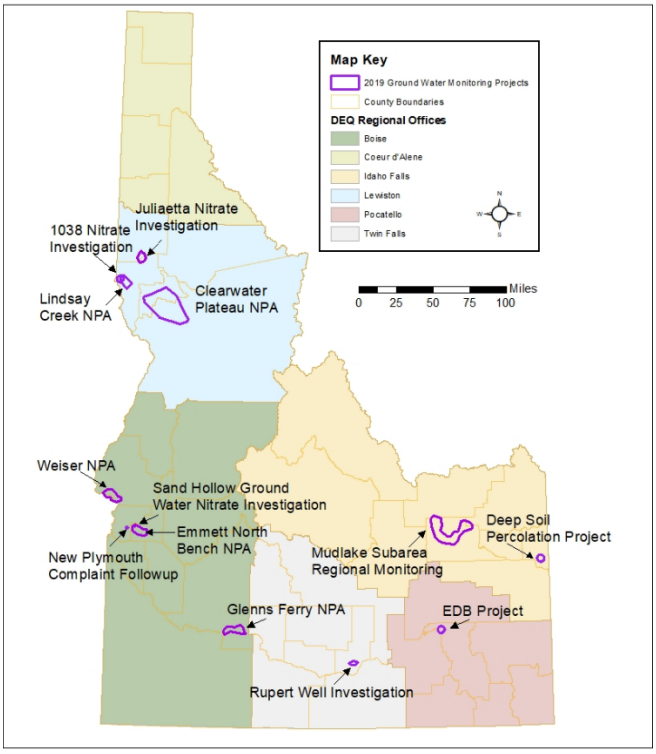
Summary Report for the Idaho Department of Environmental Quality Ground Water Quality Monitoring Projects—2019

Ground Water Quality Technical Report No. 53



State of Idaho

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Prepared by
Hailey Shingler
Idaho Department of Environmental Quality
Water Quality Division
1410 N. Hilton
Boise, ID 83706

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Acronyms, Abbreviations, and Symbols

°C	degrees Celsius
µg	micrograms
µS	microsiemens
bgs	below ground surface
BMP	best management practice
BTEX	benzene, toluene, ethylbenzene, and xylene
$CaCO_3$	calcium carbonate
cfu	colony forming unit
cm	centimeter
DEQ	Idaho Department of Environmental Quality
DO	dissolved oxygen
E. coli	*Escherichia coli*
EPA	United States Environmental Protection Agency
ESRP	Eastern Snake River Plain
FSP	field sampling plan
GWQM	ground water quality management
IBL	Idaho Bureau of Laboratories
IDAPA	refers to citations of Idaho's administrative rules
IDWR	Idaho Department of Water Resources
ISDA	Idaho State Department of Agriculture
L	liter
m+p-Xylene	meta-Xylene plus para-Xylene
MCL	maximum contaminant level
mg	milligram
mL	milliliter
MPN	most probable number
MPN/100mL	most probable number per 100 milliliters
NA	not applicable
ND	nondetect
NPA	nitrate priority area
NPDWR	National Primary Drinking Water Regulation
NSDWR	National Secondary Drinking Water Regulation
o-Xylene	orthoxylene
per mil (‰)	parts per thousand

pCi	picocuries
PWS	public water system
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
TC	total coliform
TDS	total dissolved solids
$\delta^{15}N$	ratio of the two stable nitrogen isotopes ^{15}N and ^{14}N
$\delta^{15}N_{nitrate}$	ratio of the two stable nitrogen isotopes ^{15}N and ^{14}N of the nitrate
$\delta^{18}O$	ratio of the two stable oxygen isotopes ^{18}O and ^{16}O
$\delta^{18}O_{nitrate}$	ratio of the two stable oxygen isotopes ^{18}O and ^{16}O of the nitrate

1 Introduction

Ground water is a key resource in Idaho — providing drinking water to 95% of Idahoans — and a critical component of the state's economy. The economic and social vitality of almost every Idaho community depends on access to a safe and clean ground water supply.

Idaho Code §39-120 "Department of Environmental Quality Primary Administrative Agency – Agency responsibilities" designates the Idaho Department of Environmental Quality (DEQ) as the primary agency to coordinate and administer ground water quality protection programs for the state. DEQ is also responsible for collecting and analyzing data for ground water quality management purposes. The code further directs DEQ, the Idaho Department of Water Resources (IDWR), and the Idaho State Department of Agriculture (ISDA) to conduct ground water quality monitoring and promote public awareness of ground water issues by making results of ground water quality investigations available to the public.

Public water systems (PWSs) are regulated by DEQ under the federal Safe Drinking Water Act and the "Idaho Rules for Public Drinking Water Systems" (IDAPA 58.01.08). These regulations require chemical analysis of drinking water for various contaminants. DEQ ensures that follow-up monitoring is conducted when contaminants of concern are detected in PWSs. The US Environmental Protection Agency (EPA) sets National Primary Drinking Water Regulations (NPDWRs) as legally-enforceable standards, expressed as maximum contaminant levels (MCLs), which apply to PWSs. The established levels protect public health by limiting the amount and number of contaminants in drinking water. EPA also sets NSDWRs as nonmandatory standards established as guidelines to assist PWSs in managing their drinking water for aesthetic considerations (e.g., taste, color, odor).

Although these limits only apply to PWSs, they can be used to evaluate water quality in private wells, as is done throughout this report. Total coliform (TC) and *Escherichia coli* (*E. coli*) bacteria sampling results were compared to the ground water quality standards in Idaho's Ground Water Quality Rule (IDAPA 58.01.11) rather than national regulations. The single samples collected during these projects were not appropriate for comparison to the national standards, which are based on exceedances during a month-long sampling period.

DEQ also responds to detections of contaminants of concern identified by monitoring programs implemented by other entities, such as the Statewide Ambient Ground Water Quality Monitoring Program, administered by IDWR. Follow-up investigations may develop into a DEQ local or regional monitoring project to assess conditions and identify areas where public health may be threatened. The investigation results can facilitate management decisions that protect the resource and promote public awareness for ground water protection.

Field measurements taken during follow-up investigations and monitoring projects should be considered estimates and not used for determining exceedances of Idaho's ground water quality standards. Field measurements are used to monitor well water during purging, ensure water in the wellbore is removed from the well before sampling, and to qualitatively evaluate water quality variability between wells.

The ground water quality monitoring results can also be used to define and prioritize degraded ground water quality areas, such as nitrate priority areas (NPAs). In 2020, DEQ identified 35 areas in the state with elevated concentrations of nitrate (as N)[1] in ground water. These NPAs are ranked based on population, water quality, and water quality trends. The criterion for an NPA designation is met when 25% or more of the wells sampled within the area meet or exceed 5 mg/L concentration, or half of the MCL (10 mg/L). EPA established an MCL for nitrate at 10 mg/L and Idaho adopted this MCL as the ground water quality standard. The NPAs are reevaluated and reranked approximately every five years following the NPA delineation and ranking process (DEQ 2021).

Prioritization effectively allocates resources for water quality improvement strategies. DEQ works with state and federal agencies and stakeholders to develop ground water quality improvement plans (i.e., ground water quality management plans) to address ground water degradation in NPAs. Ground water quality data are used to evaluate the effectiveness of plan implementation.

DEQ's Ground Water Program implemented regional ground water monitoring using a statistically-based approach to determine the monitoring network design. Most of these regional projects focused on areas designated as NPAs. This report provides an overview of DEQ's ground water monitoring projects and investigation activities accomplished with public funds in 2019. It does not include results from privately funded sampling activities, including monitoring required by permits, monitoring associated with ongoing environmental remediation projects, Kootenai County Aquifer Protection District funding, or PWS requirements.

Well owners allowing DEQ access to sample are notified of the results and informed if concentrations exceed an MCL. Well owners with concentrations above health-based standards are also provided with information on health risks and possible treatment options.

2 Summary of Ground Water Quality Projects by Region

This section presents data from ground water quality monitoring and investigation projects conducted by DEQ in 2019. Projects are presented by DEQ regional offices and in Figure 1.

All ground water quality data in this section are provided through an *interactive mapping application* available on DEQ's website. The application contains ground water quality data that DEQ or its contractors collected from 1987 to the present. The application can be used to view and download data for over 350 contaminants, ranging from nitrate—a widespread ground water contaminant—to emerging contaminants (e.g., personal care products, pharmaceuticals). The application was developed to help citizens, local officials, researchers, water quality professionals, consultants, and other stakeholders make informed decisions about land use activities. The application also provides private well owners with an indication of ground water quality conditions in an area when considering treatment options for protecting their family's health.

[1] Unless otherwise noted, *nitrate* refers to nitrate (as N) throughout the document.

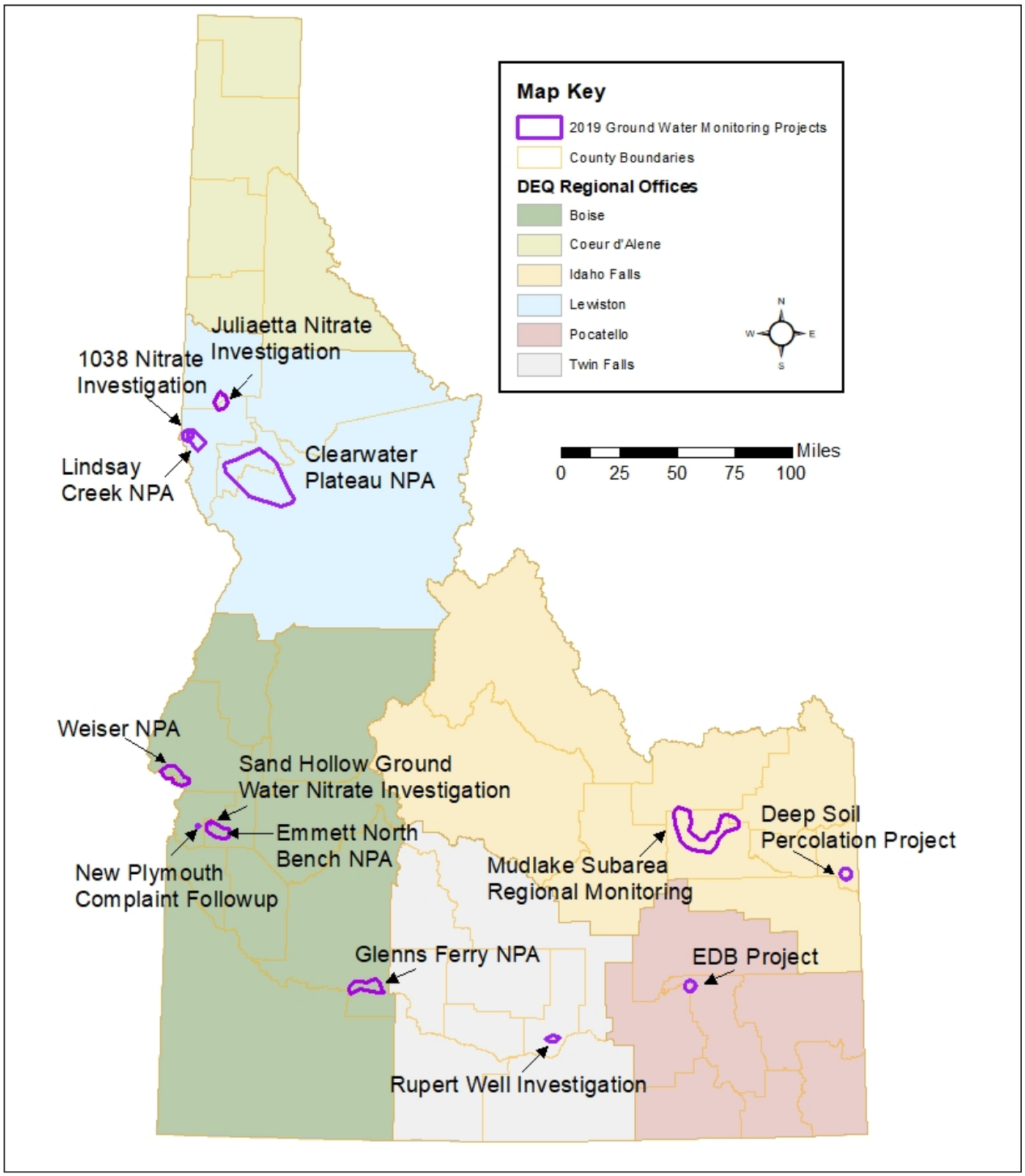


Figure 1. DEQ's 2019 ground water quality project locations by region.

2.1 Boise Region

In 2019, five ground water quality monitoring projects were conducted in the Boise region using public funds.

DEQ is responsible for conducting regional ground water monitoring activities, per the Idaho Ground Water Quality Plan (DEQ 1996). The DEQ Boise Regional Office (BRO) staff develops specific monitoring projects within the region to provide data on ground water quality. Currently, the focus is on regional ground water quality associated with NPAs.

The western Snake River Plain is a deep structural depression (basin) bounded by major northwest-trending faults. Volcanic ash and lake and stream sediments, including clay, silt, sand, and gravel, were deposited in the basin (Newton 1991). The western Snake River Plain is a down-dropped fault-block basin, with normal (vertical) north-northwest trending faults along the margins of the basin. The faulting along the margins of the western Snake River Plain began about 11 million years ago, the resultant central basin underwent rapid subsidence, and the subsidence was largely finished about 9 million years ago. The basin filled with rhyolite ash, basalt lava flows, and sediments that eroded off the surrounding hills, or were deposited by streams or into lakes (Alt and Hyndman 1995). A major lacustrine (lake) system, named Lake Idaho, developed in the basin and existed about 9.5 to 1.7 million years ago (Wood and Clemens 2002). The lake system was formed by lava flows in western Idaho and eastern Oregon that blocked major surface water drainages in western Idaho. The lake level elevation and boundaries fluctuated over time, likely due to changes in precipitation, the size of the surface water drainage area, tectonics, or the establishment of a lower elevation outlet for the lake.

2.1.1 Emmett North Bench NPA Ground Water Monitoring Project

2.1.1.1 Purpose and Background

The Emmett North Bench NPA ground water monitoring project was initiated in 2014, with sampling conducted at 45 domestic or irrigation wells, and designed to evaluate how NPA designations affect nitrate concentrations. In 2020, the Emmett North Bench NPA ranked as the 35th-most impacted NPA in Idaho (DEQ 2021).

The south and southwestern areas of Gem County, which include the Emmett North Bench NPA, are located within the western Snake River Plain. Sedimentary deposits related to Lake Idaho are exposed in the hills north and south of the Payette River. More recent stream and other water-laid sediments are found along the Payette River and in drainages feeding the river (Alt and Hyndman 1995).

The predominant land uses in the Emmett North Bench NPA are agricultural and residential. All residences within the NPA rely on private wells for their drinking and household water needs. DEQ's review of the IDWR well driller's reports indicated the subsurface in this project area consists of interbedded clay, sand, and gravel. Project wells were generally completed in sand and gravel aquifers at depths ranging from 33 to 188 feet. All wells sampled for this project had a well completion depth of less than 190 feet below ground surface (bgs). The depth to ground water shown on well driller's reports for the project wells ranged from 15 to 113 feet bgs. A blue/gray clay layer was identified in several of the well driller's reports. This clay, locally

identified by well drillers as “blue clay,” is often present in various thicknesses and elevations throughout the central and western Boise River valley. The clay forms confining units that can separate shallow aquifers from deeper zones (Petrich and Urban 2004). Based on IDWR’s regional ground water flow map (IDWR 2014), the ground water flow direction within the Emmett North Bench NPA is generally southwest towards the Payette River (Figure 2).

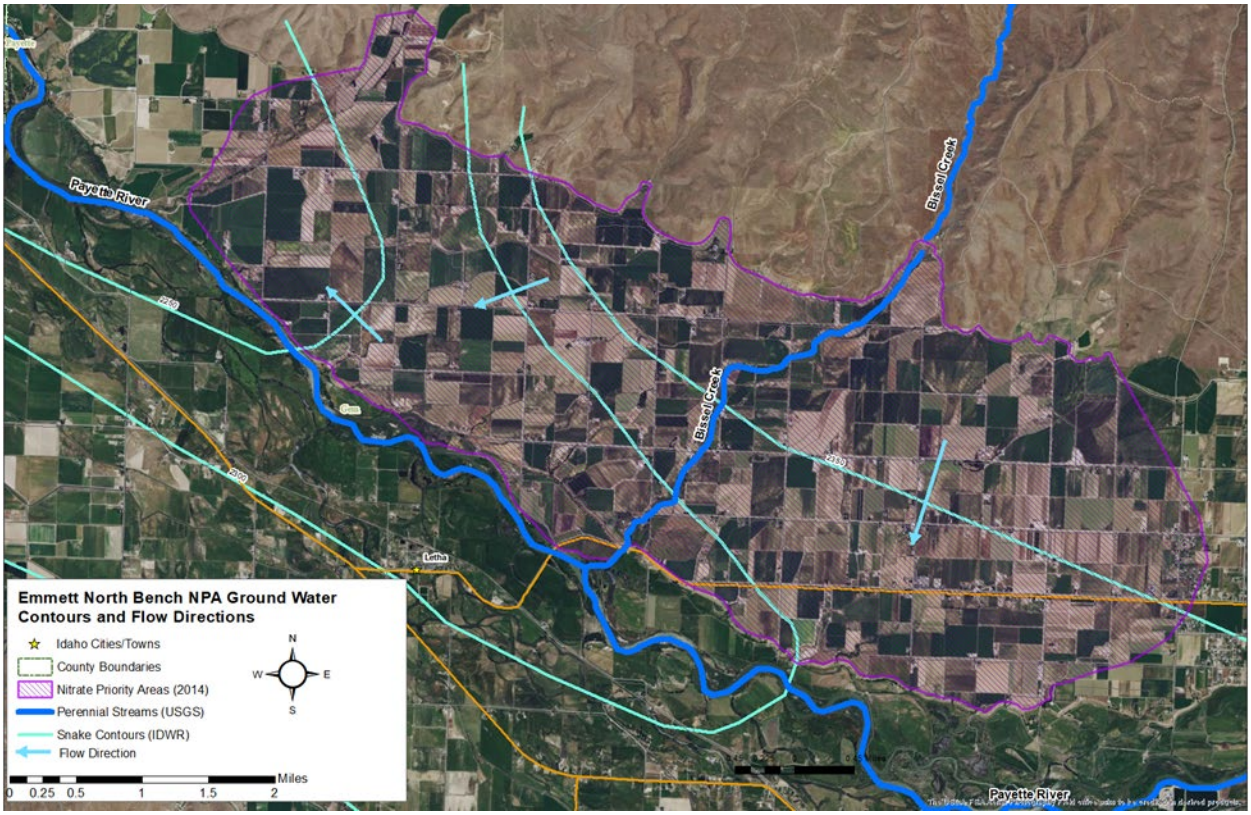


Figure 2. Sample sites and nitrate concentrations—Emmett North Bench Ground Water Monitoring Project.

2.1.1.2 Methods and Results

A statistical process, developed for DEQ by Dr. Kirk Steinhorst of the University of Idaho, was used to determine the number of samples to be collected within the Emmett North Bench NPA to ensure the sampling event was statistically valid (Steinhorst 2011). The statistical model determined that 52 samples were needed to be within 15% of the true mean with a 90% confidence. DEQ sent letters to 53 well owners but was only able to get permission to sample 31 wells. Therefore, the mean for the 2019 Emmett North Bench NPA Sampling Event was within 26% of the true mean with a 90% confidence level.

Ground water samples were collected in April and May 2019 from 31 domestic or irrigation wells in the Emmett North Bench NPA using procedures outlined in the Regional Nitrate Priority Area Ground Water Monitoring Activities Boise Region Quality Assurance Project Plan (QAPP) (DEQ 2019b). Program objectives, design, and well selection processes are identified in the regional ground water monitoring network design (DEQ 2019a). Water quality field parameters

(i.e., pH, temperature, specific conductivity, and DO) were measured at each well prior to sample collection (Table 1).

General Ground Water Chemistry Results

Ground water samples were submitted to Idaho Bureau of Laboratories in Boise, Idaho and analyzed for nitrate, ammonia, *E. coli*, and total coliform to assess the water quality in the project area (Table 2). Nitrogen isotope ($\delta^{15}N$) samples were collected at each sampling location and frozen and stored at DEQ pending nitrate analysis. After DEQ received nitrate analysis results, those samples from wells with nitrate concentrations greater than 5 mg/L were sent to the University of Arizona Environmental Isotope Geosciences Laboratory in Tucson, Arizona, for $\delta^{15}N$ analysis.

Table 1. Water quality field parameters—Emmett North Bench NPA Ground Water Monitoring Project

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Water Temperature (°C)	Specific Conductance (µS/cm)	pH[A]	Dissolved Oxygen (mg/L)
1266	96	04/22/2019	14.92	448	*6.07*	0.45
1288	105	05/01/2019	15.13	408	*6.48*	0.71
1289	55	04/24/2019	15.87	609	6.84	7.75
1291	91	04/24/2019	14.70	504	6.72	0.47
1293	106	04/24/2019	15.94	603	6.83	0.61
1294	78	05/01/2019	18.39	219	*5.22*	0.79
1295	68	04/24/2019	14.79	835	6.86	6.06
2088	140	04/22/2019	15.38	653	7.74	0.36
2233	109	04/22/2019	17.80	428	6.60	6.29
2306	121	04/24/2019	15.24	617	6.80	3.80
2307	98	04/22/2019	14.92	499	7.11	6.79
2316	130	04/24/2019	15.15	592	6.56	5.26
2317	129	04/24/2019	14.84	677	6.90	5.88
2318	98	05/07/2019	14.68	510	6.86	0.68
2321	117	04/24/2019	15.13	543	6.53	5.45
2323	73	04/22/2019	15.38	516	*6.19*	6.00
2324	54	04/22/2019	13.90	471	6.88	4.96
2325	44	04/24/2019	15.25	819	6.86	8.33
2327	92	04/22/2019	17.97	438	7.20	2.96
2328	84	04/24/2019	16.38	760	6.85	7.72
2330	83	04/22/2019	14.60	560	6.99	0.46
2331	86	04/22/2019	17.29	410	6.62	7.65
2332	117	05/01/2019	15.60	256	*5.80*	0.62

2333	87	04/22/2019	15.39	452	7.04	1.28
2335	123	05/01/2019	15.68	472	*6.18*	7.54
2338	128	05/01/2019	14.40	442	*5.88*	7.98
2902	90	05/07/2019	14.11	642	6.45	7.59
2918	59	04/22/2019	15.09	775	7.19	8.10
2924	106	05/01/2019	15.72	395	*6.40*	5.65
2930	127	05/01/2019	15.79	529	*6.29*	7.18
2932	Unk	05/07/2019	14.16	574	6.59	6.92

Notes: ft bgs = feet below ground surface; °C = degrees Celsius; µS/cm = microsiemens/centimeter; pH = standard pH units; mg/L = milligrams per liter; Unk = unknown, well log not found; Shaded and italicized numbers indicate a violation of a National Secondary Drinking Water Regulation (NSDWR) standard.NSDWR standards are recommended limits for PWSs but can be used to evaluate to private well water quality.
[A] = Parameter with a National Secondary Drinking Water Regulation (NSDWR) standard (pH is 6.5–8.5).

Nutrient Results

The wells sampled in the Emmett North Bench NPA had nitrate concentrations ranging between less than the detection limit (<0.18 mg/L) to 11.3 mg/L. Two of the 31 wells (6%) had nitrate concentrations above the MCL with 11.2 mg/L and 11.3 mg/L. Four wells (13%) had nitrate concentrations above half the MCL (5 mg/L), ranging from 5.63 mg/L to 8.44 mg/L. The remaining 25 wells sampled (81 %) had nitrate concentrations of less than 5 mg/L, however 4 of the 31 wells contained nitrate concentrations between 4 and 5 mg/L. (Table 2 and Figure 2).

Samples collected from wells with dissolved oxygen concentrations below 2.0 mg/L were submitted to the lab for ammonia analysis. Of the 10 wells analyzed for ammonia, six had detections; the reported ammonia concentrations ranged from below the detection limit (<0.50 mg/L) to 1.1 mg/L (Table 2).

Table 2. Nutrient and nutrient-related isotope results—Emmet North Bench NPA Ground Water Monitoring Project

DEQ Site ID	Well Depth	Sample Date	Nutrient Concentration			Isotopes
			Nitrite[A]	Nitrate[A] mg/L	Ammonia	$\delta^{15}N$ ‰
Water Quality Standard:			**1.0**	**10**	**No Stand.**	
1266	96	04/22/2019	<0.30	1.11	<0.50	—
1288	105	05/01/2019	<0.30	<0.18	0.36	—
1289	55	04/24/2019	<0.30	7.07	—	5.8
1291	91	04/24/2019	<0.30	0.282	<0.050	—
1293	106	04/24/2019	<0.30	<0.18	0.10	—
1294	78	05/01/2019	<0.30	1.63	<0.050	—
1295	68	04/24/2019	<0.30	**11.3**	—	7.0
2088	140	04/22/2019	<0.30	<0.18	0.81	—
2233	109	04/22/2019	<0.30	2.79	—	—
2306	121	04/24/2019	<0.30	4.60	—	—
2307	98	04/22/2019	<0.30	3.73	—	—
2316	130	04/24/2019	<0.30	8.44	—	8.9
2317	129	04/24/2019	<0.30	0.763	—	—
2318	98	05/07/2019	<0.30	<0.18	1.1	—
2321	117	04/24/2019	<0.30	**11.2**	—	4.4
2323	73	04/22/2019	<0.30	4.98	—	—
2324	54	04/22/2019	<0.30	2.24	—	—
2325	44	04/24/2019	<0.30	4.33	—	—
2327	92	04/22/2019	<0.30	1.65	—	—
2328	84	04/24/2019	<0.30	0.894	—	—
2330	83	04/22/2019	<0.30	0.218	0.13	—
2331	86	04/22/2019	<0.30	2.93	—	—
2332	117	05/01/2019	<0.30	<0.18	0.083	—
2333	87	04/22/2019	<0.30	0.679	<0.050	—
2335	123	05/01/2019	<0.30	3.92	—	—
2338	128	05/01/2019	<0.30	3.22	—	—
2902	90	05/07/2019	<0.30	4.90	—	—
2918	59	04/22/2019	<0.30	6.37	—	6.9
2924	106	05/01/2019	<0.30	1.80	—	—
2930	127	05/01/2019	<0.30	3.59	—	—
2932	Unk	05/07/2019	<0.30	5.63	—	6.5

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; ‰ = per mil; Unk = Unknown. Well log not found; (-) = Not Analyzed; No Stand. = No Primary or Secondary Drinking Water Regulation standard currently established. Shaded and bolded numbers indicate an EPA National Primary Drinking Water Regulation (NPDWR) standard was reached or exceeded.

[A.] Contaminants with National Primary Drinking Water Regulation standard.

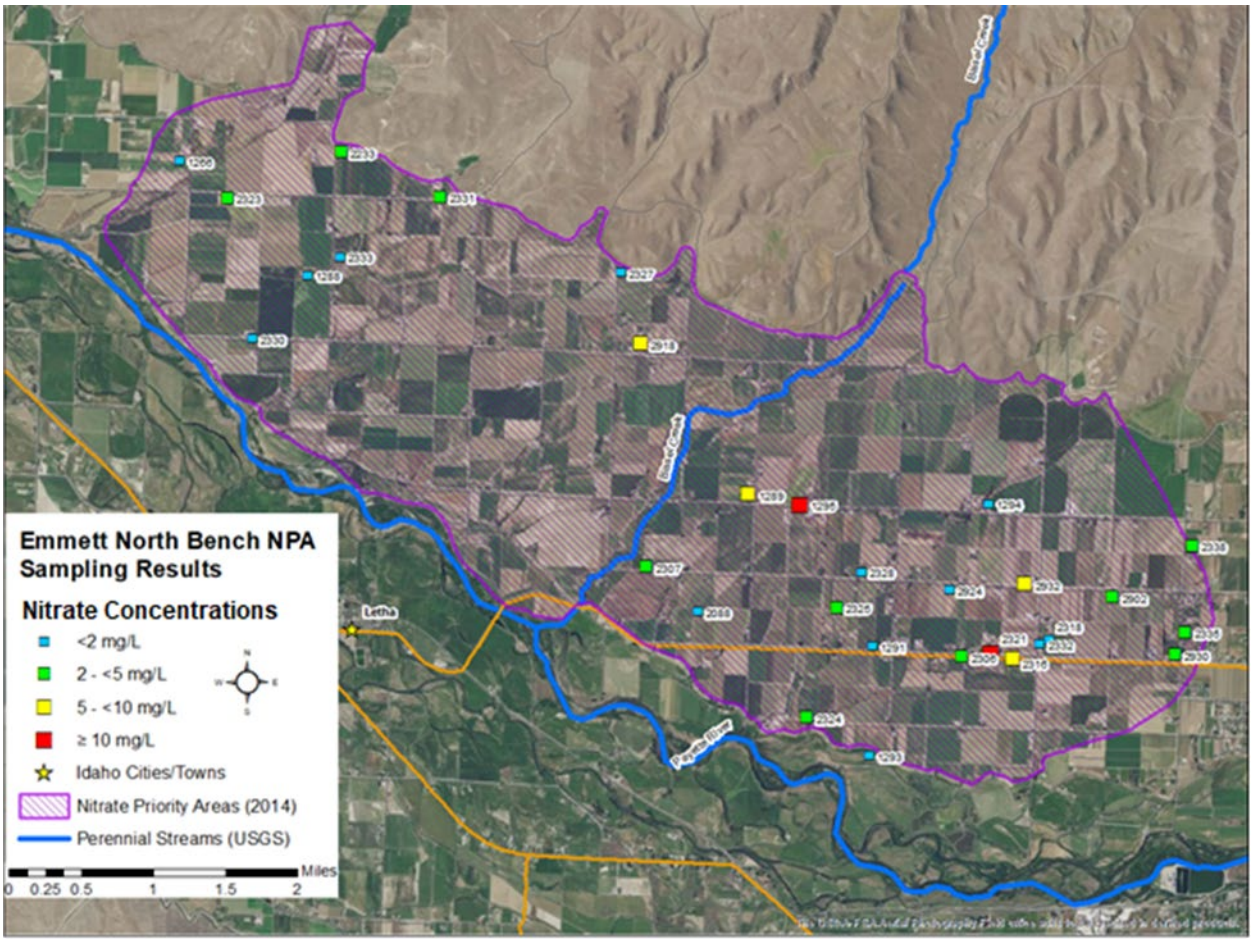


Figure 3. Sample locations and nitrate concentrations—Emmett North Bench Ground Water Monitoring Project.

Nitrate concentrations in wells that were sampled in both 2014 and 2019 were compared to evaluate changes in concentrations within the Emmett North Bench NPA. Other than Wells 2328 and 1295, the decreases were less than 1.5 mg/L. Increases in nitrate concentrations were between 0.09 mg/L and 6.34 mg/L (Table 3). The spatial distribution of changes (increase or decreases) between nitrate samples taken in 2014 and nitrate samples taken in 2019 is shown in Figure 3. Eleven wells had an increase in nitrate concentrations between 2014 and 2019. Twelve wells either had a decrease in concentration or no change in concentration between 2014 and 2019. Based on a sum of the magnitude of the changes, it can be estimated that the nitrate levels increased between 2014 and 2019 (Table 3).

Table 3. Comparison of Nitrate Results between 2014 sampling and 2019 sampling.

DEQ Site ID	Well Depth (ft bgs)	Nitrate[A] 2014 (mg/L)	Nitrate[A] 2019 (mg/L)	Change (mg/L)
Water Quality Standard:		**10 (mg/L)**	**10 (mg/L)**	
1266	96	1.02	1.11	+0.09
1288	105	<0.18	<0.18	0
1289	55	6.24	7.07	+0.83
1291	91	0.187	0.282	+0.095
1293	106	<0.18	<0.18	0
1295	68	13.6	11.3	-2.3
2233	109	2.88	2.79	-0.09
2306	121	2.2	4.60	+2.4
2316	130	2.12	8.44	+6.32
2317	129	0.617	0.763	+0.146
2318	98	<0.18	<0.18	0
2321	117	9.19	11.2	+2.01
2323	73	3.23	4.98	+1.75
2324	54	2.64	2.24	-0.4
2325	44	2.42	4.33	+1.91
2327	92	1.76	1.65	-0.11
2328	84	5.37	0.894	-4.47
2330	83	0.965	0.218	-0.747
2331	86	3.48	2.93	-0.55
2332	117	<0.18	<0.18	0
2333	87	2.88	2.79	-0.99
2335	123	1.65	3.92	+2.27
2338	128	1.80	3.22	+1.42
			Sum of Change in Concentration:	**+9.57**

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; ‰ = per mil; Unk = Unknown. Well log not found; (-) = Not Analyzed; Shaded and bolded numbers indicate an EPA National Primary Drinking Water Regulation (NPDWR) standard was reached or exceeded.

[A.] Contaminants with National Primary Drinking Water Regulation standard.

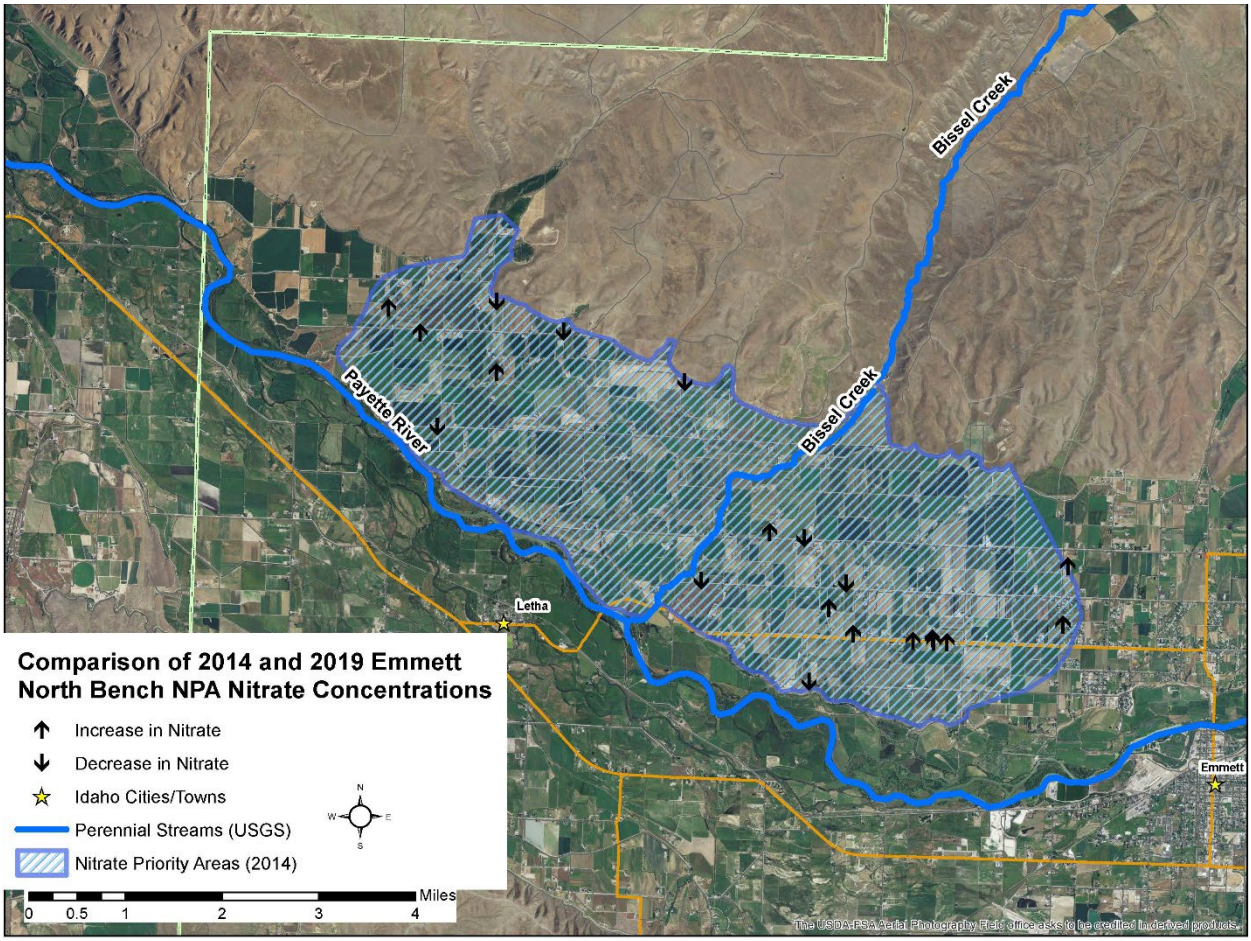


Figure 4. Comparison of 2014 and 2019 Nitrate Concentrations—Emmett North Bench Ground Water Monitoring Project.

Nitrogen Isotope Results

Nitrogen isotope ($\delta^{15}N$) ratios can be helpful in determining the potential sources of nitrate in the ground water. Nitrogen isotope ratios were determined for the six samples with nitrate concentrations greater than 5 mg/L (Table 2). Nitrogen from human or animal waste and fertilizer sources has distinguishable $\delta^{15}N$ signatures. Typical $\delta^{15}N$ values for various nitrogen sources are listed in Table 4.

The $\delta^{15}N$ samples were collected from the six wells with nitrate concentrations over 5 mg/L. The isotope ratio results ranged from 4.4‰ to 8.9‰, indicating the source of nitrates in the soil was most likely from a mixed organic source (Table 4).

Table 4. Typical $\delta^{15}N$ values from various nitrogen sources.

Potential Nitrate Source	$\delta^{15}N$ (‰)
Precipitation	−4
Commercial fertilizer	−4 to +4
Organic nitrogen in soil or mixed nitrogen source	+4 to +9
Animal or human waste	Greater than +9

Source: Seiler 1996

Bacteria Results

The reported total coliform (TC) bacteria concentrations ranged from below the detection limit to 16 MPN/100 mL; five of the 31 samples had positive TC detections. The five sample sites with TC detections had no history of TC detections. All 31 samples were negative for *E. coli* (Table 5).

Table 5. Bacteria Results—Emmett North Bench NPA Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Bacteria Concentrations[A]	
			E. coli	Total Coliform
			MPN/100 mL	
Water Quality Standard:			**<1**	**1.0**
1266	96	04/22/2019	<1	<1
1288	105	05/01/2019	<1	<1
1289	55	04/24/2019	<1	<1
1291	91	04/24/2019	<1	<1
1293	106	04/24/2019	<1	<1
1294	78	05/01/2019	<1	<1
1295	68	04/24/2019	<1	<1
2088	140	04/22/2019	<1	<1
2233	109	04/22/2019	<1	<1
2306	121	04/24/2019	<1	<1
2307	98	04/22/2019	<1	<1
2316	130	04/24/2019	<1	<1
2317	129	04/24/2019	<1	3
2318	98	05/07/2019	<1	<1
2321	117	04/24/2019	<1	<1
2323	73	04/22/2019	<1	<1
2324	54	04/22/2019	<1	<1
2325	44	04/24/2019	<1	<1
2327	92	04/22/2019	<1	16
2328	84	04/24/2019	<1	<1
2330	83	04/22/2019	<1	<1

2331	86	04/22/2019	<1	<1
2332	117	05/01/2019	<1	<1
2333	87	04/22/2019	<1	<1
2335	123	05/01/2019	<1	4
2338	128	05/01/2019	<1	<1
2902	90	05/07/2019	<1	<1
2918	59	04/22/2019	<1	<1
2924	106	05/01/2019	<1	<1
2930	127	05/01/2019	<1	1
2932	Unk	05/07/2019	<1	<1

Notes: MPN/100 mL = most probable number per 100 milliliters; [A.] Total coliform and E. coli standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

2.1.1.3 Conclusions

The criterion for an NPA designation is met when 25% or more of the wells sampled within the area meet or exceed 5 mg/L concentration, or half of the MCL (10 mg/L). The Emmett North Bench NPA ground water monitoring project evaluated ongoing nitrate contamination concerns in the area. In this project, 6 of the 31 wells sampled (19.35%) had nitrate values equal to or greater than 5 mg/L. EPA's drinking water MCL for nitrate (10 mg/L) was exceeded in two samples. Reported nitrate concentrations have generally increased in the area since 2014, as evidenced by the positive net change in nitrate concentration of 23 wells sampled both years. Nitrogen isotopic signatures were evaluated for 6 of the 31 wells with nitrate concentrations at or above 5 mg/L. The $\delta^{15}N$ results suggest multiple potential sources of nitrogen.

2.1.1.4 Recommendations

DEQ may consider changing the NPA boundaries during the next 5-year ranking period. The portion of the NPA east of Bissell Creek appears to have nitrate concentrations of 5 mg/L or more, although recent change in land use from dairy to farming may impact future nitrate levels. DEQ plans to resample this project again in 2024 during the next NPA review.

2.1.2 Glenns Ferry NPA Ground Water Monitoring Project

2.1.2.1 Purpose and Background

This ground water monitoring project was designed to evaluate the water quality and nitrate concentrations in the Glenns Ferry NPA in Elmore County. In 2008, the Glenns Ferry NPA ranked as the 17th most impacted NPA in Idaho (DEQ 2021). In 2014, the Glenns Ferry NPA was ranked

the 19th most impacted NPA and was found to have no observable trend (DEQ 2014). The predominant land uses in the Glenns Ferry NPA are agricultural and residential. All residences located within the NPA, but outside Glenns Ferry city limits, are served by private wells.

Elmore County is located along the northeast margin of the central western Snake River Plain (Shervais et al. 2002). DEQ's review of the IDWR well driller's reports for wells located within the project area indicated the subsurface generally consists of layers of clay, sand, and gravel with some basalt. The depth to ground water shown on well driller's reports ranged from 13 to 239 feet bgs. The wells sampled for this project were completed at depths ranging from 24 to 738 feet and were generally completed into water-bearing sand and/or gravel layers. The Glenns Ferry NPA is located on both the north and south sides of the Snake River. IDWR's regional ground water flow map (IDWR 2014) shows ground water flow within the NPA is generally toward the Snake River.

In 2019, DEQ collected ground water samples from 12 domestic or irrigation wells in the Glenns Ferry NPA using procedures outlined in the regional project QAPP (DEQ 2019a). Program objectives, design, and well selection processes are identified in the "Regional Ground Water Monitoring Network Design" developed by staff in BRO and Technical Services in 2019 (DEQ 2019b). DEQ analyzed the ground water samples for common water quality analytes including nitrate and coliform to assess the water quality in the project area. Nitrogen isotope samples were sent to the University of Arizona lab for analysis while all other samples were taken to Idaho Bureau of Laboratories.

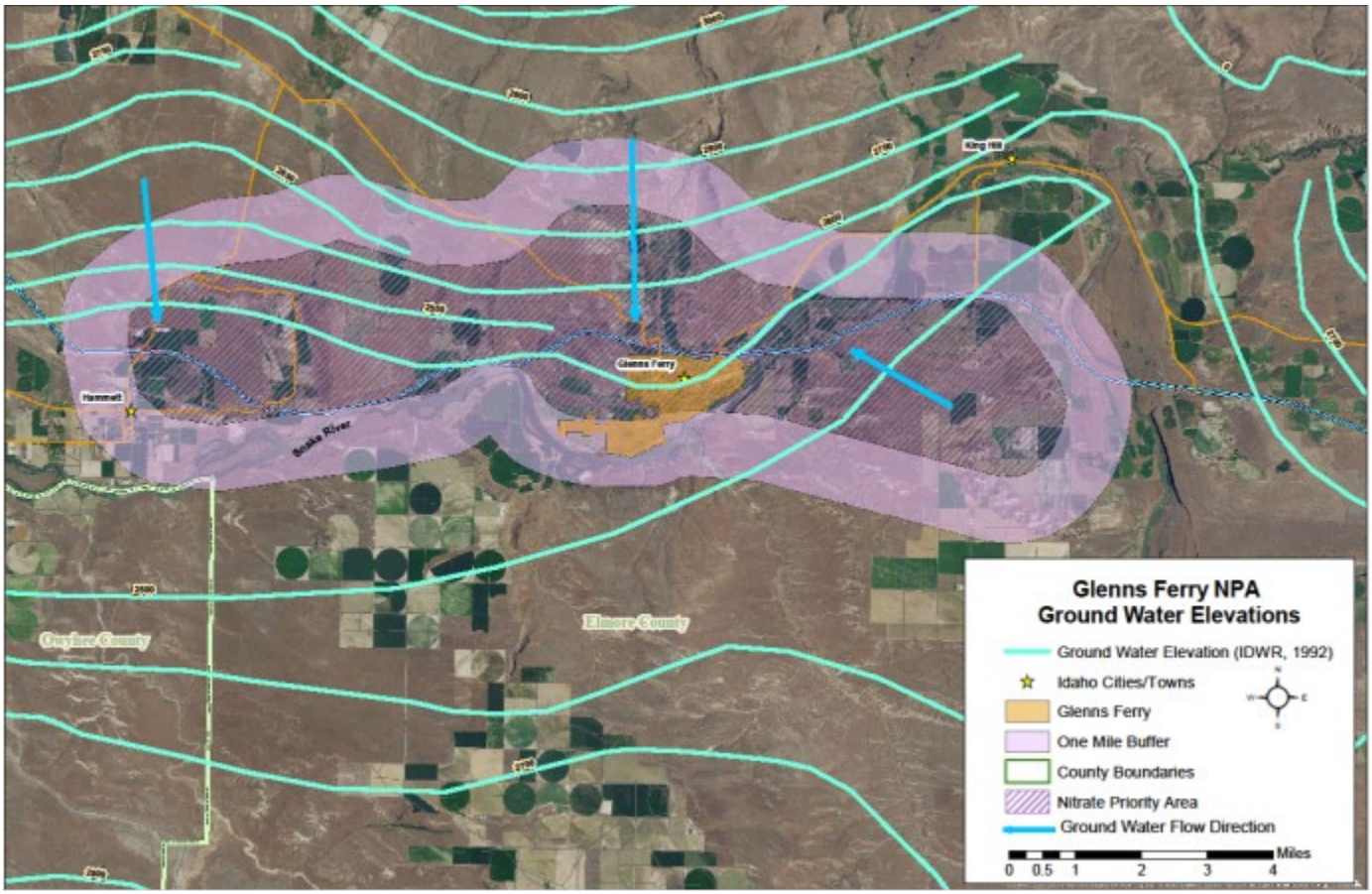


Figure 5. Sample sites and location of Glenns Ferry—Glenns Ferry Nitrate Priority Area Ground Water Monitoring Project.

2.1.2.2 Methods and Results

Sample locations were selected in accordance with the Regional Network Design (DEQ, 2019). A statistical model was used to determine the number of samples that are required for collection within the NPA to ensure statistically valid sampling results for this project. The number of wells required for the Glenns Ferry NPA to be within 15% percent of the true mean with a confidence of 90% is 64 wells.

DEQ identified 43 wells within the 2019 Glenns Ferry NPA boundary that met the criteria of the Regional Network Design. Due to the absence of available potential sample locations which meet the needs of the project and the inability to obtain permission to sample sufficient wells, the project had inadequate data to meet the statistical goal to be within 15% percent of the true mean with a confidence of 90%.

Table 6. Water quality field parameters—Glenns Ferry NPA Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Water Temperature (°C)	Specific Conductance (µS/cm)	pH[A]	Dissolved Oxygen (mg/L)
2369	738	10/23/2019	23.45	531	8.29	0.17
2372	59	10/22/2019	16.44	1030	7.11	5.85
2373	500	10/23/2019	21.74	436	*8.69*	0.27
2374	332	10/23/2019	21.65	434	8.06	0.46
2377	360	10/22/2019	17.57	808	6.93	0.40
2780	118	10/23/2019	33.33	557	*8.73*	0.21
2974	600	10/22/2019	25.28	567	*9.01*	0.28
2975	298	10/22/2019	20.98	426	*9.25*	0.25
2976	179	10/22/2019	16.18	1060	7.66	4.21
2977	500	10/22/2019	20.7	522	*8.63*	0.41
2978	380	10/22/2019	22.58	1270	7.74	0.34
2979	325	10/23/2019	16.89	692	7.41	6.04

Notes: ft bgs = feet below ground surface; °C = degrees Celsius; µS/cm = microsiemens/centimeter; pH = standard pH units; mg/L = milligrams per liter; Unk = unknown, well log not found; Shaded and italicized numbers indicate a violation of a National Secondary Drinking Water Regulation (NSDWR) standard. NSDWR standards are recommended limits for PWSs but can be used to evaluate to private well water quality.
[A] = Parameter with a National Secondary Drinking Water Regulation (NSDWR) standard (pH is 6.5–8.5).

Nutrient Results

Of the 12 wells sampled in the Glenns Ferry NPA, two wells (2372 and 2976), had nitrate concentrations greater than half the MCL. Well 2976 had a nitrate concentration exceeding the MCL of 10 mg/L (11.6 mg/L). Well 2976 was sampled for the first time in 2019 with a nitrate concentration of 6.05 mg/L. The ten remaining wells had concentrations below the detection limit (See Figure 2).

The reported ammonia concentrations for nine of the wells ranged from 0.32 mg/L to 2.2 m/L. The remaining three wells with DO levels above 2 mg/L were not sampled for ammonia.

Table 7. Nutrient and nutrient-related isotope results—Glenns Ferry NPA Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Nutrient Concentration			Isotopes
			Nitrite[A]	Nitrate[A]	Ammonia	$\delta^{15}N$
			(mg/L)			(‰)
Water Quality Standard:			**1.0**	**10**	**No Stand.**	**No Stand.**
2369	738	10/23/2019	<0.30	0.531	1.1	—
2372	59	10/22/2019	<0.30	6.05	—	5.6
2373	500	10/23/2019	<0.30	<0.18	0.61	—
2374	332	10/23/2019	<0.30	<0.18	1.4	—
2377	360	10/22/2019	<0.30	0.695	2.2	—
2780	118	10/23/2019	<0.30	<0.18	0.68	—
2974	600	10/22/2019	<0.30	<0.18	0.69	—

2975	298	10/22/2019	<0.30	<0.18	0.32	—
2976	179	10/22/2019	<0.30	**11.6**	—	5.3
2977	500	10/22/2019	<0.30	<0.18	1.0	—
2978	380	10/22/2019	<0.30	<0.18	2.2	—
2979	325	10/23/2019	<0.30	0.597	—	—

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; ‰ = per mil; Unk = Unknown. Well log not found; (-) = Not Analyzed; No Stand. = No Primary or Secondary Drinking Water standard currently established. Shaded and bolded numbers indicate an EPA National Primary Drinking Water Regulation (NPDWR) standard, was reached or exceeded.

[A.] Contaminants with National Primary Drinking Water Regulation standard.

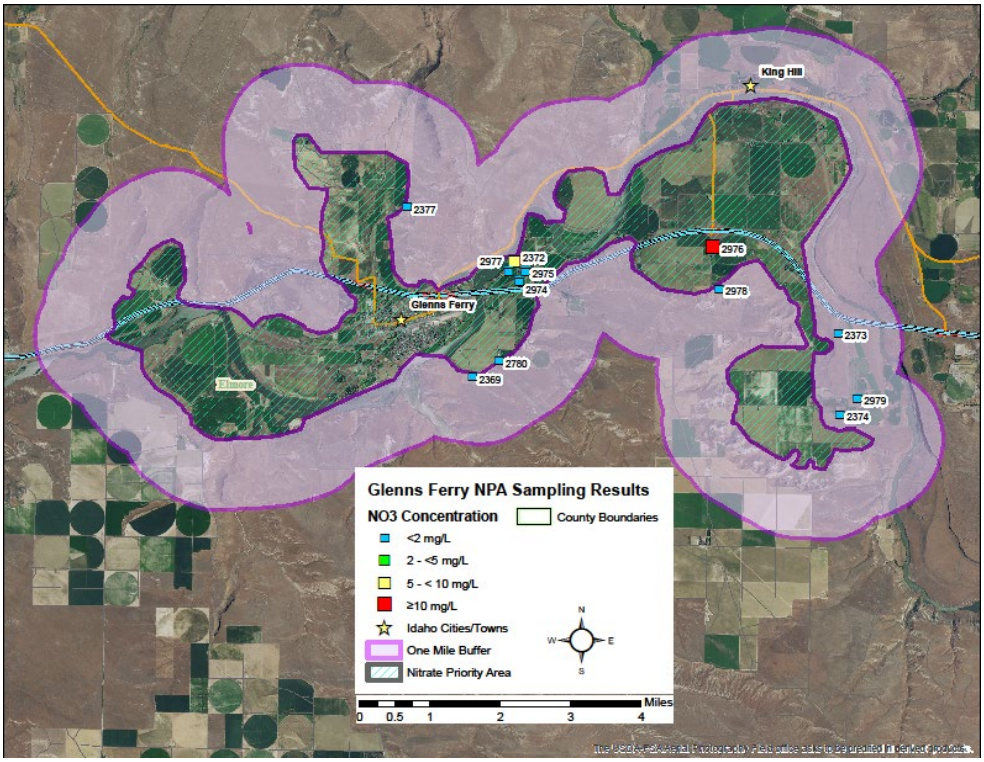


Figure 6. Sample locations and nitrate concentrations—Glenns Ferry NPA.

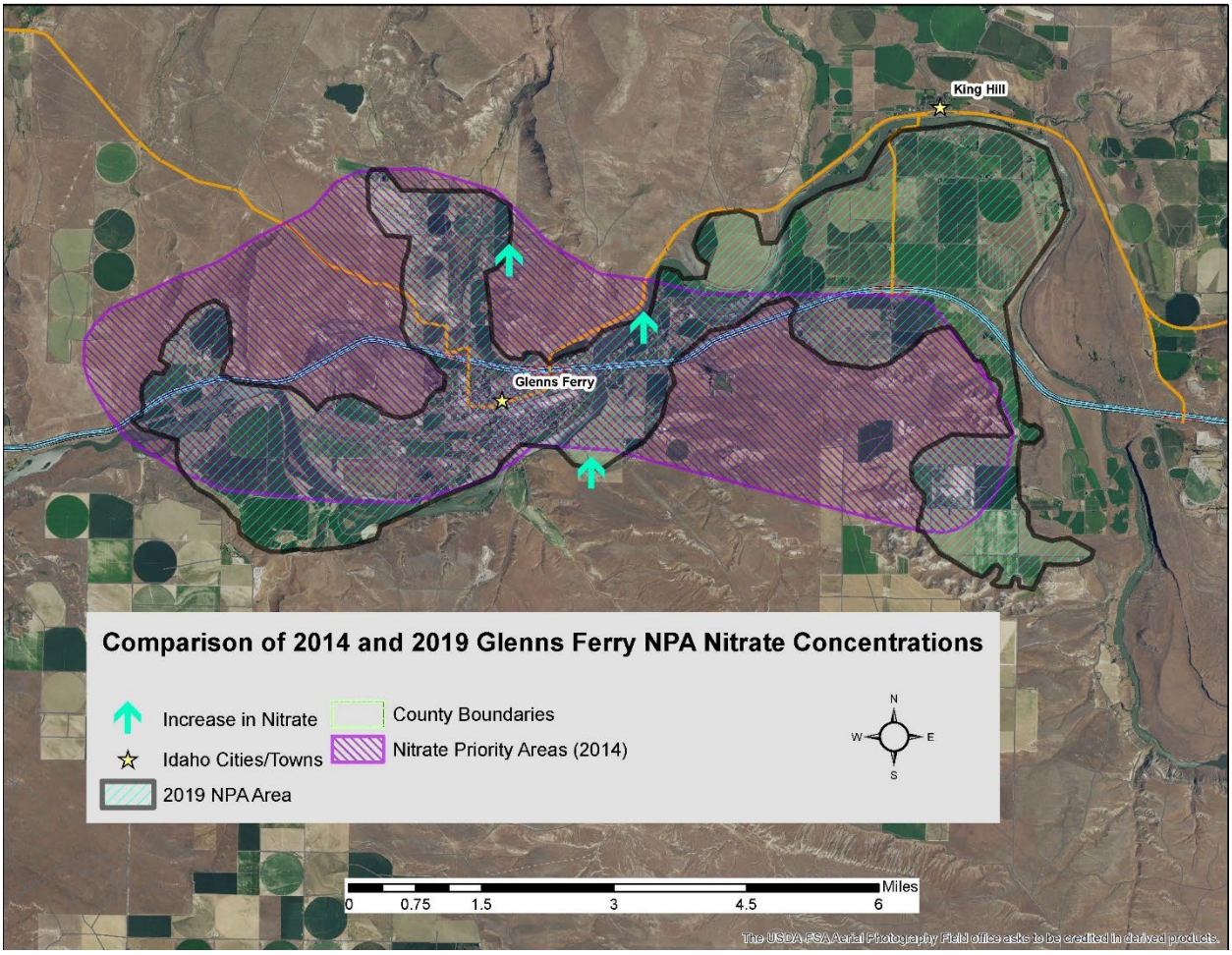


Figure 7. Sample sites nitrate concentration comparison 2014 & 2019—Glenns Ferry Nitrate Priority Area Ground Water Monitoring Project.

Table 8. Comparison of Nitrate Results between 2014 sampling and 2019 sampling.

DEQ Site ID	Well Depth (ft bgs)	Comparative Nitrate Concentrations (mg/L)		
		Nitrate[A] 2014	Nitrate[A] 2019	Change
Water Quality Standard:		**10**	**10**	
2369	738	0.217	0.531	+0.314
2372	59	3.58	6.05	+2.47
2373	500	<0.18	<0.18	0
2374	332	<0.18	<0.18	0
2377	360	0.5285	0.695	+0.166

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter;
[A.] Contaminants with National Primary Drinking Water Regulation standard.

Five of the 12 wells sampled in 2019 were sampled in 2014. Other than Well 2372, the increases in three wells were minimal. Well 2372 and Well 2374 showed no changes in nitrate concentrations.

Nitrogen Isotope Results

Nitrogen isotope samples were collected from the two wells (Wells 2372 and 2976) with nitrate concentrations over 5 mg/L. Both had results in the 4.0‰ to 9.0‰ range, indicating the source of nitrates in the soil was most likely from a mixed organic source (Table 4).

Bacteria Results

Two of the 12 wells sampled (Wells 2372 and 2377) had detections of Total Coliform (TC). Well 2372 has a history of TC detections. No other wells had detections of TC and no wells had *E. coli* detections (Table 9).

Table 9. Bacteria Results—Glenns Ferry NPA Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Bacteria Concentrations[A]	
			E. coli	Total Coliform
			(MPN/100 mL)	
Water Quality Standard:			**<1**	**1.0**
2369	738	10/23/2019	<1	<1
2372	59	10/22/2019	<1	27
2373	500	10/23/2019	<1	<1
2374	332	10/23/2019	<1	<1
2377	360	10/22/2019	<1	1
2780	118	10/23/2019	<1	<1
2974	600	10/22/2019	<1	<1
2975	298	10/22/2019	<1	<1
2976	179	10/22/2019	<1	<1
2977	500	10/22/2019	<1	<1
2978	380	10/22/2019	<1	<1
2979	325	10/23/2019	<1	<1

Notes: ft bgs = feet below ground surface; MPN/100 mL = most probable number per 100 milliliters.

[A.] Total coliform and E. coli standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

2.1.2.3 Conclusions

Two of the 12 wells sampled (16.66%) in the Glenns Ferry NPA had nitrate concentrations greater than or equal to 5 mg/L.

Shallow wells with the coolest water contained the highest nitrate concentrations. No wells with depths greater than 200 ft contained nitrate concentrations above 1 mg/L.

Of the three wells containing DO above 1 mg/L, two contained nitrate above 5 mg/L.

These results indicate the possibility of an impacted shallow aquifer, but the deeper aquifer does not seem to be impacted.

2.1.2.4 Recommendations

More robust sampling in this area is needed to evaluate the NPA in order for the Glenns Ferry NPA boundaries to be reevaluated during the next scheduled NPA ranking evaluation.

DEQ plans to repeat the Glenns Ferry NPA sampling in 2024.

2.1.3 Weiser NPA Ground Water Monitoring Project

2.1.3.1 Purpose and Background

This ground water monitoring project was designed to evaluate the water quality and nitrate concentrations in the Weiser NPA in Washington County. In 2014, the Weiser NPA ranked as the 2nd most impacted NPA in Idaho. In 2014, DEQ collected ground water samples from 37 domestic or irrigation wells in the Weiser NPA.

Over 11 days, between March 18 and May 7, 2019, DEQ collected ground water samples from 72 domestic or irrigation wells in the Weiser NPA using procedures outlined in the QAPP (DEQ 2019a). Program objectives, design, and well selection processes are identified in the "Regional Ground Water Monitoring Network Design" developed by staff in BRO and Technical Services in 2019 (DEQ 2019b). DEQ analyzed the ground water samples for common water quality analytes including nitrate, nitrite, ammonia, nitrogen isotopes, *E. coli*, and total coliform to assess the water quality in the project area.

The southernmost portion of Washington County is part of the western Snake River Plain. The western Snake River Plain is a down dropped fault-block basin, with normal (vertical) north-northwest trending faults along the margins of the basin. The faulting along the margins of the western Snake River Plain began about 11 million years ago, the resultant central basin underwent rapid subsidence, and the subsidence was largely finished about 9 million years ago. A major lacustrine (lake) system, named Lake Idaho, developed in the basin and existed from about 9.5 to 1.7 million years ago. The lake system was formed by lava flows in western Idaho and eastern Oregon that blocked major surface water drainages in western Idaho. The lake's elevation and boundaries fluctuated over time, likely due to changes in precipitation, the lake's drainage basin, tectonics, or the establishment of a lower elevation outlet for the lake. Both lake and stream sediments, including volcanic ash, clay, silt, sand, and gravel, were deposited in the basin. The area surrounding Weiser contains Lake Idaho-related sediments (e.g., clay, silt, sand), and more recent stream- and wind-deposited sediments (Wood and Clemens 2002).

The predominant land use in the Weiser NPA is agricultural and residential. The residences within the City of Weiser Water System boundaries are served by the City of Weiser. A few of these residences retained their original wells and use these wells for irrigation purposes. All residences outside the City of Weiser are served by private wells.

DEQ staff reviewed project area well logs and determined a thick blue clay confining layer starts between 24 and 66 feet bgs. All wells sampled for this project had a well completion depth of less than 165 feet bgs. The regional ground water flow direction is generally to the southwest (Figure 8).

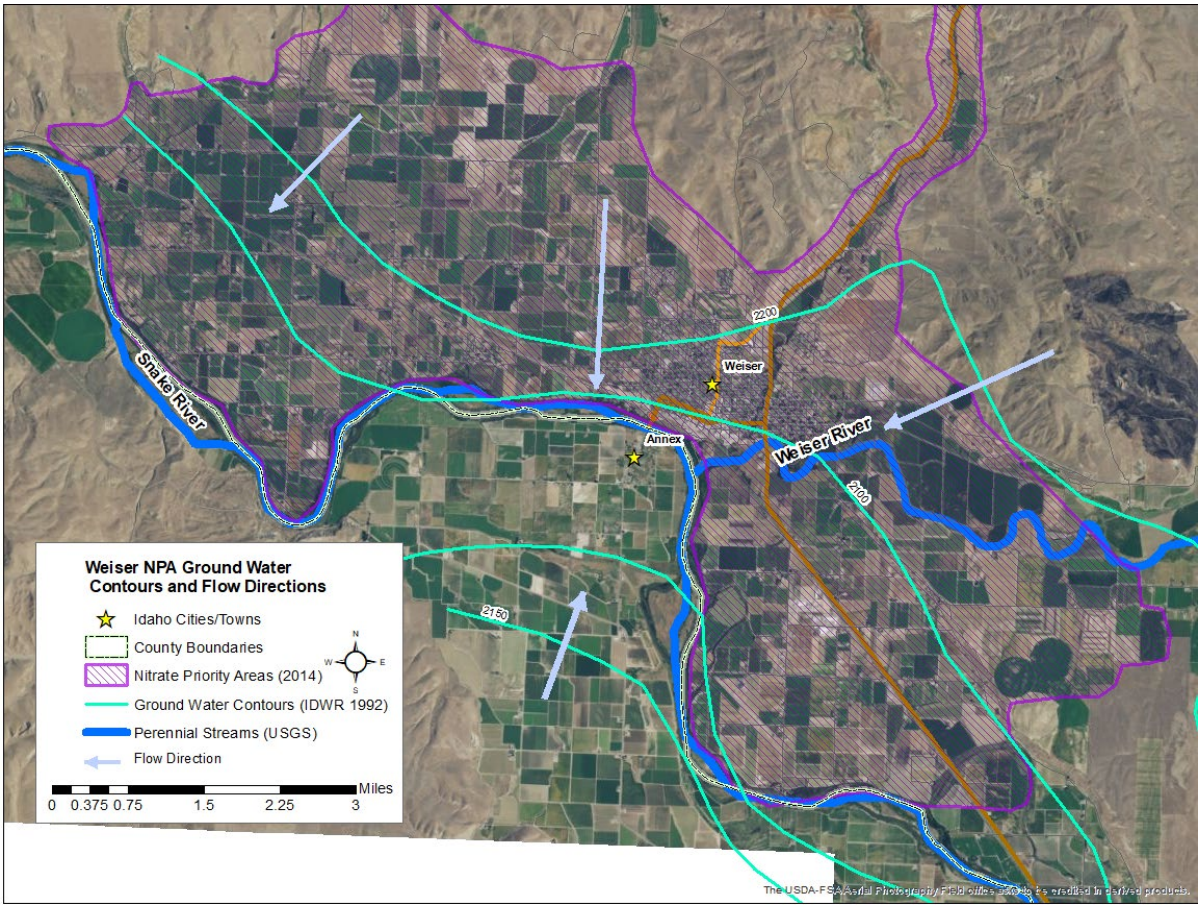


Figure 8. Sample sites and location of Weiser—Weiser Nitrate Priority Area Ground Water Monitoring Project.

2.1.3.2 Methods and Results

Sample locations were selected in accordance with the Regional Network Design (DEQ, 2019). A statistical model was used to determine the number of samples that are required for collection within the NPA to ensure statistically valid sampling results for this project. The model determined the total number of wells required for the Weiser NPA to be within 10% percent of the true mean with a confidence of 90% is 75. In total, 73 wells were sampled.

Table 10. Water quality field parameters—Weiser NPA Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Water Temperature (°C)	Specific Conductance (µS/cm)	pH[A]	Dissolved Oxygen (mg/L)
1047	40	03/18/2019	12.99	3890	7.41	0.47
1049	36	03/18/2019	15.54	3290	7.28	0.54
2268	42	03/19/2019	14.18	963	6.64	2.38
2270	59	03/25/2019	14.65	872	7.68	1.87
2271	36	03/18/2019	14.51	934	7.26	1.52
2276	47.8	04/02/2019	15.13	939	7.24	0.93

2278	104	03/25/2019	14.5	1110	7.50	2.44
2284	36	03/26/2019	13.48	907	7.01	0.77
2285	60	03/19/2019	14.05	975	6.76	0.33
2287	124	03/27/2019	17.17	1620	6.75	0.36
2289	33	03/18/2019	14.68	989	6.81	0.37
2290	50	03/25/2019	14.54	857	7.94	0.95
2291	30	03/26/2019	14.05	735	7.08	0.56
2295	50	03/25/2019	16.28	2540	7.24	4.46
2296	33	03/18/2019	14.31	2130	6.83	3.04
2299	31	03/19/2019	12.93	1140	6.54	2.58
2301	50	04/02/2019	15.36	969	7.23	7.02
2305	79	03/27/2019	14.17	918	6.85	0.57
2883	45	03/19/2019	15.05	1440	6.81	0.65
2884	47.7	04/23/2019	14.46	1080	7.21	1.02
2885	87	04/02/2019	14.63	1060	7.28	7.03
2886	23.5	04/01/2019	14.91	1140	6.79	3.73
2888	75	03/26/2019	14.69	592	*6.30*	2.03
2889	33	04/23/2019	14.54	991	7.19	6.63
2890	48	03/26/2019	14.27	793	6.94	0.41
2891	31	03/27/2019	13.51	753	7.19	4.56
2892	30	03/25/2019	14.44	844	7.57	2.08
2893	72	03/25/2019	14.26	879	7.66	3.40
2894	45	03/20/2019	15.57	543	7.05	4.24
2895	72	03/18/2019	13.67	5340	7.46	2.59
2897	35	03/18/2019	14.79	1900	6.79	4.91
2898	34	03/18/2019	14.64	996	6.74	6.90
2899	147	03/19/2019	18.01	392	6.92	0.82
2900	145	03/19/2019	16.33	977	*6.21*	0.62
2901	40	03/19/2019	14.65	1030	6.78	0.42
2903	40	03/26/2019	14.44	802	7.15	1.00
2904	42	04/01/2019	14.44	772	7.12	3.15
2905	49	04/02/2019	14.00	1120	7.08	0.37
2906	70	03/25/2019	14.22	1530	7.28	3.10
2907	38	03/19/2019	13.49	963	6.65	1.15
2908	34	03/26/2019	14.07	732	7.11	0.38
2909	50	03/25/2019	14.7	1100	7.77	1.56

2910	26	03/26/2019	10.66	1970	*6.37*	3.58
2911	50	03/26/2019	16.14	784	7.18	2.11
2912	40	03/20/2019	16.34	634	7.17	6.01
2913	44	03/20/2019	15.97	716	7.02	5.49
2914	160	05/07/2019	13.82	908	7.09	1.08
2915	40	03/20/2019	17.01	588	*6.44*	2.32
2916	60	03/25/2019	14.62	984	7.43	6.67
2920	45	03/26/2019	13.80	786	7.17	1.76
2921	80	04/02/2019	14.47	1020	7.39	7.92
2922	40	04/02/2019	13.74	1140	7.20	6.59
2923	42	03/27/2019	16.49	791	7.17	4.47
2927	unk	03/27/2019	15.59	724	7.38	4.20
2928	30	03/27/2019	14.80	700	6.92	0.85
2929	35	04/01/2019	14.36	905	*6.31*	3.28
2933	50	04/01/2019	15.68	518	7.06	3.81
2934	56	04/01/2019	12.05	744	6.56	0.64
2935	40	04/02/2019	14.59	727	7.19	2.75
2936	55	04/03/2019	13.41	1060	7.16	0.41
2938	53	04/02/2019	14.64	917	7.28	3.14
2939	75	04/01/2019	14.7	864	6.84	5.13
2940	55	04/01/2019	14.79	1040	6.85	10.98
2941	41	04/03/2019	14.25	708	7.09	0.40
2942	48.5	04/02/2019	13.97	843	7.19	1.33
2943	58	04/02/2019	14.78	1.12	7.13	0.96
2944	41	04/01/2019	13.50	1070	*6.45*	2.34
2946	60	04/03/2019	14.41	354	7.55	0.32
2947	50	04/23/2019	14.21	816	7.40	1.99
2948	37	04/23/2019	—	—	—	—
2949	38	04/23/2019	14.56	4000	7.04	0.37
2950	46	05/07/2019	14.91	1270	7.10	8.04
2951	40	05/07/2019	15.6	2740	6.85	0.48

Notes: ft bgs = feet below ground surface; µS/cm = microsiemens/centimeter; pH = standard pH units; mg/L = milligrams per liter; Shaded and italicized numbers indicate an EPA National Secondary Drinking Water Regulation (NSDWR) standard was reached or exceeded. NSDWR standards are recommended limits for PWSs but can be used to evaluate to private well water quality.

[A] = Parameter with a National Secondary Drinking Water Regulation (NSDWR) standard (pH is 6.5–8.5).

Nutrient Results

In the Sunnyside and Weiser Flats areas of the Weiser NPA, 34 wells had nitrate concentrations equal to or greater than the MCL (10 mg/L) ranging from 10.0 mg/L to 92.7 mg/L (Table 11 and Figure 9). Well 1049 had a nitrate concentration of 91.10 mg/L and well 2895 had a nitrate concentration of 92.70 mg/L. Fifty of the 73 wells had nitrate concentration equal to or greater than 5 mg/L.

Samples collected from wells with dissolved oxygen concentrations below 2 mg/L, were analyzed for ammonia. Nine of the 41 wells analyzed had detections; the reported ammonia concentrations ranged from 0.054 mg/L to 2.7 m/L (Table 11).

Table 11. Nutrient and nutrient-related isotope results—Weiser NPA Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Nutrient Concentration			Isotopes
			Nitrite[A]	Nitrate[A]	Ammonia	N-15/14
			(mg/L)			(‰)
Water Quality Standard:			**1.0**	**10**	**No Stand.**	**No Stand.**
1047	40	03/18/2019	<0.30	**43.1**	<0.050	18.8
1049	36	03/18/2019	<0.30	**91.1**	<0.050	20.0
2268	42	03/19/2019	<0.30	5.34	—	6.7
2270	59	03/25/2019	<0.30	**12.6**	<0.050	4.3
2271	36	03/18/2019	<0.30	**16.4**	<0.050	3.6
2276	47.8	04/02/2019	<0.30	**13.9**	<0.050	4.0
2278	104	03/25/2019	<0.30	9.08	—	3.4
2284	36	03/26/2019	<0.30	**11.2**	<0.050	7.6
2285	60	03/19/2019	<0.30	**16.8**	<0.050	3.4
2287	124	03/27/2019	<0.30	<0.18	1.2	—
2289	33	03/18/2019	<0.30	**10.0**	<0.050	16.6
2290	50	03/25/2019	<0.30	1.86	<0.050	—
2291	30	03/26/2019	<0.30	7.63	0.054	7.3
2295	50	03/25/2019	<0.30	0.191	0.92	-—
2296	33	03/18/2019	<0.30	**31.3**	-—	5.6
2299	31	03/19/2019	<0.30	**17.6**	-—	8.1
2301	50	04/02/2019	<0.30	**20.0**	-—	5.3
2305	79	03/27/2019	<0.30	<0.18	2.3	-—
2883	45	03/19/2019	<0.30	**15.7**	<0.050	7.1
2884	47.7	04/23/2019	<0.30	**15.2**	<0.050	6.4
2885	87	04/02/2019	<0.30	**10.5**	-—	3.4
2886	23.5	04/01/2019	<0.30	7.84	-—	6.9

2888	75	03/26/2019	<0.30	4.07	0.056	--
2889	33	04/23/2019	<0.30	**14.4**	--	4.6
2890	48	03/26/2019	<0.30	3.96	<0.050	--
2891	31	03/27/2019	<0.30	1.82	--	--
2892	30	03/25/2019	<0.30	**12.7**	--	2.8
2893	72	03/25/2019	<0.30	6.67	--	4.2
2894	45	03/20/2019	<0.30	3.03	--	--
2895	72	03/18/2019	<0.30	**92.7**	<0.050	13.2
2897	35	03/18/2019	<0.30	**35.0**	--	5.4
2898	34	03/18/2019	<0.30	**14.2**	0.10	5.0
2899	147	03/19/2019	<0.30	<0.18	2.7	2.1
2900	145	03/19/2019	<0.30	1.55	0.16	--
2901	40	03/19/2019	<0.30	**14.4**	<0.050	4.4
2903	40	03/26/2019	<0.30	**15.4**	<0.050	3.6
2904	42	04/01/2019	<0.30	6.18	--	4.9
2905	49	04/02/2019	<0.30	8.10	<0.050	5.5
2906	70	03/25/2019	<0.30	8.66	--	6.1
2907	38	03/19/2019	<0.30	7.19	<0.050	7.1
2908	34	03/26/2019	<0.30	7.75	0.052	7.4
2909	50	03/25/2019	<0.30	**13.0**	<0.050	5.4
2910	26	03/26/2019	<0.30	**38.9**	--	21.6
2911	50	03/26/2019	<0.30	**12.4**	--	3.6
2912	40	03/20/2019	<0.30	3.25	--	--
2913	44	03/20/2019	<0.30	4.71	--	--
2914	160	05/07/2019	<0.30	8.73	<0.050	8.4
2915	40	03/20/2019	<0.30	3.16	--	--
2916	60	03/25/2019	<0.30	**19.1**	--	5.8
2920	45	03/26/2019	<0.30	**11.8**	<0.050	1.6
2921	80	04/02/2019	<0.30	**16.9**	--	1.2
2922	40	04/02/2019	<0.30	**17.9**	--	1.9
2923	42	03/27/2019	<0.30	5.38	<0.050	6.1
2927	Unk	03/27/2019	<0.30	2.95	--	--
2928	30	03/27/2019	<0.30	1.11	<0.050	--
2929	35	04/01/2019	<0.30	4.56	--	--
2933	50	04/01/2019	<0.30	0.424	0.095	--
2934	56	04/01/2019	<0.30	3.59	<0.050	--

2935	40	04/02/2019	<0.30	5.31	-—	6.6
2936	55	04/03/2019	<0.30	8.69	<0.050	9.0
2938	53	04/02/2019	<0.30	**16.2**	-—	1.5
2939	75	04/01/2019	<0.30	9.79	-—	4.5
2940	55	04/01/2019	<0.30	**35.1**	-—	6.9
2941	41	04/03/2019	<0.30	4.55	<0.050	-—
2942	48.5	04/02/2019	<0.30	2.32	<0.050	-—
2943	58	04/02/2019	<0.30	4.87	<0.050	-—
2944	41	04/01/2019	<0.30	6.67	-—	7.6
2946	60	04/03/2019	<0.30	<0.18	0.22	-—
2947	50	04/23/2019	<0.30	**11.1**	<0.050	2.8
2948	37	04/23/2019	<0.30	4.80	-—	4.9
2949	38	04/23/2019	<0.30	**33.0**	<0.050	10.2
2950	46	05/07/2019	<0.30	**25.4**	-—	11.2
2951	40	05/07/2019	<0.30	**13.0**	<0.050	24.7

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; ‰ = per mil; Unk = Unknown. Well log not found; (-) = Not Analyzed; No Stand. = No Primary or Secondary Drinking Water standard currently established. Shaded and bolded numbers indicate an EPA National Primary Drinking Water Regulation (NPDWR) standard, was reached or exceeded.

[A.] Contaminants with National Primary Drinking Water Regulation standard.

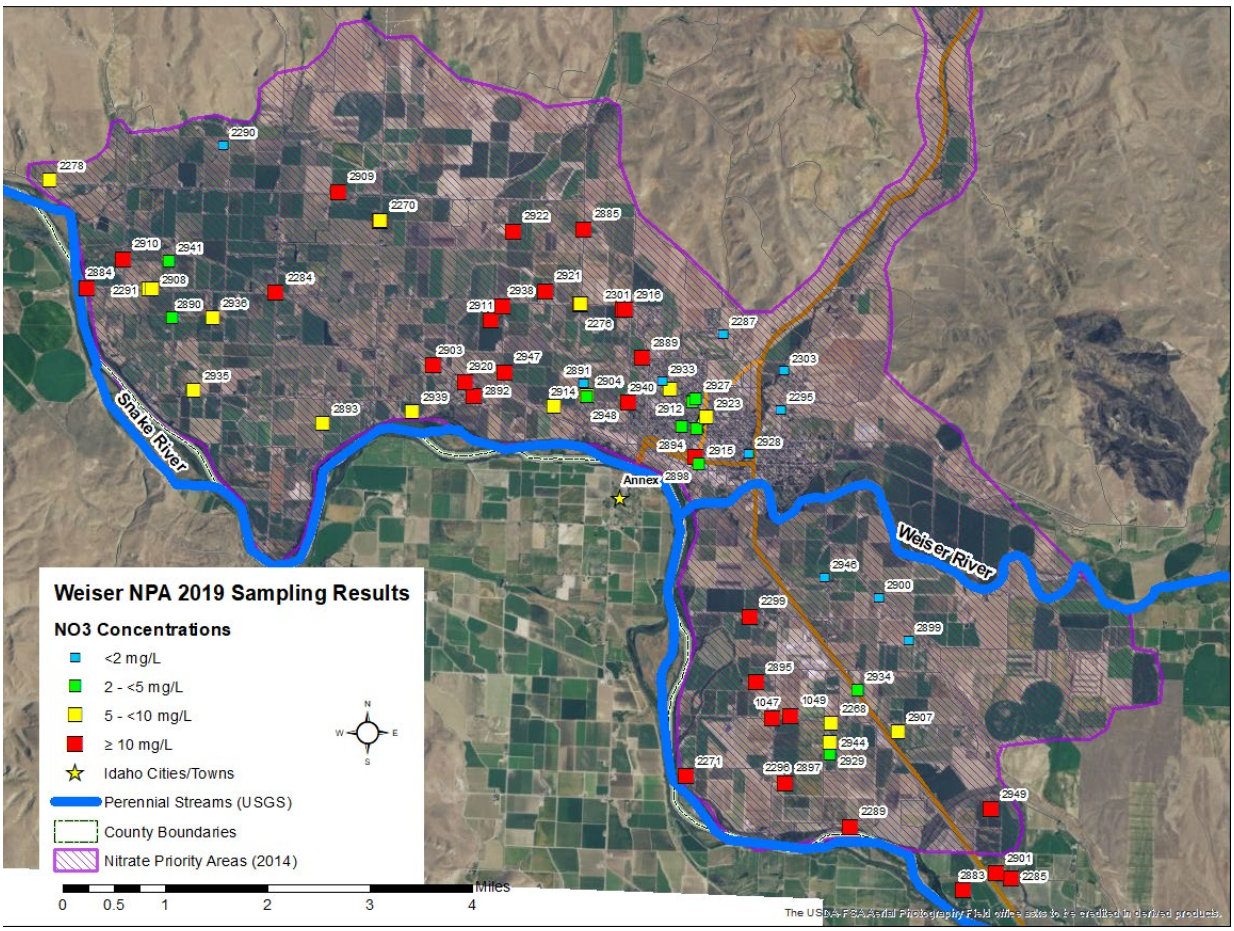


Figure 9. Sample sites with nitrate concentration results—Weiser Nitrate Priority Area Ground Water Monitoring Project.

Nitrate concentrations in wells that were sampled in both 2014 and 2019 were compared to evaluate changes in concentrations within the Weiser NPA. Only four of the 15 wells sampled both years showed decreases. The other 11 wells all showed increases ranging from 0.30 mg/L to 7.40 mg/L. The spatial distribution of changes (increase or decreases) between nitrate samples taken in 2014 and nitrate samples taken in 2019 is shown in Figure 3. Based on a sum of the magnitude of the changes, it can be estimated that the nitrate levels increased between 2014 and 2019 (Table 12).

Table 12. Comparison of Nitrate Results between 2014 sampling and 2019 sampling.

DEQ Site ID	Well Depth (ft bgs)	Comparative Nitrate Concentrations		Change
		Nitrate[A] 2014	Nitrate[A] 2019	
		(mg/L)		
Water Quality Standard:		**10**	**10**	
2290	50.00	1.69	1.86	+0.17
2278	104.00	3.64	9.08	+5.44
2276	47.80	**12.50**	**13.90**	+1.4
2270	54.00	**12.30**	**12.60**	+0.30
2301	50.00	**16.60**	**20.00**	+3.40
2271	36.00	**13.60**	**16.40**	+2.80
2285	60.00	**11.10**	**16.80**	+5.70
2296	35.00	**22.90**	**31.30**	+8.40
2291	30.00	5.70	7.63	+1.93
2299	31.00	**10.20**	**17.60**	+7.40
2284	36.00	8.14	**11.20**	+3.06
2305	79.00	2.48	0.00	-2.84
2295	50.00	0.79	0.19	-0.60
2268	42.00	**12.30**	5.34	-6.96
2289	33.00	**11.10**	**10.00**	-1.10
			Sum of Change in Concentration:	**+28.5**

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; Shaded and bolded numbers indicate an EPA National Primary Drinking Water Regulation (NPDWR) standard, was reached or exceeded.
[A.] contaminant with National Primary Drinking Water Regulation standard.

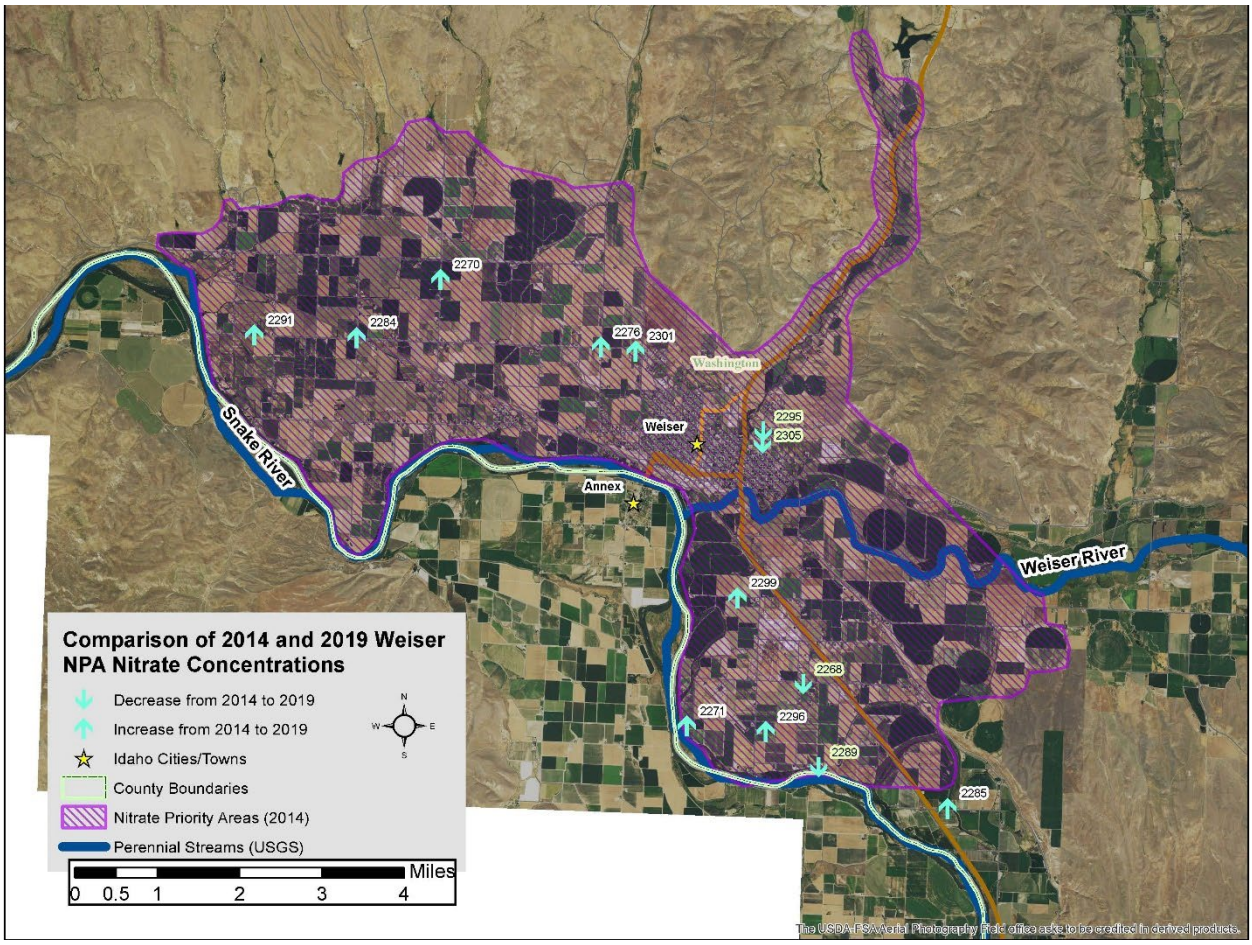


Figure 10. Comparison of 2014 and 2019 nitrate concentrations—Weiser Nitrate Priority Area Ground Water Monitoring Project.

Nitrogen Isotope Results

Nitrogen isotope samples were collected from the 52 wells with nitrate concentrations over 5 mg/L. The nitrogen isotope results for 13 of the wells ranged from 1.2‰ to 3.9‰, indicating the source of nitrates in the ground water is most likely from inorganic commercial fertilizer fertilizers (Seiler 1996; Table 4). Thirty-one wells had results ranging from 4.0‰ to 9.0‰, indicating the source of nitrates in the soil was most likely from a mixed organic source. Eight of the wells had results ranging from 9.1‰ to 24.7‰, indicating the source of nitrates in the soil was most likely from either animal or human waste. Seven of these samples were in the Sunnyside area and one was in the Weiser Flats area (Table 13).

Other than Well 2289, wells in the Sunnyside area that had isotope signatures for human or animal waste are located near or down gradient from a field that had been used as a cull onion dump for several years. In 2019, this field was plowed and had a crop planted in it at the time the sample team was in the area. There were reports that manure had been applied to the field prior to planting, but the sampling team could not confirm these reports. A conclusion on the source of human or animal waste could not be confirmed.

Bacteria Results

Seven samples were positive for Total Coliform (TC). One sample (2910) was positive for both TC and *E. coli*. The 11 wells that were positive for TC did not have a history of bacteria in the wells during DEQ's 2014 Weiser NPA sampling project (Table 3).

Table 13. Bacteria Results—Weiser NPA Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Bacteria Concentrations[A]	
			E. coli	Total Coliform
			(MPN/100 mL)	
Water Quality Standard:			**<1**	**1.0**
1047	40	03/18/2019	<1.0	<1.0
1049	36	03/18/2019	<1.0	<1.0
2268	42	03/19/2019	<1.0	<1.0
2270	59	03/25/2019	<1.0	<1.0
2271	36	03/18/2019	<1.0	<1.0
2276	47.8	04/02/2019	<1.0	<1.0
2278	104	03/25/2019	<1.0	<1.0
2284	36	03/26/2019	<1.0	<1.0
2285	60	03/19/2019	<1.0	<1.0
2287	124	03/27/2019	<1.0	<1.0
2289	33	03/18/2019	<1.0	4.0
2290	50	03/25/2019	<1.0	<1.0
2291	30	03/26/2019	<1.0	<1.0
2295	50	03/25/2019	<1.0	<1.0
2296	33	03/18/2019	<1.0	<1.0
2299	31	03/19/2019	<1.0	<1.0
2301	50	04/02/2019	<1.0	<1.0
2305	79	03/27/2019	<1.0	<1.0
2883	45	03/19/2019	<1.0	<1.0
2884	47.7	04/23/2019	<1.0	<1.0
2885	87	04/02/2019	<1.0	<1.0
2886	23.5	04/01/2019	<1.0	1
2888	75	03/26/2019	<1.0	<1.0
2889	33	04/23/2019	<1.0	<1.0
2890	48	03/26/2019	<1.0	<1.0
2891	31	03/27/2019	<1.0	<1.0
2892	30	03/25/2019	<1.0	<1.0
2893	72	03/25/2019	<1.0	<1.0
2894	45	03/20/2019	<1.0	4.0
2895	72	03/18/2019	<1.0	<1.0
2897	35	03/18/2019	<1.0	<1.0
2898	34	03/18/2019	<1.0	<1.0
2899	147	03/19/2019	<1.0	<1.0
2900	145	03/19/2019	<1.0	<1.0

2901	40	03/19/2019	<1.0	<1.0
2903	40	03/26/2019	<1.0	166
2904	42	04/01/2019	<1.0	<1.0
2905	49	04/02/2019	<1.0	<1.0
2906	70	03/25/2019	<1.0	<1.0
2907	38	03/19/2019	<1.0	<1.0
2908	34	03/26/2019	<1.0	<1.0
2909	50	03/25/2019	<1.0	5.0
2910	26	03/26/2019	**2**	8
2911	50	03/26/2019	<1.0	<1.0
2912	40	03/20/2019	<1.0	<1.0
2913	44	03/20/2019	<1.0	<1.0
2914	160	05/07/2019	<1.0	<1.0
2915	40	03/20/2019	<1.0	<1.0
2916	60	03/25/2019	<1.0	7.0
2920	45	03/26/2019	<1.0	<1.0
2921	80	04/02/2019	<1.0	<1.0
2922	40	04/02/2019	<1.0	<1.0
2923	4	03/27/2019	<1.0	<1.0
2927	Unk	03/27/2019	<1.0	<1.0
2928	30	03/27/2019	<1.0	<1.0
2929	35	04/01/2019	<1.0	<1.0
2933	50	04/01/2019	<1.0	<1.0
2934	56	04/01/2019	<1.0	<1.0
2935	40	04/02/2019	<1.0	<1.0
2936	55	04/03/2019	<1.0	<1.0
2938	53	04/02/2019	<1.0	<1.0
2939	75	04/01/2019	<1.0	1
2940	55	04/01/2019	<1.0	<1.0
2941	41	04/03/2019	<1.0	<1.0
2942	48.5	04/02/2019	<1.0	<1.0
2943	58	04/02/2019	<1.0	<1.0
2944	41	04/01/2019	<1.0	<1.0
2946	60	04/03/2019	<1.0	1
2947	50	04/23/2019	<1.0	219
2948	37	04/23/2019	<1.0	<1.0
2949	38	04/23/2019	<1.0	<1.0
2950	46	05/07/2019	<1.0	1.0
2951	40	05/07/2019	<1.0	<1.0

Notes: ft bgs = feet below ground surface; MPN/100 mL = most probable number per 100 milliliters.

[A.] Total coliform and E. coli standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by bold shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. The presence of E. coli is considered a potential health threat and is a violation of the Idaho Ground Water Quality Standard. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

2.1.3.3 Conclusions

The Weiser NPA ground water monitoring project was conducted to evaluate continuing nitrate contamination concerns in the area. In this project, 50 of the 73 wells sampled (68.48%) had nitrate values greater than or equal to 5 mg/L. The EPA's drinking water MCL for nitrate is 10 mg/L and was exceeded in 34 samples. Reported nitrate concentrations have generally increased in the area since 2014, with 11 of 15 wells sampled in 2013 showing increase in nitrate concentration by 2019.

Nitrogen isotopic signatures were evaluated for 52 of the 73 wells with nitrate concentrations at or above 5 mg/L. Eight of the wells had results ranging from 9.1‰ to 24.7‰, indicating the source of nitrates in the soil was most likely from either animal or human waste. Seven of these samples were in the Sunnyside area and one was in the Weiser Flats area.

Well 2910, located in the Weiser Flats area was the only well that was positive for both TC and *E. coli*. The nitrate, nitrogen isotope, and specific conductance results from this well suggest impacts from a waste source. This well is located down gradient from a small Concentrated Animal Feeding Operation (CAFO).

Wells in the Sunnyside area (except Well 2289) are located down gradient from a former cull onion dump that is now a crop field. There were reports that manure had been applied to the field prior to planting, but the sampling team could not confirm these reports. A conclusion on the source of human or animal waste could not be confirmed.

2.1.3.4 Recommendations

ISDA and Southwest District Health (SWDH) may conduct additional sampling to try to determine a source for the high nitrates in the Sunnyside area.

DEQ plans to sample the Weiser NPA sampling in 2024 and potentially focus more on connections between specific conductance, nitrogen 15 isotope, and nitrate.

2.1.4 New Plymouth Complaint Follow-Up Ground Water Monitoring Project

2.1.4.1 Purpose and Background

The purpose of this project was to conduct follow-up sampling in response to an elevated nitrate detection in a domestic well (2786). To identify the extent of nitrate contamination surrounding Well 2786, DEQ staff obtained permission to sample wells up-gradient, cross-gradient, and down-gradient of the complainant's well.

On March 21, 2018, SWDH informed DEQ of a resident with a qualitative nitrate result (from a nitrate test strip) from their domestic well, indicating a nitrate concentration greater than 20 mg/L. A well water sample collected by the resident, and submitted to Idaho Bureau of Labs (IBL) for analysis, was reported to contain a nitrate concentration of 33 mg/L. SWDH collected additional samples on March 22, 2018 to confirm the nitrate concentration as well as bacteria content. The lab again reported 33 mg/L of nitrate with no presence of TC bacteria, according to SWDH. On March 28, 2018, DEQ personnel visited the general area around the well in question and noticed manure being added and tilled into a field that already had dried manure

on it, as well as additional fields where land application of manure was occurring (See Figure 11).

Residences in the area rely on individual septic systems. The land use in the area surrounding Well 2871 is mostly agricultural with a few dairies.

During the October 2018 sampling event, DEQ personnel spoke with several long-term well owners in the area. After speaking with one well owner, staff learned that in the early spring of 2018 (and possibly late fall of 2017), landowners in the area had applied thicker layers of manure than they had observed in the past. This statement is in line with the observations of SWDH during their March 15, 2018, site visit and sampling.

Two sampling rounds were conducted in 2019, one in the spring and one in the fall.

The 19 samples collected in April of 2019 were taken after neighboring farms had been tilled and fertilized. Due to heavy spring rains, the fields were very wet and muddy. Additional samples outside this original sampling area were collected to determine the extent of nitrate contamination.

The September 2019 sampling event was preceded by three months of relatively dry weather. The 16 wells that were originally sampled in October of 2018 were resampled in September of 2019.

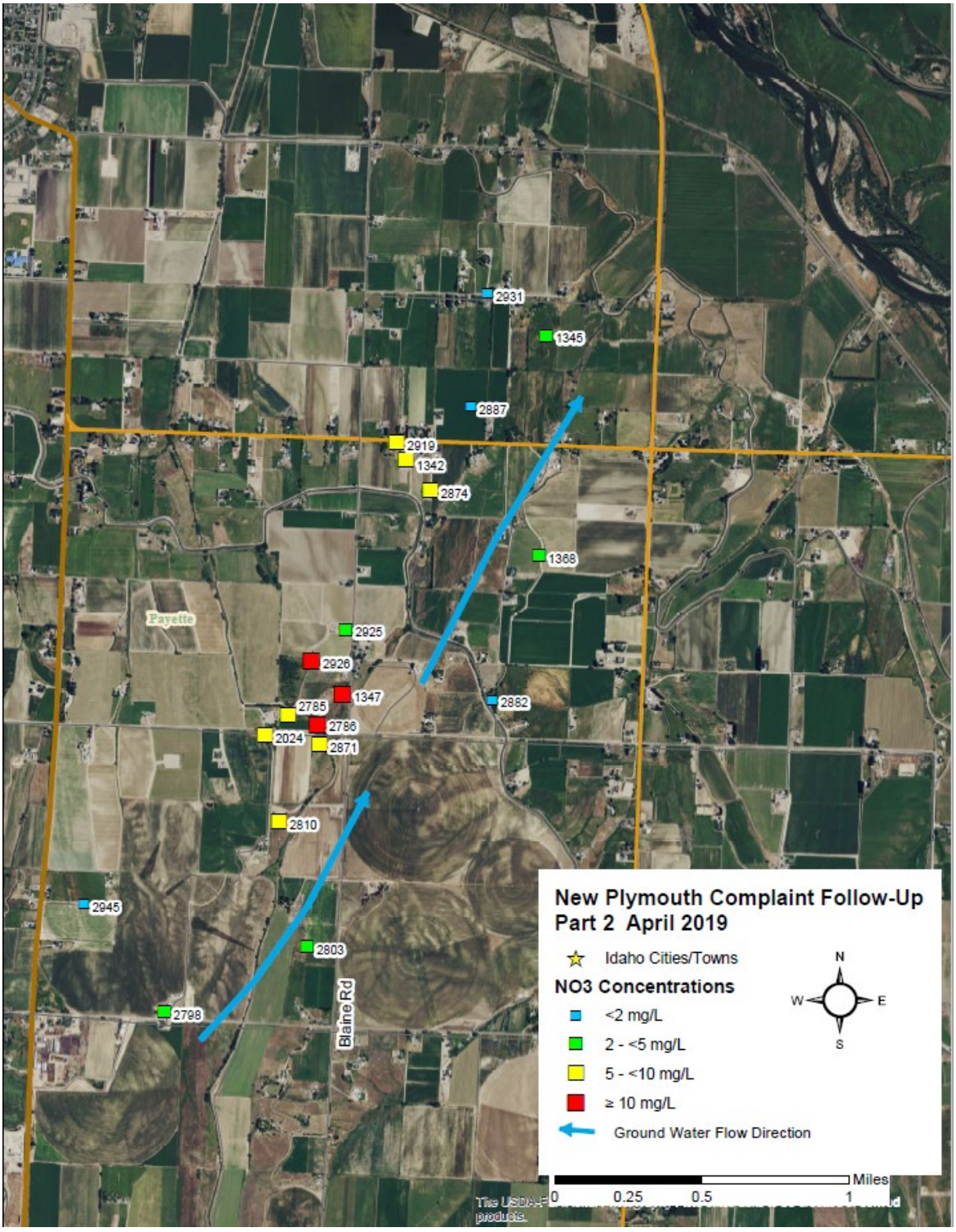


Figure 11. Spring 2019 Sampling locations and nitrate concentrations—New Plymouth Complaint Follow-Up Ground Water Monitoring Project.

2.1.4.2 Methods and Results

DEQ collected ground water samples from 19 wells in April 2019 in accordance with the QAPP (DEQ 2017a) and the Field Sampling Plan (FSP) (DEQ 2018c). Water quality field parameters (pH, temperature, specific conductance, turbidity, DO) were measured at each well before sample collection to ensure adequate purging of the well for a representative sample of the local aquifer. Samples were analyzed for nitrate, nitrite, copper, and bacteria (TC and *E. coli*). Copper is an element commonly added to confined bovine feed supplements in the region of Idaho included in this project. DEQ added copper to the analyte list for the Spring 2019 sampling to determine if reported copper results can be correlated with nitrate and/or N15 results, and therefore be a tracer for bovine waste application.

Based on DO readings in the field, selected samples were analyzed for ammonia and nitrogen isotopes in accordance with the FSP. All samples were submitted to IBL for analysis.

Table 14. Water quality field parameters—New Plymouth Complaint Follow-up Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Water Temperature (°C)	Specific Conductance (µS/cm)	pH[A]	Dissolved Oxygen (mg/L)
1342	75	04/09/2019	16.39	635	7.31	3.70
		09/25/2019	17.18	720	7.58	5.57
1345	63	04/08/2019	16.55	558	7.25	5.24
		09/25/2019	16.44	512	7.69	5.73
1347	80	04/09/2019	15.14	856	7.31	7.11
		09/25/2019	16.27	821	7.57	5.5
1368	75	04/09/2019	15.78	317	7.08	4.24
		09/25/2019	16.04	263	7.43	5.95
2023	129	09/24/2019	16.08	871	7.31	35.5
2024	145	04/08/2019	15.83	811	7.06	6.04
		09/24/2019	15.83	802	7.42	6.93
2785	91	04/08/2019	14.96	650	7.03	7.15
		09/24/2019	15.67	633	7.73	37.67
2786	52	04/08/2019	15.16	1200	7.19	7.13
		09/24/2019	15.23	815	7.76	6.90
2798	106.5	04/08/2019	15.83	439	7.02	6.94
		09/24/2019	15.8	349	7.24	7.6
2803	115	04/08/2019	15.24	550	6.72	4.10
		09/24/2019	16.99	431	7.75	7.8
2810	126	04/08/2019	15.53	836	6.88	6.11
		09/24/2019	15.66	832	6.97	6.34
2871	97	04/08/2019	15.15	752	7.18	6.73
		09/24/2019	15.69	720	7.74	6.52

2874	78	04/09/2019	15.72	445	7.00	3.66
		09/25/2019	15.87	337	7.39	6.14
2882	100	04/09/2019	14.69	682	7.16	1.16
2887	145	04/09/2019	14.35	214	*9.03*	0.43
2919	65	04/09/2019	15.91	570	7.48	4.47
		09/25/2019	16.92	658	7.74	5.74
2925	68	04/09/2019	15.75	575	7.38	6.91
		09/25/2019	15.94	508	7.76	7.30
2926	70	04/08/2019	14.72	765	7.37	6.82
		09/25/2019	15.07	866	7.62	—
2931	82	04/09/2019	14.96	466	7.29	0.43
2945	208	04/08/2019	16.43	466	7.07	0.72

Notes: ft bgs = feet below ground surface; µS/cm = microsiemens/centimeter; pH = standard pH units; mg/L = milligrams per liter; Shaded and italicized numbers indicate an EPA National Secondary Drinking Water Regulation (NSDWR) standard was reached or exceeded. NSDWR standards are recommended limits for PWSs but can be used to evaluate to private well water quality.
[A] = Parameter with a National Secondary Drinking Water Regulation (NSDWR) standard (pH is 6.5–8.5).

Nutrient Results

Nutrient results, for April 2019, are presented in Table 15 and shown in Figure 11. Samples collected from four surrounding wells (Well 2882 to the west, Well 2945 to the southwest, and Wells 2887 and 2931 downgradient) relative to the complainant's Well 2871, contained nitrate concentrations below 2.0 mg/L. Seven of the 19 wells sampled in April 2019 had nitrate concentrations between 5 mg/L and 10 mg/L, while three had concentrations greater than 10 mg/L (Figure 11).

Well 1347, located on the border of a land application area, was sampled in November 2011 for the Lower Payette NPA and had a nitrate concentration of 5.0 mg/L (DEQ 2013c). This increased to 9.45 mg/L during the October 2016 Lower Payette NPA sampling (DEQ 2016) and saw another increase in this sampling round.

Table 15. Nutrient and nutrient-related isotope results—New Plymouth Complaint Follow-up Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Nutrient Concentration			Isotopes
			Nitrite[A]	Nitrate[A]	Ammonia	N-15/14
				(mg/L)		(‰)
Water Quality Standard:			**1.0**	**10**	**No Stand.**	**No Stand.**
1342	75	04/09/2019	<0.30	9.50	-	8.9
		09/25/2019	<0.30	**11.0**	-	9
1345	63	04/08/2019	<0.30	3.89	-	-
		09/25/2019	<0.30	4.30	-	-
1347	80	04/09/2019	<0.30	**14.1**	-	8.6
		09/25/2019	<0.30	**14.0**	-	8.7
1368	75	04/09/2019	<0.30	4.52	-	-
		09/25/2019	<0.30	3.0	-	-
2023	129	09/24/2019	<0.30	5.47	-	6.2

2024	145	04/08/2019	<0.30	5.76	-	6.3
		09/24/2019	<0.30	4.93	-	-
2785	91	04/08/2019	<0.30	5.05	-	5.1
		09/24/2019	<0.30	4.12	-	-
2786	52	04/08/2019	<0.30	**33.6**	-	9.1
		09/24/2019	<0.30	**12.2**	-	7.8
2798	106.5	04/08/2019	<0.30	2.53	-	-
		09/24/2019	<0.30	1.41	-	-
2803	115	04/08/2019	<0.30	4.09	-	-
		09/24/2019	<0.30	4.39	-	-
2810	126	04/08/2019	<0.30	6.82	-	7.1
		09/24/2019	<0.30	6.89	-	6.7
2871	97	04/08/2019	<0.30	7.26	-	7.8
		09/24/2019	<0.30	5.42	-	6.5
2874	78	04/09/2019	<0.30	6.06	-	12.9
		09/25/2019	<0.30	3.89	-	-
2882	100	04/09/2019	<0.30	1.28	<0.050	-
2887	145	04/09/2019	<0.30	<0.18	0.17	-
2919	65	04/09/2019	<0.30	5.87	-	6.6
		09/25/2019	<0.30	8.83	-	7.2
2925	68	04/09/2019	<0.30	4.33	-	-
		09/25/2019	<0.30	4.29	-	-
2926	70	04/08/2019	<0.30	**13.2**	-	9.3
		09/25/2019	<0.30	**21.6**	-	8.8
2931	82	04/09/2019	<0.30	0.498	<0.050	-
2945	208	04/08/2019	<0.30	<0.18	<0.050	-

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; ‰ = permil; (-) = Not Analyzed; No Stand. = No Primary or Secondary Drinking Water Regulation currently established. Bold shaded numbers indicate EPA's National Primary Drinking Water Regulation (NPDWR) standard was exceeded.

[A] Contaminant with a National Primary Drinking Water Regulation standard.

Table 16. Comparison of Nitrate Results between Fall 2018 sampling and Spring 2019 sampling.

		Comparative Nitrate Concentrations		
	Well Depth (ft bgs)	Nitrate 10/2018	Nitrate[A] 4/2019	Change in Concentration
DEQ Site ID		(mg/L)		
Water Quality Standard:		10	10	
1342	75	6.63	9.50	2.87
1347	80	**16.6**	**14.1**	-2.5
2024	145	4.64	5.76	1.12
2785	91	6.16	5.05	-1.11
2786	52	**27.8**	**33.6**	5.8
2798	106.5	1.41	2.53	1.12
2803	115	4.29	4.09	-0.2
2810	126	7.06	6.82	-0.24

2871	97	6.59	7.26	0.67
2874	78	**12.5**	6.06	-6.44
		Sum of Change in Concentration:		**1.27**

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; Shaded and bolded numbers indicate an EPA National Primary Drinking Water Regulation (NPDWR) standard, was reached or exceeded.
[A.] Contaminant with National Primary Drinking Water Regulation standard.

Analysis of the April 2019 sample results, when compared to October 2018, samples indicated the spatial distribution of nitrate contamination remained the same while nitrate concentrations varied (Figure 12).

Nutrient results for September 2019, are presented in Table 15 and shown in Figure 13. Samples were collected from 16 of the original wells sampled in October of 2019 so a final comparison could be made between the fall of 2018 and the fall of 2019.

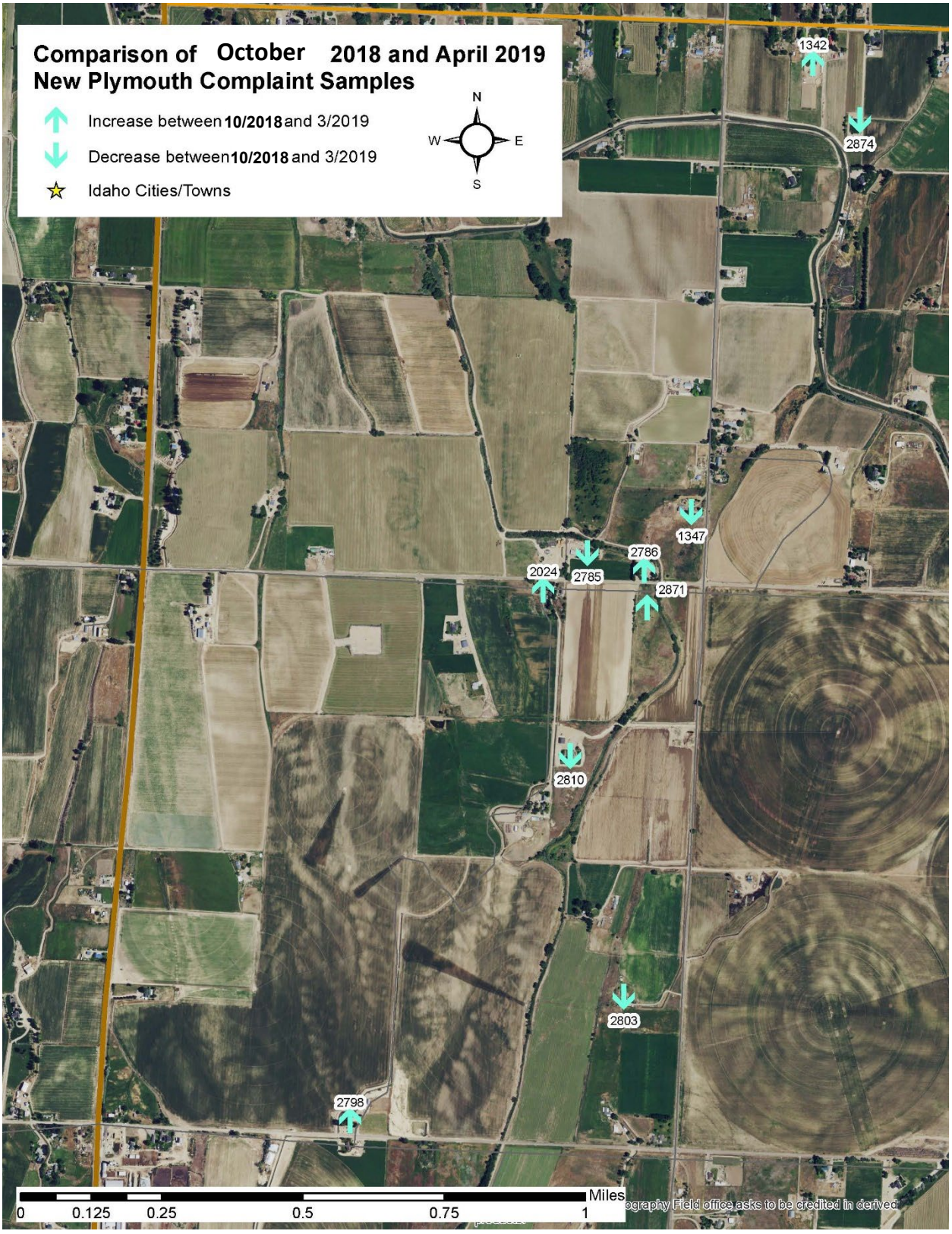


Figure 12. Comparison of October 2018 and April 2019 nitrate sampling — New Plymouth Complaint Follow-Up Ground Water Monitoring Project.

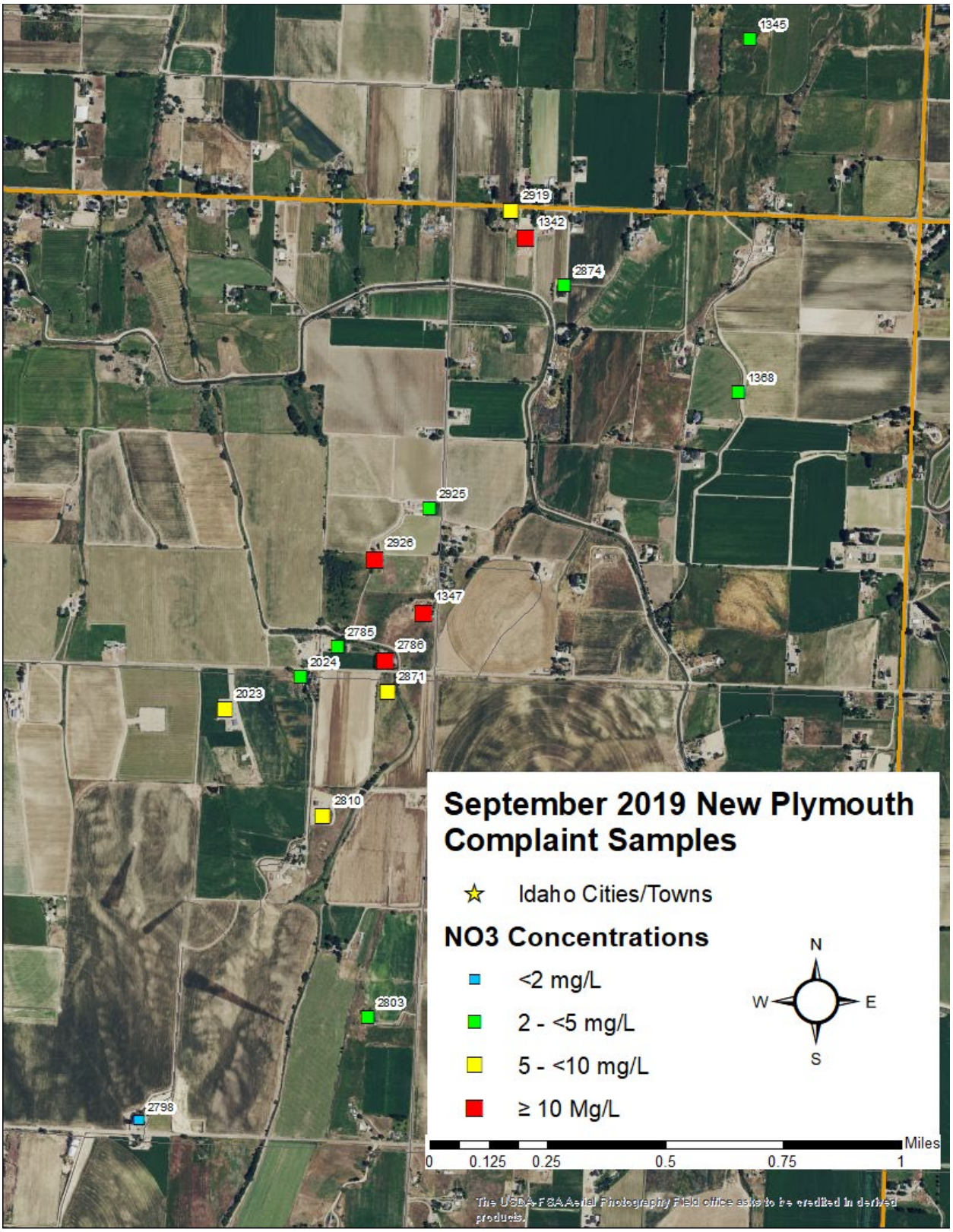


Figure 13. Fall 2019 sampling locations and nitrate concentrations — New Plymouth Complaint Follow-Up Ground Water Monitoring Project.

Next, a comparison was done between the April 2019 sampling data and the September 2019 sampling data. A review of the data in Table 17 indicates decreasing nitrate concentrations in the area around Well 2786 and increasing nitrate concentrations farther down gradient and closer to the Payette River.

The areas with increasing and decreasing concentrations may indicate a wash down of nitrate in the area between the months of April and September when neighboring farms were irrigating fields regularly to sustain planted crops.

Table 17. Comparison of Nitrate Results between Spring 2019 sampling and Fall 2019 sampling.

DEQ Site ID	Well Depth (ft bgs)	Comparative Nitrate Concentrations		Change in Concentration
		Nitrate[A] 4/2019	Nitrate[A] 9/2019	
		(mg/L)		(mg/L)
Water Quality Standard:		**10**	**10**	
1342	75	9.50	**11.0**	1.50
1345	63	3.89	4.30	0.41
1347	80	**14.1**	**14.0**	-0.10
1368	75	4.52	3.0	-1.52
2024	145	5.76	4.93	-0.83
2785	91	5.05	4.12	-0.93
2786	52	**33.6**	**12.2**	-21.4
2798	106.5	2.53	1.41	-1.12
2803	115	4.09	4.39	0.30
2810	126	6.82	6.89	0.06
2871	97	7.26	5.42	-1.84
2784	78	6.06	3.89	-1.16
2919	65	5.87	8.83	2.96
2925	68	4.33	4.29	0.04
2926	70	**13.2**	**21.6**	8.80
		Sum of Change in Concentration:		**-14.8**

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; ‰ = permil; (-) = Not Analyzed; Bold shaded numbers indicate EPA's National Primary Drinking Water Regulation (NPDWR) standard was exceeded.

[A] Contaminant with a National Primary Drinking Water Regulation standard.

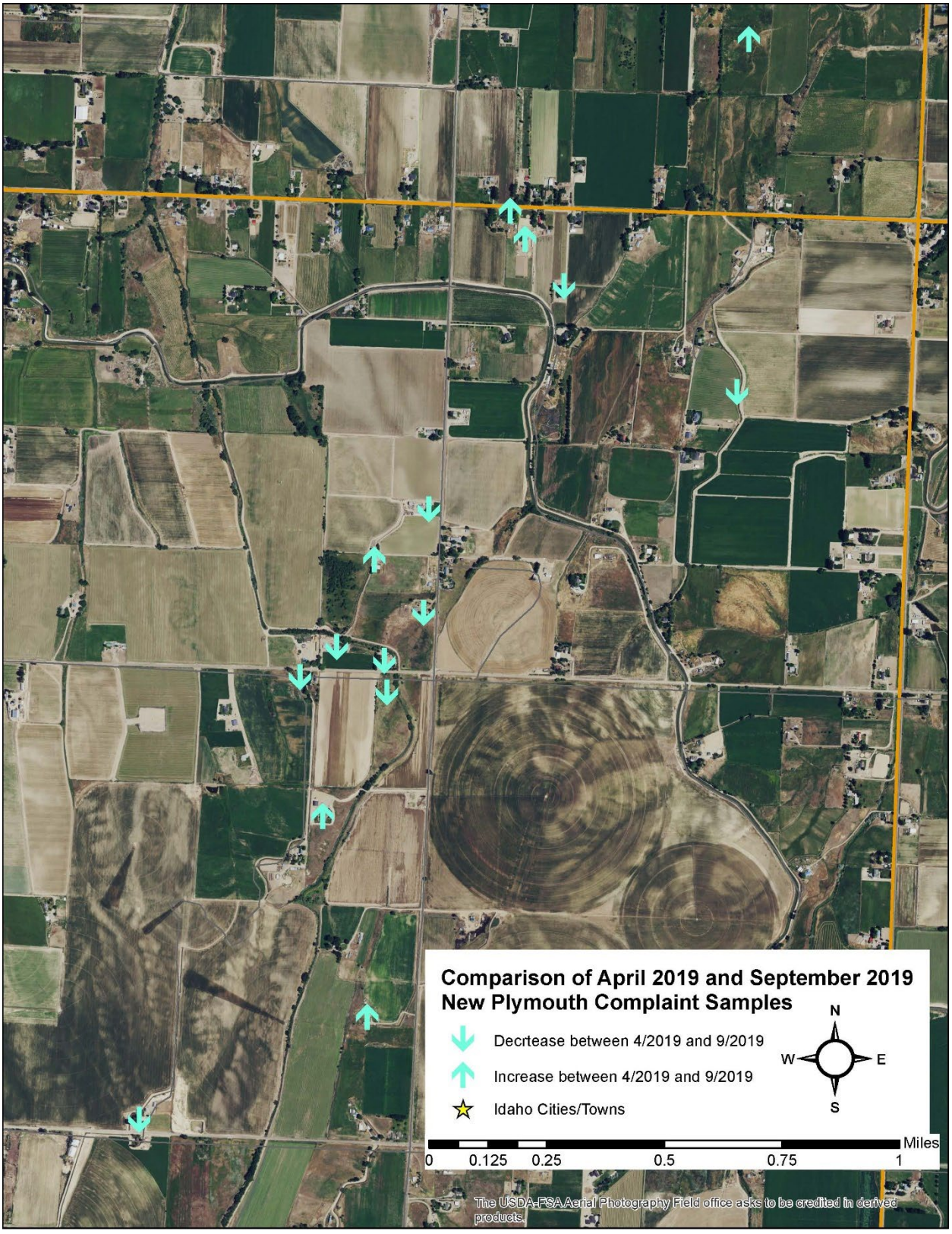


Figure 14. Comparison between April 2019 and September 2019 nitrate samples — New Plymouth Complaint Follow-Up Ground Water Monitoring Project.

DEQ compared the data collected from the same 11 wells during the October 2018 and the September 2019 sampling events (Table 18 and Figure 15). Figure 15 shows a general decrease in nitrate concentrations in well samples from October 2018 to September 2019. The increase of nitrates in Wells 2024 and 2803 were minimal.

Well 1342 had maintained a fall nitrate concentration of less than 10 mg/L until September of 2019.

Three of the 11 wells (1342, 2786, and 2874) had changes in nitrate concentration greater than 50% between October 2018 and September 2019.

Table 18. Comparison of Nitrate Results between October 2018 sampling and September 2019 sampling.

DEQ Site ID	Well Depth (ft bgs)	Comparative Nitrate Concentrations		Change in Concentration
		Nitrate [A] 10/2018	Nitrate[A] 9/2019	
		(mg/L)		
Water Quality Standard:		**10**	**10**	
1342	75	6.63	**11.0**	4.37
1347	80	**16.6**	**14.0**	-2.60
2023	129	5.59	5.47	-0.12
2024	145	4.64	4.93	0.29
2785	91	6.16	4.12	-2.04
2786	52	**27.8**	**12.2**	-15.6
2798	106.5	1.41	1.41	0
2803	115	4.29	4.39	0.100
2810	126	7.06	6.89	-0.170
2871	97	6.59	5.42	-1.17
2874	78	**12.5**	3.89	-8.61
		Sum of Change in Concentration:		**-25.6**

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; ‰ = permil; (-) = Not Analyzed; Bold shaded numbers indicate EPA's National Primary Drinking Water Regulation (NPDWR) standard was exceeded.

[A] Contaminant with a National Primary Drinking Water Regulation standard.

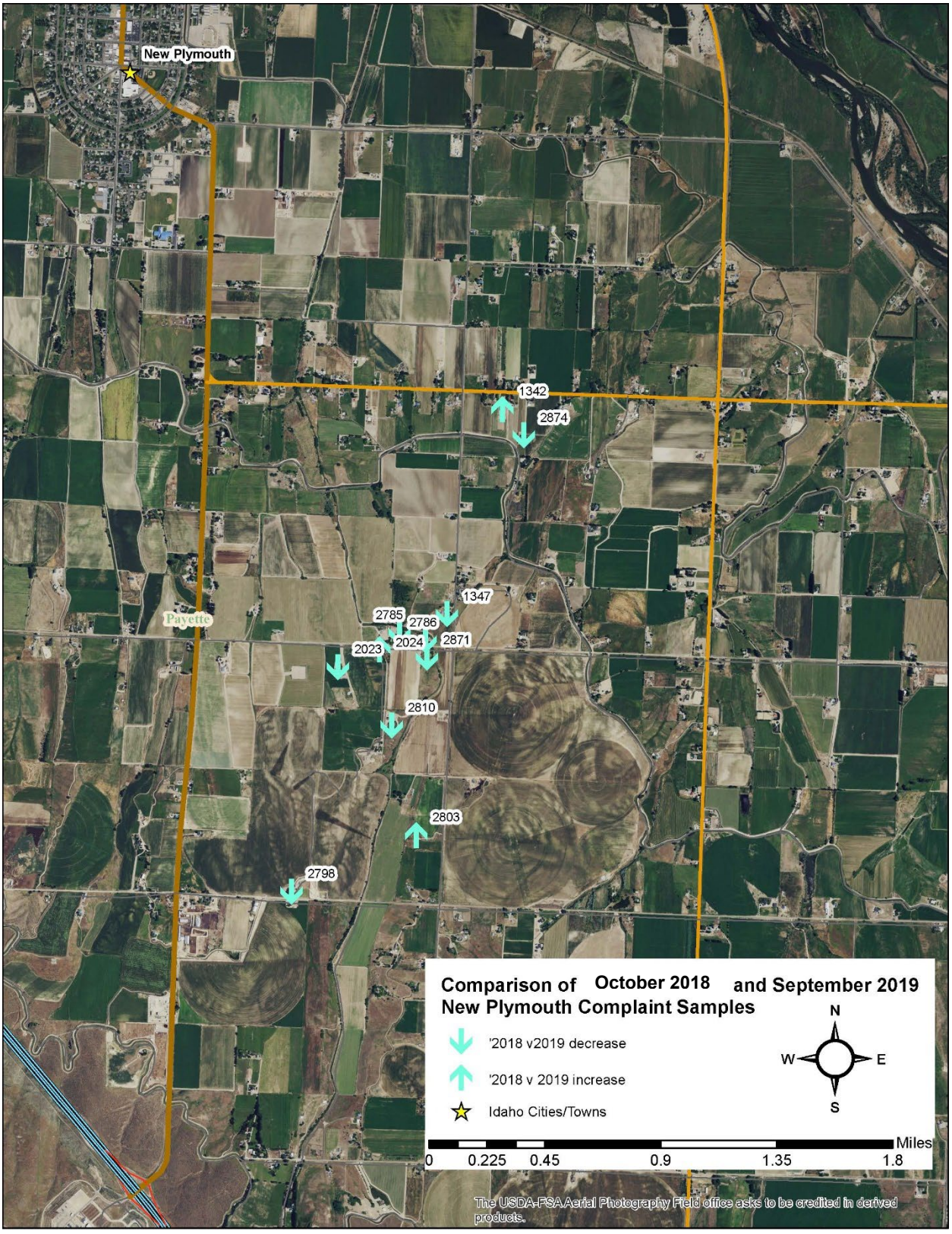


Figure 15. Comparison between October 2018 and September 2019 nitrate samples — New Plymouth Complaint Follow-Up Ground Water Monitoring Project.

Nitrogen Isotope Results

In the April 2019 sampling event, ten samples were analyzed for nitrogen isotope ($\delta^{15}N$) ratios (Table 15). The $\delta^{15}N$ results for all wells ranged from $\delta^{15}N$ 5.1‰ to $\delta^{15}N$ 12.9‰. Wells 2786, 2874, and 2926 had an isotope ratio greater than $\delta^{15}N$ 9‰, which indicates nitrate compounds in the form of human or animal waste (Table 4). Well 2874 is also one of the wells that is the farthest down gradient from well 2871 and close to the Payette River. All remaining isotope sample ratios suggested a mixture of organic wastes.

In the September 2019 sampling event, $\delta^{15}N$ ratios were determined for eight samples (Table 15). The $\delta^{15}N$ results for all wells ranged from $\delta^{15}N$ 6.2‰ to $\delta^{15}N$ 9‰, which suggested a mixture of organic wastes. (Table 4). Well 1342, the well farthest down gradient from Well 2786 and closest to the Payette River had the highest isotope results of $\delta^{15}N$ 9‰.

Ammonia and Bacteria Results

In April 2019, Wells 2798, 2781, 2887 and 2945 had results that were positive for TC.

Well 2887 sampling results also indicated an ammonia concentration of 0.17 mg/L (Table 15). This well produced the only sample with positive ammonia and TC results. DEQ recommended the owner contact the well driller to check the seal on the well.

Table 19. Bacteria Results—New Plymouth Complaint Follow-Up Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Bacteria Concentrations[A]	
			E. coli	Total Coliform
			(MPN/100 mL)	
Water Quality Standard:			**<1.0**	**1.0**
1342	75	04/09/2019	<1.0	<1.0
		09/25/2019	<1.0	<1.0
1345	63	04/08/2019	<1.0	<1.0
		09/25/2019	<1.0	<1.0
1347	80	04/09/2019	<1.0	<1.0
		09/25/2019	<1.0	<1.0
1368	75	04/09/2019	<1.0	<1.0
		09/25/2019	<1.0	7
2023	129	09/24/2019	<1.0	<1.0
2024	145	04/08/2019	<1.0	<1.0
		09/24/2019	<1.0	<1.0
2785	91	04/08/2019	<1.0	<1.0
		09/24/2019	<1.0	<1.0
2786	52	04/08/2019	<1.0	<1.0
		09/24/2019	<1.0	127

2798	106.5	04/08/2019	<1.0	55
		09/24/2019	<1.0	<1.0
2803	115	04/08/2019	<1.0	<1.0
		09/24/2019	<1.0	3.0
2810	126	04/08/2019	<1.0	<1.0
		09/24/2019	<1.0	<1.0
2871	97	04/08/2019	<1.0	6
		09/24/2019	<1.0	<1.0
2874	78	04/09/2019	<1.0	<1.0
		09/25/2019	<1.0	<1.0
2882	100	04/09/2019	<1.0	<1.0
2887	145	04/09/2019	<1.0	93
2919	65	04/09/2019	<1.0	<1.0
		09/25/2019	<1.0	<1.0
2925	68	04/09/2019	<1.0	<1.0
		09/25/2019	<1.0	<1.0
2926	70	04/08/2019	<1.0	<1.0
		09/25/2019	<1.0	<1.0
2931	82	04/09/2019	<1.0	<1.0
2945	208	04/08/2019	<1.0	1.0

Notes: ft bgs = feet below ground surface; MPN/100 mL = most probable number per 100 milliliters.

[A] Total coliform and *E. coli* standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

In fall 2019, wells 1368, 2786, and 2803 had positive TC results.

No samples were positive for *E. coli* or ammonia (Table 19).

Copper Sampling Results

A comparison of the Spring 2019 copper results and the Spring 2019 nitrate results did not indicate a correlation between the two analytes. No samples contained copper concentrations above water quality standards. Only one sample (Well 2024) contained a copper concentration within 10% of a standard.

Table 20. Copper and Nitrate sampling results—New Plymouth Complaint Follow-Up Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Copper[AB]	Nitrate
			mg/L	
Water Quality Standard:			**1.3/1.0**	**10**
1342	75	04/09/2019	0.0019	9.50
1345	63	04/08/2019	0.0021	3.89
1347	80	04/09/2019	0.0040	14.1
1368	75	04/09/2019	0.0016	4.52
2024	145	04/08/2019	0.10	5.76
2785	91	04/08/2019	0.0016	5.05
2786	52	04/08/2019	0.0056	**33.6**
2798	106.5	04/08/2019	0.0016	2.53
2803	115	04/08/2019	0.0016	4.09
2810	126	04/08/2019	0.0017	6.82
2871	97	04/08/2019	0.0020	7.26
2874	78	04/09/2019	0.039	6.06
2882	100	04/09/2019	0.0024	1.28
2887	145	04/09/2019	0.0012	<0.18
2919	65	04/09/2019	0.0031	5.87
2925	68	04/09/2019	0.0023	4.33
2926	70	04/08/2019	0.0045	**13.2**
2931	82	04/09/2019	0.0012	0.498
2945	208	04/08/2019	<0.0010	<0.18

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; ‰ = permil; (-) = Not Analyzed; No Stand = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established. Bold shaded numbers indicate EPA's National Primary Drinking Water Regulation (NPDWR) standard was exceeded.

[A] Contaminant with a National Primary Drinking Water Regulation standard.

[B] Contaminant with a National Secondary Drinking Water Regulation standard.

2.1.4.3 Conclusions

The purpose of this study was to achieve an understanding of elevated nitrate concentrations in and around the complainant's well (Well 2786). The nitrate concentration in the complainant's well decreased over time from a concentration of 33 mg/L in March 2018 to 12.2 mg/L in September of 2019. Nitrate concentrations were generally significantly higher to the north (downgradient) of the complainant's well. Nitrate concentrations were generally lower to the south/southwest of the complainants well (up gradient).

Many of the wells sampled for the three parts of the New Plymouth Complaint were wells that had been sampled in 2011 and 2016 as part of the Lower Payette NPA sampling event. The wells did not have a history of nitrate concentrations above the MCL.

One of the well owners told the DEQ sampling team that in the Spring of 2018, the farmers on plots next to the well owner's land had applied the thickest layers of manure that he had ever seen in the 30 years he had lived there.

It is speculated that the manure was responsible for the increased nitrate concentrations. However, this hypothesis is not corroborated by the nitrogen isotope results, which indicate a mixed source of nitrate.

DEQ has received no further complaints from the residents along the two smaller tracts where manure was heavily applied in 2018. The largest tract has been partially subdivided, but there is no evidence that building had begun at the time this report was written.

2.1.4.4 Recommendations

DEQ is exploring the potential to collaborate with other agencies (e.g. ISDA, SWCD, NRCS) on an outreach campaign directed towards landowners that are applying nutrients to their property and encourage them to follow BMPs.

The wells with the highest nitrate concentrations found during the New Plymouth Complaint sampling event also lie within the boundaries of the Lower Payette NPA. Permissions allowing, these wells will be included in the next Lower Payette NPA sampling event in Fall 2022.

2.1.5 Sand Hollow Creek Ground Water Nitrate Investigation

2.1.5.1 Purpose and Background

The project site is in southwestern Gem County on the northwestern border of the Emmett North Bench NPA. The site property is in the northern end of a hollow, which extends into the foothills on the north bench of the Payette River; Sand Hollow Creek drains the hollow. The site includes a residence, barns, and outbuildings on approximately 120 acres of farm and rangeland. Land use south and east of the site is generally agricultural, with rangeland to the west and an approximate 1,800-head dairy located adjacent to the north end of the property (Figure 16).

In 2013, DEQ responded to a complaint of possible ground water contamination at the site. Multiple sources of nitrate with the potential to impact ground water are present in the area, including agricultural fertilizers, dairy waste applied to fields north and east of the site, septic systems at the residence and dairy, stockpiled solid dairy waste, and a dairy waste lagoon. Laboratory analyses of ground water samples collected from the site's domestic well (Well 2232) by DEQ and site residents, detected concentrations of nitrate that increased from approximately 8 mg/L in August 2012 to 21 mg/L in October 2015.

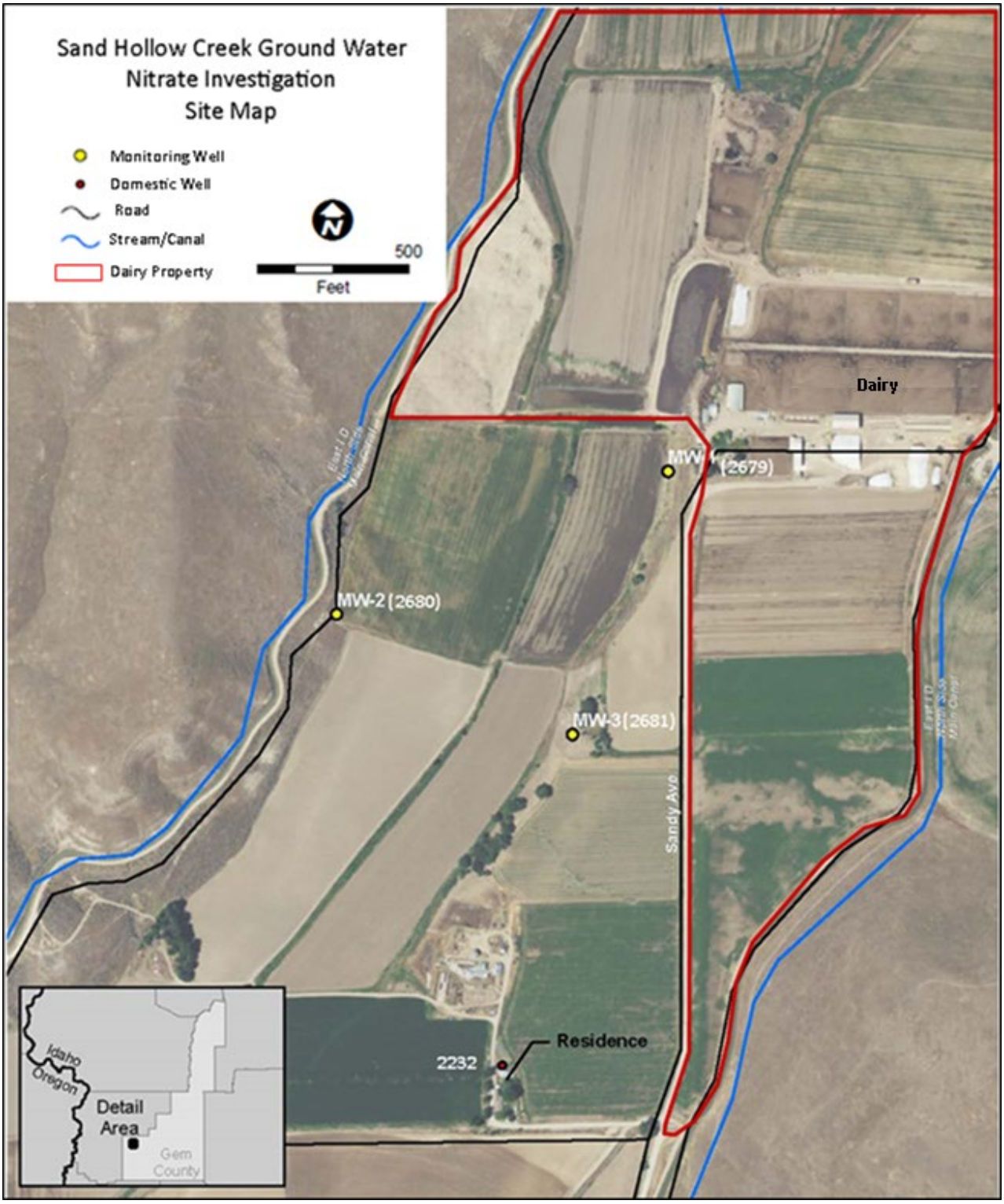


Figure 16. Project site map (modified from Tetra Tech 2018a)—Sand Hollow Creek Ground Water Nitrate Investigation.

The depth and construction of Well 2232 is not known. However, the owner stated that the well is approximately 68 feet deep. DEQ's assessment of the property did not identify any on-site land use changes that could account for the significant increase in nitrate concentrations in ground water at the well. DEQ conducted the Sand Hollow Creek ground water nitrate investigation to identify potential off-site nitrate sources impacting ground water at the Well 2232.

In December 2016, STRATA (DEQ's initial subcontractor on this project) installed three monitoring wells (Well 2679, Well 2680, and Well 2681) at locations estimated to be upgradient or cross gradient of Well 2232 (Figure 17). The monitoring wells were installed to identify the ground water flow direction and assess ground water quality upgradient of Well 2232 (Table 21). Subsurface lithology at all wells generally consisted of poorly graded sand, silty sand, and clay.

Table 21. DEQ Monitoring Well Construction Information—Sand Hollow Ground Water Nitrate Investigation.

DEQ Well ID	Well Depth (ft bgs)	Top of Casing Elevation (ft amsl)	Screened Interval (ft bgs)
2679 (MW-1)	60	2,390.51	2,331 to 2,351
2680 (MW-2)	40	2,417.8	2,378 to 2,398
2681 (MW-3)	45	2,405.65	2,361 to 2,381

Notes: ft bgs = feet below ground surface; ft amsl = feet above mean sea level

2.1.5.2 Methods and Results

In 2019, the project was sampled by both DEQ and Tetra Tech. Tetra Tech completed one final round of sampling in May to conclude their contract, while DEQ augmented the conclusion of the study with some isolated sampling and exploratory efforts aimed at guiding future sampling efforts, if needed.

In the first half of 2019 (January through July), DEQ measured ground water elevations at the monitoring wells and evaluated nitrate concentrations with field screening level nitrate test strips. Tetra Tech also collected water level measurements and nitrate test strip screening during their May sampling effort.

DEQ collected three rounds of nitrate and nitrogen isotope samples from the site's domestic well (Well 2232) and analyzed the samples for comparison with previous sampling efforts and nitrate test strips (a field screening tool).

Additionally, DEQ sampled Well 2680 (MW-1) for nitrate, bacteria and copper in May using a Hydrasleeve™, an in-situ low-flow sampling tool, to evaluate potential ground water impacts from the lagoon, as well as potential viability of the method as a future sampling method in lieu of traditional low-flow sampling technique, as conducted by Tetra Tech. The Hydrasleeve™ was placed in the well on April 9 (after the water level measurement and nitrate test strip was evaluated) and retrieved May 2; prior to the anticipated sampling by Tetra Tech. Tetra Tech sampled Well 2679 on May 3.

Water quality field parameters (pH, temperature, specific conductance, DO, turbidity, and oxygen-reduction potential) were measured during well purging and ground water sample collection to ensure a representative sample of ground water was collected. Water quality field parameters are presented in Table 22.

Table 22. Water quality field parameters—Sand Hollow Ground Water Nitrate Investigation.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Water Temperature (°C)	Specific Conductance (µS/cm)	pH[A]	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)	Turbidity[B] (NTU)
2232	Unk	02/14/2019	14.35	784	6.80	—	—	—
		03/19/2019	14.94	705	6.54	10.36	—	—
		04/09/2019	14.79	763	*6.21*	3.67	—	—
		05/02/2019[B]	14.3	650	6.8	5.6	312	0
2679 (MW-1)	60	05/03/2019[B]	13.5	690	7.3	4.2	276	7
2680 (MW-2)	40	05/02/2019[B]	15.4	150	7.9	7.3	234	3
2681 (MW-3)	45	05/02/2019[B]	15.7	490	7.7	12.1	276	74

Notes: ft bgs = feet below ground surface; °C = degrees Celsius; µS/cm = microsiemens/centimeter; pH = standard pH units; mg/L = milligrams per liter; mV = millivolt; NTU = Nephelometric Turbidity Unit; Unk = Unknown. Well log not found; (-) = Not Analyzed.

[A] Contaminant with a National Secondary Drinking Water Regulation standard. The NSDWR for pH is 6.5-8.5. NSDWR standards are recommended limits for public water systems but can be applied to private wells to evaluate water quality.
[B] Measured by Tetra Tech.

Tetra Tech collected samples that were analyzed for nutrients, common ions, and metals and submitted to Eurofins Lancaster Laboratories in Lancaster, Pennsylvania. DEQ collected ground water samples from Well 2232 and Well 2679 (MW-1) which were submitted to IBL in Boise, ID for analyses of nitrate. Ground water samples collected by both Tetra Tech and DEQ were frozen and shipped to the Environmental Isotope Laboratory at the University of Arizona in Tucson, AZ for nitrogen isotope ($\delta^{15}N$) analyses.

Ground Water Flow Direction

Tetra Tech prepared a ground water elevation potentiometric surface map for the site using depth to water measurements collected May 2 and 3, 2019 (Table 23; Figure 17). Depth to water was measured using an electronic water level tape prior to purging the wells. Depth to water in the domestic well (Well 2232) was not measured due to the presence of a dedicated pump. DEQ also measured depth to water monthly in the three monitoring wells from January through July (Table 23; Figure 18). The flow direction and gradient are similar to those calculated for two monitoring events conducted in 2017 and 2018 (DEQ 2021). The ground water gradient, calculated along the ground water flow line shown in Figure 17, is approximately 0.017 feet per day.

Seasonal water level elevation increases are evident in the monitoring wells during the summer irrigation season.

Table 23. DEQ-Measured Ground Water Elevations 2017-2019—Sand Hollow Ground Water Nitrate Investigation.

DEQ Well ID	2679 (MW-1)		2680 (MW-2)		2681 (MW-3)	
Date	Depth to Water (ft)	Ground Water Elevation (ft amsl)	Depth to Water (ft)	Ground Water Elevation (ft amsl)	Depth to Water (ft)	Ground Water Elevation (ft amsl)
4/20/2017	8.81	2381.70	34.06	2383.74	34.25	2371.40
11/6/2017	4.71	2385.80	30.66	2387.14	29.69	2375.96
1/4/2018	9.46	2,381.05	33.36	2,384.44	33.14	2,372.51
2/6/2018	7.42	2,383.09	33.8	2,384	34.32	2,371.33
3/6/2018	8.12	2,382.39	34.03	2,383.77	35.14	2,370.51
4/5/2018	8.74	2,381.77	34.28	2,383.52	36.08	2,369.57
5/3/2018	9.34	2,381.17	34.36	2,383.44	36.38	2,369.27
6/4/2018	9.4	2,381.11	25.5	2,392.3	34.22	2,371.43
7/3/2018	8.78	2,381.73	23.64	2,394.16	27.36	2,378.29
8/7/2018	7.16	2,383.35	23.38	2,394.42	25.6	2,380.05
9/4/2018	5.67	2,384.84	24.00	2,393.8	26.92	2,378.73
10/2/2018	5.38	2,385.13	25.37	2,392.43	23.62	2,382.03
11/5/2018	5.82	2,384.69	27.56	2,390.24	27.56	2,378.09
12/6/2018	6.64	2,383.87	31.22	2,386.58	30.58	2,375.07
1/3/2019	7.40	2,383.11	32.95	2,384.85	32.19	2,373.46
2/14/2019	8.10	2,382.41	35.25	2,382.55	33.74	2,371.91
3/19/19	8.92	2,381.59	33.98	2,383.82	34.60	2,371.05
4/9/2019	9.23	2,381.28	34.20	2,383.60	35.52	2,370.13
5/2/2019	9.48	2,381.03	34.38	2,383.42	37.68	2,367.97
6/11/2019	9.65	2,380.86	28.00	2,389.80	35.70	2,369.95
7/9/2019	9.3	2,381.21	25.32	2,392.48	32.88	2,372.77

Notes: ft amsl: feet above mean sea level

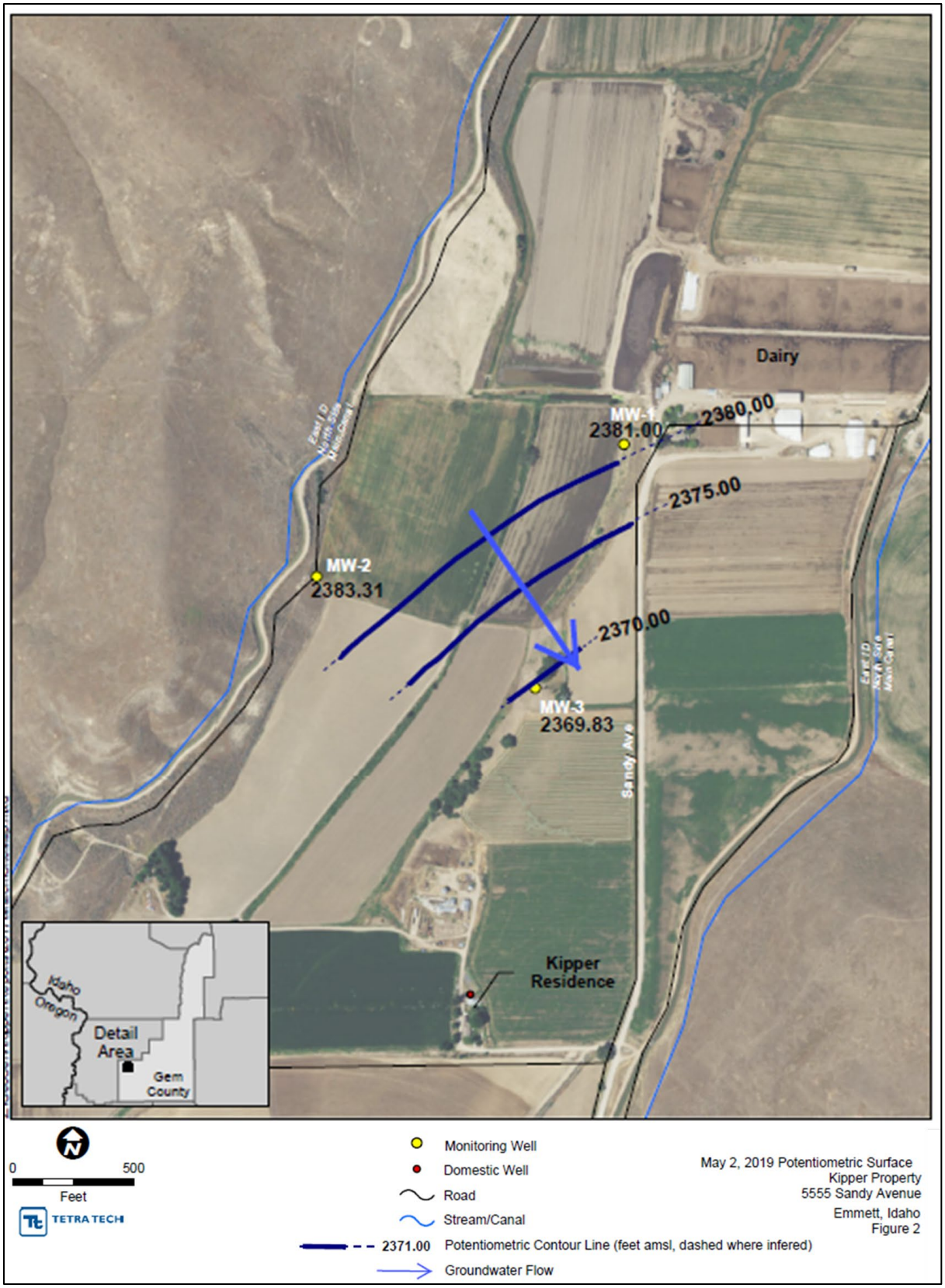


Figure 17. Potentiometric surface as measured by Tetra Tech on May 2—Sand Hollow Ground Water Nitrate Investigation.

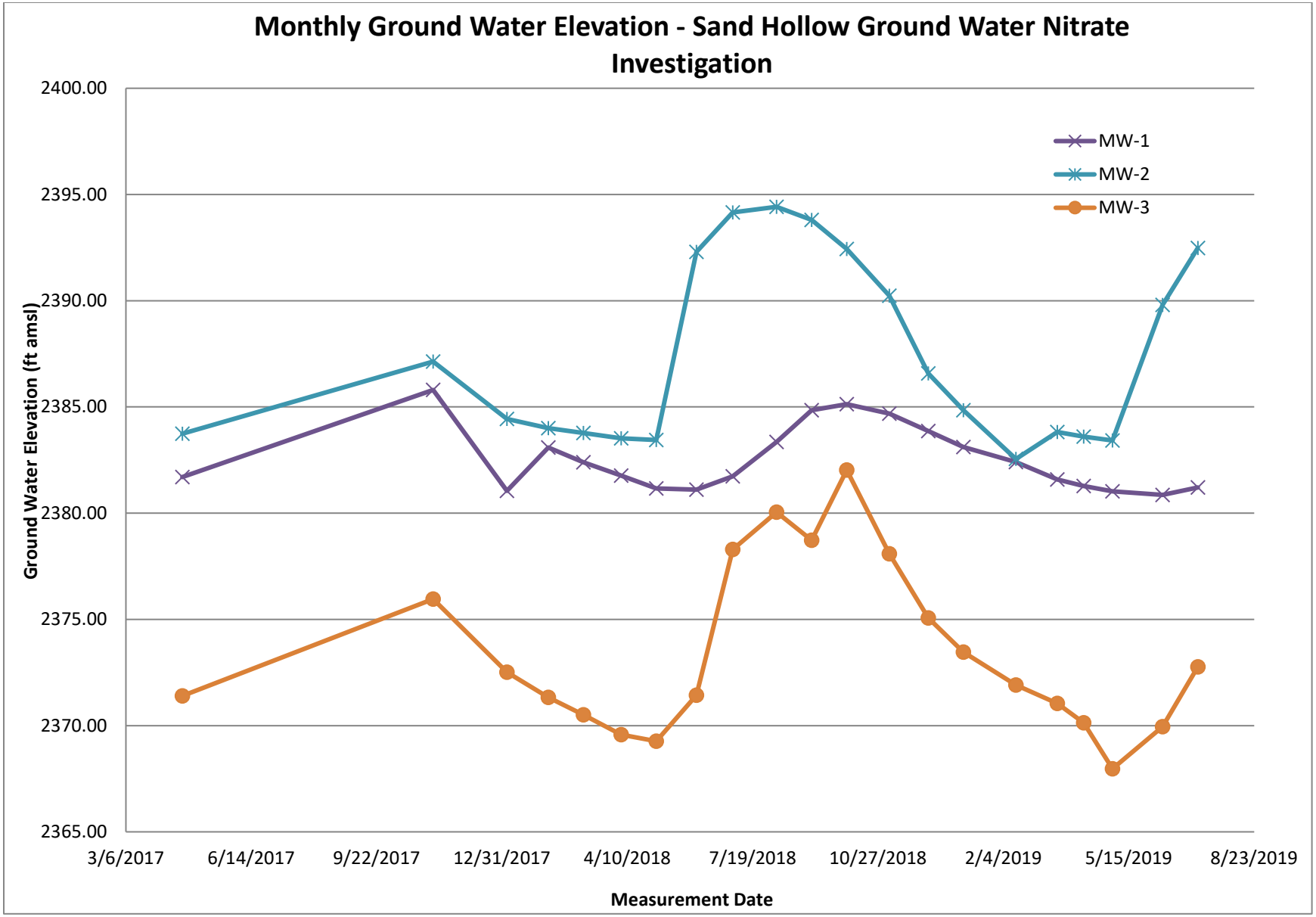


Figure 18. Monthly water level elevations—Sand Hollow Ground Water Nitrate Investigation.

General Ground Water Chemistry Results

Analytical results for common ions and alkalinity are presented in Table 24 and a trilinear diagram (Figure 19). Metals results are presented in Table 25. Water chemistry at all wells was generally acceptable, with the secondary drinking water standard for iron exceeded for the May sample from Well 2679 (MW-1) and 2681 (MW-3).

Consistent with previous evaluations, Well 2679 (MW-1) appears to be a higher sodium and chloride water whereas Wells 2232, 2680 (MW-2) and 2681 (MW-3) appear to be higher in calcium and bicarbonate. Well 2232 and Well 2681 (MW-3) have similar water chemistries. The 2019 data supports previous conclusions that Wells 2232 and Well 2681 are a mix of water characterized in Well 2679 and Well 2680 (MW-2) (Figure 19). Based on the location of wells and land uses, and, in the case of Well 2680, the water level elevation changes, Well 2680 is likely influenced by the nearby canal (Figure 16 and 17), while Well 2679 is likely influenced by the adjacent dairy lagoon.

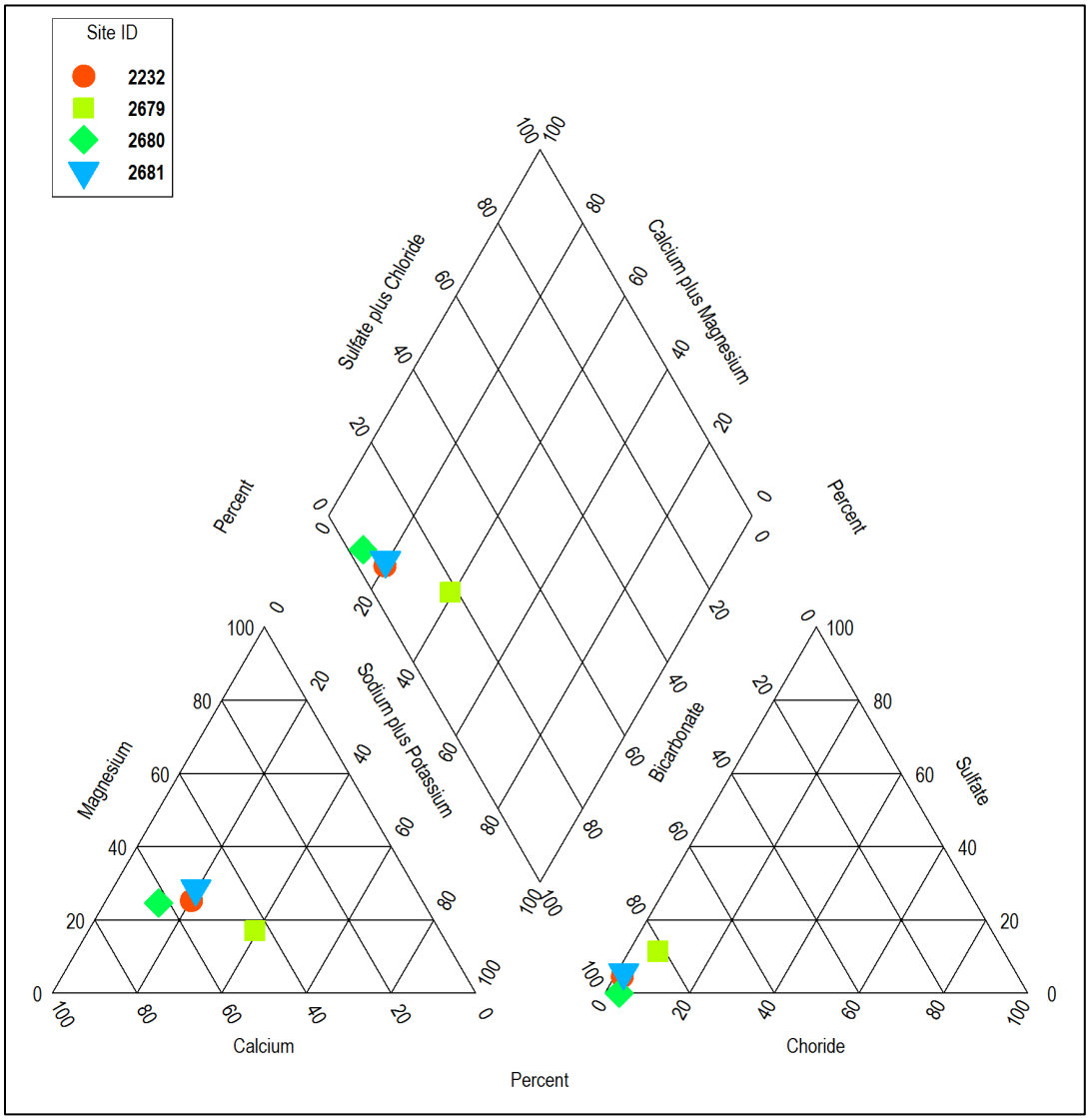


Figure 19. Trilinear diagram—Sand Hollow Ground Water Nitrate Investigation, 2019.

Table 24. General Chemistry Results—Sand Hollow Ground Water Nitrate Investigation.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Bicarbonate (as CaCO3)	Bromide	Calcium	Chloride[B]	Fluoride[AB]	Magnesium	Potassium	Sodium	Sulfate[B]	Total Dissolved Solids[B]
			(mg/L)									
Water Quality Standard:			**No Stand.**	**No Stand.**	**No Stand.**	**250**	**2.0/4**	**No Stand.**	**No Stand.**	**No Stand.**	**250**	**500**
2232	Unk	05/02/2019	324	<1.3	81.4	3.7	<0.25	22.9	4.01	32.1	12.7	427
2679 (MW-1)	60	05/03/2019	240	<1.3	63.0	11.7	0.96	15.0	<5.0U	65.0	26.5	449J[1]
2680 (MW-2)	40	05/02/2019	72.0	<1.3	20.9	1.5J	<0.25	4.99	0.309J	4.69	<1.5	110
2681 (MW-3)	45	05/02/2019	238	<1.3	58.6	2.5J	0.92	19.6	1.91	24.2	11.4	314

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established; Unk = Unknown. Well log not found or unavailable; Italicized shaded numbers indicate EPA's National Secondary Drinking Water Regulation (NSDWR) standard was exceeded. J = value is considered estimated. J[1] = Value is qualified as estimated value due to laboratory duplicate outside control limit.

[A] Contaminant with a National Primary Drinking Water Regulation standard.

[B] Contaminant with a National Secondary Drinking Water Regulation standard.

Metals Results

Samples were collected by Tetra Tech for select metals including barium, copper, iron, and manganese. DEQ collected a sample for copper analysis from Well 2679 (MW-1) on May 2. Results are presented in Table 5. The national secondary drinking water standard for iron of 0.3 mg/L was exceeded in two wells (Well 2679 and 2681). The national secondary drinking water standard for manganese of 0.05 mg/L was exceeded in Well 2681 (MW-3) with a concentration of 0.120 mg/L. Copper was added to the Tetra Tech May sampling event as well as the May sample collection at Well 2679 to evaluate possible influence from dairy waste on the ground water due to use in cattle feed supplements and hoof (footbath) treatments (with copper sulfate) (UC Davis, 1997; University of Wisconsin, 2016). Copper was detected above the Eurofins or IBL method detection limit in three wells: Well 2232, Well 2679, and Well 2681.

Table 25. Metals results—Sand Hollow Ground Water Nitrate Investigation.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Barium[A]	Copper[A]	Iron[B]	Manganese[B]
			(mg/L)			
Water Quality Standard:			**2**	**1.3**	**0.3**	**0.05**
2232	Unk	05/02/2019	<0.200	0.0087	<0.100	<0.015
2679 (MW-1)	60	05/02/2019[C]	—	*0.0034*	—	—
		05/03/2019	0.230	*<0.099*	*0.620*	0.0158J
2680 (MW-2)	40	05/02/2019	<0.200	<0.002	0.11	<0.015
2681 (MW-3)	45	05/02/2019	0.200	*0.0042*	*5.9*	*0.120*

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; Unk=Unknown. Well log not found; Italicized shaded numbers indicate EPA's National Secondary Drinking Water Regulation (NSDWR) standard was exceeded. J = value is considered estimated.
[A] Contaminant with a National Primary Drinking Water Regulation standard.
[B] Contaminant with a National Secondary Drinking Water Regulation standard.
[C] Sample collected by DEQ and analyzed by IBL.

Nutrient (Analytical and Field Screening) Results

Ground water samples collected in February, March, and April 2019 at Well 2232 had nitrate concentrations of 5.64 mg/L, 5.19 mg/L and 5.13 mg/L, respectively (Table 26). These concentrations are approximately half the maximum contaminant level (MCL) of 10 milligrams per liter (mg/L) and lower than concentrations observed at Well 2232 in 2018, which ranged from 6.6 to 7.0 mg/L.

Well 2679 (MW-1) had a nitrate concentration of 16.9 mg/L for the Hydrasleeve™ sample collected by DEQ. Tetra Tech also sampled the well on May 3 for nitrate and nitrite. The resulting concentration for the Tetra Tech sample was 20.4 mg/L and <0.015 mg/L, respectively. Tetra Tech collected samples for ammonia and orthophosphate from all 4 wells. Ammonia was not detected in any of the wells. Phosphorus ranged from less than non-detect (<0.25) to 1.0 mg/L.

Table 26. Nutrient and nutrient-related isotope results—Sand Hollow Ground Water Nitrate Investigation.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Nutrient Concentration				Isotopes
			Nitrate[A]	Nitrite[A]	Ammonia	Orthophosphate	$\delta^{15}N$
			(mg/L)				(‰)
Water Quality Standard:			**10**	**1.0**	**No Stand.**	**No Stand.**	**No Stand.**
2232	Unk	02/14/2019	5.64	—	—	—	4.9
		03/19/2019	5.19	—	—	—	4.8
		04/09/2019	5.13	—	—	—	4.8
		05/02/2019[B]	5.2	<0.015	<0.050	0.59	4.1
2679	60	05/02/2019[C]	**16.9**	—	—	—	—
		05/03/2019[B]	**20.4**	<0.015	<0.050	0.83	8.1
2680	40	05/02/2019[B]	0.20	<0.015	<0.050	<0.25	0.4
2681	45	05/02/2019[B]	2.8	<0.015	<0.050	1.0	3.4

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; ‰ = permil; Unk = Unknown. Well log not found; (-) = Not Analyzed; No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established. Bold shaded numbers indicate EPA's National Primary Drinking Water Regulation (NPDWR) standard was exceeded.

[A] Contaminant with a National Primary Drinking Water Regulation standard.

[B] Sampled by Tetra Tech.

[C] Collected by DEQ from the Hydrsleeve™.

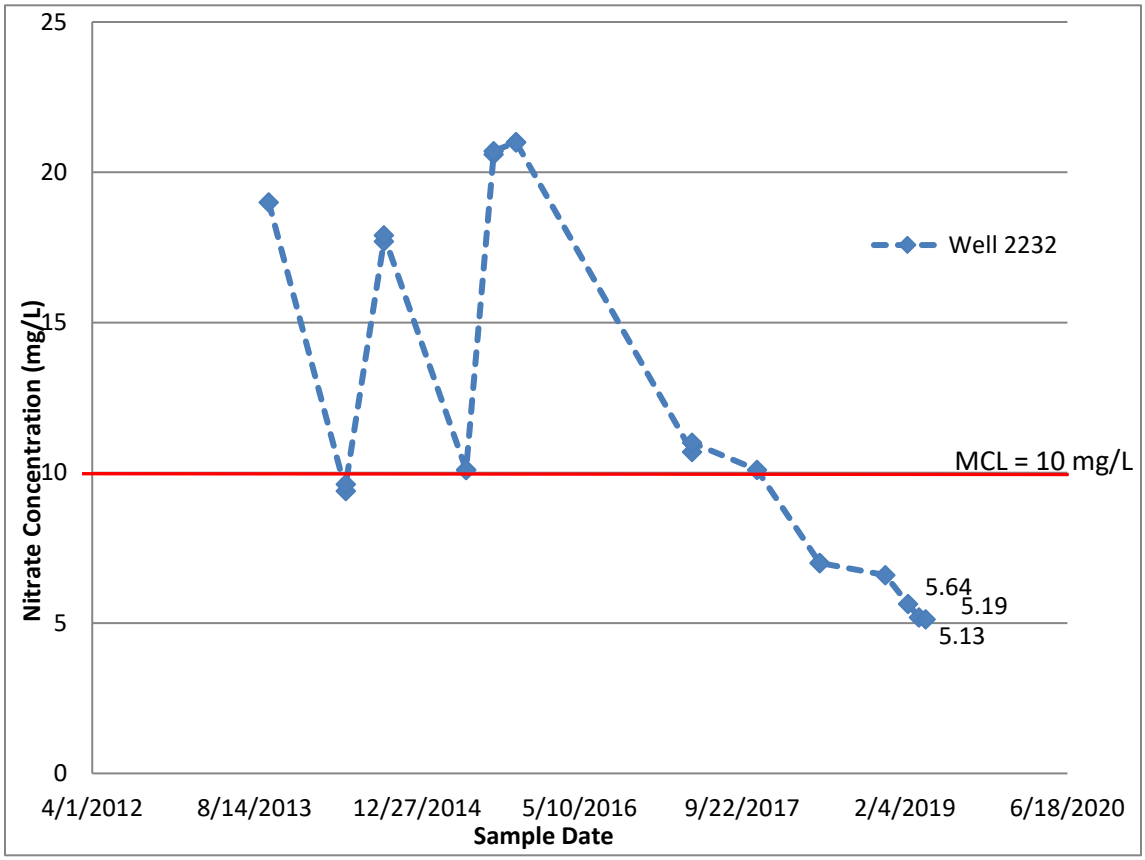


Figure 20. Nitrate concentrations over time (2013-2019) at Well 2232—Sand Hollow Nitrate Investigation.

The nitrate concentration has decreased in the domestic well (Well 2232) from more than 21 mg/L in 2015 to approximately 5 mg/L in 2019 (Figure 20).

In 2018, DEQ staff conducted exploratory field sampling of the project wells ahead of Tetra Tech in December to collect screening-level nitrate and nitrite data to use for comparison with laboratory analysis. The intent was to compare field obtained screening-level data (using nitrate test strips) for determining whether it could be used to fill in gaps between analytical testing (or to capture seasonal changes in nitrate levels). Analytical samples were also collected using a bailer (with no purging) to compare with results from samples collected after the wells were purged (using low-flow techniques). The intent was to see if bailed samples could be used in lieu of purged samples due to the limitations for collecting samples using low-flow purging methods at this site.

To obtain screening-level nitrate (and nitrite) comparison data, DEQ tested water collected with a bailer with nitrate test strips at all three monitoring wells prior to Tetra Tech purging (or sampling) the wells. DEQ staff also collected a nitrate sample from the bailer for laboratory analysis to compare with the analytical results of water collected by Tetra Tech after the wells had been purged. Additionally, Tetra Tech also used the nitrate test strips after purging for comparison to DEQ test strips. All results from this screening-level, exploratory work is presented in the 2018 annual report summary, DEQ Technical Report No. 52 (DEQ 2021).

Nitrate test strips are an inexpensive, easy-to-use screening-level tool that can provide a relatively accurate, rapid result. The type of strips used (Industrial Test Systems 480009 WaterWorks™ Nitrate/Nitrite Nitrogen) provide results as total nitrate and nitrite. The presence and concentration of nitrate or nitrite will be indicated through a color change of the appropriate reactive pad on the strip. The range of concentrations is 0, 0.5, 2, 5, 10, 20, 50 ppm (mg/L) for nitrate and 0.15, 0.3, 1, 1.5, 3, 10 ppm (mg/L) for nitrite. Interpretation of the pad color and its corresponding concentration is somewhat subjective between user and thus provides a qualitative estimate.

As reported in the 2018 annual summary report, comparing the accuracy of the test strips with the analytical data shows that, in either scenario, the interpretations of the color change by both DEQ Staff and TT staff were consistent with concentrations determined through analytical methods. Well 2680 (MW-2) and Well 2681 (MW-3) are screened across the water table which allows for water to flow through the well—this means the water inside the casing is similar to the water in the aquifer and reduces the dependency on purging in order to obtain a representative sample. The results also indicate that purging is necessary at Well 2679 (MW-1) for obtaining accurate nitrate concentrations—using a bailer to obtain an unpurged sample does not provide a representative sample of the aquifer water quality.

In 2019, nitrate test strips were analyzed by DEQ staff during select site visits to collect ground water level measurements. Tetra Tech staff also recorded test strip results during their May 2 and 3 sampling events. Test strip results (along with analytical results where available) are presented in Table 27. Other than Well 2681's May results, DEQ and Tetra Tech interpretations were similar. Nitrate test strips support analytical results and appear representative of ground water concentrations. Results were recorded as a midpoint of the range identified as most closely matching the color change. In the case of Well 2232, analytical results closely match the

top end of the 2-5 mg/L range selected. The recorded DEQ result from Well 2679 (MW-1) on May 2 was taken from the Hydrasleeve™ sample and appears to be representative as compared to the Tetra Tech interpretation (of a sample collected after purging) and the analytical result.

Table 27. Nitrate Test Strip Field Screening results—Sand Hollow Ground Water Nitrate Investigation.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Lab Result	Test Strip Result Interpretation[A]	
			Nitrate	Nitrate	Nitrite
			(mg/L)	(mg/L)	
2232	Unk	02/14/2019	5.64	7.5J	—
		05/02/2019	5.2	3.5J	—
		07/09/2019	—	3.5J	—
2679 (MW-1)	60	01/03/2019	—	5J	—
		02/14/2019	—	5J	—
		03/19/2019	—	3.5J	—
		04/09/2019	—	5J	—
		05/02/2019[B]	16.9	15J	1.25J
		05/02/2019[C]	—	1.25J	0.15J
		05/03/2019[D]	20.4	15J	0.15J
		07/09/2019	—	10J	—
2680 (MW-2)	40	01/03/2019	—	0J	—
		02/14/2019	—	0J	—
		03/19/2019	—	0J	—
		04/09/2019	—	0J	—
		05/02/2019	—	0J	—
		05/02/2019[D]	0.20	0.5J	0.15J
		07/09/2019	—	0.25J	—
2681 (MW-3)	45	01/03/2019	—	2J	—
		02/14/2019	—	1.25J	—
		03/19/2019	—	0.5J	—
		04/09/2019	—	1.1J	—
		05/02/2019	—	1.25J	—
		05/02/2019[D]	2.8	10J	0.15J
		07/09/2019	—	2J	—

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; Unk = Unknown. Well log not found; (-) = Not Analyzed. J = The analyte was detected. The associated numeric value is considered an estimated quantity.

[A] DEQ results recorded as a midpoint of interpreted range.
[B] DEQ results from Hydrasleeve™.
[C] DEQ results from bailer.
[D] Tetra Tech results after purging. Results were not reported as a mid-point.

Nitrogen Isotope Results

DEQ collected three samples from Well 2232 for nitrogen isotope ratio ($\delta^{15}N$) analyses during the three 2019 ground water monitoring events (Table 26). The $\delta^{15}N$ values were 4.9 permil (‰), 4.8‰ and 4.8‰ for the samples collected in February, March, and April, respectively. These values indicate a source of organic nitrogen in soil or a mixed nitrogen source (Table 26; Table 4). Tetra Tech also submitted $\delta^{15}N$ samples from the May 2019 sampling event. The ratio result for Well 2232 of 4.1‰ was similar to the DEQ sample result. The result for Well 2679 (MW-1) of 8.1‰ is also in the upper range for a source of organic nitrogen in soil or a mixed nitrogen source. The result for Well 2681 (MW-3) of 3.4‰ is a ratio that typically indicate a commercial fertilizer source of nitrogen (Table 4). The $\delta^{15}N$ result for Well 2680 (MW-2) of 0.4‰ also falls within the range of a commercial fertilizer source (Table 4).

Bacteria Results

One bacteria sample was collected from Well 2679 (MW-1) by DEQ in May (Table 28). Total coliform was detected at 2 MPN/100mL and no *E. coli* was present. The bacteria sample was collected from a bailer (at the top of the water column) after the volume of the Hydrasleeve™ (600mL) was used up for the nitrate and copper samples. Based on the difference in nitrate test strip result from the Hydrasleeve™ and Tetra Tech purged sample (as well as the exploratory sampled conducted in 2018 (DEQ 2021)), the bacteria results from sample collected from the bailer may not be representative of the ground water at this location.

Table 28. Bacteria Results—Sand Hollow Groundwater Nitrate Investigation Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Bacteria Concentrations[A]	
			E. coli	Total Coliform
			(MPN/100 mL)	
Water Quality Standard:			**<1**	**1.0**
2679	60	05/02/2019	<1	2.0

Notes: ft bgs = feet below ground surface; MPN/100 mL = most probable number per 100 milliliters.

[A] Total coliform and *E. coli* standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

2.1.5.3 Conclusions

The nitrate concentrations detected in the samples collected from Well 2679 (MW-1) in May (16.0; 20.4 mg/L) exceed the MCL of 10 mg/L; the analyses of samples collected from Well 2680 (MW-2), Well 2681 (MW-3), and the onsite domestic well (Well 2232) detected nitrate at concentrations less than 10 mg/L, which is an improvement over the last several years of monitoring. The $\delta^{15}N$ ratios for Wells 2232 and 2679 (MW-1) suggest the nitrate concentrations are from mixed or organic soil contributions. Potential sources include an on-site source(s); fertilizer applied to Site agricultural fields located to the north and east of the well; fertilizer and/or liquid or solid animal waste applied to off-property agricultural fields located north and east of the well.

2.1.5.4 Recommendations

Although nitrate concentrations have declined at the site's domestic well (Well 2232) since 2015 and is currently below previously recorded low concentrations, DEQ recommends continued monitoring at this site—frequency will be determined after review of the 2019 results.

2.2 Idaho Falls Region

Two ground water quality monitoring projects were conducted in the Idaho Falls region in 2019 using public funds.

2.2.1 Mud Lake Subarea Ground Water Monitoring Project

2.2.1.1 Purpose and Background

Sampling for the Mud Lake subarea was completed in calendar year 2019. However, a summary of the data was not available at the time of publication of this report. The project is described below. A summary of the data will be included in the 2020 annual summary report.

The objectives of this regional monitoring study are to identify areas of vulnerable or degraded water quality, collect data to aid in determining potential sources of degradation to direct and prioritize ground water protection efforts based on potential sources, and evaluate the effectiveness of management practices used to reduce nitrate impacts.

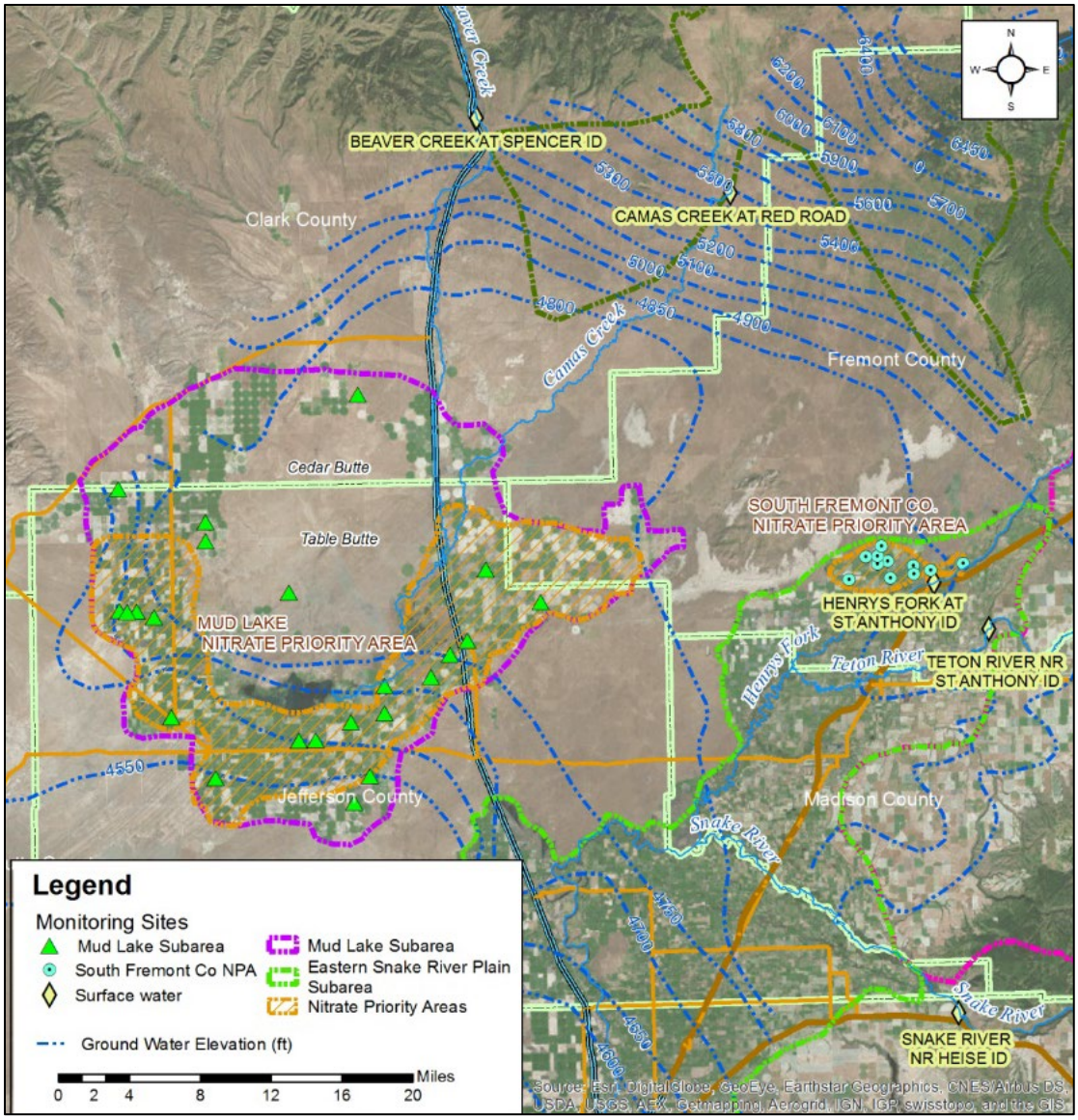


Figure 21. Site location map — Mud Lake Subarea Ground Water Monitoring Project.

The Mud Lake subarea covers 525 square miles of eastern Idaho, including the Mud Lake Terreton Basin and the lowlands surrounding the Table Butte/Cedar Butte complex of Jefferson and Clark Counties (Figure 21).

2.2.1.2 Methods and Results

Sample locations were selected from domestic and livestock wells with available well logs. A total of 24 wells were sampled in October and December 2019. Results from these randomly selected wells can statistically represent the subarea and can be combined with results from other sampling networks to make inferences concerning the subarea.

Samples were also collected at 5 surface water locations in November 2019 to characterize the potential recharge to the ESRP aquifer in the vicinity of both the Mud Lake subarea and the

South Fremont County NPA. The surface water sites were sampled at US Geological Survey (USGS) stream gages on Henrys Fork, Teton River, Snake River Beaver Creek, and Camas Creek.

The 24 project wells and 5 surface water locations were sampled following the appropriate QAPP (DEQ 2011c) and FSP (DEQ 2019). Water quality field parameters (pH, temperature, specific conductance, and DO) were measured at each site prior to sample collection.

Samples were analyzed by IBL in Boise for common ions (calcium, sodium, magnesium, potassium, chloride, fluoride, and sulfate), arsenic, total alkalinity, nitrite plus nitrate (nitrate), and ammonia. Samples for bacteria (TC and *E. coli*) were analyzed by Teton Microbiology Laboratory in Idaho Falls. After receiving the major ion chemistry and nutrient results, samples for stable isotope analysis were submitted to UC Davis for stable isotopes of nitrogen and oxygen in nitrate ($\delta^{15}N_{nitrate}$, $\delta^{18}O_{nitrate}$) and University for Arizona for stable isotopes of oxygen and hydrogen in water ($\delta^{18}O$ and $\delta^{2}H$). Samples were submitted to the University of Idaho Center for Advanced Energy Studies laboratory in Idaho Falls for total bromide and trace elements (boron, lithium, strontium).

Nutrient concentrations, bacteria, and major ion chemistry, along with stable isotope data and trace elements concentrations will be evaluated and presented in the 2020 annual report.

2.2.2 Teton Valley Deep Soil Percolation and Ground Water Sampling for BMP Evaluation Project

2.2.2.1 Purpose and Background

The DEQ IFRO sampled four ground water sites in support of multi-year soil health Cover Crop Demonstration Project in cooperation with a Teton Valley-based non-profit organization Friends of the Teton River. Sites were selected from the nearest domestic wells to the cover crop demonstration site, approximately up gradient, and down gradient of the cover crop demonstration site (Figure 22). Sites will be sampled in fall and spring through the planned three-year duration of the project, spring 2018 through spring 2021.

Sites were sampled for analytes consistent with regional nitrate monitoring and with the deep soil percolation (DSP) monitoring.

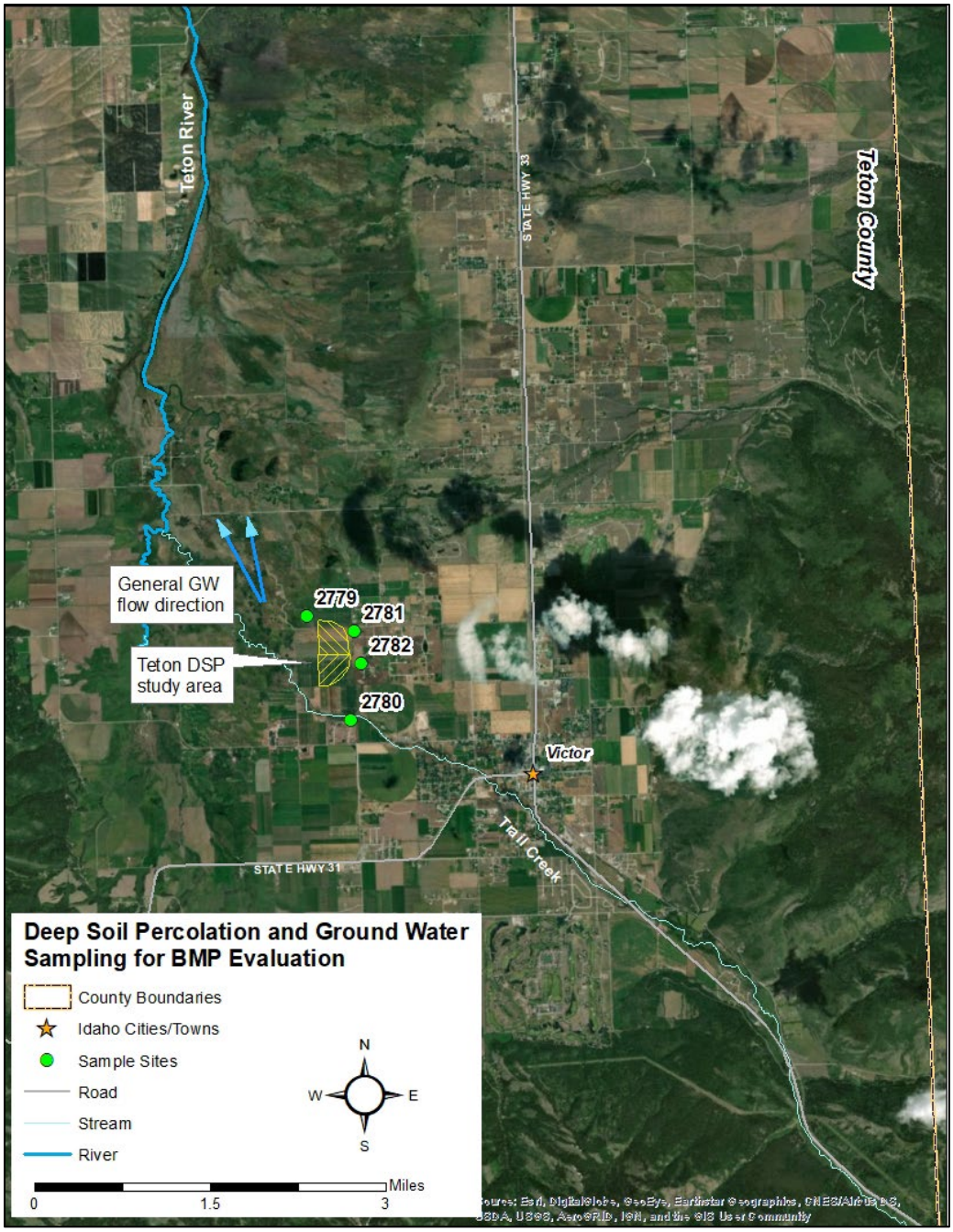


Figure 22. Sample site locations— Deep Soil Percolation and Ground Water Sampling for BMP Evaluation, Teton County SWCD, 2019 Ground Water Monitoring Project.

Methods and Results

DEQ collected ground water samples in May and December 2019, from four private domestic wells located within the Teton Valley near Victor, ID. Sample locations were selected from domestic wells with available well logs. Selection favored more recent wells with complete information on well construction, well-bore seals, and lithologic descriptions, suggesting that sampled ground water would represent the shallowest aquifer zone. One of the four selected domestic wells identified as having a drilling permit on file and an issued well tag number was

determined to not have a well driller's log. Permission has been obtained to video log the well and measure depth, based on well conditions encountered. Wells nearest to this location ranged in depth from 79–112 feet with open bottom-casing completions. Depth to water for these nearest wells ranges from 35–40 feet bgs.

Sites selected were the closest to the DSP study area. Well 2782 was maintained in the list of sample sites despite lack of confirmation of well depth due to proximity to the study area, similar age of construction to surrounding wells, and permission to sample.

Samples were analyzed by IBL for common ions (i.e., calcium, sodium, magnesium, potassium, chloride, fluoride, sulfate), arsenic, total alkalinity, nitrite-nitrate nitrogen (nitrate), and ammonia. Samples for bacteria (TC and *E. coli*) were analyzed by Teton Microbiology Lab, Idaho Falls.

After receiving the major ion chemistry and nutrient results, samples for stable isotope analysis were submitted to University of Arizona for stable isotopes of oxygen and hydrogen in water ($\delta^{18}OH_2O$ and $\delta^{2}HH_2O$) and to University of California, Davis Stable Isotope Facility for stable isotopes of nitrogen and oxygen in nitrate. All sampling was conducted according to the regional QAPP (DEQ 2011b) and FSP (DEQ 2015b).

The University of Idaho Analytical Sciences Laboratory, Moscow, Idaho performed metal analysis on samples for boron, bromide, lithium, and strontium.

Water quality field parameters (i.e., pH, temperature, specific conductance, DO) were measured before sample collection to ensure adequate purging of the well for a representative sample of the local aquifer (Table 29).

Table 29. Water quality field parameters—Deep Soil Percolation and Ground Water Sampling for BMP Evaluation, Teton County SWCD, 2019 Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Water Temperature (°C)	Specific Conductance (µS/cm)	pH[A]	Dissolved Oxygen (mg/L)
2779	62	05/21/2019	6.84	330	7.61	7.80
		12/09/2019	6.13	357	7.52	8.19
2780	118	05/21/2019	6.46	382	7.45	7.86
		12/09/2019	5.39	392	7.47	8.39
2781	80	05/21/2019	6.89	334	7.66	8.15
		12/09/2019	6.13	336	7.58	8.73
2782	Unk	05/21/2019	6.24	339	7.61	6.90
		12/09/2019	5.81	333	7.59	8.7

Notes: ft bgs = feet below ground surface; °C = degrees Celsius; µS/cm = microsiemens/centimeter; pH = standard pH units; mg/L = milligrams per liter; Unk=Unknown. Well log not found.

[A] Contaminant with a National Secondary Drinking Water Regulation standard. The NSDWR for pH is 6.5-8.5. NSDWR standards are recommended limits for public water systems but can be applied to private wells to evaluate water quality.

Nutrient and Stable Isotope Results

The nitrate (nitrite-nitrate nitrogen) results were all below the water quality standard of 10 mg/L, ranging from 0.38 mg/L to 1.3 mg/L. Ammonia results were all below the reporting limit (< 0.050 mg/L) (Table 30). Results for $\delta^{18}O_{nitrate}$ -4.68‰ to -7.28‰ and results $\delta^{15}N_{nitrate}$ ranged from 4.55‰ to 5.93‰, with all $\delta^{15}N_{nitrate}$ suggesting a mixed nitrogen source (Table 4). Results for $\delta^{2}H_{water}$ and $\delta^{18}O_{water}$ ranged from -132.5‰ to -136.4‰ and -17.5‰ to -18.2‰, respectively (Table 31).

Table 30. Nutrient and nutrient-related isotope results—Deep Soil Percolation and Ground Water Sampling for BMP Evaluation, Teton County SWCD, 2019 Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Nutrient Concentration			Isotopes	
			Total Phosphorus	Nitrate + Nitrite[A]	Ammonia	$\delta^{18}O_{Nitrate}$	$\delta^{15}N_{Nitrate}$
			(mg/L)			(‰)	
Water Quality Standard:			**No Stand.**	**10**	**No Stand.**	**No Stand.**	**No Stand.**
2779	62	05/21/2019	—	0.47	<0.050	-6.58	4.88
		12/09/2019	0.012	0.63	<0.050	-5.54	5.50
2780	118	05/21/2019	—	1.2	<0.050	-7.28	4.86
		12/09/2019	0.0096	1.3	<0.050	—	—
2781	80	05/21/2019	—	0.41	<0.050	-4.68	5.93
		12/09/2019	0.0092	0.44	<0.050	-5.84	4.55
2782	Unk	05/21/2019	—	0.42	<0.050	—	—
		12/09/2019	0.010	0.38	<0.050	-5.25	5.40

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; ‰ = permil; Unk=Unknown. Well log not found; (-) = Not Analyzed; No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established.

[A] Contaminant with a National Primary Drinking Water Regulation standard.

Table 31. Stable isotope results—Deep Soil Percolation and Ground Water Sampling for BMP Evaluation, Teton County SWCD, 2019 Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	$\delta^{2}H_{water}$	$\delta^{18}O_{water}$
			(‰)	
2779	62	05/21/2019	-136.4	-18.1
		12/09/2019	-134.8	-18.2
2780	118	05/21/2019	-133.4	-17.5
		12/09/2019	-132.5	-17.9
2781	80	05/21/2019	-135.5	-17.7
		12/09/2019	-134.1	-18.1
2782	Unk	05/21/2019	-135.3	-18.0
		12/09/2019	-134.8	-18.2

Notes: ft bgs = feet below ground surface; ‰ = permil; Unk=Unknown. Well log not found.

Bacteria Results

None of the four sites sampled had positive detections of *E. coli* or TC in either the May or December sampling round. Results are presented in Table 32.

Table 32. Bacteria Results—Deep Soil Percolation and Ground Water Sampling for BMP Evaluation, Teton County SWCD, 2019 Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Bacteria Concentrations[A]	
			E. coli	Total Coliform
			(MPN/100 mL)	
Water Quality Standard:			**<1**	**1.0**
2779	62	05/21/2019	<1.0	<1.0
		12/09/2019	<1.0	<1.0
2780	118	05/21/2019	<1.0	<1.0
		12/09/2019	<1.0	<1.0
2781	80	05/21/2019	<1.0	<1.0
		12/09/2019	<1.0	<1.0
2782	Unk	05/21/2019	<1.0	<1.0
		12/09/2019	<1.0	<1.0

Notes: ft bgs = feet below ground surface; MPN/100 mL = most probable number per 100 milliliters; Unk=Unknown. Well log not found.

[A] Total coliform and *E. coli* standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

General Ground Water Chemistry Results

The four project wells were sampled for the following major ions to evaluate the general ground water chemistry: bromide, calcium, chloride, fluoride, magnesium, potassium, sodium, and sulfate. Samples were also analyzed for alkalinity (as CaCO3). Results were consistent between May and December and are presented in Table 33.

Table 33. Common ion and Total Dissolved Solids results—Deep Soil Percolation and Ground Water Sampling for BMP Evaluation, Teton County SWCD, 2019 Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Alkalinity as (CaCO3)	Bromide	Calcium	Chloride[A]	Fluoride[AB]	Magnesium	Potassium	Sodium	Sulfate[A]
			(mg/L)	(µg/L)	(mg/L)						
Primary or Secondary Standard:			**No Stand.**	**No Stand.**	**No Stand.**	**250**	**2.0/4**	**No Stand.**	**No Stand.**	**No Stand.**	**250**
2779	62	05/21/2019	173	<10	47	1.35	<0.20	14	0.64	1.2	7.28
		12/09/2019	180	<5	49	1.74	<0.20	14	0.64	1.2	7.40
2780	118	05/21/2019	195	<10	56	2.29	<0.20	15	0.61	1.3	6.98
		12/09/2019	198	5.2J	55	2.85	<0.20	15	0.57	1.2	7.14
2781	80	05/21/2019	171	<10	46	1.67	<0.20	14	0.54	1.0	6.92
		12/09/2019	172	<5	46	1.92	<0.20	14	0.55	1.0	6.95
2782	Unk	05/21/2019	175	<10	48	1.39	<0.20	14	0.53	1.0	6.53
		12/09/2019	181	<5	45	1.92	<0.20	13	0.52	1.1	7.17

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; µg/L = micrograms per liter; Unk = Unknown. Well log not found; No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established. J = The analyte was detected, but the value of the result is an estimate.

[A] Contaminant with a National Secondary Drinking Water Regulation standard.

[B] Contaminant with a National Primary Drinking Water Regulation standard.

Metals and Radionuclide Results

All sites were sampled for trace and heavy metals including arsenic, boron, lithium, and strontium. Result between May and December sampling were consistent. The MCL for arsenic was not exceeded in any sample; all samples were below the detection limit during both rounds of sampling. Results are provided in Table 34.

Table 34. Metals results—Deep Soil Percolation and Ground Water Sampling for BMP Evaluation, Teton County SWCD, 2019 Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Arsenic[A]	Boron	Lithium	Strontium
			(µg/L)			
Water Quality Standard:			**10**	**No Stand.**	**No Stand.**	**No Stand.**
2779	62	05/21/2019	<2.0	<5.0	1.4	70
		12/09/2019	<2.0	5.0J	1.6	69
2780	118	05/21/2019	<2.0	<5.0	1.4	79
		12/09/2019	<2.0	7.0J	1.8	77
2781	80	05/21/2019	<2.0	<5.0	1.2	73
		12/09/2019	<2.0	5.4J	1.6	74
2782	Unk	05/21/2019	<2.0	<5.0	1.3	76
		12/09/2019	<2.0	<5.0	1.4	66

Notes: ft bgs = feet below ground surface; µg/L = micrograms per liter; Unk = Unknown. Well log not found; No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established. J = The analyte was detected, but the value of the result is an estimate.

[A] Contaminant with a National Primary Drinking Water Regulation standard.

2.2.2.2 Conclusions

No conclusions have been made at this time as this is a multi-year project to evaluate nutrient flow in ground water and only initial data have been collected. Conclusions will be made when the project is complete and will be summarized in a future annual report.

2.2.2.3 Recommendations

DEQ plans to continue this multi-year project to evaluate nutrient flow in ground water. Data will be summarized in a future annual report with additional details. Data may also be presented in a future technical report.

2.3 Coeur d'Alene Region

No ground water quality projects were conducted using public funds in the Coeur d'Alene region in 2019.

2.4 Lewiston Region

Three ground water quality monitoring projects were conducted in the Lewiston region in 2019 using public funds.

2.4.1 Clearwater Plateau Nitrate Priority Area Ground Water Monitoring Project

This section summarizes the 2019 sampling results from an ongoing ground water quality evaluation of nitrate concentrations in the Clearwater Plateau NPA north of Grangeville, Idaho.

2.4.1.1 Purpose and Background

The objective of this project is to use an ambient ground water quality monitoring network in the Clearwater Plateau NPA to complete a multi-year trend analysis to help determine the effectiveness of the ground water quality management plan (GWQMP) in improving ground water quality in this area.

In 1998, DEQ found that 24 of 55 wells sampled (44%) had nitrate concentrations exceeding 5 mg/L, which is half the MCL of 10 mg/L (Bentz 1998). The maximum nitrate concentration reported in the 1998 study was 77.1 mg/L. The value was later determined to be caused by a point source near the wellhead and the site has not been sampled in subsequent years.

The Clearwater Plateau NPA was designated, in part, on the 1998 nitrate investigation results. In the most recent 2014 NPA ranking, the Clearwater Plateau NPA ranked as the 14th-most degraded area in the state; data used in the assessment indicated a decreasing trend in nitrate concentrations. The Clearwater Plateau NPA covers approximately 292 square miles, or 187,000 acres, of an area approximately 1,700 square miles in size north of Grangeville, known as the Clearwater Plateau. Three major rivers border the Clearwater Plateau: the Salmon River to the south, the Snake River to the west, and the Clearwater River to the north and east. Ground water beneath the plateau generally flows northeast through Miocene basalt layers that are overlain by loess ranging in thickness from tens to hundreds of feet and forms the present surface of the Palouse and occasionally in the alluvial valley aquifers and basement rocks (Hagan 2003). Well depths from ground water sampling locations ranged from 12 to 475 ft bgs.

To address elevated nitrate concentrations in the Clearwater Plateau NPA, a ground water quality management (GWQM) plan was developed (DEQ and ISCC 2008). The GWQM plan encourages implementing voluntary best management practices (BMPs) to reduce nitrate concentrations in ground water.

As part of the plan, approximately $1 million of Clean Water Act §319 grant funds were expended within the NPA through 2011 for implementing agricultural ground water protection BMPs (e.g., direct seed practices). Direct seed practices allow crop planting with minimal soil disturbance, which may reduce nitrogen mobility when combined with other BMPs.

DEQ initiated the Clearwater Plateau NPA ground water monitoring project (i.e., Camas Prairie project) in August 2005 as part of a regional ambient ground water monitoring network. The objective of this long-term ground water monitoring is to determine the GWQM plan's

effectiveness in improving ground water quality. Nitrate concentration data are periodically evaluated to determine if ambient concentrations increase or decrease.

The project area is located immediately north of Grangeville, Idaho, straddling Lewis and Idaho Counties and encompassing the towns of Cottonwood, Ferdinand, Craigmont, and Nez Perce (Figure 23). The land use is primarily agricultural, specifically dry-land farming. Rangeland and grazing are also commonly found throughout the area.

2.4.1.2 Methods and Results

In May 2019, DEQ staff sampled 13 existing project wells, 2 existing project springs, and 1 new spring site (DEQ Site ID 3035) to assess nitrate concentrations within the Clearwater Plateau NPA. Well selection was conducted with an emphasis on historically-sampled wells, well logs, homeowner permission, and spatial distribution across the project area to achieve a representative distribution. The new spring site was added based on opportunity and the spring owner's request.

All samples were collected according to the regional QAPP (DEQ 2017b) and FSP (DEQ 2018h). When possible, water quality field parameters (i.e., pH, temperature, specific conductance, DO) were measured at each site before sample collection to ensure adequate purging of the well for a representative sample of the local aquifer (Table 35). Samples were collected for nitrate (nitrate-nitrite nitrogen). All samples were submitted for analysis to Anatek Labs, Moscow, Idaho. EPA method 300.0 was used to analyze all nitrate samples.

Table 35. Water quality field parameters—Clearwater Plateau Nitrate Priority Area Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Water Temperature (°C)	Specific Conductance (µS/cm)	pH[A]	Dissolved Oxygen (mg/L)
199	140	05/08/2019	10.1	664	7.71	13.57
202	400	05/08/2019	11.3	369	7.40	11.57
212	400	05/15/2019	9.8	436	7.64	9.64
217	200	05/08/2019	11.3	500	7.24	10.11
413	Spring	05/08/2019	10.7	429	7.27	9.21
417	187	05/08/2019	11.7	422	8.28	9.52
643	145	05/08/2019	10.7	381	7.63	14.17
2587	Unk	05/15/2019	12.2	583	7.75	3.82J
2666	700	05/08/2019	15.5	303	*8.61*	7.60
2667	380	05/08/2019	12.9	307	8.12	2.07
2671	127	05/15/2019	10.0	982	7.61	10.89
2672	Unk	05/15/2019	14.3	402	7.00	6.65
2673	400	05/15/2019	11.3	375	8.22	1.10
2675	Spring	05/15/2019	8.0	113.0	*6.19*	7.66
2678	340	05/15/2019	11.2	440	7.71	6.77
3035	Spring	05/15/2019	9.6	369	7.20	11.36

Notes: ft bgs = feet below ground surface; °C = degrees Celsius; µS/cm = microsiemens/centimeter; pH = standard pH units; mg/L = milligrams per liter; Unk=Unknown. Well log not found; Italicized shaded numbers indicate EPA's National Secondary Drinking Water Regulation (NSDWR) standard was exceeded. J = The analyte was detected, but the value of the result is an estimate.

[A] Contaminant with a National Secondary Drinking Water Regulation standard. The NSDWR for pH is 6.5-8.5. NSDWR standards are recommended limits for public water systems but can be applied to private wells to evaluate water quality.

Nutrient Results

Nitrate concentrations are presented in Table 36 and Figure 23. A total of 16 sites (13 wells and 3 springs) were sampled as part of this project. Of the 16 sites sampled in 2019, 3 (18.8%) had nitrate concentrations at or above the 10 mg/L MCL and 8 (50%) had concentrations above half the MCL. All sites, except one (3035), have been sampled as part of this project at least once previously. Five of the 16 sites show an overall increase in nitrate concentrations over their sampling history.

Well 199 experienced a significant increase in nitrate concentration from 12.7 mg/L in 2017 to 25.6 mg/L in 2018 and remained elevated at 23.3 mg/L in 2019. Historically, nitrate concentrations for this site have averaged approximately 9 mg/L.

Table 36. Nutrient and nutrient-related isotope results—Clearwater Plateau Nitrate Priority Area Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Nutrient Concentration (Nitrate + Nitrite)[A] (mg/L)
Water Quality Standard:			**10**
199	140	05/08/2019	**23.2**
202	400	05/08/2019	4.53
212	400	05/15/2019	**18.7**
217	200	05/08/2019	4.96
413	Spring	05/08/2019	8.34
417	187	05/08/2019	<0.1
643	145	05/08/2019	6.52
2587	Unk	05/15/2019	8.63
2666	700	05/08/2019	<0.1
2667	380	05/08/2019	<0.1
2671	127	05/15/2019	**23.9**
2672	Unk	05/15/2019	2.85
2673	400	05/15/2019	1.98
2675	Spring	05/15/2019	3.36
2678	340	05/15/2019	3.58
3035	Spring	05/15/2019	7.94

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; Unk=Unknown. Well log not found; Bolded shaded numbers indicate a National Primary Drinking Water Regulation (NPDWR) standard, expressed as a maximum contaminant level (MCL), standard was reached or exceeded. These regulations are applicable for public water systems only but are used to evaluate water quality in private wells.
[A] Contaminant with a National Primary Drinking Water Regulation standard.

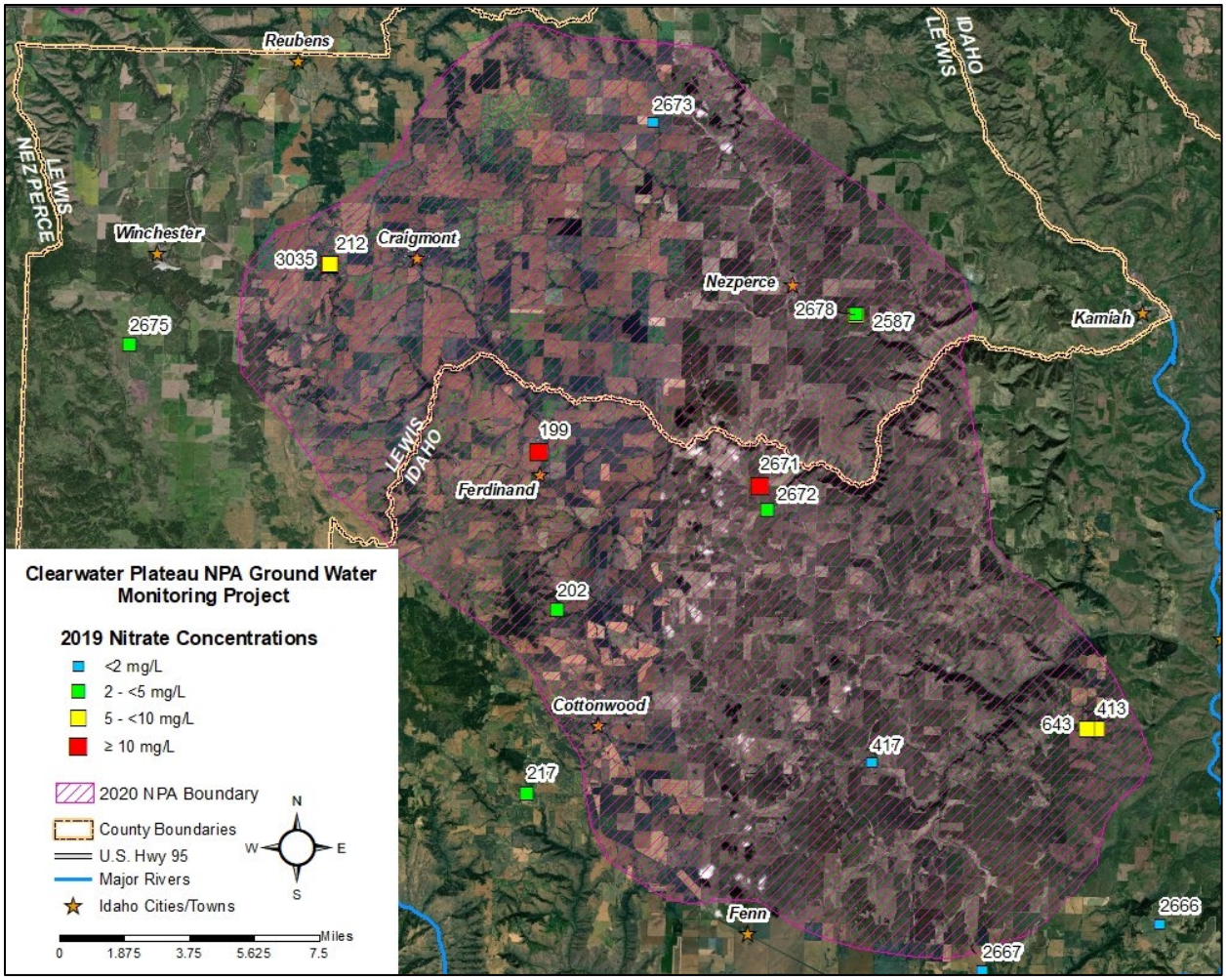


Figure 23. Nitrate concentrations and site locations—Clearwater Plateau Nitrate Priority Area Ground Water Monitoring Project.

Bacteria Results

Bacteria results are presented in Table 37. Of the 16 sites sampled, 7 sites had positive detections of TC bacteria. Laboratory results ranged from 1.0 to 344.8 MPN/100 mL. DEQ Site 413 was the only site with a positive *E. coli* detection and had a concentration of 11.0 MPN/100 mL (*E. coli* was detected at 1.0 MPN/100 mL in 2018).

Table 37. Bacteria Results—Clearwater Plateau Nitrate Priority Area Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Bacteria Concentrations[A]	
			E. coli	Total Coliform
			(MPN/100 mL)	
Water Quality Standard:			**<1**	**1.0**
199	140	05/08/2019	<1	<1
202	400	05/08/2019	<1	<1
212	400	05/15/2019	<1	6.3
217	200	05/08/2019	<1	14.1
413	Unk	05/08/2019	**11.0**	344.8
417	187	05/08/2019	<1	<1
643	145	05/08/2019	<1	<1
2587	Unk	05/15/2019	<1	<1
2666	700	05/08/2019	<1	<1
2667	380	05/08/2019	<1	<1
2671	127	05/15/2019	<1	3.0
2672	Unk	05/15/2019	<1	<1
2673	400	05/15/2019	<1	<1
2675	12	05/15/2019	<1	57.3
2678	340	05/15/2019	<1	1.0
3035	Unk	05/15/2019	<1	235.9

Notes: ft bgs = feet below ground surface; MPN/100 mL = most probable number per 100 milliliters; Unk = Unknown. Well log not found; Bolded shaded numbers indicate a National Primary Drinking Water Regulation (NPDWR) standard, expressed as a maximum contaminant level (MCL), standard was reached or exceeded. These regulations are applicable for public water systems only but are used to evaluate water quality in private wells.
[A] Total coliform and *E. coli* standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. The presence of E. coli is considered a potential health threat and is a violation of the Idaho Ground Water Quality Standard. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

2.4.1.3 Conclusions

The objective of this project is to use an ambient ground water quality monitoring network in the Clearwater Plateau NPA to complete a multi-year trend analysis. This long-term monitoring will help determine the effectiveness of the GWQM plan in improving ground water quality in this area. The Clearwater Plateau NPA is identified as an area experiencing nitrate impact to ground water based on historic sampling. Analytical results of the sites sampled show that 3 of 16 sites (18.8%) had nitrate concentrations at or above the 10 mg/L MCL. Concentrations were equal to or above half of the MCL for 8 of 16 (50%) 2019 samples compared to (85%) in 2018.

Median annual nitrate concentrations measured for the Clearwater Plateau NPA ground water monitoring project range from 5.5 mg/L to 12 mg/L. The 2019 median of 6.52 mg/L falls within the lower end of the range of historical median values.

2.4.1.4 Recommendations

Continued long-term ground water quality monitoring is recommended to determine the effectiveness of the GWQM plan in improving ground water quality in this area.

2.4.2 Lindsay Creek Nitrate Priority Area Ground Water Monitoring Project

This section summarizes the 2019 sampling results from an ongoing ground water quality evaluation of nitrate concentrations in the Lindsay Creek NPA near Lewiston, Idaho.

2.4.2.1 Purpose and Background

The goal of the Lindsay Creek NPA Ground Water Monitoring Project (previously referred to as the Tammany and Lindsay Creeks Ground Water Monitoring Project) is to create an ambient ground water quality monitoring network to complete a multi-year trend analysis that detects nitrate changes in ground water in the Lindsay Creek NPA and extend ground water quality monitoring to include the aquifer within the Tammany Creek watershed.

The project area is located east and southeast of Lewiston, Idaho (Figure 24). The land use is primarily agricultural, specifically dry-land farming. Rangeland and grazing are also common in the area. The area is underlain by the Tertiary Columbia River Basalts and consists of units that formed when lava flows filled in the preexisting topography during the Miocene era (Stevens et al. 2003). A thin layer of loess forms the present-day land surface for most of the area. Ground water in the area is mostly found in the basalt and occasionally in the alluvial valley sediments and basement rocks. Ground water generally flows to the north and eventually discharges into the Clearwater River (Hagan 2003). Well depths from ground water sampling locations ranged from 150 feet to 1,025 feet.

Limited ground water sampling has also shown elevated nitrate concentrations in the Tammany Creek area. Tammany Creek is located on the south side of the project area and the watershed has similar spring-fed nutrient load characteristics as the Lindsay Creek watershed on the north side of Lewiston. The ground water in this watershed may also be a potential source of excess nutrients to Tammany Creek. Tammany Creek is currently impaired by nutrients and has an approved nutrient total maximum daily load (DEQ 2010).

DEQ collected ground water quality data from 14 wells and/or springs as part of an ambient ground water quality monitoring network from 2010 to 2016. Nitrate concentrations from these samples were analyzed to determine if seasonal or spatial trends exist in the monitoring network in addition to monitoring long-term regional changes. Anomalous nitrate concentrations were addressed as isolated or localized situations and dropped from the ambient network.

2.4.2.2 Methods and Results

In October and November of 2019, DEQ sampled 16 sites (15 wells and 1 spring) as part of the Lindsay Creek NPA project. Site selection was conducted with an emphasis on historically-sampled wells, well logs, homeowner permission, and spatial distribution across the project area to achieve a representative distribution.

Samples were collected for nitrate (nitrate-nitrite nitrogen) and bacteria (TC and *E. coli*) in accordance with the QAPP (DEQ 2019b) and the FSP (DEQ 2019i). Due to a laboratory preservation error, nitrate samples were recollected in November at 8 of the 14 original sites, plus two additional sites (Wells 533 and 1312). All samples were submitted for analysis to Anatek Labs, Moscow, Idaho. EPA method 300.0 was used for all nitrate sample analysis.

Water quality field parameters (e.g., pH, temperature, specific conductance, DO) were measured before sample collection to ensure adequate purging of the well for a representative sample of the local aquifer. Field parameter data for both sampling efforts is presented in Table 38.

Table 38. Water quality field parameters—Lindsay Creek Nitrate Priority Area Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Water Temperature (°C)	Specific Conductance (µS/cm)	pH[A]	Dissolved Oxygen (mg/L)
Water Quality Standard:			**No Stand.**	**Not Stand.**	**6.5-8.5**	**No Stand.**
533	225	11/05/2019	12.5	1064	8.15	10.49
699	285	10/28/2019	16.3	387	8.04	4.32
1034	Unk	10/29/2019	17.5	576	8.11	6.04
1038	150	10/29/2019	12.8	1381	7.96	9.85
1039	Unk	10/28/2019	14.3	1066	7.98	9.25
		11/05/2019	13.8	1063	8.07	9.16
1217	264	10/28/2019	17.0	579	8.31	0.47
		11/05/2019	16.9	579	8.36	0.08
1218	28	10/28/2019	14.8	969	7.41	8.34
		11/05/2019	13.9	941	7.46	8.41
1225	16	10/28/2019	14.5	973	7.21	7.47
		11/04/2019	14.5	980	7.25	7.47
1243	15	10/29/2019	18.3	600	8.32	0.16
1312	1025	11/05/2019	12.5	206.3	8.44	8.41
1315	589	10/29/2019	10.5	660	8.11	10.34
		11/05/2019	9.3	643	8.16	11.96
2022	950	10/28/2019	13.7	247	*8.99*	7.42
2650	380	10/29/2019	18.1	396	8.07	5.63
2654	197	10/28/2019	11.9	1304	7.83	10.60
		11/05/2019	11.8	1328	7.91	10.44
2655	203	10/28/2019	13.4	1308	7.82	10.58
		11/05/2019	13.6	1315	7.85	10.44
2880	Unk	10/28/2019	13.7	1101	7.47	9.26
		11/04/2019	13.8	1095	7.67	9.07

Notes: ft bgs = feet below ground surface; °C = degrees Celsius; µS/cm = microsiemens/centimeter; pH = standard pH units; mg/L = milligrams per liter; No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established. Unk = Unknown. Well log not found. Italicized shaded numbers indicate EPA's National Secondary Drinking Water Regulation (NSDWR) standard was exceeded.

[A] Contaminant with a National Secondary Drinking Water Regulation standard. The NSDWR for pH is 6.5-8.5. NSDWR standards are recommended limits for public water systems but can be applied to private wells to evaluate water quality.

Nitrate Results

Nitrate results from the original (October) and follow up (November) sampling efforts are presented in Table 39 and shown in Figure 24. Of the 16 sites (15 wells and 1 spring) sampled in the combined sampling effort, 4 (25%) exceeded the MCL of 10 mg/L and 5 (31%) were between 5 mg/L and 10 mg/L. All sites had been sampled at least once historically. The median nitrate results for 2019 is 9.56 mg/L, an increase from the 2018 median of 9.32 mg/L. The mean nitrate concentration also increased from 7.62 mg/L in 2018 to 10.77 mg/L in 2019. While 25% of the wells that were sampled in 2019 showed nitrate concentrations above the MCL, of the sites in this sampling round that were last sampled in 2017 or 2018, all but one well had an unchanged or increase in nitrate concentration—Site 1038 was the only sampling site that showed a decrease.

Site 1038 was monitored quarterly in 2018 following a contamination event that resulted in nitrate concentrations above the MCL for several months. Between the conclusion of that quarterly sampling project and this Lindsay Creek NPA sampling round, a single nitrate sample was collected from Well 1038 at the request of the well-owner to ensure the nitrate level had returned to a level below the MCL. The result of the May 2019 sample was 9.06 mg/L.

Future reports will include a more detailed comparison of nitrate results by year for previous sampling rounds.

Table 39. Nutrient and nutrient-related isotope results—Lindsay Creek Nitrate Priority Area Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Nutrient Concentration		
			Nitrite[A]	(Nitrate + Nitrite)[A]	Nitrate[A]
			(mg/L)		
Water Quality Standard:			**1.0**	**10**	**10**
533	225	11/05/2019	—	**10.6**	—
699	285	10/28/2019	<0.1	<0.1J	<0.1J
1034	Unk	10/29/2019	<0.1	<0.1	<0.1
1038	150	10/29/2019	<0.1	8.81	8.81
1039	Unk	10/28/2019	<1	8.56J	8.56J
		11/05/2019	—	9.93	—
1217	264	10/28/2019	<0.1	<0.1J	<0.1J
		11/05/2019	—	<0.1	—
1218	28	10/28/2019	<0.1	8.59J	8.59J
		11/05/2019	—	9.16	—
1225	16	10/28/2019	<1	6.96J	6.96J
		11/04/2019	—	7.66	—
1243	15	10/29/2019	<0.1	<0.1	<0.1
1312	1025	11/05/2019	—	0.339	—
1315	589	10/29/2019	<0.1	**16.6J**	**16.6J**
		11/05/2019	—	**17.3**	—
2022	950	10/28/2019	<0.1	<0.1J	<0.1J
2650	380	10/29/2019	<0.1	<0.1	<0.1

2654	197	10/28/2019	<0.1	**15.5J**	**15.5J**
		11/05/2019	—	**17.8**	—
2655	203	10/28/2019	<0.1	**15.3J**	**15.3J**
		11/05/2019	—	**16.9**	—
2880	Spring	10/28/2019	<1	8.24J	8.24J
		11/04/2019	—	9.19	—

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; Unk = Unknown. Well log not found; (-) = Not Analyzed; J = The analyte was detected. The associated numeric value is considered an estimated quantity. Bolded shaded numbers indicate EPA's National Primary Drinking Water Regulation (NPDWR) standard was met or exceeded.
[A] Contaminant with a National Primary Drinking Water Regulation standard.

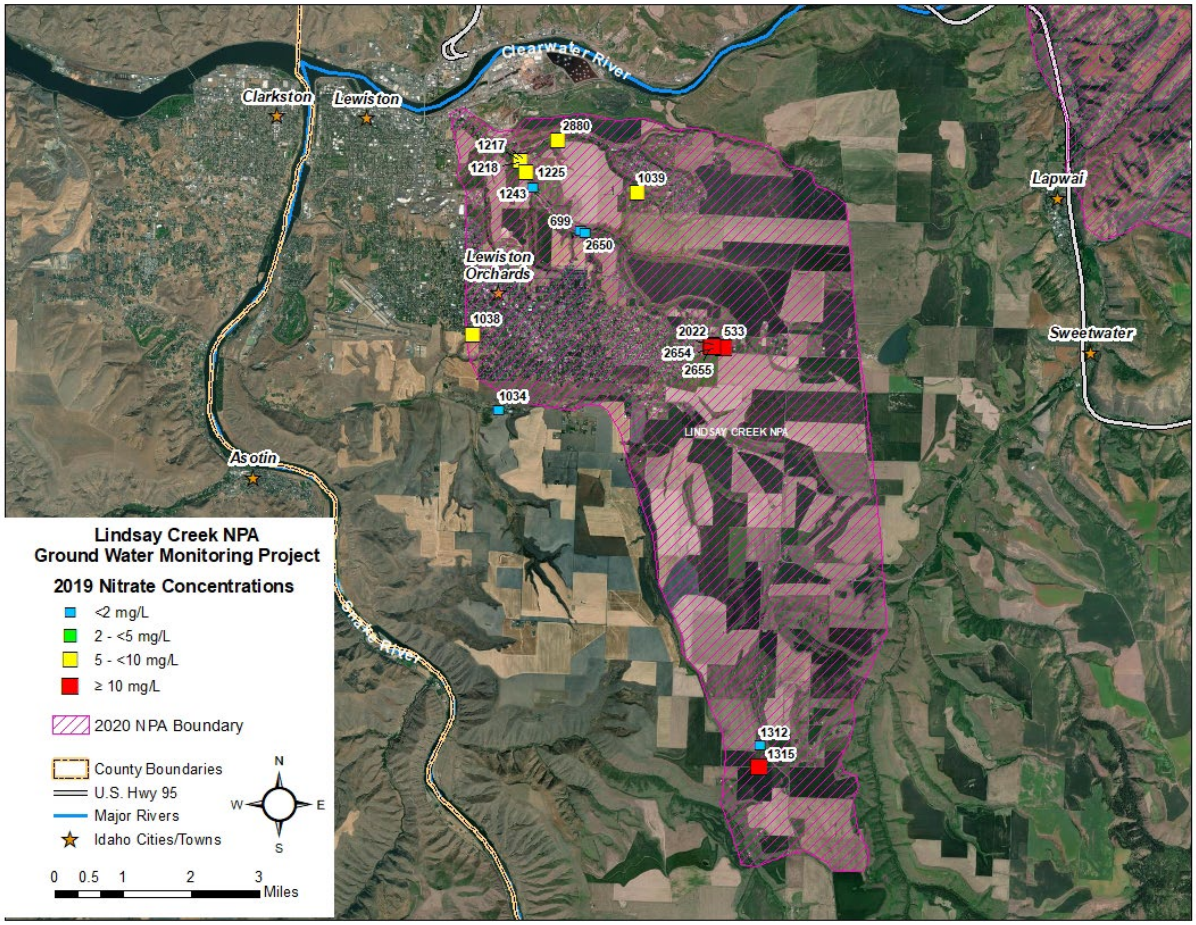


Figure 24. Nitrate results and site locations—Lindsay Creek Nitrate Priority Area Ground Water Monitoring Project.

Bacteria Results

Bacteria results from the October sampling effort are represented in Table 40. Of the 14 sites sampled, 8 (57%) had positive detections of TC bacteria. Concentrations ranged from 4.1 to 866.4 MPN/100 mL. *E. coli* was detected once at a concentration of 3.1 MPN/100 mL in the spring (2880).

Table 40. Bacteria Results—Lindsay Creek Nitrate Priority Area Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Bacteria Concentrations[A]	
			E. coli	Total Coliform
			(MPN/100 mL)	
Primary or Secondary Standard:			**<1**	**1.0**
699	285	10/28/2019	<1	<1
1034	Unk	10/29/2019	<1	4.1
1038	150	10/29/2019	<1	<1
1039	Unk	10/28/2019	<1	866.4
1217	264	10/28/2019	<1	<1
1218	28	10/28/2019	<1	224.7
1225	16	10/28/2019	<1	20.1
1243	15	10/29/2019	<1	<1
1315	589	10/29/2019	<1	5.2
2022	950	10/28/2019	<1	<1
2650	380	10/29/2019	<1	4.1
2654	197	10/28/2019	<1	17.1
2655	203	10/28/2019	<1	<1
2880	Spring	10/28/2019	**3.1**	55.6

Notes: ft bgs = feet below ground surface; MPN/100 mL = most probable number per 100 milliliters; Unk = Unknown. Well log not found. Bolded red numbers indicate either an EPA National Primary Drinking Water Regulation (NPDWR) standard, expressed as a maximum contaminant level (MCL), or an Idaho Ground Water Quality Rule (IDAPA 58.01.11.200) standard was reached or exceeded. These regulations are applicable for public water systems only but are used to evaluate water quality in private wells.

[A] Total coliform and *E. coli* standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. The presence of E. coli is considered a potential health threat and is a violation of the Idaho Ground Water Quality Standard. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

2.4.2.3 Conclusions

The objective of this ongoing project is to use an ambient ground water quality monitoring network in the Lindsay Creek NPA to complete a multi-year trend analysis for nitrate.

DEQ conducted an annual sampling round in the Lindsay Creek NPA to assess nitrate concentrations and evaluate ground water quality. The Lindsay Creek NPA is identified as an area experiencing nitrate impact to ground water based on historic sampling. Of the 15 wells and 1 spring sampled, between the two sample collection efforts, 4 (25%) exceeded the MCL of 10 mg/L and 5 of 16 (31%) were equal to or greater than half the MCL of 5 mg/L. The spring site (2880) had a detection of *E. Coli* bacteria.

Tracking trends in ambient nitrate ground water concentration due to changes in land uses or source controls will be accomplished by comparing concentrations over multiple years. This comparison will assist in determining nitrate concentration variability due to changes in cropping patterns, fertilizer application, nitrogen uptake by crops due to growing season conditions, and leaching rates related to the amount and timing of precipitation available to mobilize nitrogen below the crop root zone.

2.4.2.4 Recommendations

Yearly monitoring of wells and springs in the Lindsay Creek NPA should continue to enhance the ambient ground water quality data set. Continuing to develop the ambient ground water quality data set allows DEQ to track multi-year trends, specifically for nitrate. For future annual NPA monitoring, outlier tests and common ion chemistry could be used to determine if samples represent ambient conditions and to monitor long-term trends in ground water quality. Wells yielding nitrate concentrations or other parameters inconsistent with the ambient conditions should be evaluated to determine if they represent the impacted aquifer. Nitrogen isotope analysis should be included in future sampling efforts to help determine sources of nitrate.

DEQ recommends future sampling efforts at locations with low DO concentrations include ammonia. It is also recommended that staff determine if well modifications (for example, deepening) have been made to wells sampled by DEQ over the past 30 years.

2.4.3 Juliaetta Nitrate Investigation

2.4.3.1 Purpose and Background

Juliaetta is a small town in northern Idaho approximately 2 miles north of the Nez Perce Indian Reservation, along Highway 3 and the Potlatch River, with a population of just over 500. City residents are served drinking water through the City of Juliaetta public water system (PWS). The PWS currently operates 2 wells, 1 spring, and a surface water plant (source is the Potlatch River) and serves its users through 279 connections. Nearby residents outside the city rely on private wells for their drinking water and household water needs.

Private well owners are not required to sample for water quality; however, under the Safe Drinking Water Rules, PWSs are required to sample water for various constituents to ensure water served to the public meets federal and state drinking water standards. The DEQ Drinking Water Program (DWP) provides regulatory oversight for PWSs and reviews the required monitoring data. A review of monitoring data from Juliaetta's Well #5 (prior to this project) showed increases of both picloram (an herbicide used on deeply rooted herbaceous weeds and woody plants) and nitrate over the past several years. A 3.63 micrograms per liter (µg/L) increase in the picloram concentration at well #5 in a little over one year (increasing from 1.35 µg/L on May 25, 2016 to 4.98 µg/L on November 29, 2017), prompted concern from the DWP staff which led to discussions with the DEQ Ground Water Bureau regarding possible sources of the picloram and nitrate as there was a comparable increase in nitrate concentration in well #5 over that same time period. After discussions on possible next steps, a joint project with the Idaho State Department of Agriculture (ISDA) was deemed essential to capture the necessary monitoring scope and requirements since the project was aimed at evaluating ground water for both nutrients and pesticides. ISDA is the state agency with authority over the licensing and use of pesticides in the state and the ISDA Water Quality Program monitors for pesticides in ground water and surface water throughout the state.

Goals of this project were to determine if picloram and elevated nitrate were widespread in the ground water, and to assist in identification of picloram sources impacting the City of Juliaetta Public Water Supply (PWS) Well #5 (DEQ Site ID 2963) (Figure 25). During initial discussions and

review of the PWS's source water delineation (zone of influence) for Juliaetta Well #5, it was determined that a surface water monitoring component could be helpful in identifying potential sources of picloram, as the Potlatch River intersected the delineation (Figure 25). As such, a possible hydraulic connection (e.g., losing stream segment) between the surface water and ground water was considered a potential source of picloram.

A review of possible sources of the picloram included ISDA discussions with the PWS operator as well as possible pesticide applicators in the vicinity of well #5 and within the project area. GRASLAN, a restricted use pesticide which has active ingredients of picloram (14.44%) and 2,4-D (43.62%) per the specimen label, was identified as having historic use in the watershed to control deeply-rooted weeds (e.g., Dalmatian Toadflax, Canada Thistle, Spotted Knapweed) (Cooper, 2022).

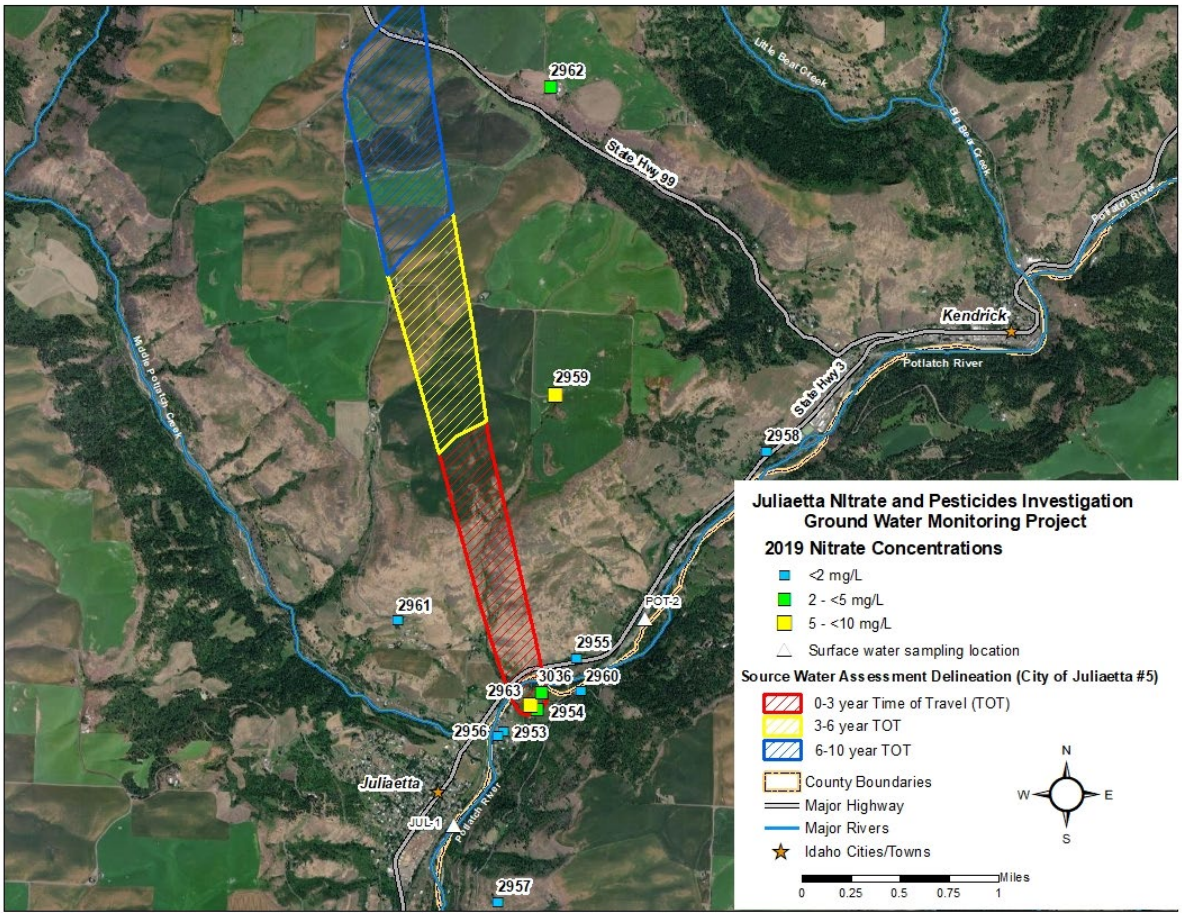


Figure 25. Site location and nitrate concentration map — Juliaetta Nitrate Investigation.

2.4.3.2 Methods and Results

DEQ and ISDA collected ground water and surface water quality samples in the Juliaetta area from July 22–24, 2019. Twelve wells were sampled for pesticides (Appendix C), common ions, bacteria (total coliform and *E. coli*), and nitrate. Ammonia samples were also collected from select wells, based on dissolved oxygen concentrations. The goal was to evaluate ground water in the Juliaetta/Potlatch Watershed area for the presence of possible pesticide (picloram) and

nitrogen impacts, where no known monitoring for pesticide concentrations in the ground water has been done outside of the public water system. Well selection was initially targeted within the Juliaetta Well #5 (2963) source water delineation (zone of influence/capture zone) and ultimately determined by acquired well owner permissions.

Samples were collected in accordance with the quality assurance project plan (QAPP) (DEQ 2019a) and the field sampling plan (FSP) (DEQ 2019a). Pesticide samples were submitted to the Idaho Food Quality Assurance Laboratory (IFQAL) in Twin Falls, ID for analysis. The samples for nitrate, ammonia (for three wells), bacteria, and common ions analysis were submitted to Anatek Labs in Moscow, ID for analysis.

Water quality field parameters (i.e., pH, temperature, specific conductance, and DO) were measured at each sample location before sample collection to ensure adequate purging of the well for a representative sample of the local aquifer (Table 41).

Table 41. Water quality field parameters—Juliaetta Nitrate Investigation Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Water Temperature (°C)	Specific Conductance (µS/cm)	pH[A]	Dissolved Oxygen (mg/L)
2953	50	07/23/2019	12.6	183.5	6.53	3.67
2954	173	07/22/2019	25.0	286.8	7.52	9.40
2955	Unk	07/22/2019	15.3	280.4	7.57	9.32
2956	77	07/23/2019	13.1	333.3	8.36	0.11
2957	700	07/22/2019	19.3	287.8	7.72	6.73
2958	Unk	07/24/2019	14.3	326.7	7.84	2.10
2959	75	07/24/2019	12.6	338.7	7.55	8.69
2960	220	07/23/2019	13.7	298.7	7.51	6.35
2961	250	07/22/2019	16.5	309.8	7.58	8.75
2962	108	07/24/2019	13.4	246.3	7.81	12.63
2963	758	07/22/2019	14.3	524.4	7.56	5.45
3036	Unk	07/22/2019	13.7	447.1	7.48	6.80

Notes: ft bgs = feet below ground surface; °C = degrees Celsius; µS/cm = microsiemens/centimeter; pH = standard pH units; mg/L = milligrams per liter; Unk = Unknown. Well log not found.

[A] Contaminant with a National Secondary Drinking Water Regulation standard. The NSDWR for pH is 6.5-8.5. NSDWR standards are recommended limits for public water systems but can be applied to private wells to evaluate water quality.

In addition to the ground water monitoring, surface water quality monitoring was conducted at 2 locations along the Potlach River (JUL-1 and POT-2)(Figure 25). A total of 5 surface water samples (4 samples from 2 locations and 2 sample dates and 1 duplicate) were submitted for analysis using the IFQAL Pesticide Suite (Appendix C). All surface water samples were collected by the ISDA Water Program Lead following the methods set forth in the ISDA Ground Water and Surface Water SOPs (ISDA 2017). These surface water data are not presented in this report but may be obtained from ISDA.

Pesticide Results

Of the 12 wells sampled, only one (City of Juliaetta's Well #5/Well 2963), had detections of pesticides. Picloram (herbicide) was detected at a concentration of 4.2 µg/L, which is less than

1% of the Drinking Water Standard (MCL) of 500 µg/L. Triclopyr (a general use herbicide used to control woody plants and broadleaf weeds) was also identified in the well at a concentration of 0.17 µg/L, which is also less than 1% of the non-enforceable Human Health Benchmarks for Pesticides, Lifetime Chronic exposure of 300 µg/L. None of the other 11 wells had any reportable pesticide detections.

The surface water samples did not have detections of picloram and thus did not provide indications the Potlach River is a contributing source of the picloram in the PWS well.

Nutrient Results

Nitrate concentrations ranged from non-detect (<0.010 mg/L) to 8.0 mg/L (Table 42). None of the samples exceeded the MCL of 10 mg/L for nitrate. The median nitrate concentration was 1.65 mg/L. The mean (average) concentration was 2.49 mg/L. Three sites (2953, 2956, and 2958) were analyzed for ammonia due to low DO concentrations— two sites had results below the detection limit for ammonia. Well 2956 had a concentration of 0.12 mg/L.

Table 42. Nutrient and nutrient-related isotope results—Juliaetta Nitrate Investigation Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Nutrient Concentration	
			(Nitrate + Nitrite)[A]	Ammonia
			(mg/L)	
Water Quality Standard:			**10**	**No Stand.**
2953	50	07/23/2019	0.51	<0.050
2954	173	07/22/2019	3.8	—
2955	Unk	07/22/2019	1.6	—
2956	77	07/23/2019	<0.010	0.12
2957	700	07/22/2019	0.46	—
2958	Unk	07/24/2019	1.3	<0.050
2959	75	07/24/2019	7.5	—
2960	220	07/23/2019	1.7	—
2961	250	07/22/2019	0.53	—
2962	108	07/24/2019	2.2	—
2963	758	07/22/2019	8.0	—
3036	Unk	07/22/2019	2.3	—

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; Unk = Unknown. Well log not found; (—) = Not Analyzed; No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard established;
[A] Contaminant with a National Primary Drinking Water Regulation standard.

Common Ion Results

Results for common ions are presented in Table 43 and Figure 26. No primary or secondary standards were exceeded in any of the 12 wells.

The Piper diagram indicates that samples from all wells, except Well 3036, have similar water chemistry. This well is completed to 700 feet bgs and is only shallower than Well 2963, which is completed to 738 feet bgs. The anomalous water chemistry in samples from Well 3036 suggest this well is drawing water from different aquifer materials than the other wells.

Table 43. Common ion and Total Dissolved Solids results—Juliaetta Nitrate Investigation Ground Water Monitoring Project

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Alkalinity as (CaCO3)	Calcium	Chloride[A]	Fluoride[AB]	Magnesium	Potassium	Sodium	Sulfate[A]
			(mg/L)							
Water Quality Standard:			**No Stand.**	**No Stand.**	**250**	**2.0/4**	**No Stand.**	**No Stand.**	**No Stand.**	**250**
2953	50	07/23/2019	75.2	15	7.48	<0.20	6.4	5.9	7.8	3.40
2954	173	07/22/2019	158	35	5.54	<0.20	14	4.4	15	7.69
2955	Unk	07/22/2019	133	26	1.34	0.223	9.8	3.8	14	3.79
2956	77	07/23/2019	149	24	8.26	0.306	12	2.7	24	12.4
2957	700	07/22/2019	134	19	1.37	0.364	7.4	5.5	27	6.99
2958	Unk	07/24/2019	158	29	2.59	0.266	14	2.6	16	9.07
2959	75	07/24/2019	133	36	0.688	0.402	12	0.82	12	9.37
2960	220	07/23/2019	129	28	8.85	<0.20	12	2.8	11	5.48
2961	250	07/22/2019	153	24	1.55	<0.20	14	5.9	16	4.47
2962	108	07/24/2019	115	23	0.837	0.349	11	2.9	9.4	3.57
2963	758	07/22/2019	205	47	11.9	0.208	20	5.1	26	14.9
3036	Unk	07/22/2019	215	44	8.13	<0.20	18	4.9	18	8.58

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; Unk=Unknown. well log not found.; No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established;

[A] Contaminant with a National Secondary Drinking Water Regulation standard.

[B] Contaminant with a National Primary Drinking Water Regulation standard.

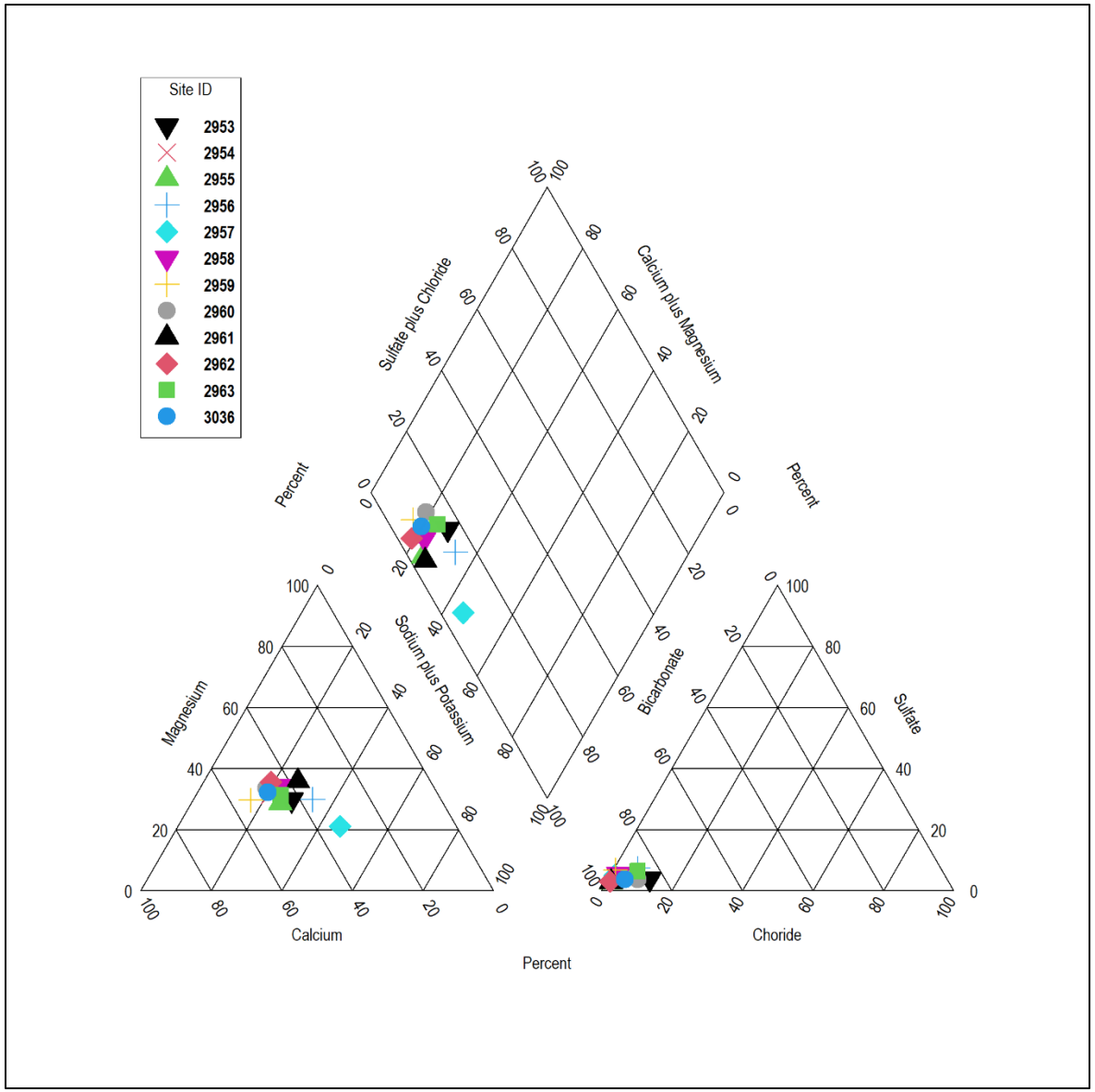


Figure 26. Piper diagram for July 2019 results — Juliaetta Nitrate Investigation Ground Water Monitoring Project.

Bacteria Results

Results of bacteria sampling are presented in Table 44. Three of the 12 wells sampled (2953, 2955, and 2962) were positive for bacteria—both TC and *E. coli* were detected in the three wells. The TC concentrations ranged from 14.8 MPN/100 mL to 146.4 MPN/100 mL and the *E. coli* detections ranged from 1.0 MPN/100mL to 12.0 MPN/100 mL.

It is possible Well 2953 has some influence from a surface water source given it had the lowest temperature, specific conductance, pH, alkalinity, calcium, and magnesium in addition to the TC detection.

Table 44. Bacteria Results—Juliaetta Nitrate Investigation Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Bacteria Concentrations[A]	
			E. coli	Total Coliform
			(MPN/100 mL)	
Water Quality Standard:			**<1**	**1.0**
2953	50	07/23/2019	**1.0**	14.8
2954	173	07/22/2019	<1	1.0
2955	Unk	07/22/2019	**12.0**	146.4
2956	77	07/23/2019	<1	<1
2957	700	07/22/2019	<1	<1
2958	Unk	07/24/2019	<1	<1
2959	75	07/24/2019	<1	<1
2960	220	07/23/2019	<1	<1
2961	250	07/22/2019	<1	<1
2962	108	07/24/2019	**2.0**	30.5
2963	758	07/22/2019	<1	<1
3036	Unk	07/22/2019	<1	<1

Notes: ft bgs = feet below ground surface; MPN/100 mL = most probable number per 100 milliliters; Unk=Unknown. Well log not found; Bolded shaded numbers indicate either an EPA National Primary Drinking Water Regulation (NPDWR) standard, expressed as a maximum contaminant level (MCL), or an Idaho Ground Water Quality Rule (IDAPA 58.01.11.200) standard was reached or exceeded. These regulations are applicable for public water systems only but are used to evaluate water quality in private wells.

[A] Total coliform and *E. coli* standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present. Although the standards are given in cfu/100 mL, analytical results provided in MPN/100 mL are acceptable for comparison to the standard.

2.4.3.3 Conclusions

Sampling was conducted in the City of Juliaetta PWS Well #5 and surrounding area to determine whether ground water impacts from picloram use were widespread and whether elevated nitrate was a concern for this area. Picloram was only detected in Juliaetta Well #5 and the nitrate concentration was higher as compared to the other wells sampled as part of this project. Well 2954 which is approximately 70 meters upgradient from the PWS well had no detectable pesticides and had nitrate measured at 3.8 mg/L, which is less than half of the 8 mg/L measured in the PWS well (Figure 25). Well 3036 approximately 150 meters up-gradient from the PWS well, and within the source water delineation, had no detectable pesticide concentrations and nitrate measured at 2.3 mg/L.

The 2019 project results seem to suggest that picloram is not a wide-spread concern in the ground water in and near the City of Juliaetta. It is assumed that the picloram in the PWS well is from a currently unidentified localized source. It is also undetermined if the picloram in the PWS Well #5 is a legacy issue or from more recent applications. Historical ISDA data for the PWS Well #5 was evaluated and no picloram was detected, suggesting the impacts or source was introduced between 1997 and 2016. In 1997, ISDA collected and analyzed samples from the PWS well (formerly ISDA well number 7203501). On 7 May 1997, there was a detection of Prometon at 0.009 µg/L. There was no follow-up nor additional monitoring by ISDA.

2.4.3.4 Recommendations

Additional monitoring may be necessary to determine contaminant sources if the concentrations increase or are identified in other PWS wells.

2.5 Pocatello Region

In 2019, the DEQ Pocatello regional office used public funds to conduct a ground water quality monitoring project on the extent of a historical ethylene dibromide (EDB) plume.

2.5.1 Ethylene Dibromide Assessment Project

2.5.1.1 Purpose and Background

This project is a follow-up assessment of an area exposed to EDB (also known as 1,2-Dibromoethane) contamination in Bannock and Power Counties near Chubbuck, Idaho (DeJongh, 1996; Safford, 2005). Dibromochloropropane (DBCP), a soil fumigant formerly used in agriculture, was also included in the analyses. This sampling effort assessed the current state of EDB contamination south of Reservation Road and east of Laughran/Tank Farm Road (Figure 27). The data will provide guidance for future sampling. No synoptic sampling of the wells off of the reservation has been conducted since 2005 and potentially-impacted residents are generally unaware of the current state of ground water contamination in the area.

EDB is a chemical manufactured for use as a solvent, waterproofing agent, chemical intermediate in the synthesis of dyes and pharmaceuticals, and as a precursor in the synthesis of vinyl chloride. It is also used in the treatment of felled logs for bark beetle and control of wax moths in beehives. Before leaded gasoline was phased out in the United States, the primary use of EDB was as an anti-knock compound. In the 1970s and early 1980s, EDB was used as a pesticide in row crops and orchards and as a soil fumigant on golf courses. By 1984, EPA regulations had eliminated most of the use of EDB as a pesticide. However, EDB is still manufactured for other purposes (HHS, 2005).

In 1993, EDB was detected in the drinking water supply of the Fort Hall Indian Reservation at levels exceeding the MCL of 0.05 micrograms per liter (µg/L). Further sampling showed that EDB was found in drinking water supplies in an area encompassing about 63 square miles, both on and off the reservation. The plume of EDB in north Bannock County is presumed to have originated on the Fort Hall Indian Reservation where EDB was applied as a pesticide in row crops. In the late 1990s, the EPA conducted a Phase I Site Assessment on the reservation to

locate a point-source of EDB. No point-source was found and the site was never listed on the EPA's National Priority List. No known pesticide applications of EDB occurred outside the exterior boundaries of the reservation, but EDB contamination of private and public water supplies persists in the area south and east of the reservation (Safford, 2005).

EDB is considered a dense non-aqueous phase liquid (DNAPL) and apparent concentrations of this relatively insoluble compound can be affected by the length and position of the screened interval within a well and samples from adjacent wells may indicate significantly different levels of contamination, potentially interfering with characterization of the plume. The volatility of the compound makes the collection of a representative sample more difficult and the very low drinking water standard makes sampling by the well owner generally unadvisable. Residents in the impacted area are reliant on DEQ for reliable information regarding their potential exposure to this compound.

The study area is in north Bannock County and eastern Power County in southeast Idaho (Figure 26). The American Falls Reservoir lies 2–3 miles to the northwest and the Portneuf River is within the study area. The Fort Hall Indian Reservation borders the area to the north and west. Land use is semi-rural residential surrounded by agricultural uses; heavy industrial areas are located to the southwest.

Two primary aquifers exist in the study area. The shallower aquifer is composed of sand and gravel (Michaud Gravel), whereas the deeper aquifer is in the ESRP basalt. For wells used in the 2005 study, driller's logs indicate that sand and gravel wells are drilled to depths between 65 and 186 feet bgs, and basalt wells are drilled to depths between 160 and 204 feet bgs. Mean depth to ground water is 65 feet (Safford, 2005). Ground water flow in the area is generally to the southwest (Parliman and Young, 1992). The previous EDB studies in the area found the presence of the compound in both the upper alluvial and lower basalt aquifers.

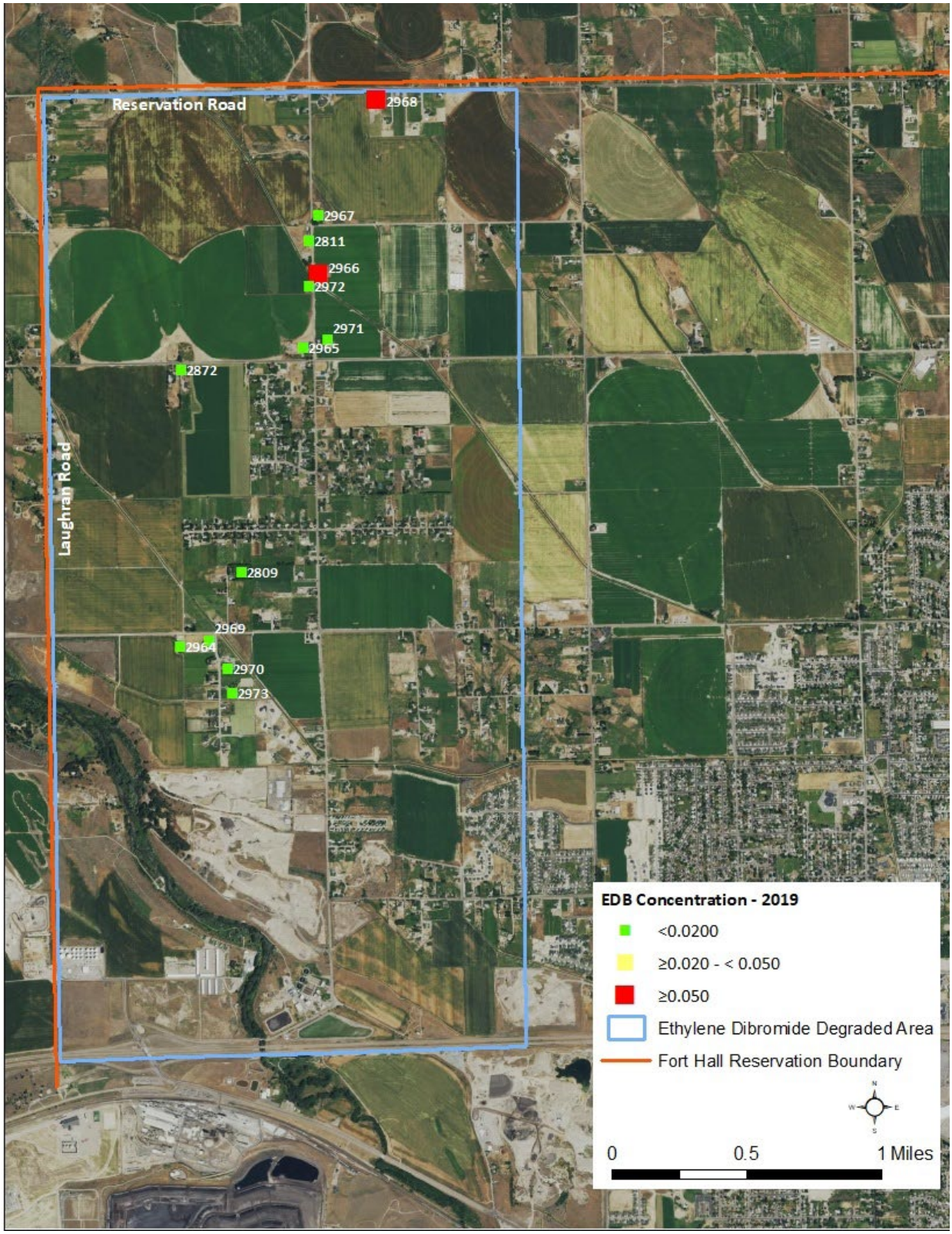


Figure 27. Ethylene Dibromide 2019 sample results—Ethylene Dibromide Assessment Project Ground Water Monitoring Project.

2.5.1.2 Methods and Results

The 2019 sampling campaign focused on the area, SE of the reservation boundary, in which EDB has been previously detected. To inform additional ground water users and expand the data set regarding the extent of contamination, sampling locations were primarily selected from those wells that had not been previously sampled. A total of 13 sites were sampled in 2019 for EDB and DBCP. Samples were sent to the IAS EnviroChem lab in Pocatello, ID and Anatek Labs in Moscow, ID for analysis. The resultant data will provide guidance for additional sampling and subsequent data collection efforts. All sampling was conducted in accordance with the project QAPP (DEQ 2011c) and the FSP (DEQ 2018k).

Water quality field parameters (i.e., pH, temperature, specific conductance, DO) were measured before sample collection to ensure adequate purging of the well for a representative sample of the local aquifer (Table 45).

Table 45. Water quality field parameters—Ethylene Dibromide Assessment Project Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Water Temperature (°C)	Specific Conductance (µS/cm)	pH[A]	Dissolved Oxygen (mg/L)
2809	Unk	09/25/2019	14.08	603	7.16	7.43
2811	112	10/02/2019	11.59	1050	7.17	8.28
2872	Unk	09/26/2019	13.43	775	7.24	5.09
2964	80	09/26/2019	14.08	647	7.00	6.87
2965	80	09/30/2019	12.59	745	7.31	6.87
2966	185	10/02/2019	13.13	585	7.55	5.46
2967	105	10/02/2019	12.22	899	7.18	3.79
2968	187	09/26/2019	12.41	555	7.28	5.80
2969	150	09/25/2019	13.84	627	7.18	7.08
2970	100	09/30/2019	13.84	644	7.23	7.09
2971	Unk	09/30/2019	12.71	633	7.22	7.68
2972	Unk	10/02/2019	13.05	822	6.96	4.74
2973	140	09/25/2019	13.84	680	7.36	7.18

Notes: ft bgs = feet below ground surface; °C = degrees Celsius; µS/cm = microsiemens/centimeter; pH = standard pH units; mg/L = milligrams per liter; Unk = Unknown. Well log not found.

[A] Contaminant with a National Secondary Drinking Water Regulation standard. The NSDWR for pH is 6.5-8.5. NSDWR standards are recommended limits for public water systems but can be applied to private wells to evaluate water quality.

EDB and DBCP Results

EDB and DBCP results are presented in Table 46. Wells 2966 and 2968 had EDB concentrations above the MCL for drinking water (0.05 µg/L), which were 0.086 µg/L and 0.056 µg/L, respectively. No other wells had detections above the detection limit (.020 µg/L). No sites had detections of DBCP.

The two deepest wells contained detectable concentrations of EDB. However, the construction and geology of those wells does not allow for a reliable determination as to which aquifer, or both, is the source of the contamination.

Table 46. VOC results—Ethylene Dibromide Assessment Project Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Dibromochloropropane (DBCP)[A]	1,2-Dibromoethane (EDB)[A]
			(µg/L)	
Water Quality Standard:			**0.2**	**0.05**
2809	Unk	09/25/2019	<0.040	<0.020
2811	112	10/02/2019	<0.040	<0.020
2872	Unk	09/26/2019	<0.040	<0.020
2964	80	09/26/2019	<0.040	<0.020
2965	80	09/30/2019	<0.040	<0.020
2966	185	10/02/2019	<0.040	**0.086**
2967	105	10/02/2019	<0.040	<0.020
2968	187	09/26/2019	<0.040	**0.054**
2969	150	09/25/2019	<0.040	<0.020
2970	100	09/30/2019	<0.040	<0.020
2971	Unk	09/30/2019	<0.040	<0.020
2972	Unk	10/02/2019	<0.040	<0.020
2973	140	09/25/2019	<0.040	<0.020

Notes: ft bgs = feet below ground surface; µg/L = micrograms per liter; Unk = Unknown. Well log not found.

[A] Contaminant with a National Primary Drinking Water Regulation standard.

2.5.1.3 Conclusions

DEQ was able to assess the current level of impact of EDB contamination at 13 well locations. Property owners and residents were advised of the concentration of EDB in their water source. EDB concentrations at two locations exceeded the drinking water standard (0.05 µg/L). The existing data indicate continuing areas of significant, localized contamination appear to be concentrated along an apparent plume axis trending from northeast to southwest but are spread along its length from the up-gradient portion of the study area to the down-gradient boundary.

2.5.1.4 Recommendations

The data collected through this project provide a reference for future sampling. Additional sampling locations will be identified to further define the extent of the EDB plume and assess the concentration of the contaminant at those locations. In future sampling, DEQ may evaluate the potential correlation between EDB concentration and well depth and take into consideration whether the screened interval crosses the sand and gravel/basalt boundary. Residents in the impacted area will continue to be reliant on DEQ for reliable information regarding their potential exposure to this compound and continued monitoring of new and existing sampling locations will be required into the foreseeable future.

2.6 Twin Falls Region

One ground water quality monitoring project was conducted in the Twin Falls region in 2019 using public funds.

2.6.1 Rupert Well Investigation

This section summarizes the 2019 sampling results from a ground water quality investigation in Minidoka County, Idaho.

2.6.1.1 Purpose and Background

The project is a continuation of a project initiated in 2018 to confirm acute concentrations of nitrate and nitrite concentrations detected in water samples collected from a domestic well. At the annual Ground Water Awareness Fair held in Heyburn in April 2018, a private well sample was presented showing an approximate nitrate concentration of >50 mg/L and a nitrite concentration of >10 mg/L (via nitrate test strip), from a well south of Rupert in Minidoka County. These concentrations are well above the drinking water MCL of 10 mg/L for nitrate and 1 mg/L for nitrite. Confirmation sampling and laboratory analysis corroborated the initial readings, and, additionally, revealed high concentrations of sulfate (456 mg/L) and ammonia (150 mg/L) were present in the well water. A project was undertaken to resample the contaminated well (Well 2741) and wells in the immediate area to determine the source and spatial distribution of the ground water contamination in the local aquifer.

The project area is in southeast Minidoka County in the southwestern part of the upper Snake River Basin. Regional ground water flow in the Eastern Snake River Plain Aquifer (ESRPA) is generally to the west-southwest. The project area is approximately two miles southwest of Rupert and is underlain by a shallow perched aquifer, caused by an underlying clay layer which limits downward movement of recharge water into the deeper aquifer. According to residents, this perched aquifer did not exist before the canal system was built in 1907 (Rupert et al. 1996). An evaluation of seven well driller logs in the vicinity shows the subsurface lithology consisting of sand, gravel, and sandy clay down to 31-35 feet below ground surface (bgs) followed by brown and/or gray clay between 31-40 feet bgs. Depth to ground water varied from 5–20 feet.

Well 2741 is located on a residential parcel immediately adjacent to the southern perimeter of an agricultural chemical distribution facility (Figure 27) where various bulk fertilizer and pesticide products are stored, mixed, and distributed to local producers. Liquid products on the site include urea-ammonium nitrate, anhydrous ammonia, sulfuric acid, and phosphoric acid. Dry bulk products include urea, potash, ammonium sulfate, boron, manganese, iron, iron sulfate, zinc, and mono-ammonium phosphate. The facility has been in this location since 1978. Land use in the populated southern region of the county is predominantly irrigated agriculture. Well 2741 was drilled in October 2017 and is completed to a depth of 34 feet, cased down to 26 feet, sealed with bentonite to 22 feet, and screened from 26–31 feet. Depth to ground water was 6 feet bgs at the time of drilling. The septic system for the property was installed at about the same time. In 2019, two neighboring domestic wells (2742 and 2743) located to the west and north of Well 2741 were reported by the owners to be shallow wells less than 40 feet deep, of indeterminate age, and no driller's logs are available.

The use of shallow wells for domestic water supplies in this alluvial aquifer is very common in Minidoka County seemingly because they are less expensive to construct. Shallow wells are more susceptible to contamination from surface activities. The area is located within the

Minidoka NPA. The 2020 NPA ranking indicated the Minidoka NPA as a High Priority area with 41% of sampled sites having nitrate concentrations greater than 5 mg/L.

The purpose of this project was to collect ground water quality data to confirm and outline the extent of current ground water contamination near a 32-acre parcel in use by an agricultural chemical distribution facility (also referred to in this document as the project site), located south of Rupert, Idaho. Specifically, the objective of the ground water sampling conducted by DEQ was to determine if nitrate results in shallow domestic wells located adjacent to the project site were still elevated above the drinking water standard (as compared to 2018 results).

Two sampling rounds were conducted in 2019, one in March and one in November.

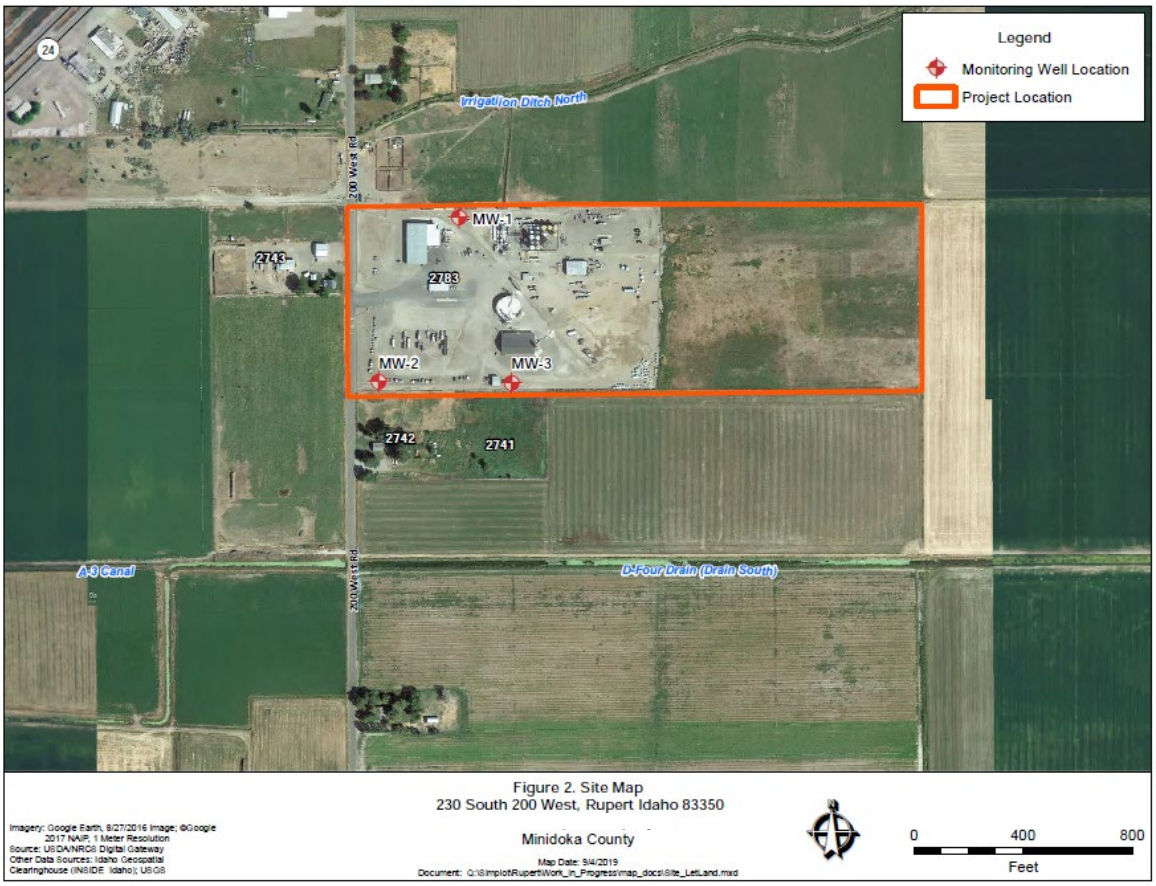


Figure 28. Site location map—Rupert Well Investigation Ground Water Monitoring Project.

2.6.1.2 Methods and Results

On March 29, 2019, monitoring wells MW1, MW2, and MW-3 were constructed by a contractor of the agricultural chemical distribution facility on their property. These wells were completed to target the shallow aquifer and were arranged as one up-gradient (MW-1) and two down-gradient (MW-2 and MW-3) monitoring wells (Figure 27). The contractor collected their first monitoring samples for pesticides immediately following the completion of the wells in addition to taking ground water level measurements and soil quality tests. The contractor conducted two additional sampling events in August and December of 2019 (those data are not included in this report). This sampling was conducted by the contractor hired by the agricultural chemical distribution facility and overseen by DEQ representatives. Further details about the agricultural chemical distribution facility's independent sampling investigation are available via the DEQ Twin Falls Regional Office.

In addition to the sampling being conducted by the agricultural chemical distribution facility, DEQ conducted two rounds of ground water monitoring sampling on domestic wells in March and November 2019 (Wells 2741, 2742, and 2743) adjacent to the project area (Figure 27). DEQ samples were collected in accordance with the regional QAPP and FSP. These wells were purged and water quality field parameters (pH, temperature, specific conductance, and DO) were monitored and recorded until stable to ensure a representative sample of the local aquifer (Table 47).

During November sampling, no reading was recorded for specific conductivity in Well 2741, due to an equipment error. Dissolved oxygen (DO) was higher in the spring than in the fall in Well 2741 and Well 2742. In the fall, DO was below 0.5 mg/L, which is considered anoxic, in both wells (Table 47). Lack of landowner permission resulted in the exclusion of Well 2743 from the November sampling round.

Table 47. Water quality field parameters—Rupert Well Investigation Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Water Temperature (°C)	Specific Conductance (µS/cm)	pH[A]	Dissolved Oxygen (mg/L)
2741	34	03/25/2019	15.63	—	7.54	1.62
		11/07/2019	13.42	—	7.54	0.19
2742	Unk	03/25/2019	10.50	944	7.54	0.74
		11/07/2019	11.45	967	7.07	0.32
2743	Unk	03/25/2019	12.32	988	7.40	0.07

Notes: ft bgs = feet below ground surface; °C = degrees Celsius; µS/cm = microsiemens/centimeter; pH = standard pH units; mg/L = milligrams per liter; Unk = Unknown; (—) = not analyzed. Well log not found.

[A] Contaminant with a National Secondary Drinking Water Regulation standard. The NSDWR for pH is 6.5-8.5. NSDWR standards are recommended limits for public water systems but can be applied to private wells to evaluate water quality.

General Chemistry Results

A trilinear plot is a way of visualizing the chemistry of a water sample and the dominant ion composition. A trilinear plot of the results for all three project sampling rounds was calculated to also delineate variability in water quality among the sites (Figure 28). Two of the three samples are representative of the calcium-magnesium-bicarbonate type water generally found in the ESRPA. Well 2741 stands apart from the others, representing no specific dominant cation-anion pair but showing a higher sulfate-chloride influence.

In both sampling rounds, Well 2741 also contained chloride, sodium, potassium, sulfate, and total dissolved solids (TDS) concentrations 2-4 times higher than the other shallow wells. All are constituents in the bulk fertilizers stored at the agricultural chemical distribution facility.

Table 48. Common Ion and Total Dissolved Solids results—Rupert Well Investigation Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Alkalinity (CaCO3)	Bicarbonate	Calcium	Chloride[A]	Magnesium (mg/L)	Potassium	Sodium	Sulfate[A]	Total Dissolved Solids[A]
Primary/Secondary Standard:			**No Stand.**	**No Stand.**	**No Stand.**	**250**	**No Stand.**	**No Stand.**	**No Stand.**	**250**	**500**
2741	34	03/25/2019	<1	485	114	81.4	44.4	36.0	49.0	*334*	*1220*
		11/07/2019	450	—	138	81.3	56.2	42.4	68.6	278	*760*
2742	Unk	03/25/2019	332	332	77.3	38.0	44.4	9.02	31.5	69.1	*620*
		11/07/2019	324	—	96.5	34.0	53.1	9.29	30.4	69.6	420
2743	Unk	03/25/2019	<1	353	95.6	44.9	42.0	12.0	30.7	70.5	*700*

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; Unk = Unknown. Well log not found; (—) = Not Analyzed; No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established; Italicized shaded numbers indicate EPA's NSDWR standard was exceeded. Regulations are only applicable for public water systems, but may still be used to evaluate water quality in private wells.

[A] Contaminant with a National Secondary Drinking Water Regulation standard.

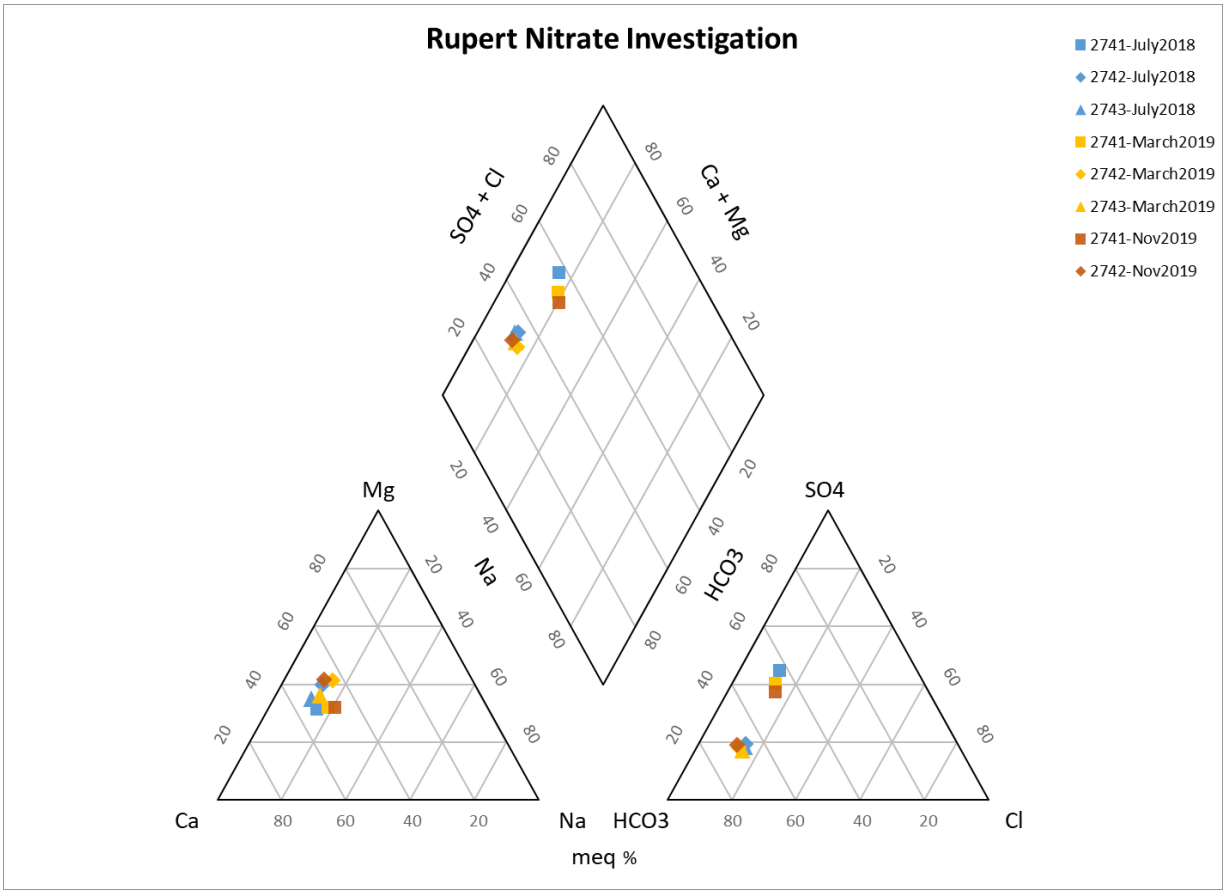


Figure 29. Piper diagram for July 2018–November 2019 results — Rupert Well Investigation Ground Water Monitoring Project.

Nutrient Results

Once purged, DEQ utilized nitrate test strips to measure both nitrate and nitrite levels of the domestic wells. The results of the sampling indicated that nitrate levels in Well 2741 remained greater than 50 mg/L during both sampling rounds. Lab results confirmed the nitrate test strip results taken in the field (Table 49). March 2019 nitrate results in all three wells decreased from 2018 sampling results (2018 report). Nitrate in Well 2741 continued to decrease between March and November 2019, but the concentration in Well 2742 increased from below the MCL in the spring to exceeding it in the fall.

Table 49. Nutrient and nutrient-related isotope results—Rupert Well Investigation Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Nutrient Concentration			
			Nitrite[A]	Nitrate[A]	Ammonia	Phosphorus
			(mg/L)			
Water Quality Standard:			**1.0**	**10**	**No Stand.**	**No Stand.**
2741	34	03/25/2019	<0.20	**99.8**	141J	0.88
		11/07/2019	<0.20	**89.8**	163	0.62
2742	Unk	03/25/2019	<0.20	8.46	0.07	0.14
		11/07/2019	<0.20	**10.7**	0.07	0.12
2743	Unk	03/25/2019	0.56	**10.7**	<0.05	0.09

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; Unk = Unknown. Well log not found; No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established; J = The analyte was detected. The associated numeric value is considered an estimated quantity. Bolded red numbers indicate either an EPA National Primary Drinking Water Regulation (NPDWR) standard, expressed as a maximum contaminant level (MCL), or an Idaho Ground Water Quality Rule (IDAPA 58.01.11.200) standard was reached or exceeded. These regulations are applicable for public water systems only but are used to evaluate water quality in private wells.

[A] Contaminant with a National Primary Drinking Water Regulation standard.

All three well samples were analyzed for ammonia, given the low (below 2 mg/L) DO readings in the field. Well 2743 had no detectable ammonia in the March 2019 sampling. Well 2742 had ammonia concentrations slightly above the detection limit (0.05 mg/L) that did not change between March and November. Most notable are the levels of nitrate (99.8, 89.8 mg/L) and ammonia (141,163 mg/L) in Well 2741. The concentrations of nitrate and ammonia in Well 2741 are extremely high compared to values found in the literature for ground water in the ESRPA (Fox and Carlson 2003; Rupert 1994; Rupert 1997; Frans et.al. 2012). Nitrate levels below 1 or 2 mg/L are considered background levels. Occasionally, a well sample in the ESRPA, particularly in a nitrate priority area, will contain a level above 50 mg/L, but only Well 2741 has recorded a nitrate level above 100 mg/L.

Ammonia concentrations found in Well 2741 greatly exceed the health advisory and levels that may be expected from a single septic drainfield. In general, the concentrations of nitrate, ammonia, and sulfate found in Well 2741 would indicate the presence of a significant localized contaminant source. In a USGS study in eastern Nebraska, well water likely derived from septic system seepage contained a maximum concentration of 1.39 mg/L ammonia-N (Verstraeten et.al. 2004). The Lifetime Health Advisory for ammonia is 30 mg/L (EPA 2018).

Phosphorous concentrations in samples from Well 2741 were approximately five times greater than concentrations detected in Wells 2742 and 2743. Phosphorus, nitrogen, and potassium are the main three nutrients in fertilizers. The elevated levels of these three elements suggest agricultural chemicals are the source of the ground water degradation in Well 2741.

Dissolved oxygen was present in Well 2741 along with high nitrate, while the other shallow wells which were more anoxic had much lower nitrate levels.

Bacteria Results

Total coliform colonies were present in Well 2741 and 2742, in the November sampling round (Table 50). However, *E. coli* were absent in all samples on both sampling dates.

Table 50. Bacteria Results—Rupert Well Investigation Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Bacteria Concentrations[A]	
			E. coli	Total Coliform
				Present(P)/Absent (A)[B]
Primary or Secondary Standard:			**<1**	**1.0**
2741	34	03/25/2019	<1	<1
		11/07/2019	<1	P
2742	Unk	03/25/2019	<1	<1
		11/07/2019	<1	P
2743	Unk	03/25/2019	<1	<1

Notes: ft bgs = feet below ground surface; P/A = present or absent of bacteria; Unk = Unknown. Well log not found.
[A] Total coliform and *E. coli* standards are from the Idaho Ground Water Quality Rule (IDAPA 58.01.11.200). An exceedance of the primary ground water quality standard for total coliform (indicated by gray shaded numbers) is not a violation of these rules. Total coliform is not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present.
[B]Presence (P) result is considered an exceedance.

Metals Results

Ground water samples collected in March 2019 were analyzed for iron. Iron was only detected at a level above the detection limit at Well 2741, but was below the secondary drinking water standard (Table 51).

Table 51. Metals results—Rupert Well Investigation Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Iron[A] (mg/L)
Primary or Secondary Standard:			**0.3**
2741	34	03/25/2019	0.09
2742	Unk	03/25/2019	<0.01
2743	Unk	03/25/2019	<0.01

Notes: ft bgs = feet below ground surface; mg/L = milligrams per liter; Unk = Unknown. Well log not found.
[A] Contaminant with a National Secondary Drinking Water Regulation standard.

Pesticides Results

The March 2019 pesticide results (Table 52) are consistent with results of pesticide analyses conducted on well water samples collected by the Idaho State Department of Agriculture ISDA in the area in 2018 and 2019. All 5 detected pesticides are used in Idaho on crops regularly grown in the Magic Valley and Rupert/Burley areas, and all are registered for use in Idaho. While none of the pesticides detected exceed an MCL, a Health Advisory Level or other recommendation, the combination of these five pesticides create a cocktail with an unknown toxicity. Individually each detection is within acceptable consumption levels, but the combination is concerning. The number of pesticides detected is not typical for wells in Idaho.

The number of detections is not indicative of normal usage and infiltration by pesticides in the State, or for this region when compared to nearby wells. When combined with other results (nutrients and the specific conductance), these are measurements not typical for the Rupert area.

Table 52. Pesticides results—Rupert Well Investigation Ground Water Monitoring Project.

DEQ Site ID	Well Depth (ft bgs)	Sample Date	Bromacil	Cycloate	EPTC	Hexazinone	Metolachlor
			(µg/L)				
Primary or Secondary Standard:			**No Stand.**				
2741	34	03/25/2019	3.6	1.0	3.9	4.1	0.42
2742	Unk	03/25/2019	0.76	<0.24	<0.24	<0.74	<0.24
2743	Unk	03/25/2019	2.1	<0.24	<0.24	<0.74	<0.24

Notes: ft bgs = feet below ground surface; µg/L = micrograms per liter; Unk = Unknown. Well log not found; No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established;

2.6.1.3 Conclusions

It is well documented that agricultural practices are a major source of nitrate in ground water of this area (Rupert 1996 and others). In the case of Well 2741, it seems likely that these concentrations are a result of 40 years of chemical product releases from the agricultural chemical distribution facility, mixed with run-on from nearby fields, settling onto the ground and infiltrating through the bare soil into the shallow aquifer. Lower nitrate levels in downgradient wells and reducing conditions (low DO) provides some evidence that denitrification may be occurring (Esser et al. 2009). Clark et.al. (2008) demonstrated that ammonium and nitrate losses in ground water contaminated by a fertilizer blending plant and chemical treatment ponds were due to anaerobic oxidation reactions.

Well 2741 has been decommissioned, but further investigation is needed to confirm the identity of the source(s) and to develop a better understanding of the biological and geochemical processes occurring down-gradient. The agricultural distribution facility owner has embarked on an investigation of the subsurface conditions on its property and has added three additional monitoring wells, since DEQ conducted the 2019 sampling rounds.

Results from the sampling conducted by DEQ in November 2019 indicated that the complainant's shallow domestic well (Well 2741), located adjacent and down-gradient to the project site, was still producing ground water with nitrate levels well above the drinking water quality standards.

Additional domestic wells in the area that were not immediately down-gradient of the project site were also sampled and indicated nitrate levels were below drinking water quality MCL.

Sample results indicated that ground water samples from Well 2741 continued to contain multiple contaminants at concentrations above drinking water standards and Idaho Ground Water Quality Standards.

2.6.1.4 Recommendations

DEQ is still actively coordinating with the agricultural distribution facility owner and will be monitoring results of the 2020 and 2021 quarterly ground water monitoring events.

3 DEQ Cooperative Project

This section presents data from special ground water quality monitoring projects conducted jointly by DEQ and other state agencies in calendar year 2019.

3.1 DEQ-IDWR Ground Water Monitoring Project

This section presents data from special ground water quality monitoring and investigation projects that were conducted jointly by DEQ and IDWR in calendar year 2019.

3.1.1 Purpose

The IDWR Statewide Ambient Ground Water Quality Monitoring Network assesses ground water quality across Idaho. DEQ partnered with IDWR to collect dissolved methane and nitrogen isotope ($\delta^{15}N$) samples to help assess ground water quality in Idaho. The counties of interest for the methane analysis included Canyon, Gem, and Payette. The ground water samples were collected by IDWR staff during statewide network sampling events, while DEQ paid for the analysis. The data will help establish baseline ground water quality for dissolved methane and identify any potential health threats associated with the gas. The addition of $\delta^{15}N$ will assist in future nitrogen source evaluation. Results are provided in Appendix A.

3.1.2 Methods and Results

IDWR collected 12 samples for dissolved methane from 12 domestic wells across the southwest portion of the state following its EPA-approved QAPP (IDWR 2019). Samples were collected using the Isotech Laboratories IsoFlask and were submitted to IBL in Boise, Idaho, and subcontracted to Isotech Laboratories, Inc. (a Weatherford Company) in Champaign, Illinois (Table A1). The IsoFlask was used due to its unique design that maintains (does not alter) the quantity or isotopic characteristic of any potential dissolved hydrocarbon gases in the sample (as compared to direct fill and inverted VOC sampling). Nitrogen isotope samples were also collected from 21 wells (sites with nitrate concentrations greater than 5 mg/L) in 2018 and 32 wells in 2019. The 2018 and 2019 isotope samples were submitted together to the University of Arizona in Tucson, AZ for analysis. Results for the 2018 samples are presented with the 2019 results (Appendix A).

Methane Results

Dissolved methane concentrations reported for this project ranged from nondetect (< 0.2 μg/L) to 42 μg/L (Table A1; Figure A1); five of the 12 samples were nondetect (below the method detection level of 0.20 μg/L). There is no MCL or NSDWR standard for dissolved methane in ground water. The hazard with methane in ground water occurs when dissolved methane exsolves (outgasses) from the water into the surrounding air or a confined space, where it can

potentially ignite and/or explode. The suggested action level for methane is 28,000 μg/L (Eltschlager et al. 2001). All results were below the explosive risk level.

Nitrogen Isotope Results

Nitrogen isotope ($\delta^{15}N$) ratios from 2018 and 2019 sampling efforts are reported in this annual report summary. The $\delta^{15}N$ ratios for the 2018 sampling effort ranged from 3.1‰ to 15‰ (Table A2; Figure A2). In 2018, one (1) of the 21 samples (0.5%) had a ratio consistent with inorganic sources (<4.0‰); 12 (57%) samples had ratios consistent with a mixed or organic source of nitrogen (4 – 9.0‰); 8 (38%) samples had ratios consistent with waste (animal or human) sources of nitrogen (>9.0‰) (Table 4).

The 2019 $\delta^{15}N$ results are presented in Table A3; Figure A2. The $\delta^{15}N$ ratios ranged from 3.0‰ to 22.3‰. Four of the 32 samples (12.5%) had a ratio consistent with inorganic sources (<4.0‰); 22 (69%) samples had ratios consistent with a mixed or organic source of nitrogen (4.0 – 9.0‰); 6 (19%) samples had ratios consistent with waste (animal or human) sources of nitrogen (Table 4).

3.1.3 Conclusions

The cooperative project between IDWR and DEQ resulted in the cost-effective collection of additional dissolved methane data that helped assess ground water quality in southern Idaho. These data will be helpful in establishing baseline concentrations of dissolved methane in drinking water in areas with potential for oil and gas development or ongoing gas exploration and development. The nitrogen isotope ratios provide one line of evidence for the potential sources of nitrogen contributing to the nitrate concentrations in ground water.

3.1.4 Recommendations

This project is an example of a collaborative effort between state agencies in Idaho saving time and money by using existing ground water monitoring networks and sampling schedules. IDWR and DEQ should continue these cooperative efforts to increase program efficiency and protect ground water quality in the state of Idaho.

3.2 DEQ-ISDA Ground Water Monitoring Project

This section presents data from special ground water quality monitoring and investigation projects that were conducted jointly by DEQ and ISDA in calendar year 2019 with a nutrient focus.

3.2.1 Purpose

The ISDA Ground Water Program has developed a ground water monitoring network across Idaho to assess the impacts of pesticide use on ground water quality. DEQ partnered with ISDA and paid for analysis of nitrate, ammonia, total phosphorus, and $\delta^{15}N$ to help assess ground water quality across the state. The ground water samples were collected by ISDA staff during pesticide sampling events, while DEQ paid for the analysis. The data will help identify areas of concern and potential health threats associated with degraded ground water quality.

Additionally, the information will be used to augment data from public water systems, the IDWR Statewide Ambient Ground Water Quality Monitoring Network, and local-scale monitoring projects to be used in the NPA ranking process.

3.2.2 Methods and Results

In cooperation with DEQ, ISDA submitted ground water samples from a total of 255 domestic wells across the state following its *Ambient Ground Water Quality Monitoring* QAPP (ISDA 2017a) and corresponding regional FSPs: *Ambient Ground Water Quality Monitoring: Boise Regional Office* FSP, *Ambient Ground Water Quality Monitoring: Idaho Falls Regional Office* FSP, *Ambient Ground Water Quality Monitoring: Northern Regional Office* FSP, *Ambient Ground Water Quality Monitoring: Pocatello Regional Office* FSP, and *Ambient Ground Water Quality Monitoring: Twin Falls Regional Office* FSP (ISDA 2019b-f). The analytes of interest included nitrate (nitrate-nitrite nitrogen), ammonia, total phosphorus, and the nitrogen ($\delta^{15}N$) isotope. Of the 255 wells sampled, 251 wells were sampled for nitrate. A subset of the 251 wells were also sampled for ammonia and total phosphorus, based on location within known areas with presence of elevated concentrations or special interest. Four wells in the Bliss project were sampled for total phosphorus only due to a sample collection error. In addition, 39 quality assurance samples (33 duplicates samples and 3 blank samples) were collected. Samples for nitrate, ammonia, and total phosphorus analysis were submitted to IBL in Boise, Idaho. Most samples with nitrate concentrations above 5 mg/L were sent to the University of Arizona in Tucson, AZ for $\delta^{15}N$ analysis. Water quality field parameters (pH, temperature, and specific conductivity) were measured and recorded before sample collection. Field parameter, ammonia, nitrate, and $\delta^{15}N$ results are shown in Table B1 (Appendix B).

Nitrate (Nitrate-Nitrite Nitrogen) Results

Nitrate (nitrate-nitrite nitrogen) concentrations for this project ranged from nondetect (less than 0.010 mg/L) to 79 mg/L. Out of the 251 samples collected for nitrate analysis, 64 samples (25.5%) were between 5 mg/L (half the EPA MCL of 10 mg/L) and 10 mg/L; 53 samples (21.1%) met or exceeded the MCL. Five of the 30 ISDA projects (Projects 530 [Ada County], 710 [Washington/Payette Counties], 790 [Cassia County], 865 [Owyhee County] and 950 [Nez Perce/Lewis/Idaho Counties]) sampled in 2019 represented 58.5% of the 10 mg/L or greater nitrate concentrations. In total, 174 samples (69.3%) were at or greater than 2 mg/L, indicating some type of nitrogen source associated with human activities; 2 mg/L is generally considered background level (DEQ 2014).

Well locations and nitrate concentrations are shown in Table B1 and Figures B1–B27.

Ammonia Results

A total of 16 wells were sampled for ammonia in addition to nitrate. Ammonia concentrations for this project ranged from nondetect (less than 0.050 mg/L) to 11 mg/L (Table B1). Median concentration was 6.9 mg/L. Most wells sampled for ammonia were within Owyhee County, which is known to have wells drilled into a deeper, confined aquifer with low or depleted dissolved oxygen concentrations. Sampling for ammonia can provide information on potential sources of nitrogen in ground water with environmental conditions not consistent with

presence of nitrate. There is currently no MCL or Ground Water Quality Rule standard for ammonia.

Total Phosphorus Results

A total of 26 wells from three projects (730 (Minidoka County (shallow), 740 (Minidoka County (deep), and 870 (Gooding County)) were sampled for phosphorus. Total phosphorus concentrations for this project ranged from 0.014 mg/L to 0.78 mg/L (Table B1). Median concentration was 0.041 mg/L. Phosphorus is not often a constituent of concern for ground water as it is typically adsorbed onto soil particles. Under certain environmental conditions, it can become mobile and enter ground water systems. This sampling was conducted to help augment research being conducted by the USGS as well as determine current phosphorus levels in the ground water. There is currently no MCL or Ground Water Quality Rule standard for phosphorus.

Nitrogen Isotope Results

DEQ submitted a total of 117 ISDA-collected nitrogen isotope ($\delta^{15}N$) samples from 115 wells (includes 2 duplicate samples not included in this report), with nitrate concentrations of approximately 5 mg/L or greater (Table B1). The measurable $\delta^{15}N$ values ranged from 0.6‰ to 29.6‰. The $\delta^{15}N$ values for 30 samples (8 or 27% of which were from project 710 [Washington/Payette Counties]) ranged from +0.6‰ to +3.9‰, suggesting commercial fertilizer as the likely nitrate source; 74 samples had $\delta^{15}N$ values between +4.0‰ and +8.7‰, suggesting organic nitrogen in soil or a mixed nitrogen source as the likely nitrate source; 11 samples had $\delta^{15}N$ values equal to or greater than +9‰, suggesting an animal or human waste source as the likely nitrate source (Table 4).

3.2.3 Conclusions

The cooperative project between ISDA and DEQ resulted in the cost-effective collection of additional nitrate and $\delta^{15}N$ data that helped assess ground water quality across the state. Out of the 251 samples collected for nitrate analysis, 53 samples (21.1%) met or exceeded the EPA nitrate MCL of 10 mg/L and 64 samples (25.5%) were between 5 mg/L and 10 mg/L. The nitrate results indicate degraded ground water in specific vulnerable aquifers within a few counties (Figures B1-B27). These data will be helpful in the next NPA delineation and ranking process conducted by DEQ and the *Ground Water Monitoring Technical Committee*. The $\delta^{15}N$ ratios provide one line of evidence for the potential sources of nitrogen contributing to the nitrate concentrations in ground water.

3.2.4 Recommendations

This project is an example of a collaborative effort between state agencies in Idaho saving time and money by using existing ground water monitoring networks and sampling schedules. ISDA and DEQ should continue these cooperative efforts to increase program efficiency and protect ground water quality in Idaho.

Additionally, when budgets allow, arsenic and uranium samples should be collected in areas with known elevated concentrations to provide more information regarding the presence of

those naturally occurring constituents of concern. This data provides valuable information to homeowners as well as for those working to better understand areas with concentrations at levels that present human health risks.

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Appendix A. Idaho Department of Water Resources Collected Data–2019

Table A1. 2019 dissolved methane results—DEQ-IDWR Joint Ground Water Monitoring Project.

Report Map ID	Site ID	County	Well Depth (ft bgs)	Sample Date	Water Temperature (°C)	pH[A]	Specific Conductance (mS/cm)	Dissolved Oxygen (mg/L)	Dissolved Methane[B] (µg/L)
Water Quality Standard:					**No Stand.**	**6.5-8.5**	**No Stand.**	**No Stand.**	**No Stand.[C]**
M-1	432654116375801	Canyon	435	7/11/2019	23.3	7.98	941	0.02	0.65
M-2	433022116385701	Canyon	494	7/16/2019	22.8	7.84	383.6	0.83	0.64
M-3	433521116402001	Canyon	398	7/31/2019	16	7.98	257.3	1.52	<0.2
M-4	433602116363801	Canyon	461	7/18/2019	24.5	7.15	239	5.91	<0.2
M-5	434207116422801	Canyon	420	7/30/2019	—	—	—	—	41
M-6	435206116562101	Payette	115	6/19/2019	18.6	7.56	747.1	6.92	0.3
M-7	440312116574501	Payette	220	8/6/2019	13.6	6.65	454.2	0.8	42
M-8	440649116532701	Payette	88	7/30/2019	18.8	7.71	584.3	2.25	<0.2
M-9	435304116413002	Gem	140	7/17/2019	23.5	7.85	93.77	0.18	0.48
M-10	435433116420501	Gem	57	7/17/2019	17.4	7.92	102.3	0.31	<0.2
M-11	435543116295501	Gem	91	7/20/2019	17.8	7.23	688.7	—	<0.2
M-12	435630116190901	Gem	128	8/5/2019	19.4	7.44	276.2	6.18	0.2

Notes: ft bgs = feet below ground surface; °C = degrees Celsius; µS/cm = microsiemens per centimeter; mg/L = milligrams per liter; µg/L = micrograms per liter; (-) = not analyzed or data are unavailable. No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established.

[A] Contaminant with a National Secondary Drinking Water Regulation standard. The NSDWR for pH is 6.5-8.5. NSDWR standards are recommended limits for public water systems but can be applied to private wells to evaluate water quality.

[B] Results were converted from mg/L (as reported by Isotech Labs) to µg/L for this report.

[C] Explosive risk for dissolved methane is 28,000 µg/L.

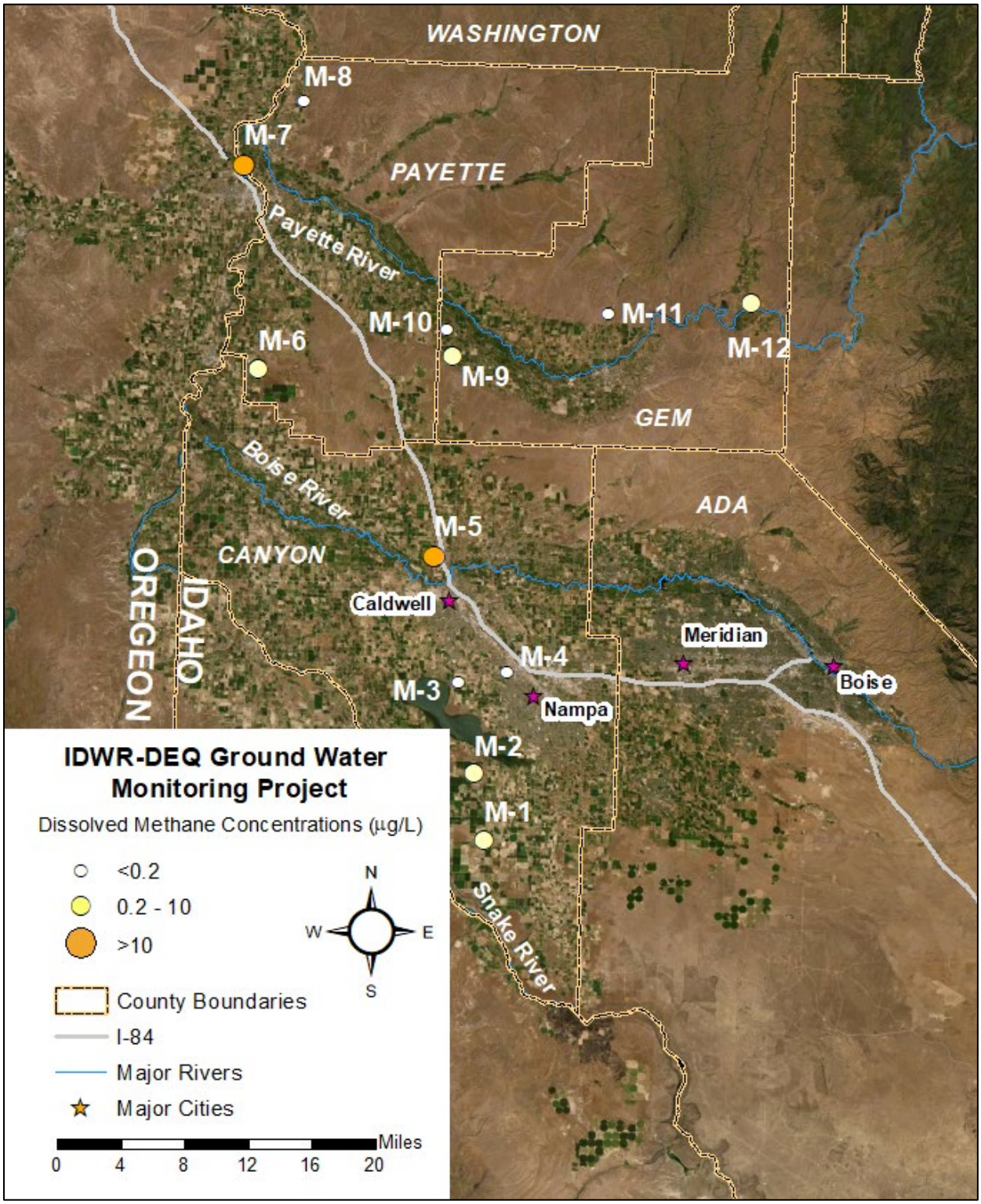


Figure A1. Dissolved methane results in southwestern Idaho—DEQ-IDWR Joint Ground Water Monitoring Project, 2019.

Table A2. 2018 nitrogen isotope results—DEQ-IDWR Joint Ground Water Monitoring Project.

Report Map ID	IDWR Well ID	Sample Date	County	Well Depth (ft bgs)	Water Temperature (°C)	pH[A]	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	Nitrate[B] (mg/L)	$\delta^{15}N$ (‰)
Water Quality Standard:					**No Stand.**	**6.5-8.5**	**No Stand.**	**No stand.**	**10**	**No Stand.**
N-1 (18)	33N 01E 12CAC1	8/8/2018	LEWIS	396	13.5	7.4	724	5.89	**16**	9.8
N-2 (18)	33N 02E 11BAA1	8/22/2018	LEWIS	180	18.2	7.2	1281	4.41	**54**	15.3
N-3 (18)	33N 02W 10AAB1	8/22/2018	LEWIS	275	11.6	7.2	580	6.95	**16**	12.1
N-4 (18)	07N 05W 33CDB1	8/15/2018	PAYETTE	120	16.2	7.5	828	6.45	7.0	4.7
N-5 (18)	08N 05W 26ABB1	7/24/2018	PAYETTE	38	15.5	7.7	921	4.00	**12**	4.0
N-6 (18)	07N 02W 34ACC1	7/24/2018	GEM	102	15.5	7.3	715	5.16	5.4	5.0
N-7 (18)	02N 02W 23ABD1	7/17/2018	CANYON	110	15.5	7.8	571	8.35	5.6	5.9
N-8 (18)	03N 02W 12BAB1	7/3/2018	CANYON	35	15.3	7.3	1082	0.67	**11**	9.6
N-9 (18)	04N 02W 36CCC1	8/23/2018	CANYON	108	14.0	7.3	552	1.45	5.5	6.6
N-10 (18)	03N 01E 15CBD1	7/3/2018	ADA	90	15.2	7.2	999	4.17	9.5	8.7
N-11 (18)	05S 06E 01AAD1	7/2/2018	ELMORE	435	18.6	7.9	1350	8.07	**12**	6.3
N-12 (18)	11S 19E 35DDD1	6/26/2018	TWIN FALLS	575	18.2	7.5	659	—	2.6	4.9
N-13 (18)	11S 16E 09CCC1	6/26/2018	TWIN FALLS	500	15.0	8.0	1472	—	6.3	10.7
N-14 (18)	11S 21E 07BBC1	6/29/2018	CASSIA	625	16.1	8.0	2246	—	**17**	12.0
N-15 (18)	09S 25E 27CDD1	8/6/2018	CASSIA	260	17.9	7.5	1620	—	**13**	14.0
N-16 (18)	09S 29E 05DDD3	6/29/2018	POWER	100	12.1	7.6	1146	7.51	9.3	8.5
N-17 (18)	11S 37E 21DDCD1	7/9/2018	BANNOCK	85	12.2	7.5	860	7.10	**11**	12.9
N-18 (18)	02S 36E 33AAC1	7/10/2018	BINGHAM	140	13.1	7.4	618	0.61	4.9	5.4
N-19 (18)	07N 45E 20BAB1	8/29/2018	TETON	422	8.5	7.6	640	9.02	7.6	6.1
N-20 (18)	09N 44E 30CBB1	9/18/2018	FREMONT	300	9.3	7.8	1140	18.40	**20**	8.2
N-21 (18)	08N 37E 34BAC1	8/29/2018	FREMONT	240	11.4	7.9	675	7.48	8.8	3.1

Notes: ft bgs = feet below ground surface; °C = degrees Celsius; µS/cm = microsiemens per centimeter; milligrams per liter; ‰ = per mil; (-) = not analyzed or data are unavailable. Bold shaded numbers indicated an EPA primary drinking water standard regulation was exceeded. No Stand. = No Primary or Secondary Drinking Water Regulation or Idaho Ground Water Quality Rule standard currently established.

[A] Contaminant with a National Secondary Drinking Water Regulation standard. The NSDWR for pH is 6.5-8.5. NSDWR standards are recommended limits for public water systems but can be applied to private wells to evaluate water quality.

[B] Contaminant with a National Primary Drinking Water Regulation standard.

Table A3. 2019 nitrogen isotope results—DEQ-IDWR Joint Ground Water Monitoring Project.

Report Map ID	IDWR Well ID	Sample Date	County	Well Depth (ft bgs)	Water Temperature (°C)	pH[A]	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	Nitrate[B] (mg/L)	$\delta^{15}N$ (‰)
Water Quality Standard:					**No Stand.**	**6.5-8.5**	**No Stand.**	**No Stand.**	**10**	**No Stand.**
N-1	35N 05W 02CCA1	7/9/2019	NEZ PERCE	244	20.7	8.4	701	7.98	4.9	5.7
N-2	34N 01W 34DAD1	7/9/2019	LEWIS	122	12.4	7.3	517	3.77	6.6	9.0
N-3	10N 05W 17ABBB1	7/29/2019	WASHINGTON	206	15.8	7.4	2368	0.01	**16**	7.5
N-4	11N 04W 34CBC1	7/29/2019	WASHINGTON	69	19.9	7.3	819	5.08	**10**	3.0
N-5	10N 05W 09ACDD1	7/29/2019	WASHINGTON	40	14.6	7.3	1151	4.02	6.6	8.0
N-6	03N 02W 33CAD2	7/16/2019	CANYON	67	17.9	7.2	965	5.56	7.0	6.1
N-7	03N 02W 17CCB2	8/14/2019	CANYON	104	17.1	7.8	1049	4.19	5.3	6.5
N-8	03N 04W 03AAD1	7/10/2019	CANYON	78	18.9	7.6	801	5.90	**14**	4.0
N-9	04N 04W 28ACB2	7/10/2019	CANYON	63	16.9	7.7	685	5.39	**12**	6.9
N-10	04N 04W 30BBB2	6/19/2019	CANYON	71	17.2	7.5	504	8.07	1.3	6.2
N-11	04N 05W 07DCA1	7/10/2019	CANYON	200	17.4	7.7	952	0.59	9.7	5.1
N-12	05N 05W 20CCD1	6/19/2019	CANYON	37	19.7	7.7	1010	1.40	9.3	5.4
N-13	01S 02W 03DBC1	6/18/2019	CANYON	44	18.5	7.7	816	7.64	8.9	6.4
N-14	02N 02W 30BBA1	7/11/2019	CANYON	160	17.4	7.9	750	8.93	9.0	3.9
N-15	03N 01W 31DDA2	8/6/2019	CANYON	130	15.8	7.4	755	6.80	6.8	6.3
N-16	04N 01W 01CAA1	8/8/2019	ADA	260	16.5	7.2	630	6.59	5.1	8.0
N-17	05S 06E 32AAA1	7/9/2019	ELMORE	68	17.5	7.3	997	3.24	**12**	7.7
N-18	05S 09E 27DBB1	7/2/2019	ELMORE	130	15.5	7.5	1047	—	6.6	3.6
N-19	05S 09E 13ACD1	7/3/2019	ELMORE	37	16.0	7.3	2481	0.43	6.9	22.3
N-20	04S 05E 21DBDD1	8/1/2019	ELMORE	600	18.6	8.0	570	7.93	**10**	10.4
N-21	05S 13E 32CCC1	7/3/2019	GOODING	450	17.1	7.6	896	9.15	8.4	8.7
N-22	12S 13E 26BCC1	7/9/2019	TWIN FALLS	260	—	—	—	—	**16**	8.4
N-23	10S 13E 14DAC1	8/21/2019	TWIN FALLS	287	15.0	7.5	797	7.86	5.5	5.7
N-24	10S 15E 03ADD1	7/23/2019	TWIN FALLS	100	14.6	6.2	935	6.43	6.6	6.7
N-25	01S 21E 23BCB1	6/25/2019	BLAINE	205	11.6	7.4	735	5.38	4.0	8.2
N-26	10S 23E 09CBCB1	7/17/2019	MINIDOKA	32	12.3	7.1	1213	4.90	**20**	18.9
N-27	11S 23E 11CDD1	7/22/2019	CASSIA	48	14.8	7.1	908	6.49	7.4	6.5
N-28	04S 34E 15CDC1	6/24/2019	BINGHAM	94	11.5	7.5	987	3.58	**26**	3.7
N-28	13S 35E 27CCC1	6/19/2019	ONEIDA	155	12.7	7.4	991	6.97	6.3	9.8
N-29	02S 37E 07DCC1	6/26/2019	BINGHAM	90	17.0	7.2	678	6.50	4.3	7.5
N-30	01N 37E 21CBC1	6/26/2019	BINGHAM	185	15.7	7.5	705	6.11	6.8	7.3
N-31	06S 42E 01DAC1	6/25/2019	CARIBOU	85	8.8	7.2	317	5.77	2.8	10.0

Notes: ft bgs = feet below ground surface; °C = degrees Celsius; µS/cm = microsiemens per centimeter; mg/L = milligrams per liter; ‰ = per mil; No Stand. = No Primary or Secondary Drinking Water Regulation standard currently established.; (-) = not analyzed or data are unavailable. Bold shaded numbers indicate an EPA National Primary Drinking Water Regulation standard was exceeded.

[A] Contaminant with a National Secondary Drinking Water Regulation standard. The NSDWR for pH is 6.5-8.5. NSDWR standards are recommended limits for public water systems but can be applied to private wells to evaluate water quality.

[B] Contaminant with a National Primary Drinking Water Regulation standard.

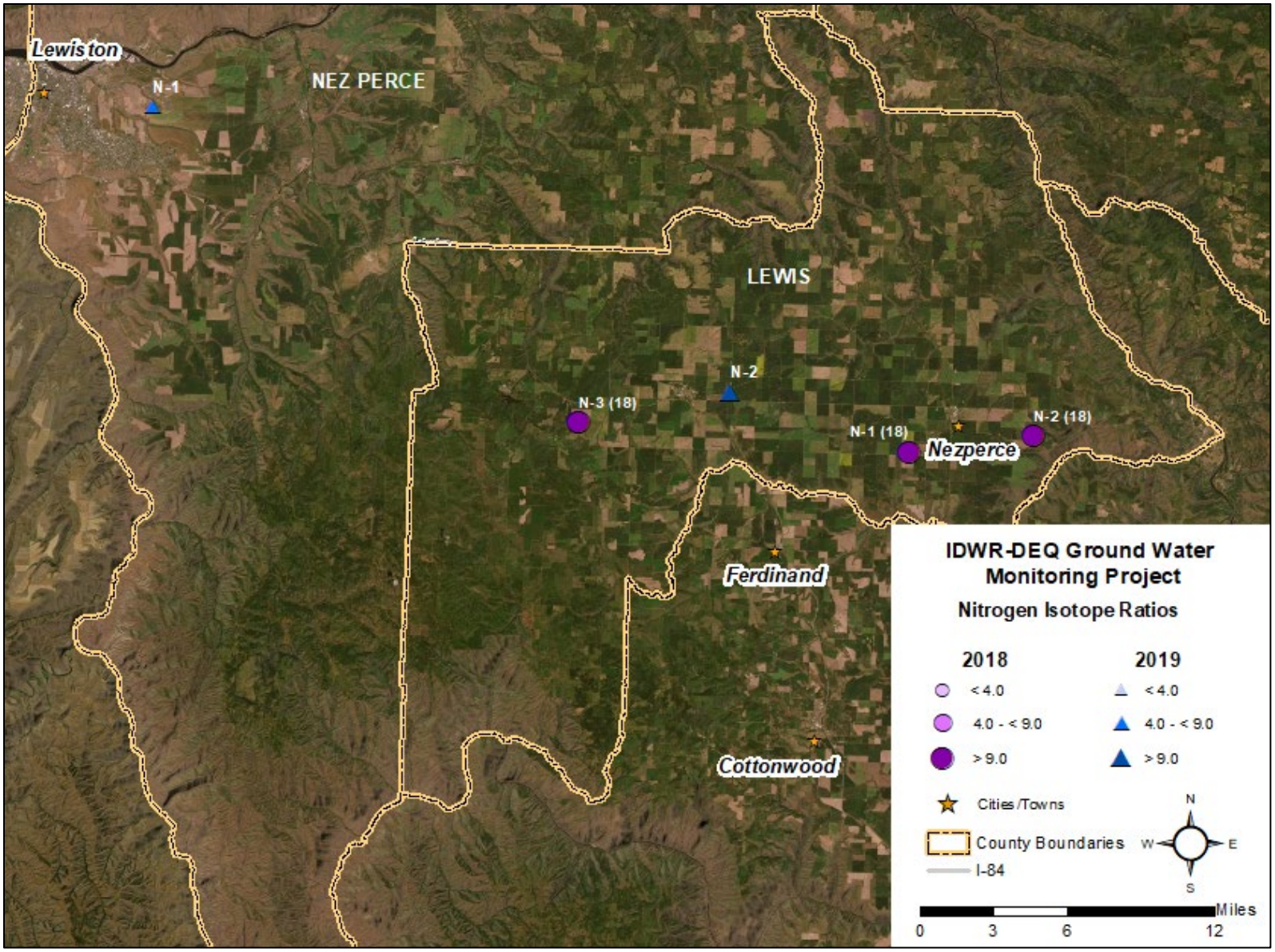


Figure A2. 2018 and 2019 northern Idaho nitrogen isotope ratios—DEQ-IDWR Joint Ground Water Monitoring Project.

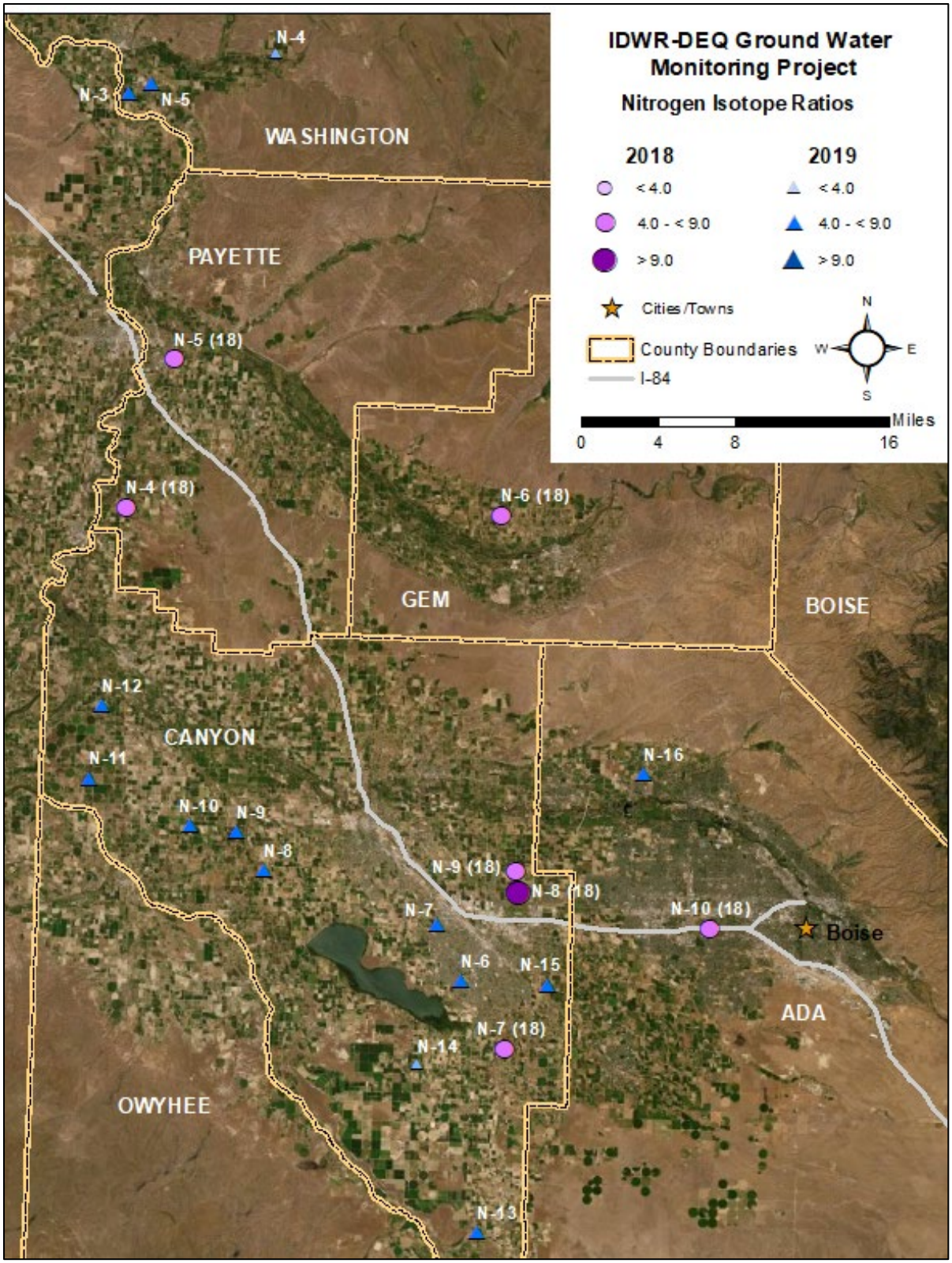


Figure A3. 2018 and 2019 southwest Idaho nitrogen isotope ratios—DEQ-IDWR Joint Ground Water Monitoring Project.

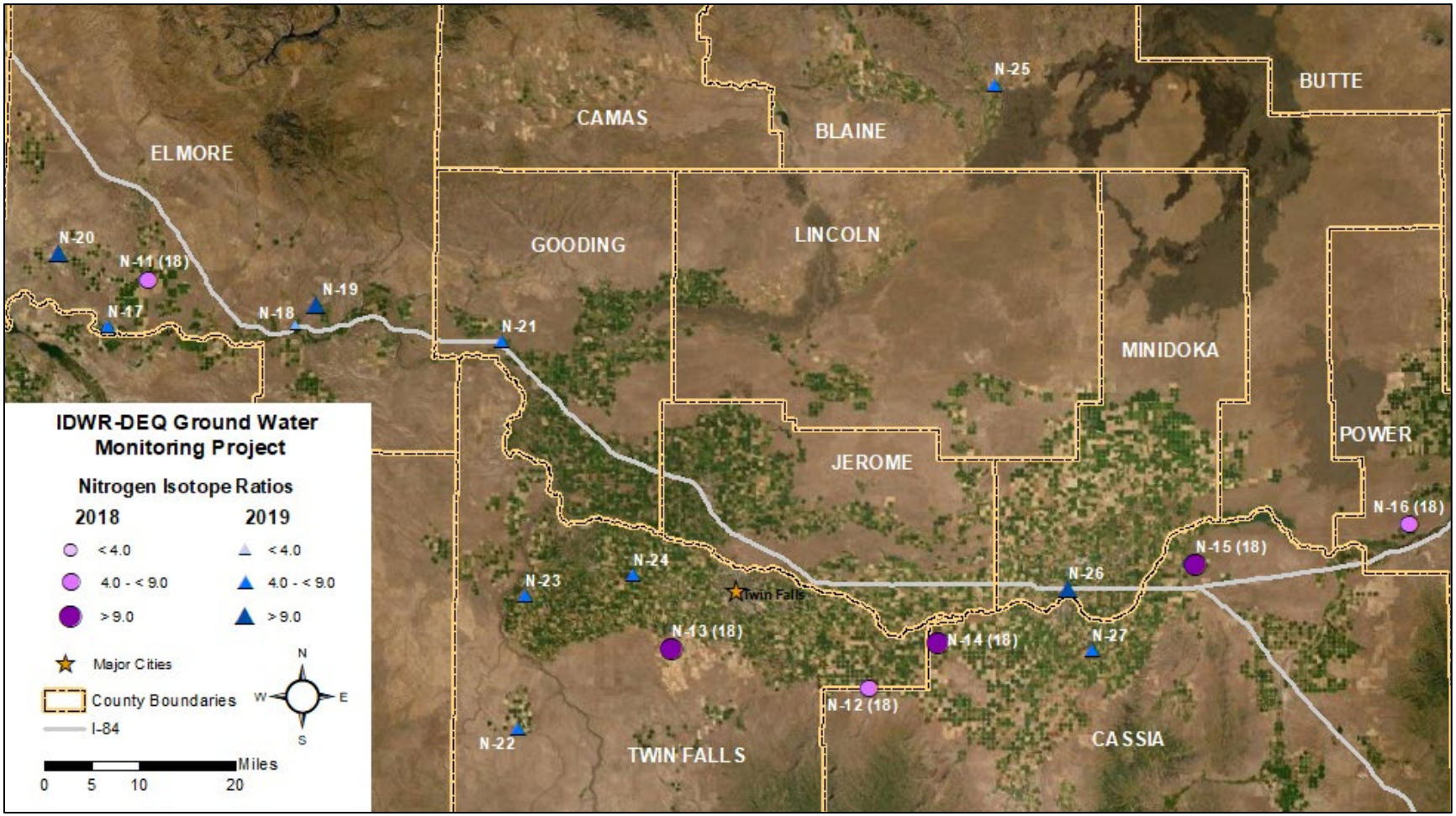


Figure A4. 2018 and 2019 southcentral Idaho nitrogen isotope ratios—DEQ-IDWR Joint Ground Water Monitoring Project.

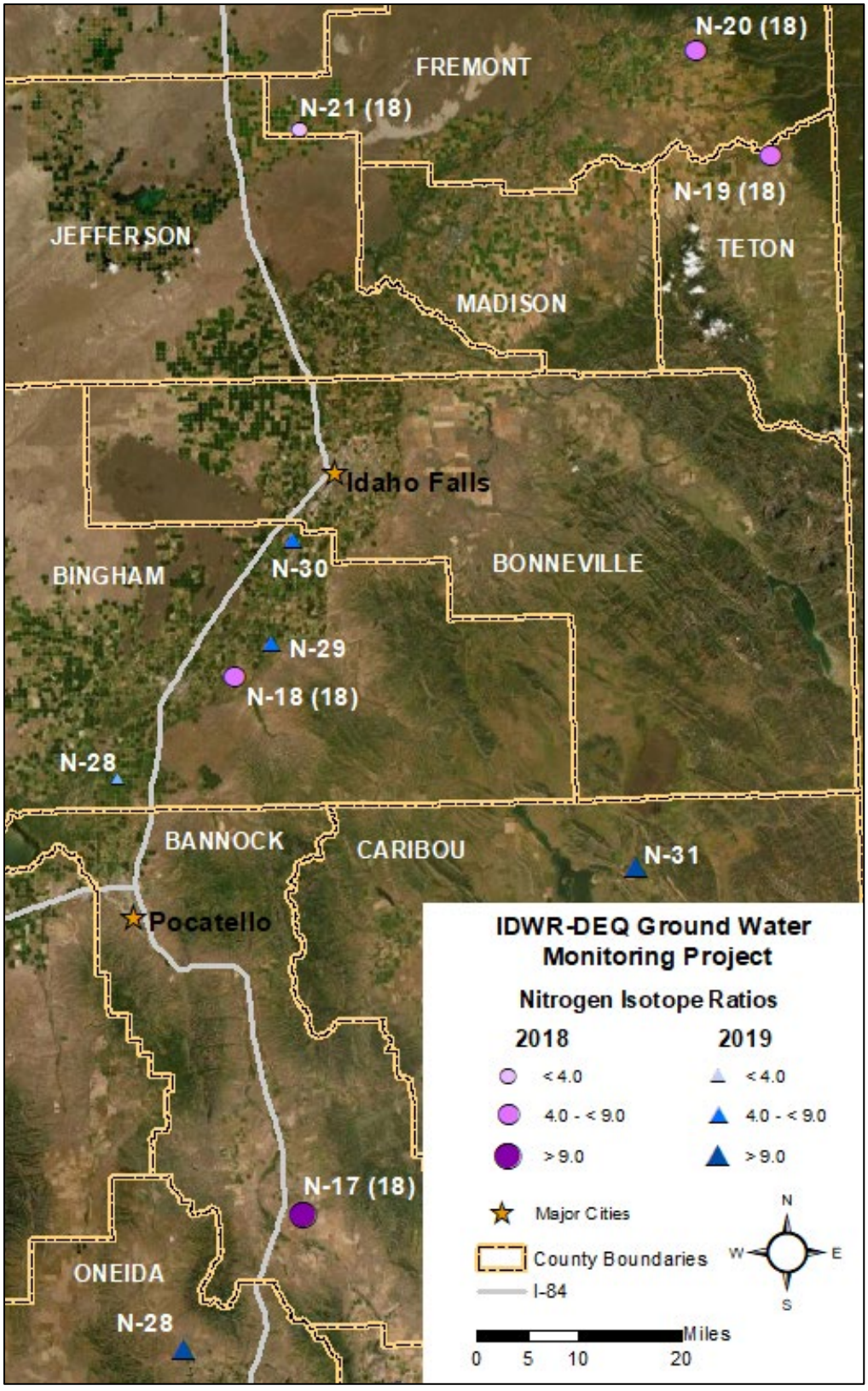


Figure A5. 2018 and 2019 eastern Idaho nitrogen isotope ratios—DEQ-IDWR Joint Ground Water Monitoring Project.

Appendix B. Idaho State Department of Agriculture Collected Data–2019

Table B1. DEQ–ISDA Ground Water Monitoring Project data.

ISDA Well ID	Project Number	Sample Date	Project Location County	Temperature (°C)	pH[A]	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	Nutrients		
								Nitrate-Nitrite as N[B]	Ammonia	Total Phosphorus
								(mg/L)		
Water Quality Standard:				**No Stand.**	**6.5-8.5**	**No Stand.**	**No Stand.**	**10**	**No Stand.**	**No Stand.**
2200301	220	6/5/2019	Ada/Canyon	14.2	7.71	852.4	-	**14**	-	-
2201301	220	6/5/2019	Ada/Canyon	14.9	7.99	674.5	-	6.7	-	-
2201701	220	6/3/2019	Ada/Canyon	18.2	7.79	401.1	-	2.5	-	-
2201801	220	6/10/2019	Ada/Canyon	14.1	7.58	674	-	7.0	-	-
2201901	220	6/10/2019	Ada/Canyon	15.8	7.58	685.2	-	5.2	-	-
2203001	220	6/4/2019	Ada/Canyon	13.7	7.12	634.4	-	6.0	-	-
2203101	220	6/3/2019	Ada/Canyon	14	7.36	8681	-	8.4	-	-
2204801	220	6/3/2019	Ada/Canyon	16.6	7.61	1138	-	**11**	-	-
2206401	220	6/5/2019	Ada/Canyon	17.4	7.78	446	-	1.3	-	-
2206501	220	6/10/2019	Ada/Canyon	14.2	7.53	642.1	-	5.8	-	-
2230101	223	6/5/2019	Canyon	15.8	7.53	861.2	-	6.8	-	-
3003001	300	8/28/2019	Latah	13.6	7.45	317.9	-	0.016	-	-
3003101	300	8/5/2019	Latah	12.3	7.08	338	-	4.7	-	-
3003601	300	8/5/2019	Latah	14.7	*6.34*	213.2	-	**10**	-	-
3003701	300	8/5/2019	Latah	11.5	7.07	215.9	-	2.3	-	-
3006101	300	7/23/2019	Latah	12.6	6.53	183.5	3.67	0.51	<0.050	-
3006201	300	7/22/2019	Latah	25	7.52	286.8	9.4	3.8	-	-
3006301	300	7/22/2019	Latah	15.3	7.57	208.4	9.32	1.6	-	-
3006401	300	7/23/2019	Latah	13.1	8.36	333.3	0.11	<0.010	0.12	-
3006501	300	7/22/2019	Latah	19.3	7.72	287.8	6.73	0.46	-	-
3006601	300	7/24/2019	Latah	14.3	7.84	326.7	2.1	1.3	<0.050	-
3006701	300	7/24/2019	Latah	12.6	7.55	338.7	8.69	7.5	-	-
3006801	300	7/23/2019	Latah	13.7	7.51	298.7	6.35	1.7	-	-
3006901	300	7/22/2019	Latah	16.5	7.58	309.8	8.75	0.53	-	-
3007001	300	7/24/2019	Latah	13.4	7.81	246.3	12.63	2.2	-	-
3007101	300	7/22/2019	Latah	14.3	7.56	524.4	6.45	8.0	-	-
3007201	300	7/22/2019	Latah	13.7	7.48	447.1	6.8	2.3	-	-
3100201	310	6/24/2019	Owyhee	21.8	7.42	2571	-	<0.010	7.1	-
3100401	310	6/25/2019	Owyhee	20.9	7.74	2570	-	0.078	8.6	-
3100601	310	6/24/2019	Owyhee	21.4	7.58	2490	-	1.7	7.2	-
3100701	310	6/24/2019	Owyhee	16.8	7.58	2069	-	<0.010	6.7	-

3101001	310	6/24/2019	Owyhee	19.7	7.54	3359	-	0.33	11	-
3101101	310	6/24/2019	Owyhee	19.6	7.56	2680	-	1.0	7.9	-
3101601	310	6/24/2019	Owyhee	21.9	7.83	2341	-	0.44	8.8	-
3200101	320	8/19/2019	Fremont	8.6	7.47	618.4	-	9.6	-	-
3201001	320	8/19/2019	Fremont	11.7	7.81	534.2	-	**12**	-	-
3300501	330	8/28/2019	Nez Perce	15.4	8.18	337.6	-	0.065	-	-
3400101	340	9/9/2019	Payette	15.4	7.44	1020	-	9.6	-	-
3400701	340	9/9/2019	Payette	15.7	7.57	912.3	-	**10**	-	-
3400801	340	9/9/2019	Payette	14.8	7.45	1072	-	8.2	-	-
3401501	340	9/9/2019	Payette	14.9	7.65	1029	-	**12**	-	-
4602801	460	8/21/2019	Franklin	16.1	7.43	1087	-	<0.010	-	-
4605101	460	8/21/2019	Franklin	13.2	7.37	1138	-	3.6	-	-
4605901	460	8/21/2019	Franklin	15.9	7.33	1141	-	**15**	-	-
4900801	490	7/15/2019	Caribou	12.1	7.48	775.4	-	2.9	-	-
4901601	490	7/15/2019	Caribou	10.3	7.63	1008	-	5.3	-	-
4902601	490	7/15/2019	Caribou	14.6	7.62	678.6	-	1.9	-	-
5302401	530	6/4/2019	Ada	13.6	7.13	869.1	-	**26**	-	-
5302701	530	6/4/2019	Ada	13.7	6.99	883.2	-	**45**	-	-
5303401	530	6/4/2019	Ada	14.1	7.10	997.7	-	**42**	-	-
5303801	530	6/5/2019	Ada	13.6	6.89	920.4	-	**47**	-	-
5304001	530	6/4/2019	Ada	15.1	7.33	449.9	-	0.81	-	-
7100201	710	9/17/2019	Washington	15.3	7.42	1376	-	**34**	-	-
7100501	710	9/17/2019	Washington	13.6	7.63	811.6	-	**11**	-	-
7100601	710	9/16/2019	Washington	14.6	7.47	851.9	-	**12**	-	-
7100901	710	9/16/2019	Washington	14.5	7.30	1295	-	**18**	-	-
7101101	710	9/17/2019	Washington	14.1	7.17	3524	-	**59**	-	-
7101701	710	9/16/2019	Washington	15	7.62	827	-	**12**	-	-
7102101	710	9/16/2019	Washington	13.1	7.50	656	-	5.1	-	-
7102301	710	9/16/2019	Washington	13.7	7.32	829.7	-	8.9	-	-
7102501	710	9/16/2019	Washington	14.6	7.04	2143	-	**33**	-	-
7103801	710	9/16/2019	Washington	16.8	7.33	945.7	-	**11**	-	-
7104201	710	9/16/2019	Washington	14	7.25	748.7	-	**14**	-	-
7104601	710	9/17/2019	Washington	14.3	7.24	867.1	-	**10**	-	-
7104801	710	9/16/2019	Washington	13.8	7.61	1095	-	**18**	-	-
7105101	710	9/16/2019	Washington	13.5	7.43	800.2	-	**11**	-	-
7300201	730	6/18/2019	Minidoka (Shallow)	13.6	7.35	1031	-	9.8	-	0.042
7300501	730	6/18/2019	Minidoka (Shallow)	16.3	7.71	636.8	-	0.74	-	0.04
7300801	730	6/18/2019	Minidoka (Shallow)	11.9	7.38	1827	-	**28**	-	0.088
7300901	730	6/18/2019	Minidoka (Shallow)	13.3	7.45	1054	-	6.5	-	0.11

7301101	730	6/18/2019	Minidoka (Shallow)	14.9	7.50	670.6	-	6	-	0.032
7301601	730	6/18/2019	Minidoka (Shallow)	12.3	7.43	949.4	-	**11**	-	0.045
7302001	730	6/18/2019	Minidoka (Shallow)	15.9	7.49	641	-	2.8	-	0.034
7302801	730	6/18/2019	Minidoka (Shallow)	13.2	7.39	2797	-	**11**	-	0.096
7303201	730	6/19/2019	Minidoka (Shallow)	13	7.21	3355	-	**41**	-	0.05
7303401	730	6/19/2019	Minidoka (Shallow)	11.3	7.62	636	-	0.21	-	0.08
7303901	730	6/18/2019	Minidoka (Shallow)	14.7	7.55	639.1	-	8.8	-	0.11
7304101	730	6/19/2019	Minidoka (Shallow)	14.2	7.56	720.4	-	8.2	-	0.05
7304301	730	6/18/2019	Minidoka (Shallow)	14.7	7.46	666.7	-	4.7	-	0.045
7304501	730	6/18/2019	Minidoka (Shallow)	12	7.41	1007	-	**10**	-	0.07
7304701	730	6/18/2019	Minidoka (Shallow)	12.2	7.92	2416	-	**70**	-	0.78
7401501	740	6/17/2019	Minidoka (Deep)	14.9	7.48	856.3	-	7.3	-	0.035
7401701	740	6/17/2019	Minidoka (Deep)	13.4	7.53	973.7	-	8.8	-	0.028
7401801	740	6/17/2019	Minidoka (Deep)	14.1	7.58	972.9	-	6.3	-	0.018
7403201	740	6/17/2019	Minidoka (Deep)	14.4	7.56	1212	-	7.6	-	0.029
7404801	740	6/17/2019	Minidoka (Deep)	13.6	7.49	950	-	8.4	-	0.037
7404901	740	6/17/2019	Minidoka (Deep)	20.1	8.05	482.2	-	1	-	0.014
7405101	740	6/17/2019	Minidoka (Deep)	14.4	7.69	839.5	-	6.1	-	0.02
7502401	750	5/6/2019	Jerome/Gooding/Lincoln	14.3	7.68	803	-	3.6	-	-
7504701	750	5/7/2019	Jerome/Gooding/Lincoln	14.9	7.81	1014	-	4.5	-	-
7504801	750	5/7/2019	Jerome/Gooding/Lincoln	14.7	7.77	747.1	-	3.2	-	-
7505601	750	5/7/2019	Jerome/Gooding/Lincoln	14.8	7.38	685.9	-	3.8	-	-
7505801	750	5/7/2019	Jerome/Gooding/Lincoln	14.6	7.24	649.5	-	2.9	-	-
7507001	750	5/7/2019	Jerome/Gooding/Lincoln	13.9	7.60	1216	-	**14**	-	-
7507401	750	5/6/2019	Jerome/Gooding/Lincoln	15.9	7.59	695.2	-	3.8	-	-
7700801	770	9/10/2019	Gem/Payette	15	7.68	287.1	-	1.2	-	-
7701701	770	9/10/2019	Gem/Payette	15	7.45	1031	-	4.5	-	-
7702001	770	9/10/2019	Gem/Payette	15.4	7.41	1245	-	9.8	-	-
7702501	770	9/10/2019	Gem/Payette	14.5	7.74	690.9	-	3.1	-	-
7702801	770	9/10/2019	Gem/Payette	16.8	7.12	443.1	-	2.5	-	-
7703201	770	9/9/2019	Gem/Payette	14.2	7.65	809.7	-	6.4	-	-
7705301	770	9/9/2019	Gem/Payette	14.4	7.76	873.7	-	**14**	-	-
7800201	780	5/13/2019	Twin Falls	13.8	7.57	878	-	5.1	-	-
7800301	780	5/13/2019	Twin Falls	14.9	7.83	877.7	-	5.2	-	-
7801701	780	5/13/2019	Twin Falls	14	7.86	1024	-	8	-	-
7803601	780	5/14/2019	Twin Falls	12.7	7.80	1090	-	8.4	-	-
7804201	780	5/14/2019	Twin Falls	13.2	7.54	901.1	-	7.6	-	-
7804301	780	5/14/2019	Twin Falls	13.2	7.53	1001	-	9.3	-	-
7804401	780	5/15/2019	Twin Falls	14.7	7.45	948.1	-	3.5	-	-

7804501	780	5/15/2019	Twin Falls	18.5	7.98	589.7	-	2	-	-
7805501	780	5/13/2019	Twin Falls	13.8	7.55	902.5	-	8.5	-	-
7805601	780	5/14/2019	Twin Falls	13.9	7.59	915.8	-	6.3	-	-
7805701	780	5/13/2019	Twin Falls	13.8	7.56	887.6	-	8.3	-	-
7806401	780	5/13/2019	Twin Falls	14.9	7.51	866.4	-	5	-	-
7806601	780	5/14/2019	Twin Falls	12	7.47	941	-	5.2	-	-
7900101	790	5/22/2019	Cassia	16.5	7.73	950.7	-	5.4	-	-
7900601	790	5/22/2019	Cassia	12.4	7.64	1005	-	**10**	-	-
7900701	790	5/21/2019	Cassia	12.3	7.18	892.7	-	**10**	-	-
7900901	790	5/20/2019	Cassia	13.4	7.46	679	-	5	-	-
7901101	790	5/22/2019	Cassia	15.4	7.64	604.6	-	3.3	-	-
7901401	790	5/21/2019	Cassia	12.7	7.42	952	-	**15**	-	-
7901501	790	5/21/2019	Cassia	14.1	7.51	894.8	-	7.4	-	-
7901701	790	5/21/2019	Cassia	12.3	7.59	759.8	-	6.5	-	-
7902001	790	5/21/2019	Cassia	12.7	7.45	1034	-	**11**	-	-
7902201	790	5/21/2019	Cassia	11.2	7.10	797.1	-	2	-	-
7903501	790	5/20/2019	Cassia	11.9	7.48	1081	-	**19**	-	-
7903601	790	5/21/2019	Cassia	12.9	7.56	851.1	-	**11**	-	-
7903801	790	5/22/2019	Cassia	13.2	7.33	914.7	-	**14**	-	-
7904001	790	5/20/2019	Cassia	1335	7.38	910.7	-	8.7	-	-
7904101	790	5/20/2019	Cassia	12.7	7.38	629.3	-	5.1	-	-
8050301	805	8/20/2019	Madison/Fremont/Teton	10.6	7.67	624.8	-	**13**	-	-
8050801	805	8/19/2019	Madison/Fremont/Teton	12.3	7.59	461.6	-	7.1	-	-
8050901	805	8/19/2019	Madison/Fremont/Teton	11.8	7.48	452.4	-	6	-	-
8051301	805	8/19/2019	Madison/Fremont/Teton	9.9	7.54	565.7	-	5.3	-	-
8051401	805	8/19/2019	Madison/Fremont/Teton	11.6	7.45	478.1	-	8.3	-	-
8053401	805	8/20/2019	Madison/Fremont/Teton	10.5	7.80	377.6	-	3	-	-
8053501	805	8/20/2019	Madison/Fremont/Teton	8.6	7.40	619.3	-	**10**	-	-
8053901	805	8/19/2019	Madison/Fremont/Teton	14	7.63	444.3	-	7.6	-	-
8055201	805	8/20/2019	Madison/Fremont/Teton	12.4	7.85	599.8	-	8.7	-	-
8070101	807	8/26/2019	Teton	7.3	7.82	378.7	-	0.4	-	-
8070201	807	8/26/2019	Teton	7.9	7.77	416.8	-	1.8	-	-
8070301	807	8/26/2019	Teton	7.9	7.77	423.4	-	1.6	-	-
8070401	807	8/26/2019	Teton	6.7	7.88	363.8	-	0.39	-	-
8070501	807	8/26/2019	Teton	6.7	7.88	354.3	-	0.087	-	-
8070601	807	8/26/2019	Teton	7.4	7.99	303.8	-	0.17	-	-
8070701	807	8/26/2019	Teton	9.4	7.81	405.7	-	2.3	-	-
8070801	807	8/28/2019	Teton	7.8	8.11	322.8	-	<0.010	-	-
8070901	807	8/27/2019	Teton	9.2	7.79	414.6	-	2	-	-

8071001	807	8/27/2019	Teton	8	7.92	365	-	4.8	-	-
8071101	807	8/27/2019	Teton	7.89	7.87	327.6	-	2.1	-	-
8071201	807	8/27/2019	Teton	8	7.75	499.8	-	3.8	-	-
8071301	807	8/27/2019	Teton	8.5	7.50	364	-	0.051	-	-
8071401	807	8/27/2019	Teton	8.8	7.26	437.6	-	0.34	-	-
8071501	807	8/27/2019	Teton	7.8	7.70	534.5	-	4.2	-	-
8071601	807	8/28/2019	Teton	7.1	7.76	502.8	-	2.3	-	-
8100401	810	7/10/2019	Elmore	13.8	7.67	1352	-	**15**	-	-
8100601	810	7/10/2019	Elmore	13.6	7.56	1340	-	**21**	-	-
8101701	810	7/10/2019	Elmore	13.5	6.88	402	-	5.1	-	-
8102101	810	7/10/2019	Elmore	15	7.28	475.4	-	8.4	-	-
8104801	810	7/10/2019	Elmore	18.7	8.39	342.6	-	1.9	-	-
8201201	820	8/12/2019	Kootenai/Bonner	9.4	8.08	294.8	-	3.8	-	-
8202901	820	8/13/2019	Kootenai/Bonner	16.2	7.88	336.9	-	2	-	-
8204501	820	8/12/2019	Kootenai/Bonner	9.7	8.00	359.9	-	2.2	-	-
8204601	820	8/13/2019	Kootenai/Bonner	9.8	8.11	317.1	-	1.5	-	-
8204701	820	8/13/2019	Kootenai/Bonner	9.8	8.11	317.1	-	1.3	-	-
8204801	820	8/13/2019	Kootenai/Bonner	9.1	8.04	318.2	-	0.77	-	-
8204901	820	8/12/2019	Kootenai/Bonner	9.6	7.90	391	-	2.1	-	-
8205001	820	8/13/2019	Kootenai/Bonner	13.4	7.99	327.5	-	1.9	-	-
8205101	820	8/12/2019	Kootenai/Bonner	9	7.99	357.3	-	2.1	-	-
8205201	820	8/13/2019	Kootenai/Bonner	14.4	8.04	315.6	-	2.8	-	-
8300301	830	7/30/2019	Jefferson	12.3	7.98	357.4	-	4.3	-	-
8300401	830	7/30/2019	Jefferson	13.1	8.11	332.6	-	4.2	-	-
8300501	830	7/30/2019	Jefferson	13.4	8.05	382.7	-	6	-	-
8302001	830	7/30/2019	Jefferson	12.1	8.40	306.7	-	<0.010	-	-
8303001	830	7/30/2019	Jefferson	11.3	7.77	761.2	-	6.5	-	-
8401601	840	7/31/2019	Bonneville/Jefferson/Madison	11.2	7.60	467	-	1.4	-	-
8404201	840	7/31/2019	Bonneville/Jefferson/Madison	11.8	7.65	505	-	1.8	-	-
8404301	840	7/29/2019	Bonneville/Jefferson/Madison	12.8	7.70	404	-	0.7	-	-
8404401	840	9/25/2019	Bonneville/Jefferson/Madison	12.8	7.57	521.4	-	2.5	-	-
8404801	840	7/29/2019	Bonneville/Jefferson/Madison	12.4	7.46	553.3	-	1.6	-	-
8404901	840	7/29/2019	Bonneville/Jefferson/Madison	12.3	7.57	457.6	-	0.9	-	-
8405001	840	7/29/2019	Bonneville/Jefferson/Madison	12.1	7.59	475.7	-	1.8	-	-
8405301	840	7/31/2019	Bonneville/Jefferson/Madison	9.6	7.76	461.8	-	0.67	-	-
8405801	840	7/31/2019	Bonneville/Jefferson/Madison	11.8	7.59	509.3	-	0.93	-	-
8406101	840	7/29/2019	Bonneville/Jefferson/Madison	12.7	7.54	511.9	-	1.2	-	-
8406501	840	7/30/2019	Bonneville/Jefferson/Madison	12.3	8.14	306.6	-	5.7	-	-
8406601	840	7/29/2019	Bonneville/Jefferson/Madison	11.8	7.70	500.4	-	1.6	-	-

8407501	840	7/31/2019	Bonneville/Jefferson/Madison	12.2	7.50	524.4	-	1.5	-	-
8420101	842	9/25/2019	Bingham/Bonneville	13.2	7.34	629	-	0.69	-	-
8420201	842	9/23/2019	Bingham/Bonneville	13.5	7.49	555.3	-	1.7	-	-
8420301	842	9/23/2019	Bingham/Bonneville	13.8	7.54	584.1	-	1.9	-	-
8420401	842	9/23/2019	Bingham/Bonneville	15.3	7.59	750	-	2.3	-	-
8420501	842	9/23/2019	Bingham/Bonneville	13.7	7.62	599.7	-	2.8	-	-
8420601	842	9/23/2019	Bingham/Bonneville	12.5	7.58	605.3	-	2.8	-	-
8420701	842	9/24/2019	Bingham/Bonneville	12.9	7.52	621.3	-	1.6	-	-
8420801	842	9/25/2019	Bingham/Bonneville	14.2	7.52	441.4	-	0.61	-	-
8420901	842	9/24/2019	Bingham/Bonneville	13.4	7.42	564.2	-	2.2	-	-
8421001	842	9/24/2019	Bingham/Bonneville	12.9	7.49	579.7	-	3.2	-	-
8421201	842	9/25/2019	Bingham/Bonneville	13.3	7.40	599.4	-	3.8	-	-
8421301	842	9/25/2019	Bingham/Bonneville	13.3	7.41	588.2	-	3.8	-	-
8421401	842	9/25/2019	Bingham/Bonneville	13.5	7.21	681.8	-	2.7	-	-
8421501	842	9/24/2019	Bingham/Bonneville	13	7.47	584.9	-	3.5	-	-
8421601	842	9/24/2019	Bingham/Bonneville	13.2	7.52	593.8	-	2.9	-	-
8421701	842	9/24/2019	Bingham/Bonneville	12.9	7.55	574	-	2.6	-	-
8421801	842	9/24/2019	Bingham/Bonneville	14.4	7.63	444.5	-	1.7	-	-
8421901	842	9/24/2019	Bingham/Bonneville	13	7.49	576.9	-	3.2	-	-
8450301	845	7/17/2019	Bingham	15.5	7.34	537.3	-	0.73	-	-
8450601	845	7/16/2019	Bingham	12.8	7.57	447.7	-	1.4	-	-
8450801	845	7/16/2019	Bingham	13.6	7.57	499.9	-	1.9	-	-
8450901	845	7/16/2019	Bingham	13.3	7.47	530.2	-	1.4	-	-
8452101	845	7/16/2019	Bingham	13.5	8.20	469.2	-	<0.010	-	-
8452501	845	7/17/2019	Bingham	13.5	7.53	503.5	-	1.9	-	-
8452701	845	7/16/2019	Bingham	14.1	7.73	466.9	-	0.89	-	-
8452801	845	7/17/2019	Bingham	12.4	7.47	474.8	-	0.85	-	-
8453101	845	7/16/2019	Bingham	11.8	7.67	494.1	-	1.4	-	-
8453301	845	7/17/2019	Bingham	13.2	7.52	477	-	1.8	-	-
8453801	845	7/17/2019	Bingham	12.5	7.61	399.8	-	0.71	-	-
8601101	860	6/24/2019	Owyhee	14.9	7.33	2469	-	6.4	<0.050	-
8601401	860	6/25/2019	Owyhee	15.2	7.31	1498	-	9	<0.050	-
8601801	860	6/25/2019	Owyhee	16.7	7.93	1095	-	0.03	5.8	-
8602001	860	6/25/2019	Owyhee	14.8	7.13	2485	-	**11**	0.35	-
8602901	860	6/25/2019	Owyhee	21.5	7.69	2306	-	0.01	11	-
8603001	860	6/25/2019	Owyhee	20.6	7.28	1538	-	<0.010	10	-
8650101	865	7/23/2019	Owyhee	15.2	7.45	1064	-	12	-	-
8650201	865	7/23/2019	Owyhee	16.3	7.61	954.1	-	9.7	-	-
8650301	865	7/23/2019	Owyhee	14.9	7.12	2628	-	**79**	-	-

8650501	865	7/23/2019	Owyhee	17.2	7.11	2440	-	**20**	-	-
8652501	865	7/23/2019	Owyhee	17.2	7.90	870.4	-	**15**	-	-
8700501	870	5/7/2019	Gooding	12	7.73	743.8	-	-	-	0.11
8700601	870	5/8/2019	Gooding	15.5	7.84	520.6	-	-	-	0.025
8700801	870	5/15/2019	Gooding	13.4	7.63	927.3	-	8	-	-
8701801	870	5/8/2019	Gooding	15.8	7.45	860.5	-	-	-	0.032
8706201	870	5/8/2019	Gooding	12.6	7.42	1329	-	-	-	0.027
8900501	890	7/9/2019	Elmore	17.4	7.56	875	-	3.4	-	-
8900601	890	7/9/2019	Elmore	16.5	7.49	857	-	3.8	-	-
8900801	890	7/9/2019	Elmore	15.7	7.46	1527	-	**41**	-	-
8901801	890	7/9/2019	Elmore	16.9	7.54	1112	-	6.3	-	-
8902201	890	7/9/2019	Elmore	17.1	7.65	1117	-	**13**	-	-
9500201	950	8/7/2019	Nez Perce/Lewis/Idaho	13	7.49	642.7	-	9.5	-	-
9501201	950	8/27/2019	Nez Perce/Lewis/Idaho	11.8	7.40	382.1	-	3.9	-	-
9501401	950	8/6/2019	Nez Perce/Lewis/Idaho	12.3	7.27	1158	-	**38**	-	-
9501901	950	8/6/2019	Nez Perce/Lewis/Idaho	15.2	7.59	519.5	-	5.1	-	-
9502201	950	8/26/2019	Nez Perce/Lewis/Idaho	12.2	7.77	506.5	-	**10**	-	-
9502701	950	8/27/2019	Nez Perce/Lewis/Idaho	12.2	7.91	446.3	-	4.6	-	-
9502801	950	8/7/2019	Nez Perce/Lewis/Idaho	12.4	8.04	451.3	-	0.35	-	-
9503701	950	8/27/2019	Nez Perce/Lewis/Idaho	18.3	7.74	357.5	-	<0.010	-	-
9503901	950	8/27/2019	Nez Perce/Lewis/Idaho	11	7.66	333.4	-	3.8	-	-
9504301	950	8/7/2019	Nez Perce/Lewis/Idaho	11.5	7.49	1183	-	**24**	-	-
9504501	950	8/27/2019	Nez Perce/Lewis/Idaho	8.9	7.19	280.5	-	4	-	-
9505401	950	8/6/2019	Nez Perce/Lewis/Idaho	12.5	7.72	708.6	-	**16**	-	-
9505701	950	8/27/2019	Nez Perce/Lewis/Idaho	10.8	7.56	334.6	-	3.4	-	-
9506001	950	8/26/2019	Nez Perce/Lewis/Idaho	10.8	7.07	269.9	-	7.7	-	-
9506401	950	8/26/2019	Nez Perce/Lewis/Idaho	12.7	7.88	361.5	-	<0.010	-	-
9507601	950	8/7/2019	Nez Perce/Lewis/Idaho	12.3	7.85	465.1	-	4.1	-	-
9507901	950	8/6/2019	Nez Perce/Lewis/Idaho	12.7	7.98	3705	-	2.8	-	-

Notes: **°C** = degrees Celsius; µS/cm = microsiemens per centimeter; mg/L = milligrams per liter; (-) = Not Analyzed. Italicized red numbers indicate EPA's National Secondary Drinking Water Regulation (NSDWR) standard was exceeded. Bolded red numbers indicate EPA's National Primary Drinking Water Regulation NPDWR standard (NPDWR), expressed as a maximum contaminant level (MCL), was reached or exceeded.

a. Contaminant with a NSDWR standard.

b. Contaminant with a NPDWR standard.

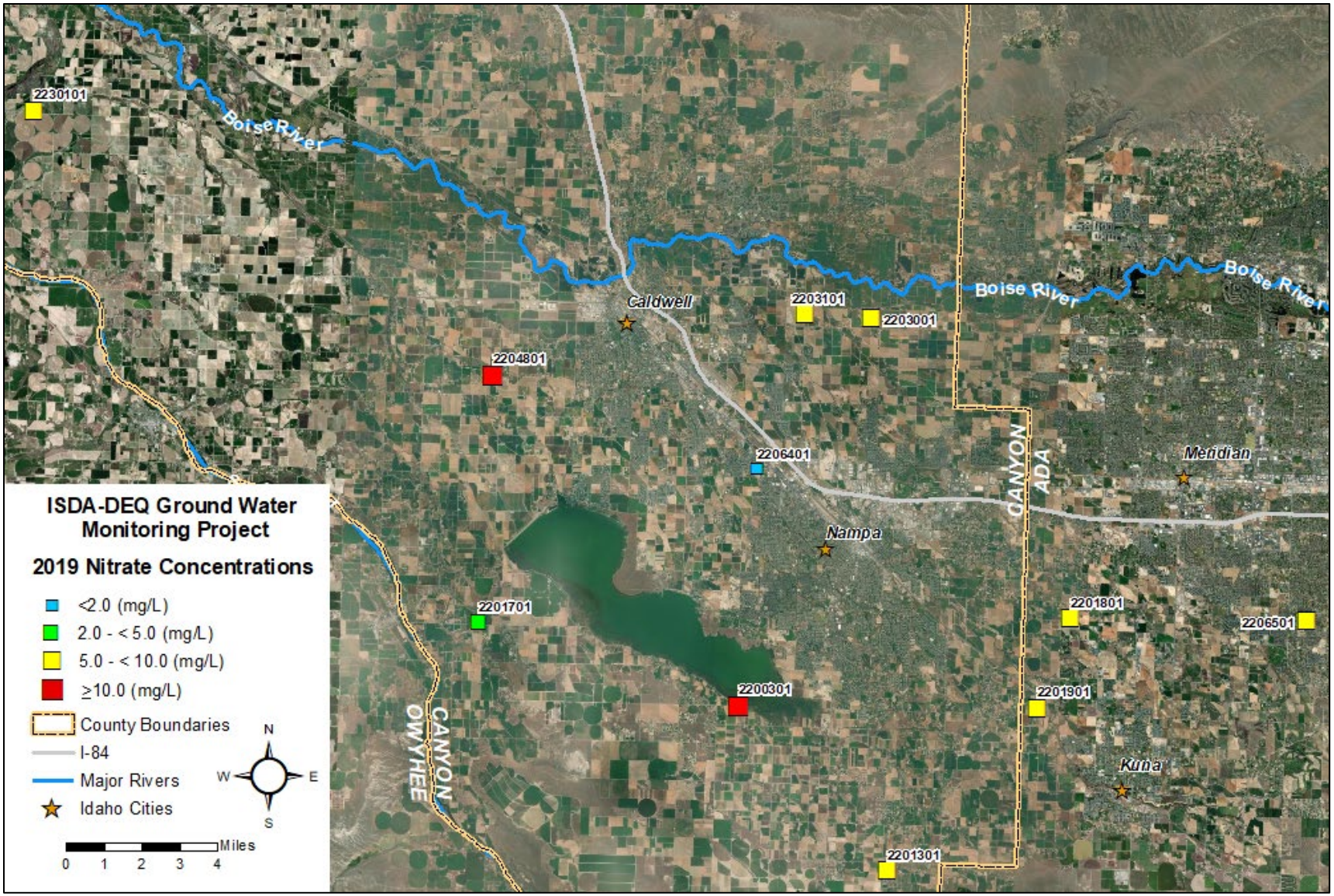


Figure B1. Project 220 (Ada and Canyon Counties) nitrate concentrations, 2019 ISDA data.

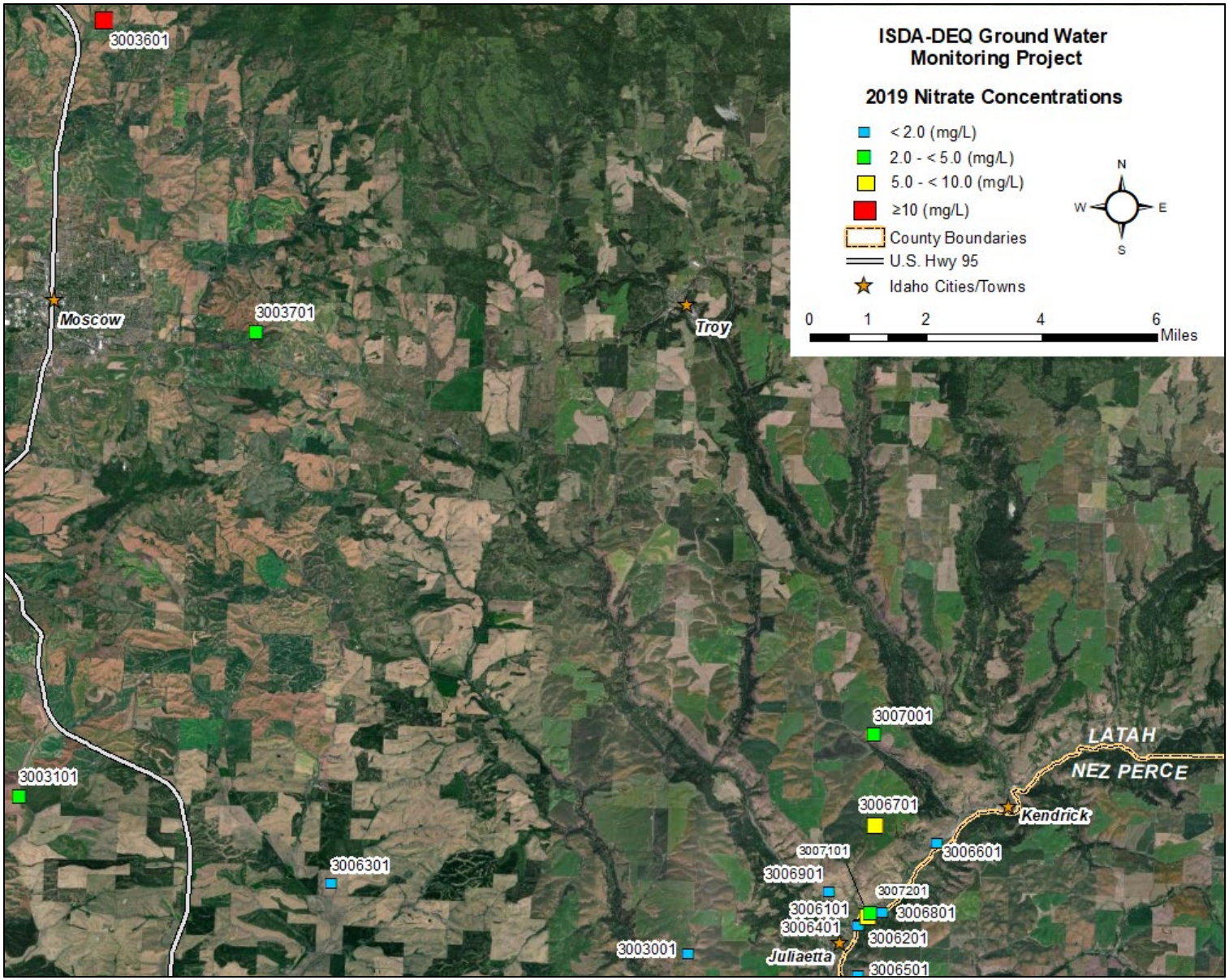


Figure B2. Project 300 (Latah County) nitrate concentrations, 2019 ISDA data.

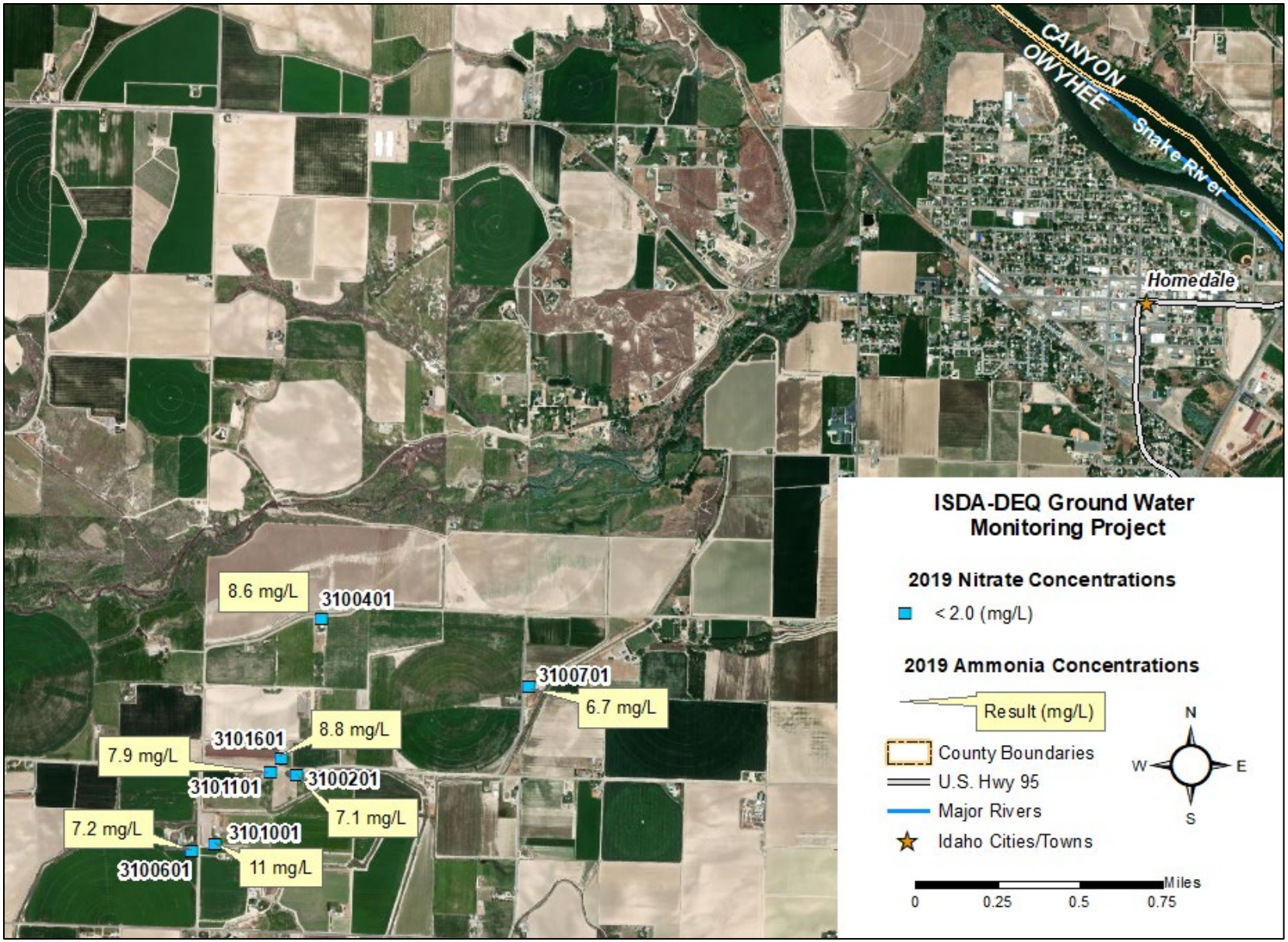


Figure B3. Project 310 (Owyhee County) nitrate concentrations, 2019 ISDA data.

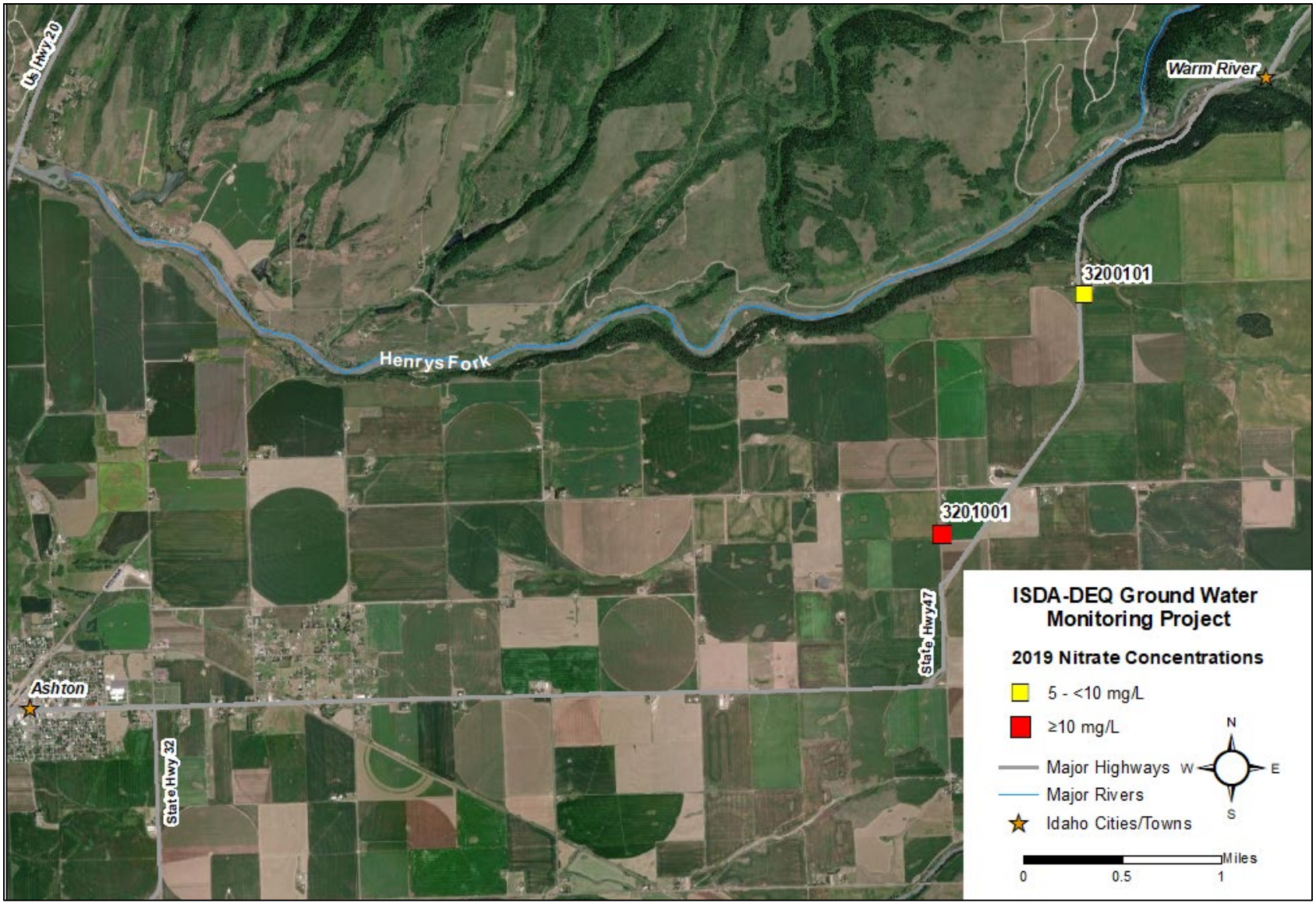


Figure B4. Project 320 (Fremont County) nitrate concentrations, 2019 ISDA data.

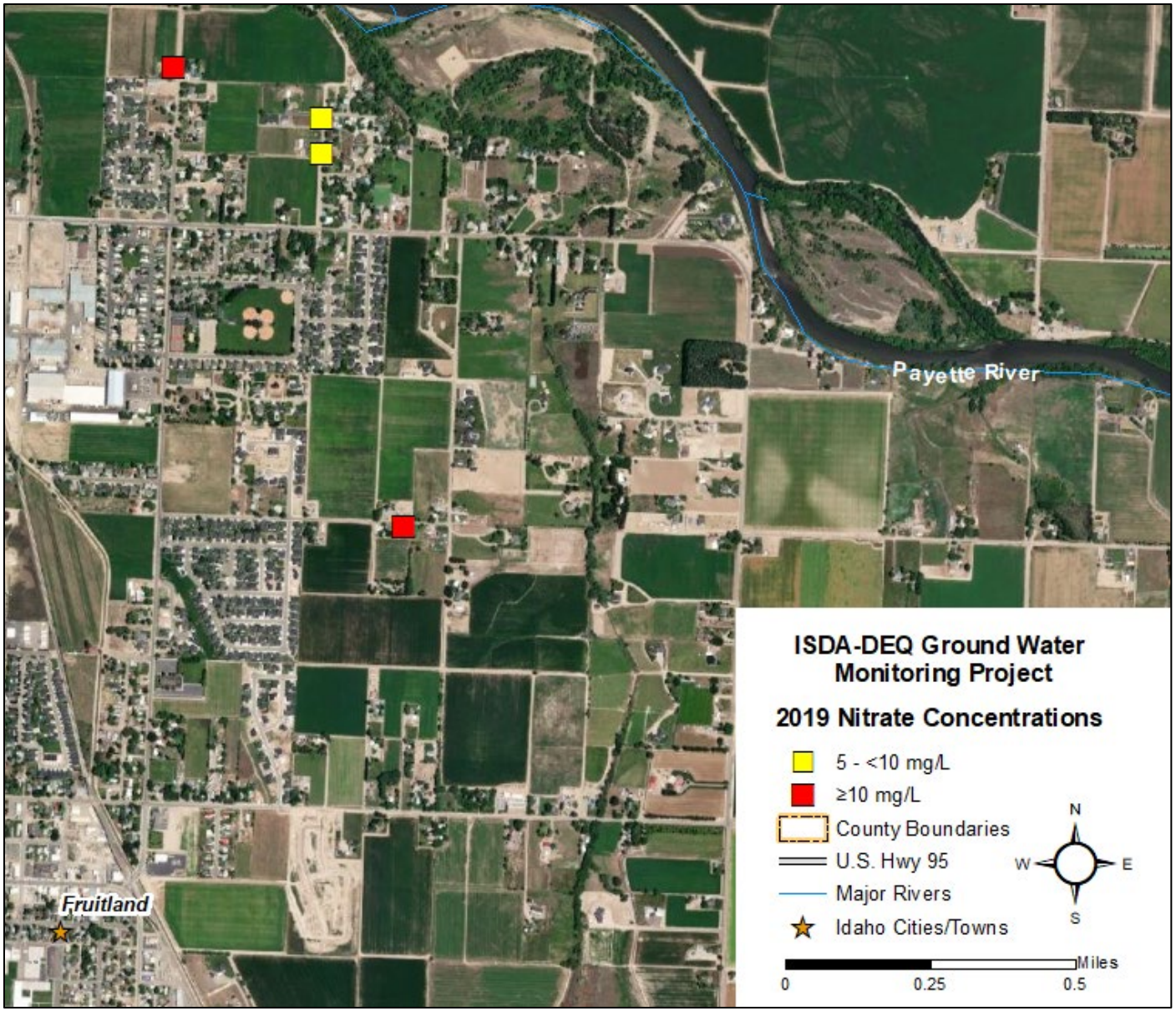


Figure B5. Project 340 (Payette County) nitrate concentrations, 2019 ISDA data.

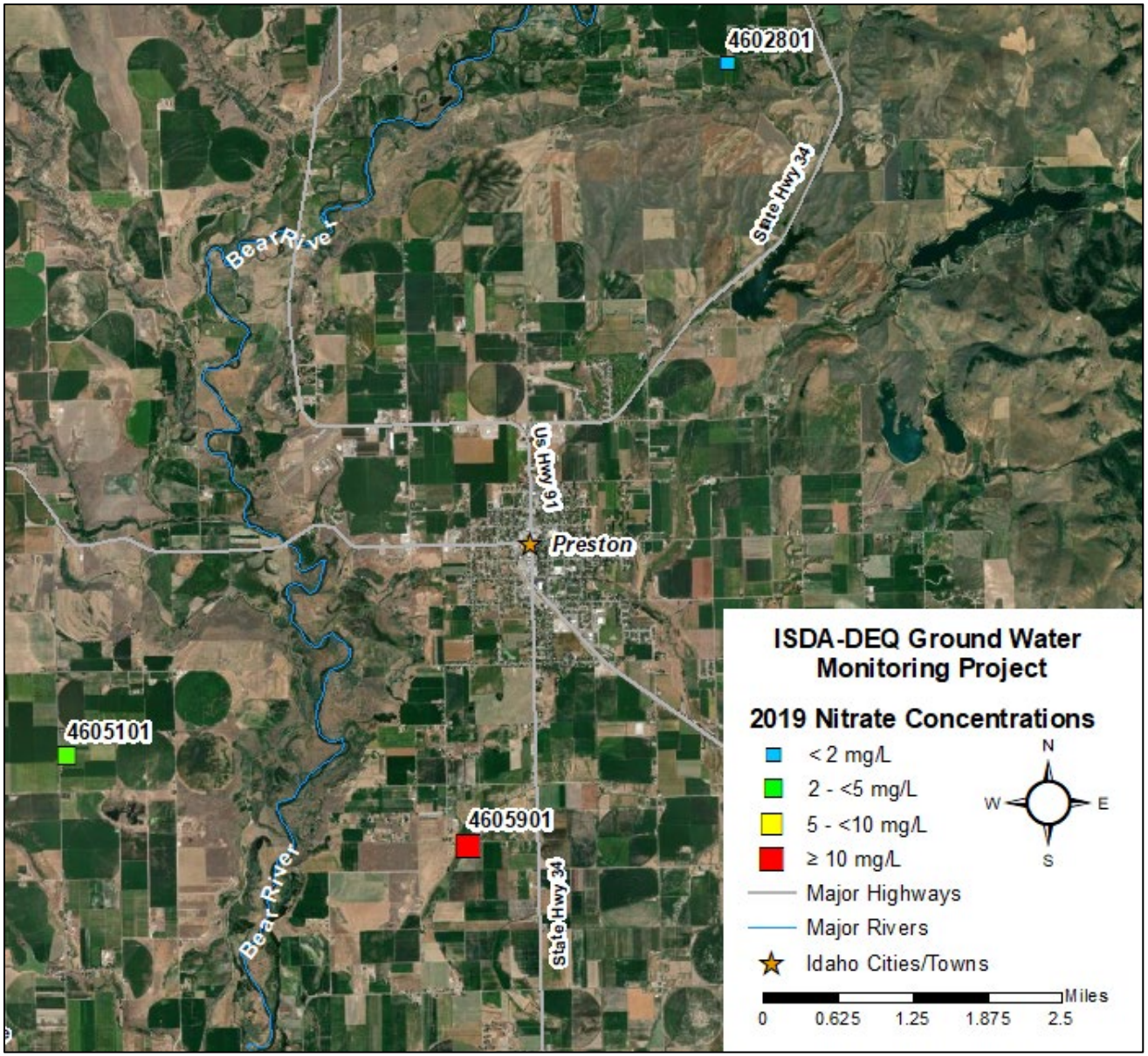


Figure B6. Project 460 (Franklin County) nitrate concentrations, 2019 ISDA data.

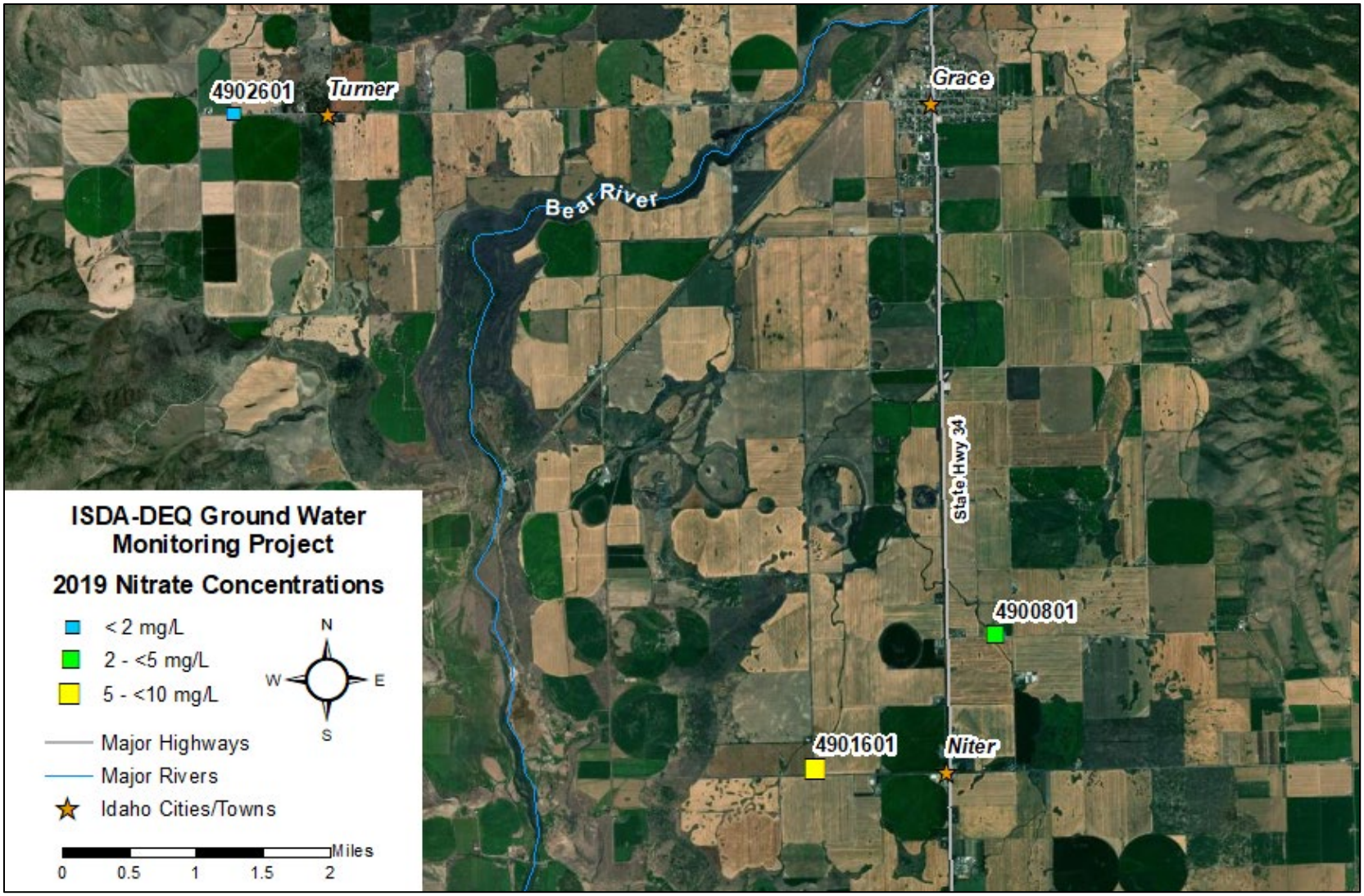


Figure B7. Project 490 (Caribou County) nitrate concentrations, 2019 ISDA data.

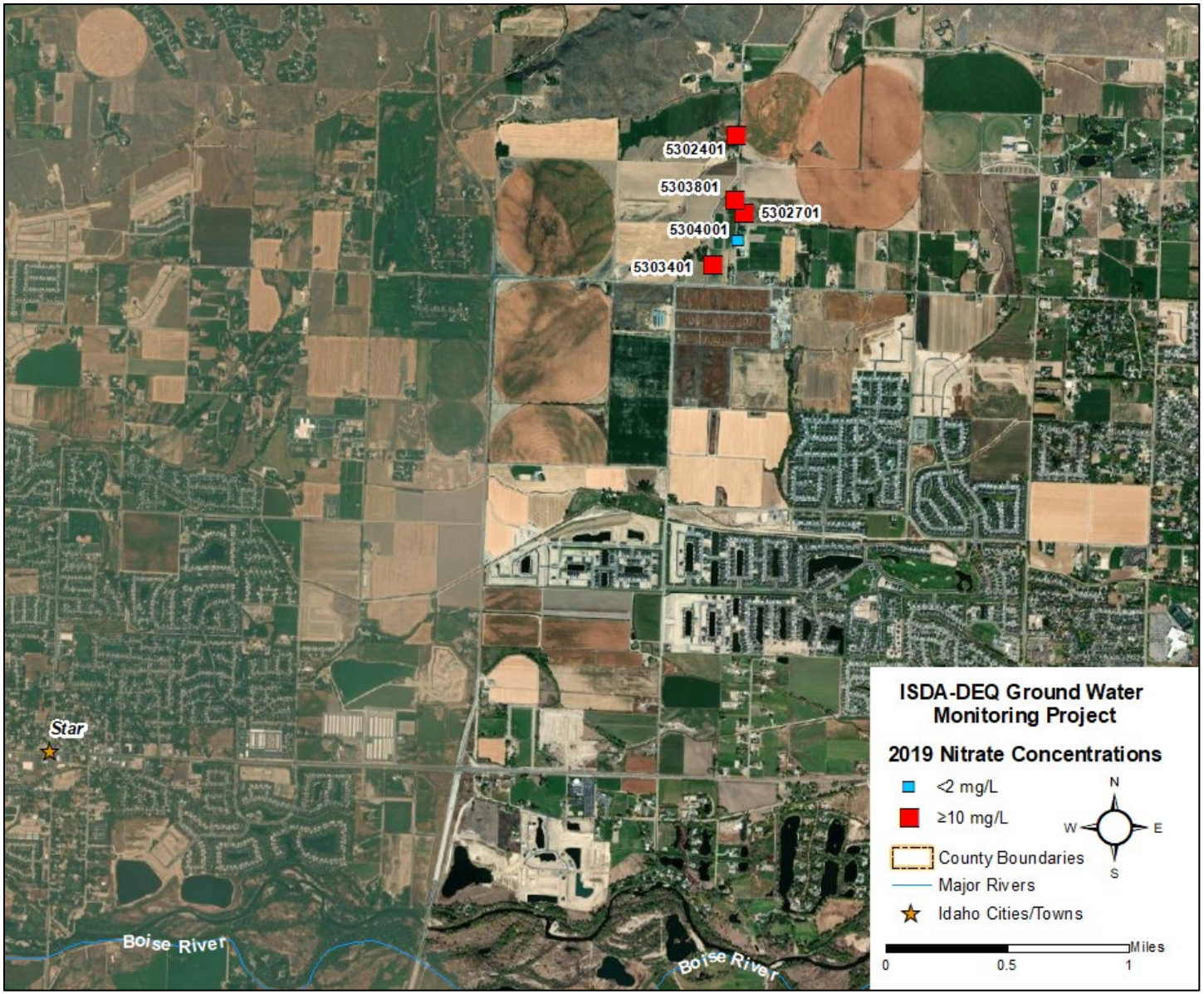


Figure B8. Project 530 (Ada County) nitrate concentrations, 2019 ISDA data.

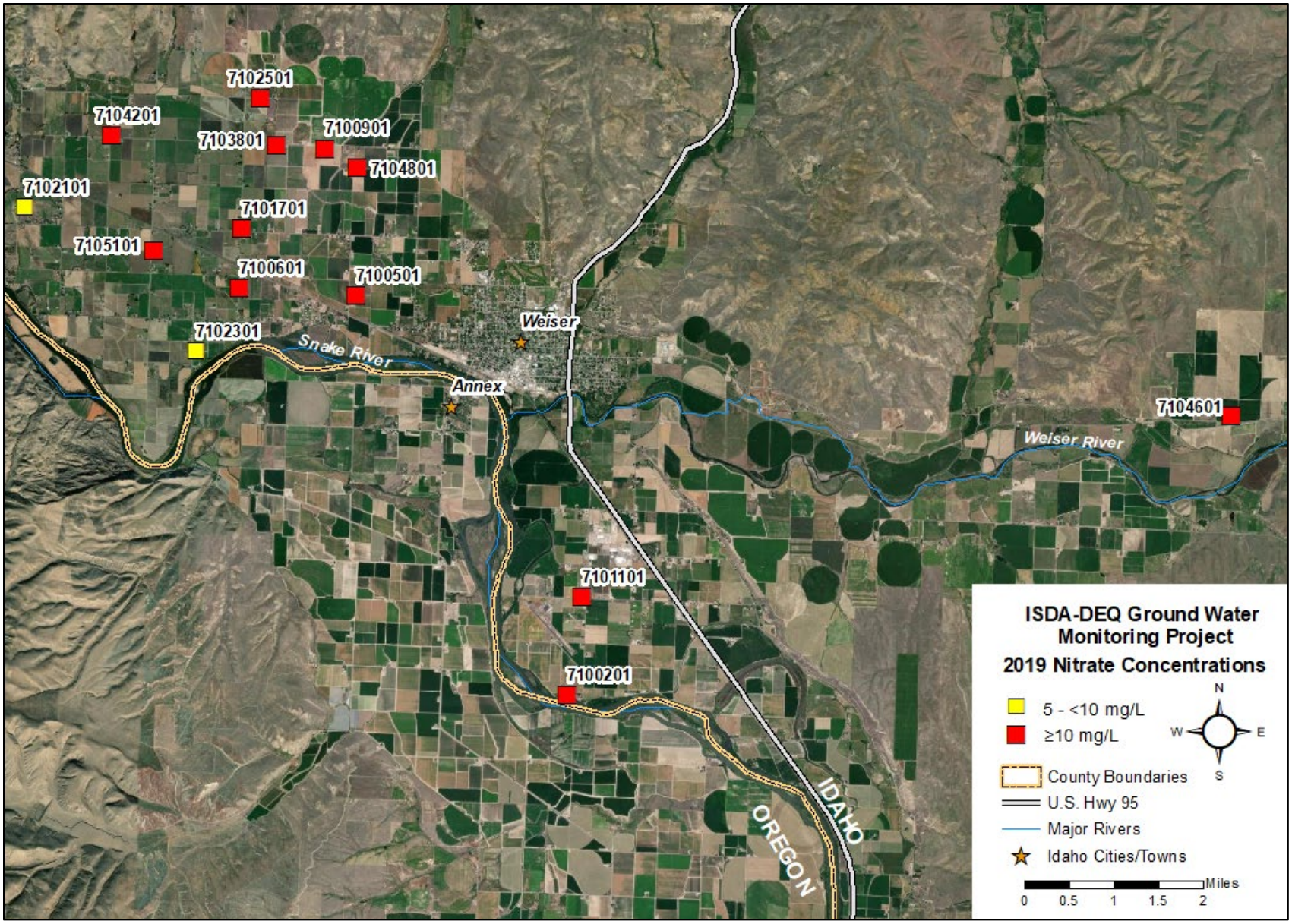


Figure B9. Project 710 (Washington County) nitrate concentrations, 2019 ISDA data.

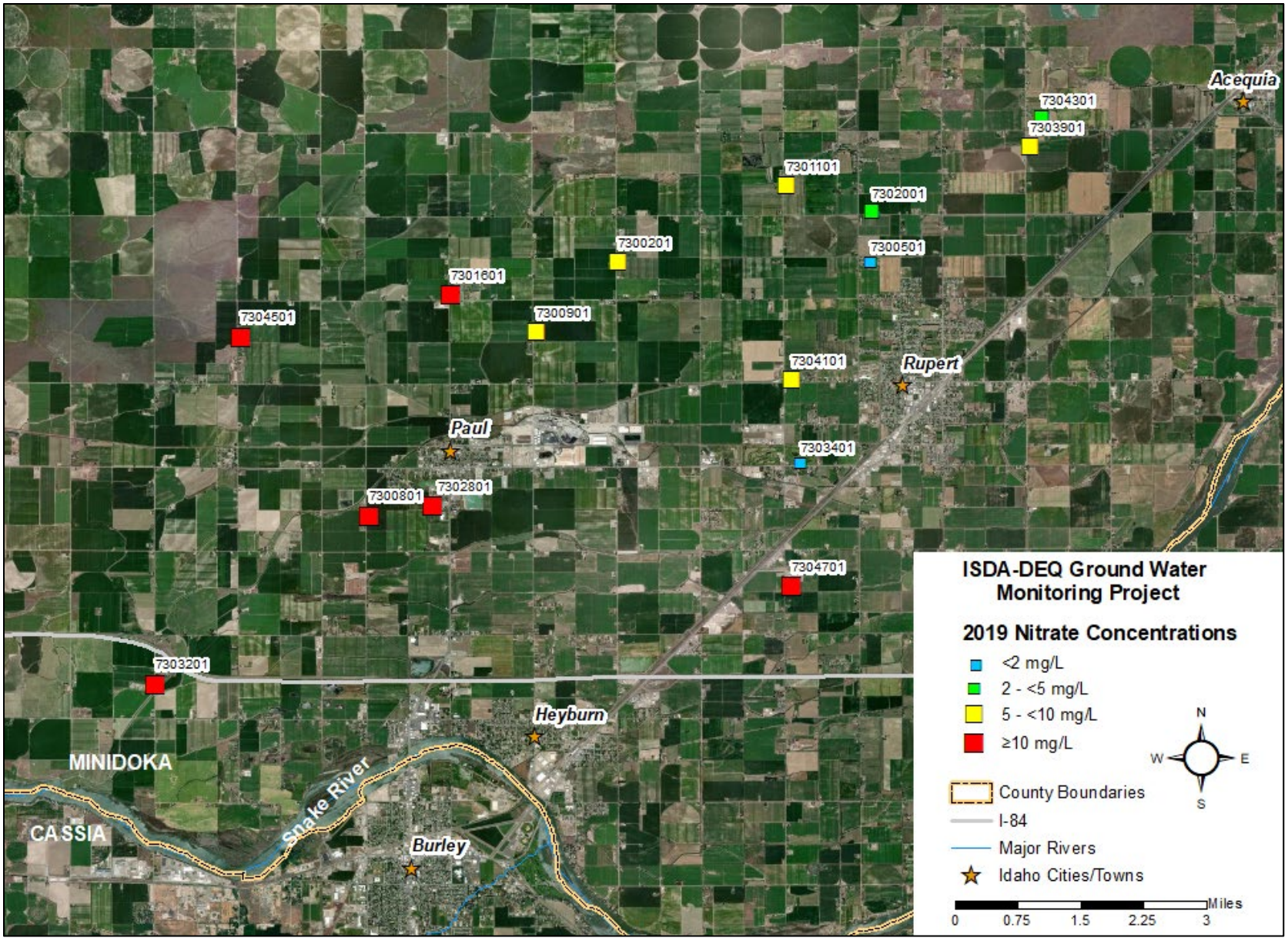


Figure B10. Project 730 (Minidoka County (shallow)) nitrate concentrations, 2019 ISDA data.

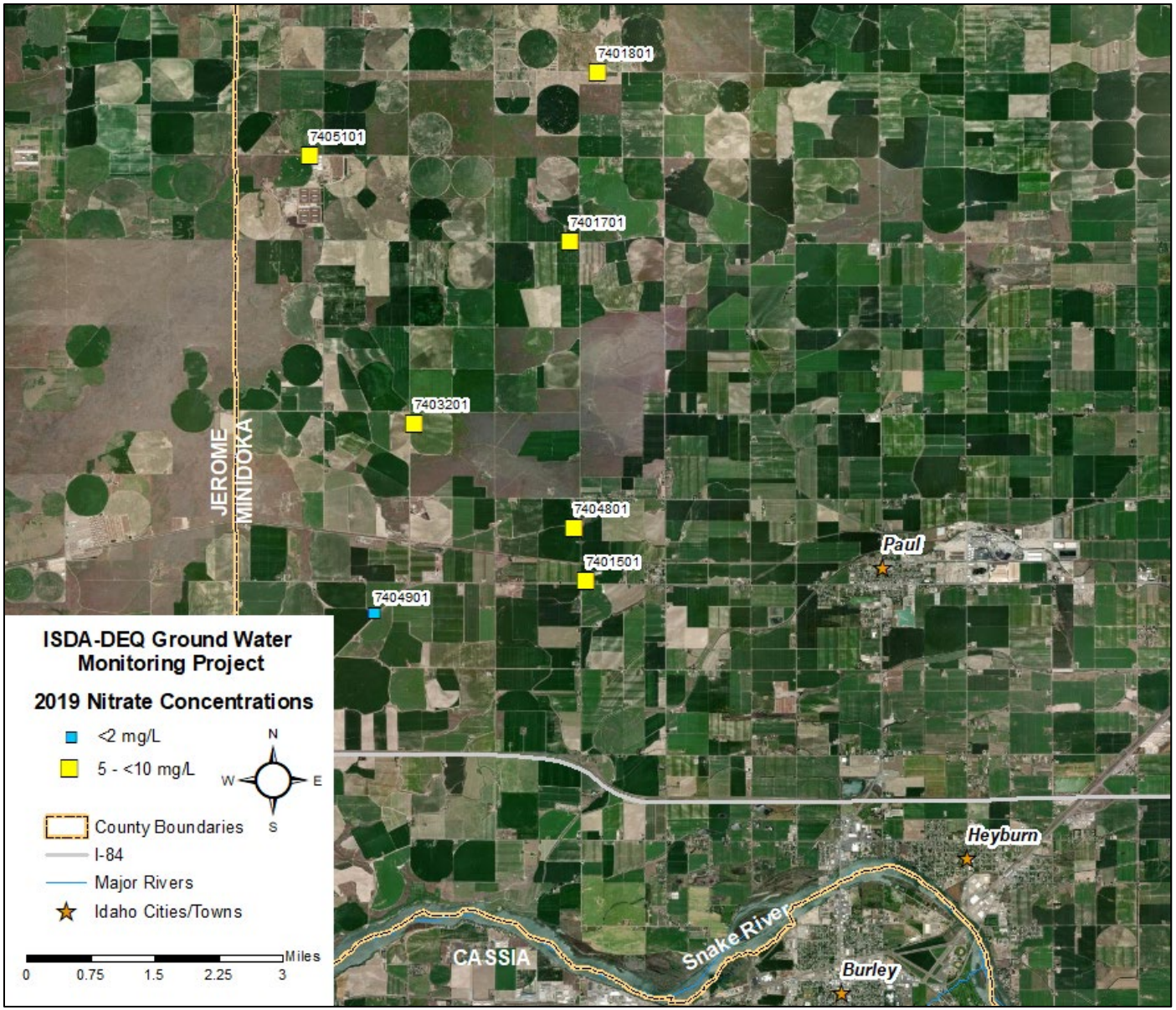


Figure B11. Project 740 (Minidoka County (deep)) nitrate concentrations, 2019 ISDA data.

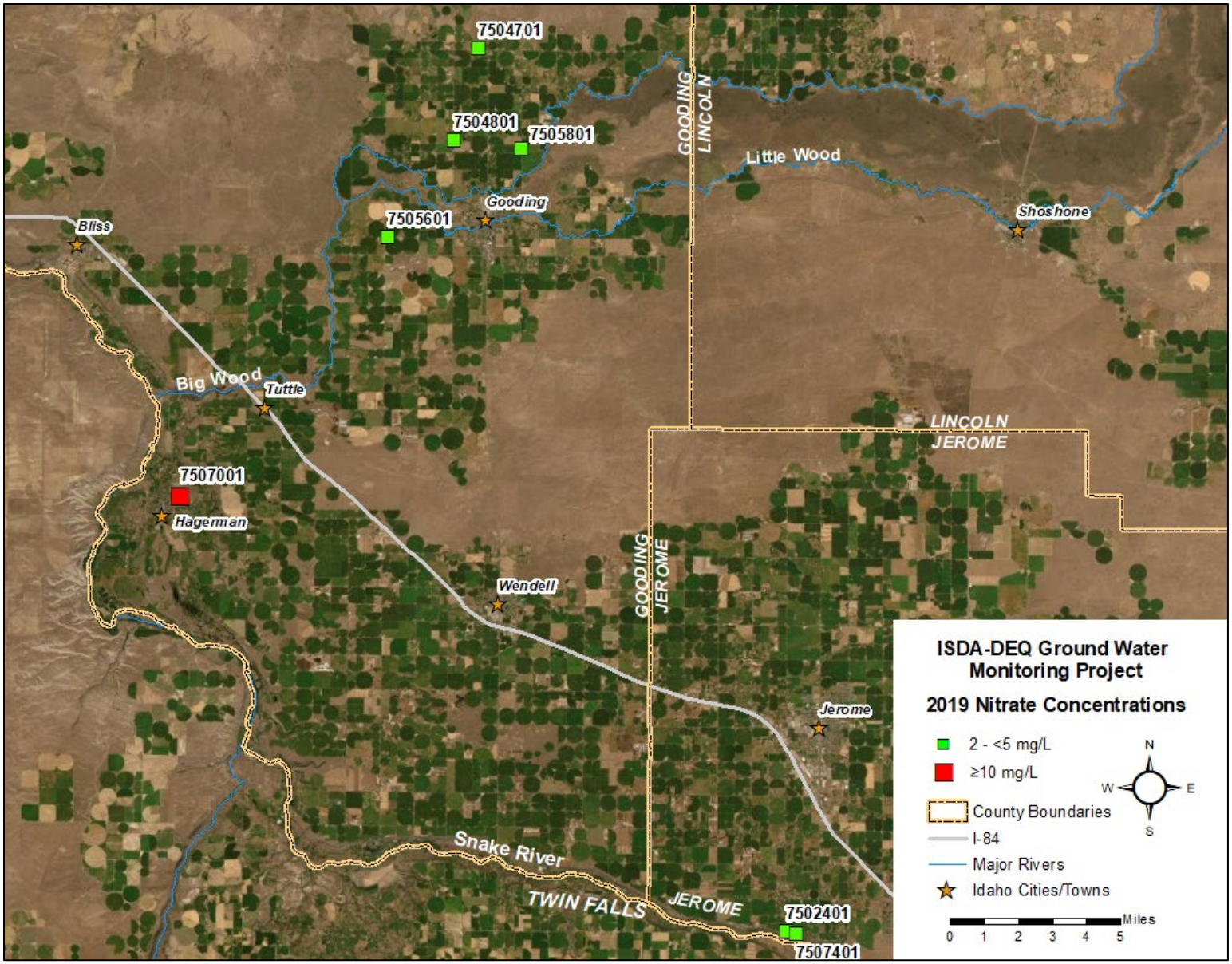


Figure B12. Project 750 (Gooding and Jerome Counties) nitrate concentrations, 2019 ISDA data.

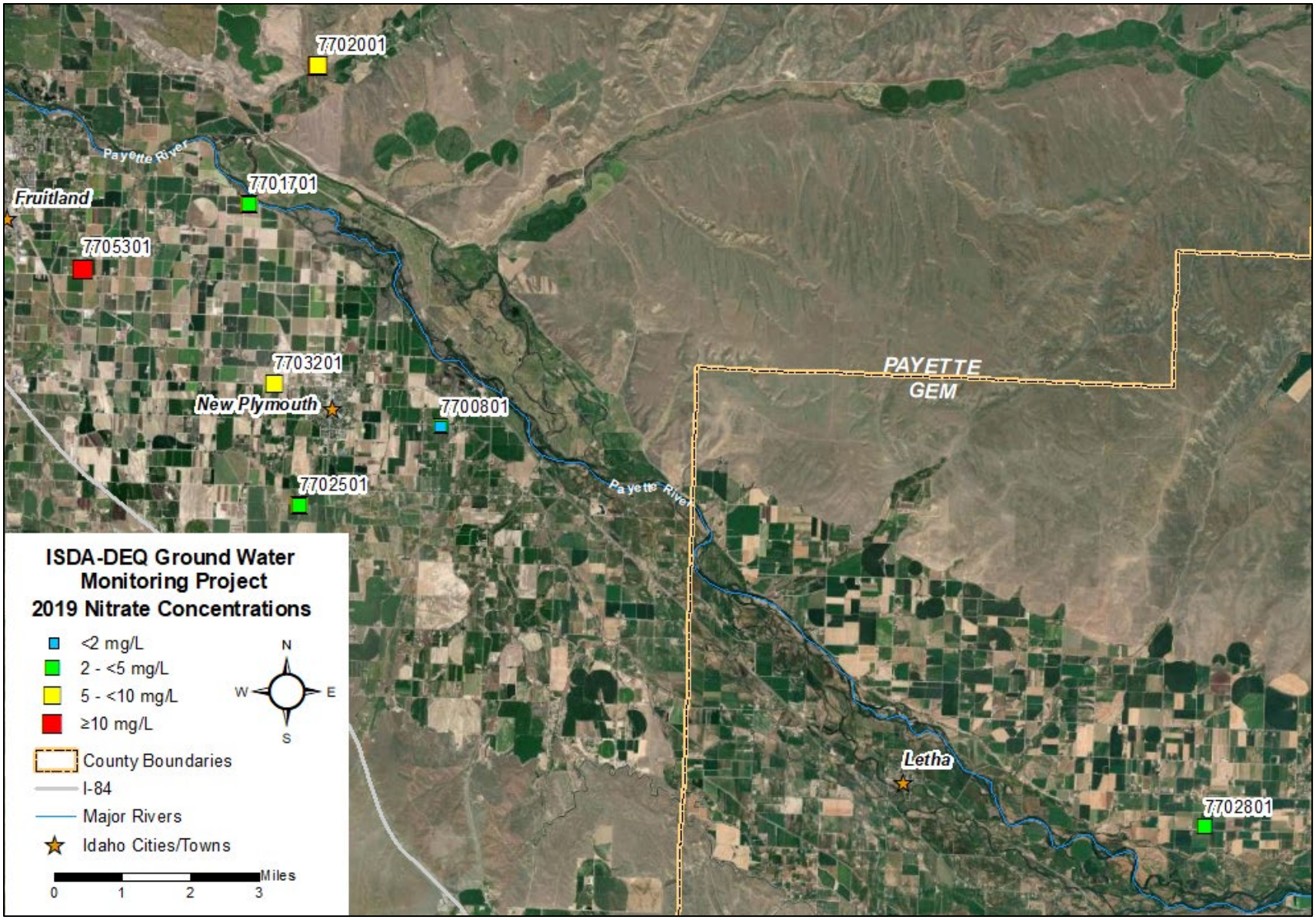


Figure B13. Project 770 (Gem and Payette Counties) nitrate concentrations, 2019 ISDA data.

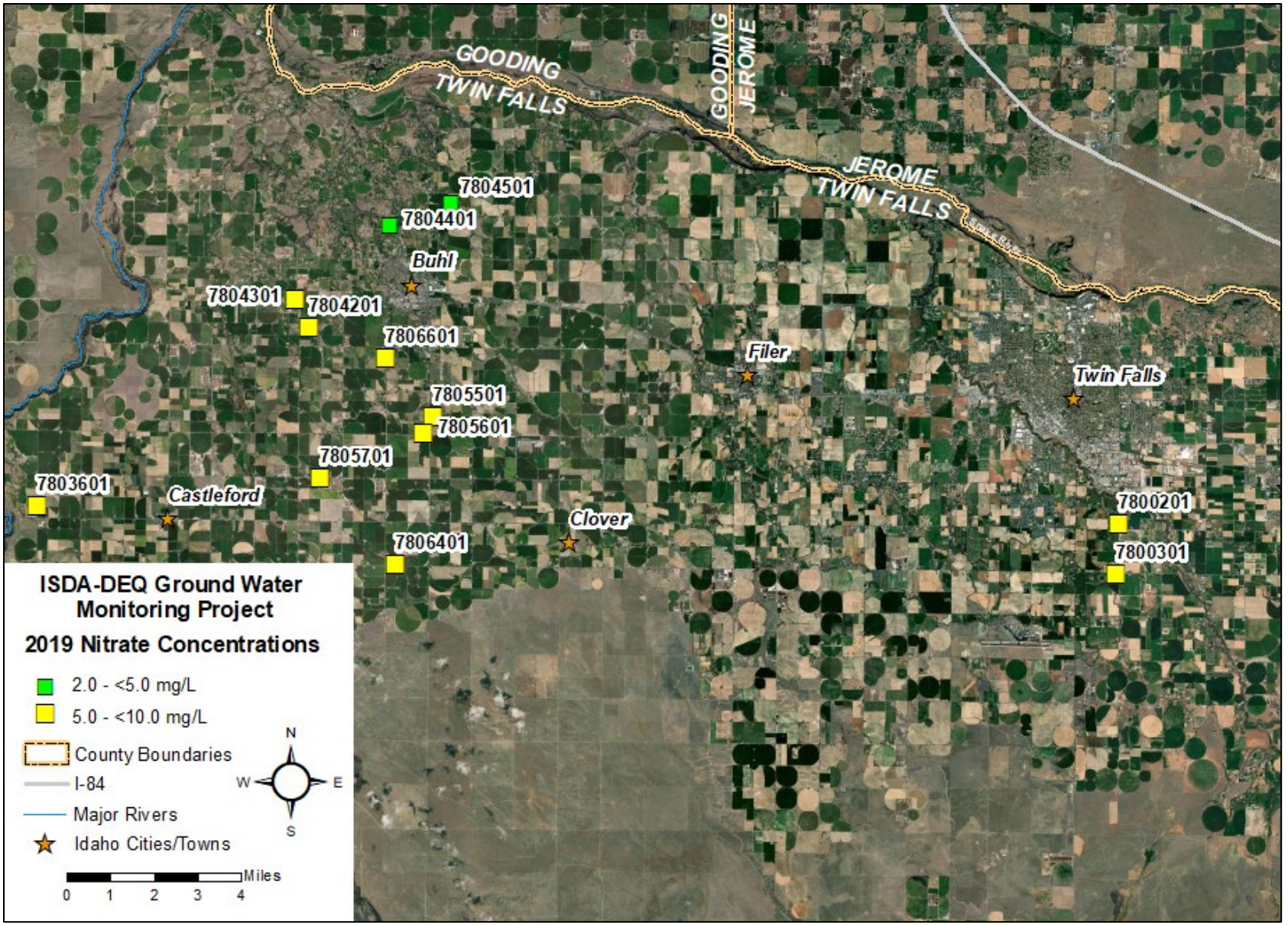


Figure B14. Project 780 (Twin Falls County) nitrate concentrations, 2019 ISDA data.

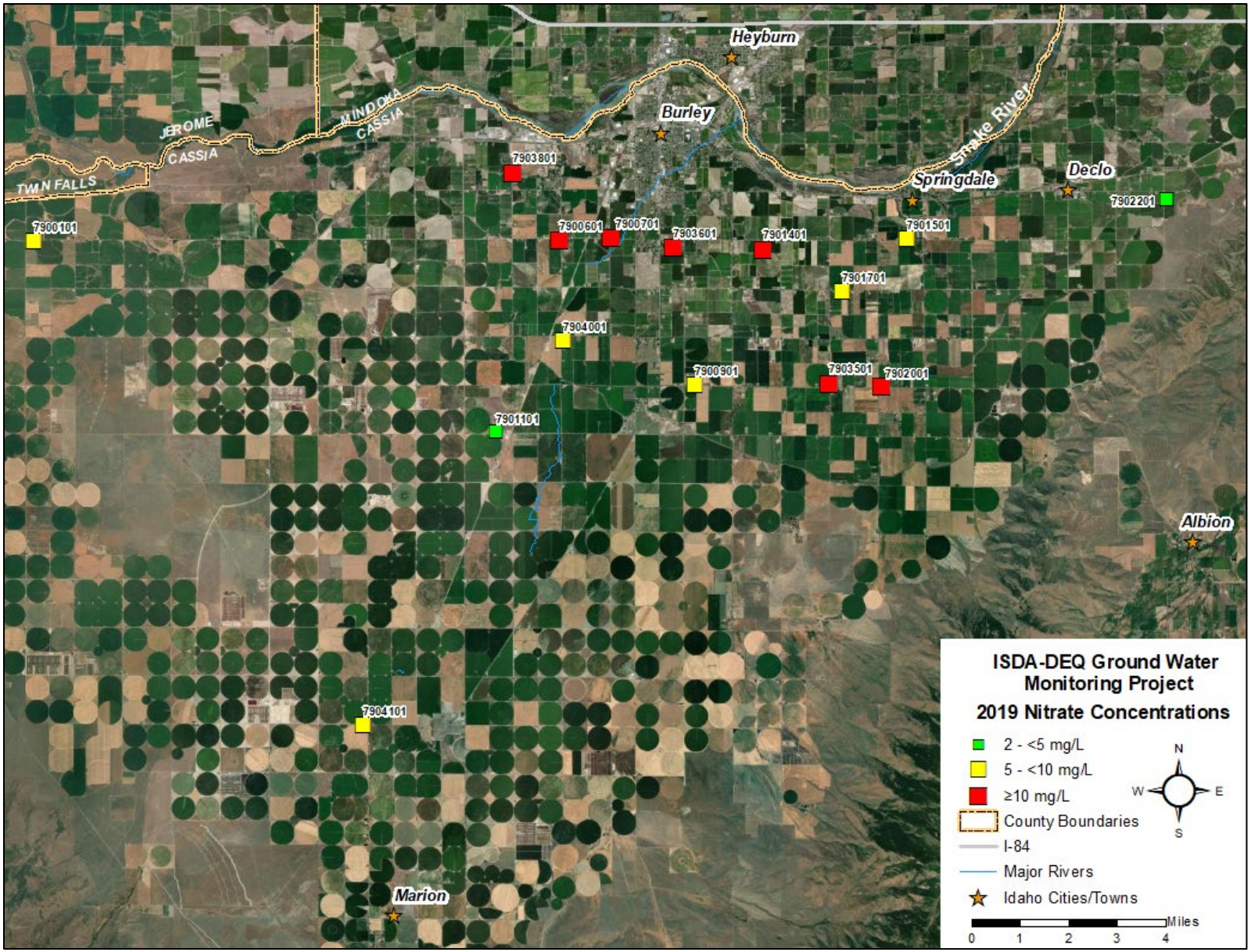


Figure B15. Project 790 (Cassia County) nitrate concentrations, 2019 ISDA data.

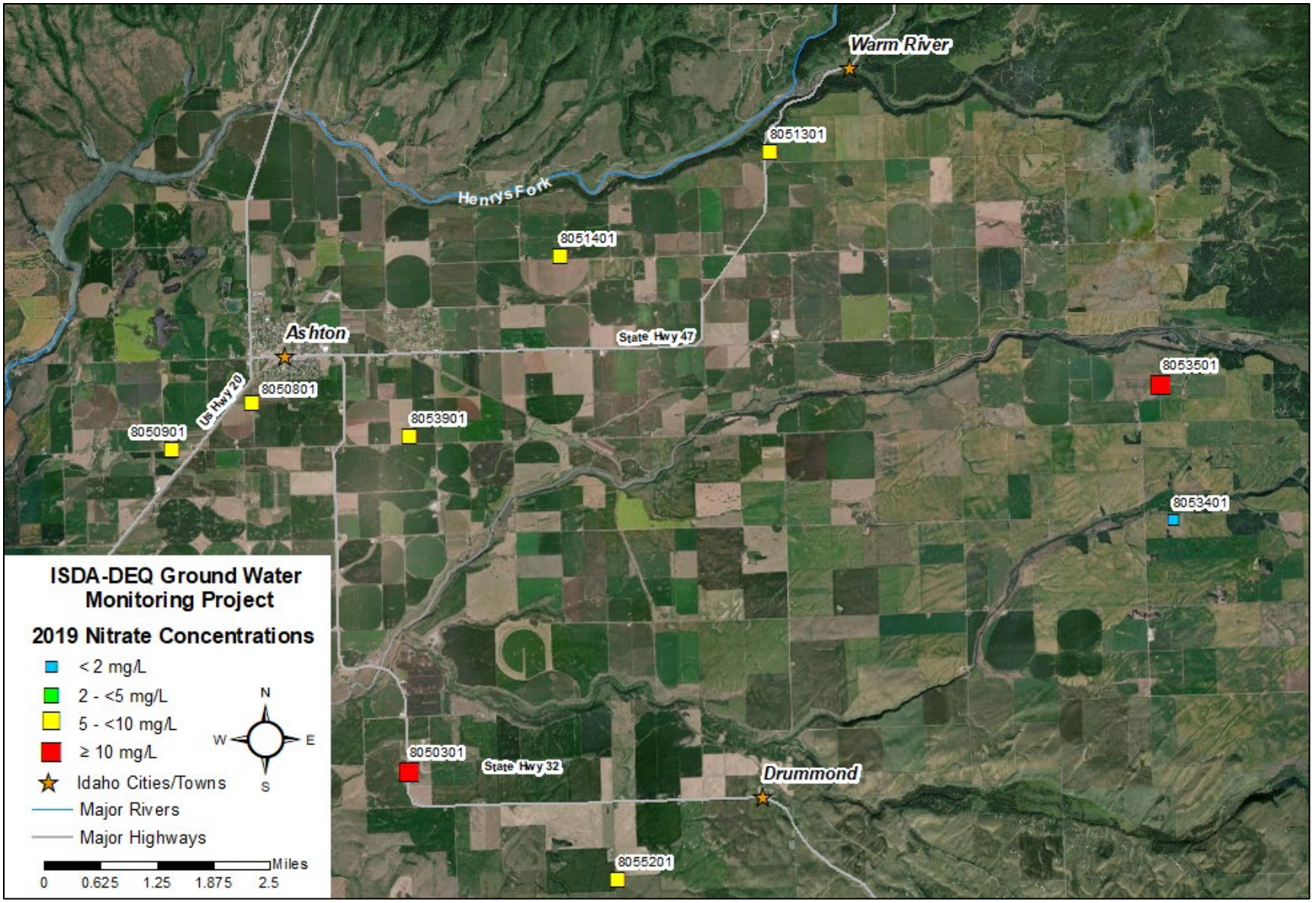


Figure B16. Project 805 (Fremont County) nitrate concentrations, 2019 ISDA data.

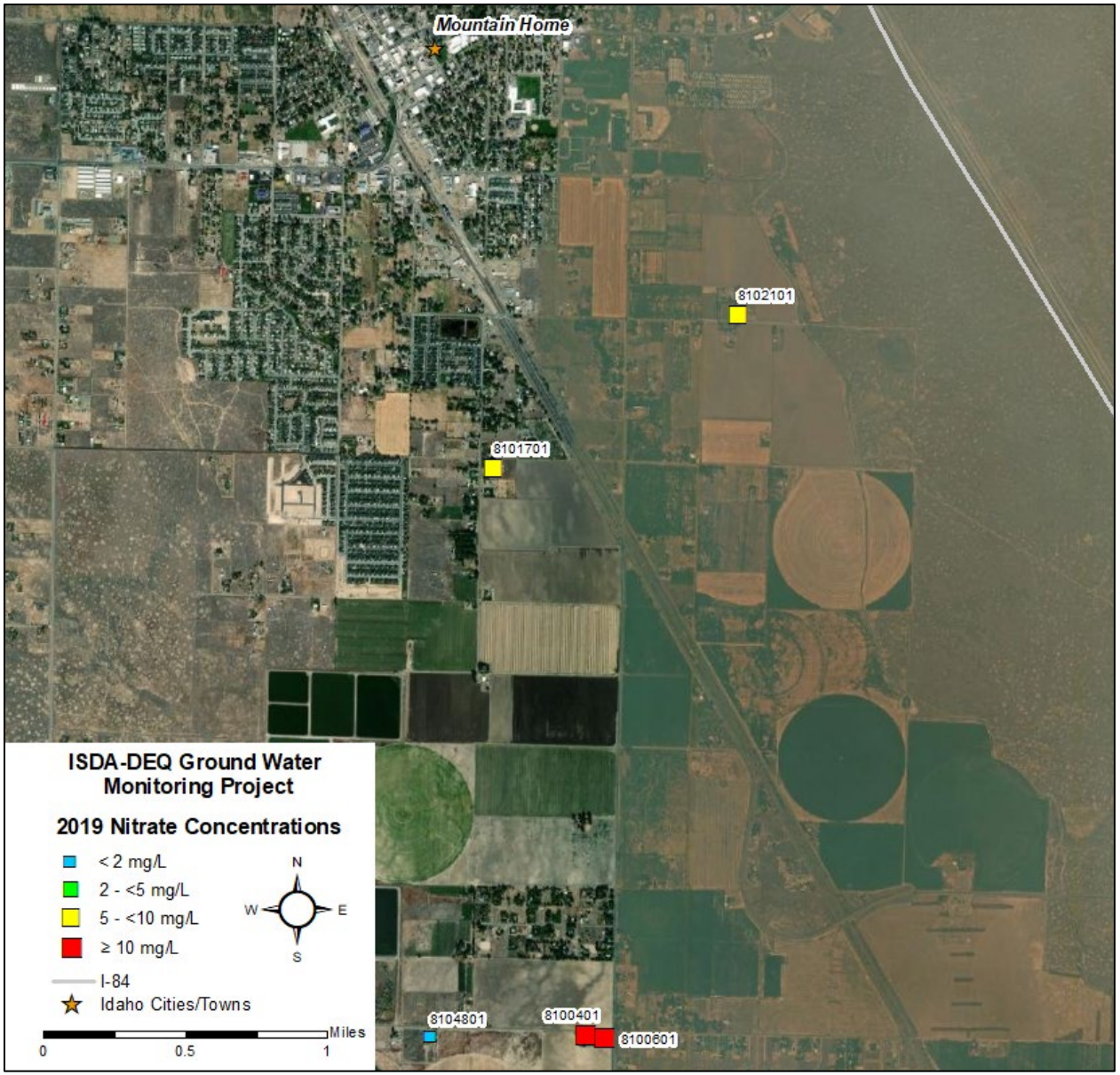


Figure B17. Project 810 (Elmore County) nitrate concentrations, 2019 ISDA data.

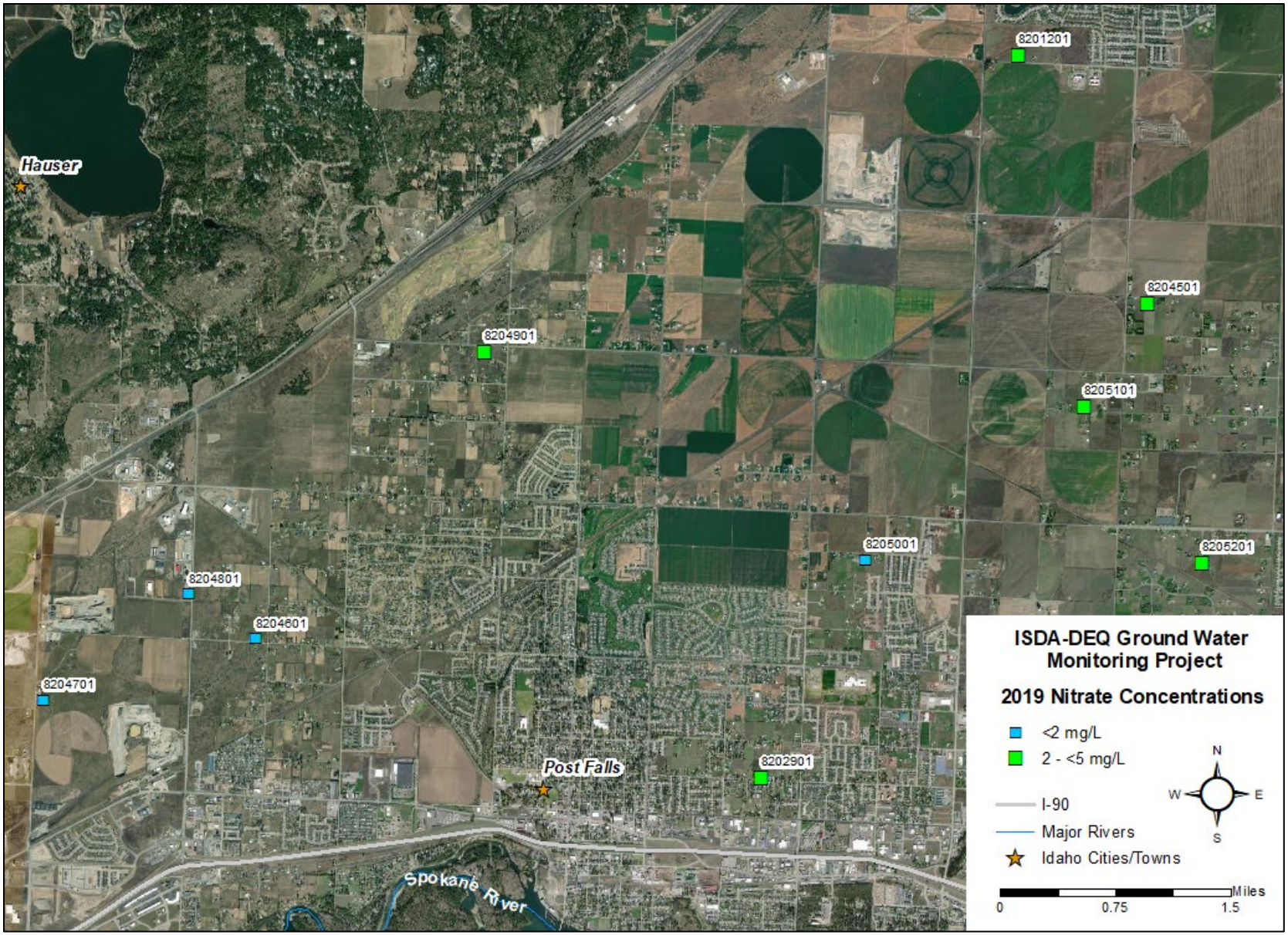


Figure B18. Project 820 (Kootenai County) nitrate concentrations, 2019 ISDA data.

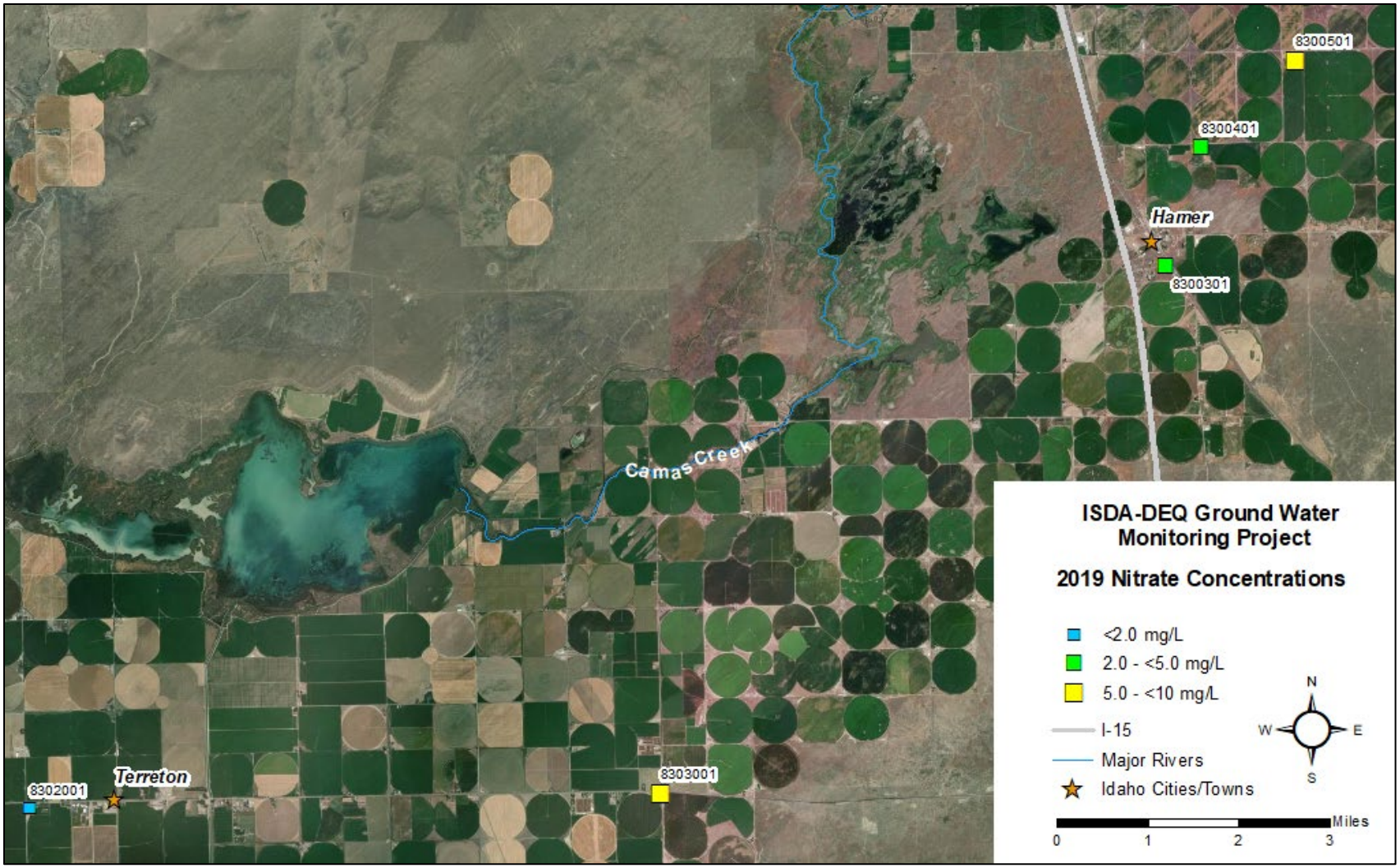


Figure B19. Project 830 (Jefferson County) nitrate concentrations, 2019 ISDA data.

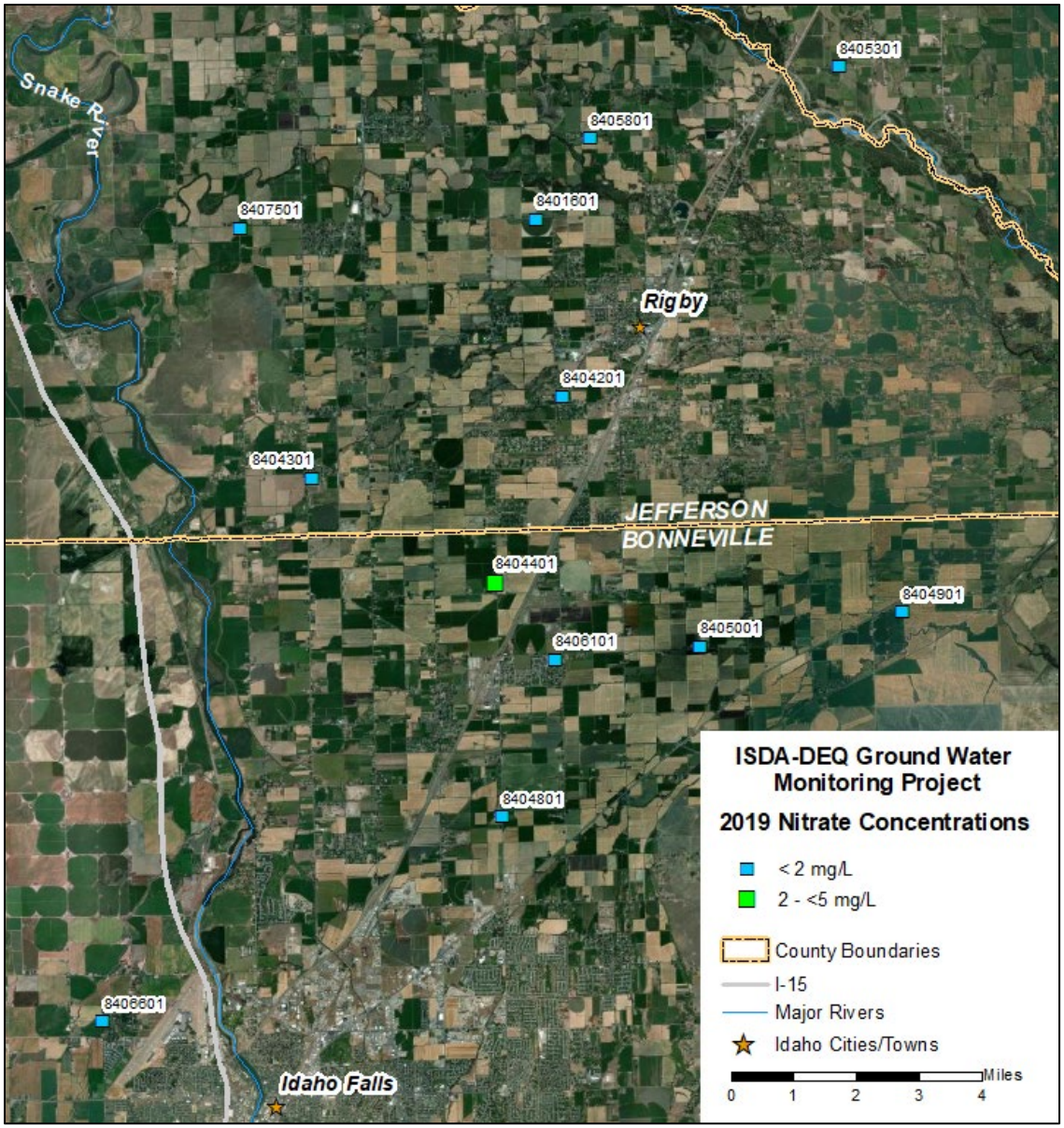


Figure B20. Project 840 (Bonneville, Jefferson, and Madison Counties) nitrate concentrations, 2019 ISDA data.

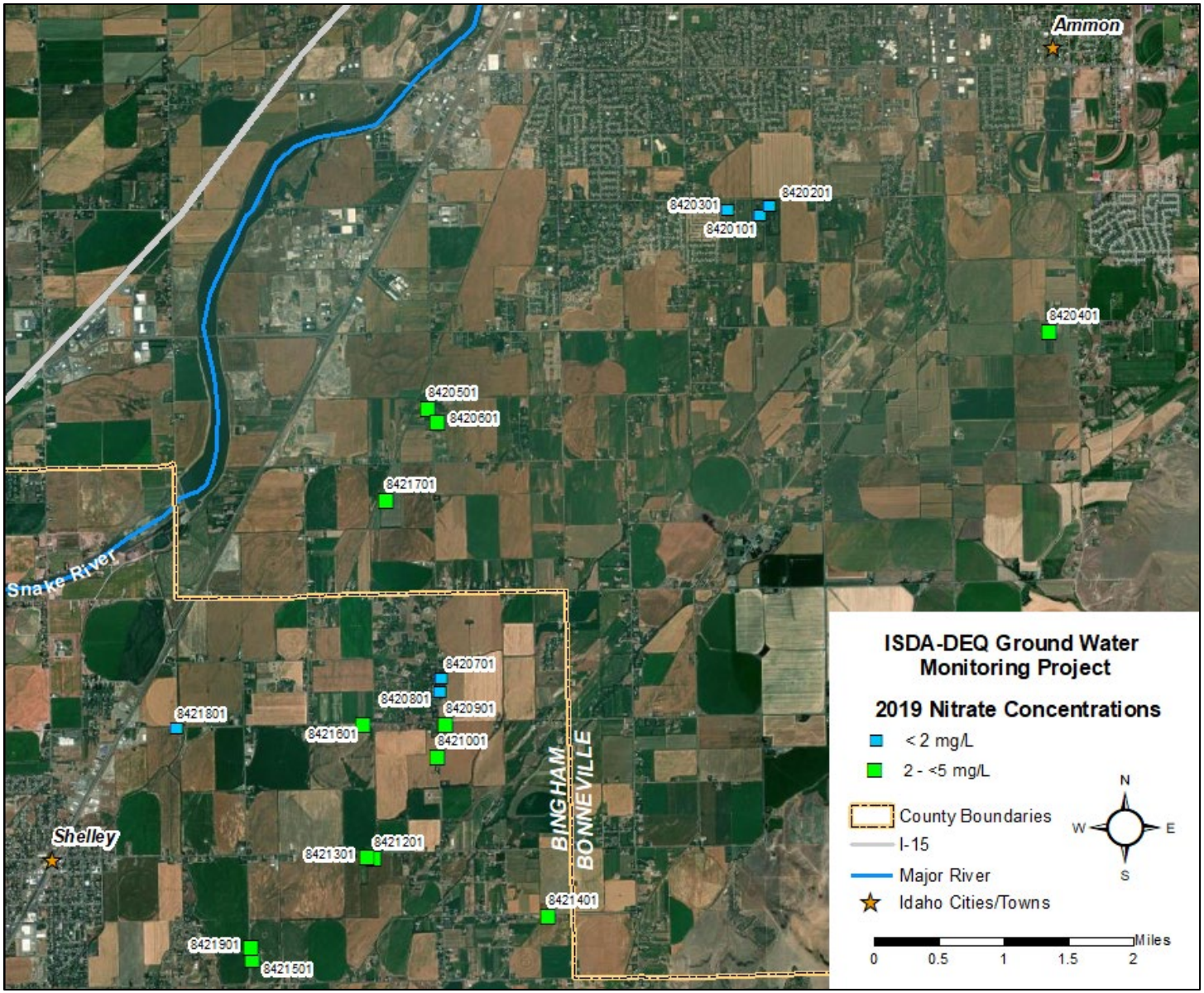


Figure B21. Project 842 (Bingham and Bonneville Counties) nitrate concentrations, 2019 ISDA data.

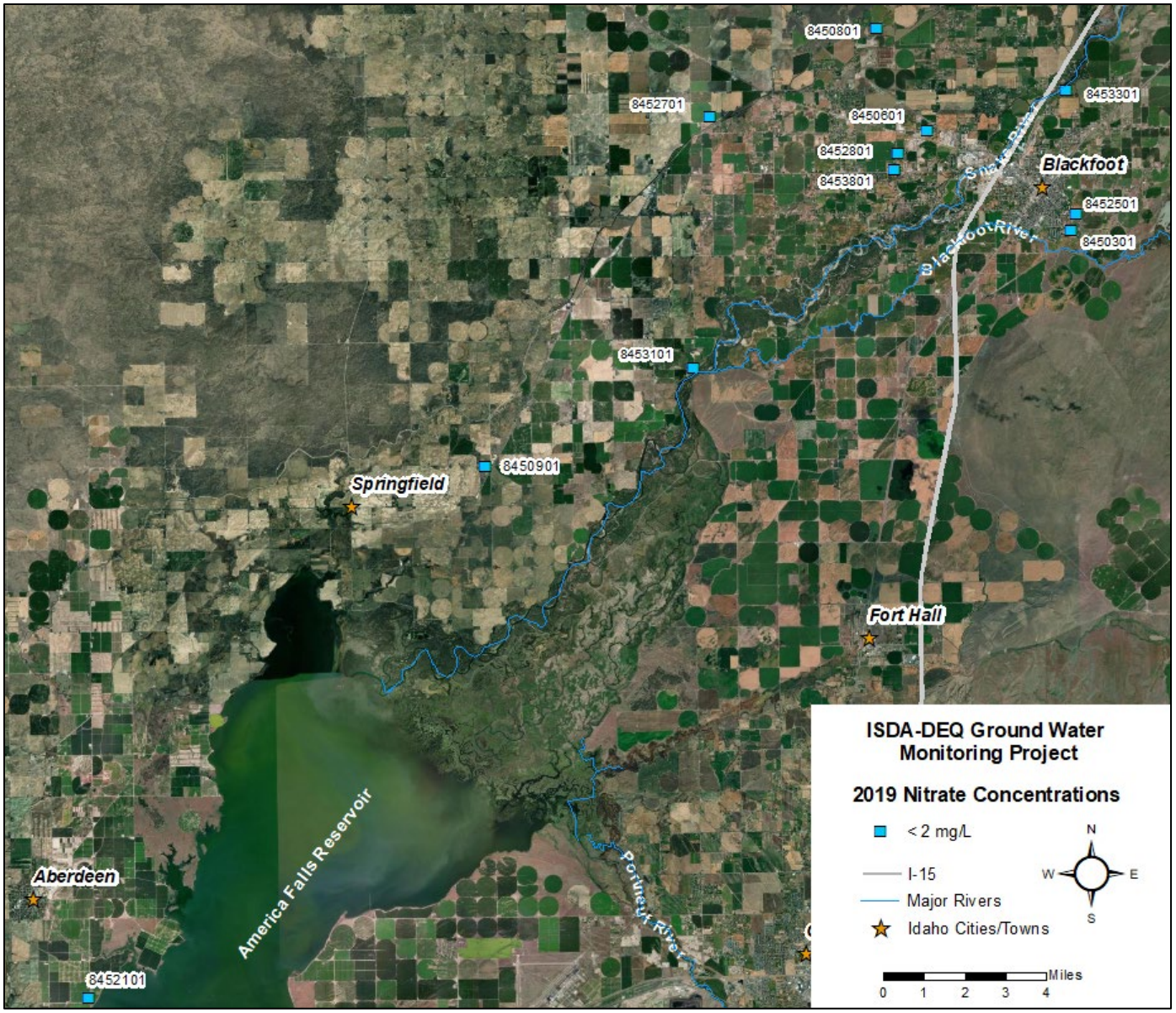


Figure B22. Project 845 (Bingham County) nitrate concentrations, 2019 ISDA data.

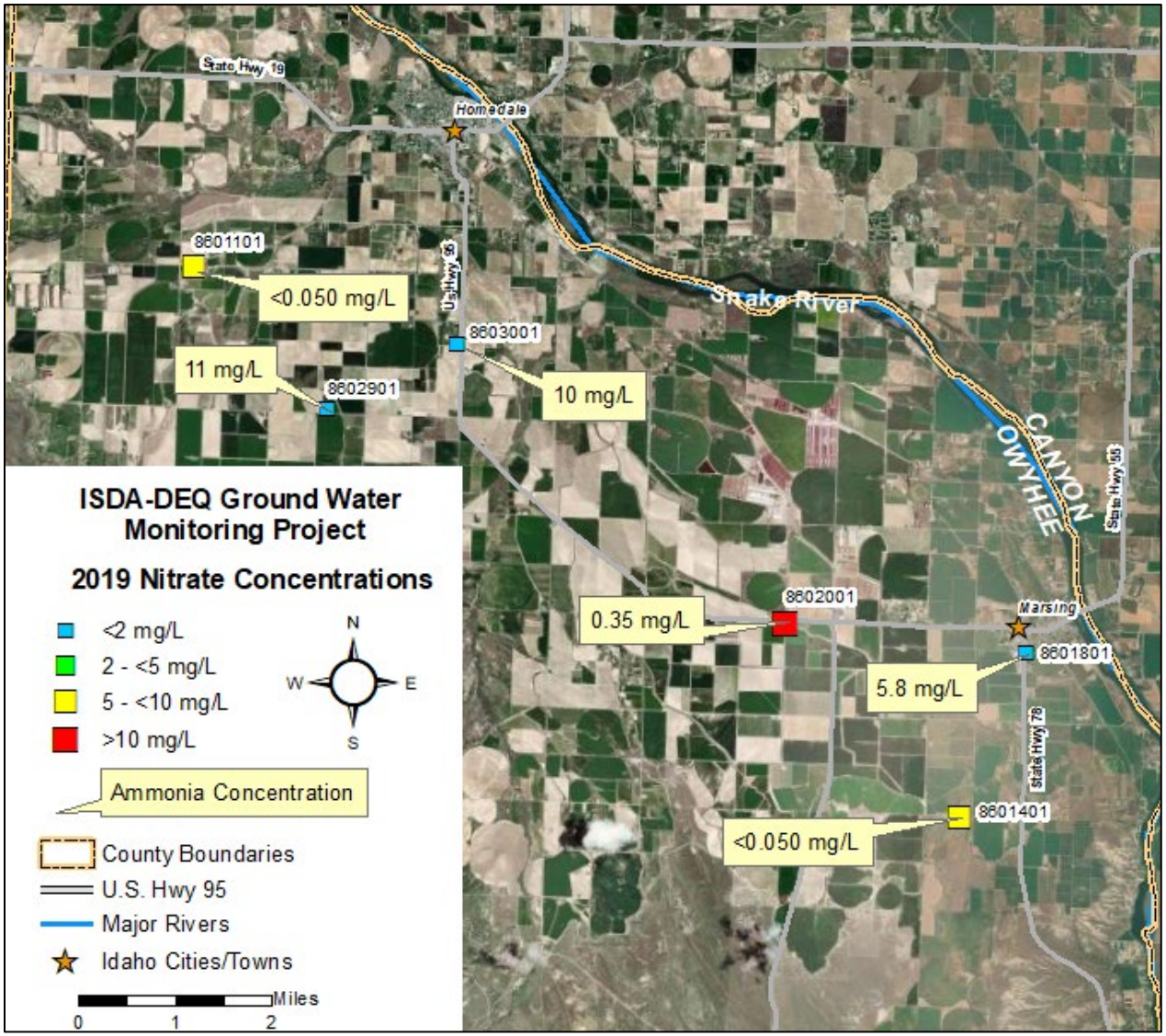


Figure B23. Project 860 (Owyhee County) nitrate concentrations, 2019 ISDA data.

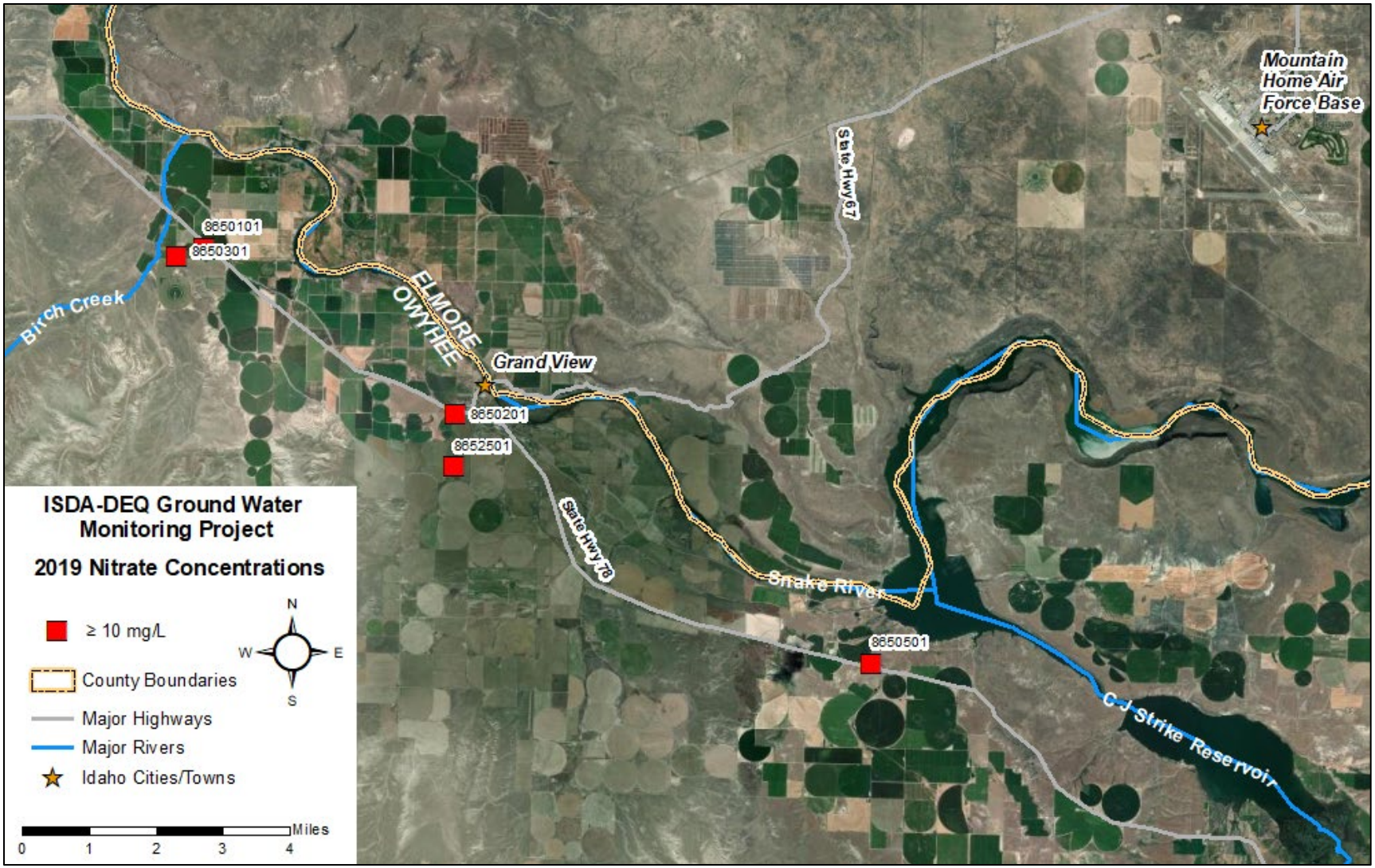


Figure B24. Project 865 (Owyhee County) nitrate concentrations, 2019 ISDA data.

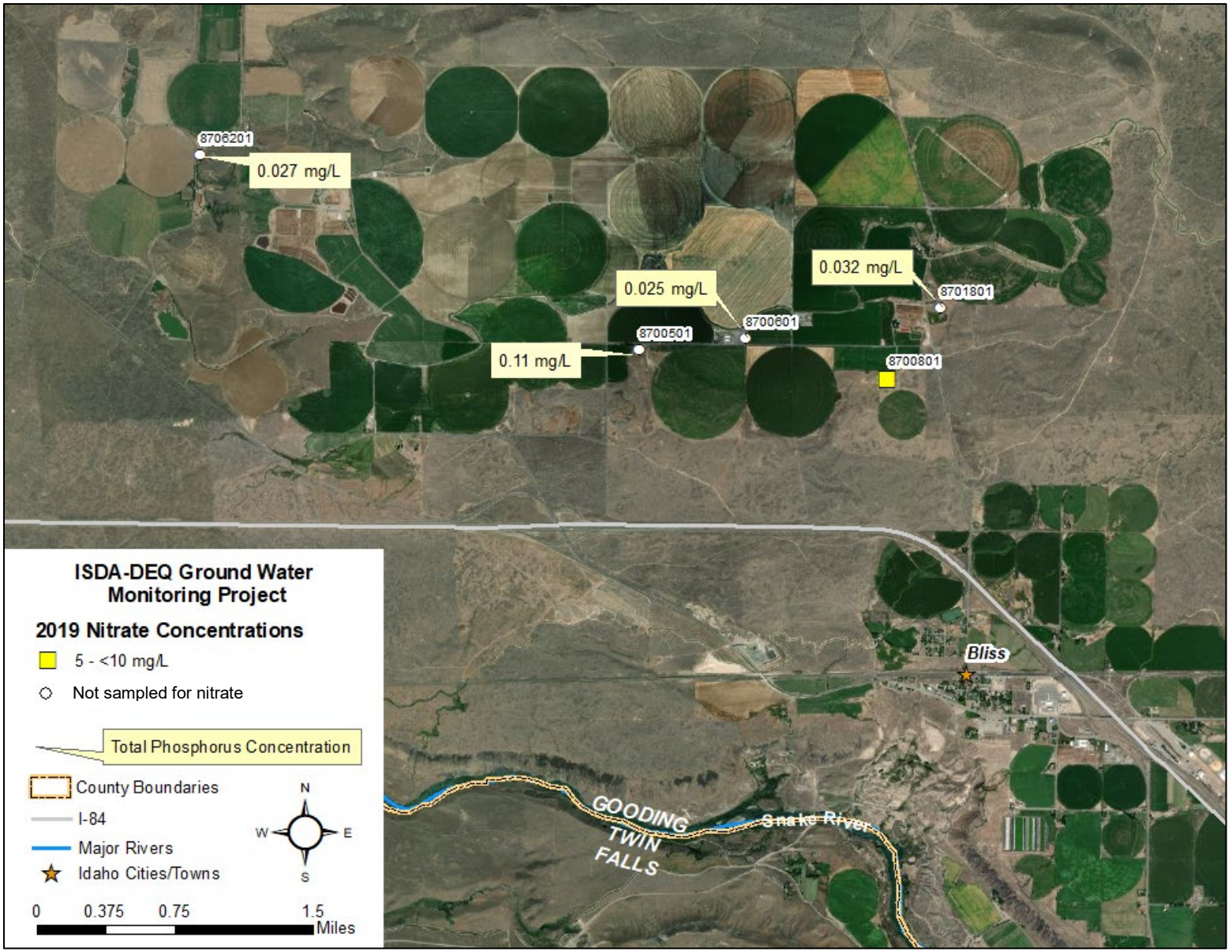


Figure B25. Project 870 (Gooding County) nitrate concentrations, 2019 ISDA data.

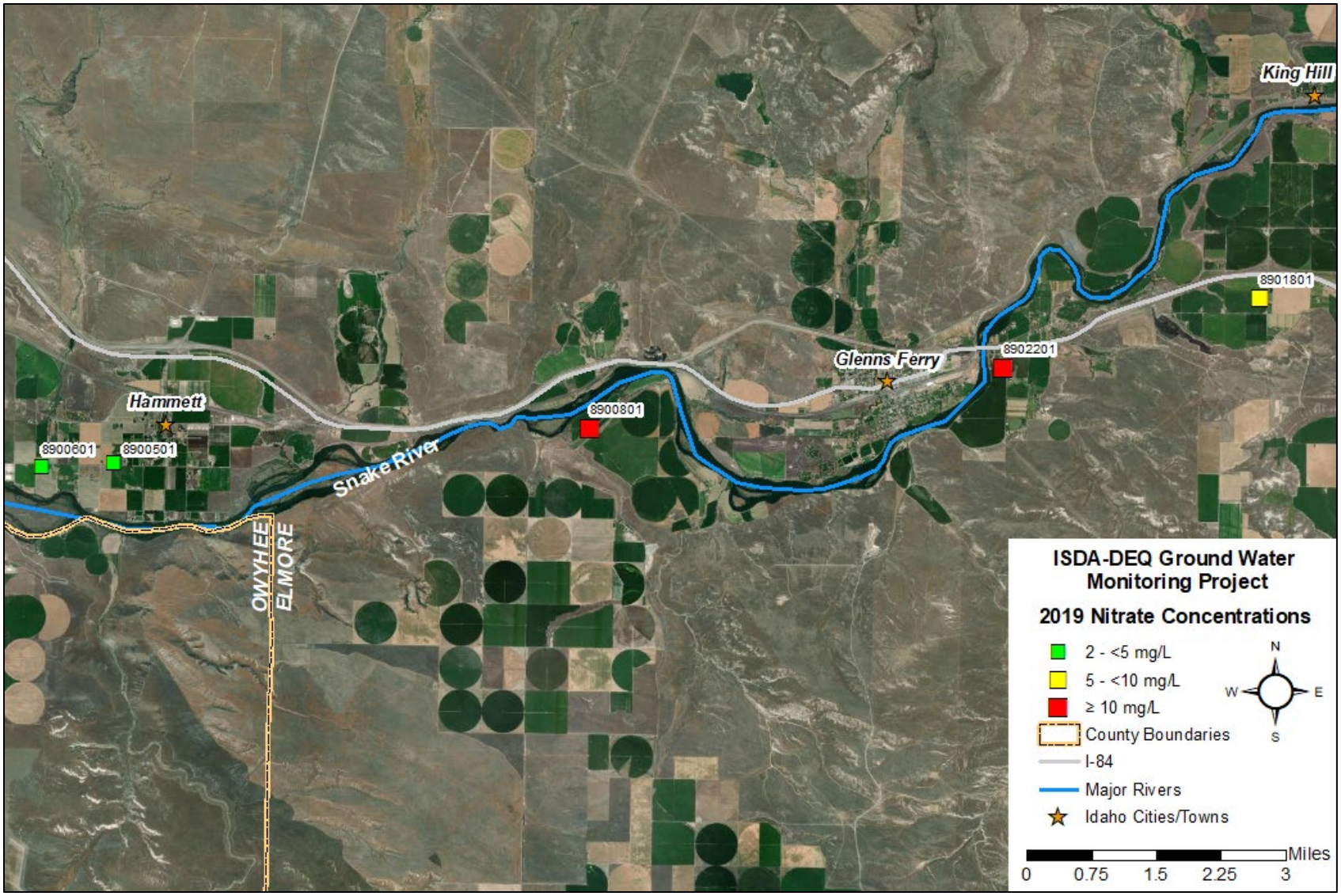


Figure B26. Project 890 (Elmore County) nitrate concentrations, 2019 ISDA data.

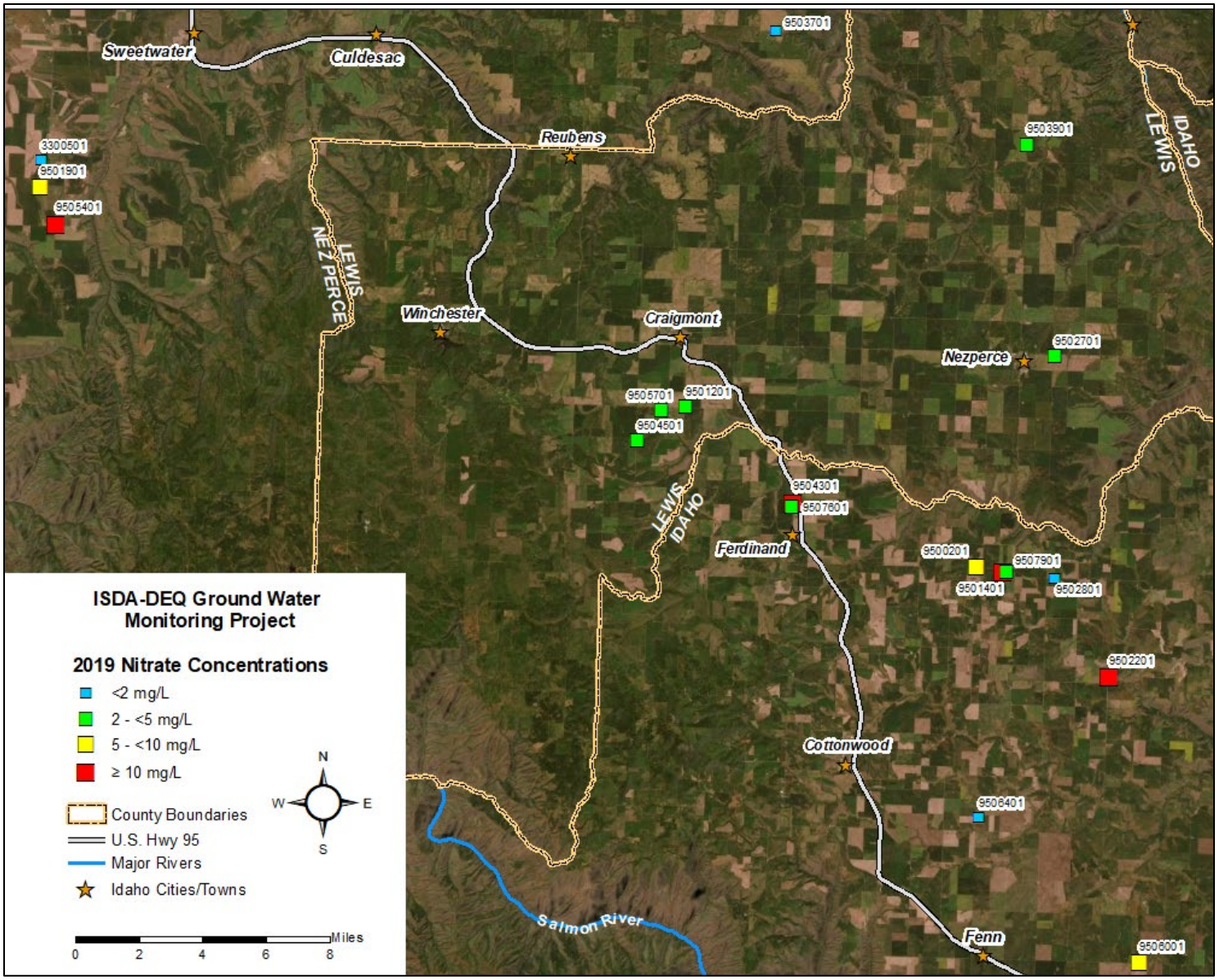


Figure B27. Projects 330 and 950 (Idaho, Lewis, and Nez Perce Counties) nitrate concentrations, 2019 ISDA data.

Appendix C. Juliaetta Nitrate Investigation Ground Water Quality Monitoring Project Pesticides Results

Idaho Food Quality Assurance Laboratory
Water Analyte List and MDL
2019

LC/TQD Negative

Analyte	MDL (µg/L)
clopyralid	0.10
picloram	0.15
dicamba	0.10
bentazon	0.050
dacthal monoacid	0.10
bromoxynil	0.050
2,4-D	0.10
2,4-DCBA	0.050
MCPA	0.050
triclopyr	0.10
MCPP	0.050
dichlorprop	0.050
2,4-DB	0.15
3,5-Dichlorobenzoic Acid	0.050
dinoseb	0.050
pentachlorophenol	0.050

Total Dacthal

Analyte	MDL (µg/L)
total dacthal (dacthal, dacthal monoacid, dacthal di-acid)	0.080

*separate test, by request only

LC/TQD Positive

Analyte	MDL (µg/L)
2,6-DEA	0.10
3-OH carbofuran	0.025
aldicarb	0.050
aldicarb sulfone	0.050
allethrin	0.050
azinphos methyl	0.025
azoxystrobin	0.025
bensulide	0.050
benthiocarb	0.025
bromacil	0.050
carbaryl	0.025
carbofuran	0.025
coumaphos	0.050
cycloate	0.075
deisopropyl atrazine	0.050
desethyl atrazine	0.025
diflubenzuron	0.025
dimethoate	0.025
diuron	0.025
fluometuron	0.025
imidacloprid	0.025
iprodione	0.050
linuron	0.050
metalaxyl	0.050
methiocarb	0.050
methomyl	0.050
methyl paraoxon	0.050
MGK-264	0.050
monuron	0.025
naled	0.15
norflurazon	0.025
oryzalin	0.050
oxamyl	0.050
propargite	0.050
propazine	0.025
propiconazole	0.025
propoxur	0.050
pyraclostrobin	0.025
simazine	0.025
tebuthiuron	0.025
terbacil	0.050
thiamethoxam	0.050
tralkoxydim	0.025
triadimefon	0.025

GC/TQD

Analyte	MDL (µg/L)
alachlor	0.050
ametryne	0.050
atrazine	0.025
benfluralin	0.10
bifenthrin	0.015
boscalid (nicobifen)	0.050
chlorothalonil	0.050
chloropropham	0.075
chlorpyrifos	0.025
cyfluthrin	0.050
cypermethrin	0.050
DCPA	0.025
deltamethrin	0.040
diazinion	0.025
dichlobenil	0.10
dichlorvos	0.050
diclofop methyl	0.050
EPTC	0.050
esfenvalerate	0.040
ethalfluralin	0.10
ethoprop (ethoprophos)	0.025
etridiazole (Terrazole)	0.10
fenarimol	0.025
fenpropathrin	0.025
hexazinone	0.025
lambda cyhalothrin	0.025
malathion	0.050
methidathion	0.050
metolachlor	0.050
metribuzin	0.050
MGK-264	0.050
napropamide	0.025
oxyfluorfen	0.050
parathion-methyl	0.075
pendimethalin	0.025
permethrin	0.10
phorate	0.10
phosmet	0.050
piperonyl butoxide	0.060
prometon	0.025
propyzamide	0.050
resmethrin	0.030
stirofos (tetrachlorvinphos)	0.025
sumithrin (phenothrin)	0.050
terbufos	0.050
triallate	0.050
trifluralin	0.050