



EDUCATION, AWARENESS, & TECHNOLOGY

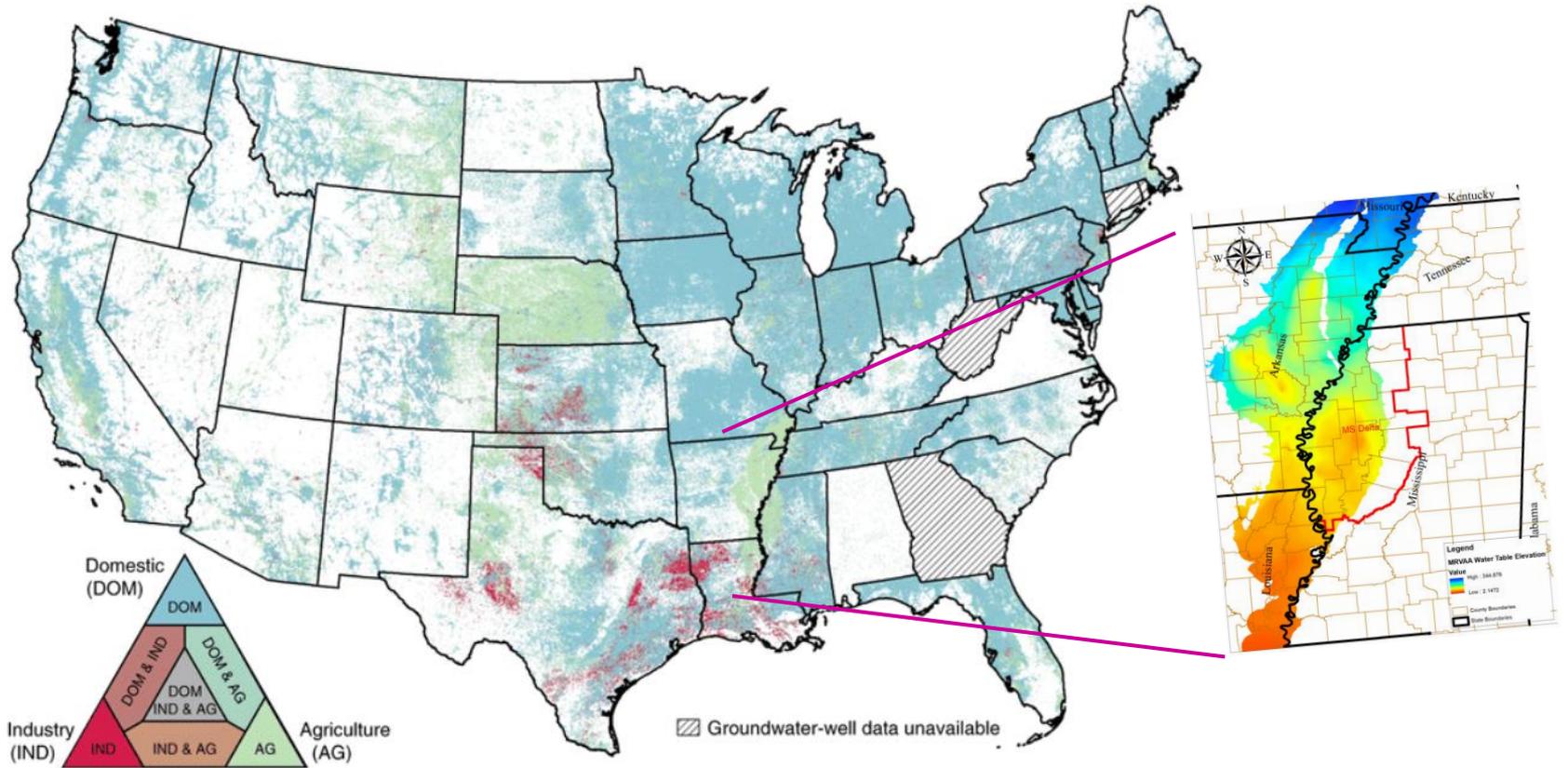


*2025 MISSISSIPPI RIVER ALLUVIAL AQUIFER STATES GROUNDWATER CONFERENCE*

# High-Value Groundwater-Level Monitoring Using Submersible Pump Wells

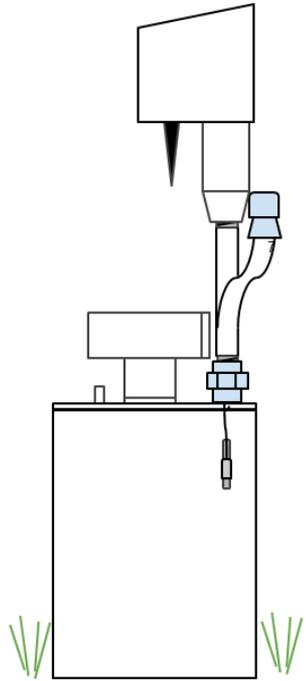
Charles Dunning  
WellIntel  
VP Hydrology





Nature Sustainability: Deeper well drilling an unsustainable stopgap to groundwater depletion, Perrone and Scott, 2019

**Measurement** can start with our sensor which turns production wells into real-time monitoring points ...

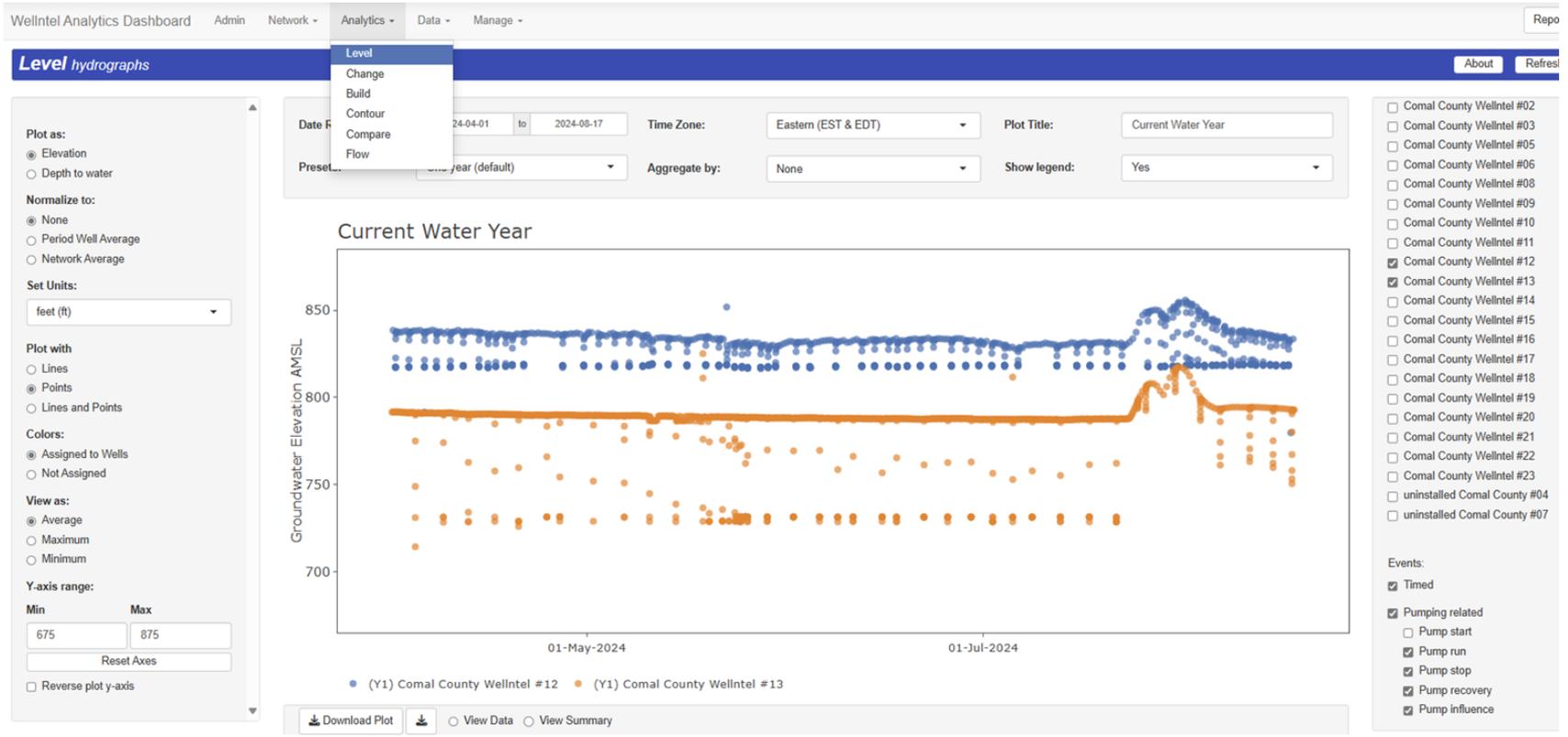


- **Designed for submersible pump and monitoring wells**
- Acoustic, non-invasive
- Plug and play install ~ 1 hour
- USGS-tested 0.1' accuracy

# The WellIntel Acoustic Sensor



# The WellIntel Water Information System



## ANY SENSOR MEASUREMENT



Groundwater



Surface Water



Precipitation



Flow/Pumping



Quality

## ANY TIME SERIES DATA

Any history

Spreadsheets/ CSVs

Single measurements

APIs

SCADA



## PUBLICLY AVAILABLE DATA IN THE US

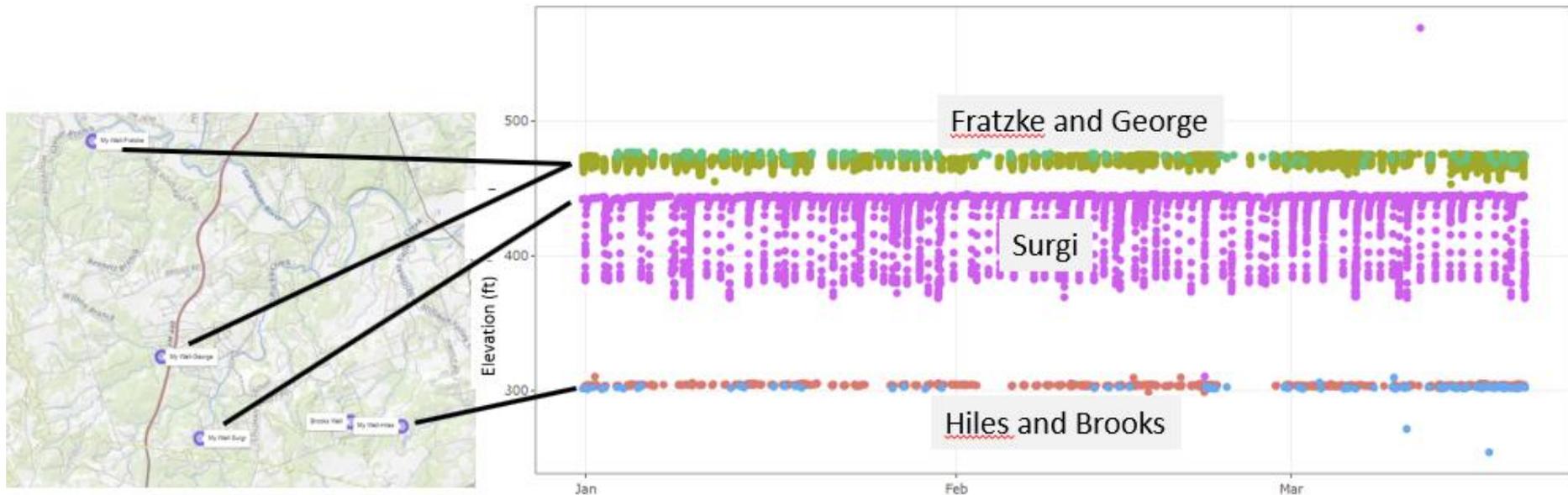


CALIFORNIA DEPARTMENT OF WATER RESOURCES

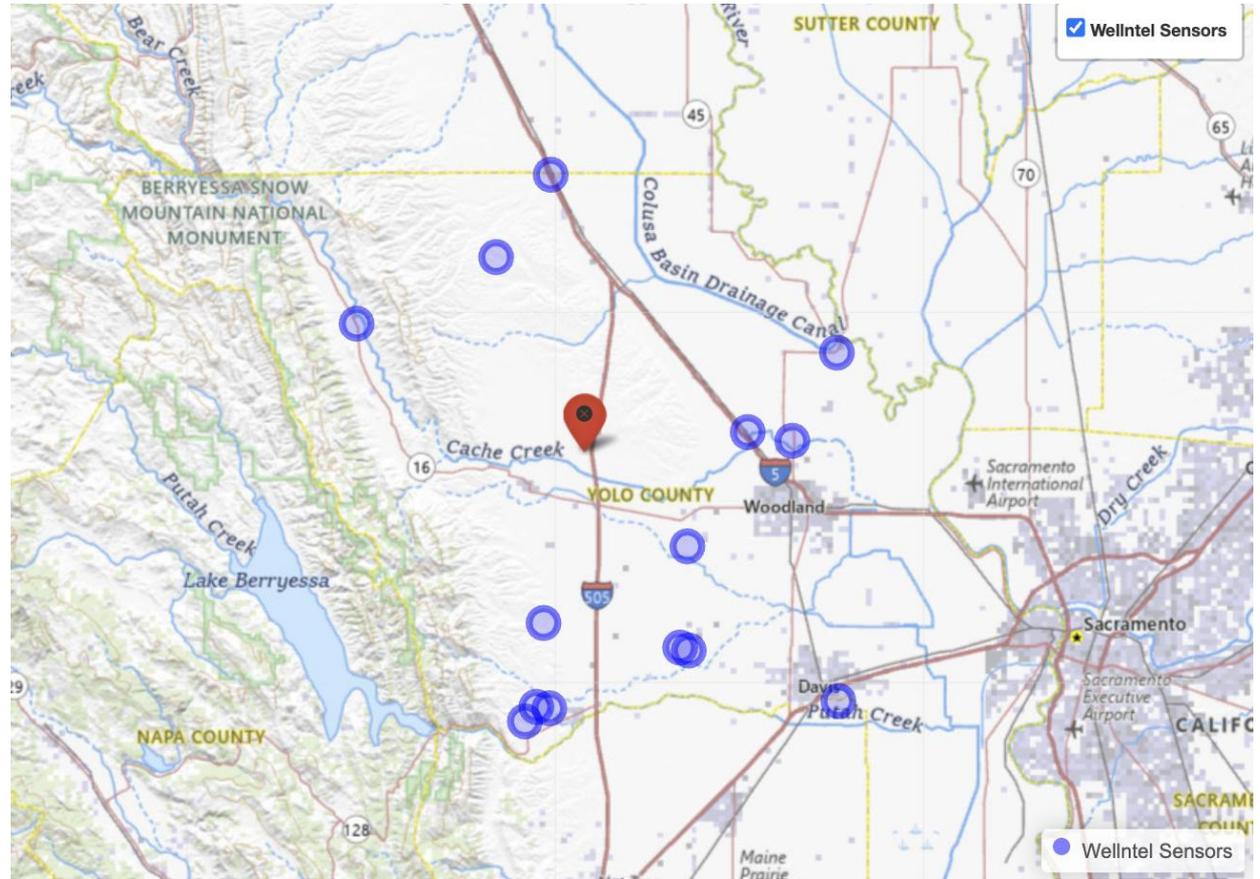


... continuously adding more states

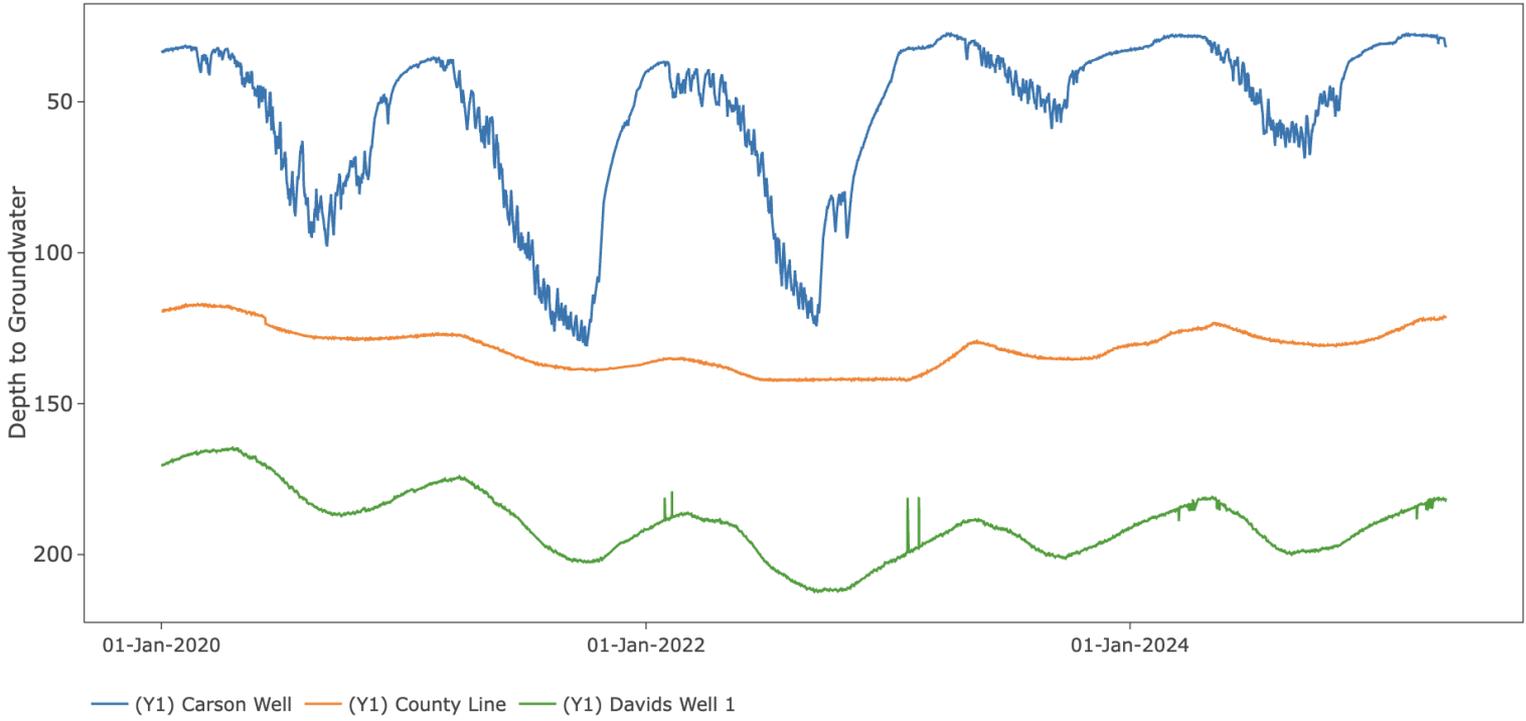
# Hydrogeologic setting



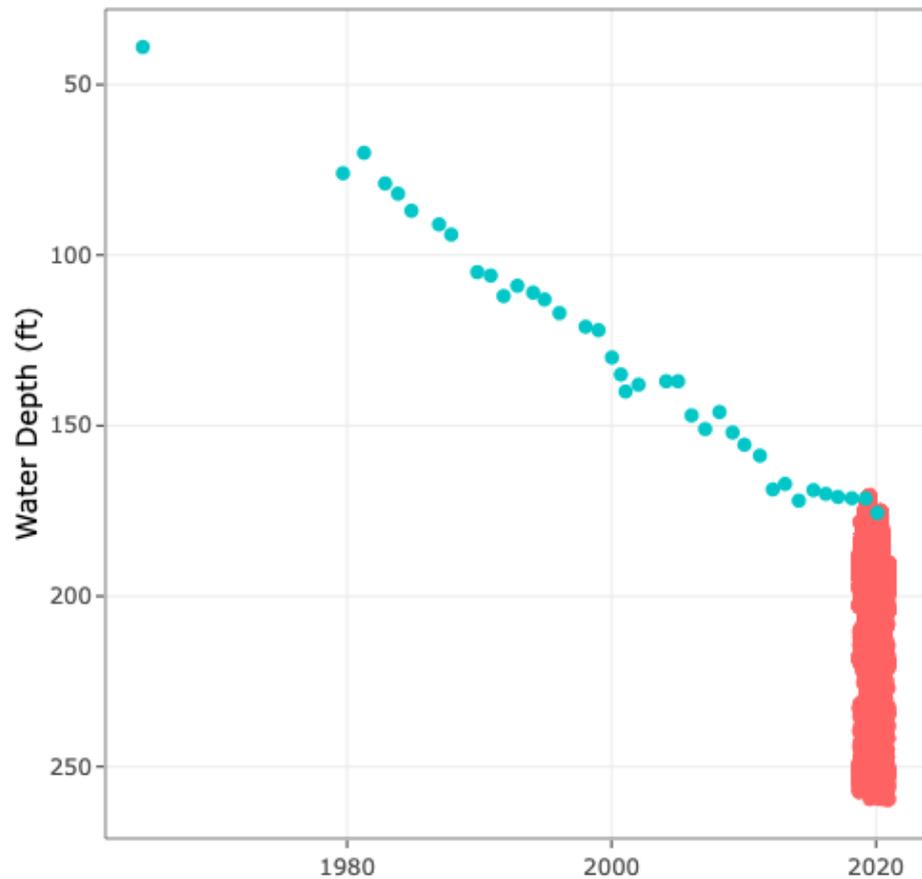
# Multi-year trends



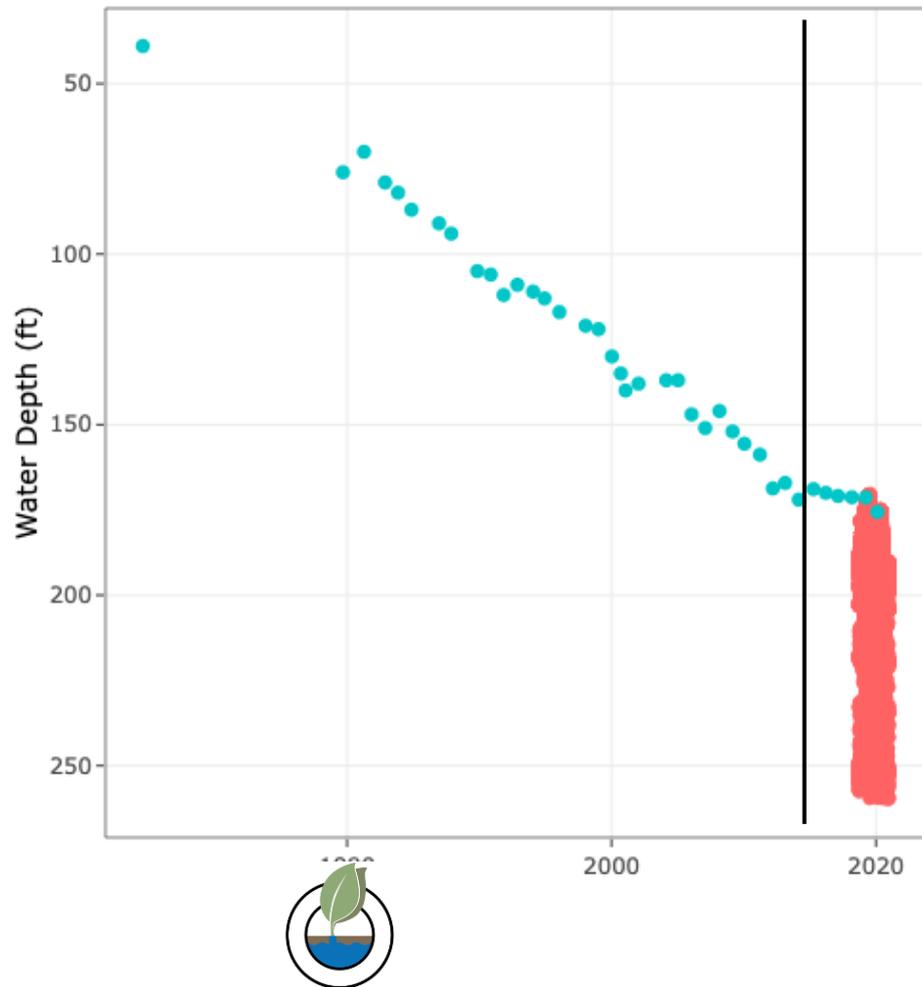
# Multi-year trends



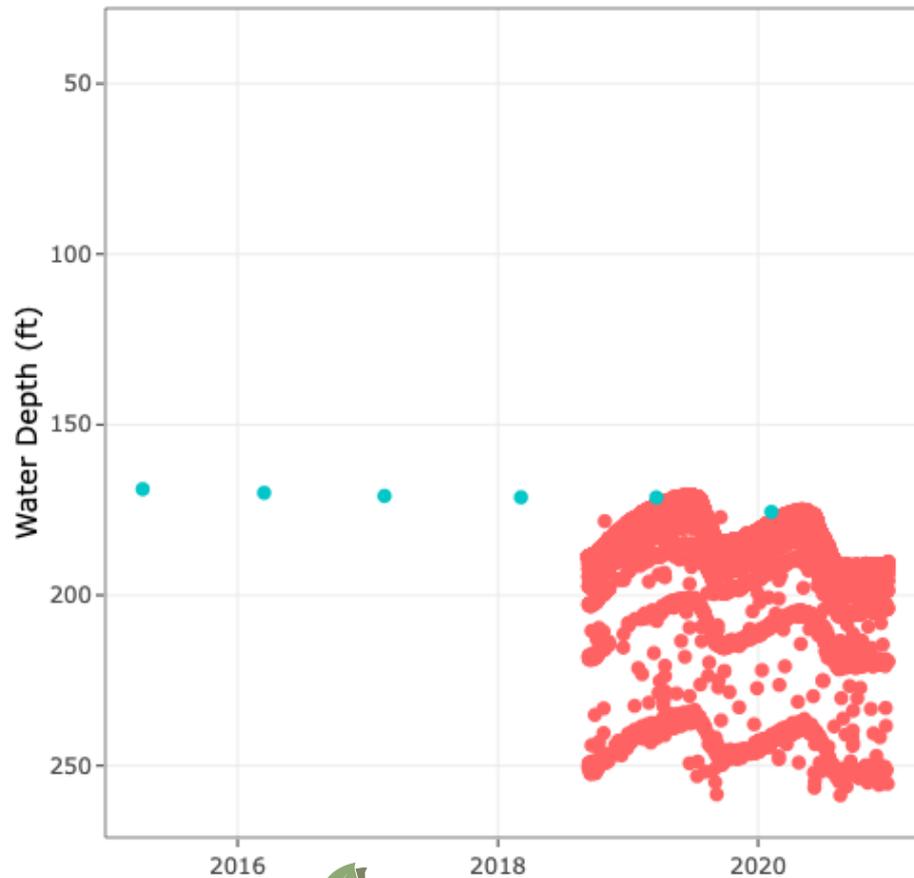
# Multi-decade trends



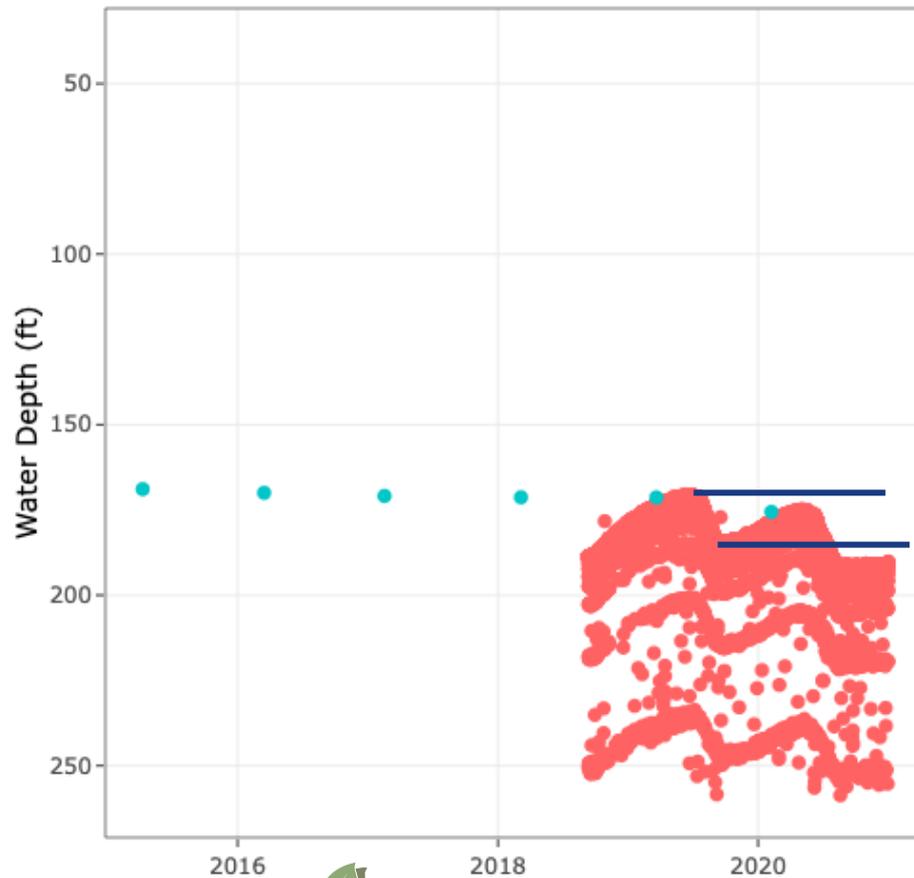
# Multi-decade trends



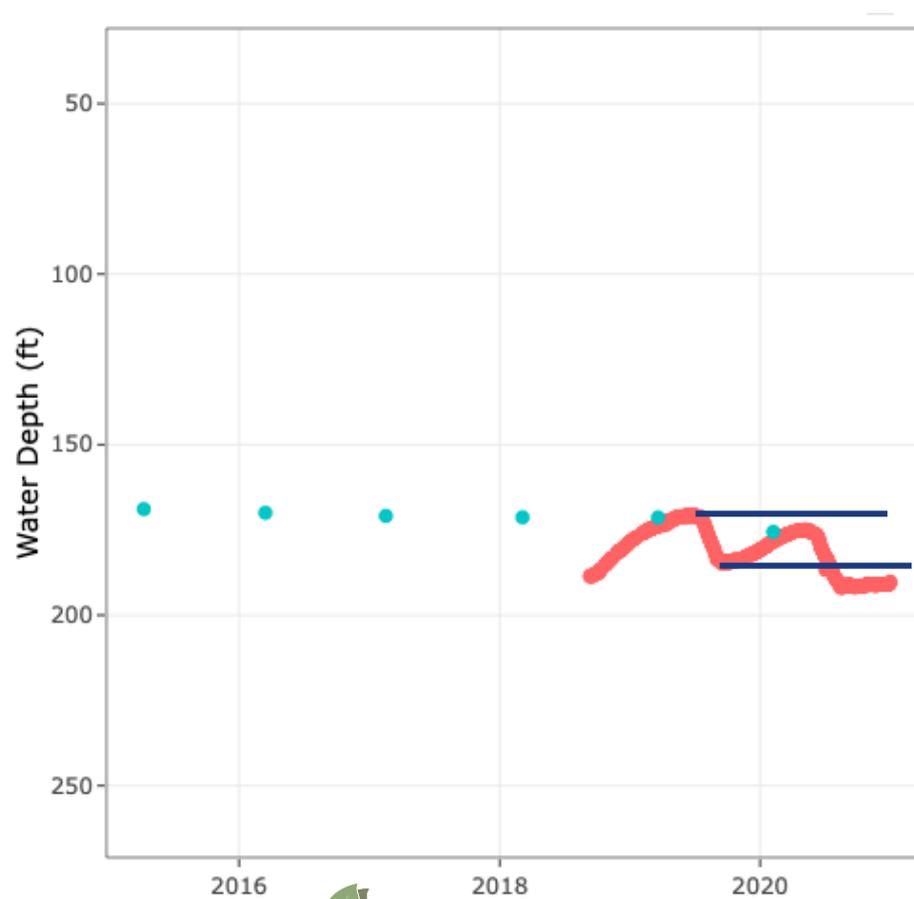
# Multi-decade trends



# Multi-decade trends



# Multi-decade trends



### Level hydrographs

About Refresh

- Level
- Change
- Build
- Contour
- Compare
- Flow

Date Range: 2024-04-01 to 2024-08-17 Time Zone: Eastern (EST & EDT) Plot Title: Current Water Year

Presets: Current Year (default) Aggregate by: None Show legend: Yes

**Plot as:**

- Elevation
- Depth to water

**Normalize to:**

- None
- Period Well Average
- Network Average

**Set Units:**

feet (ft)

**Plot with**

- Lines
- Points
- Lines and Points

**Colors:**

- Assigned to Wells
- Not Assigned

**View as:**

- Average
- Maximum
- Minimum

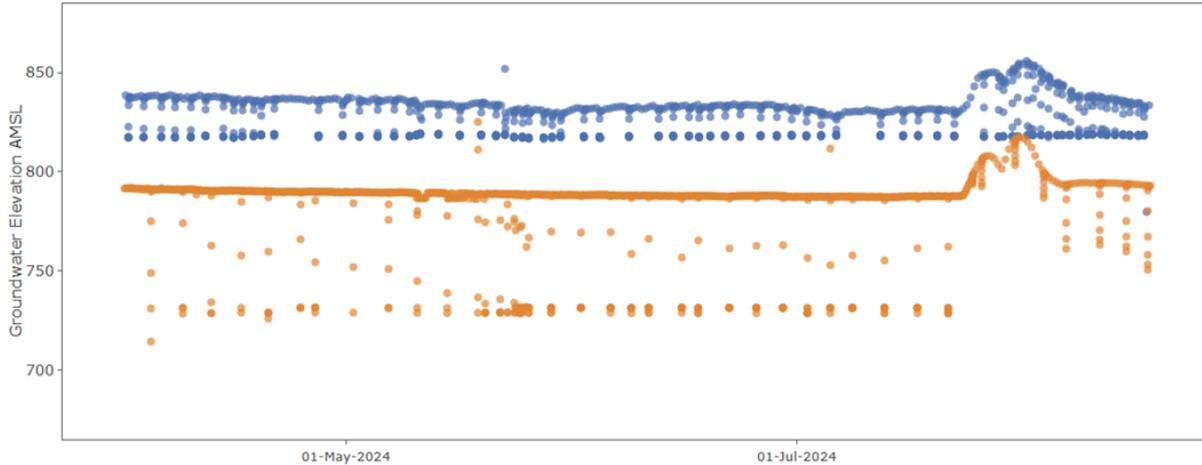
**Y-axis range:**

Min: 675 Max: 875

Reset Axes

Reverse plot y-axis

### Current Water Year



● (Y1) Comal County WellIntel #12 ● (Y1) Comal County WellIntel #13

Download Plot View Data View Summary

- Comal County WellIntel #02
- Comal County WellIntel #03
- Comal County WellIntel #05
- Comal County WellIntel #06
- Comal County WellIntel #08
- Comal County WellIntel #09
- Comal County WellIntel #10
- Comal County WellIntel #11
- Comal County WellIntel #12
- Comal County WellIntel #13
- Comal County WellIntel #14
- Comal County WellIntel #15
- Comal County WellIntel #16
- Comal County WellIntel #17
- Comal County WellIntel #18
- Comal County WellIntel #19
- Comal County WellIntel #20
- Comal County WellIntel #21
- Comal County WellIntel #22
- Comal County WellIntel #23
- uninstalled Comal County #04
- uninstalled Comal County #07

- Events:**
- Timed
  - Pumping related
    - Pump start
    - Pump run
    - Pump stop
    - Pump recovery
    - Pump influence



### Level hydrographs

About Refresh

- Level
- Change
- Build
- Contour
- Compare
- Flow

Date From: 2024-04-01 to 2024-08-17 Time Zone: Eastern (EST & EDT) Plot Title: Current Water Year

Presets: Current Year (default) Show legend: Yes

**Plot as:**

- Elevation
- Depth to water

**Normalize to:**

- None
- Period Well Average
- Network Average

**Set Units:**

feet (ft)

**Plot with**

- Lines
- Points
- Lines and Points

**Colors:**

- Assigned to Wells
- Not Assigned

**View as:**

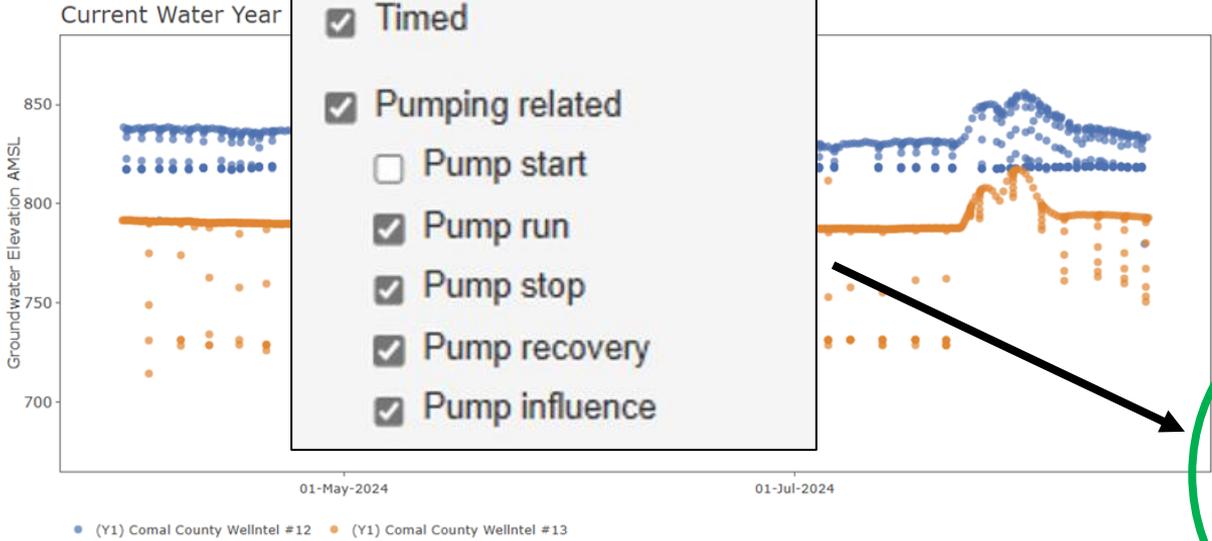
- Average
- Maximum
- Minimum

**Y-axis range:**

Min: 675 Max: 875

Reset Axes

Reverse plot y-axis



**Events:**

- Timed
- Pumping related
  - Pump start
  - Pump run
  - Pump stop
  - Pump recovery
  - Pump influence

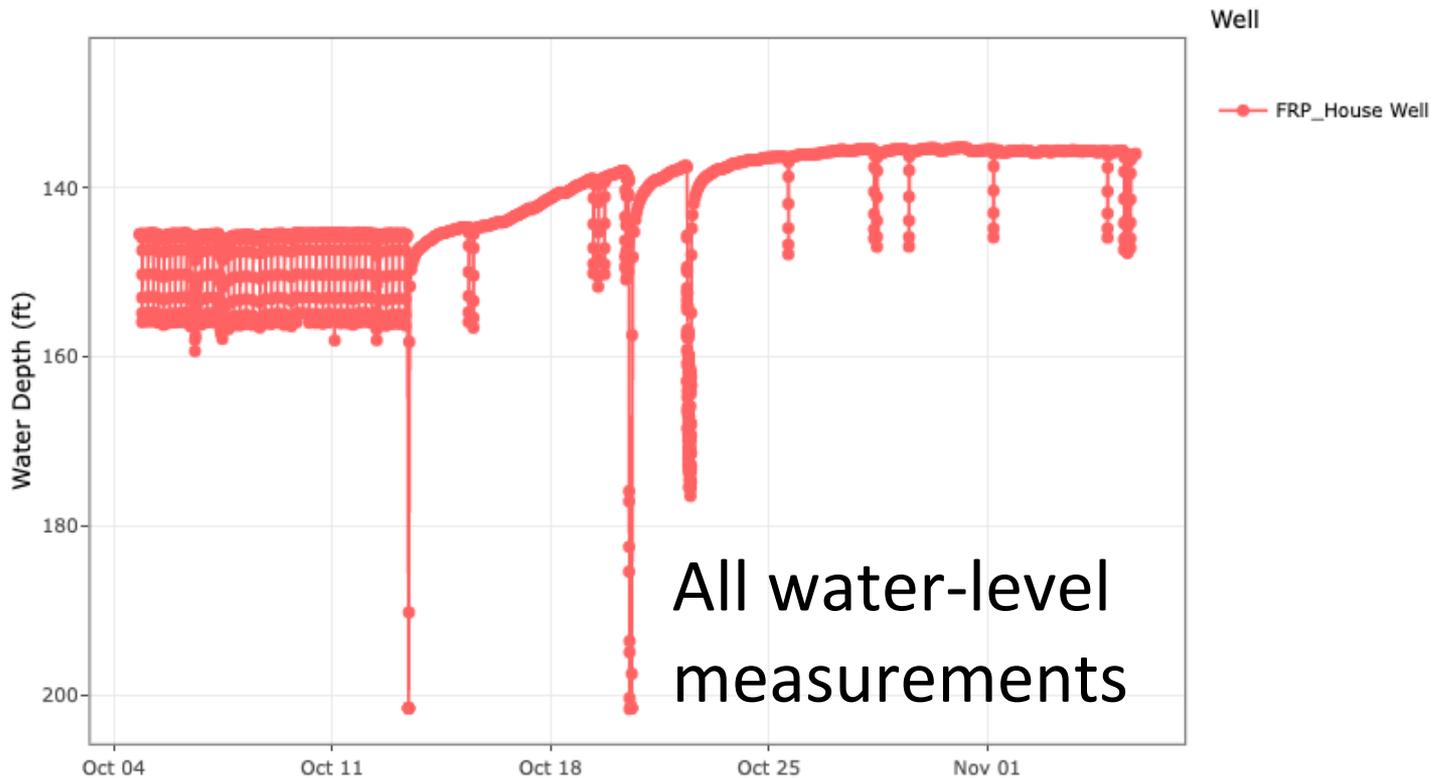
- Comal County WellIntel #02
- Comal County WellIntel #03
- Comal County WellIntel #05
- Comal County WellIntel #06
- Comal County WellIntel #08
- Comal County WellIntel #09
- Comal County WellIntel #10
- Comal County WellIntel #11
- Comal County WellIntel #12
- Comal County WellIntel #13
- Comal County WellIntel #14
- Comal County WellIntel #15
- Comal County WellIntel #16
- Comal County WellIntel #17
- Comal County WellIntel #18
- Comal County WellIntel #19
- Comal County WellIntel #20
- Comal County WellIntel #21
- Comal County WellIntel #22
- Comal County WellIntel #23
- Uninstalled Comal County #04
- Uninstalled Comal County #07

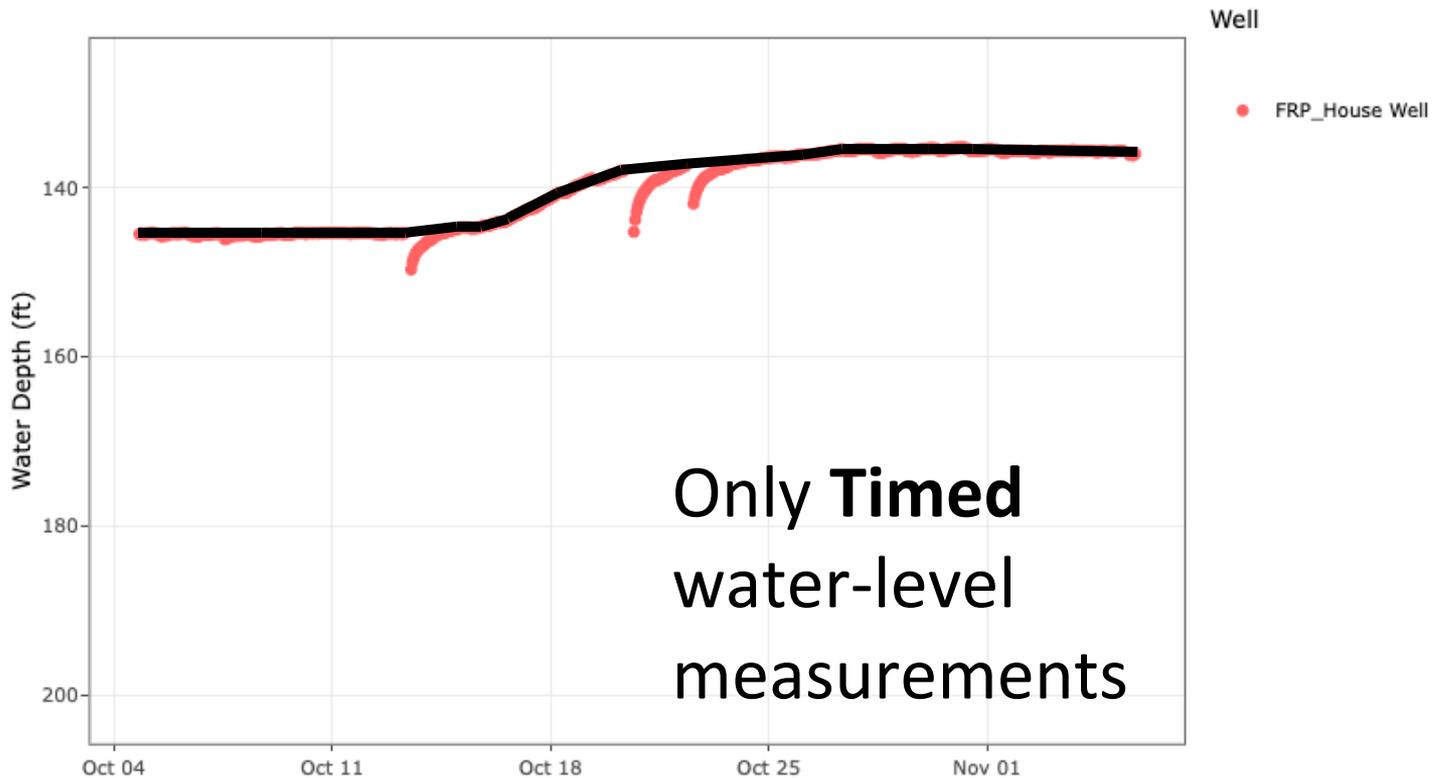
**Events:**

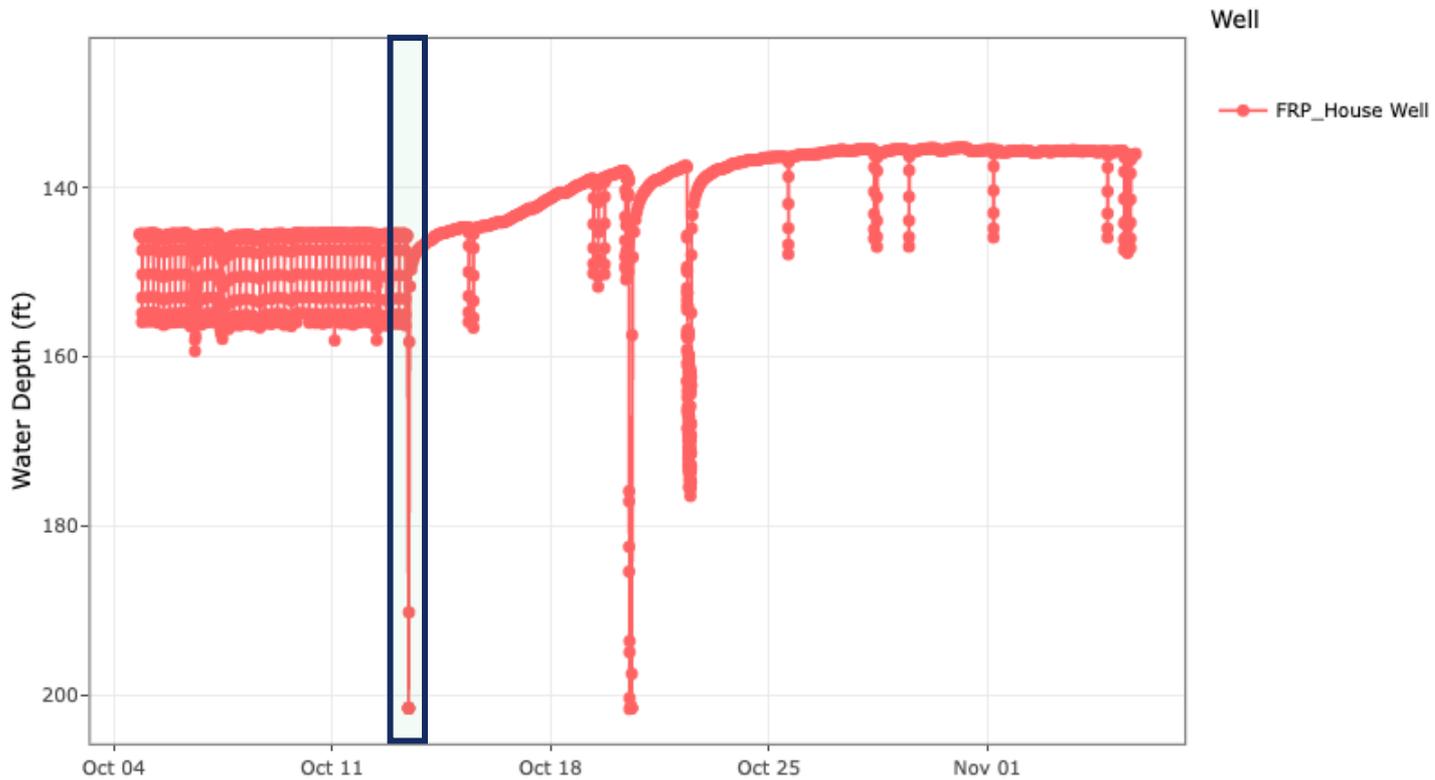
- Timed
- Pumping related
  - Pump start
  - Pump run
  - Pump stop
  - Pump recovery
  - Pump influence

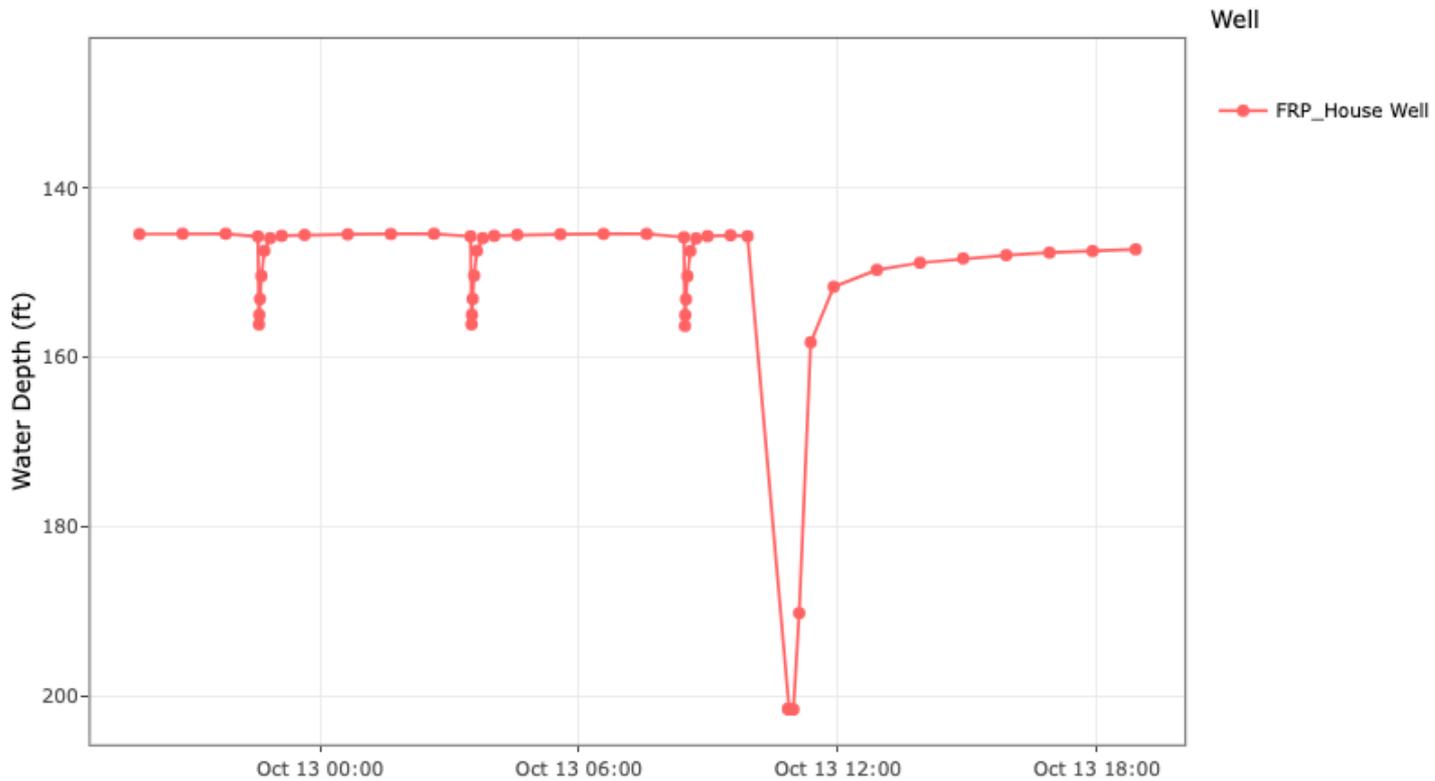
Download Plot View Data View Summary

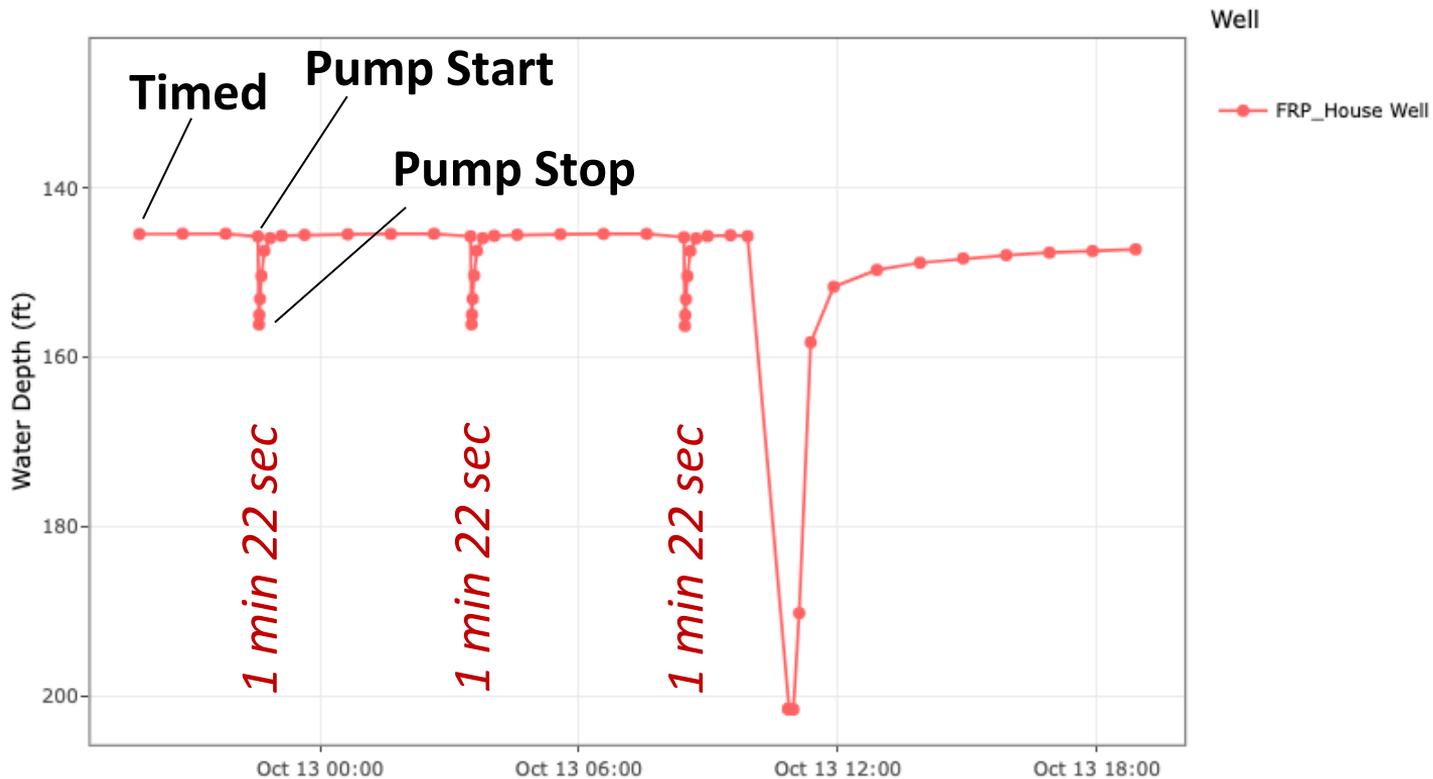


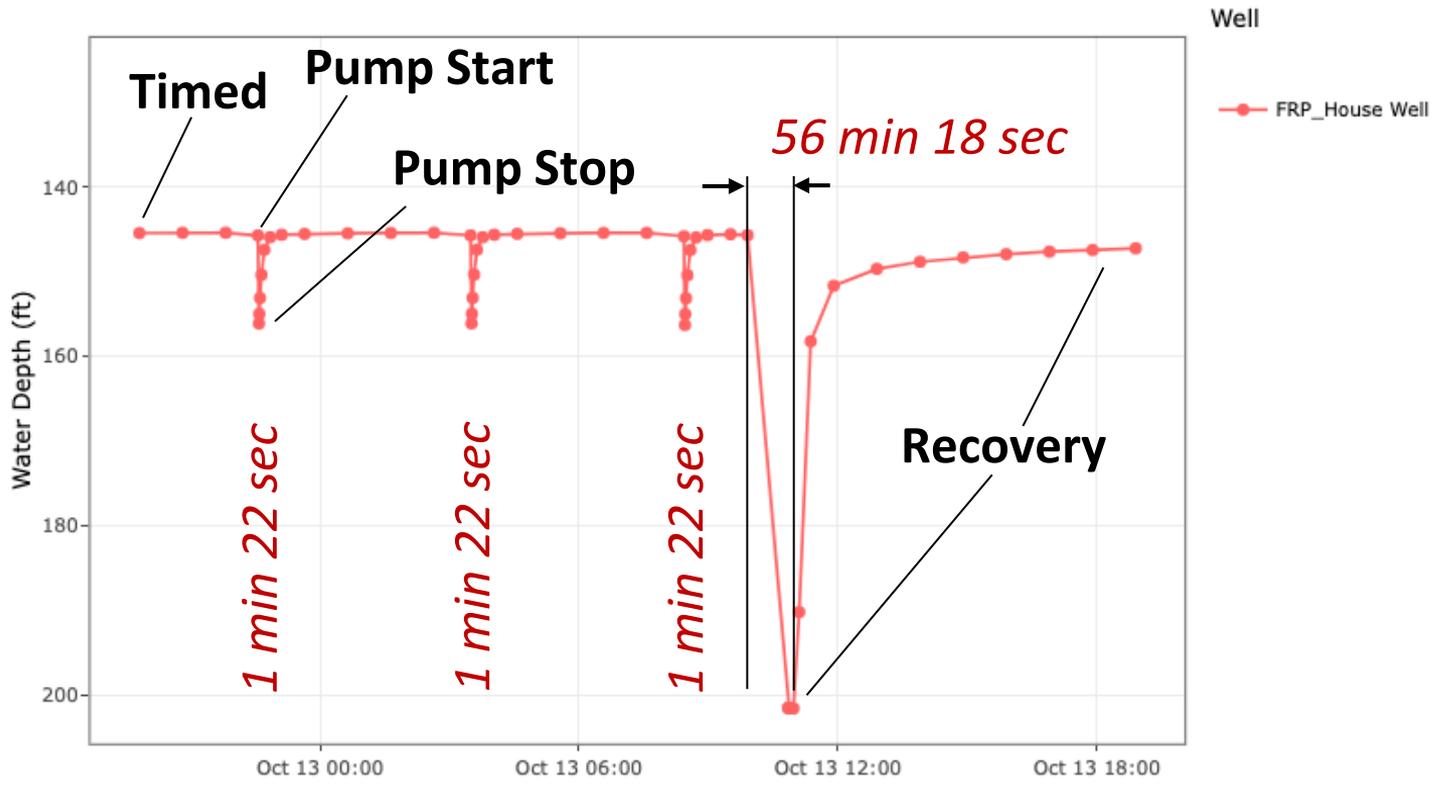




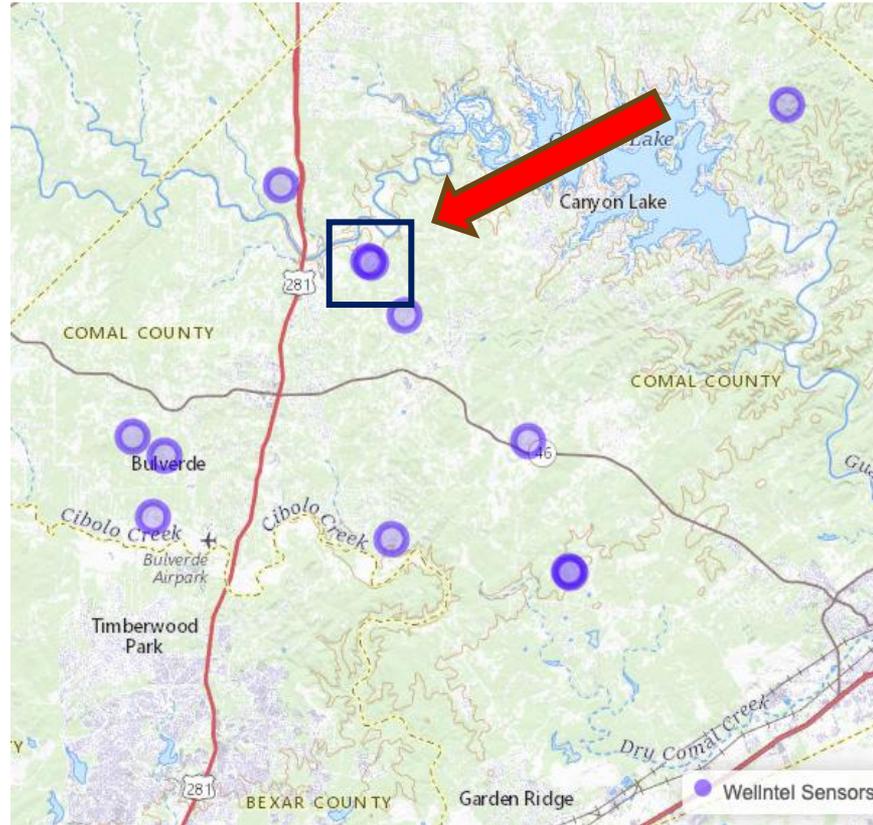






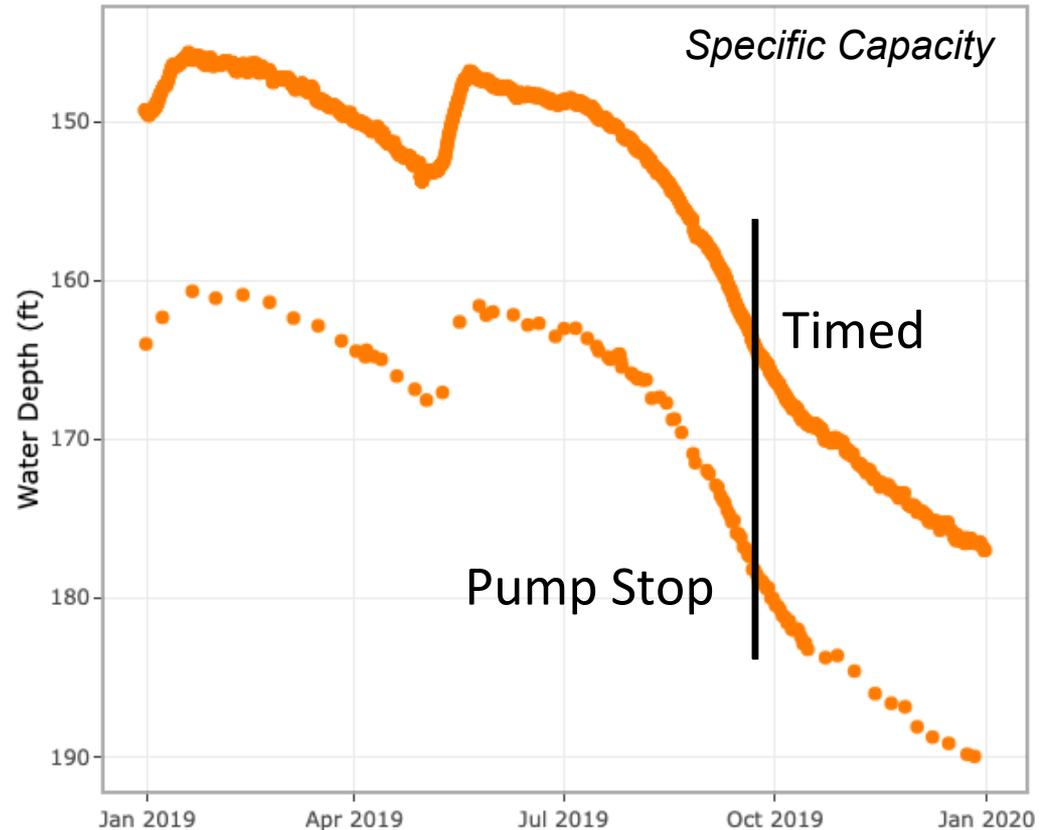


## Single-well analysis



# Single-well analysis

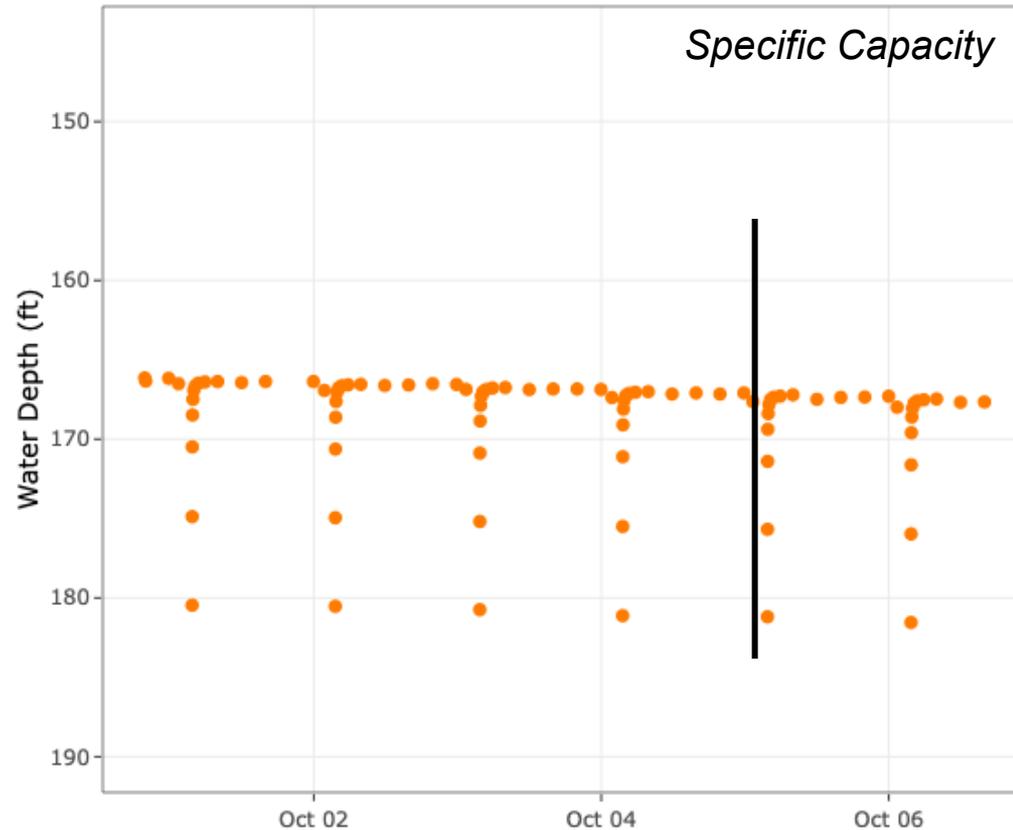
Q  
Drawdown



# Single-well analysis

Q  
Drawdown

Gallons per minute  
Foot of drawdown



# Multiple-well analysis

NE Wisconsin  
5000-head  
Dairy CAFO



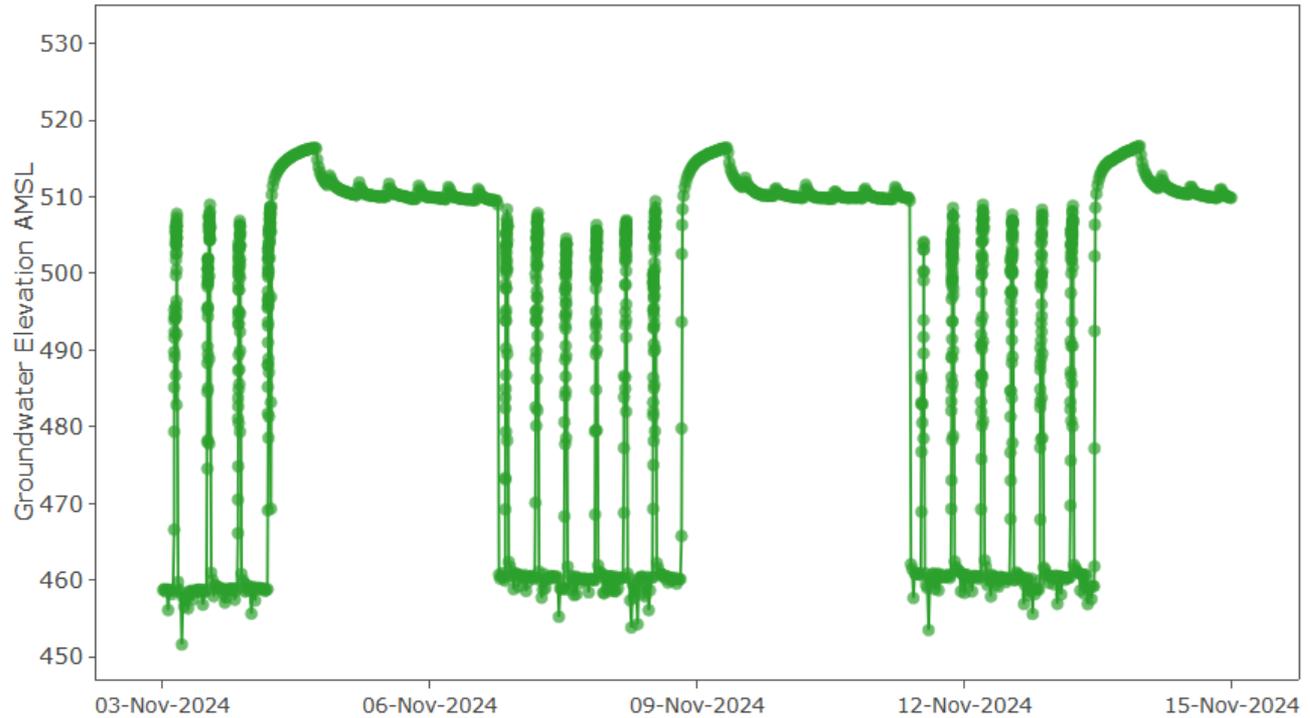
# Multiple-well analysis

Water for all dairy operations comes from three wells that are pumped with the following schedule in rotation:

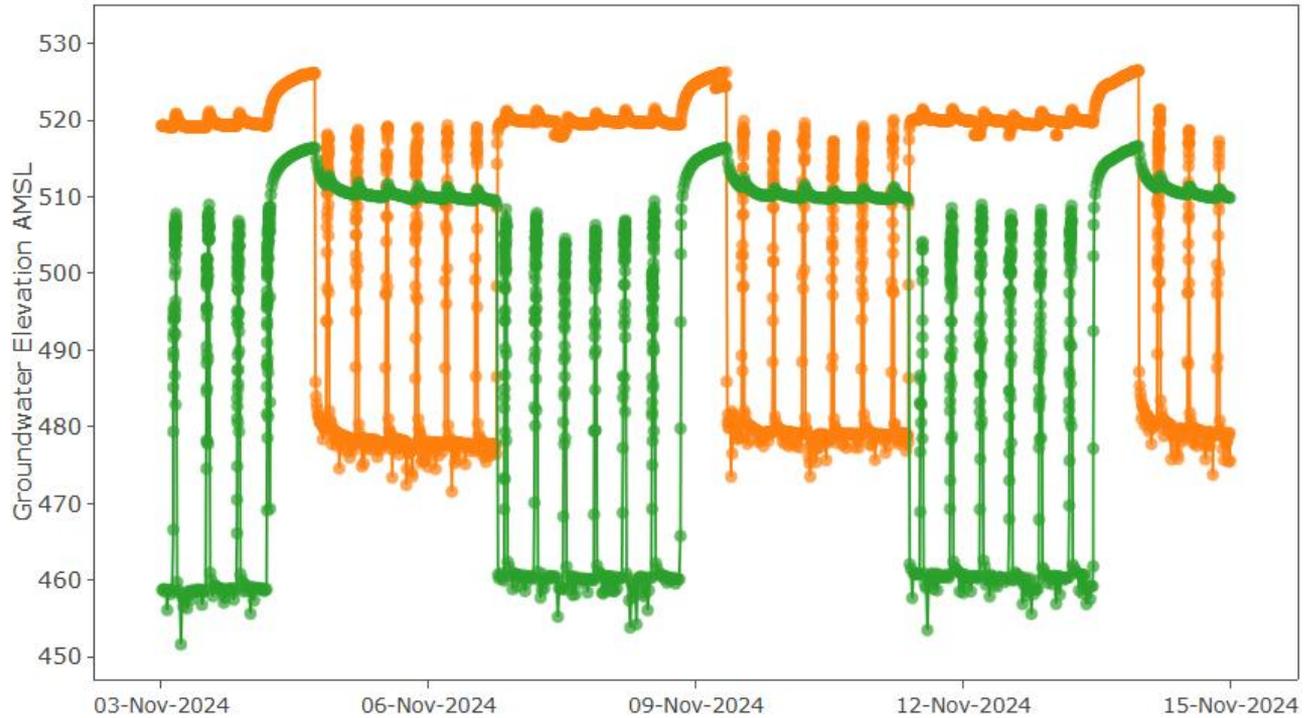
- 48 hours – Well #4
- 48 hours – Well #3
- 12 hours – Well #2



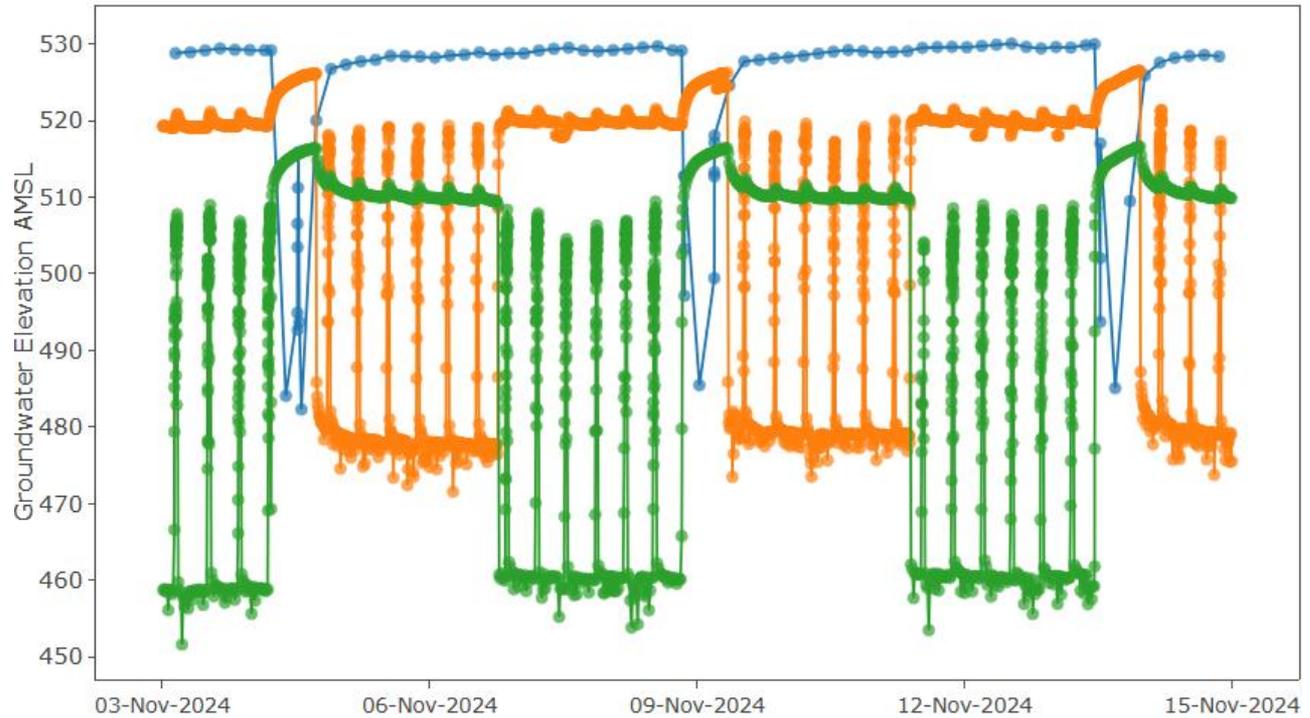
## Multiple-well analysis



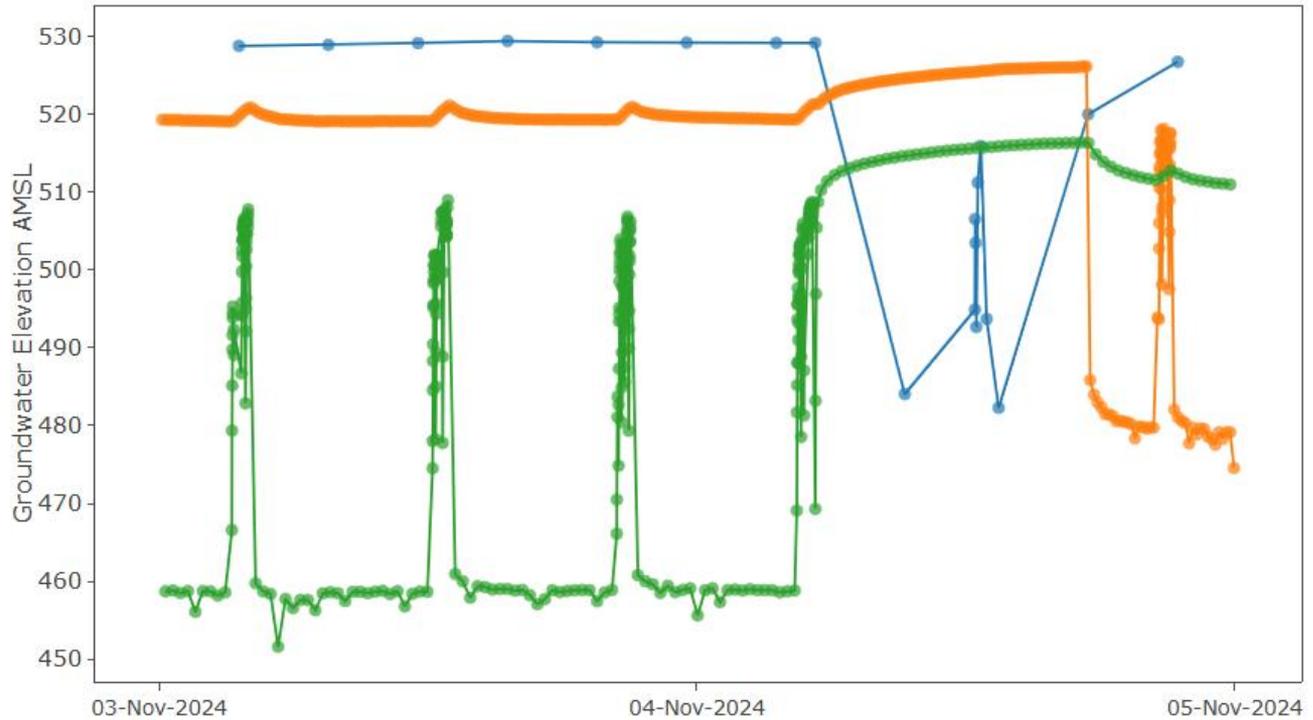
## Multiple-well analysis



## Multiple-well analysis



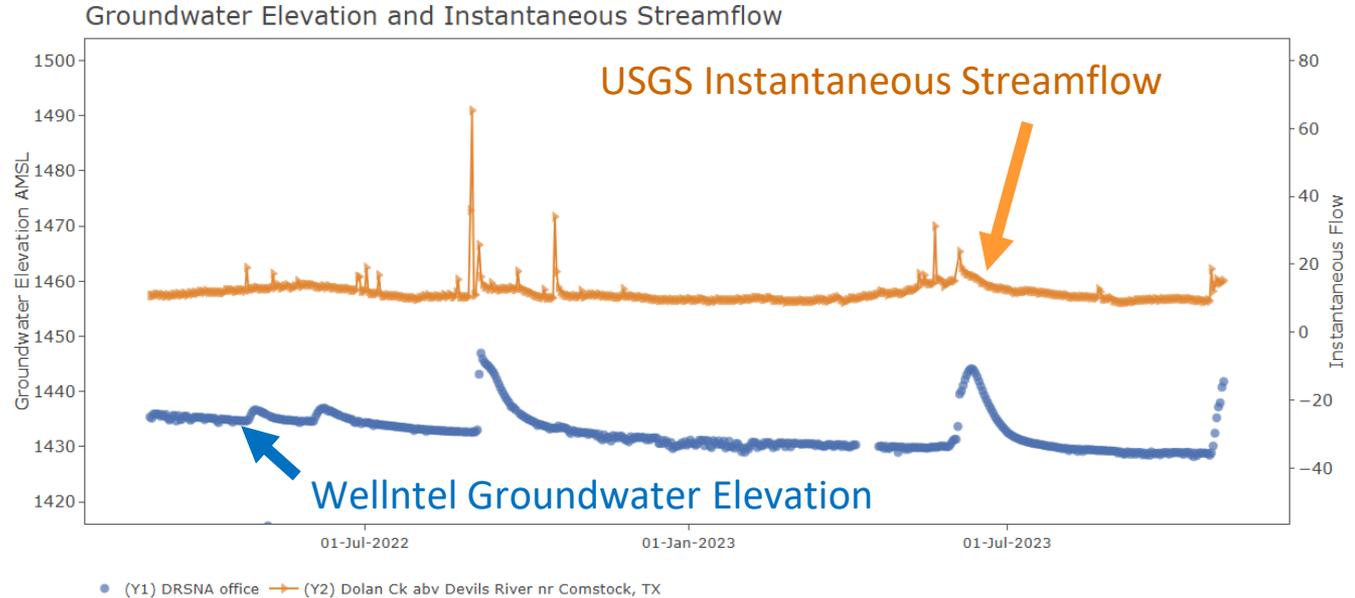
## Multiple-well analysis



# Integration of data types

USGS streamflow

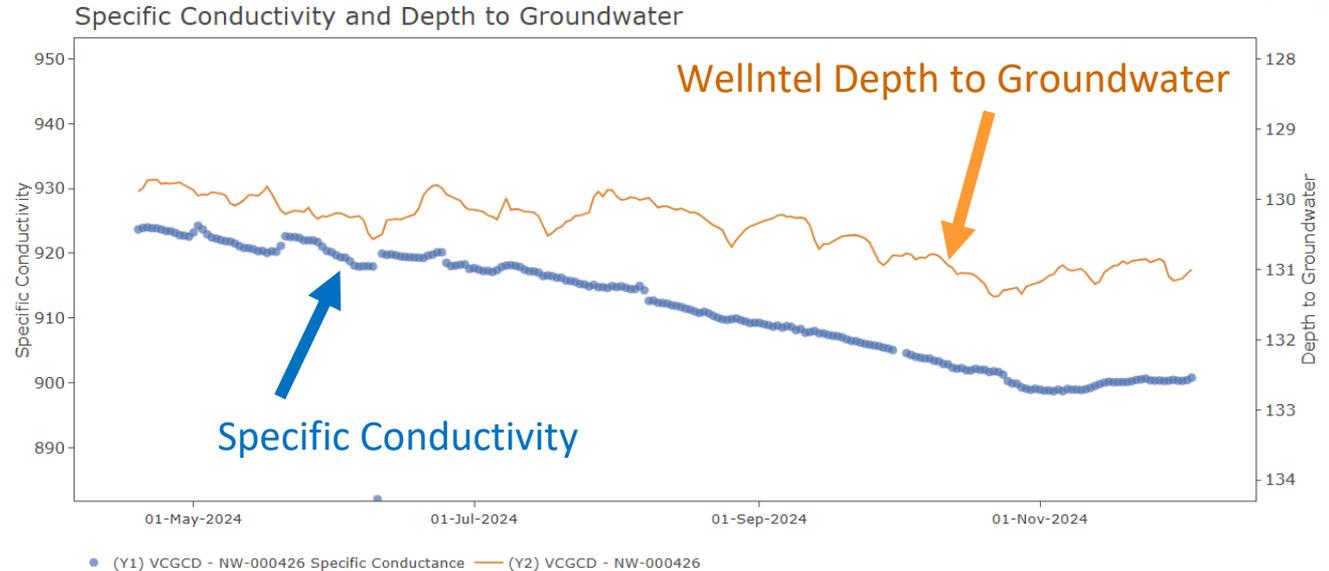
WellIntel acoustic level



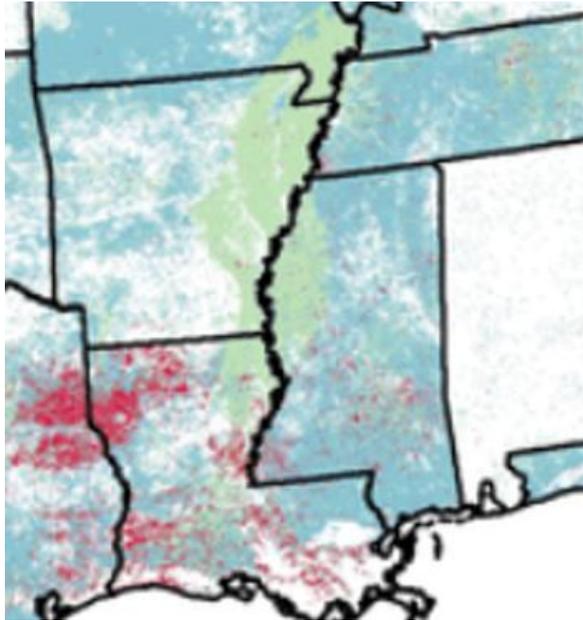
# Integration of data types

Specific conductivity

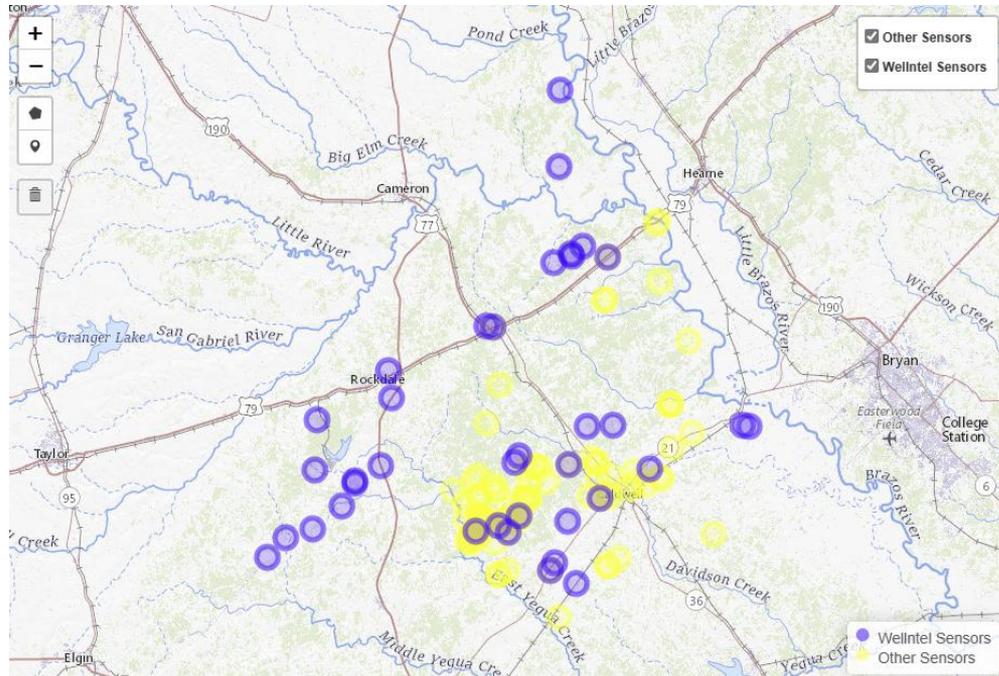
WellIntel acoustic level



# High-Value Groundwater-Level Monitoring Using Submersible Pump Wells



# High-Value Groundwater-Level Monitoring Using Submersible Pump Wells



- Challenge: Texas Major Aquifer, diversion of water 142 miles to San Antonio, measuring and monitoring local impacts near well field
- Solution: Large and growing monitoring network, integration of other sensors and historical data
- Results: Real-time impacts illuminated, adaptive management, GWAP

# High-Value Groundwater-Level Monitoring Using Submersible Pump Wells

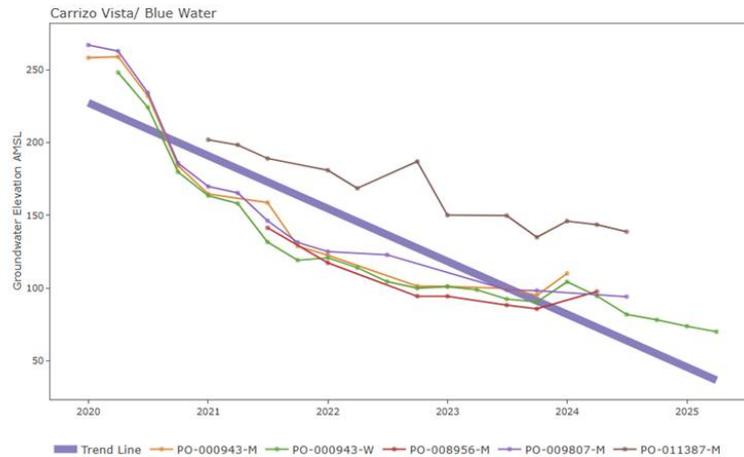
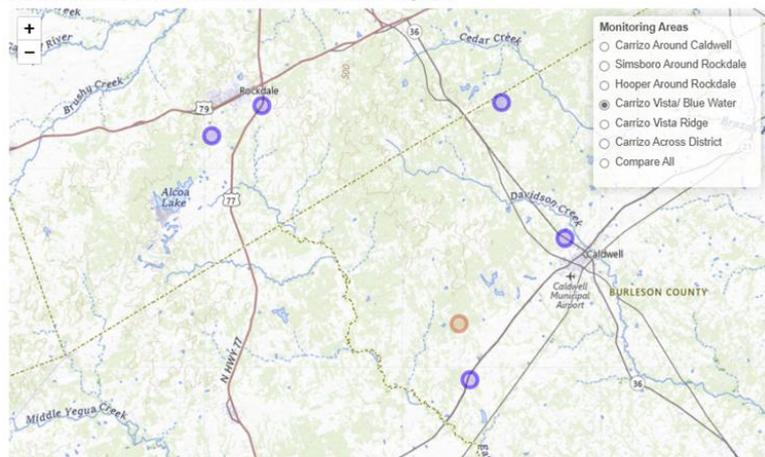


## REAL-TIME GROUNDWATER LEVELS

View and download groundwater change by management district

←  
How

Post Oak Savannah Groundwater Conservation District Monitoring Areas



Leaflet | Powered by Esri | USDA, USGS The National Map, Orthimagery, Data refreshed June, 2024, USGS The National Map, National Hydrography Dataset, Data refreshed February...

Topography 
  Base street map 
  Aerial with labels 
  Aerial without labels 
  Hydrography 
  Light 
  Dark

Disclaimer: Data is intended for informational and analytical purposes only. While efforts have been made to ensure the accuracy and completeness of this data, it may contain inaccuracies, inconsistencies, or errors. As such, this data should not be relied upon for operational or decision-making purposes. WellIntel and Post Oak Savannah GCD disclaims any liability for decisions made or actions taken based on the data provided. Contact: POSGCD at admin@posgcd.org for any questions or further information

**Date Range**

2020-01-01 to 2025-04-18

View Summary [Download Data](#)  
 View Sample Data [Download Plot](#)



# High-Value Groundwater-Level Monitoring Using Submersible Pump Wells

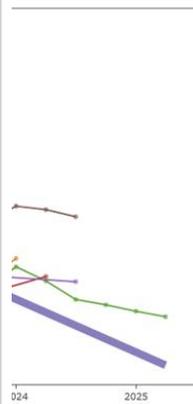
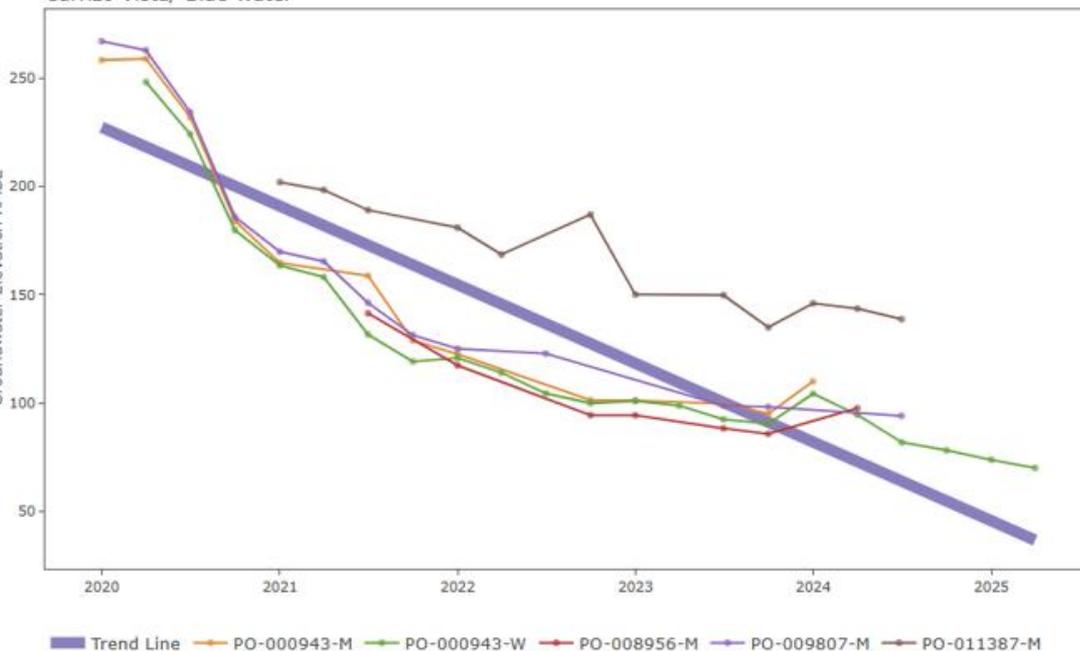


Post Oak Savannah Groundwater C



Disclaimer: Data is intended for informational purposes only. It may contain inaccuracies, inconsistencies, and errors. Post Oak Savannah GCD disclaims any liability for use of this data. For more information, contact admin@posgcd.org for any questions or further assistance.

Carrizo Vista/ Blue Water



9807-M PO-011387-M

[Download Data](#)

[Download Plot](#)





**WellIntel**<sup>®</sup>

Contact:

Charles Dunning, PhD  
VP Hydrology  
WellIntel

cpdunning@wellintel.com  
414-343-6408

