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# South Bluff Groundwater Study

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# Kansas Turnpike South of Wichita





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# Recent Local Issues







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# Citizen Requests

## Turn on Derby Water Wells

- County paid to run two Derby wells
- Ran four months from 9/2016 – 12/2016
- Cost: \$21,742

## Ask farmers to pump their wells

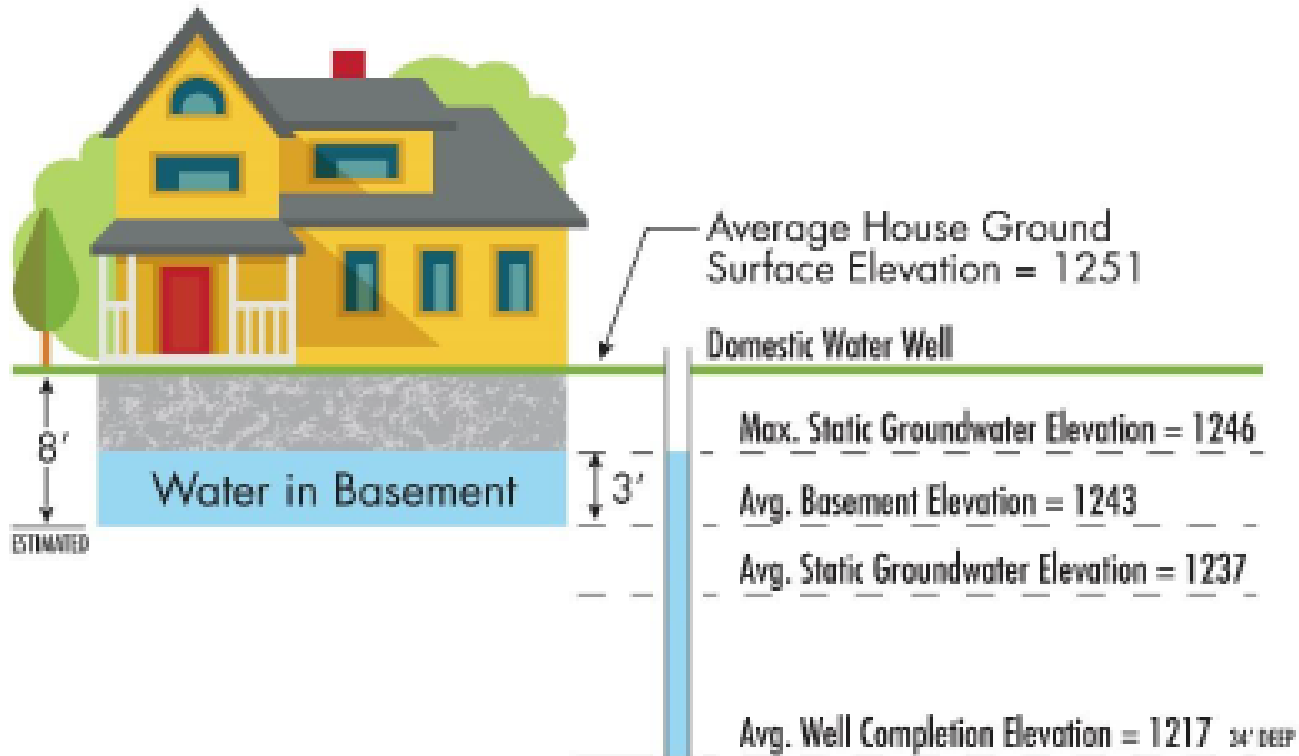
## Asked Sedgwick County for help

- County funded two groundwater studies



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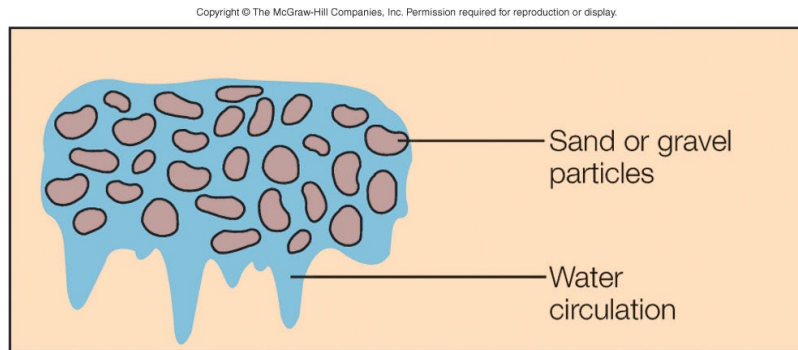
## Surface and Subsurface Elevations Schematic



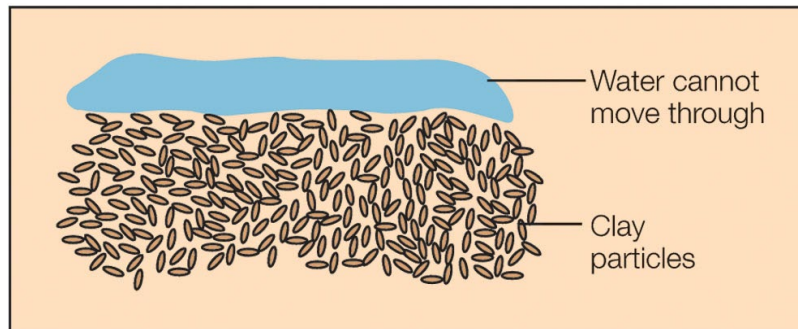
Note: The elevations shown are approximate. Basements were assumed to be eight feet below ground surface.



# Groundwater Flow



A



B

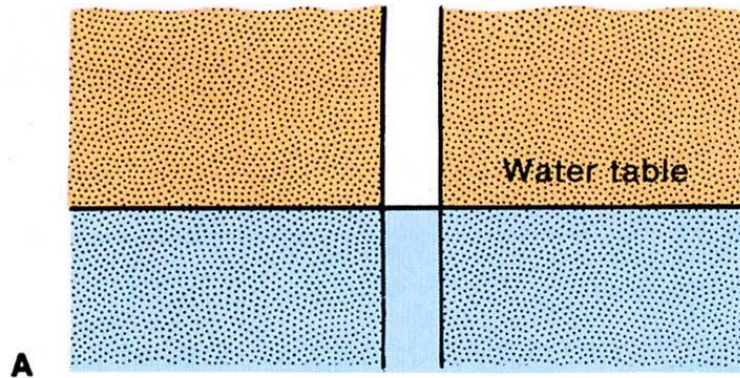
- Sand and gravel
  - Open pore spaces
  - Permeable to water flow
- Clay
  - Low porosity
  - Impermeable when saturated or compressed



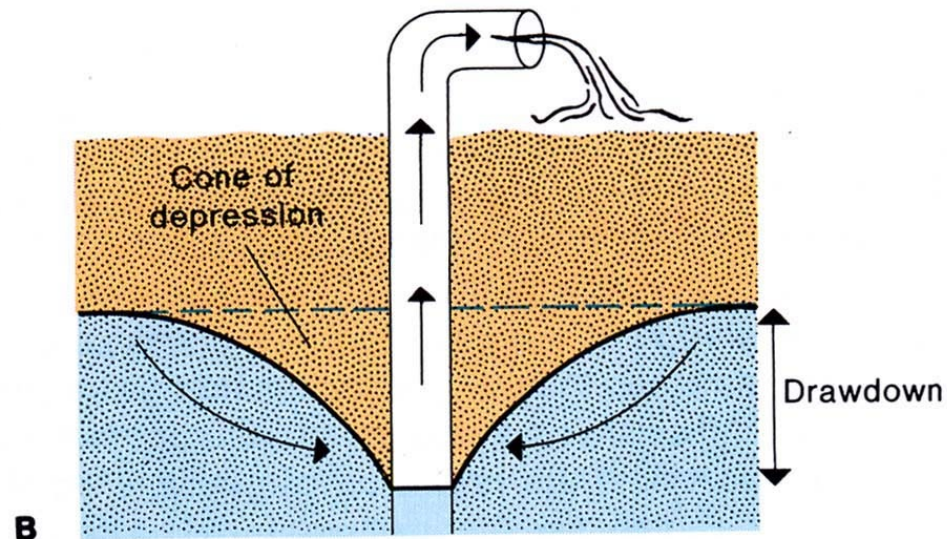
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# Dewatering Wells

Well (not pumped)



Pumping well





# What happens when a well is pumped?

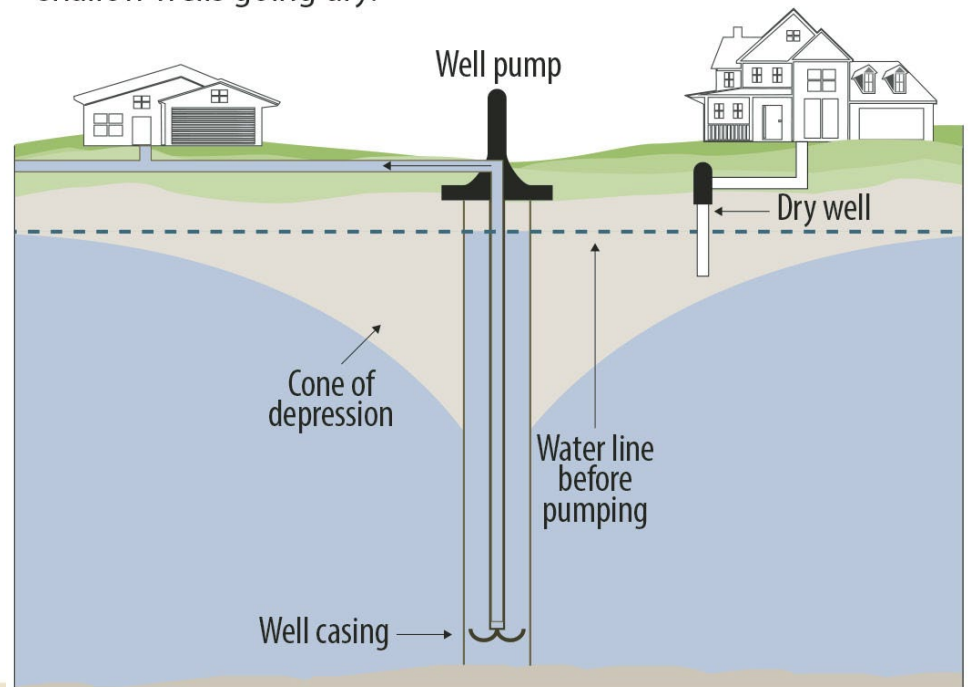
How big is the cone of depression?

Depends on aquifer properties

- Hydraulic Conductivity (K)
- Saturated thickness (how many feet of water)

## A cone of depression

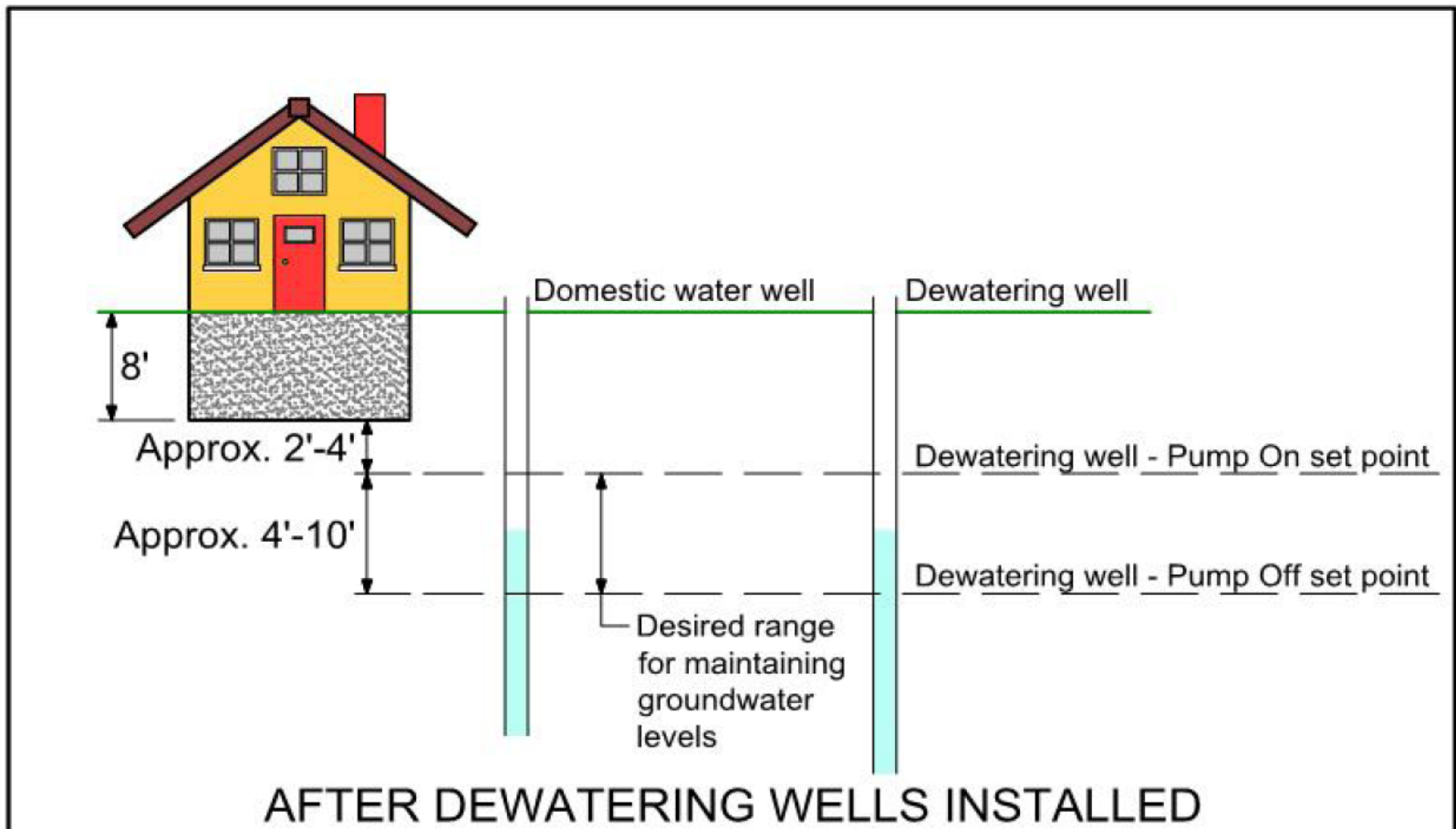
Large water withdrawals from an aquifer can lower the water table and create a "cone of depression" that can result in shallow wells going dry.







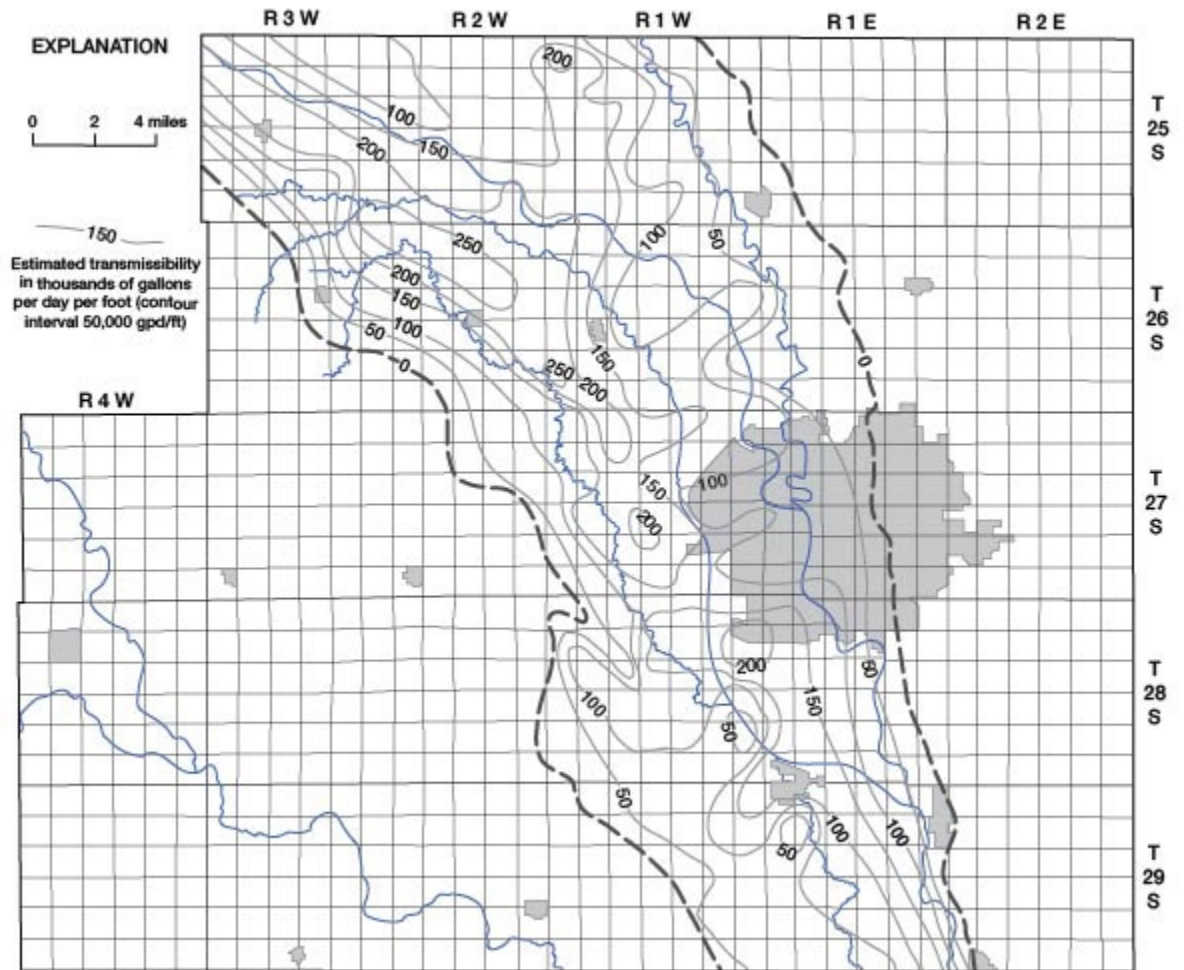
**Figure 3: Proposed Groundwater Elevations Following Dewatering Well Construction**

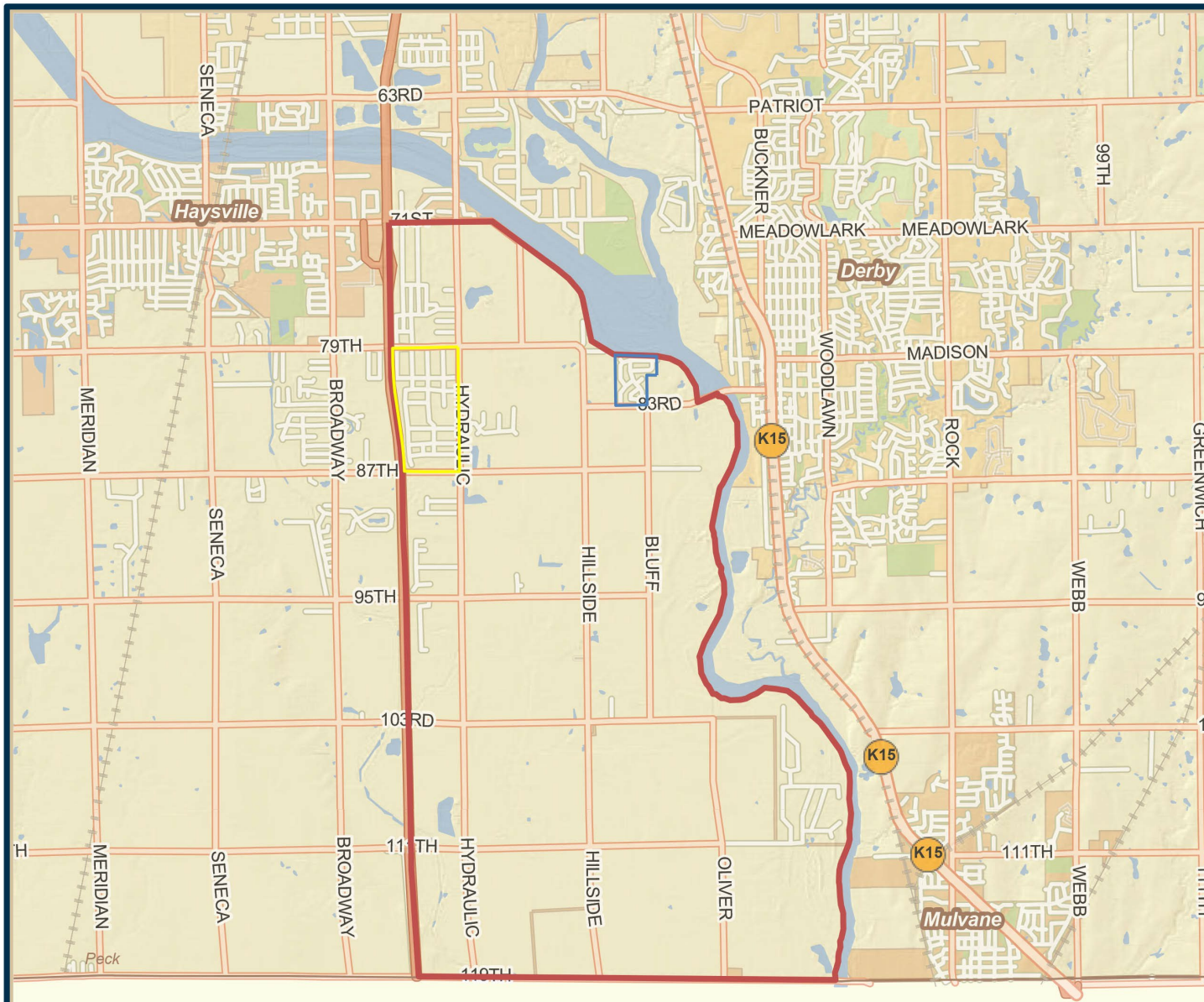




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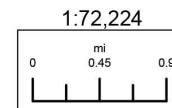
Estimated  
transmissibility  
of the  
unconsolidated  
sediments  
in the Arkansas  
Valley.





## South Bluff Study Area

Sedgwick County, Kansas



Date: 2/18/2022

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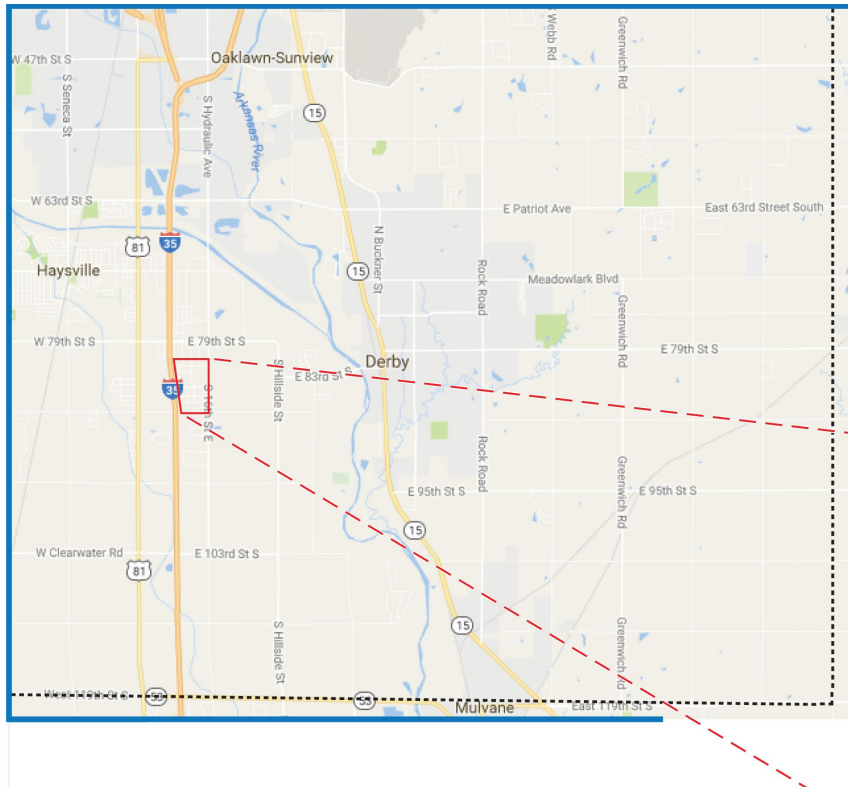
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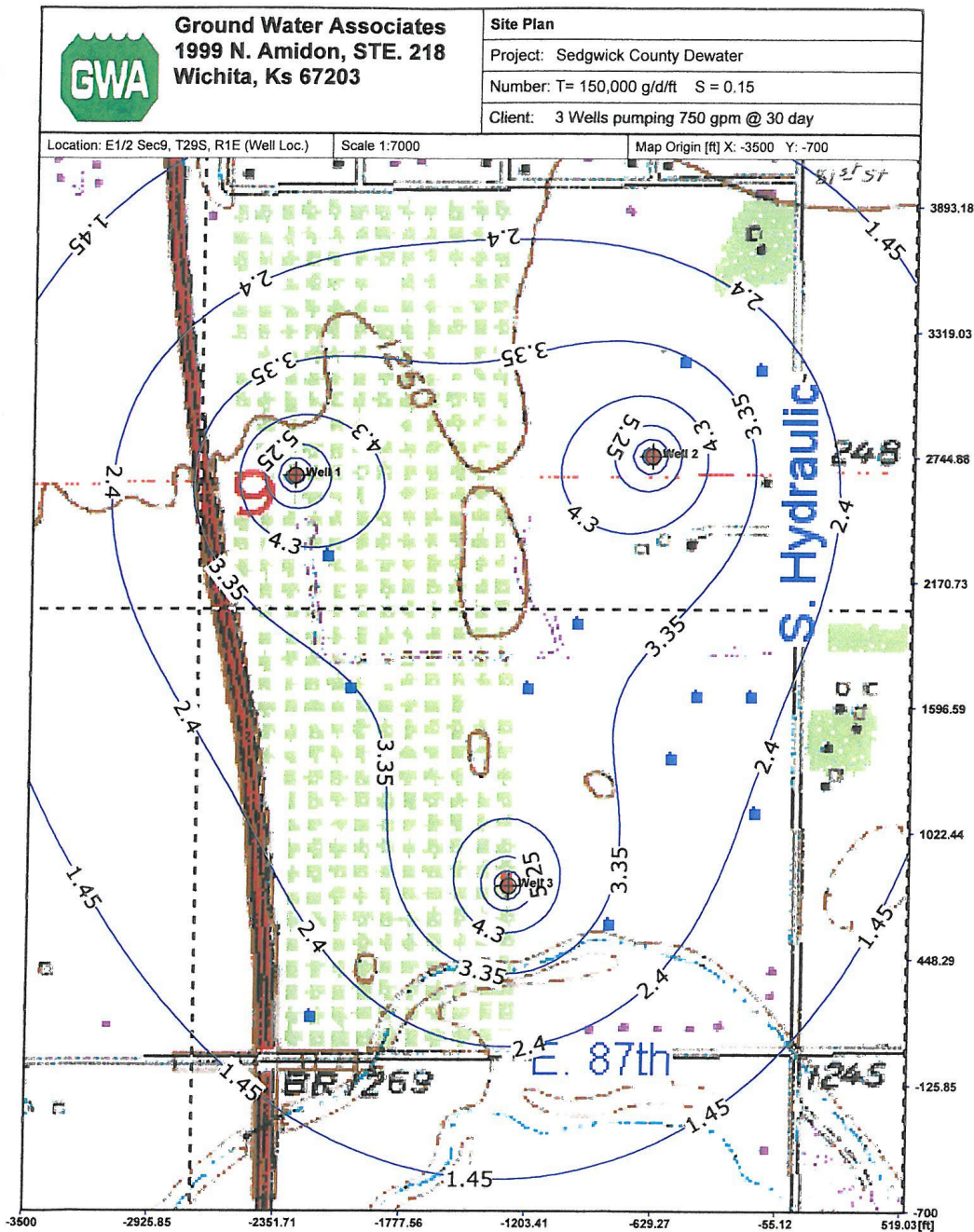
# Peach Valley Estates



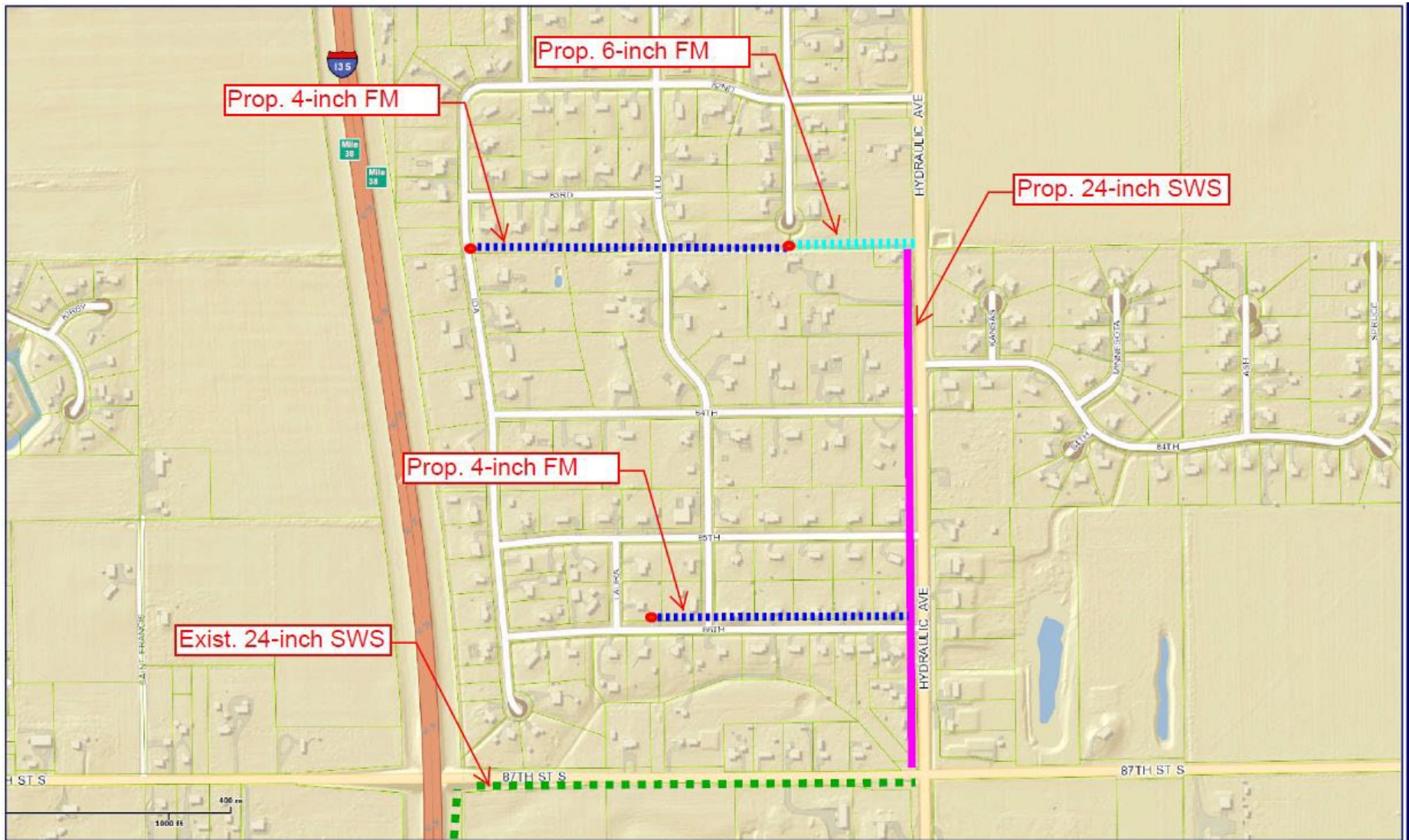
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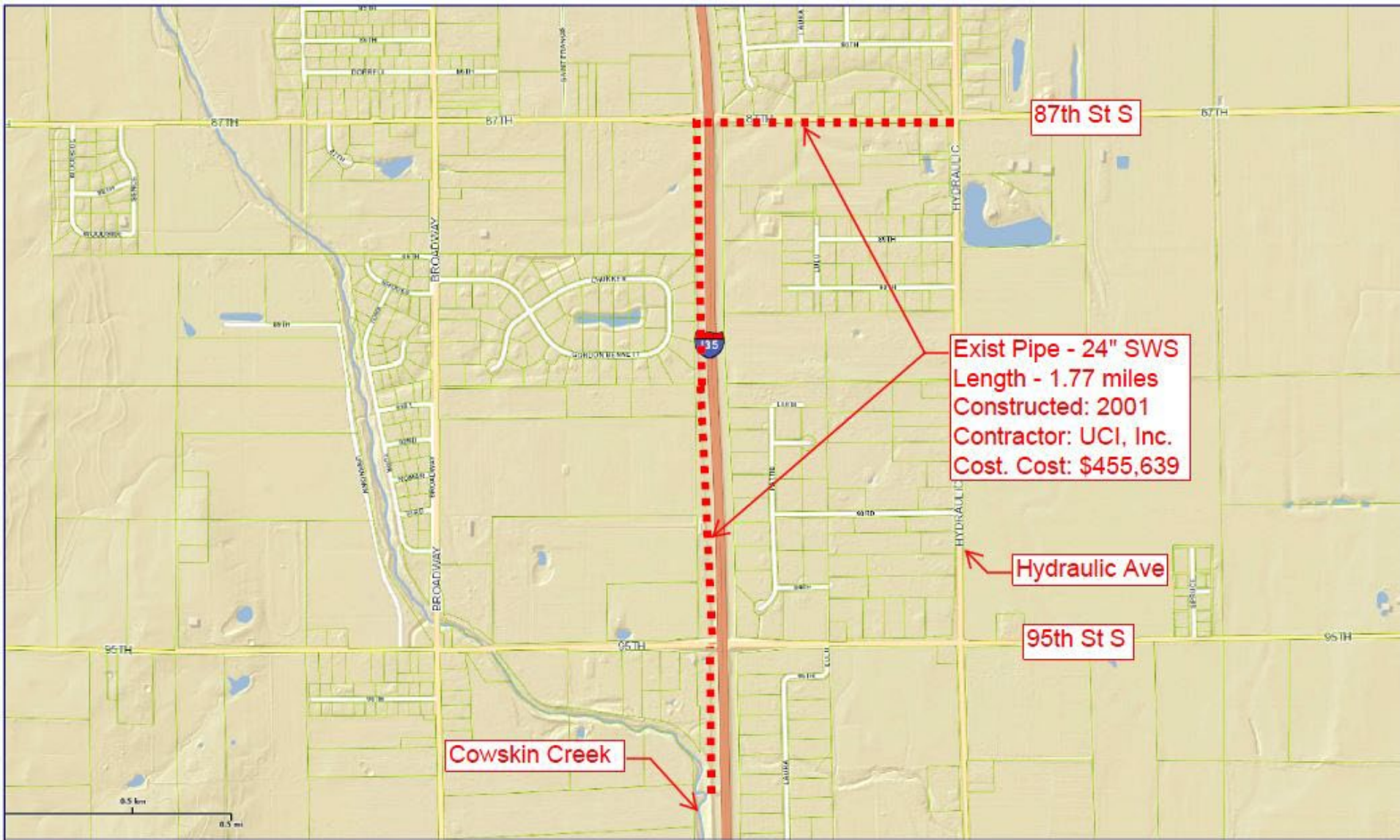
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Division of Information & Operations  
[www.sedgwickcounty.org/gis](http://www.sedgwickcounty.org/gis)  
525 N. Main, Suite 212, Wichita, KS 67203  
Tel: 316.660.9290 Fax: 316.262.1174

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Thu Mar 2 08:34:32 GMT-0600 2017





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## Peach Valley Estates

- PEC performed groundwater study in 2017
  - Cost for Study: \$22,500
  - Benefit District
    - 155 lots in the area
    - Principal cost per lot at \$2.1M = \$13,548
    - Maximum bond repayment period = 20 years
    - Assume 4% interest on bonds
    - Assessment at 20 years = \$83/month
  - Improvement District
    - Estimated cost per lot = \$28 - \$40 per month



## Properties Flagged for Groundwater



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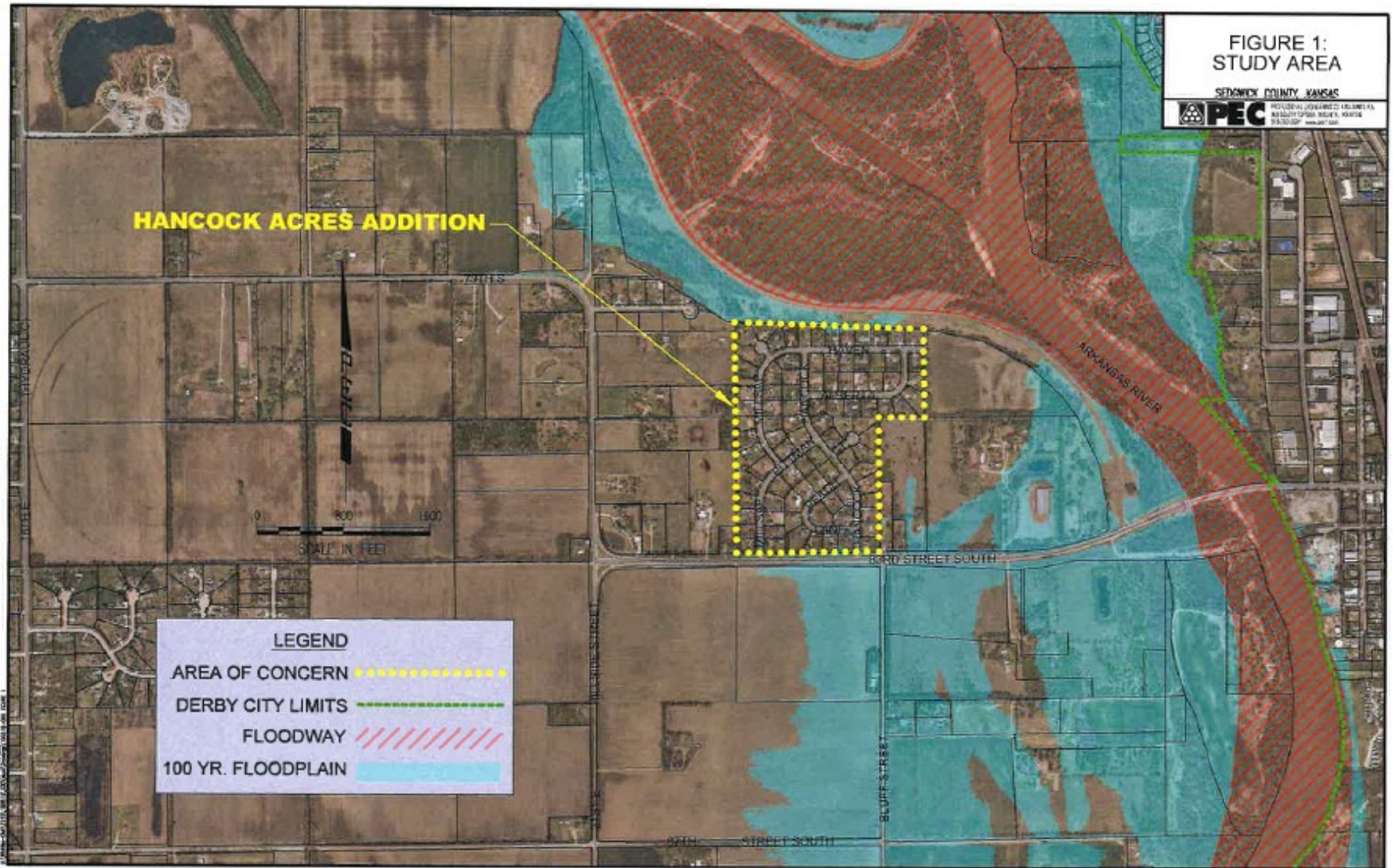
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Map No: 10-10-25-42 GINT-0000 2816



**Journal** 10-27-2018 11:02 AM by CCL  
**File Name** 10-27-2018 11:02 AM by CCL  
**E-mail** CCL@CCL.org by CCL



# Surface and Subsurface Elevations

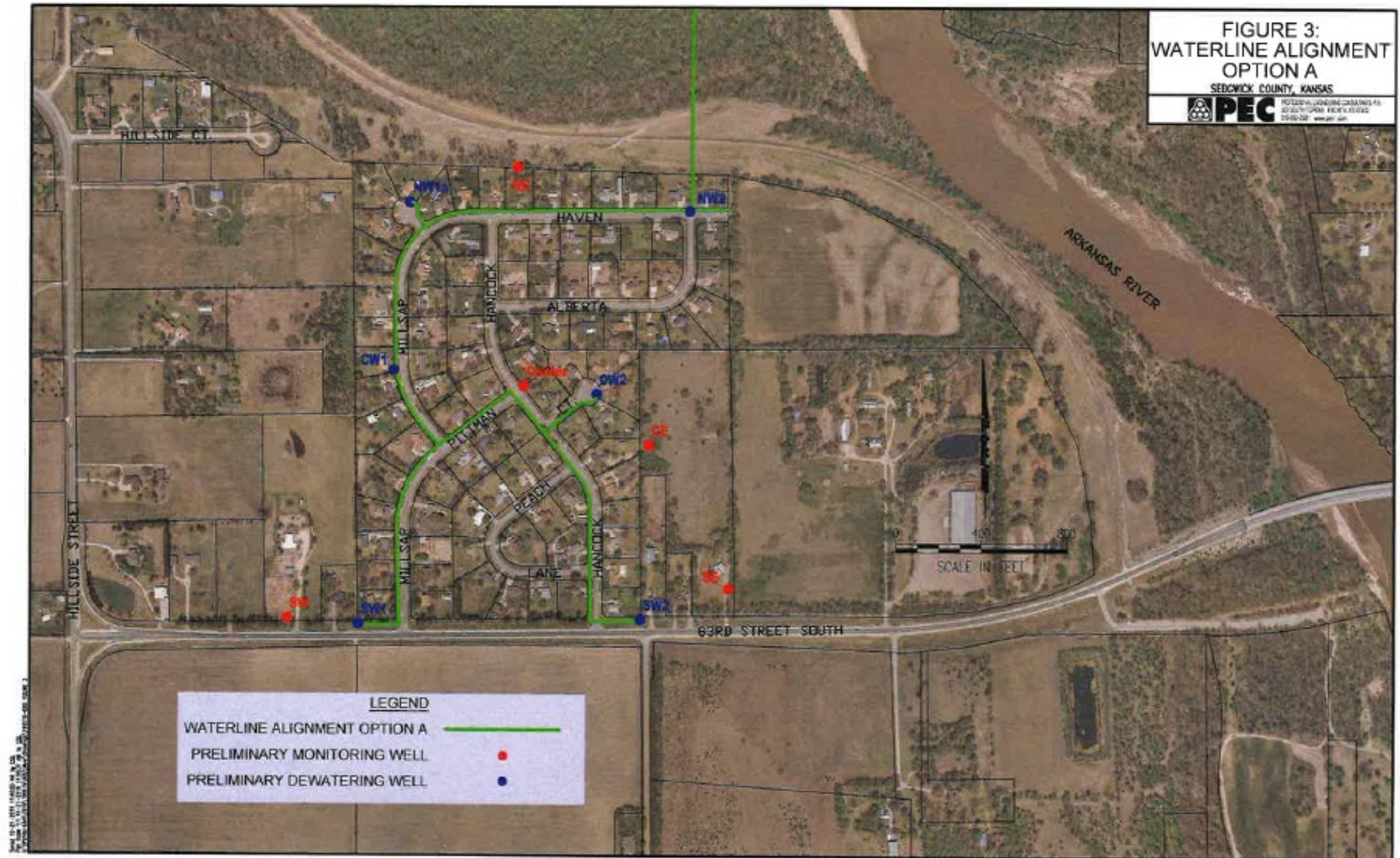
	Average	Maximum	Minimum
House Elevation	1251	1253	1248
Basement Elevation <sup>(1)</sup>	1243	1245	1240
Bottom of Well Elev.	1217	1235	1190
Static Water Elev. <sup>(2)</sup>	1237	1246	1225

(1) Assumes a basement depth of 8 feet

(2) Static water levels at time of construction. Wells were constructed between 1975 and 2015.



# Waterline Alignment - A







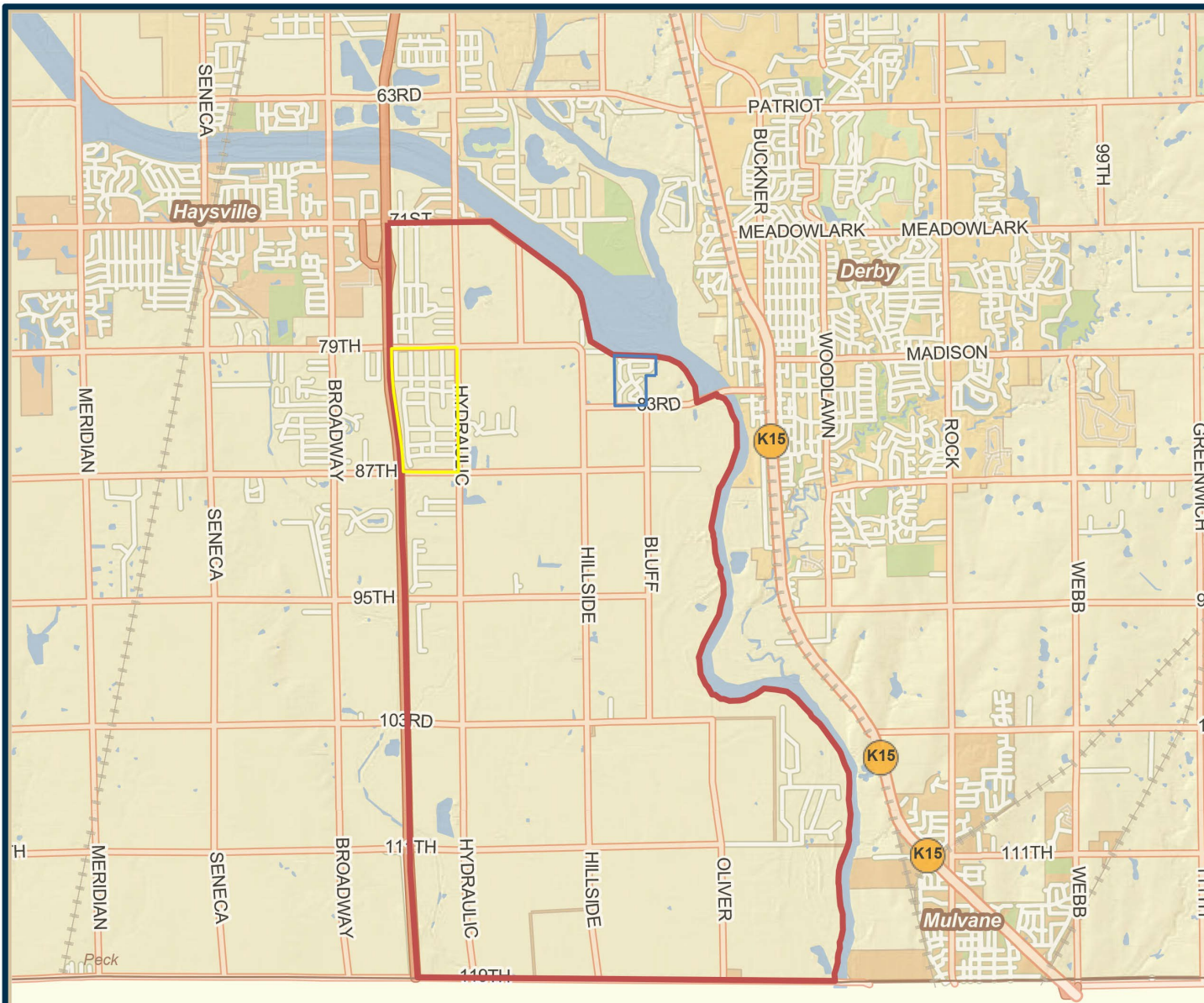
# Hancock Acres

- PEC performed groundwater study in 2019
  - Cost for study: \$31,800
  - Benefit District
    - 99 lots in the area
    - Principal cost per lot at \$1.6 M = \$18,480
    - Maximum bond repayment period = 20 years
    - Assume 4% interest on bonds
    - Assessment at 20 years = \$112/month
  - Improvement District
    - Estimated cost per lot = \$42 per month



# Kansas Water Office

- Dedicated water research funds to study this larger area
- Given a grant to Sedgwick County for a groundwater/dewatering study
- Sedgwick County has received \$92,800 for a contract with PEC to perform the study

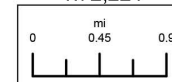


## South Bluff Study Area

Sedgwick County, Kansas



1:72,224



Date: 2/18/2022

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# Comparison

	Peach Valley Estates	Hancock Acres	South Bluff
# Total Parcels	155	99	1288
# Active Addresses	144	91	984
# Single Family Res.	141	91	651
Total Land Value	\$4,379,600	\$2,105,300	\$25,317,760
Total Improvement Value	\$21,125,270	\$12,349,770	\$103,212,380
Total Value	\$25,504,870	\$14,455,070	\$128,530,140
Total Land Assessment	\$504,329	\$242,136	\$3,364,705
Total Improvement Assessment	\$2,429,417	\$1,420,232	\$12,030,589
Total Assessment	\$2,933,746	\$1,662,368	\$15,395,294

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# South Bluff Study

Studies a larger area

County has a citizen committee representing this area

Incorporate existing data and develop models

Determine best dewatering well locations

Incorporate future Derby water wells

Offer options for removing generated water

Determine costs



# Considerations

- Basement flooding due to groundwater has existed in this area since the early 1980s
- Derby had 11 wells
  - Contract with Wichita required wells to be turned off in 2002
  - Studies determined that the cone of depression from these water wells extended to 0.7 mile after 60 days of pumping





# What happens when a well is pumped?

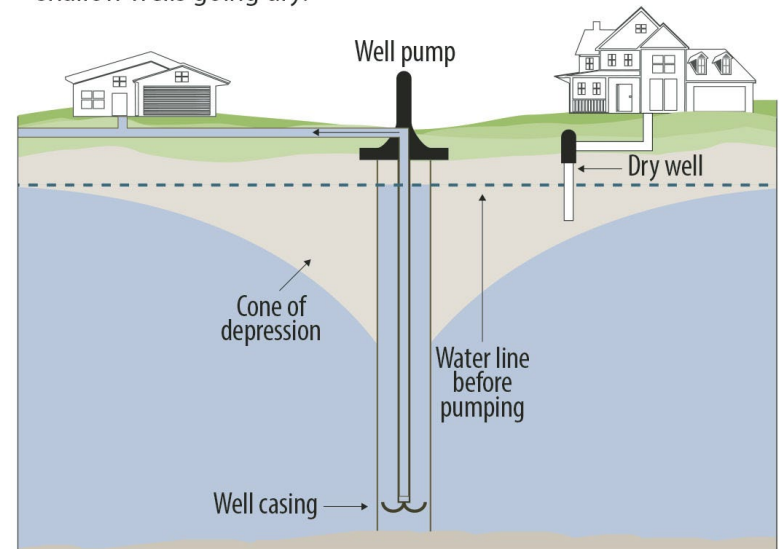
How big is the cone of depression?

Autor	Referencia	Fórmula	Radio de Influencia
Lembke	(1886, 1887)	$R = h_o \times \sqrt{\frac{K}{2N}}$	
Weber	[Kyrieleis-Sichardt, 1930]	$R = 3 \times \sqrt{\frac{h_o \times K \times t}{n_s}}$	
Kusakin	Chertusov, 1949	$R = 575 \times s_w \times \sqrt{K \times h_o}$	
Kusakin	Aravin y Numerov, 1953	$R = 1,9 \times \sqrt{\frac{h_o \times K \times t}{n_s}}$	
Sichardt	[Kirieleis-Sichardt, 1930]	$R = 3000 \times s_w \times \sqrt{K}$	

Radius of cone from one of the Derby wells = ~0.5-0.7 miles

## A cone of depression

Large water withdrawals from an aquifer can lower the water table and create a "cone of depression" that can result in shallow wells going dry.



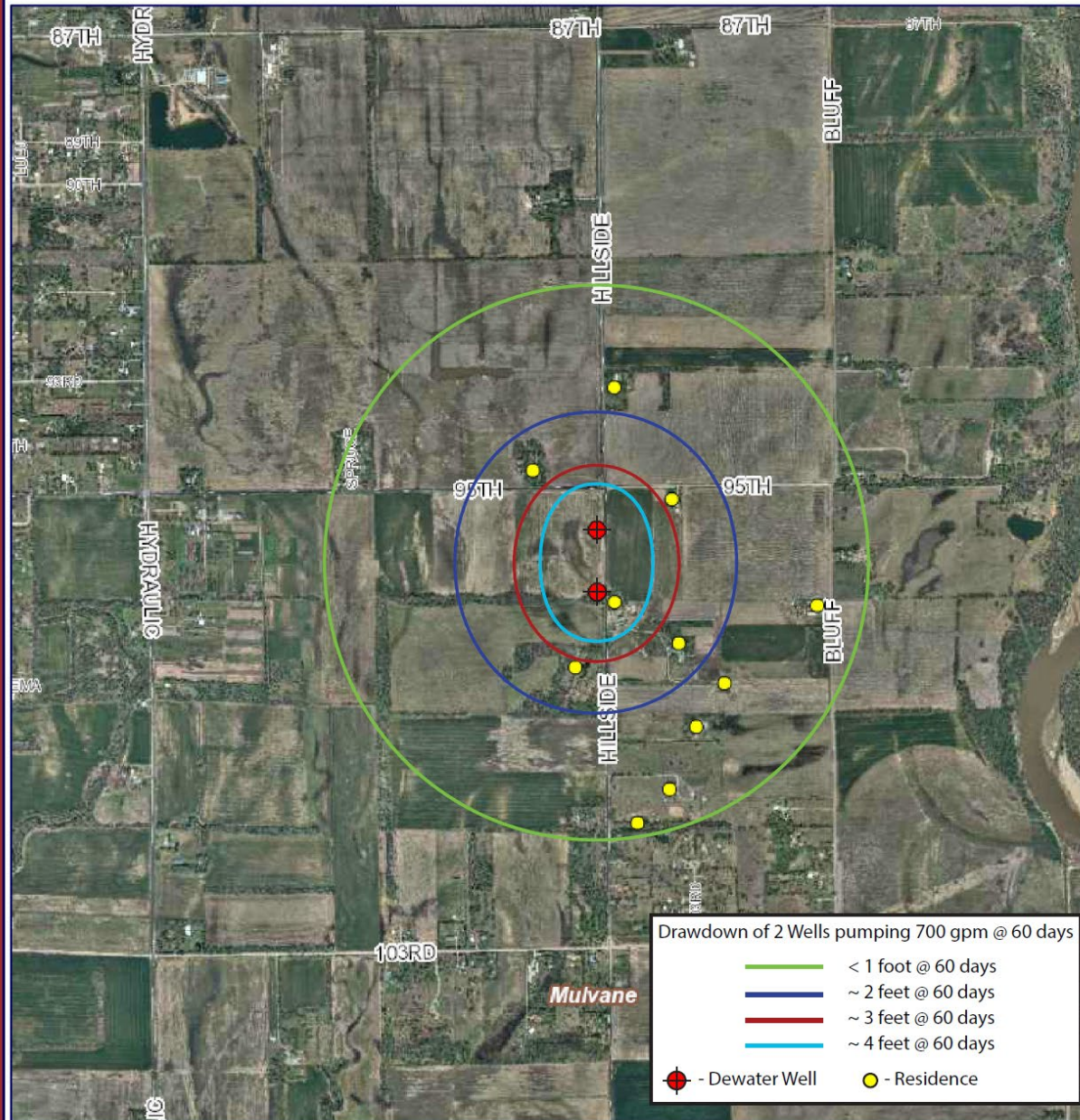
SOURCE: MOUNT PLEASANT WATERWORKS AND U.S. GEOLOGICAL SURVEY

STAFF



Sedgwick

# Sedgwick County Dewatering Hillside and 95th St. S.



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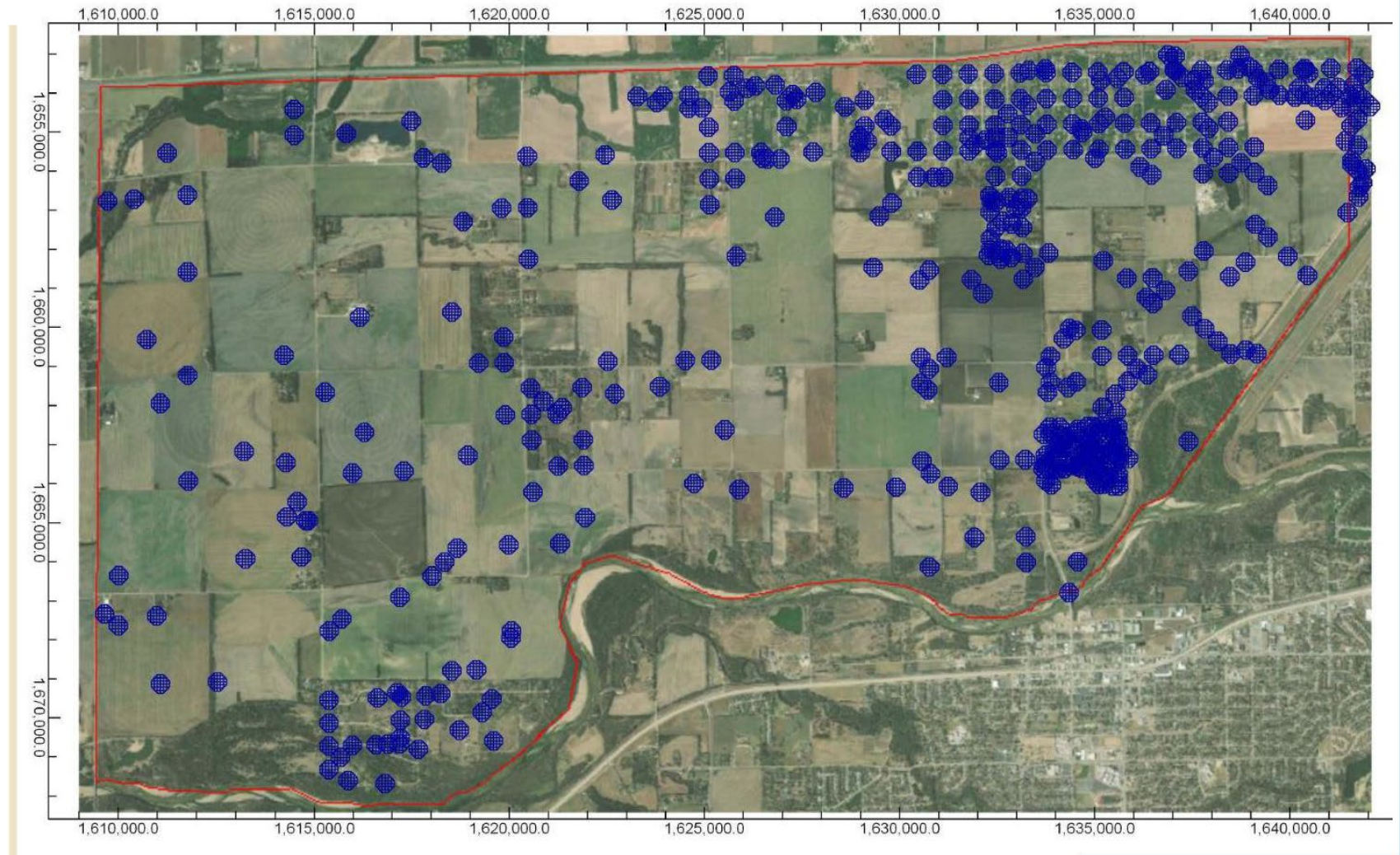
# South Bluff Study Progress

- Constructing a conceptual site model
  - Surface elevations
  - Subsurface geology
  - Climate data (rainfall, evapotranspiration, streamflow, etc.)
  - Groundwater levels and pump tests
- Review and incorporate recent Derby well test data
- Model calibration to a USGS data set

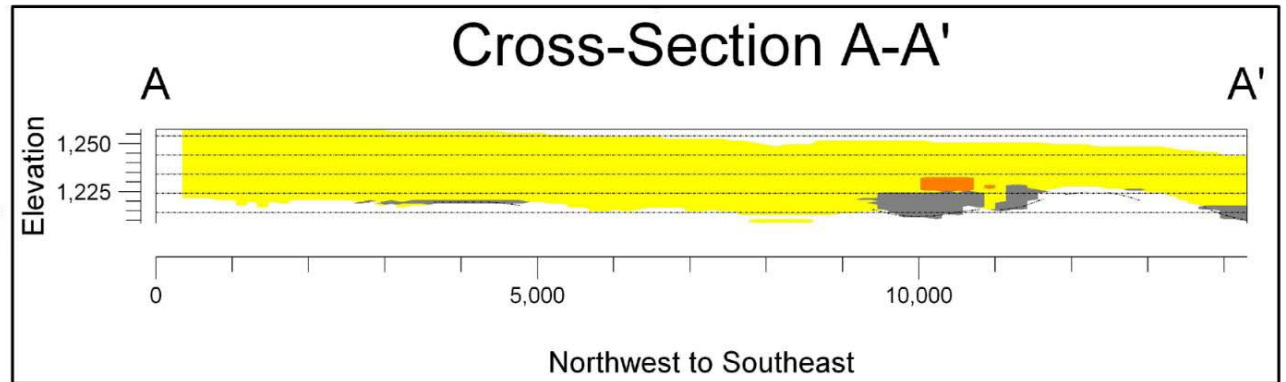
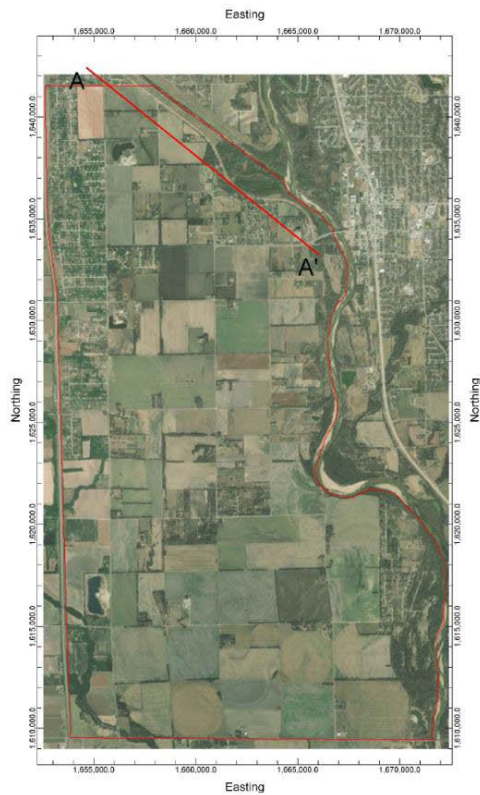




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### Legend



**CROSS-SECTION A TO A'**  
**SOUTH BLUFF DEWATERING PROJECT**  
**SEDGWICK COUNTY, KANSAS**

**SCS ENGINEERS**

Wichita, KS

June 2022



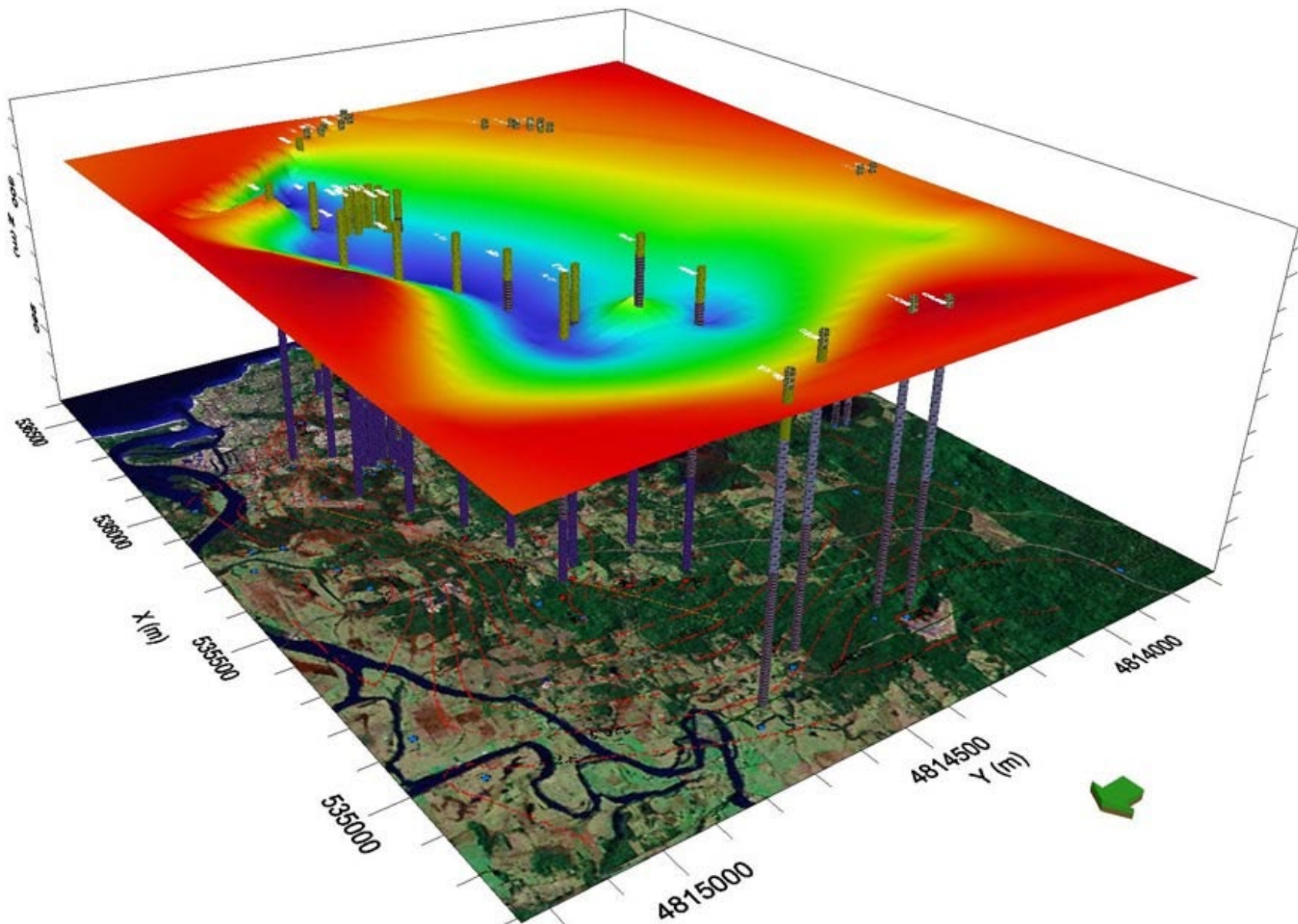
**Figure 2**



## South Bluff Study Work Plan

- Conceptual Site Model:
  - Simulate high flow condition
  - Simulate drought condition
  - Add groundwater withdrawals to simulate efforts needed to maintain a desired water level
  - Provide visualization of withdrawal impacts





EXAMPLE VISUALIZATION



# South Bluff Work Plan

## Work Plan Going Forward

- Conceptual Design of Infrastructure Required for Simulated Withdrawals
- Evaluate Impact of Receiving Water Body
- Review Right-of-Way and Record Utility Information in Vicinity of Potential Infrastructure Improvements
- Determine Permitting Requirements and Restrictions
- Estimate construction and ongoing operations and maintenance costs



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# Future Considerations

## – Future Derby Water Supply Wells

- Keep two existing wells near 95<sup>th</sup> St S and Hillside
- New Contract with Wichita allows Derby to supplement water
  - Wichita will supply 90% of winter use, year round
  - Derby to supply 10% of winter use, and 100% of additional summer use
- 3 new wells anticipated to replace the rest of the existing wells, currently evaluating potential well locations
- All wells limited to 694 MGY and 2,500 gpm by water appropriations
- Wells 10 and 11 limited to 700 gpm





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# Next Steps

- Creation of Groundwater Models
- Determine options
- Determine costs and possible grants and other funding options
- Present Report at another Town Hall Meeting



# Potential Future Steps

- Creation of Benefit and Improvement Districts
- Required to obtain a permit from the Kansas Department of Agriculture, Division of Water Resources
- Purchase of property and easements as necessary
- Possible action related to zoning of the property
- Timing—would be likely to take 1 year or more to become operational





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# QUESTIONS Comments

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<https://www.sedgwickcounty.org/environment/>

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