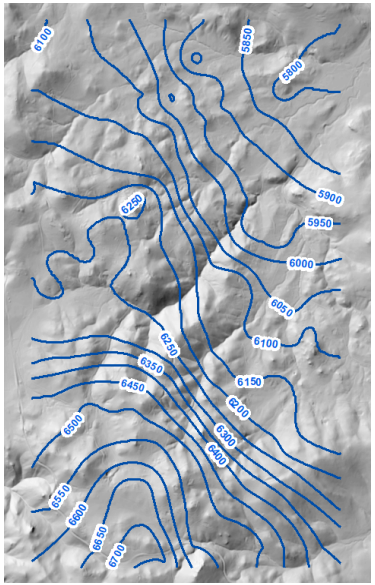
# Virginia City Highlands Groundwater Investigation: Year 3 Summary

Storey County Planning Commission Meeting 11/5/2020




U.S. Department of the Interior
U.S. Geological Survey

By David Smith (dwsmith@usgs.gov) and Kip Allander (kalland@usgs.gov)

# Presentation Outline

(1) Problem: water-level decline and the deepening and replacement of domestic wells

(2) Annual precipitation in the Virginia City (VC) Highlands 1981-2020

(3) Water-level change during a below normal precipitation year

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Due to limited time, this presentation builds on previous year-end updates

**Year 1** – Aquifers in VC Highlands, water-level measurements, and how to access data
**Year 2** – Preliminary water-level change map (1984-2019)

Presentations available from USGS and Storey County

https://go.usa.gov/x7k3Q

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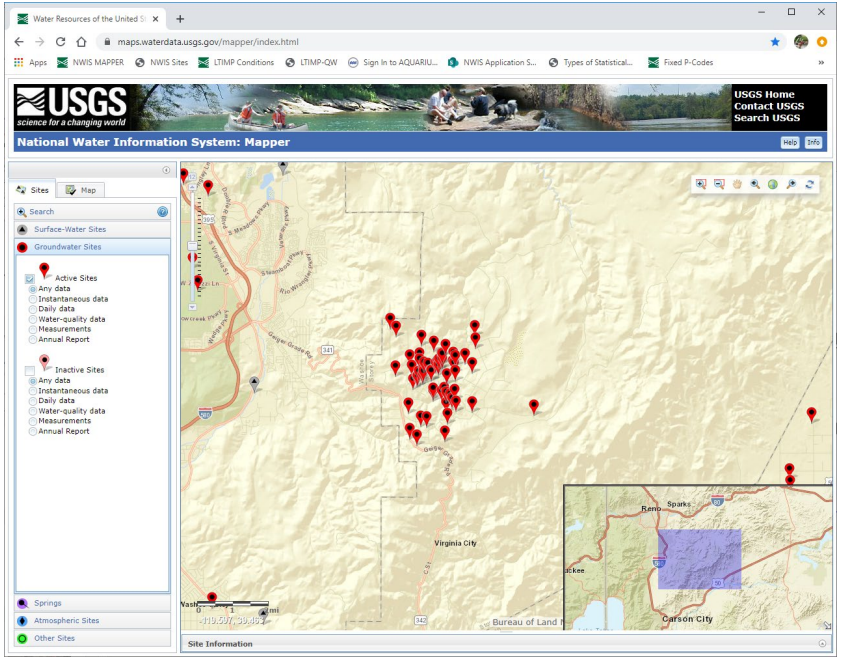
# Provisional Data Reminder

The purpose of this presentation is to inform the Storey County community on the status of this project, what we're observing in the field, and answer any questions.

<u>Reminder: data presented is considered provisional until final report is reviewed published</u>

The information we collect is publicly available. Groundwater data from the VC Highlands please visit the link below:

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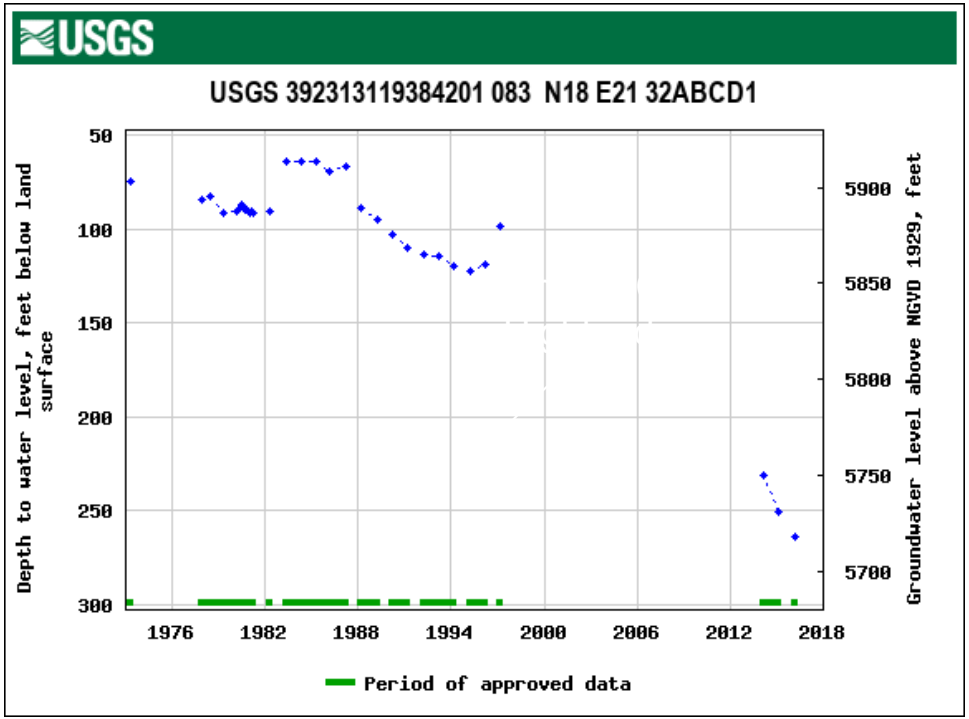
https://maps.waterdata.usgs.gov/mapper/index.html

# Problem: water-level decline in domestic wells

- Observed significant water-level declines in 2014 - 2016.
  - Two domestic wells with water-level declines of 50 and 165 feet since 1997.
  - Nevada Division of Water Resources data indicates ~112 wells in the VC Highlands have been deepened/replaced.
  - Storey County is interested in understanding the groundwater declines in the VC Highlands.
- This is the summary of year 3 of 5-year investigation to help understand the problem and inform planning.

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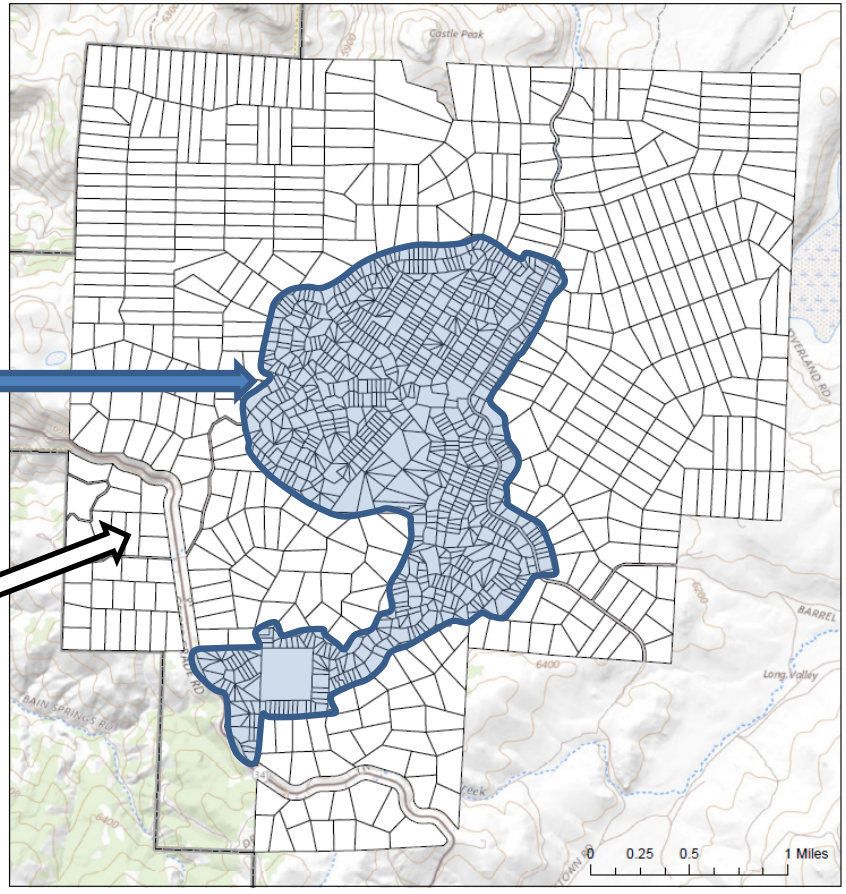
# Problem: Wells deepened or replaced

- Total parcels in VC Highlands = ~1,420
  - Includes VC Highlands and Highland Ranches areas
  - Public land (Storey County and BLM)
  - 642 total domestic wells (as of 9/2020)

- VC Highlands (mostly 1-acre parcels)
  - ~914 total parcels
  - 422 domestic wells, 46% developed*
  - 93 (22%) have been deepened or replaced

- Highland Ranches (mostly 10-acre parcels)
  - ~502 total parcels
  - 220 domestic wells, 43% developed*
  - 19 (8%) have been deepened or replaced

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*developed, indicates the presence of a domestic well

# Map of deepened or replaced domestic wells in the VC Highlands between 1980-2020

**EXPLANATION**

County Boundary

**Parcel domestic well status**

- Contains a well
- Contains a deepened or replaced well
- Without a well

71% of deepened or replaced wells are adjacent to a parcel that also has a deepened or replaced well (80 of 112 wells).

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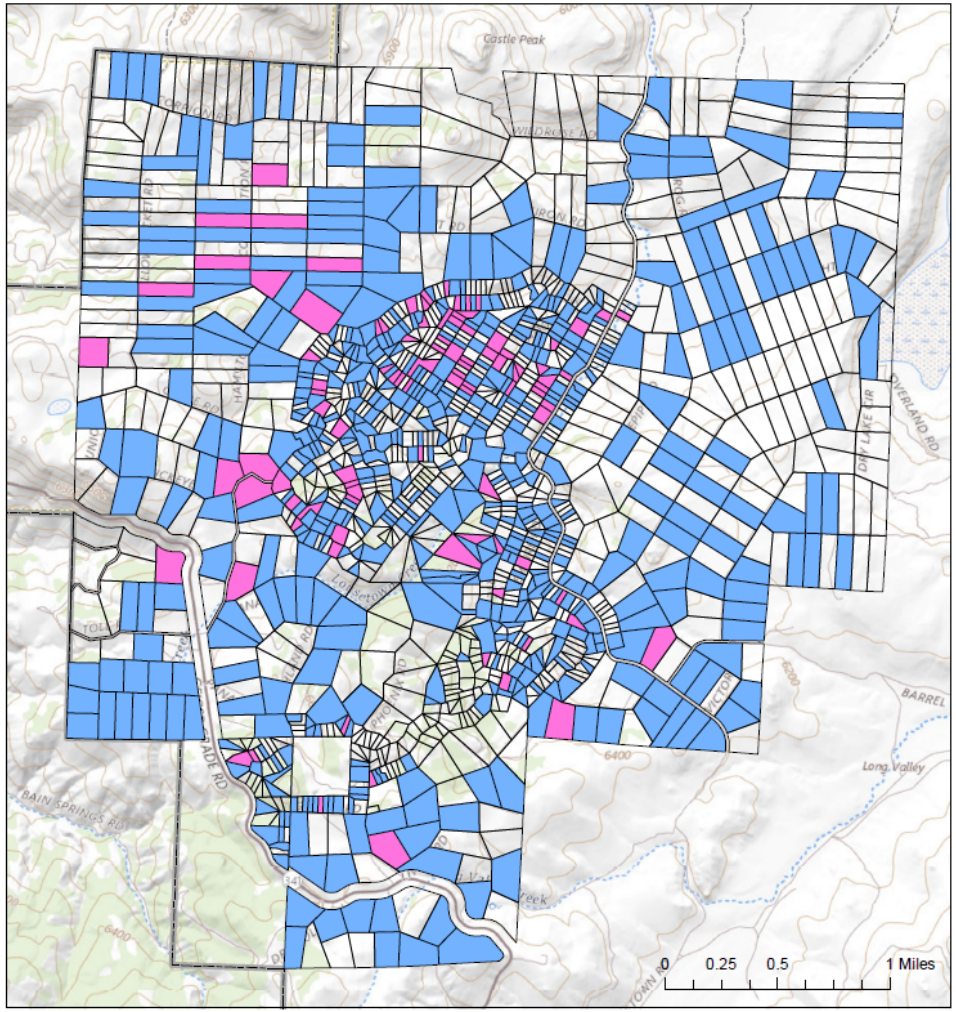
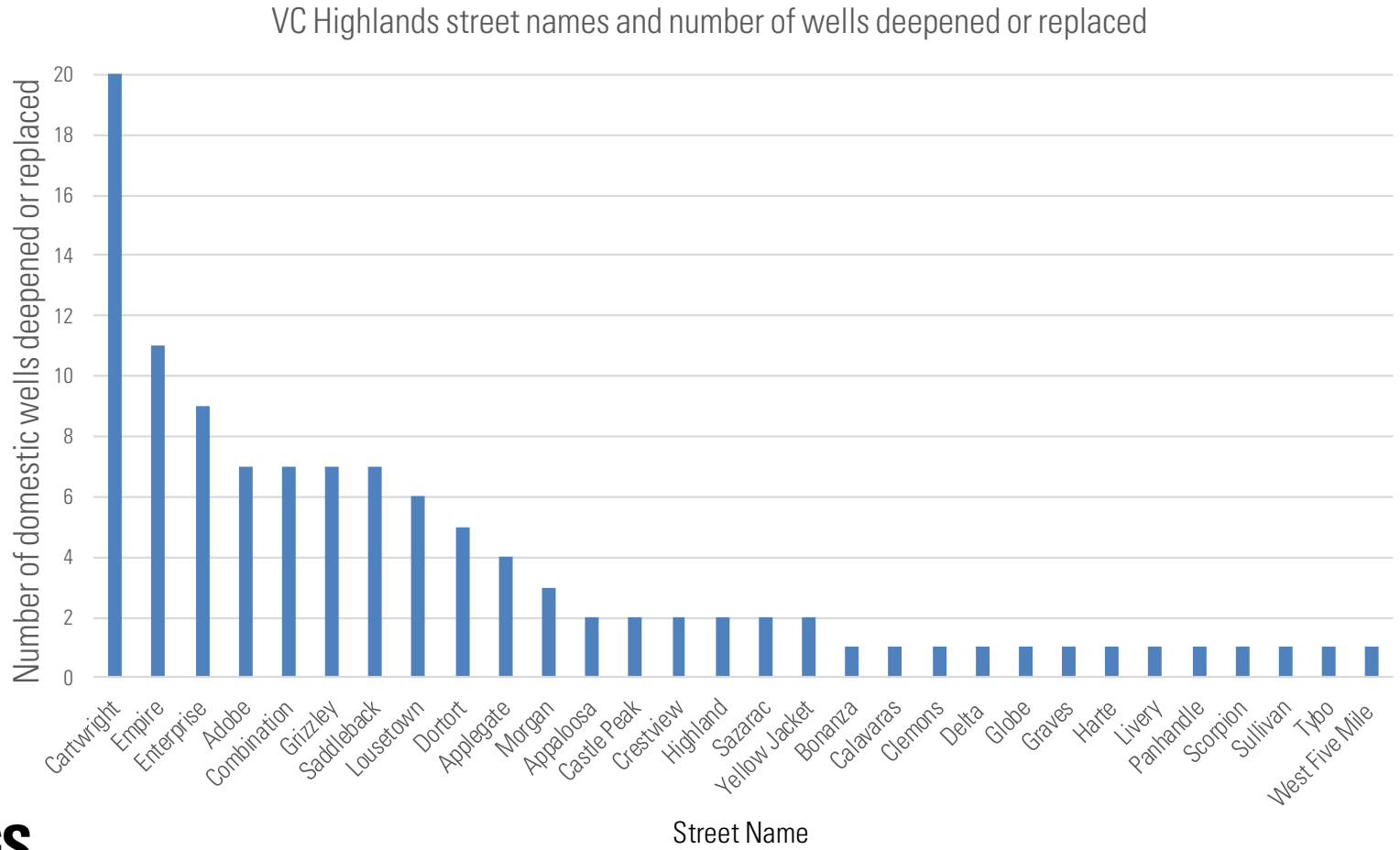



USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; 2020.

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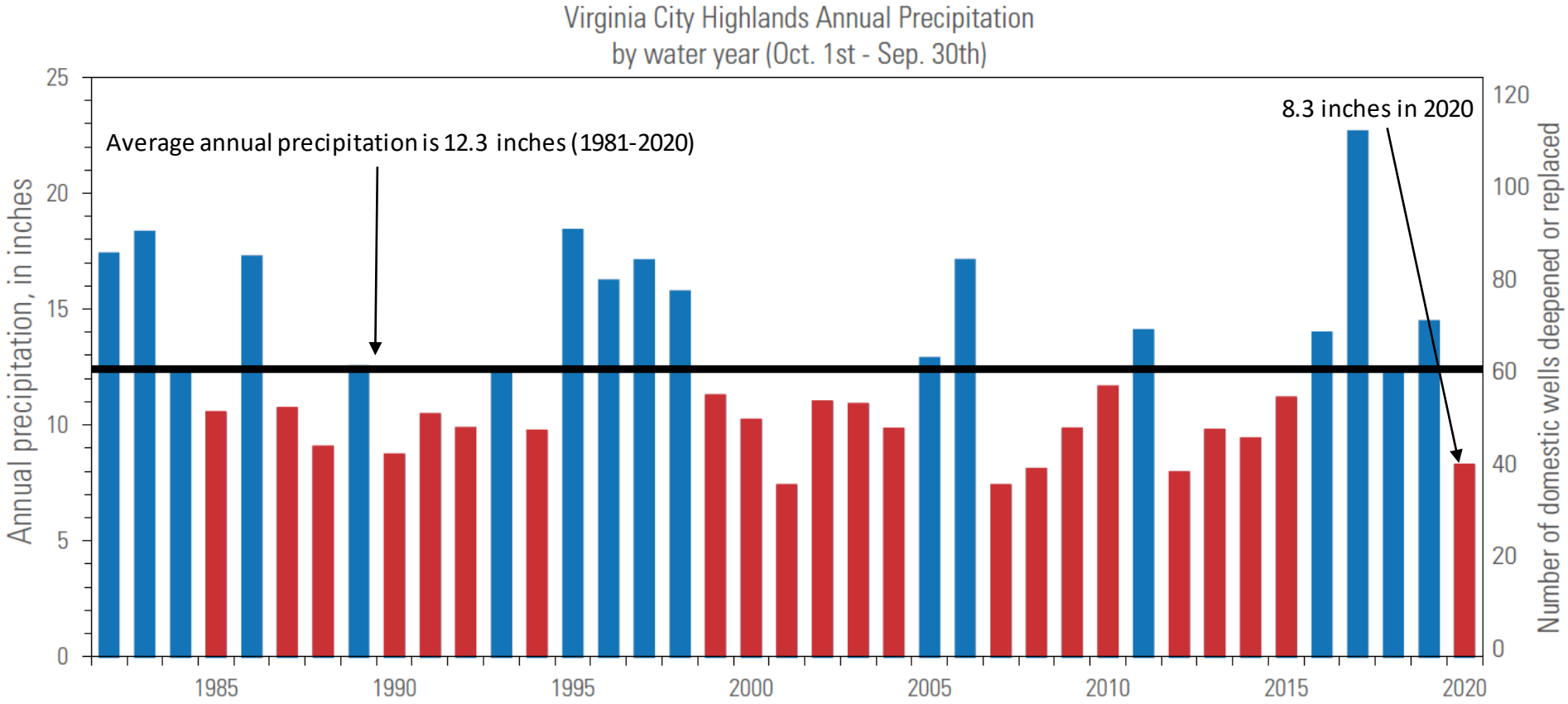
Data from Nevada Division of Water Resources driller's-log reports, 2020




2020 is the 7th lowest annual precipitation between 1981-2020

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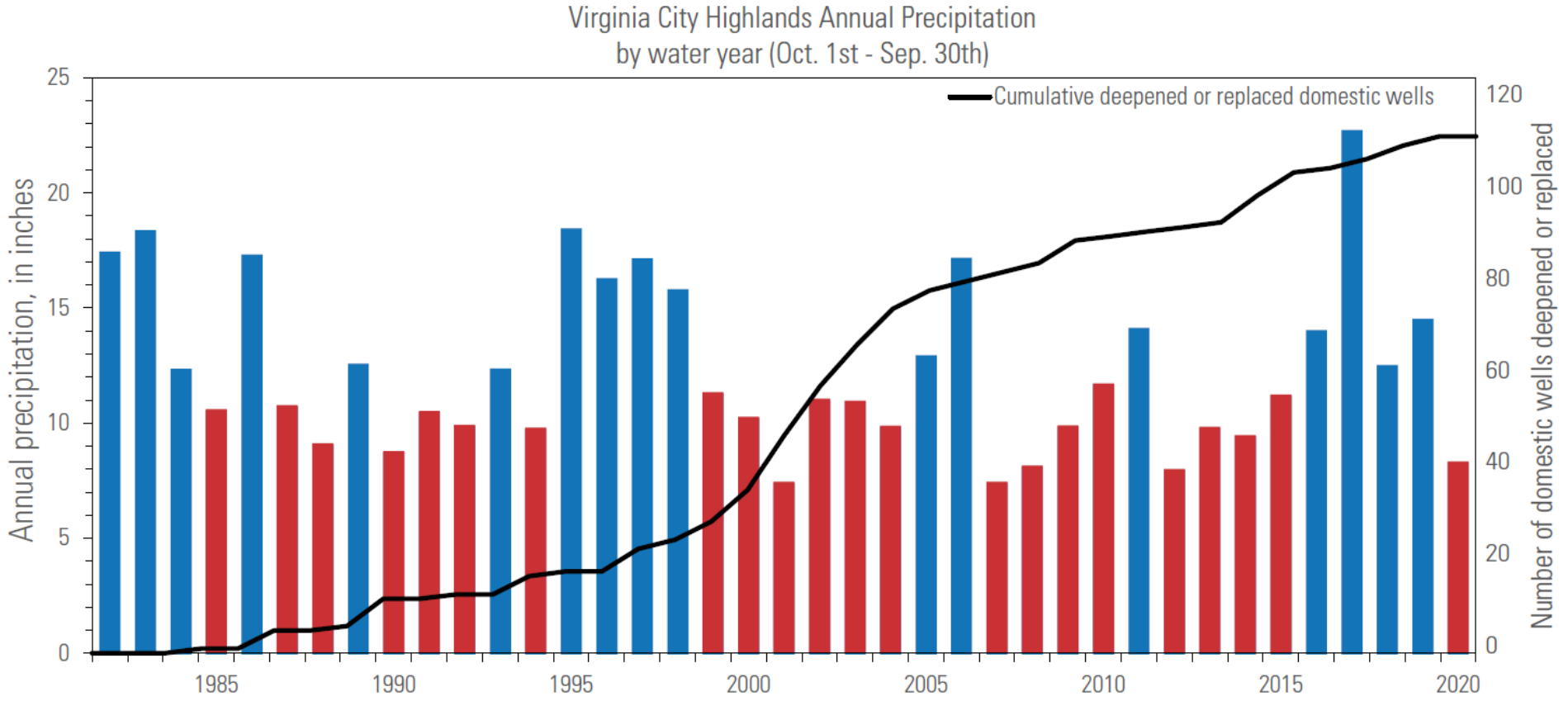
climateengine.org, 2020




USGS

climateengine.org, 2020

# Project approach

- **Water-level network in 2018**
  - Quarterly and annual monitoring
  - GPS surveying and lidar data
  - Continuous water-levels
  - Lousetown Creek recharge (discharge and flume measurements)
- **Precipitation sites installed in 2018**
  - 4 precipitation gages for the 5-year period
- **Develop informative maps 2019**
  - Aquifer surface map
  - Digitize 1984 UNR Thesis map
  - Water-level change map
- **Aquifer properties 2020-2021**
  - Aquifer tests, delayed to spring 2021 due to COVID-19

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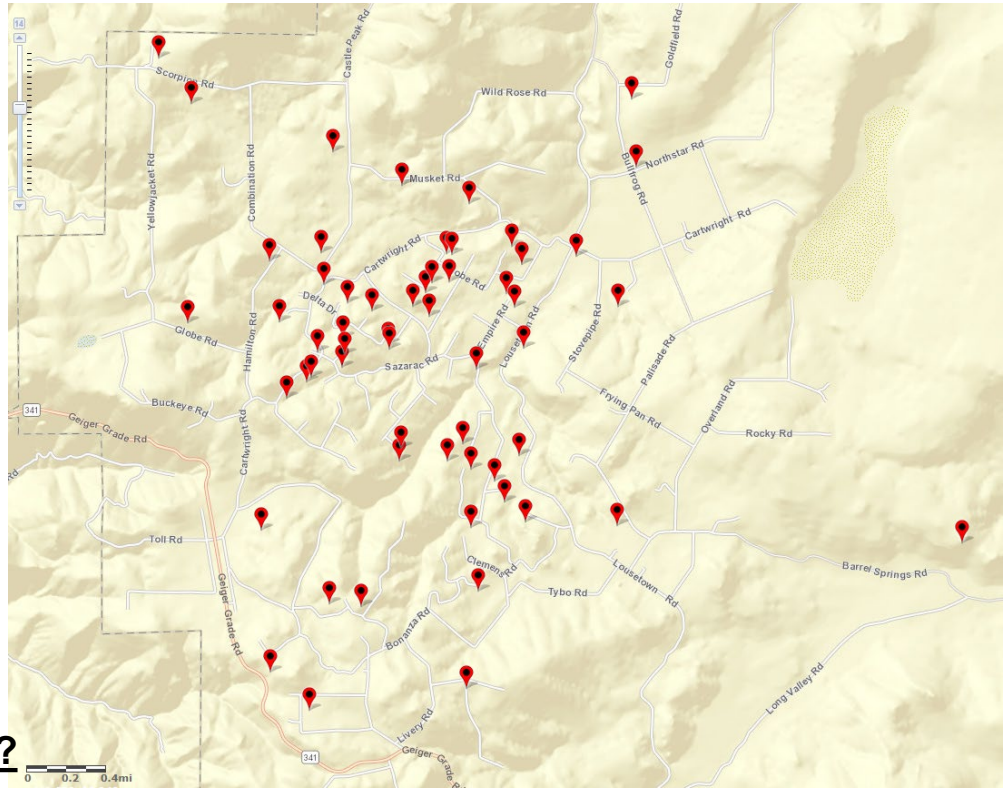
# 2020 Progress

- Year 3 tasks
- Measured groundwater network of 60 wells
  - (>200 measurements in WY20)
  - Quarterly measurements
  - Available data is available online (below URL)
- Measured 4 precipitation gages
  - First year in the study with below normal annual precipitation.
- Aquifer tests delayed until spring of 2021




**What change was measured from 2019 to 2020?**

https://maps.waterdata.usgs.gov/mapper/index.html

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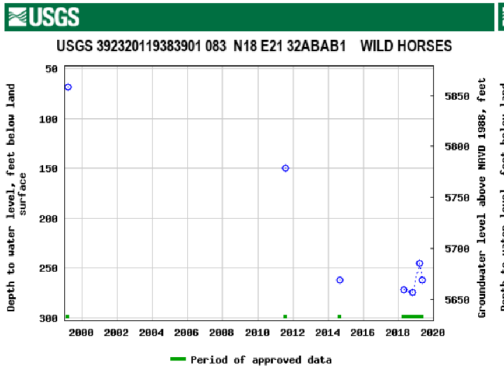
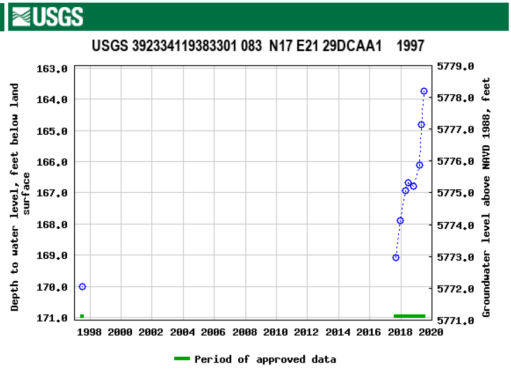
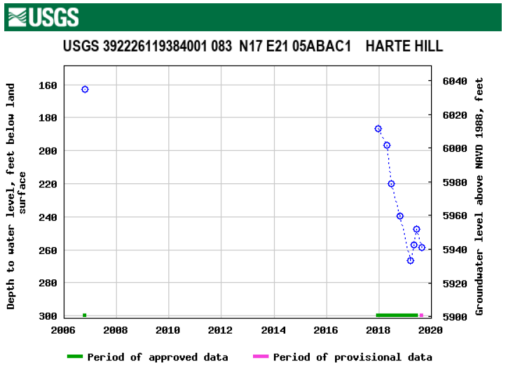
# Recap: 2019 water levels (last year)

- Significant water-level increases in WY 2019, above average precip.
- ~85% of wells in network increased
  - 41 wells increased
    - average increase of 10.7 feet
    - Largest increase 71 feet
  - 7 wells continued to decline
    - Average decline of 20 feet
    - Largest decline -60 feet

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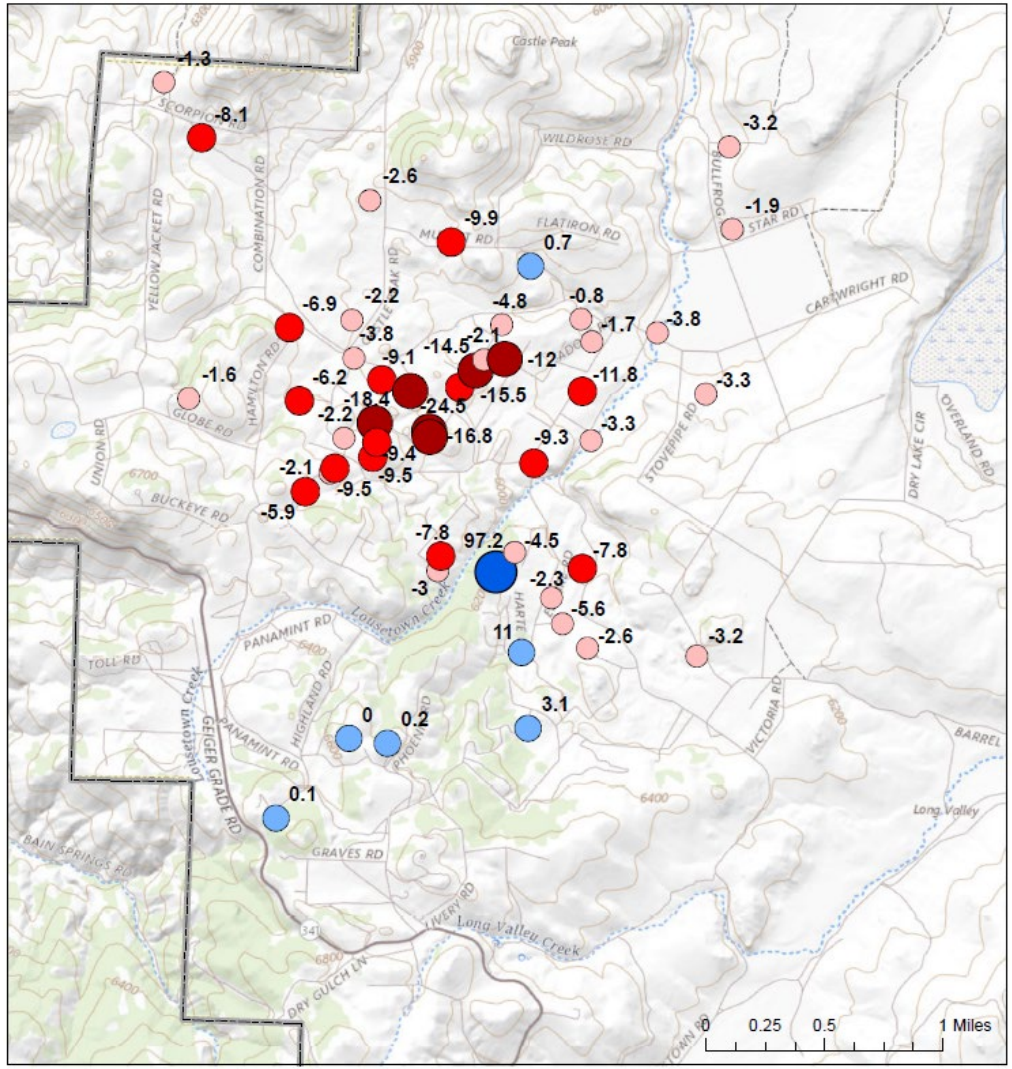
# VC Highlands water-level change from 2019 to 2020 (This year)

**87% of wells in network decreased this year**

- **8 Domestic wells increased**
  - **Average increase of 2.7 feet (without outlier)**
  - **Largest increase 97.2 feet (outlier)**
- **52 wells continued to decline**
  - **Average decline of 6.9 feet**
  - **Largest decline 25.4 feet**




**EXPLANATION**

County Boundary

Water-level change from 2019 to 2020, in feet

- -25 to -12
- -12 to -5.5
- -5.5 to 0
- 0 to 11
- 97

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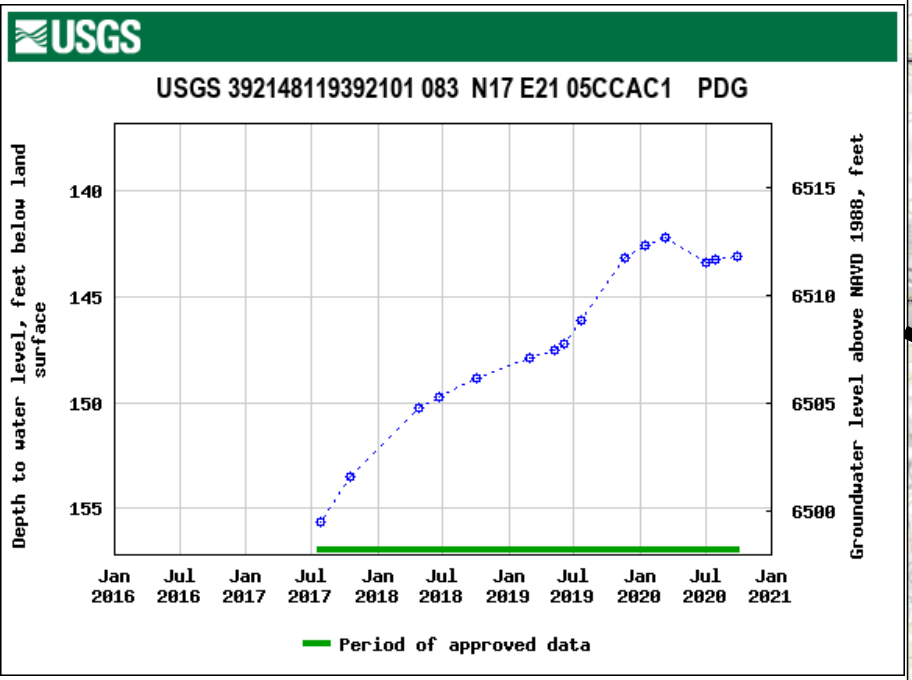
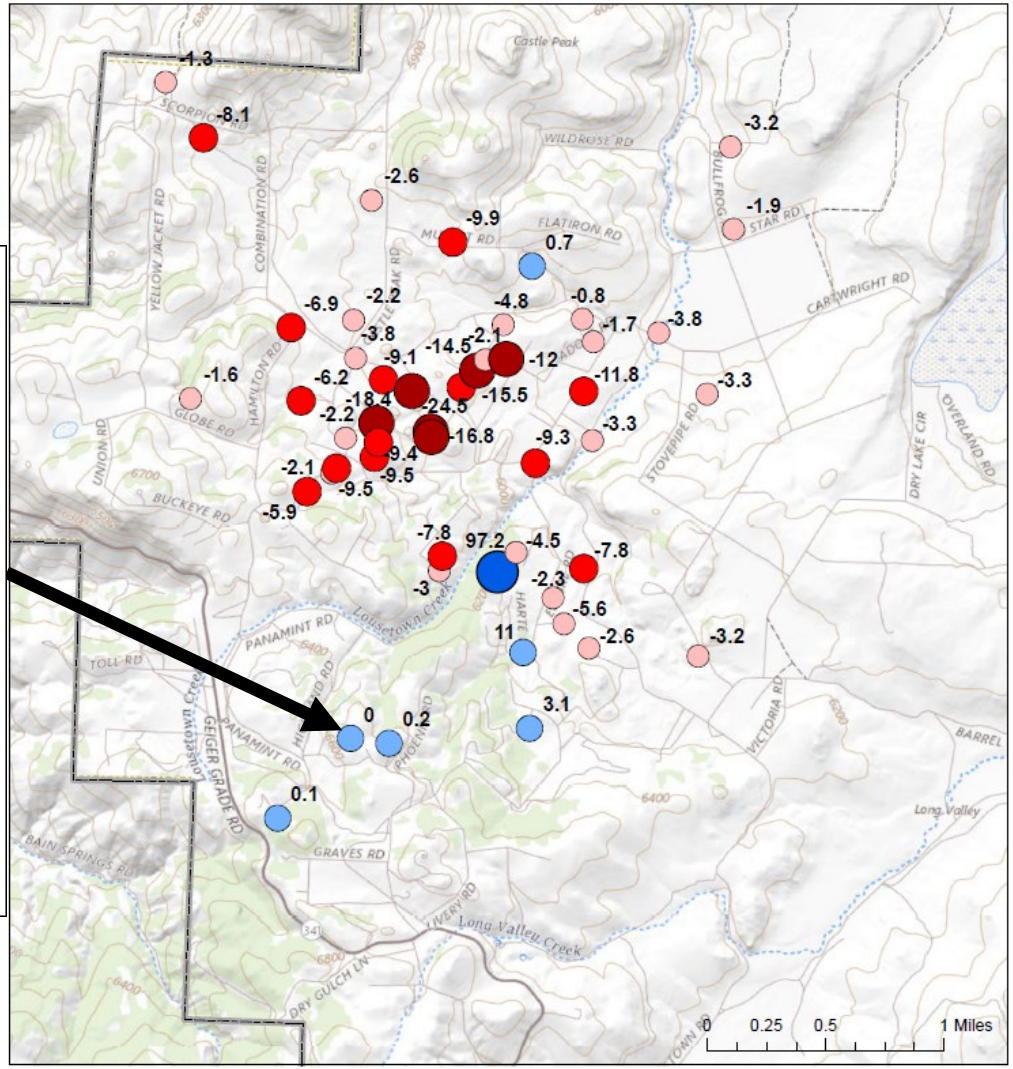
# VC Highlands water-level change map from 2019 to 2020



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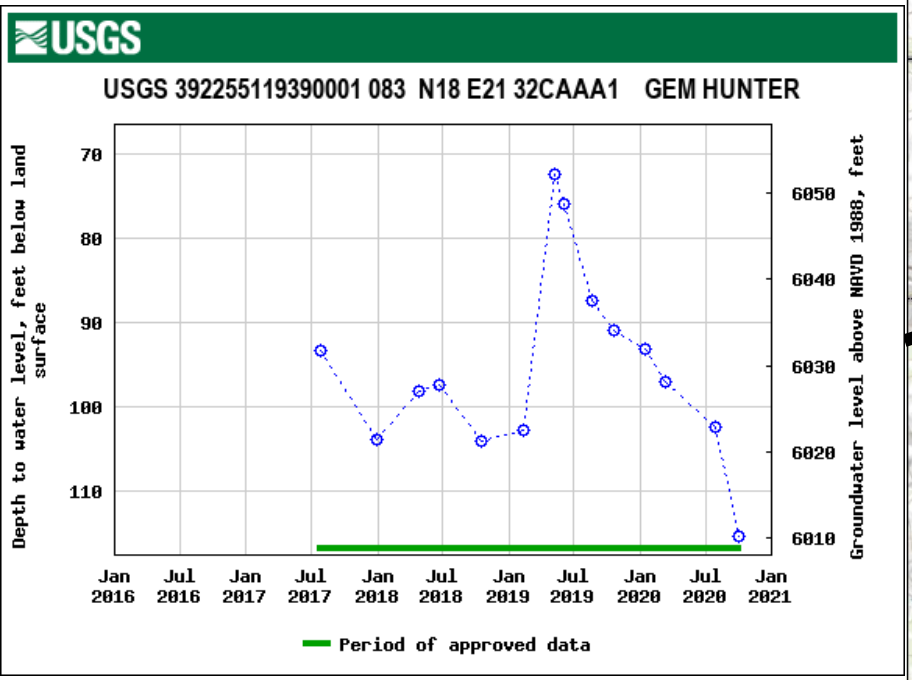


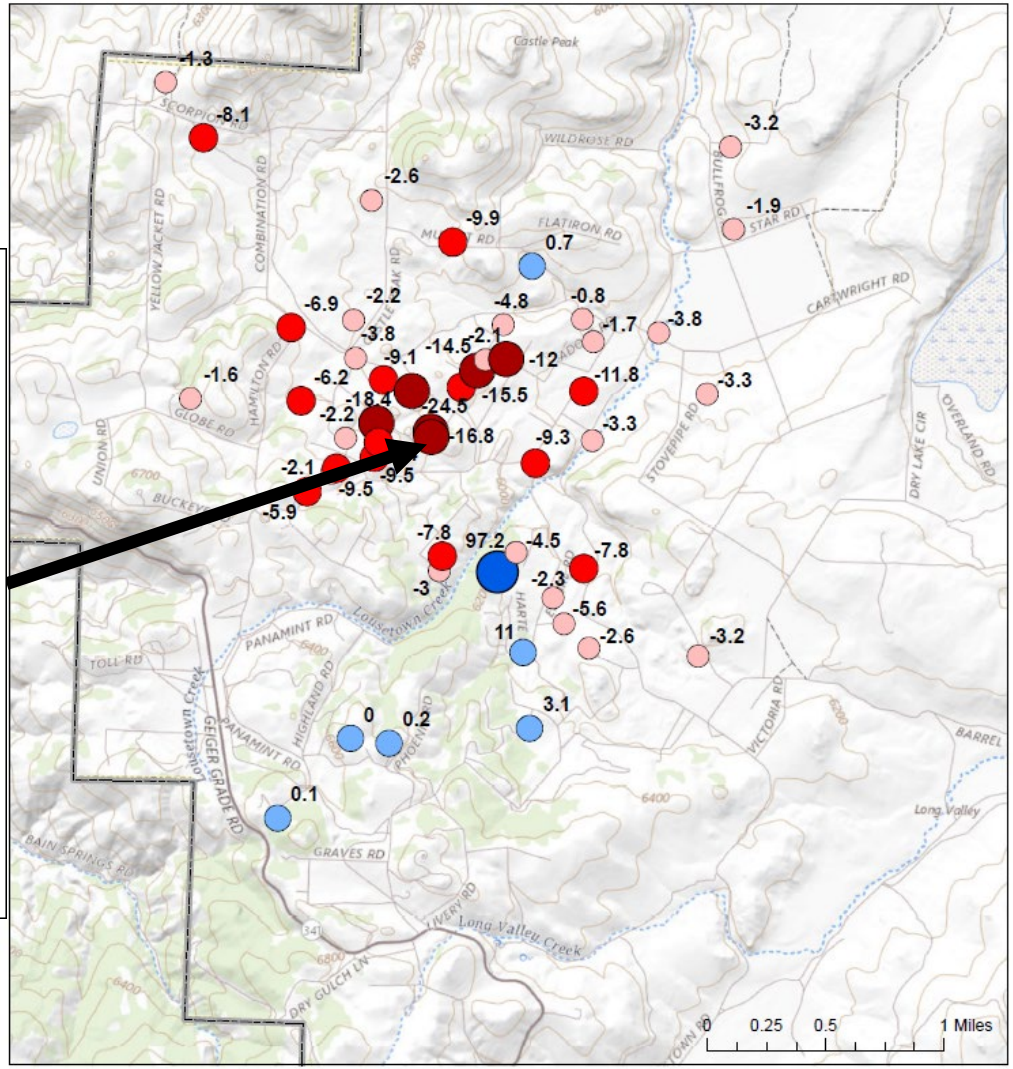


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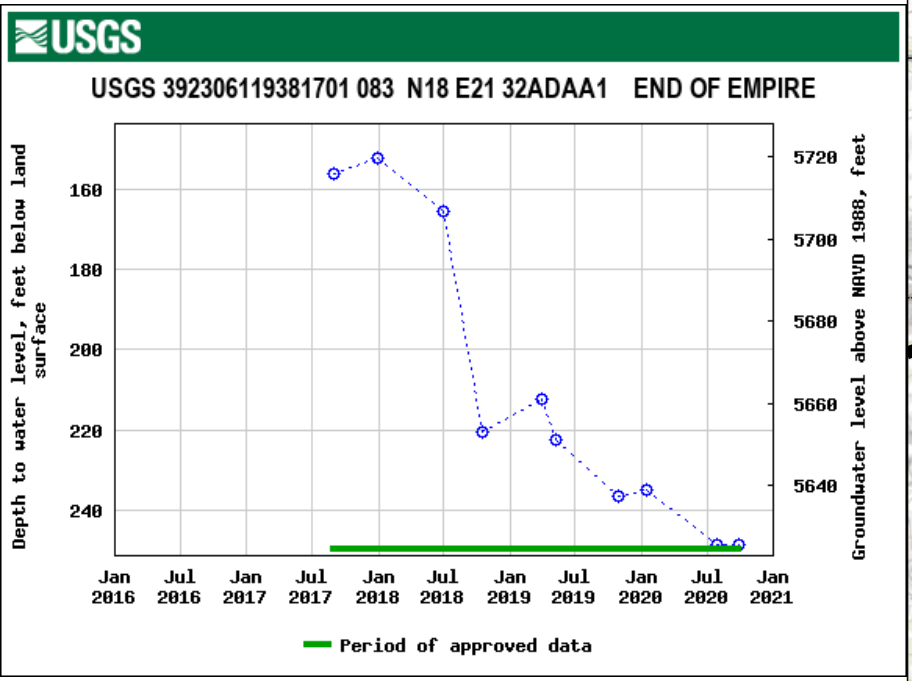


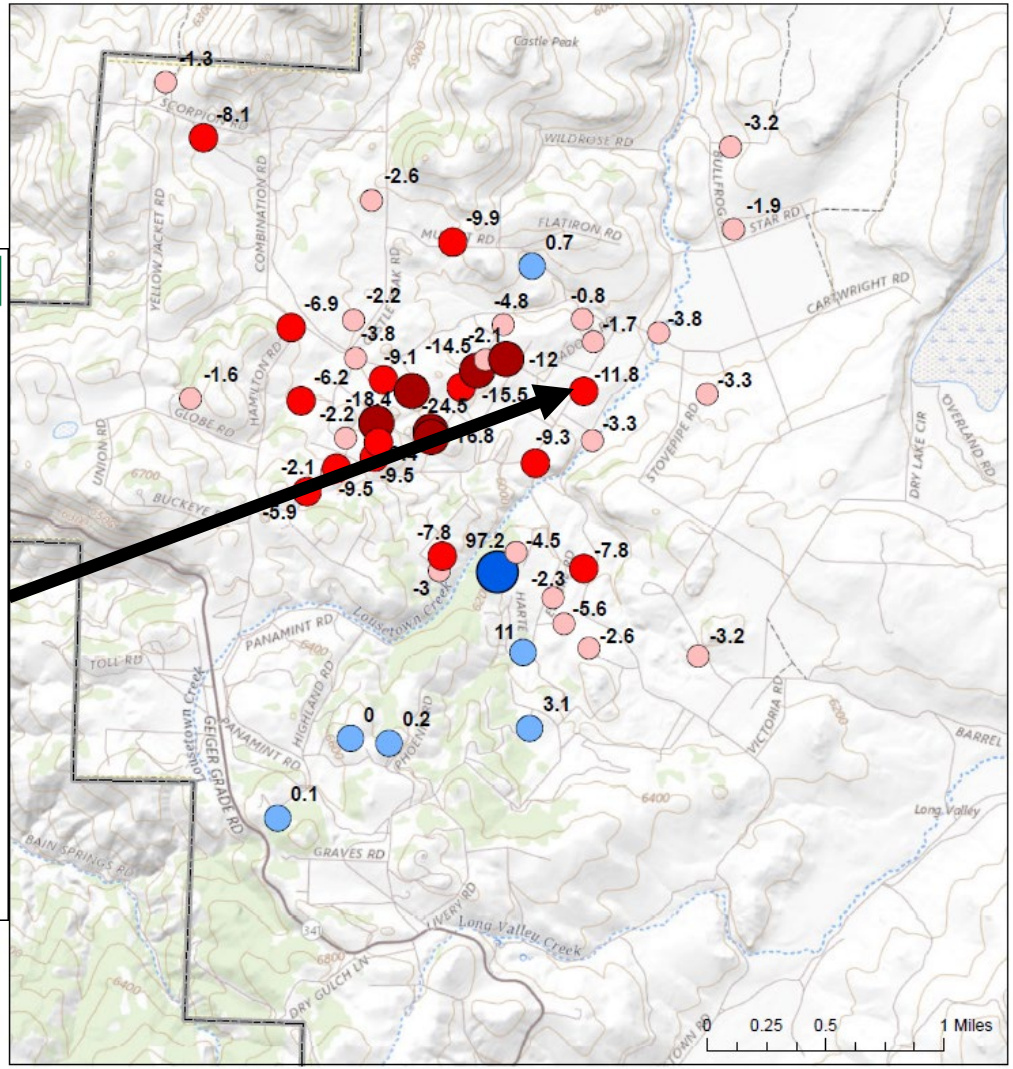

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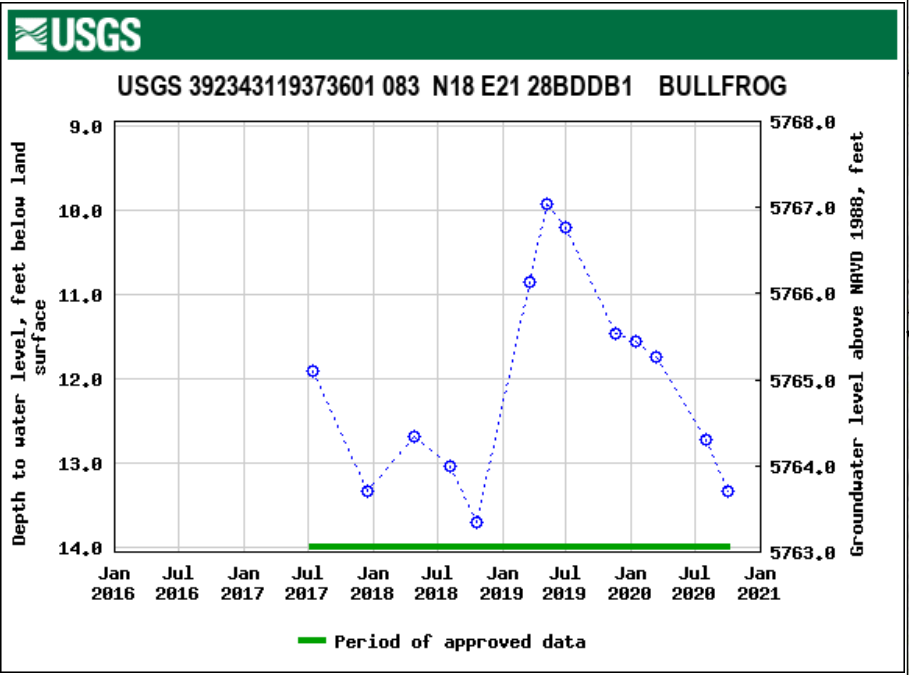


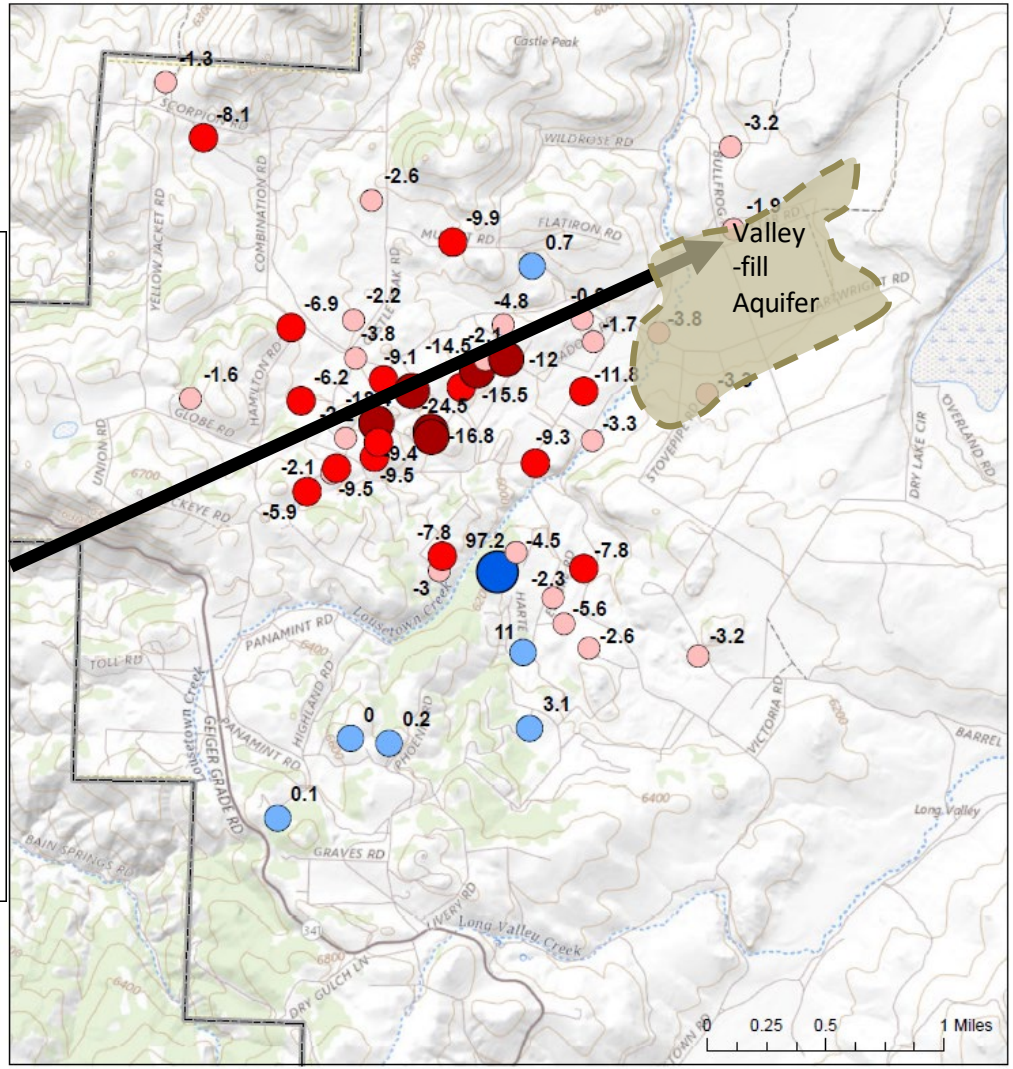

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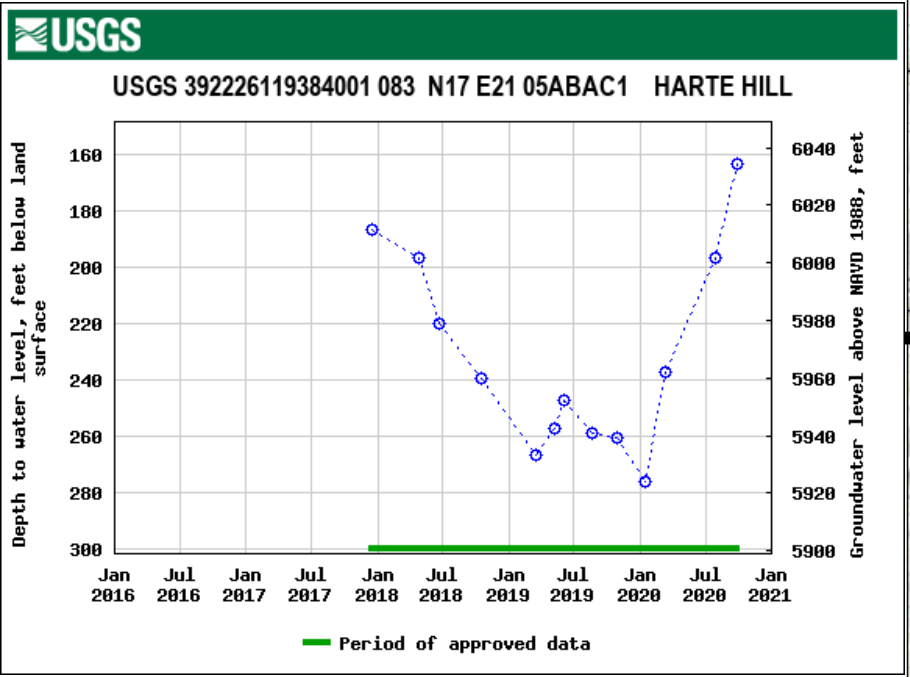


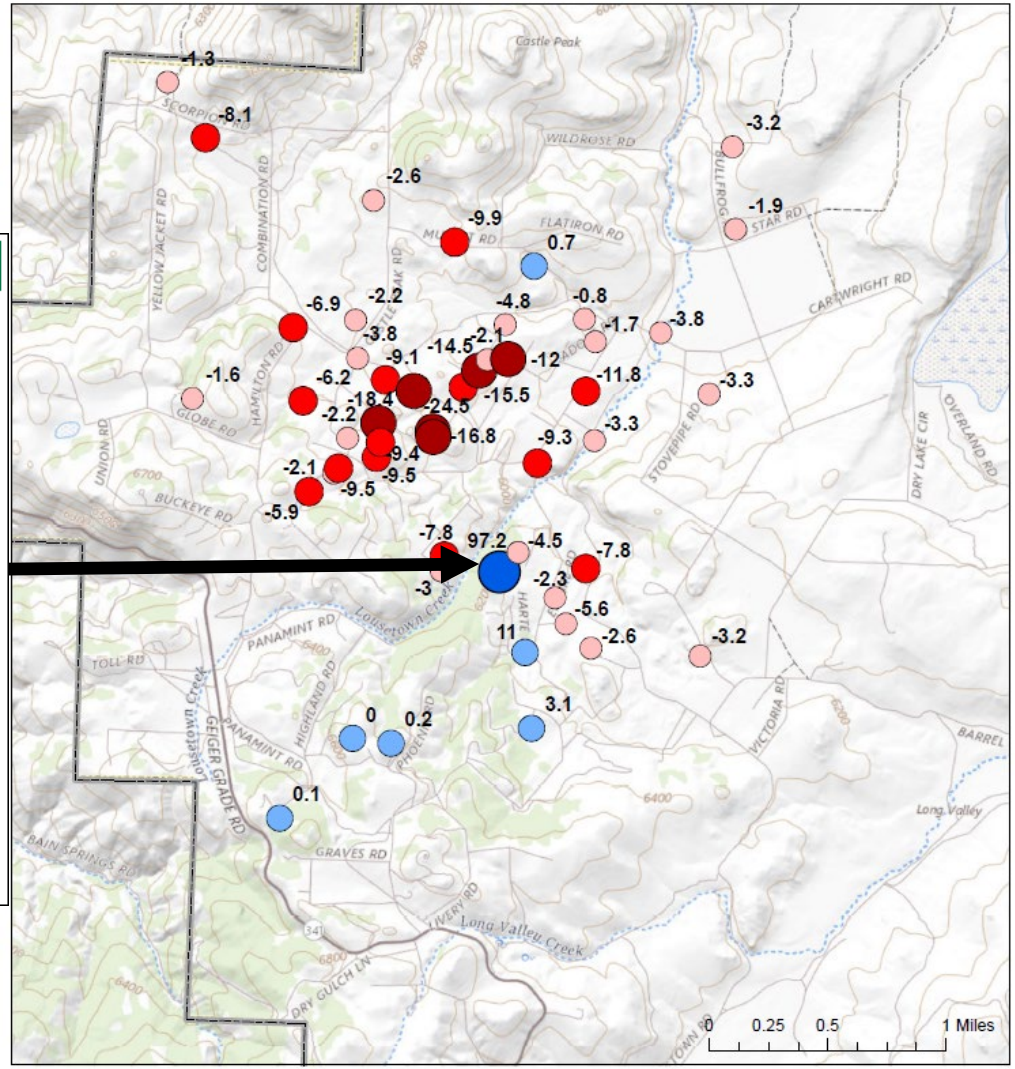

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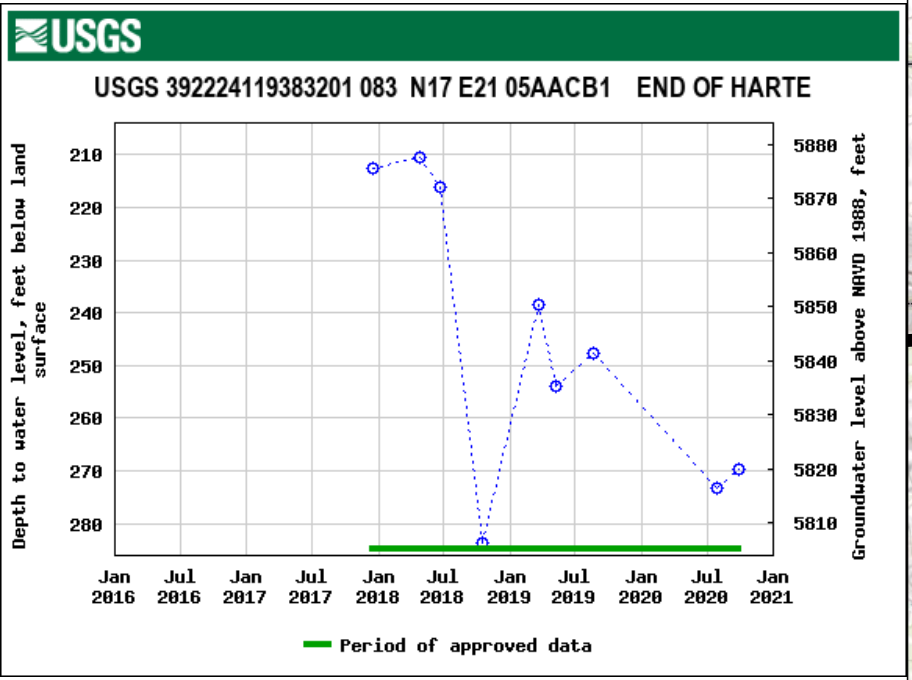


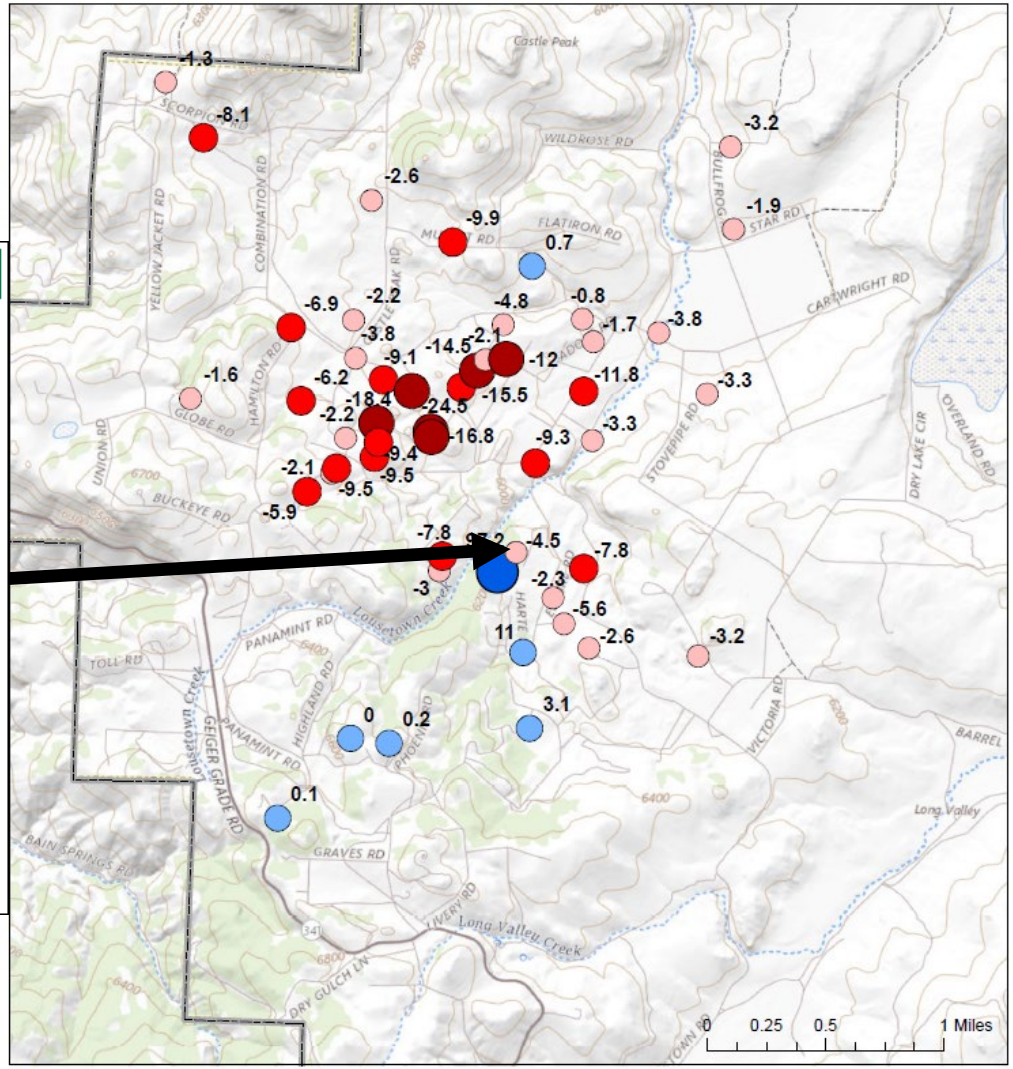


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# 2021 Tasks

- Water year 2021 is year 4 in this 5-year study.
  - Continue quarterly monitoring of network.
  - Still accepting volunteers, especially in areas of limited data.
  - Conduct aquifer tests to gain information on hydraulic properties of the fractured volcanic aquifer system.
- For additional information, year 1 and 2 stakeholder updates available from project web site.

Questions?

David Smith - 775-887-7616 (dwsmith@usgs.gov)

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Data and Project Information
https://go.usa.gov/x7k3Q