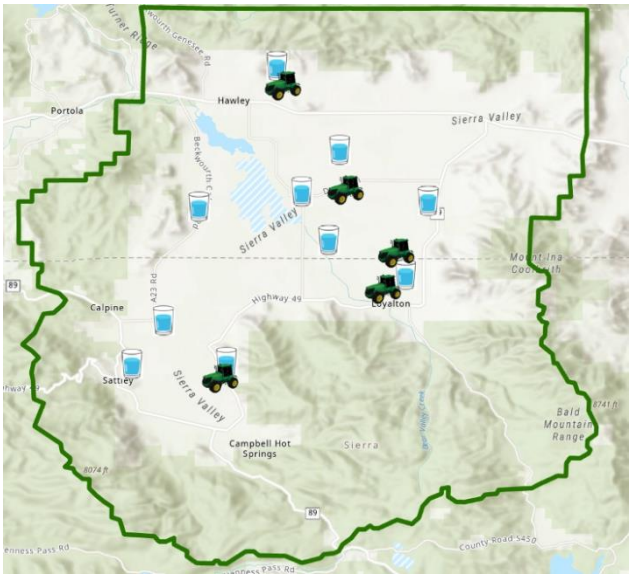


DRAFT -Sierra Valley Ground Water Cross-Sectional Analysis

Published August 3, 2021

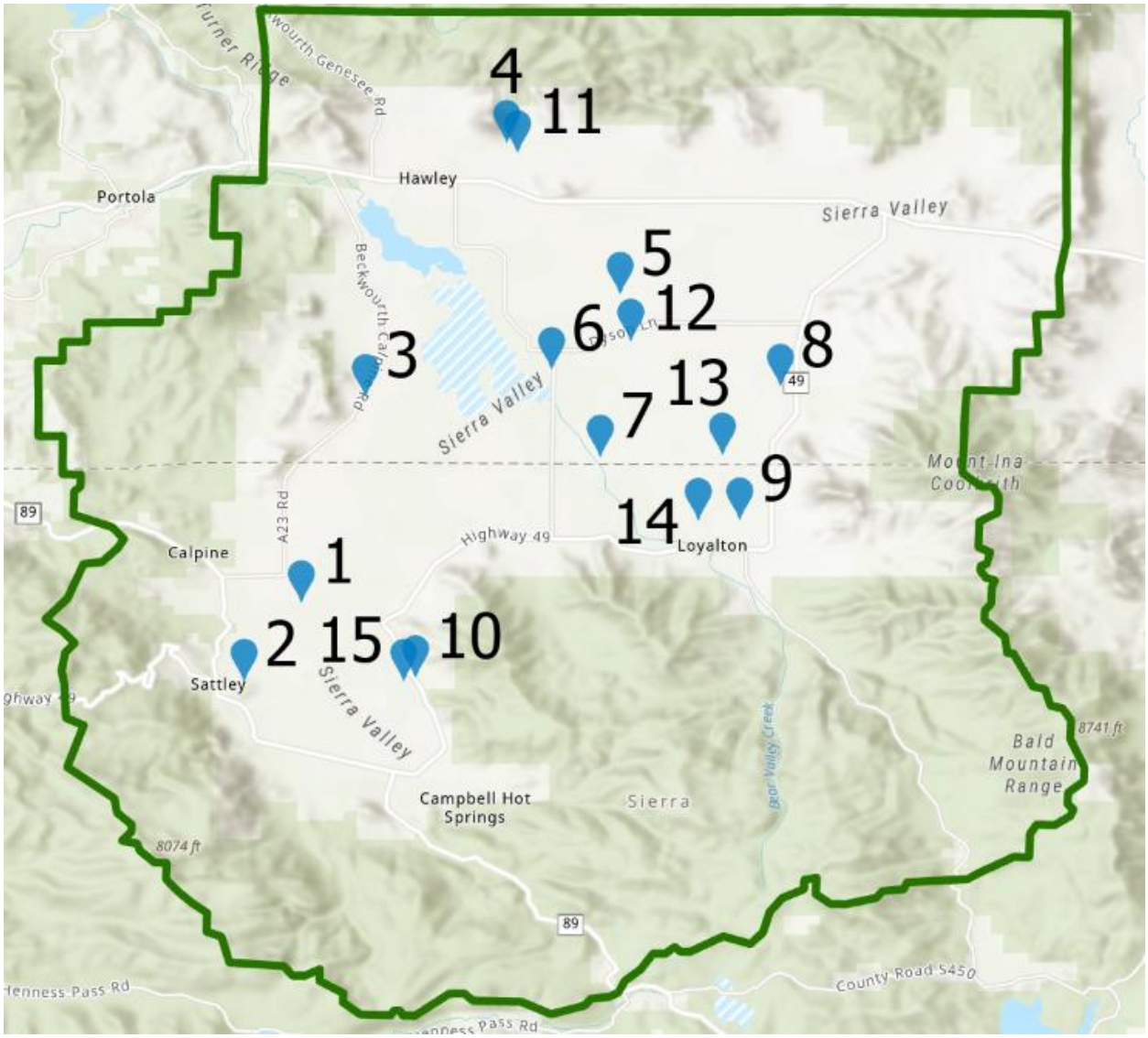
Background and Purpose



In response to concerns over potential groundwater quality impairments in the Sierra Valley Groundwater District, University of California (UC) Cooperative Extension conducted a cross-sectional analysis to examine 1) Nitrate+Nitrite as N; 2) Arsenic; 3) Boron; and 4) Total Dissolved Solids in agricultural irrigation wells and domestic drinking wells. This document summarizes the findings of the research project. Prior to the analysis, publicly available groundwater data from within Sierra Valley was absent, municipal well data is near the perimeter of the valley. This information will aid the Sierra Valley Ground Water Management District Board and Technical Advisory Committee (TAC) on the development of the Sierra Valley Groundwater Sustainability Plan (SVGSP) required by the California Sustainable Groundwater Management Act that is due by January 31, 2022. Additionally, this information will aid the Central Valley Regional Water Quality Control Board staff and leadership, among others, in consideration of alternative regulatory program for the Upper Feather River Sub-watershed group and similar sub-watershed groups. This project received funding support from the Sierra Valley Water Management District and Upper Feather River Watershed Coalition, with in kind contributions from UC Cooperative Extension.

Methods

The cross-sectional water quality survey was completed across 10 private domestic drinking wells and 5 private agricultural irrigation wells within the Sierra Valley Groundwater Management District. Key wells were identified to get a representative understanding of groundwater quality across the valley at deep agricultural irrigation wells and typically shallower drinking water wells. Sampling occurred on April 19-20, 2021. The sample in the spring followed one of the driest winters on record. Water was collected in sterile containers provided by Basic Laboratory, Chico, which were immediately stored on ice. Water samples were collected at the nearest point of the wells (e.g. faucet at well head or irrigation outlet). We allowed water that may have been sitting in the pipes to flow out before collecting the water sample. All samples were submitted for analysis to Basic Laboratory on April 20, 2021, accredited under California State Water Resources Control Board Environmental Laboratory Accreditation Program. All analysis were performed in strict adherence to established quality manuals, meeting the requirements of applicable accreditation standard.



Research Results and Discussion

Nitrate+Nitrate as N

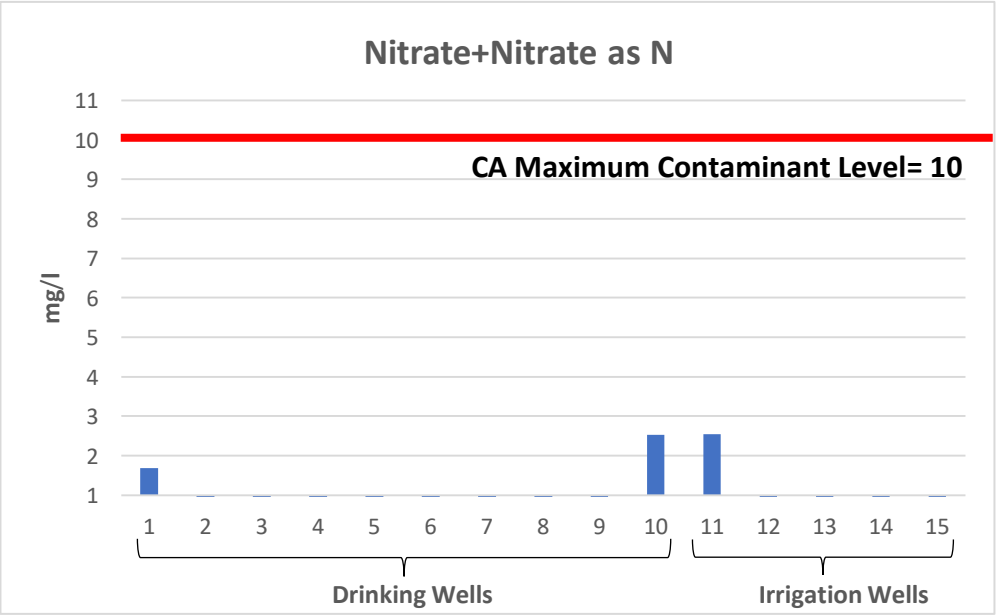
All samples of drinking water wells and agricultural irrigation wells were significantly below the state Maximum Contaminant Level of 10 mg/l (22 CCR §63341). The presence of nitrates in groundwater is generally associated with septic systems, treated wastewater, confined animal feeding operations or fertilizer use. Nitrite can interfere with the ability of red blood cells to carry oxygen to the tissues of the body, producing a condition called methemoglobinemia, and it is of greatest concern in infants and pregnant women (California Department of Public Health, 2014).

The low findings of Nitrate+Nitrate as N in groundwater is consistent with local knowledge of agricultural production systems. The Sierra Valley includes extensive irrigated agriculture, including hay farming and livestock grazing, with no confined animal feeding operations (Plumas County, 2019 and Sierra County 2019). A UC Cooperative Extension survey of irrigated agricultural producers within the Upper Feather River Watershed Coalition found nitrogen applications a rare practice in Sierra Valley (unpublished data Schohr, Tate and Saitone, 2020).

Due to relatively low economic return of pasture and hay crops, growers carefully manage inputs including nitrogen fertilizer (Wilson, et al. 2008). The UC Cooperative Extension survey of agricultural producers in the Upper Feather River Watershed Coalition also found when nitrogen was applied, it was at levels below the agronomic potential of the field.

Additionally, UCD research consistently finds nitrogen entering these systems exceeding the amount discharged as tail water, thus providing no excess nitrogen to be lost to groundwater. These results also align with sampling by the Upper Feather River Watershed Coalition that have found no nutrient exceedances during surface water testing from 2005-2018 in the region (Central Valley Regional Water Quality Control Board, 2019).

Table 1. Nitrate+Nitrate an N results from 2021 Sierra Valley Ground Water Cross-Sectional Analysis of Private Wells

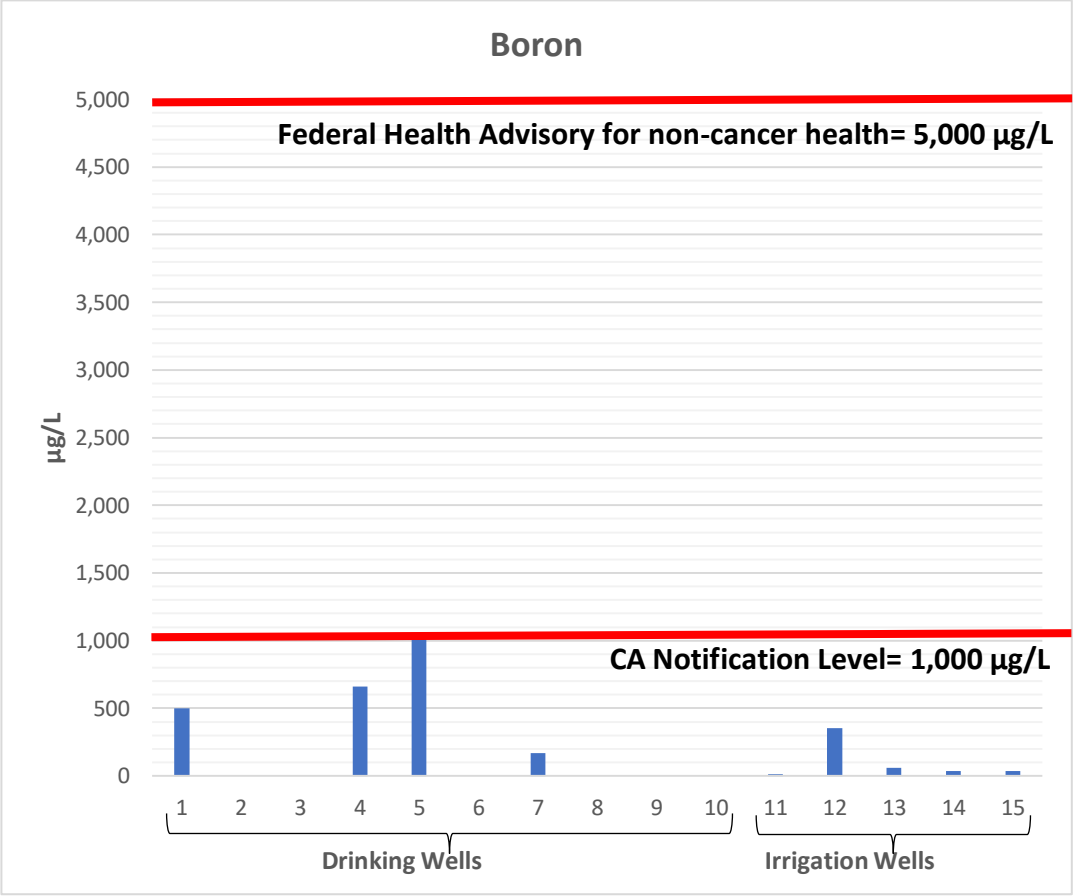


Boron

The majority of samples of drinking water wells and agricultural irrigation wells were significantly below state notification level (CA-NL) of 1,000 micrograms per liter (µg/L) and all were significantly below the federal health advisory for non-cancer health effects of 5,000 µg/L. Boron is an unregulated chemical without an established Maximum Contaminant Level.

According to the State Water Resources Control Board (SWRCB) the most prevalent sources of boron in drinking water are from the leaching of rocks and soils, wastewater, and fertilizers/pesticides. Boron can be lethal at high concentration, whereas at low concentrations can cause gastrointestinal tract distress, vomiting, abdominal pain, diarrhea, and nausea. However, low boron intake can impact cellular functions and metabolism of other important substances including calcium, copper, glucose, etc. (SWRCB, 2017)

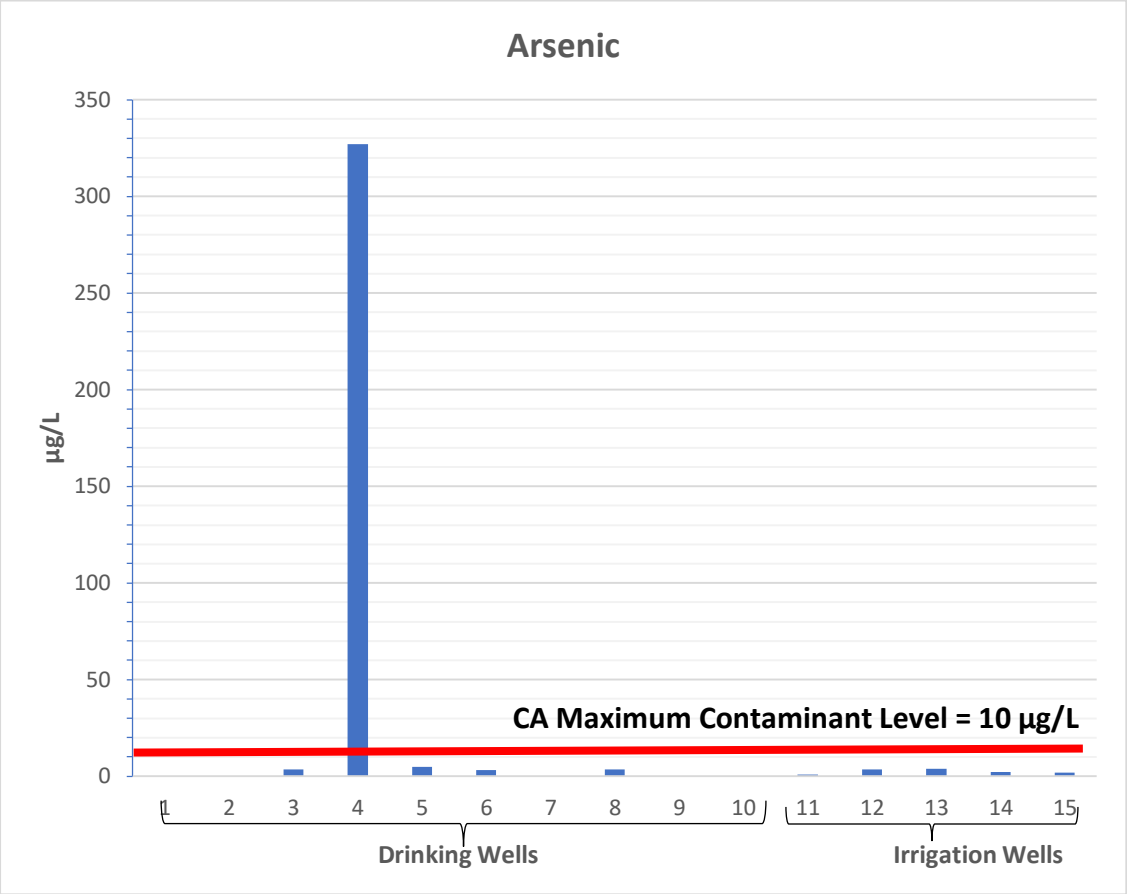
Table 2. Boron results from 2021 Sierra Valley Ground Water Cross-Sectional Analysis of Private Wells



Arsenic

There was only one well identified with arsenic above the established State Maximum Contaminant Level in drinking water of 10 µg/L. This well is located in the Northern part of the valley in volcanic rocks that are known for association with natural occurring mineral constituents, including arsenic. According to the State Water Resources Control Board the primary source of arsenic in the environment is from the weathering of arsenic-containing rocks. Arsenic is a known human carcinogen, and ingestion of arsenic has been reported to increase the risk of cancer in the liver, bladder, kidney, lungs, and skin. (SWRCB, 2017)

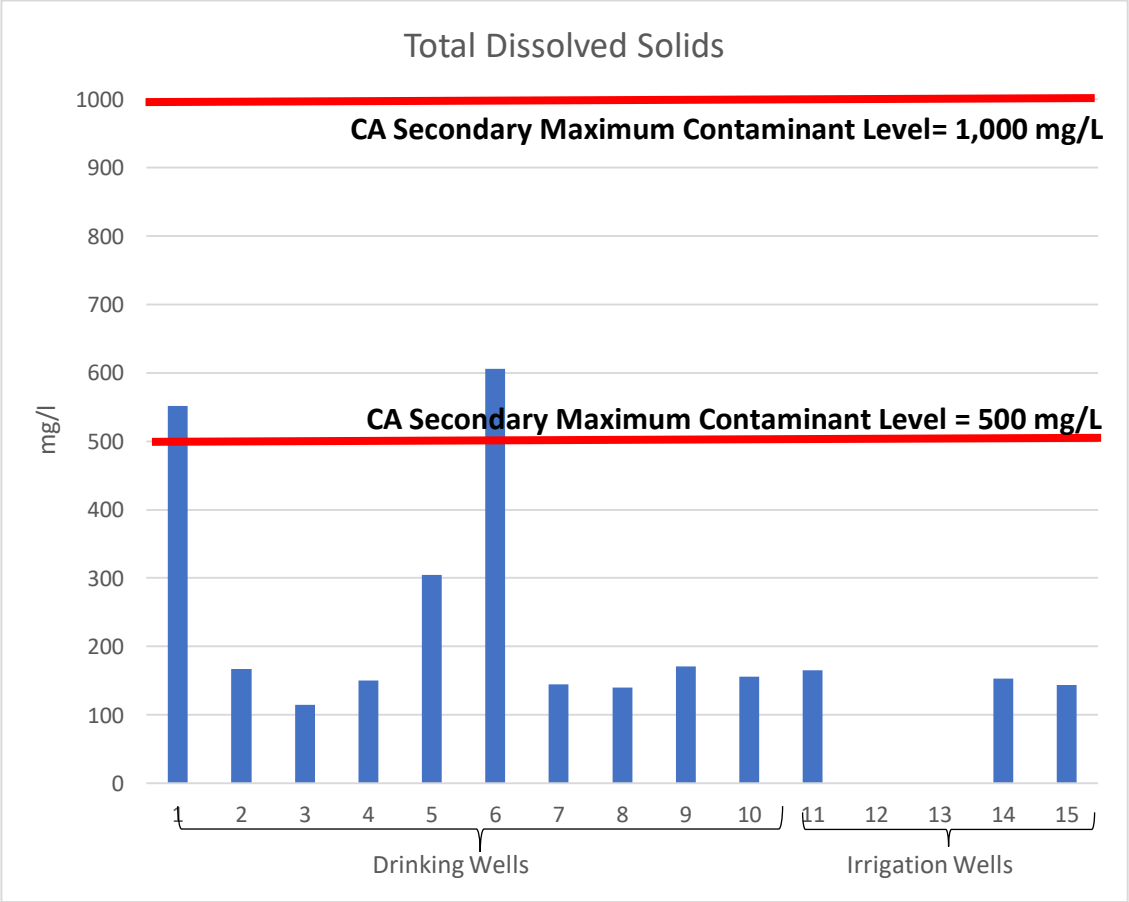
Table 3. Arsenic results from 2021 Sierra Valley Ground Water Cross-Sectional Analysis of Private Wells



Total Dissolved Solids

In this project we measured salinity as Total Dissolved Solids (TDS), including organic and suspended particles. Results found 2 drinking wells with Secondary Maximum Contaminant Level (SMCL) above the recommended threshold of 500 mg/L however all wells were well below the upper SMCL level of 1,000 mg/L. High concentrations of TDS/salts can damage agricultural productivity, impact plant growth, damage equipment and causes aesthetic concerns for drinking water. There are no public health goals (PHGs) or maximum contaminant level goals (MCLGs) for these constituents because secondary standards are set based on aesthetic concerns. (SWRCB, 2017 and 2018)

Table 4. Total Dissolved Solids results from 2021 Sierra Valley Ground Water Cross-Sectional Analysis of Private Wells



Conclusion

This Sierra Valley Ground Water Cross-Sectional Analysis was conducted in response to concerns over potential groundwater quality impairments in the Sierra Valley. Additionally, this project filled a knowledge gap of water quality in the Groundwater Ambient Monitoring and Assessment (GAMA) program, testing wells in areas of the Sierra Valley Groundwater District not represented in the online database. The results from the analysis of 4 constituents on 10 domestic wells and 5 irrigation wells found exceptional water quality. Granted there was one well reporting high levels of arsenic located in a region with known volcanic rocks, a localized concern. Overall results for Nitrate, Boron, Arsenic and Total Dissolved Solids tested in the Cross-Sectional Analysis provide evidence of the good quality water across the district. This analysis only looks at one point in time, but provides valuable insight to water quality when coupled with municipal well data near the perimeter of the valley and will aid the Sierra Valley Ground Water Management District Board and TAC on the development of the SVGSP.

Acknowledgments

Thank you to the domestic well owners and agricultural producers who allowed us access to monitor their wells. Also, to Sierra Valley Ground Water Management District Board Members who assisted with collecting samples. This project was funded in collaboration between the Sierra Valley Ground Water Management District and the Upper Feather River Watershed Coalition.

Appendix - Results from 2021 Sierra Valley Ground Water Cross-Sectional Analysis

Well ID	Description	Nitrate+Nitrate as N mg/l	Boron ug/l	Arsenic ug/l	Total Dissolved Solids mg/l
1	Drinking Well	1.68	501	ND	552
2	Drinking Well	ND	ND	ND	167
3	Drinking Well	ND	ND	3.44	115
4	Drinking Well	ND	662	327	150
5	Drinking Well	ND	1020	4.84	305
6	Drinking Well	ND	ND	3.24	606
7	Drinking Well	ND	170	ND	145
8	Drinking Well	ND	ND	3.64	140
9	Drinking Well	ND	ND	ND	171
10	Drinking Well	2.52	ND	ND	156
11	Irrigation Well	2.54	13	0.83	165
12	Irrigation Well	ND	353	3.44	ND
13	Irrigation Well	ND	58.1	3.95	ND
14	Irrigation Well	0.25	37.4	2.26	153
15	Irrigation Well	0.28	38.3	1.97	144

ND=Not Detected at or above the detection limit

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