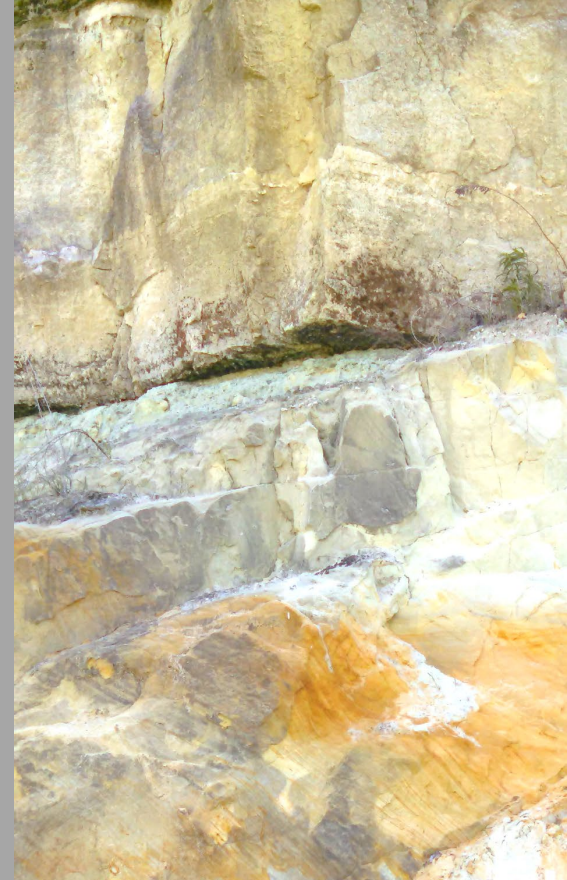


Groundwater Monitoring in Sugar Grove and Campton Townships

Project Conclusions
NWPA TAC Meeting, 11/24/2020

Daniel Hadley (ISWS)
Jerry Elliott (Sugar Grove Water Authority)
Jodie Wollnik (Kane County Water Resources Dept.)



Aquifers in Sugar Grove TWP

Two Major Bedrock Valleys

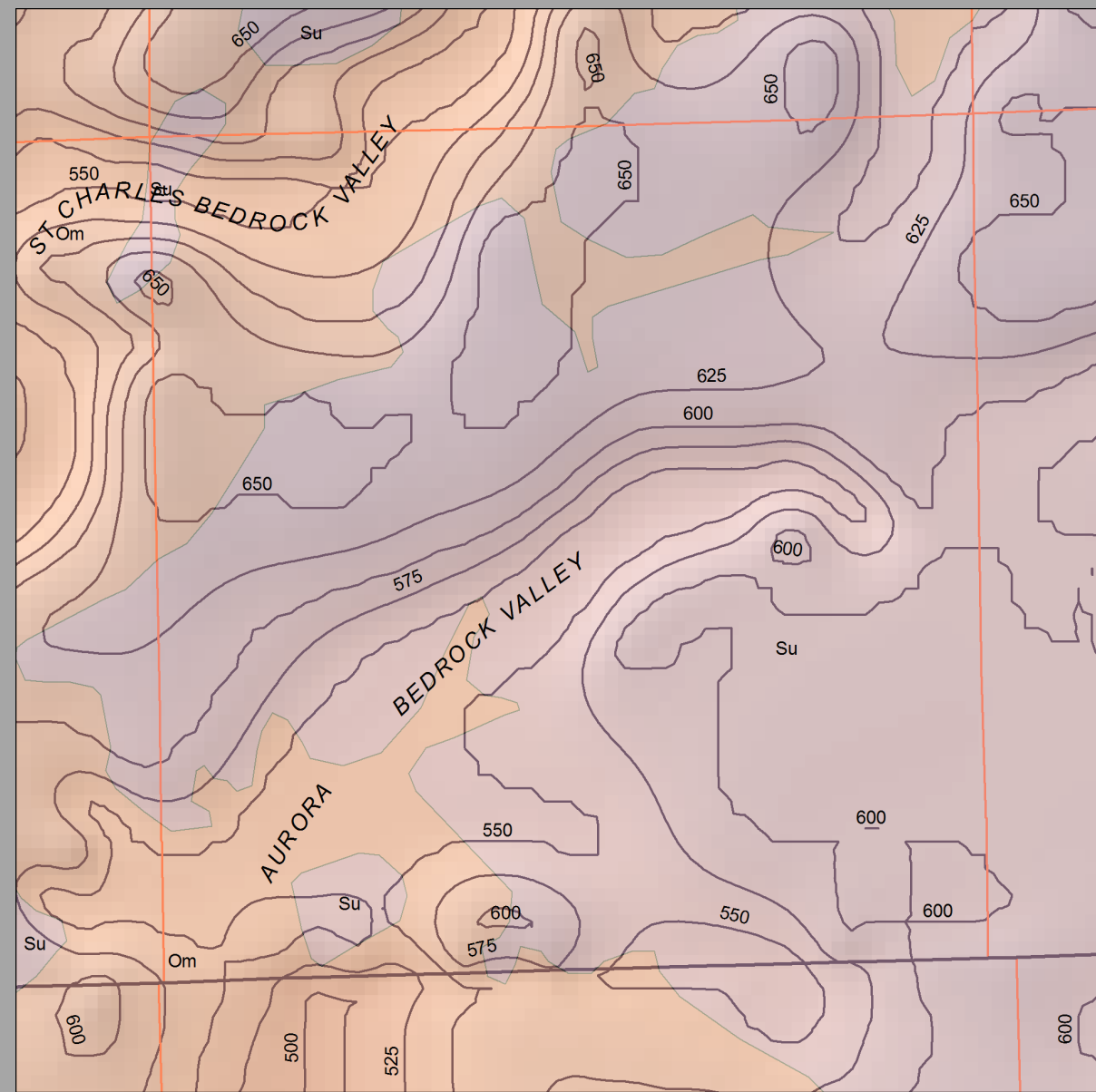
- St. Charles Bedrock Valley
- Aurora Bedrock Valley

-Filled in with glacial sands, gravels, and clays

Shallow Bedrock Aquifers

- Silurian Dolomite
- Maquoketa Shale
- Galena-Platteville Dolomite

Deep St. Peter Sandstone



Geologic Units

- Galena Group
- Maquoketa Group
- Silurian Dolomite

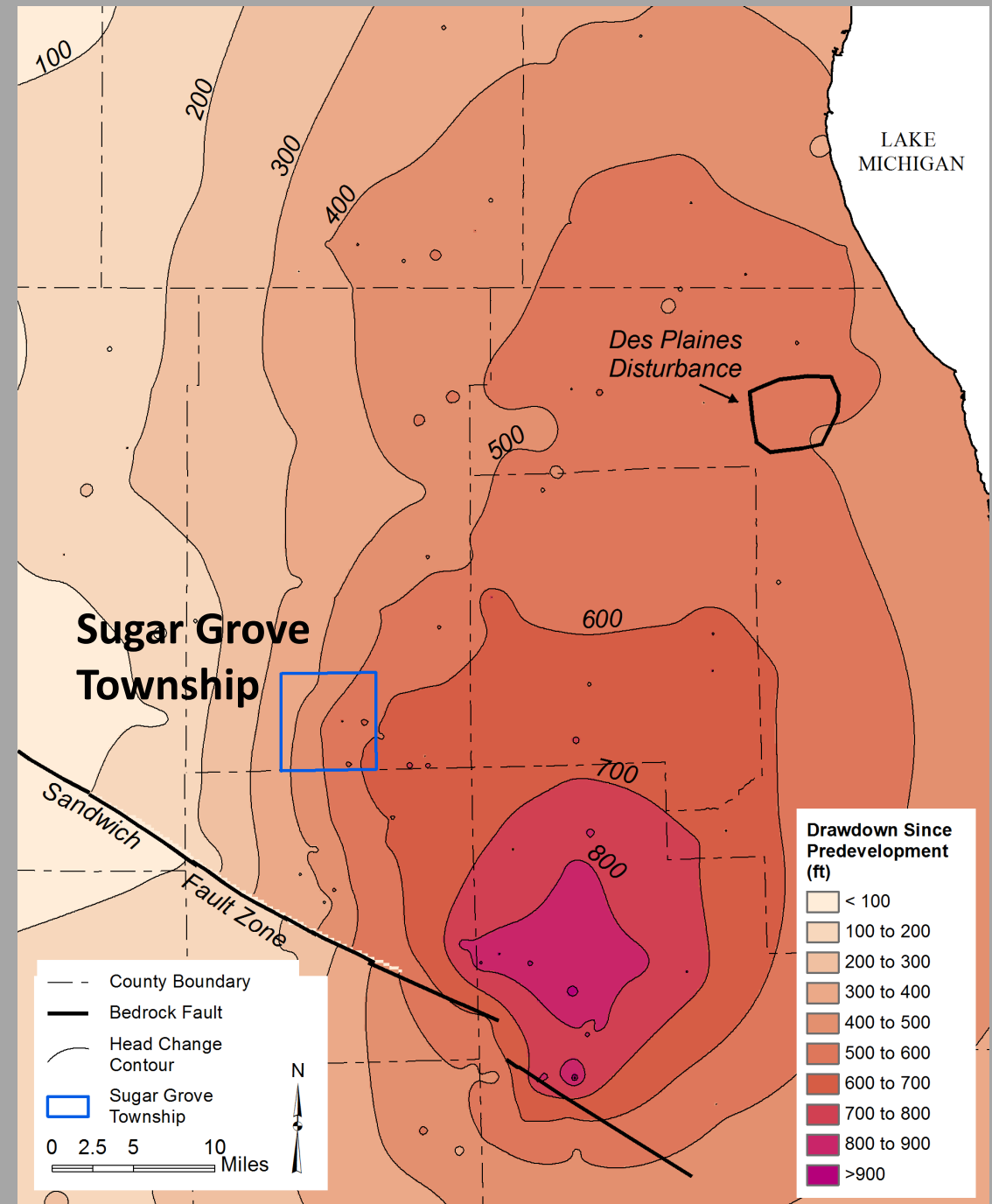
— Bedrock Elevation (ft AMSL)

- County Boundary
- Township Boundary

0 0.5 1 2 Miles

Deep Sandstone Aquifer in Sugar Grove Township

- St. Peter aquifer drawdown is 300-600' in Sugar Grove Township
- Regional drawdown from overuse in Will and Kendall counties
- Sandwich Fault acts as flow barrier, prevents groundwater from readily flowing from the south
- Current trends (population growth) are projected to continue with accompanying rates of decline groundwater decline.
- Shallow aquifers will likely have to be relied upon more in future
- Important to start long-term monitoring now



Sugar Grove Township Monitoring Sites

Six long-term monitoring sites established over 3-year period

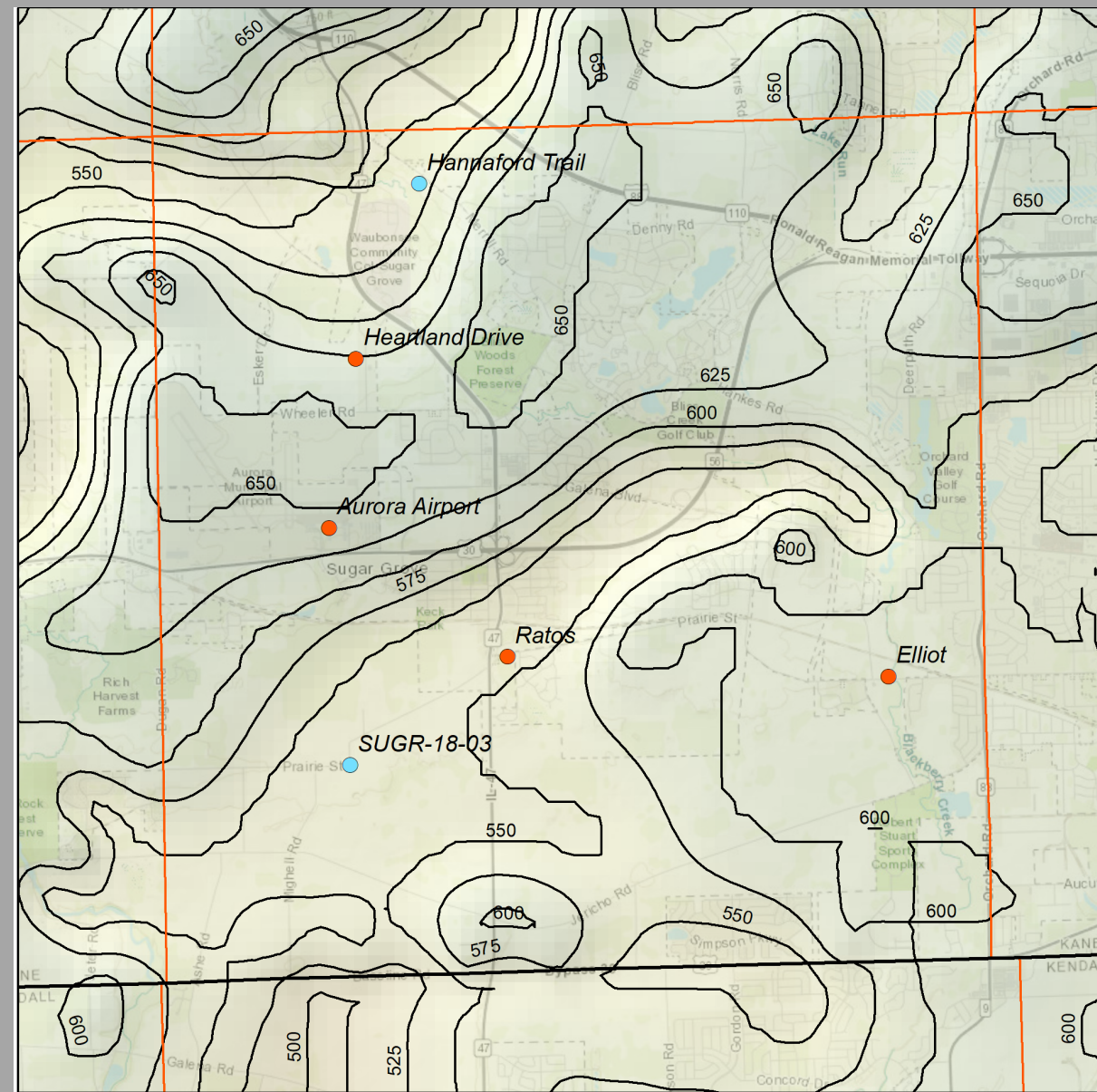
- Elliott Well
- Aurora Airport
- Heartland Drive Well Prairie Street S-Curve Site
- Hannaford Trail
- Ratos Well



Transducer/Telemetry Stations



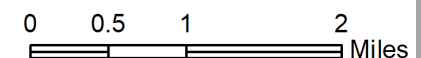
WellIntel Acoustic Sensor



Monitoring Sites

- Sand and Gravel Well
- Shallow Bedrock Well

- ▭ County Boundary
- ▭ Township Boundary
- Bedrock Elevation (ft AMSL)

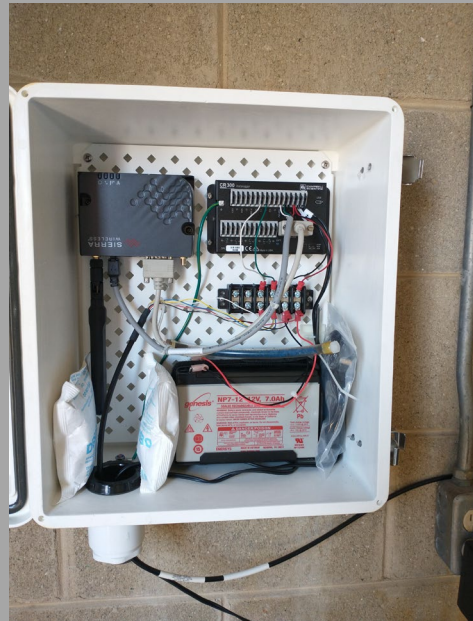




Drilling the S-Curve site



Hannaford Trail site



Aurora
Airport
Site



Ratos Site

Real-time Hydrographs

- Telemetry sites available on ISWS website
- Data is updated hourly
- Interactive hydrographs and data download

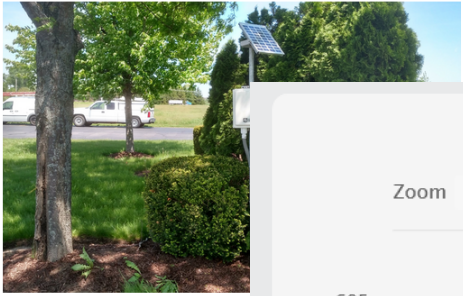
About | Contact | Research | Data | Publications | News | Staff

Groundwater Science

Home / Groundwater Science / Sugar Grove Township

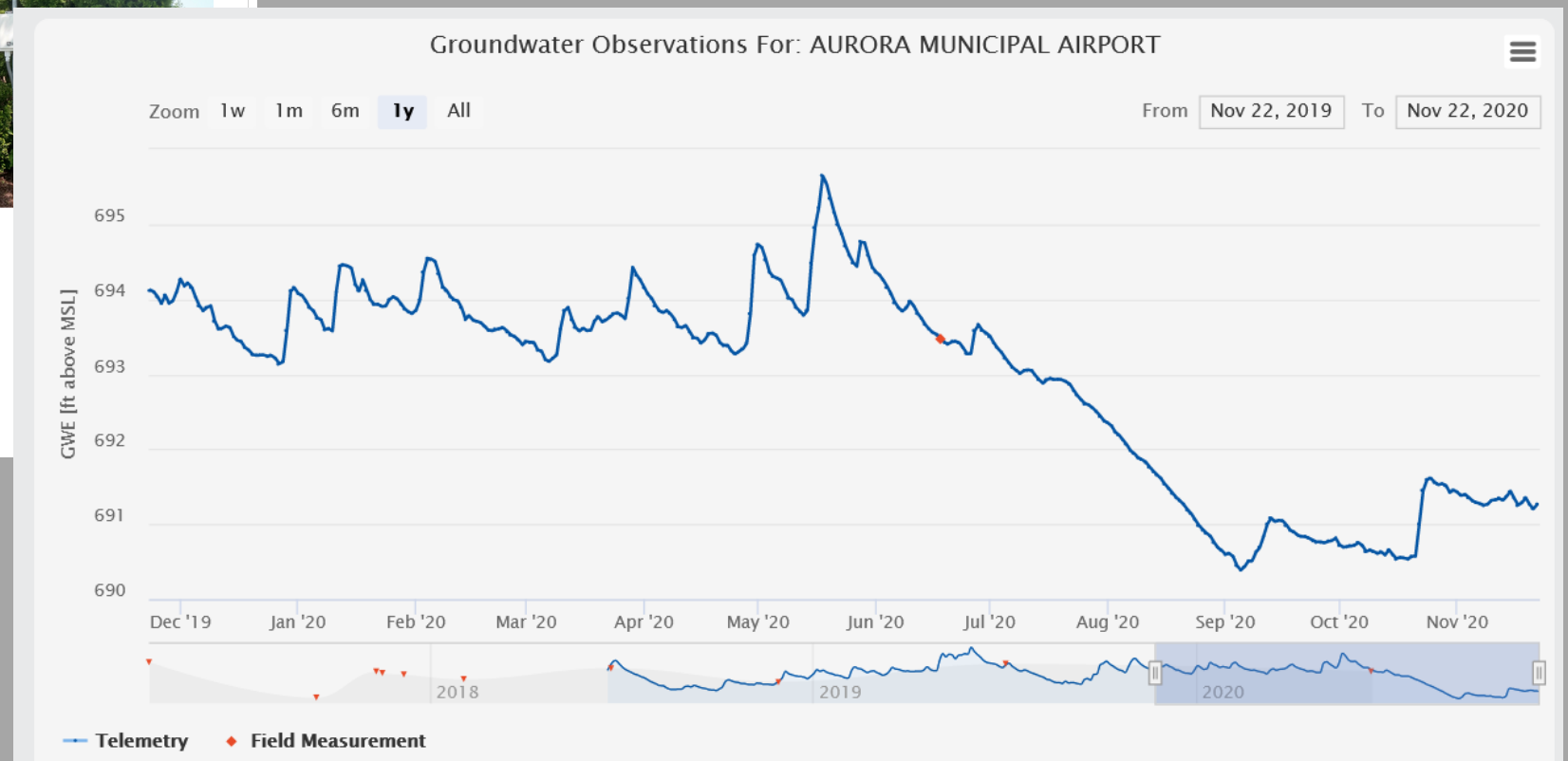
Sugar Grove Township Groundwater Monitoring Network

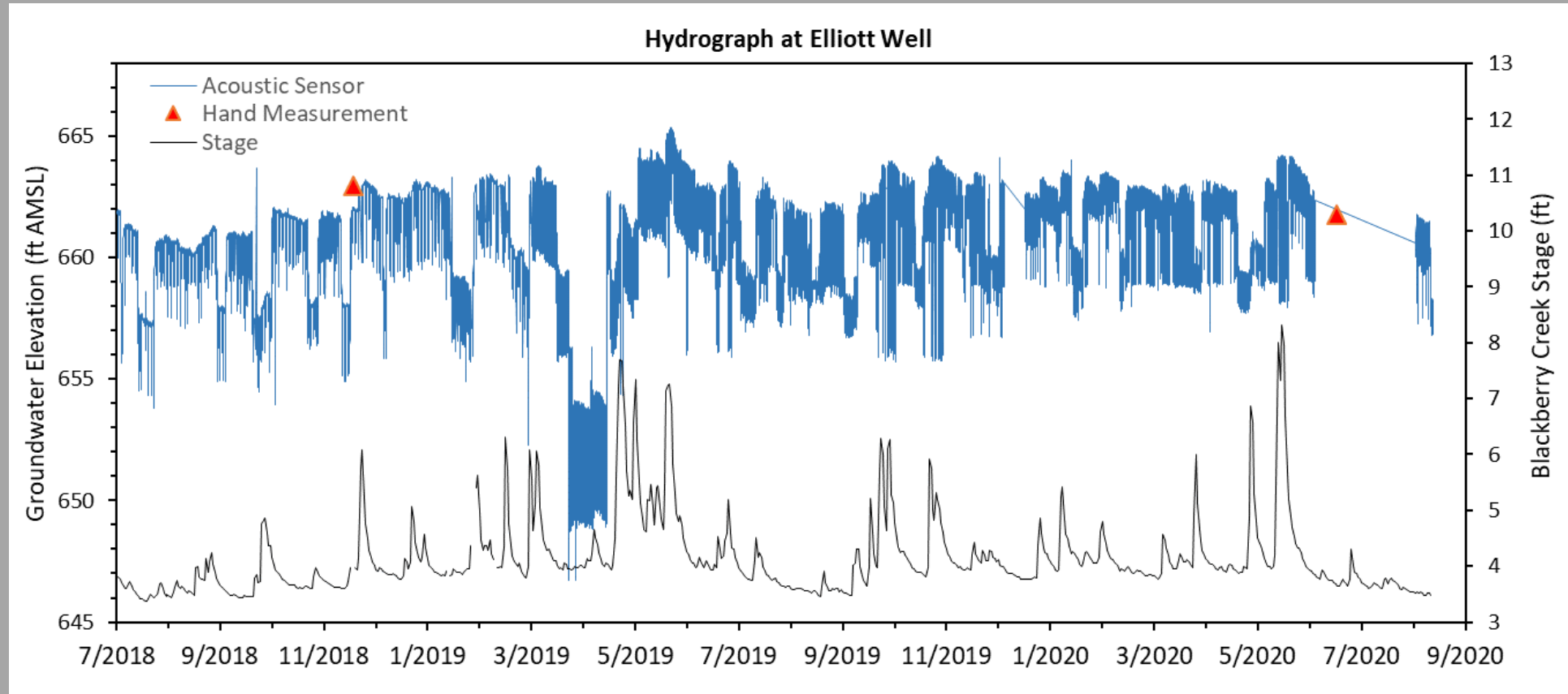
The Illinois State Water Survey, in partnership with the Sugar Grove Water Authority, has established a groundwater monitoring well network in Sugar Grove Township, Kane County. The purpose of this network is to monitor groundwater conditions in the shallow sand and gravel aquifer and the shallow bedrock (Silurian Dolomite) aquifer systems. As the township undergoes development, these data will aid in sustainable groundwater management and future planning of water resources. The following wells are equipped with real-time data. Click on a well to view the hydrograph and download the data.



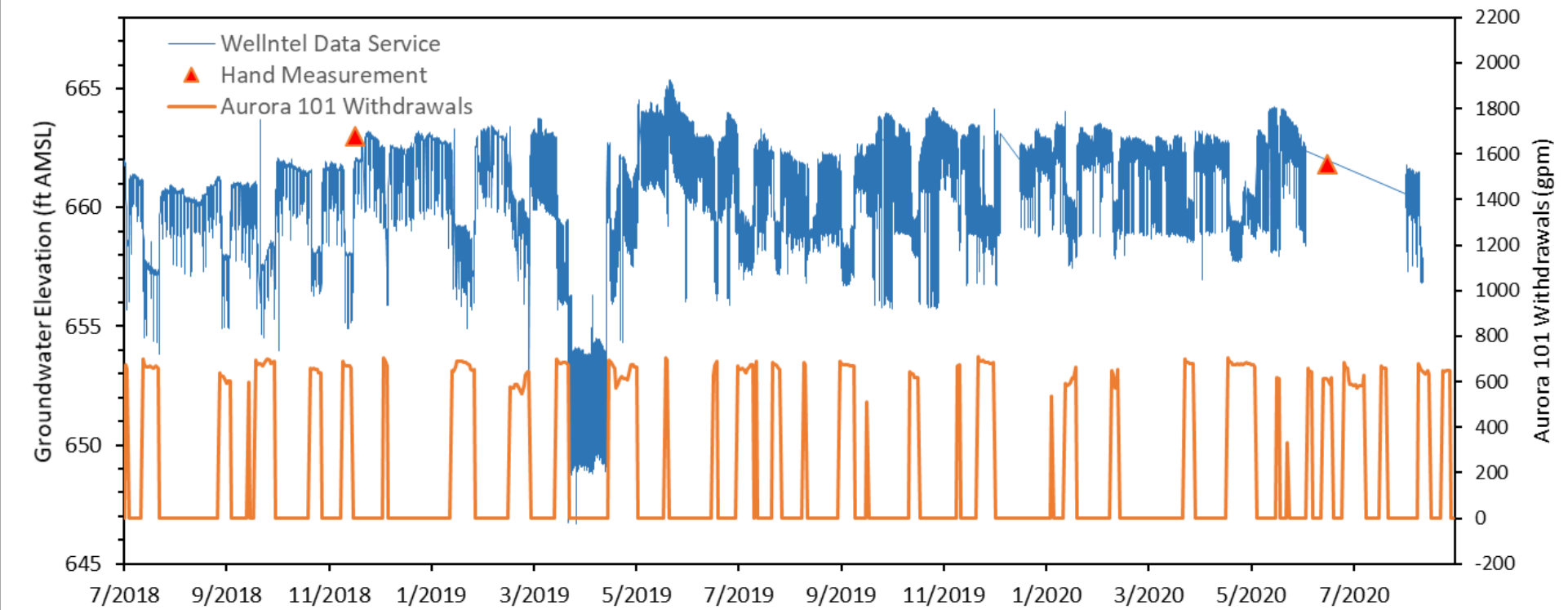
Real Time Monitoring Wells

- [Aurora Municipal Airport](#)
- [Heartland Drive](#)
- [ISGS Hannaford Trail](#)
- [SUGR-18-03](#)
- [Ratos](#)

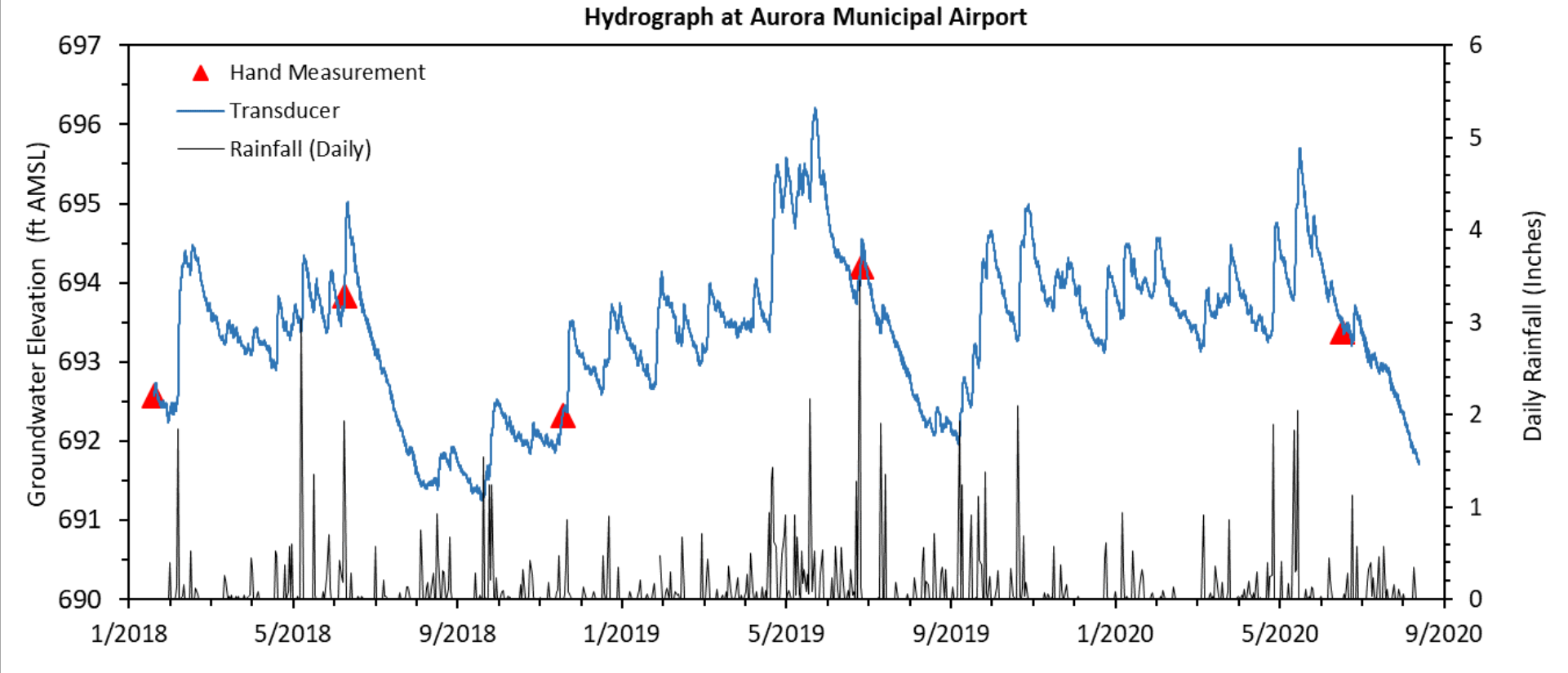




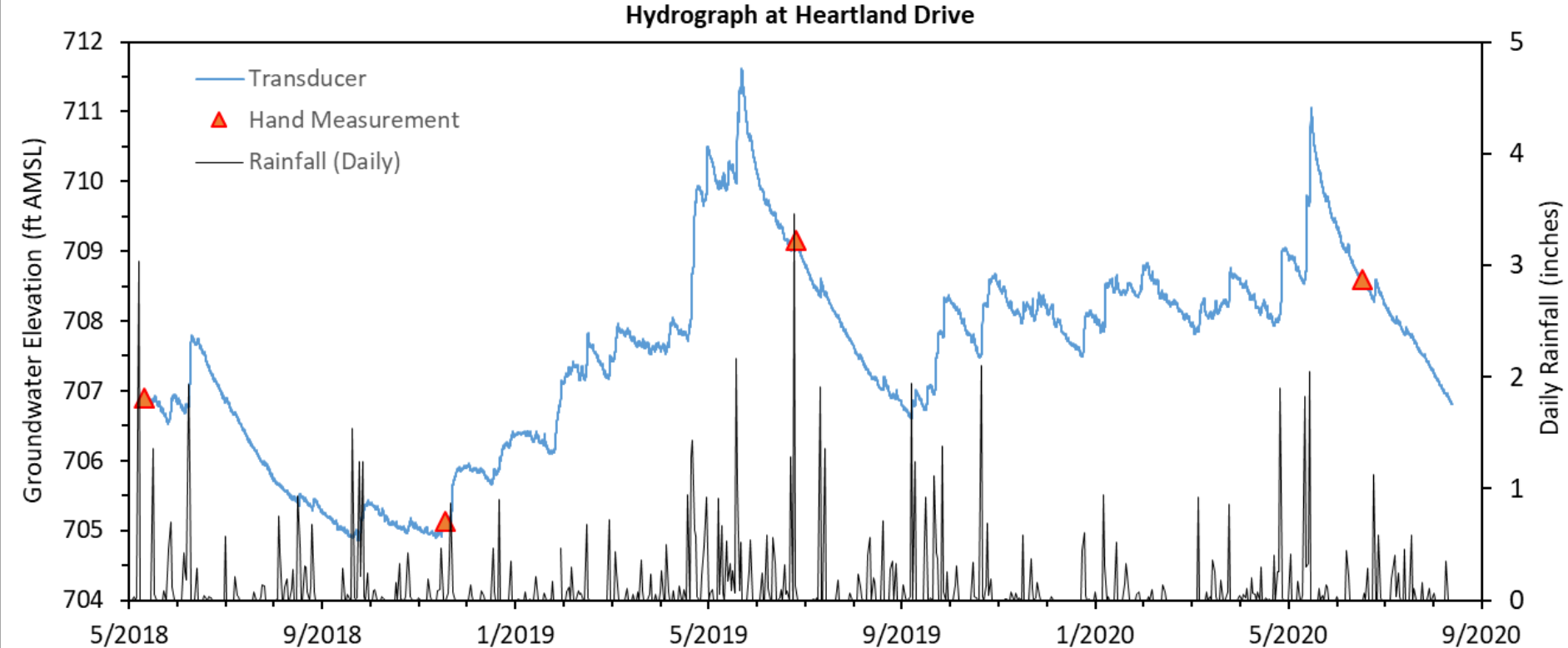
- Depth to water: ~10-15 feet
- Generally mimics Blackberry Creek levels
- Groundwater elevation and stage elevation identical, hydraulically connected
- “Noise” in data due to pumping cycles



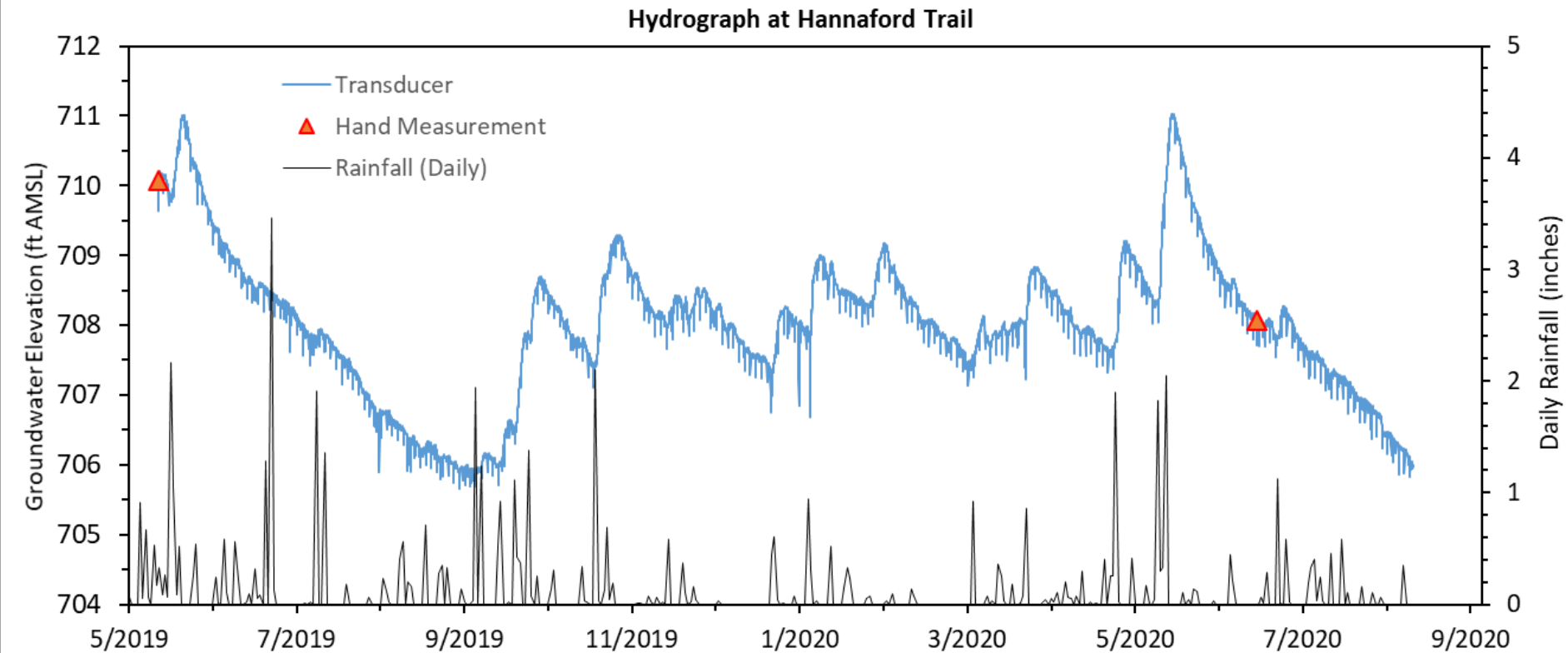
- Also responds to withdrawals from Aurora 101 (sand and gravel well)
- Sand and gravel and shallow bedrock aquifers hydraulically connected in this part of township



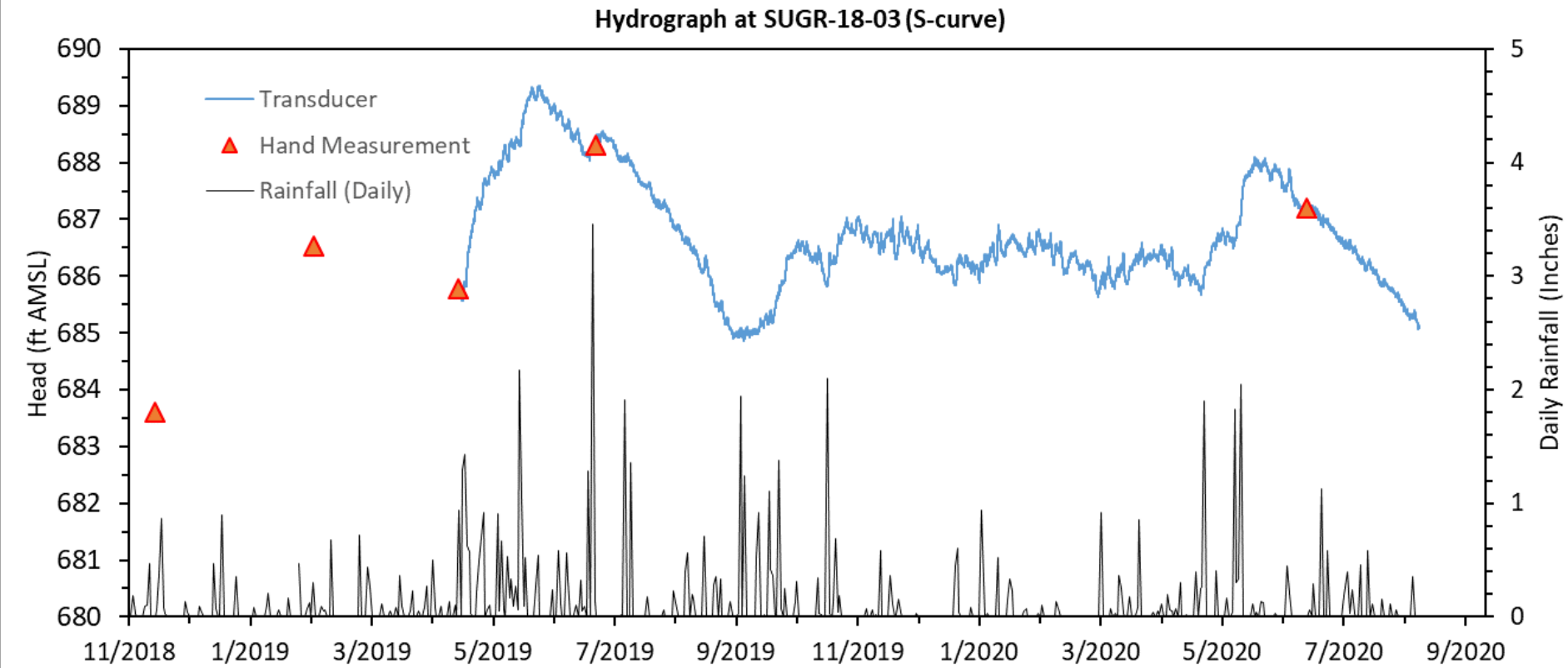
- Depth to water: ~10-15 feet
- Rapid response to large rainfall events
- Seasonality (highest in spring months, drop in summer, recharge throughout winter)



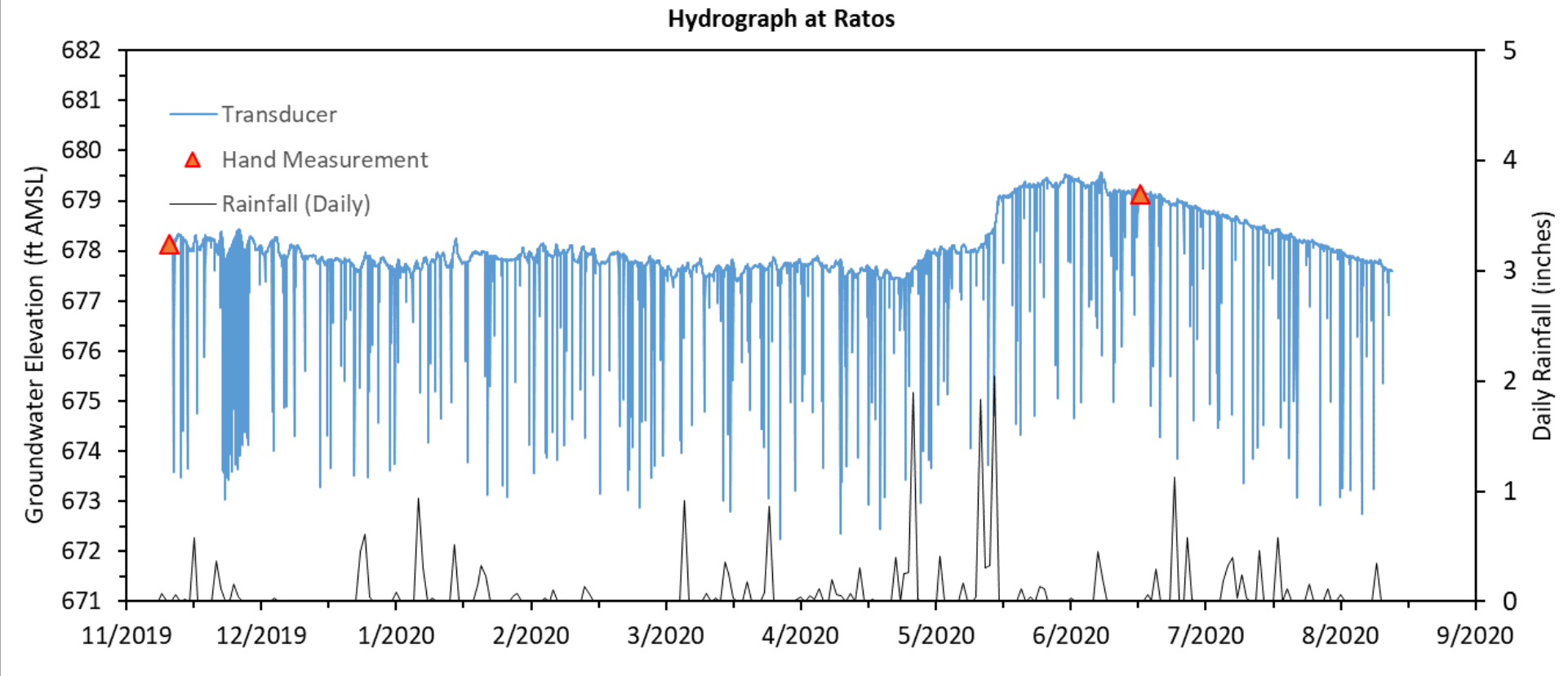
- Depth to water: ~10-15 feet
- Rapid response to large rainfall events
- Seasonality (highest in spring months, drop in summer, recharge throughout winter)



- Depth to water: ~7-12 feet
- Rapid response to large rainfall events
- Seasonality (highest in spring months, drop in summer, recharge throughout winter)
- Daily drawdown due to nearby pumping (Waubonsee Community College?)



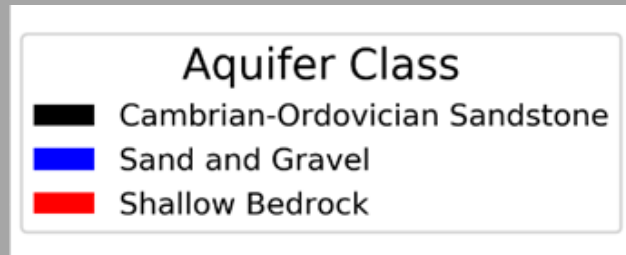
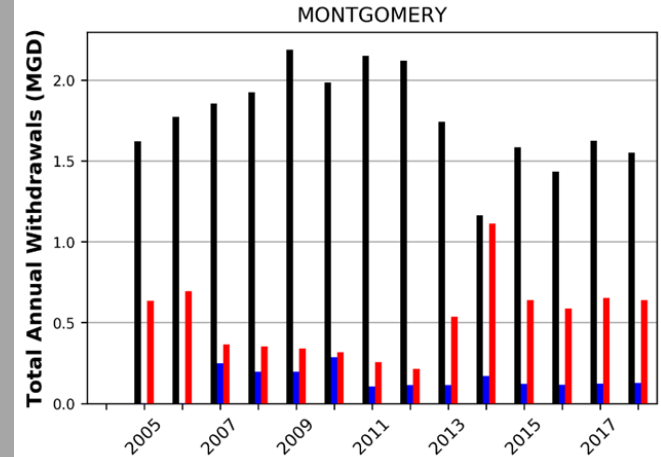
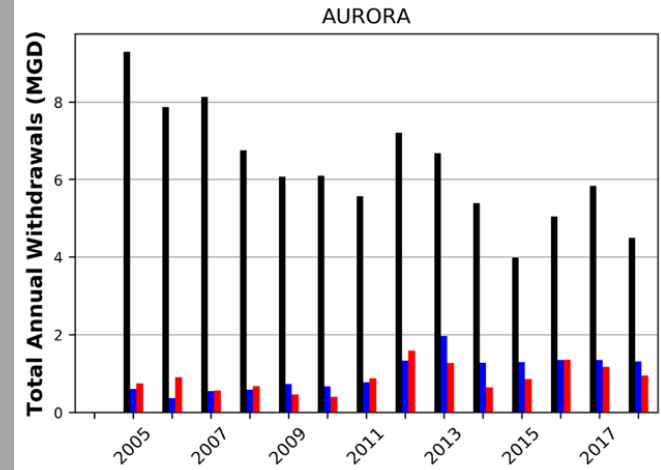
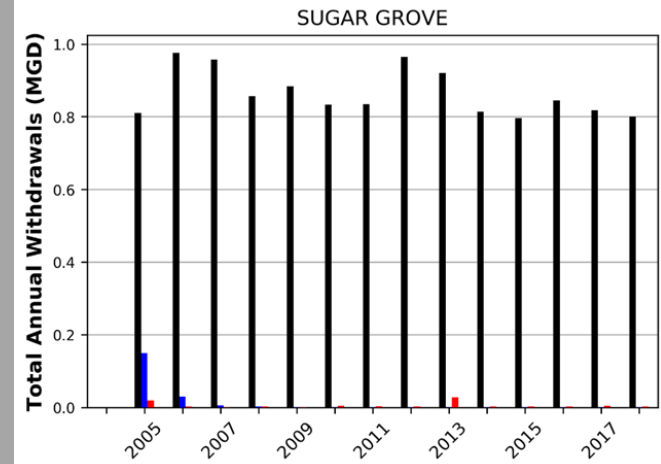
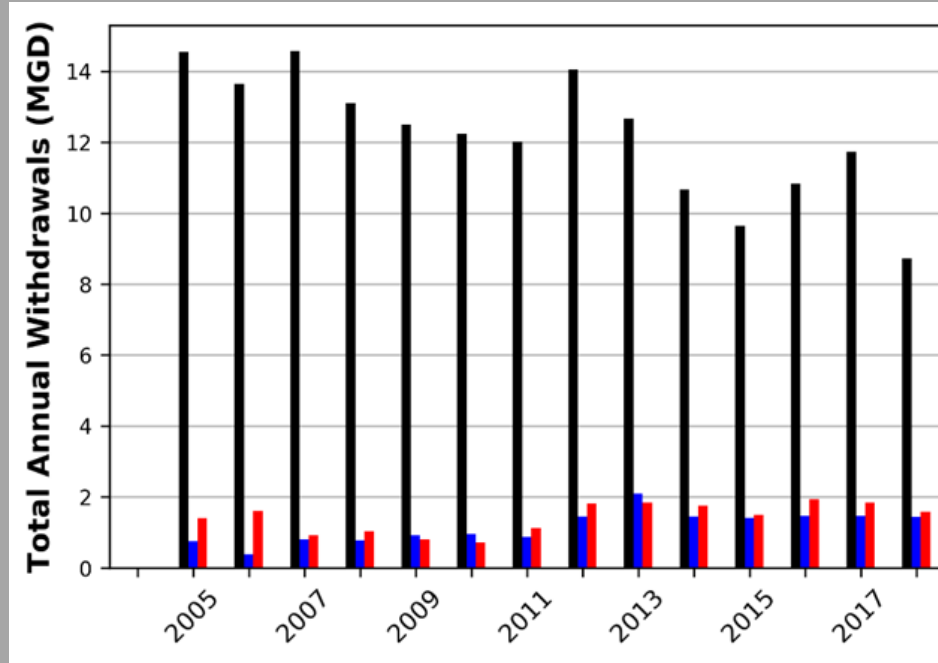
- Depth to water: ~22-28 feet
- Slower response to large rainfall events, more confined
- Seasonality (highest in spring months, drop in summer, recharge in late winter/early spring)



- Depth to water: ~38-40 feet
- Slowest response to large rainfall events, deepest monitoring well
- Seasonality (highest in spring months)
- Sharp drawdowns due to pumping cycles (domestic well)
- Groundwater elevation similar to Mallard Point subdivision, which is prone to basement flooding (area of groundwater discharge)

Groundwater Use in Sugar Grove and Surrounding Region

- Illinois Water Inventory Data from 2005-2018
- Sugar Grove, Aurora, North Aurora, Montgomery, Yorkville
- Sugar Grove uses deep sandstone primarily, steady at < 1MGD
- Overall decline of water use at Aurora (less sandstone use, more Fox River use)
- Overall, groundwater use declining due to Aurora reducing sandstone use
- Slight increase in groundwater use for shallow aquifers
- Currently around 1.5 MGD for each shallow aquifer (3.0 MGD total)



Conclusions (2017-2020)

- Overall withdrawals from the sand and gravel and shallow bedrock aquifers has increased since 2005
- Kane, Kendall, and Will Counties are expected to increase their overall water use by 26%, 51%, and 29%, respectively, out to 2050 (CMAP, 2019)
- Depth to water is very shallow at dedicated monitoring wells, plenty of available head
- Groundwater levels highest in the April and May months (recharge) and decline in the summer and fall months.
- Fast recharge to both the sand and gravel and shallow bedrock aquifers (responsive to rainfall events)
- Blackberry Creek is an important source of recharge to the aquifers
- Shallow groundwater levels are not declining, no clear downward trend yet
- Current withdrawal rates by municipalities, private businesses, or private wells seem sustainable regionally

Future Work (2020-2023)

- Continued water level monitoring
- Water quality sampling project
- Revisit few sites from Kane County 2015 study (Kelly and others, 2015) within the township

Acknowledgments

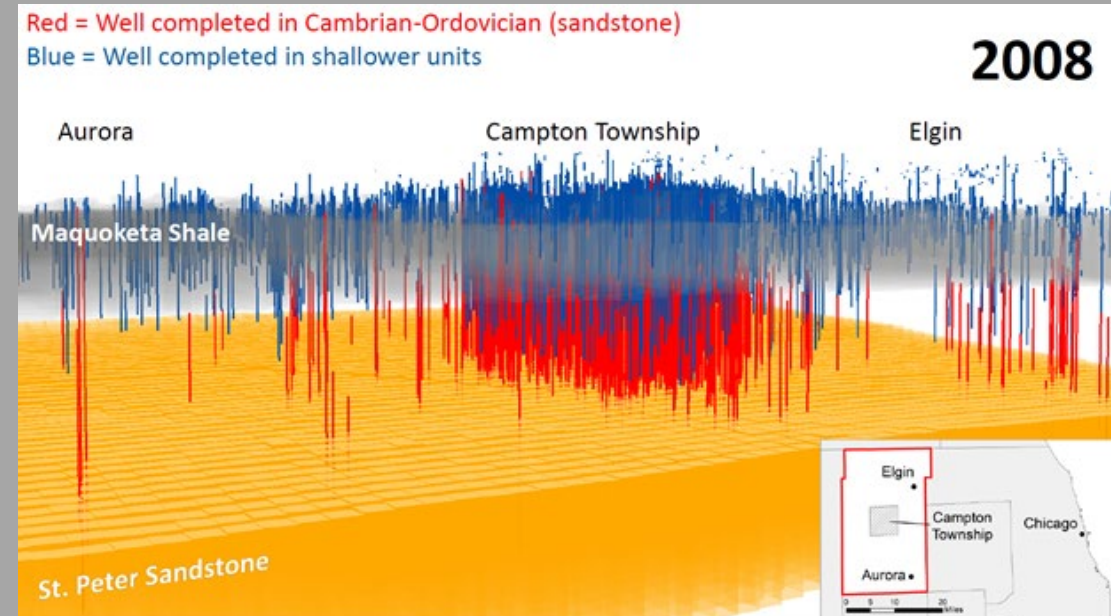
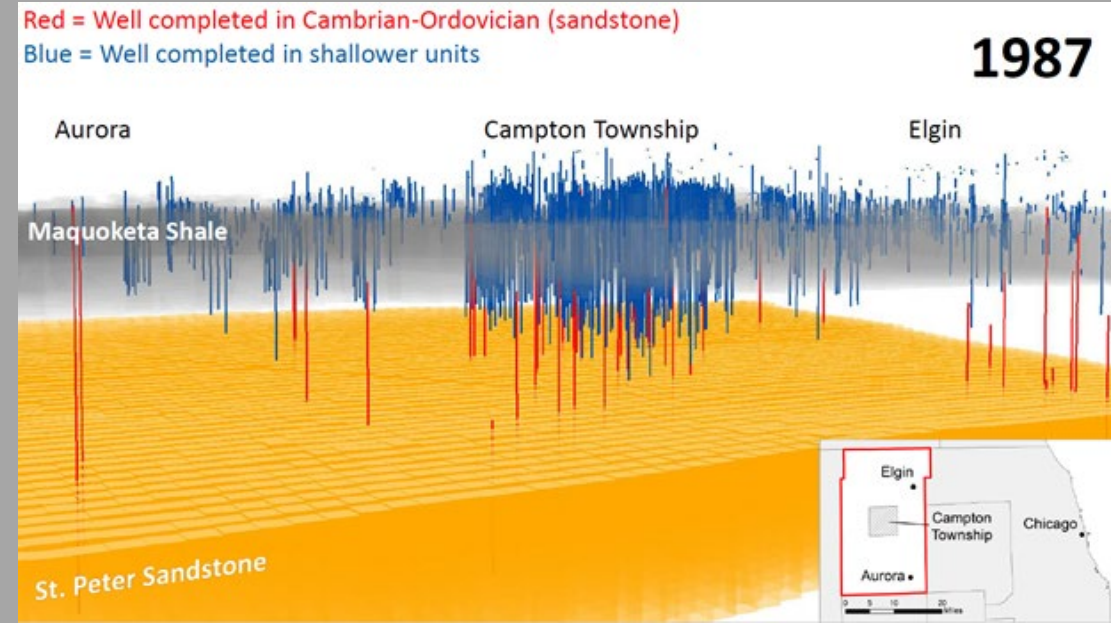
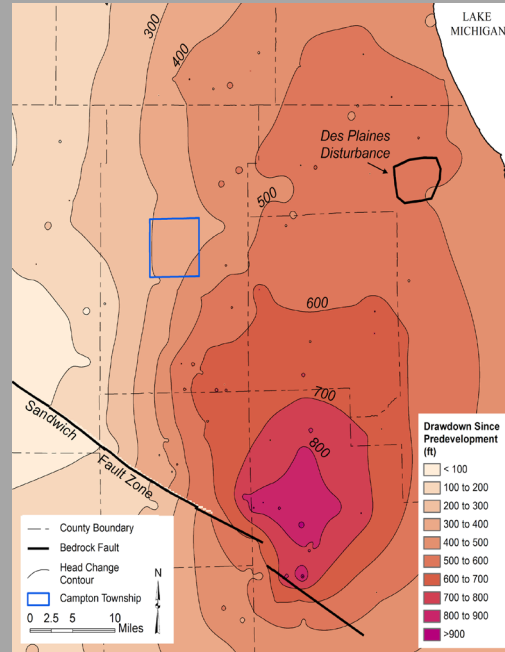
- Sugar Grove water Authority (Jerry Elliott, Dan Nagel, Jeff Babich)
- Kane County Water Resources (Jodie Wollnik)
- Kane County Forest Preserve District
- City of Aurora (Dave Schumacher)
- ISGS Drillers (Jason Thomason and crew)
- USGS funding via the National Groundwater Monitoring Program
- Jim and Mary Ratos

References:

- CMAP. 2019. On to 2050: Regional Water Demand Forecast for Northeastern Illinois, 2015-50. Chicago Metropolitan Agency for Planning FY19-0036, Chicago, IL
- Kelly, W.R., D.R. Hadley, and D.H. Mannix. 2015. Shallow Groundwater Sampling in Kane County, 2015. Illinois State Water Survey Contract Report 2016-04, Champaign, IL

Campton Township Monitoring

- 300-400 feet of drawdown in St. Peter
- High density of private wells
- Increase in number of wells that bypass the confining Maquoketa shale
- Increase in number of St. Peter wells
- Instances of multi-aquifer St. Peter wells dewatering shallower aquifers



Goals:

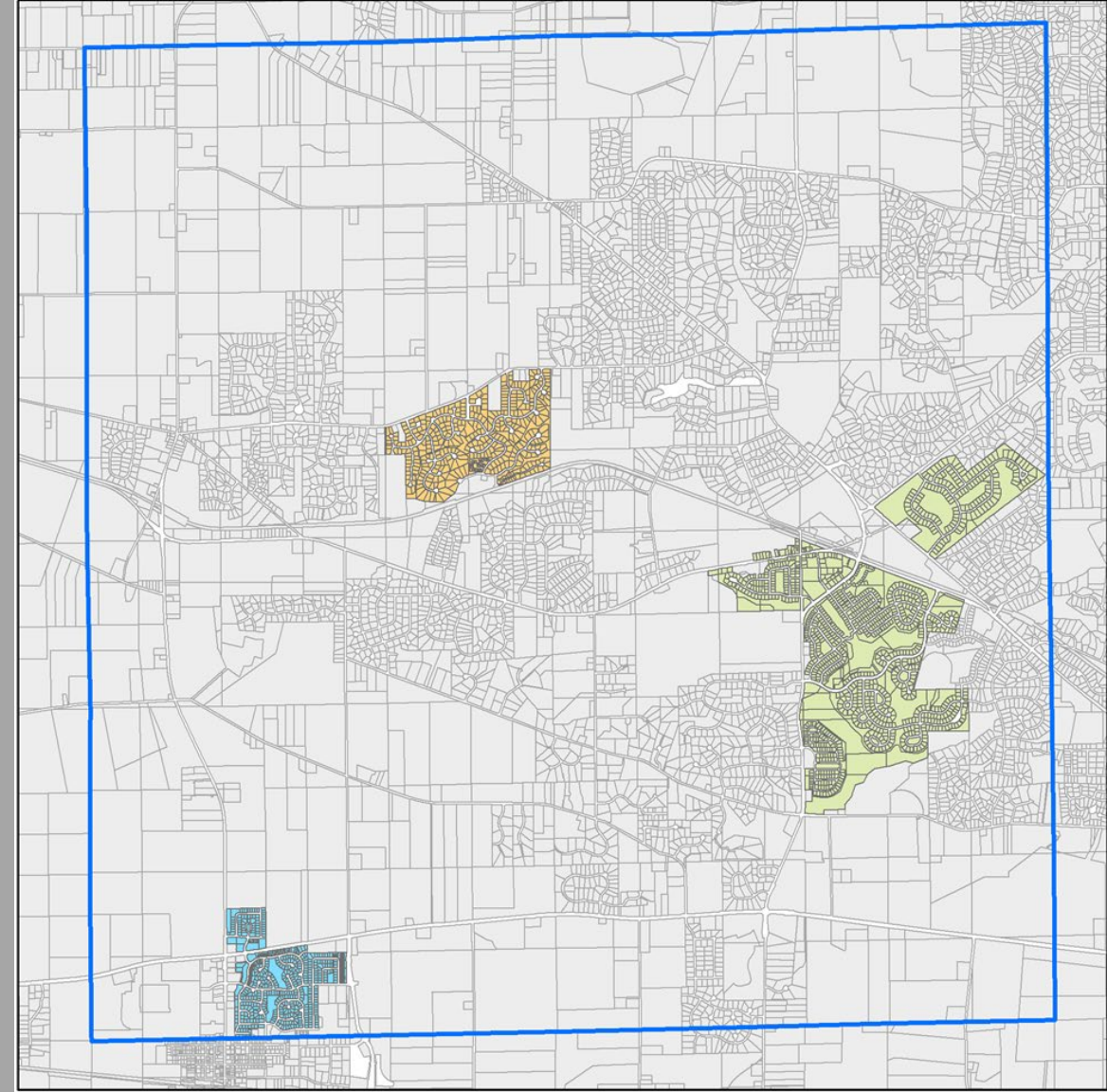
1. Map density of domestic wells (by specific aquifers), infer risk to regions in the township
2. monitor domestic wells, determine extent and magnitude of groundwater flow between aquifers at multi-aquifer wells

Methods- Domestic Well Record Analysis

- Kane County GIS coverages to map areas of municipal use vs private use
- ISGS/ISWS well records
- Python script to compare casing elevations to geologic unit elevations
- Determine open interval of domestic wells (manual checking)
- Map density of wells by aquifer type (well open interval)
- Review water levels by aquifer type (drilling levels)
- Open interval statistics

Incomplete Records

- 3,946 domestic/agricultural parcels not on municipal water
- Assuming one well per parcel
- 2,113 well logs with casing/geologic information
- Therefore, only have reliable records for ~53% of Campton wells



Explanation

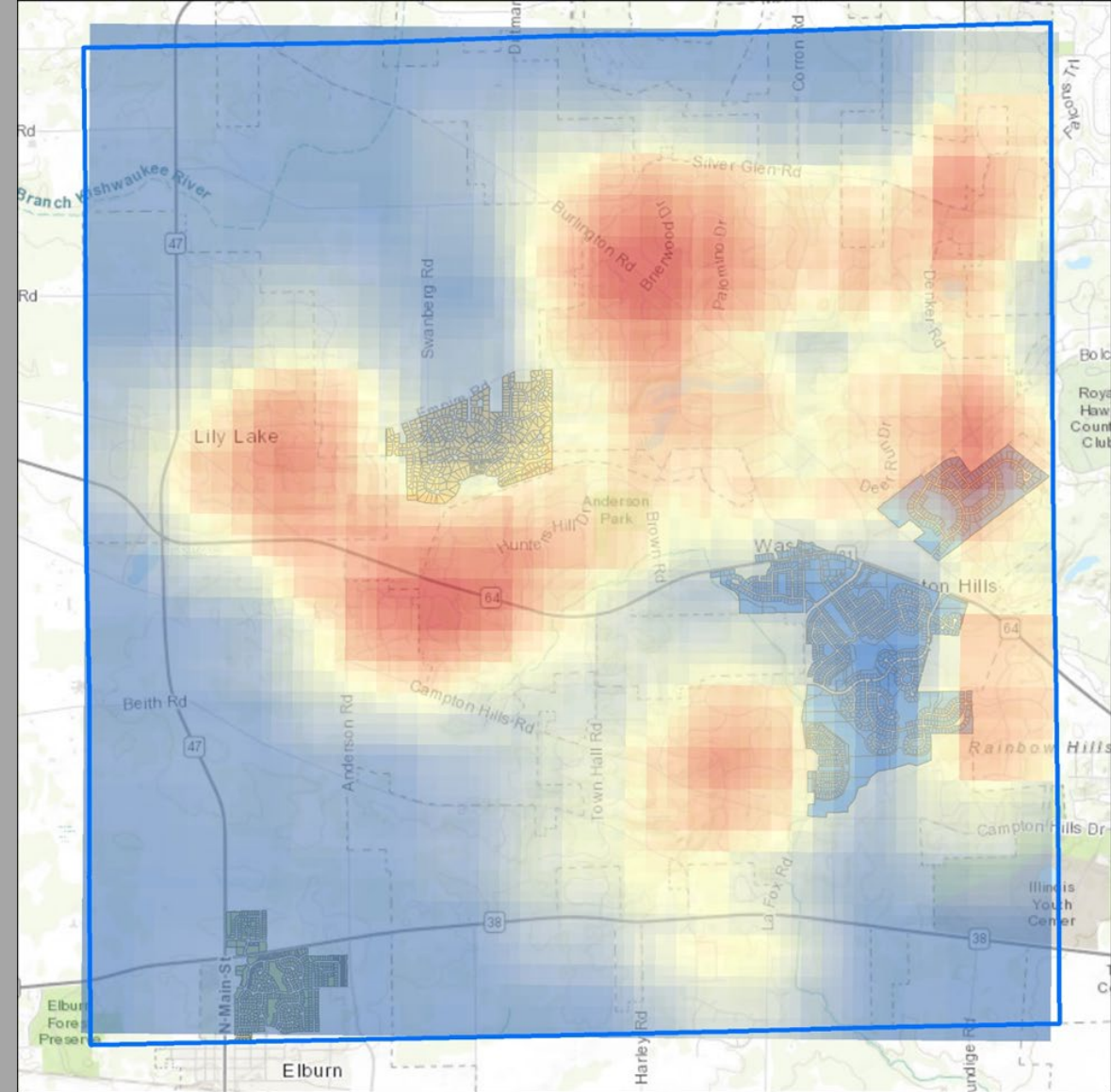
-  Township Boundary
-  Wasco Sanitary District Parcel
-  Windings Subdivision Parcel
-  Elburn Parcel
-  Self-Supplied Parcel



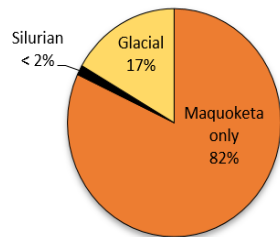
Results- Domestic Well Records Analysis

- Heads highest in upper aquifers, lowest in St. Peter sandstone
- Surprising number of Maquoketa wells and St. Peter wells (expected Galena-Platteville to be most common)
- Vast majority deep well open to upper geologic units
- 17% of Maquoketa wells also open to glacial sands
- 82% of Galena-Platteville wells also open to Maquoketa shale
- Every St. Peter well is open to upper units, 25% of which bypass Maquoketa shale
- “Swiss cheese” effect on the Maquoketa Shale, bypassing of aquitards

Deepest Aquifer Wells are Open to	Number of Wells	Percentage of Wells	Average Depth to Water (ft) when Drilled	Min Depth to Water (ft) when Drilled	Max Depth to Water (ft) when Drilled	Std. Dev. Depth to Water (ft) when Drilled	Average Head (ft AMSL)
Glacial Sand and Gravel	264	12.5%	69	3	170	39	810.5
Silurian Dolomite	12	0.6%	63	30	100	20	835.3
Maquoketa Shale	726	34.4%	81	8	230	41	768.1
Galena-Platteville Dol.	629	29.8%	275	20	550	115	581.5
St. Peter Sandstone	482	22.8%	349	100	550	62	519.4
Total	2113						

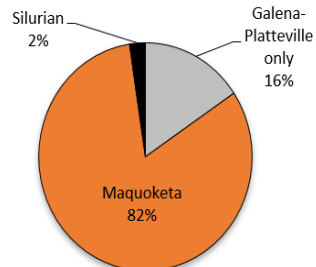


Maquoketa Wells open through:



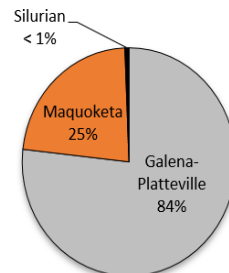
726 Wells Analyzed

Galena-Platteville wells open through:



629 Wells Analyzed

St. Peter wells open through:



482 Wells Analyzed

Explanation

Township Boundary

Wells per Square Mile (All)

High : 225

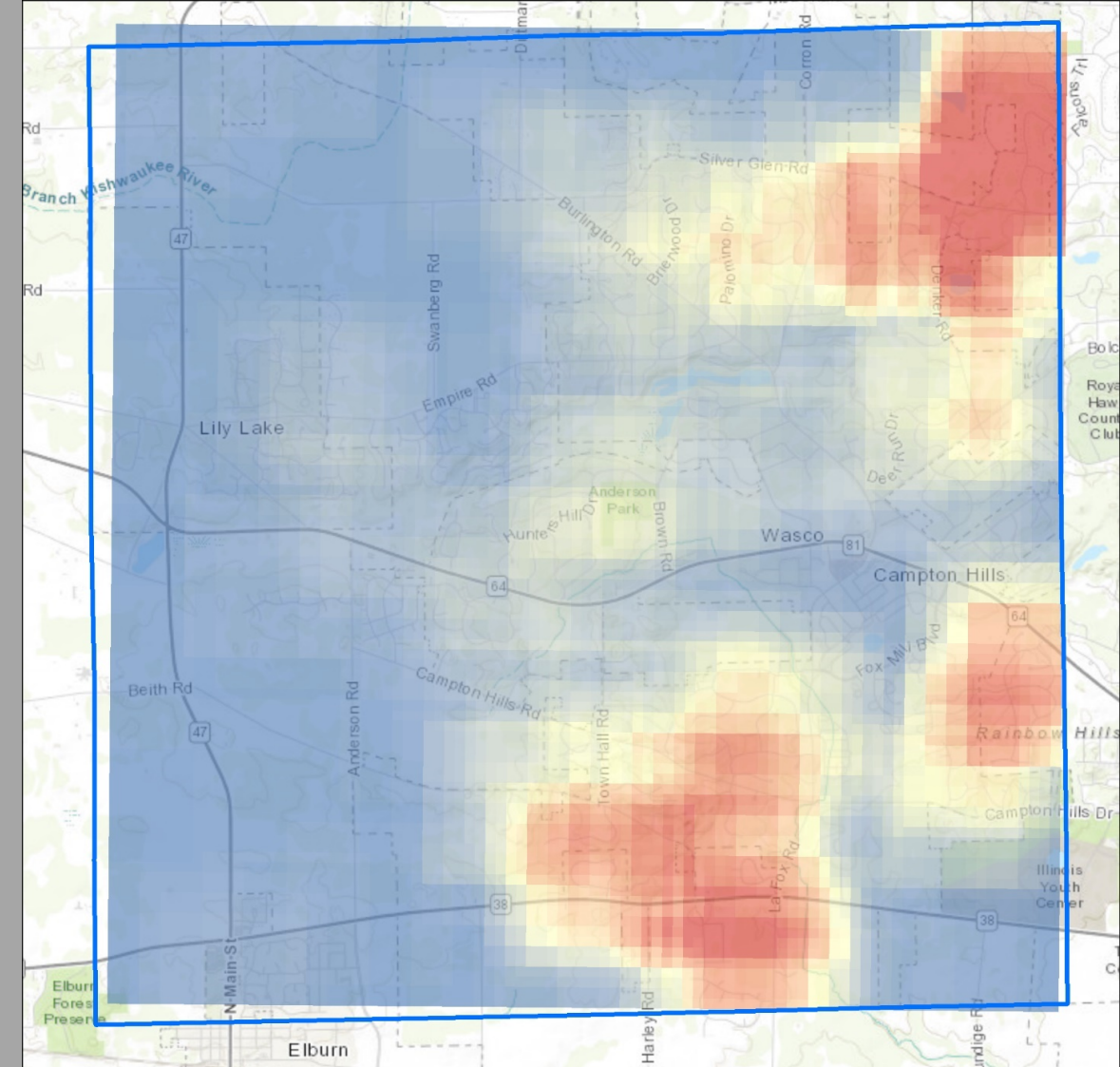
Low : 0



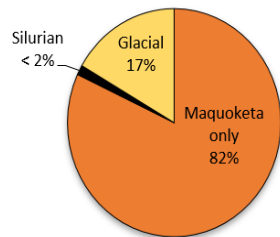
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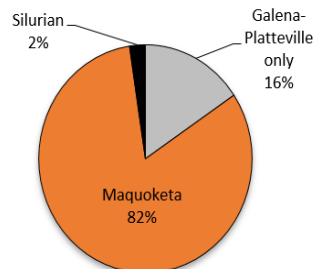


Maquoketa Wells open through:



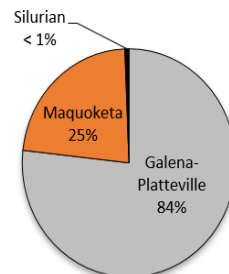
726 Wells Analyzed

Galena-Platteville wells open through:



629 Wells Analyzed

St. Peter wells open through:



482 Wells Analyzed

Explanation

Township Boundary

Maquoketa Wells per Square Mile

High : 104

Low : 0

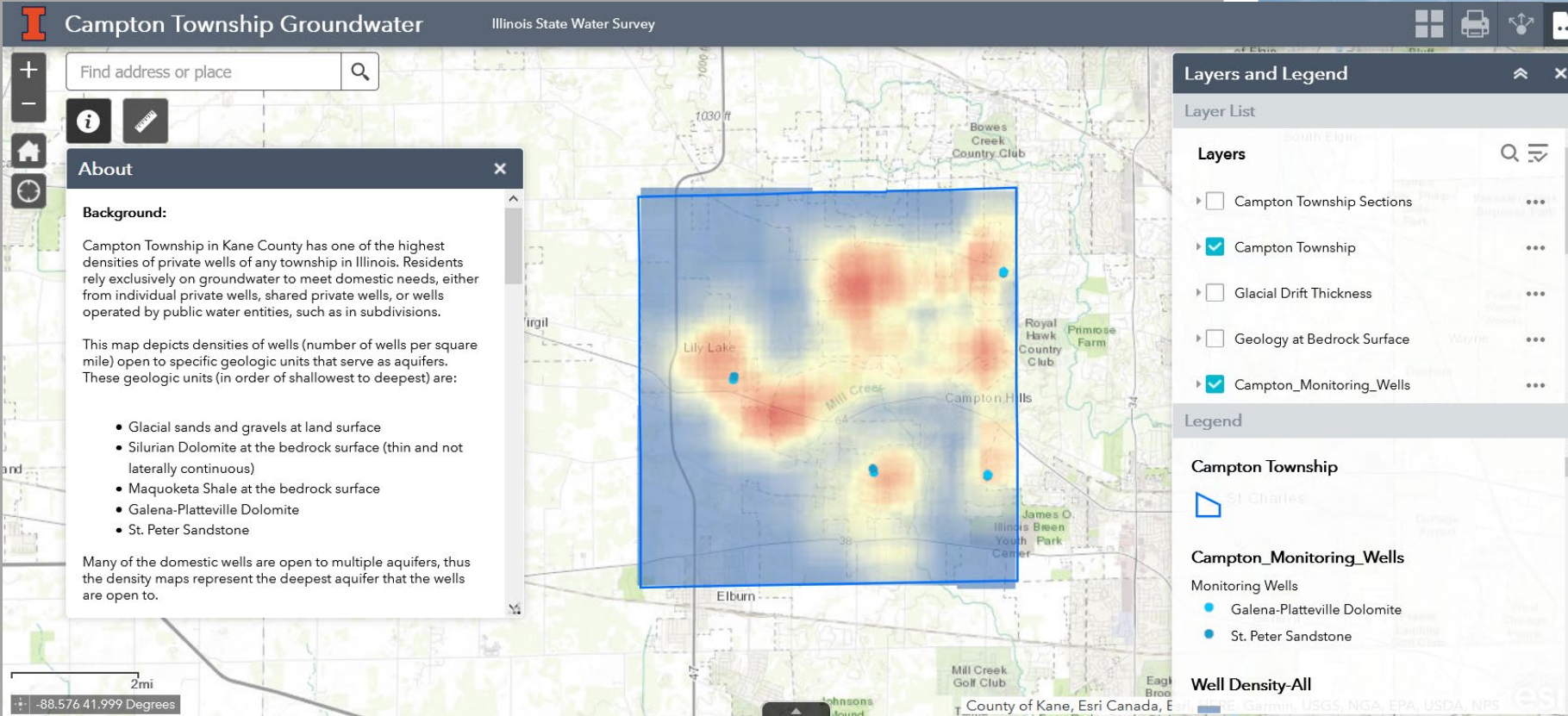
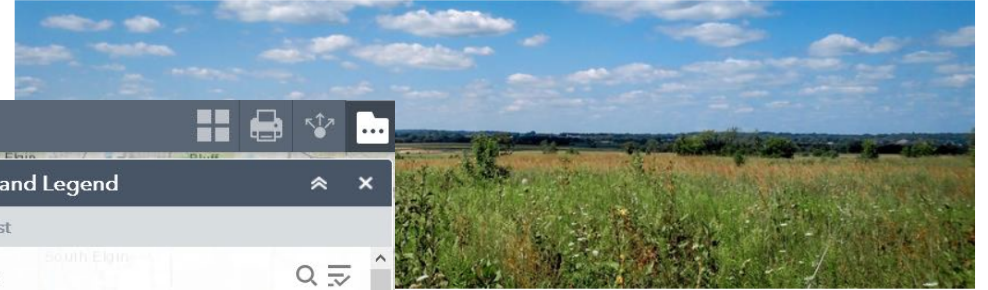
High risk of groundwater flow between upper and lower aquifer units where MQ and GP well density is high, NE corner of township and SE quadrant to lesser extent

Well Density Maps

Groundwater Science

Home / Groundwater Science / Campton Township, Kane County

Campton Township



one of the township in groundwater individual wells in draw the glacial thin

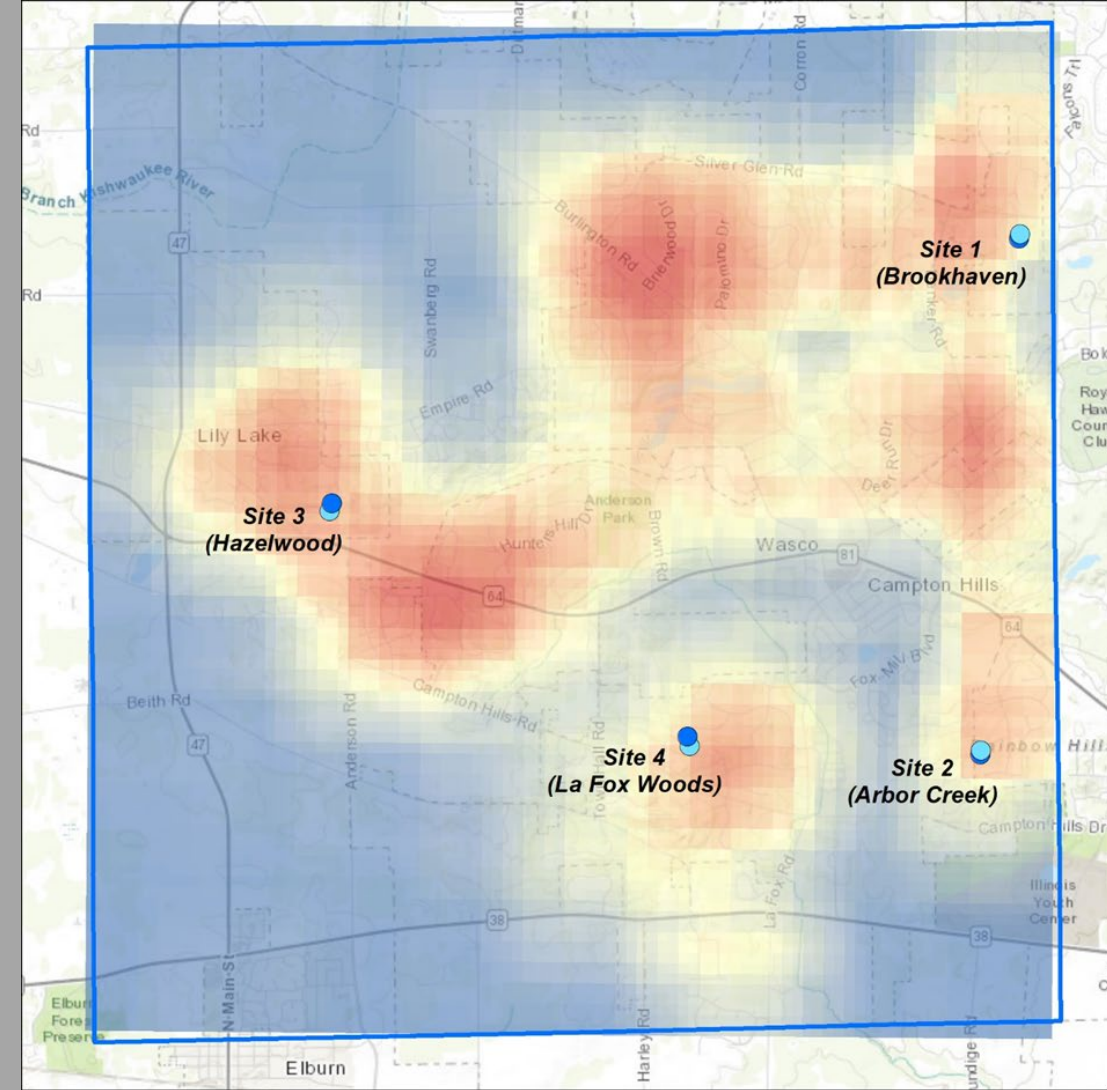
Additional Information

Illinois State Water Survey 2007 Kane County Water Resources Investigations **Executive Summary** and **Final Report**

USGS Report **Hydrogeology Water Use, and Simulated Ground-Water Flow and Availability in Campton Township, Kane County, Illinois**

Methods- Multi-aquifer well flow

- Installed 8 acoustic sensors
- 4 well pairs
- Neighbors or live across street
- One well open to Galena-Platteville, another open to Galena-Platteville and St. Peter
- Compared current levels with levels when drilled



Explanation

 Township Boundary

Monitoring Wells

-  Galena-Platteville Dolomite
-  St. Peter Sandstone

Wells per Square Mile (All)

High : 225

Low : 0

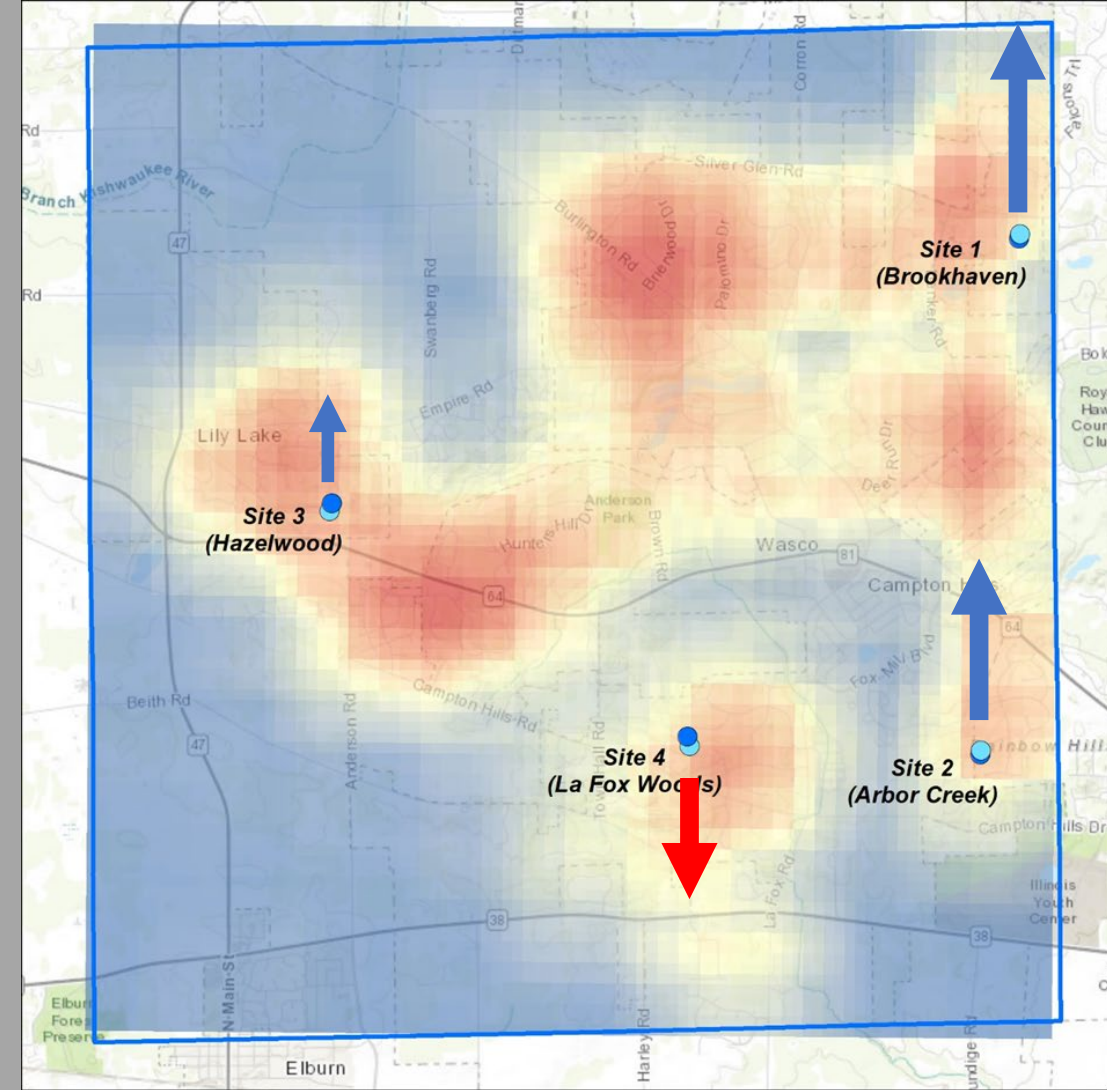
0 0.5 1 2 Miles



Site	Well Depth	Well Open Interval	Year Drilled	Static depth to water (ft) when drilled	Static head (ft AMSL) when drilled	Avg. static depth to water (ft) current	Avg. static head (ft AMSL) current	Head Change (ft)
1a	440	MQ-GP	1995	180	647	85	742	95
1b	680	GP-SP	2002	220	612	53	779	167
2a	600	MQ-GP	1993	350	463	130	683	220
2b	660	MQ-SP	1993	400	416	360	456	40
3a	540	MQ-GP	1992	340	556	320	576	20
3b	700	GP-SP	1996	340	558	325	573	15
4a	520	MQ-GP	1995	340	527	390	477	-50
4b	700	GP-SP	1996	300	547	405	442	-105

Results- Multi-aquifer well flow

- Water levels increased at 3 of 4 well pairs since drilling
- Increase seen in both wells at each pair
- Most apparent at Sites 1 and 2 (site 3 to lesser extent)
- Site 4 is only decrease since drilling
- High density of Maquoketa wells at Site 1 and Site 2 may be allowing groundwater to be flowing through aquitard via open boreholes,
- Increasing recharge to the underlying Galena-Platteville and St. Peter units
- Site 4 decline is a mystery, possible decline due to Wasco Sanitary District withdrawals?



Explanation

Township Boundary

Monitoring Wells

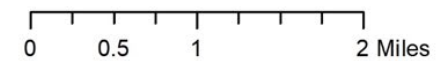
Galena-Platteville Dolomite

St. Peter Sandstone

Wells per Square Mile (All)

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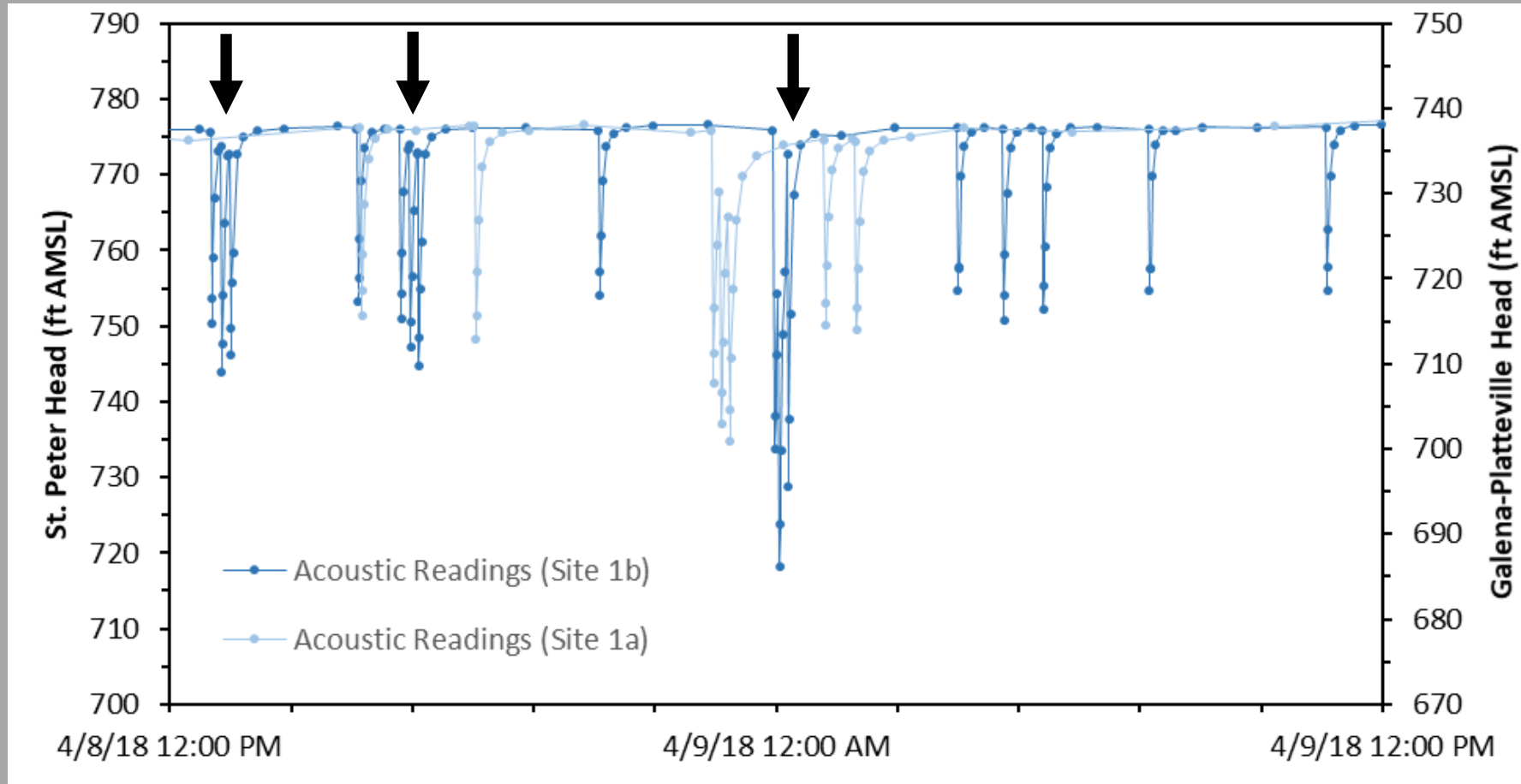
Low : 0



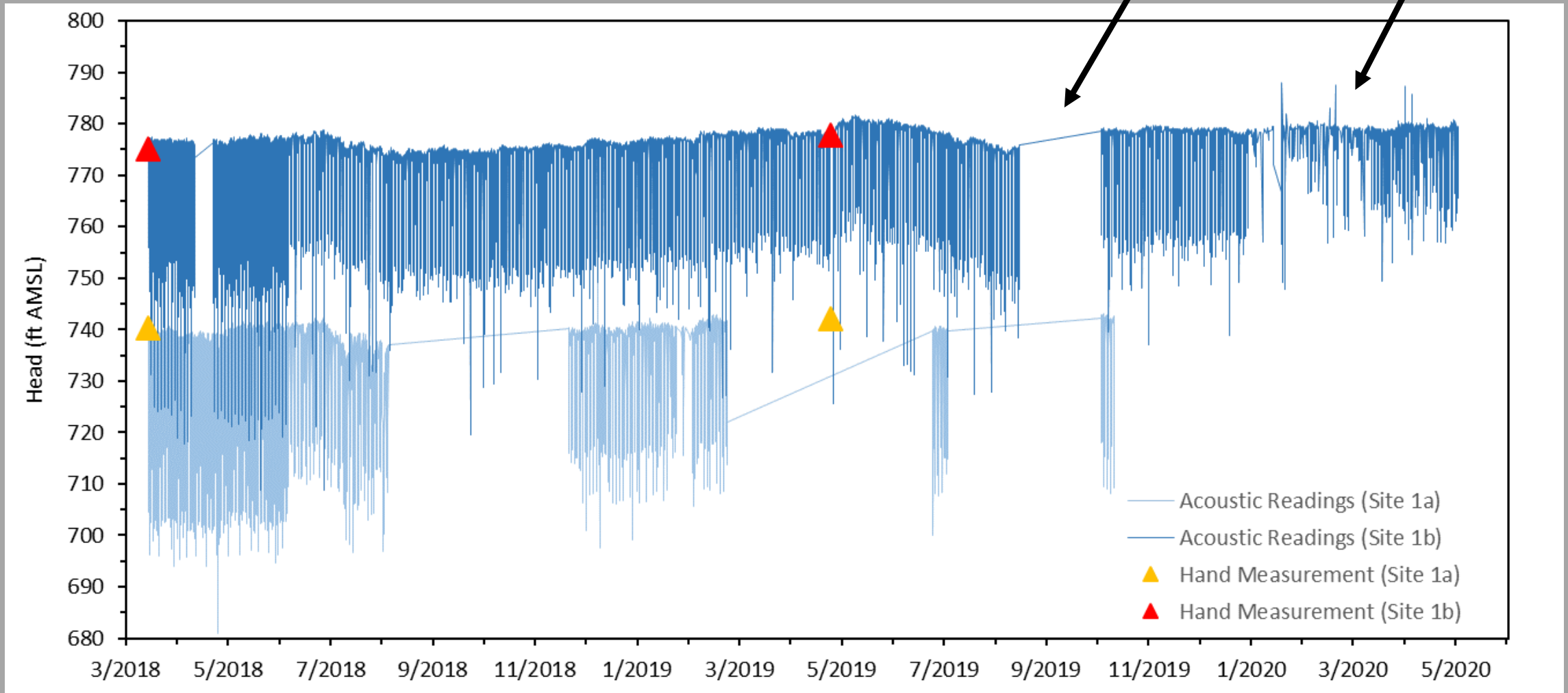
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4a	520	MQ-GP	1995	340	527	390	477	-50
4b	700	GP-SP	1996	300	547	405	442	-105

Results- Multi-aquifer well flow

- Do withdrawals from one affect the other?
 - Not really
 - Many pumping events from one well coincide with timed readings from the other well, no measured drawdown



Representative Hydrograph (Site 1)



- Acoustic sensors can have noise
- Battery life can be short (interruptions to data logging)
- Connectivity issues with homeowners Wi-Fi (data upload)

Conclusions (2017-2020)

- Long open intervals may enhance recharge to deeper aquifer units due to aquitard bypassing (NE corner of township)
- Localized “pockets:” or recharge to deeper units
- Could lead to water quality concerns for deep aquifer (chloride)
- Significant increase in St. Peter heads at most monitoring sites since drilling
- No evidence of St. Peter wells drawing down neighboring GP wells
- Water levels probably change significantly when subdivisions go in (head equilibration) and then are steady thereafter
- Few records of well deepening, no recent complaints as far as inadequate domestic groundwater supplies



Recommendations

- Awareness/enforcement for drillers to minimize length of open intervals
 - Case through sand and gravels if drilling Maquoketa well
 - Case through Maquoketa if drilling deeper well
- Correct/verify well record locations
- Isotope sampling in NE quadrant of township, determine extent that shallow recharge (precipitation) is entering Galena-Platteville and St. Peter units

Acknowledgments

- Kane County Water Resources (Jodie Wollnik)
- Jodie and other Kane County staff for battery replacements (usually in the cold!)
- Homeowners for participations