63	721									46.50	675.13			
11	3S435 Briggs	1.15	718									44.42	674.73			
12	3S430 Briggs	0.38	723									46.25	677.13			
	Well 13 Pumping Rate (gpm):			700	700	700	700	700	700	700	700	700	700	700	700	700

Stick-up* = Distance in feet from ground level to top of well casing
Ground Elev.** = Elevation in feet above sea level of the ground at the well.
DTW^ = Depth to Water in the well measured in feet below top of casing.
ELV^^ = Elevation of water level in the well in feet above sea level (Ground Elevation + Stick-Up - Depth to Water).
Highlighted values indicate residences monitored hourly during pumping test.

Well Information				Pumping Test Readings, 10/26/23												
Order	Address	Stick-Up* (feet)	Ground Elev.** (ft. asl)	8:30	3:30		4:30		5:30		8:30		9:30		11:15	
				ELV	DTW	ELV	DTW	ELV	DTW	ELV	DTW	ELV	DTW	ELV	DTW	ELV
1	30W145 Estes	1.25	720	676.75	44.58	676.67	44.75	676.50	45.13	676.13	45.33	675.92	45.13	676.13	45.50	675.75
2	30W170 Estes	0.88	719	677.38	42.54	677.33	43.00	676.88	43.00	676.88	43.38	676.50	43.42	676.46	43.46	676.42
3	30W165 Estes	0.67	718	675.29	43.46	675.21	43.67	675.00	43.75	674.92	44.29	674.37	44.42	674.25	44.33	674.33
4	30W180 Estes	0.58	719						43.46	676.13						
5	30W210 Estes	1.50	716						41.33	676.17						
6	30W221 Estes	1.08	719						43.50	676.58						
7	3S570 Briggs	0.88	716	675.63	41.33	675.54	41.38	675.50	41.63	675.25	41.79	675.08	42.13	674.75	42.13	674.75
8	3S534 Briggs	0.42	717						42.38	675.04						
9	3S465 Briggs	0.50	720	676.96	43.63	676.88	44.00	676.50	44.17	676.33	44.46	676.04	44.54	675.96	44.50	676.00
10	3S460 Briggs	0.63	721						46.63	675.00						
11	3S435 Briggs	1.15	718						45.17	673.98						
12	3S430 Briggs	0.38	723						47.00	676.38						
	Well 13 Pumping Rate (gpm):			700	700	700	853	853	853	853	853	853	853	853	853	853

Stick-up* = Distance in feet from ground level to top of well casing
Ground Elev.** = Elevation in feet above sea level of the ground at the well.
DTW^ = Depth to Water in the well measured in feet below top of casing.
ELV^^ = Elevation of water level in the well in feet above sea level (Ground Elevation + Stick-Up - Depth to Water).
Highlighted values indicate residences monitored hourly during pumping test.

Well Information								Recovery readings, 10/26/23 - 10/27/23						Recovery reading,	
Order	Address	Stick-Up* (feet)	Ground Elev.** (ft. asl)	12:30		13:30		14:30		15:15		7:45		DTW	ELV
				DTW	ELV	DTW	ELV	DTW	ELV	DTW	ELV	DTW	ELV		
1	30W145 Estes	1.25	720	45.13	676.13	45.50	675.75	44.38	676.88	44.25	677.00	43.08	678.17	38.42	682.83
2	30W170 Estes	0.88	719	43.50	676.38	43.50	676.38	42.50	677.38	42.33	677.54	41.29	678.58	36.58	683.29
3	30W165 Estes	0.67	718	44.38	674.29	44.38	674.29	43.42	675.25	43.29	675.37			37.58	681.08
4	30W180 Estes	0.58	719	44.00	675.58	44.00	675.58							37.38	682.21
5	30W210 Estes	1.50	716	41.79	675.71	41.79	675.71							35.54	681.96
6	30W221 Estes	1.08	719	44.13	675.96	44.13	675.96							37.58	682.50
7	3S570 Briggs	0.88	716	42.17	674.71	42.21	674.67	41.67	675.21	41.67	675.21	40.50	676.38	36.00	680.88
8	3S534 Briggs	0.42	717	42.75	674.67	42.79	674.62							36.50	680.92
9	3S465 Briggs	0.50	720	44.50	676.00	44.50	676.00	44.08	676.42	43.79	676.71	42.75	677.75	38.25	682.25
10	3S460 Briggs	0.63	721	47.17	674.46	47.17	674.46							40.75	680.88
11	3S435 Briggs	1.15	718	45.42	673.73	45.42	673.73							37.75	681.40
12	3S430 Briggs	0.38	723	47.29	676.08	47.33	676.04							41.13	682.25
	Well 13 Pumping Rate (gpm):			995	995	995	995	0	0	0	0	0	0	0	0

Stick-up* = Distance in feet from ground level to top of well casing
Ground Elev.** = Elevation in feet above sea level of the ground at the well.
DTW^ = Depth to Water in the well measured in feet below top of casing.
ELV^^ = Elevation of water level in the well in feet above sea level (Ground Elevation + Stick-Up - Depth to Water).
Highlighted values indicate residences monitored hourly during pumping test.