

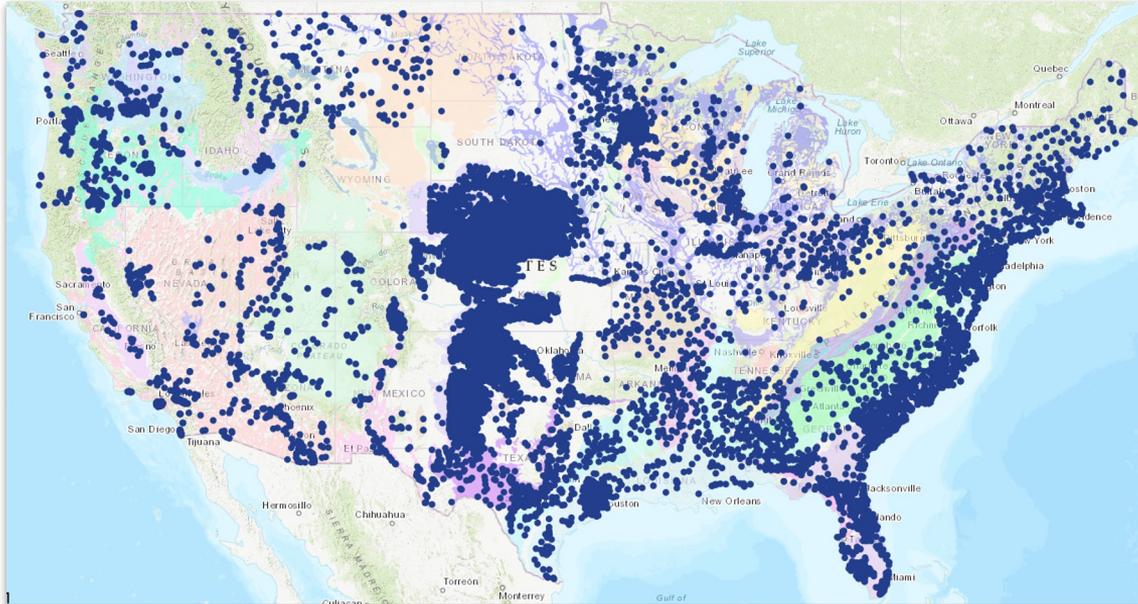
# Leveraging Domestic Wells to Cost-Effectively Fulfill Monitoring Program Goals

Charles Dunning, PhD, Vice President Hydrology  
Marian Singer, Co-Founder

September 25, 2024



# Re-imagining groundwater supply monitoring



**With 3.1M square miles in the US:**

**NGWMN:**

17,700 ... 1 per 210 sq mi

**Weather Stations:**

278,000 ... 1 per 11 sq mi

**Small Production Wells:**

13M ... 4 per sq mi

Source:

\*[National Ground-Water Monitoring Network](#) ~3,500 NGWMN + ~14,000 from cooperating entities

\*[Wikipedia](#): 3.1M square miles in the continental US

\*[Wunderground](#)

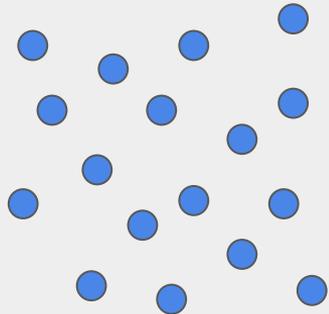
\*[USEPA](#) 13M private wells

<https://www.usgs.gov/media/images/domestic-wells-united-states>

# Small production wells can play an important role in fulfilling monitoring plan goals

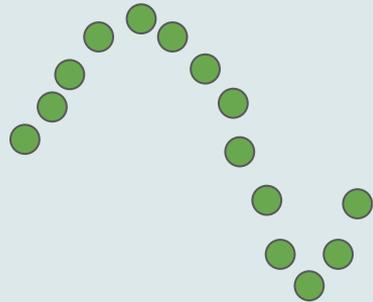
## Spatial Density

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## Data Density

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## Sentinel Site

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## Engagement

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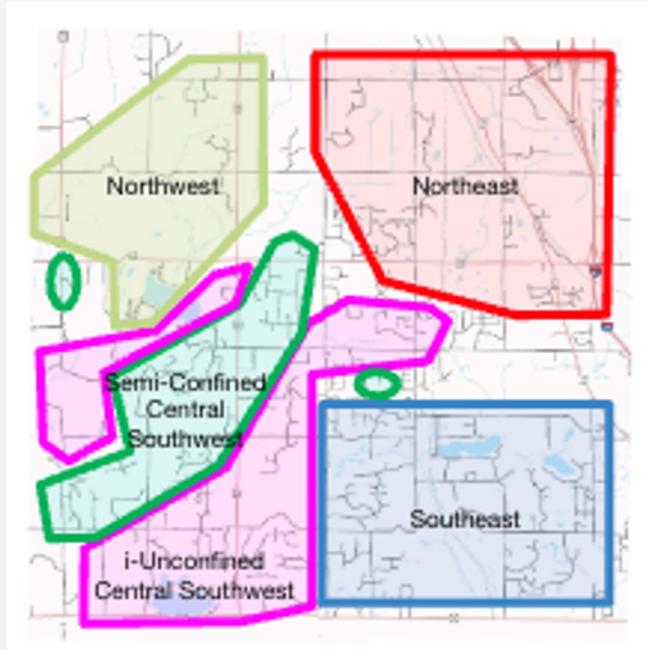


# WellIntel is an option for small production well monitoring



- Designed for submersible pump wells
- Non-invasive, acoustic, no modifications required
- Plug and play, installs ~1 hour
- Monitors pump activity for analysis or filtering
- USGS-tested, 0.1' accuracy, meets CA BMP
- Cloud-based system for analysis and sharing

# Spatial Density



## Richfield, WI

### Situation:

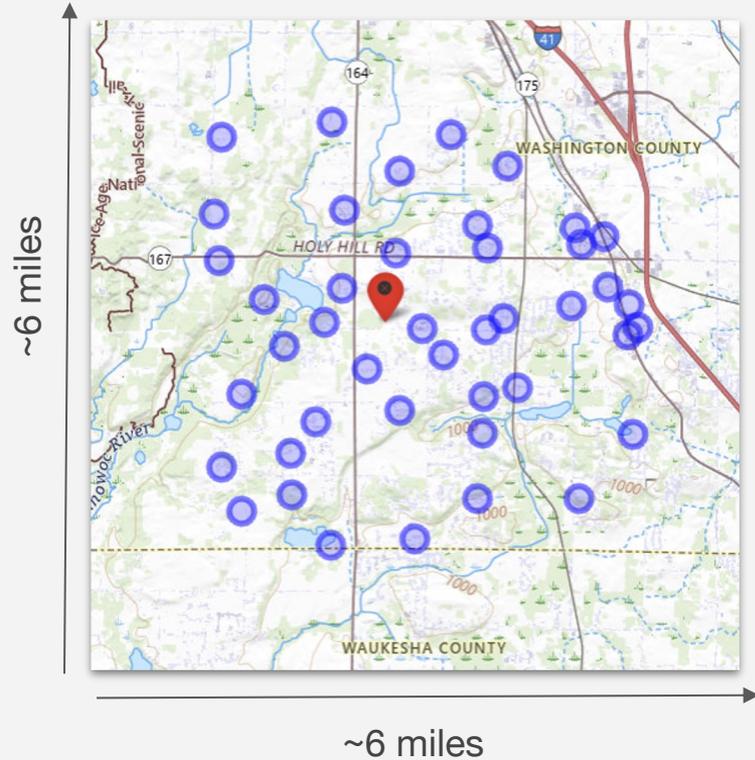
- 100% groundwater dependent
  - Concerns about neighbor overdraft
  - Monitoring 5 hydrologic areas
- 

### Monitoring Goals:

- Early identification of overdraft
- Scientific guidance for permitting
- Ensure long-term community growth

# Spatial Density

# Richfield, WI



## Program:

- 34 active monitoring locations
- 32 domestic, 1 Village Hall, 1 dedicated monitoring well
- Acoustic measurement twice a day
- Monitoring density ~1 per sq mi

# Spatial Density

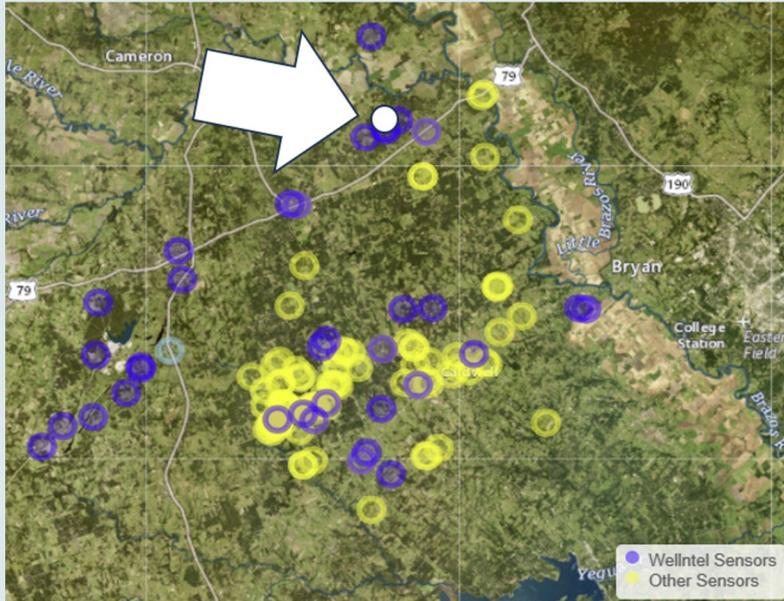
# Richfield, WI



## Insights & Actions

- 20-year historical record provides long-term insights
- Appropriate well density reveals similar hydraulic reaction across areas which supports maintaining unified permit framework
- Cooperation with neighbor community on new growth opportunities

# Data Density



# City of Gause, TX

## Situation:

- Water supply corporation
  - Operating under permit issued by GCD
  - Saturated thickness decline
- 

## Monitoring Goals:

- Characterize operating risk
- Add seasonal detail
- Improve planning

# Data Density

# City of Gause, TX

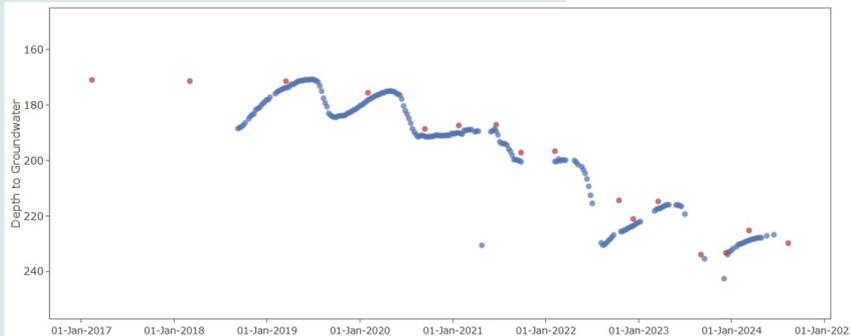
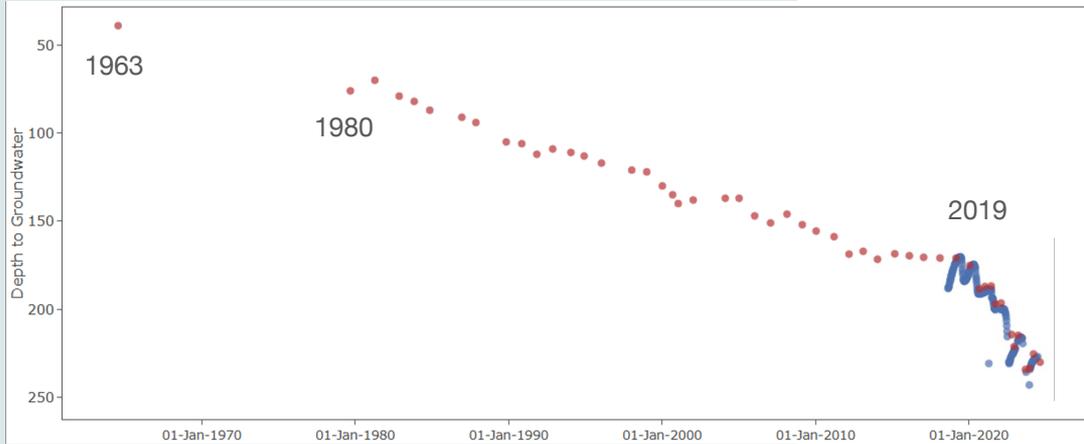


## Program:

- Continue periodic manual measurement
- Add continuous, real-time measurement
- Capture pumping events and resting levels
- Contribute data to local GCD monitoring effort

# Data Density

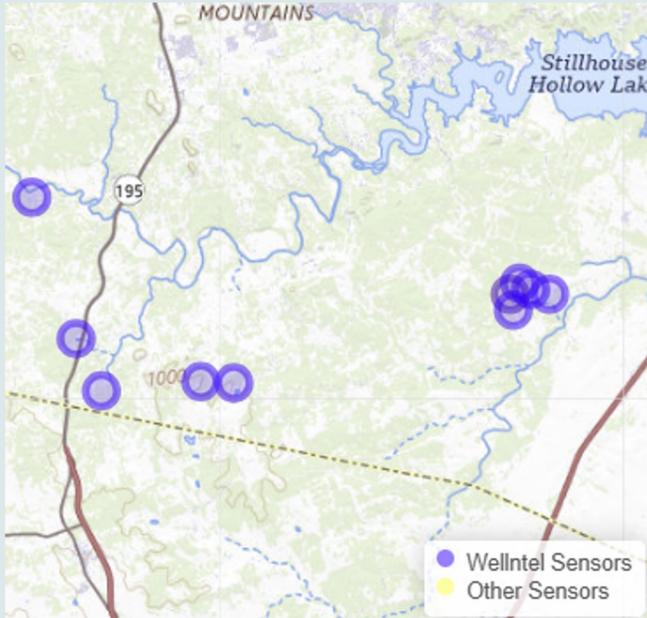
# City of Gause, TX



## Insights & Actions

- Annual measurements, long-term trend, accelerating
- Continuous data collection gives detailed insight into daily and seasonal change and saturated thickness
- Informed water planning

# Data Density



# Bell County, Texas

## Situation:

- Extreme development pressures
  - Weather and climate uncertainty
  - Monitoring managed by local GCD
- 

## Monitoring Goals:

- Contribute to the hydrologic understanding that supports responsive GCD management
- Measure pumping influence on neighboring wells, refine local aquifer parameters

# Density of Data



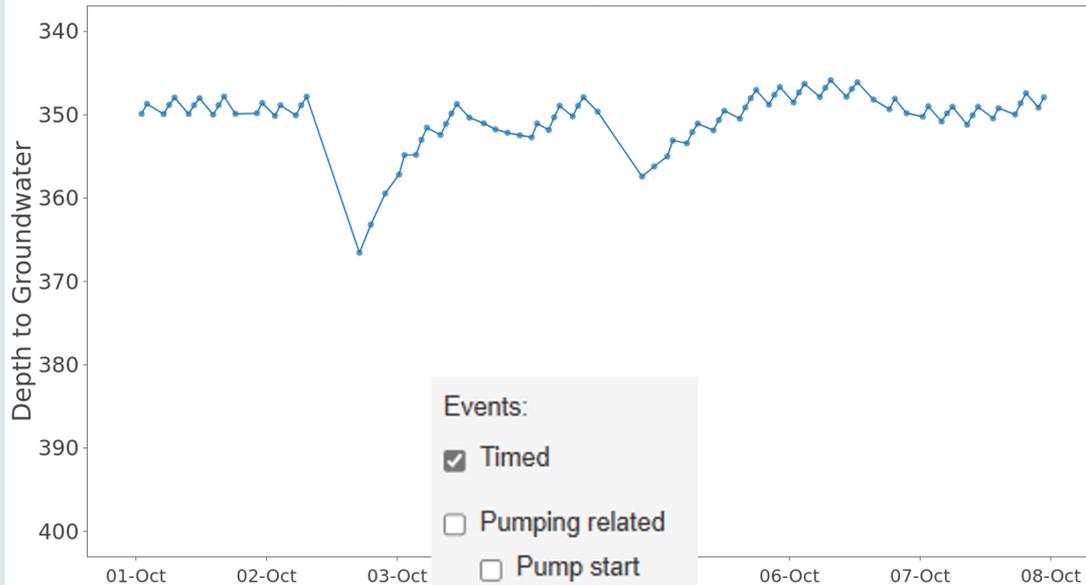
# Bell County, Texas

## Program:

- Volunteer residential wells collect continuous, real-time data
- Capture timed and pumping-related measurements
- Engage academic community to participate in site investigations and analysis

# Density of Data

# Bell County, Texas

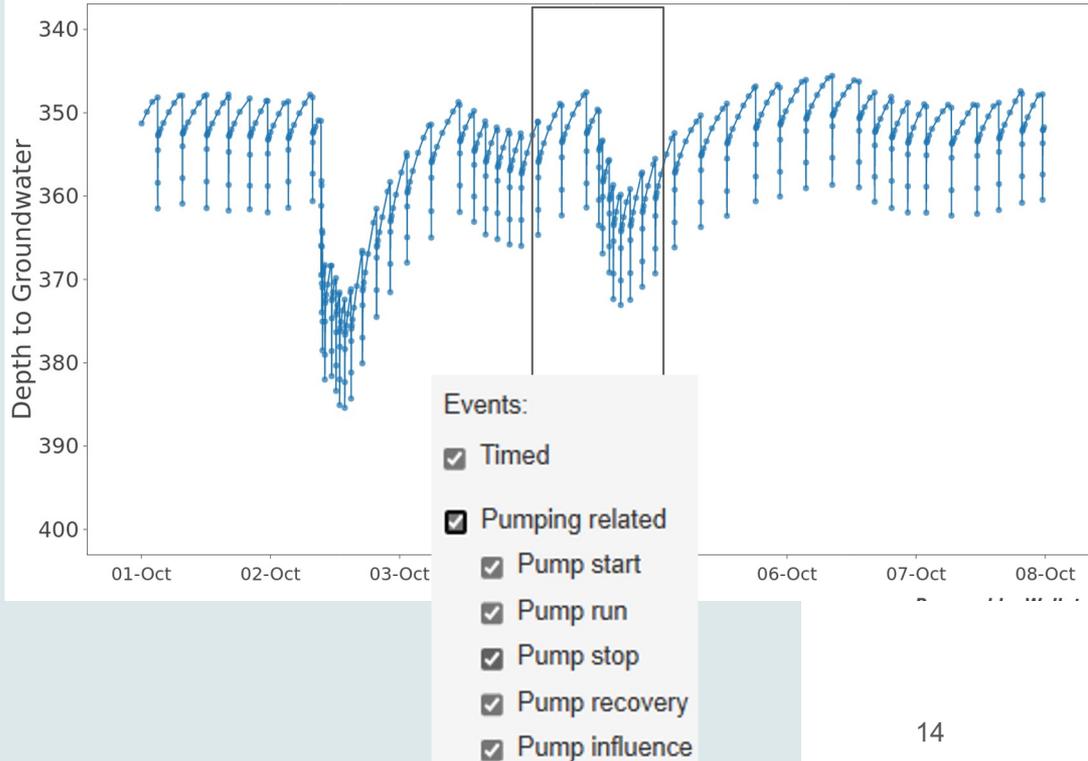


## Insights & Actions

- Continuous Timed measurements track saturated thickness trends

# Density of Data

# Bell County, Texas

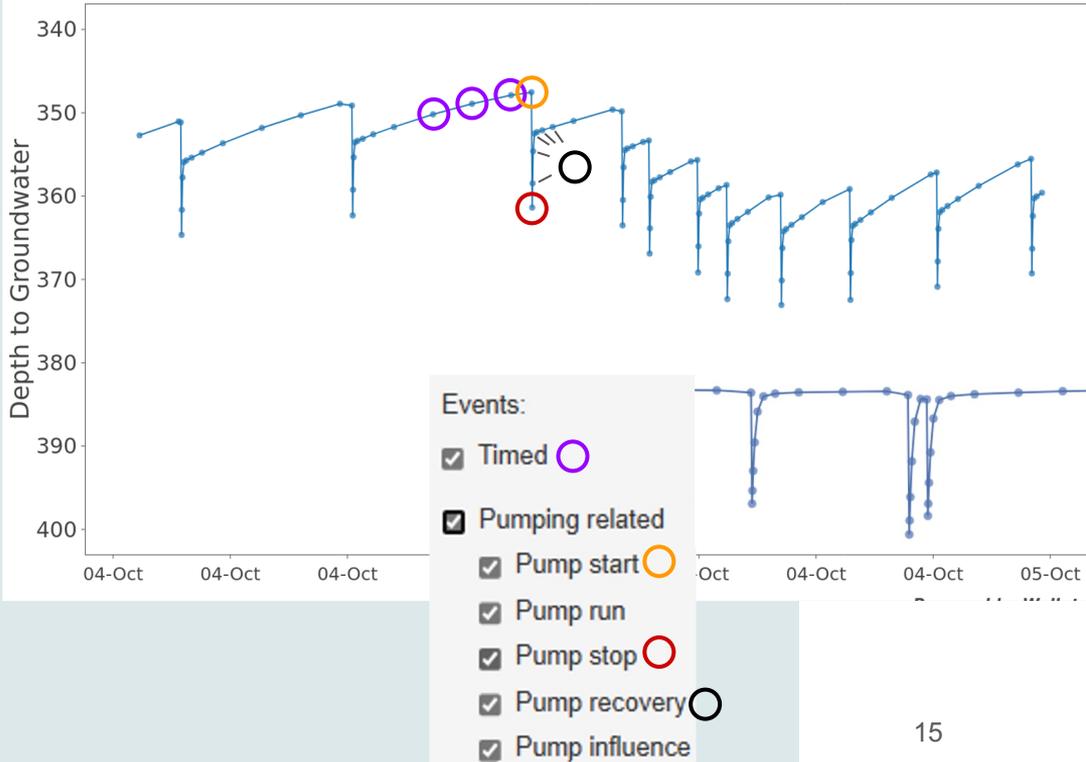


## Insights & Actions

- Continuous Timed measurements track saturated thickness trends
- Pumping data provide different type of data density
- At a minimum, specific capacity can be determined
- Response to range of pumping duration/stress

# Density of Data

# Bell County, Texas



## Insights & Actions

- Continuous Timed measurements track saturated thickness trends
- Pumping data provide different type of data density
- At a minimum, specific capacity can be determined
- Response to range of pumping duration/stress
- Recovery profile

# Sentinel Site CA



## Central Coast,

### Situation:

- Continuing regional growth in grape & wine production
  - Recent, ongoing large vineyard development
  - Concerned neighbor
- 

### Monitoring Goals:

- Early drinking water impact identification
- Timely mitigation, if necessary
- Promote good neighbor relationships

# Sentinel Site CA



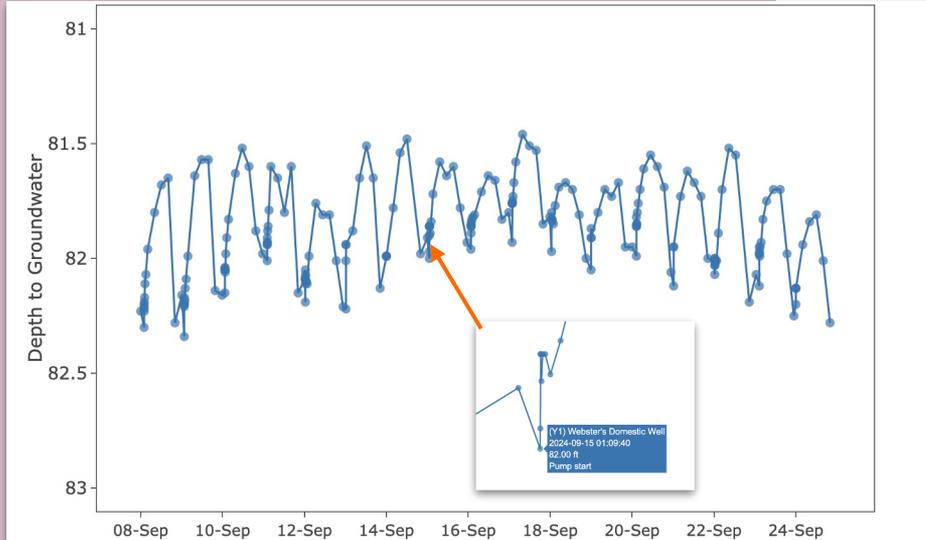
## Central Coast,

### Program:

- Vineyard purchase monitoring equipment for neighbor domestic water well
- Monitoring to capture each well owner pumping and rest event
- Vineyard and neighbor access same data

# Sentinel Site CA

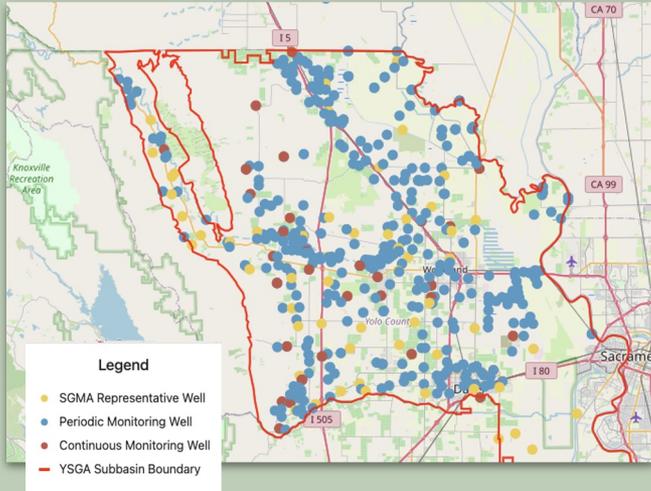
## Central Coast,



### Insights and actions:

- Vineyard in development so general regional impact shown
- Well owner pumping impact identifiable - and minimal
- Building historical record and norms

# Engagement



# Sacramento, CA

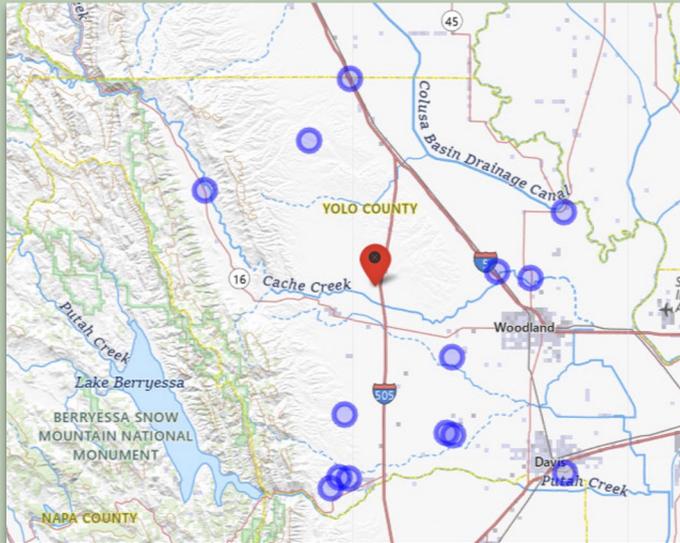
## Situation:

- Flood control & water conservation district includes groundwater in monitoring program
  - Historical use of residential volunteer wells with manual monitoring
- 

## Monitoring Goals:

- Minimize field time and expense
- Increase data density
- Engage volunteers

# Engagement

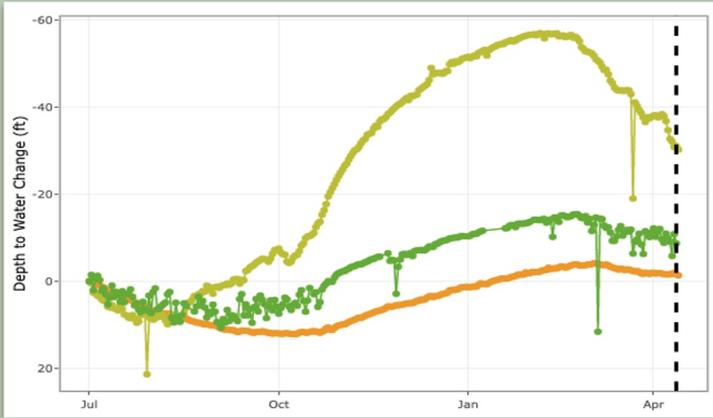


# Sacramento, CA

## Program:

- 5-year roll out of automated monitoring
- 14 wells participating
- Vineyard and neighbor share data

# Engagement



# Sacramento, CA

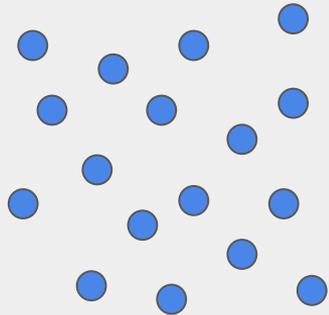
## Insights and actions:

- Daily data captures the difference in recharge and drawdown for each well
- API connection feeds district-specified data automatically to GSA database
- Well volunteer dashboard engages and informs

# Small production wells can play an important role in fulfilling monitoring plan goals

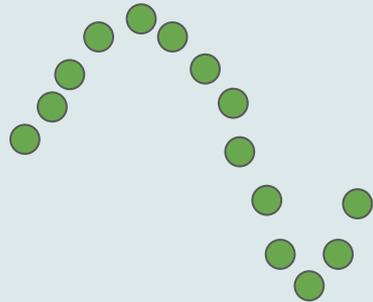
## Spatial Density

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## Data Density

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## Sentinel Site

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## Engagement

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# THANK YOU!

Charles Dunning, PhD, Vice President Hydrology

[cpdunning@wellIntel.com](mailto:cpdunning@wellIntel.com)

414-343-6408

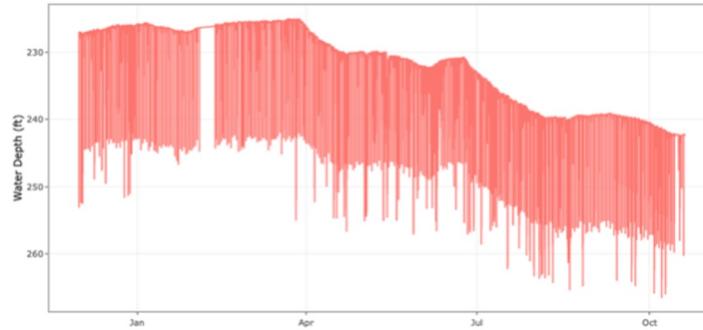
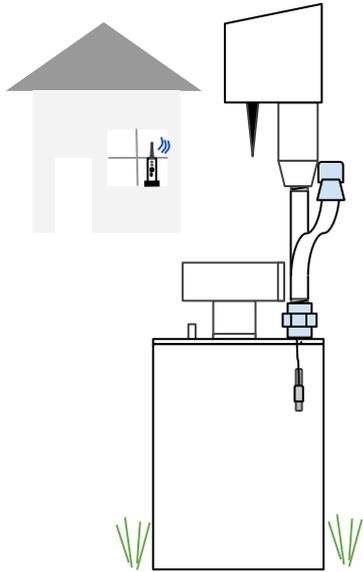
Marian Singer, Co-Founder

[mjsinger@wellIntel.com](mailto:mjsinger@wellIntel.com)

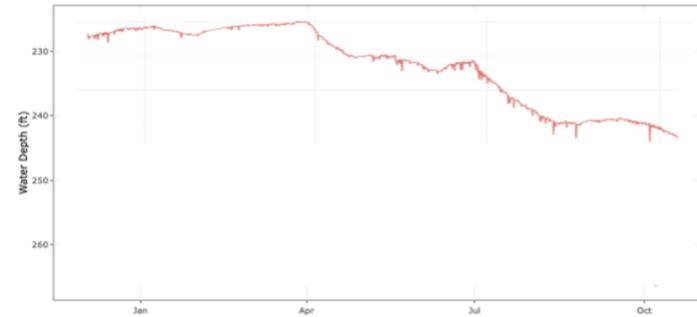
414-416-6281



# WellIntel



all readings - timed, pump start, pump stop, pump recovery



"timed" static readings only

The screenshot shows the WellIntel web interface. At the top, there is a navigation bar with the WellIntel logo and a user profile. The main content area is divided into several sections:

- Water Level:** A line graph showing water level over time from July to September. The y-axis ranges from 60 to 80. The data is represented by a blue line with frequent, sharp vertical drops, indicating the water level being pulled down by a pump.
- Area Data:** A line graph showing area data over time from June to September. The y-axis ranges from 0.0 to 1.00. The data is represented by a blue line with frequent, sharp vertical drops, indicating the area data being pulled down by a pump.
- Sensor Voltage:** A line graph showing sensor voltage over time from September to October. The y-axis ranges from 3.5 to 5.0. The data is represented by a blue line with frequent, sharp vertical drops, indicating the sensor voltage being pulled down by a pump.
- Recent Telemetry:** A table showing recent telemetry data. The table has columns for Created, Received, Device, Duplicate, and Signal Strength. The data is as follows:
 

Created	Received	Device	Duplicate	Signal Strength
8/22/24 8:33:38	8/22/24 8:20:37	PMI CS21		Gateway
8/22/24 8:33:33	8/22/24 8:20:33	PMI CS21		Gateway
8/22/24 8:33:29	8/22/24 8:20:29	PMI CS21		Gateway
8/22/24 2:57:37	8/22/24 2:57:33	PMI CS21		Sensor Strong
8/22/24 2:53:24	8/22/24 2:20:24	PMI CS21		Gateway
8/22/24 1:35:22	8/22/24 1:20:21	PMI CS21		Gateway
8/22/24 12:08:10	8/22/24 12:08:09	PMI CS21		Sensor Strong

# Four modules



Sensor



Cloud  
Database

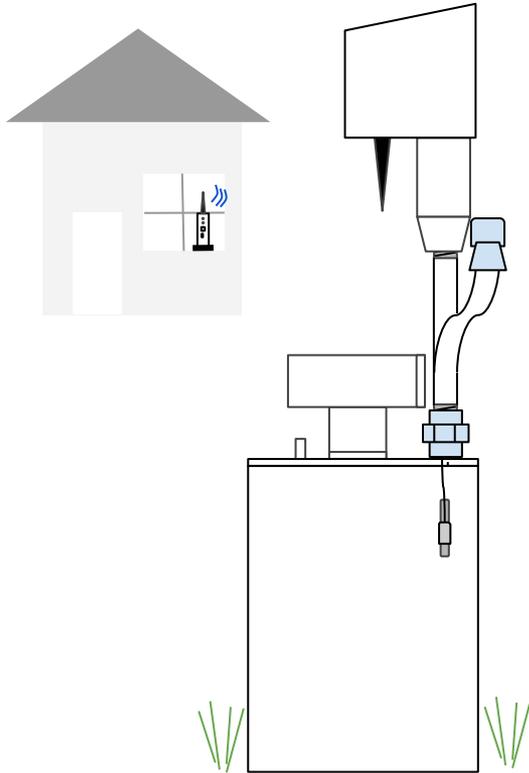


Analysis  
Platform



Alerting &  
Reporting

# WellIntel's sensor is non-invasive, designed to turn production wells into real-time monitoring points



- Designed for **submersible pump and monitoring wells**
- **Non-invasive**, acoustic, no modifications required
- **Plug and play**, installs ~1 hour
- USGS-tested, **+0.1' accuracy**
- **Telemetry options** - local (free) & cellular (annual service)

# Cloud-hosted platform and databases create flexible, sensor agnostic storage, analysis and reporting

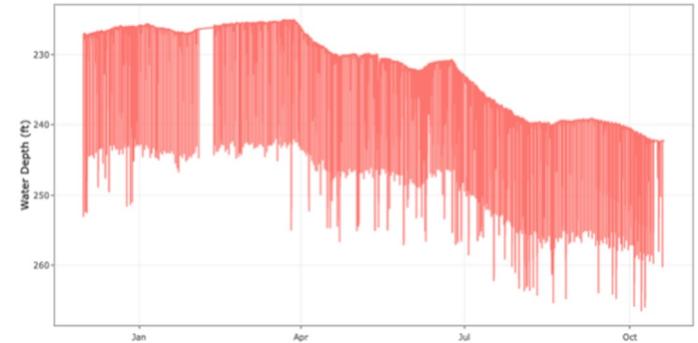


- **Any time-series water sensor measurement** - transducers, flow meters, quality sensors, precipitation
- Upload in **any format** - API cloud to cloud retrieval, spreadsheet upload, single measurement addition
- Leverage **publicly available data** - USGS ground and surface water monitoring networks, NOAA precipitation, available state network

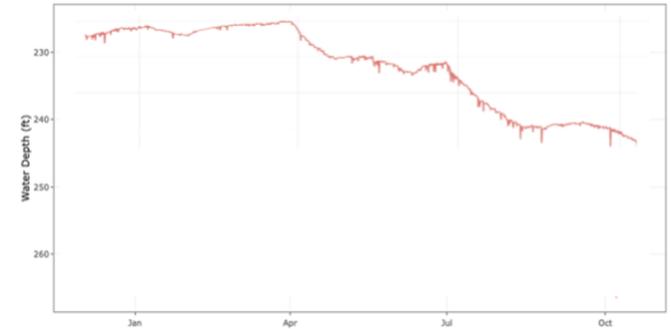
# What can you do?

## Monitor

- **Transform** domestic, small water supply, farm, and industry wells into real-time monitoring locations
- **Track and tag pumping activity**, to analyze or ignore
- Set **pump-specific alerts** and reduce operating risk



all readings - timed, pump start, pump stop, pump recovery

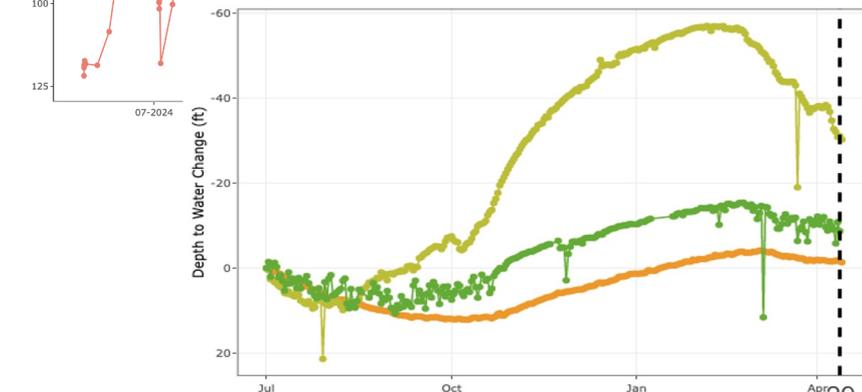
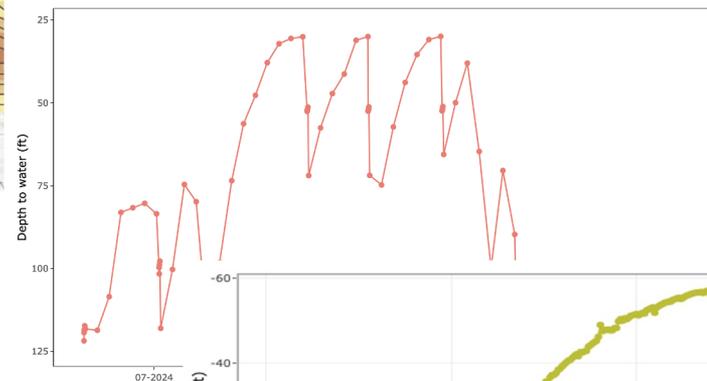
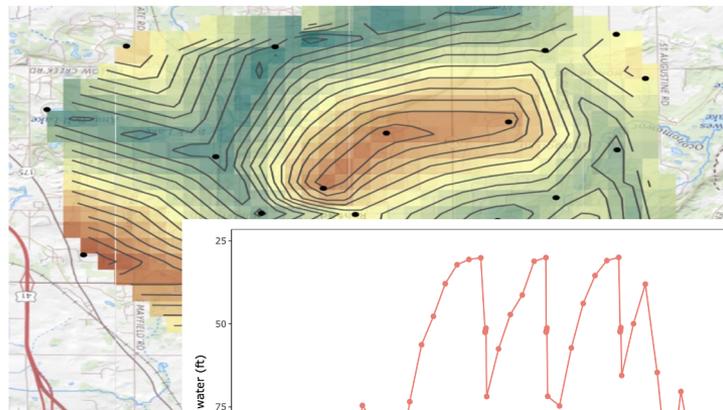


"timed" static readings only

# What can you do?

## Analyze

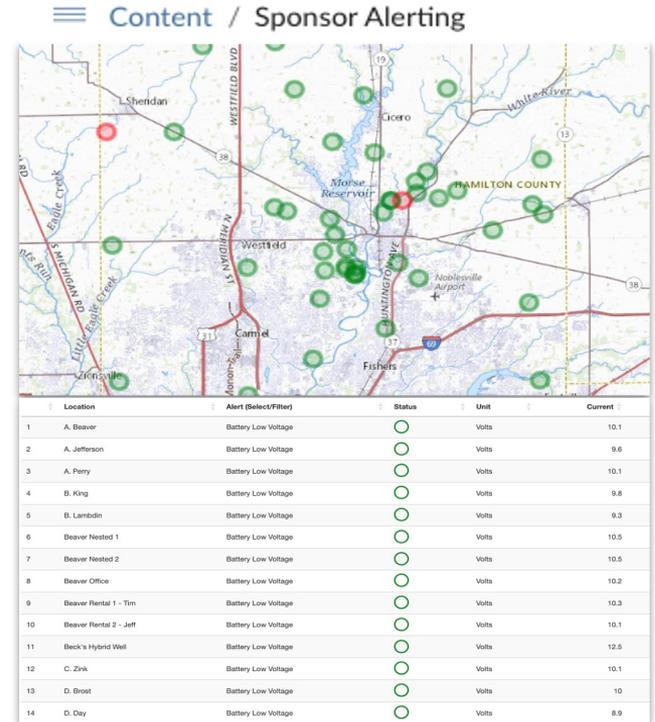
- **Track change** over a network
- **Identify external impact**
- **Compare** wells or areas



# What can you do?

## Alert

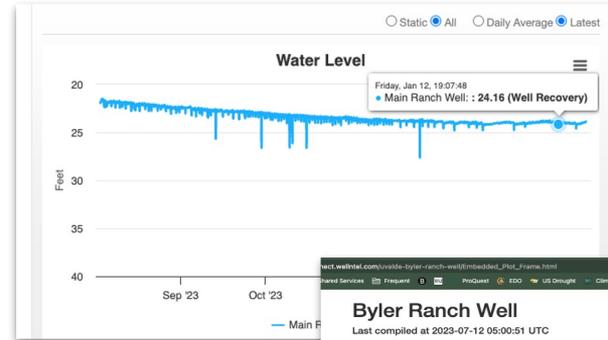
- **Identify and protect wells at risk** at risk
- **Trigger alert thresholds** for a well or network
- **Save mitigation costs** by catching early



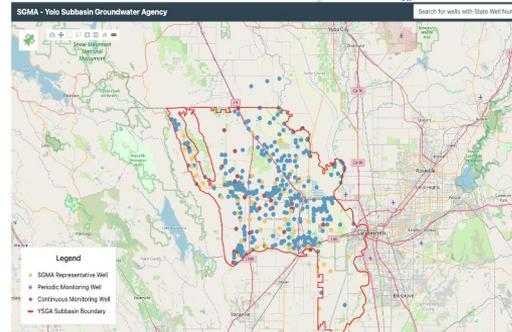
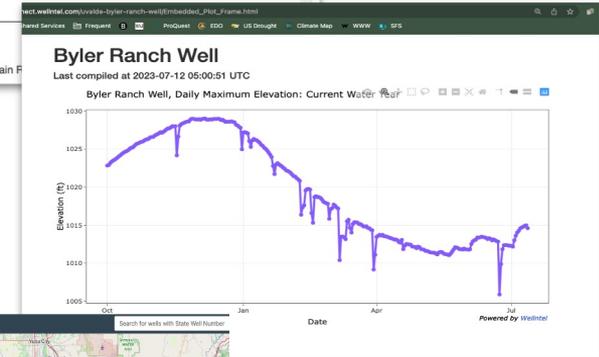
# What can you do?

Engage

- **Secure and private** well owner data collection, storage and dashboards
- **Embed live charts** in websites
- **API transfer data**



<https://connect.wellntel.com/uvalde-byler-ranch-well/Embedded Plot Frame.html>



<https://sgma.yologroundwater.org/>

# Our customers are industries and communities that need to minimize water risk and ensure compliance



## Public Agencies

Simplify compliance reporting and inform planning



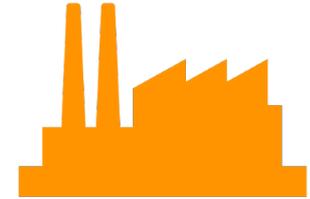
## Agriculture & Dairy

Minimize operating risk, maximize output, permit compliance



## Water Utilities

Protect operating assets, ensure permit compliance



## Industry

Inform permitting and growth decisions

# Monitoring in dozens of states

