Water Quality Protection District
LEWIS AND CLARK COUNTY, MT

1930 9th Avenue, Helena, MT 59601

Assessment of Nitrates, Radionuclides, and Trace Elements in Groundwater, Unionville, Montana,

Technical Report

Kegan McClanahan, Maddie McKeefry, Jennifer McBroom, and Angelique Frier[1]

[1] AmeriCorps, Big Sky Watershed Corps

January 2026

PREFACE

This study was conducted by the Lewis and Clark County Water Quality Protection District (LCCWQPD) in partial fulfillment of our mission to preserve, protect, and improve water quality and quantity within the boundaries of the LCCWQPD. This is achieved through the collection of stream and groundwater data, conducting investigations and outreach on local water issues, and assisting residents to better understand their water resources.

This study includes the following deliverables:

- **Technical Report**: This document serves as the final technical report for this study and will be publicly available on the LCCWQPD's website:

  https://www.LCCountyMT.gov/Government/Public-Health/Water-Quality-Protection-District

- **2-page summary**: This summary will be presented to the LCCWQPD Board of Directors. Additionally, this summary will be publicly available on the LCCWQPD website.

- **Public meeting**: The LCCWQPD will present the study's findings to the public at a minimum of one public meeting.
  - Presented at October 2023 LCCWQPD Board Meeting
  - Presented at October 2025 LCCWQPD Board Meeting

- **Interactive webpage**: A publicly available website has been developed using ESRI's StoryMap platform. This website supplements the technical report and 2-page summary to help distribute this study's findings to all interested parties.

  https://storymaps.arcgis.com/stories/50b3f91ccd1040f29410b637d9151459

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Abbreviations and Acronyms

DNRC	Montana Department of Natural Resources and Conservation
LCC	Lewis and Clark County, Montana
MBMG	Montana Bureau of Mines and Geology
MCL	U.S. Environmental Protection Agency Maximum Contaminant Level
MDEQ	Montana Department of Environmental Quality
SDWA	Safe Drinking Water Act
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
LCCWQPD	Lewis and Clark County Water Quality Protection District

Units

Ci	curie
pCi/L	picocuries per liter
mg/L	milligrams per liter
µg/L	micrograms per liter
‰	Per mille

ABSTRACT

Nutrient, radionuclide, and trace metal contamination of groundwater along the northern margin of the Boulder Batholith near Helena, Montana was investigated to identify water quality concerns for property owners. Groundwater samples collected in the spring and fall of 2023 showed elevated levels of nitrates in the groundwater. Stable isotope analyses indicated the likely source of contamination is local septic systems or animal waste. Radionuclide samples were elevated with respect to uranium and radon. Uranium was present in all wells; however, all samples were below the federal drinking water standard. At the time of this publication there is no federal drinking water standard for radon, however all samples exceeded the proposed standard of 300 pCi/L. Radon was also present in all samples above the proposed standard. These findings align with past work performed in the vicinity of the Boulder Batholith. Recommendations to property owners are presented alongside the conclusions of this study.

INTRODUCTION

The town of Unionville, Montana, is located approximately 5 miles southwest of the capital, Helena, in west-central Montana. In 2019, the Lewis and Clark County Water Quality Protection District (LCCWQPD) partnered with Dr. Willis Weight of Carroll College (since retired) to study groundwater quality in the Unionville area. The dominant source of potable water in this area is groundwater, so the 2019 study was designed as a reconnaissance mission to identify potential water quality concerns for the residents. The findings of this initial study were presented in a poster at the annual Carroll College student research symposium. While the poster presentation provided an overview of the findings, the conclusions were limited. The 2019 study concluded that wastewater in the area was impacting local groundwater resources. The fractured nature of the granite bedrock aquifer made it susceptible to anthropogenic surface contamination. Additionally, the granite bedrock that comprises the Boulder Batholith is likely a source of uranium for any wells in the area which is consistent with United States Geological Survey (USGS) findings (Caldwell et al., 2014).

The 2019 study recommended residents test their wells to determine if wastewater is impacting the water quality. Regular nutrient testing (e.g. nitrates) could help determine if additional steps are needed to manage local wastewater. It was also recommended for residents to test their wells for radionuclides, arsenic, and uranium.

In 2023, the LCCWQPD decided to perform a follow-up study with the assistance of the LCCWQPD's Big Sky Watershed Corps member. This follow-up study focused on:

(1) identifying trends and source(s) of nitrate, and
(2) trends of radionuclides and trace elements

Acknowledgements

The LCCWQPD would like to thank the numerous property owners who participated in the studies, both in 2019 and in 2023. The LCCWQPD strives to work closely with property owners for site access and to better understand their water resource concerns; without the permission of property owners to conduct work on their land, these studies would not be possible.

The field work for this project was conducted by the following LCCWQPD staff:

- Jennifer McBroom
- Maddie McKeefry (has since left the LCCWQPD)
- Angelique Frier (AmeriCorps, Big Sky Watershed Corps)

Previous Investigations

Previous work in this area has been conducted by Lorenz and Swenson (1951), Noble et al. (1982), Briar and Madison (1992), Thamke (2000), Leonard and Janzer (1978), and Caldwell et al. (2014) among others. This discussion on prior work focuses on those most relevant to this study. The reader is referred to the publications discussed here for a more thorough review of background information.

Lorenz and Swenson (1951) laid the groundwork for groundwater investigations in the Helena area. Their work characterized the occurrence and conditions of groundwater in the Helena Valley within the context of proposed irrigation in the valley as part of the Canyon Ferry Dam project. Though their work focused on the Helena Valley, and by extension the alluvial aquifer, they also characterized the Tertiary and bedrock aquifers that exist in the valley margins and in the mountains south of Helena in and around Unionville.

On a wider scale, Nobel et al. (1982) reported the characteristics of aquifers across the Rocky Mountains of Montana. This work summarized the thicknesses, potentiometric surfaces, structural configurations, and water quality of the major aquifers across this region.

Briar and Madison (1992) expanded upon the work by Lorenz and Swenson (1951) in their investigation of the Helena Valley Alluvial Aquifer. This work showed that the bedrock aquifers adjacent to the alluvial aquifer contribute a significant volume of groundwater flow to the overall flow regime of the area. A potentiometric surface map was included in this work.

Thamke (2000) evaluated the bedrock aquifers in the Helena, Montana area with respect to the geologic structure, water availability, and groundwater quality. This investigation found the bedrock yielded a spatially heterogeneous aquifer system that greatly influenced groundwater levels and hydraulic conductivity. The groundwater also showed elevated levels of nitrates above the U.S. Environmental Protection Agency's (USEPA) maximum contaminant level (MCL) for public drinking water systems.

Leonard and Janzer's (1978) work described anomalously elevated radioactivity in thermal waters (hot springs) southeast of Helena at the Alhambra Hot Springs. They concluded that high levels of radioactivity occur in silicified fractures of crystalline intrusive bedrock (Boulder Batholith). These same fractures provide porosity and permeability to the bedrock for groundwater flow and recharge.

Caldwell et al. (2014) investigated naturally occurring radionuclides in Broadwater, Deer Lodge, Jefferson, Lewis and Clark, Madison, Powell, and Silver Bow Counties in association with the numerous intrusive igneous bodies. Their work found elevated concentrations or activities of metals and radionuclides in groundwater throughout the region.

STUDY AREA

Unionville, Montana, comprises approximately 2.5 square miles (mi^2) of mountainous terrain in west-central Montana (Figure 1). Unionville is located approximately 5 miles south of Helena, Montana. As of the 2020 Decennial Census, Unionville has a population of 206 persons with approximately 100 residences (United States Census Bureau). Residences are served by individual potable water wells and individual septic systems. Groundwater is the primary source of drinking water in the area with few ephemeral surface streams. The land is predominantly forest and rangeland outside the localized residential development.

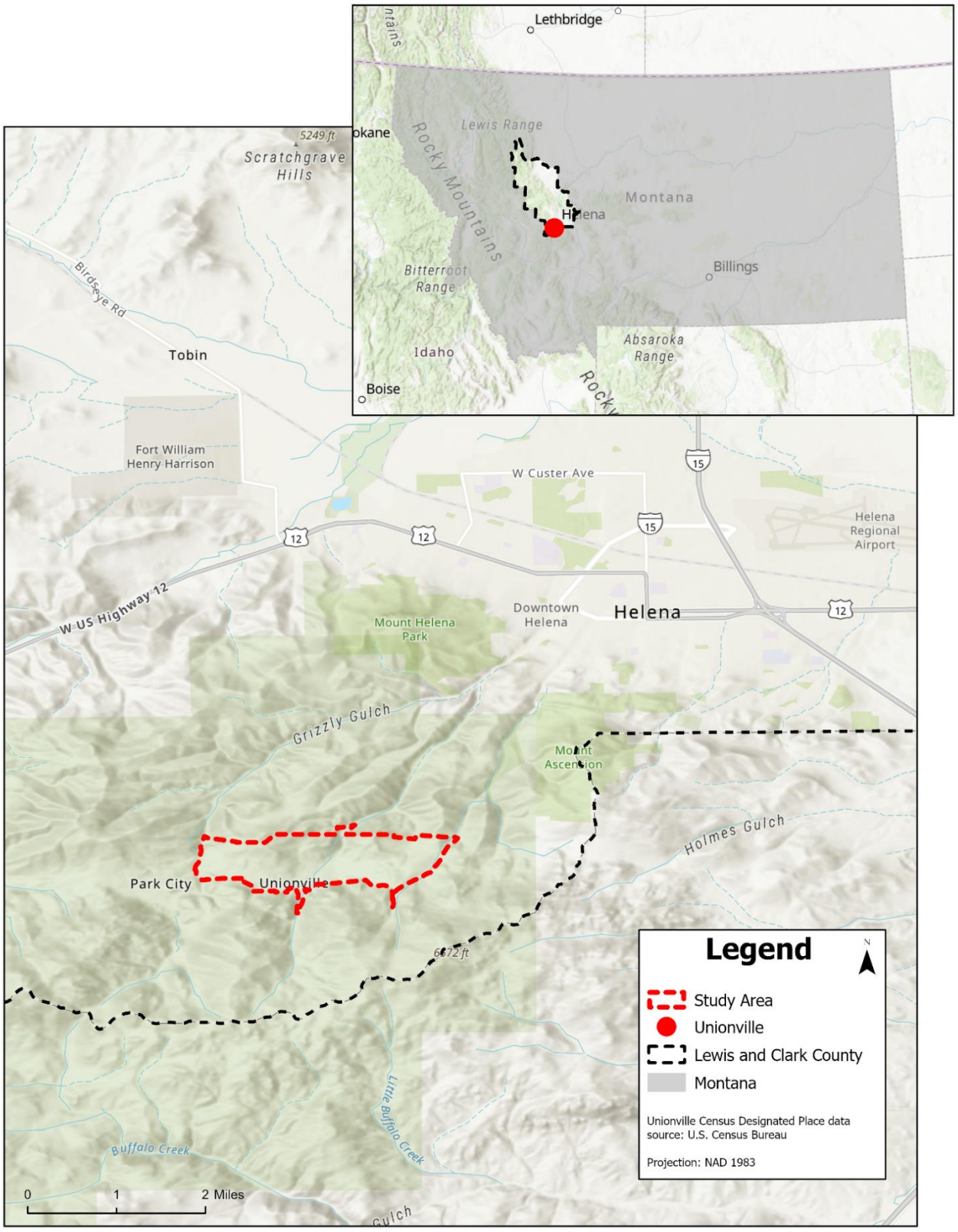

Figure 1: Location of study area. Inset map shows the location of Unionville, MT in relation to Lewis and Clark County within Montana.

Climate

Unionville has a semi-arid climate that is characteristic of regions of Montana east of the Continental Divide (Briar and Madison, 1992). The Helena Regional Airport, 9 miles northeast of study area, has recorded daily climatic data since 1893 (National Oceanic and Atmospheric Administration: Climate Data Online Station: USW00024144). Mean annual rainfall and snowfall over the 30-year period of 1990 to 2020 is 11.4 inches and 37.2 inches, respectively. Precipitation is biased toward October through April due to snowfall and spring rain events (Figure 2) with 84% of the annual precipitation falling in those months. During the 30-year period, the air temperature ranged from 23°F to 70°F (National Oceanic and Atmospheric Administration, 2025a).

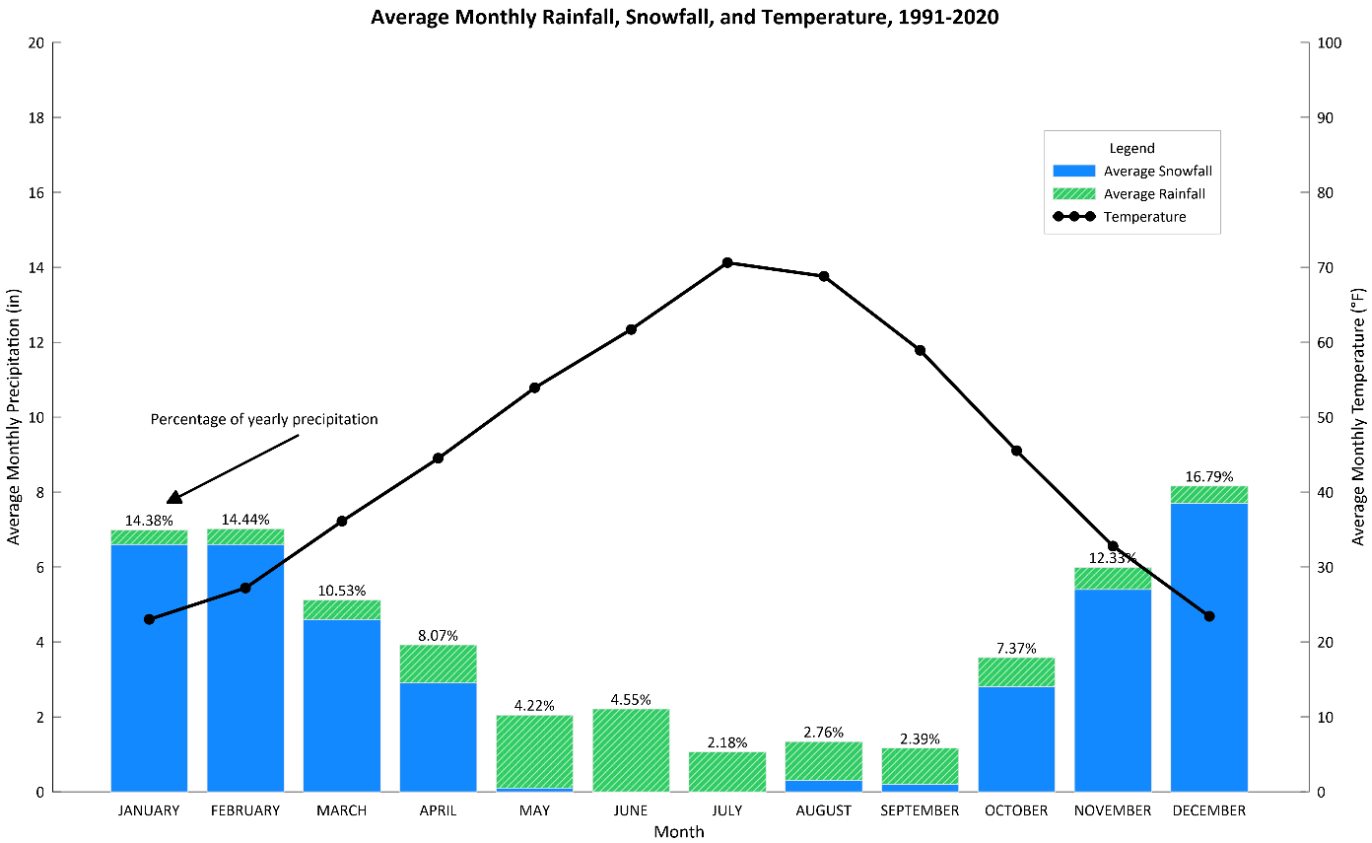

Figure 2: 1991-2020 monthly mean rainfall, snowfall, and temperature data from the Helena Regional Airport (National Oceanic and Atmospheric Administration, 2025a). Precipitation is skewed toward the spring and winter months.

2023 displayed similar precipitation and temperature trends compared to the period 1991-2020 (Figure 3). The 2023 monthly rainfall, snowfall, and temperature data were collected by the Helena Regional Airport (National Oceanic and Atmospheric Administration, 2025b). Monthly rainfall and snowfall were concentrated in October through April with the majority (63%) of the year's precipitation occurring in March and October. The total rainfall was 12.47 inches (9% above the 30-year mean) and the total snowfall was 39.5 inches (6% above the 30-year mean). The mean monthly temperature ranged from 25°F to 73°F. Climatically, 2023 was comparable to the 30-year trends for rainfall, snowfall, and temperature. Seasonal effects on water quality observed during this study should therefore be representative of long-term seasonal effects.

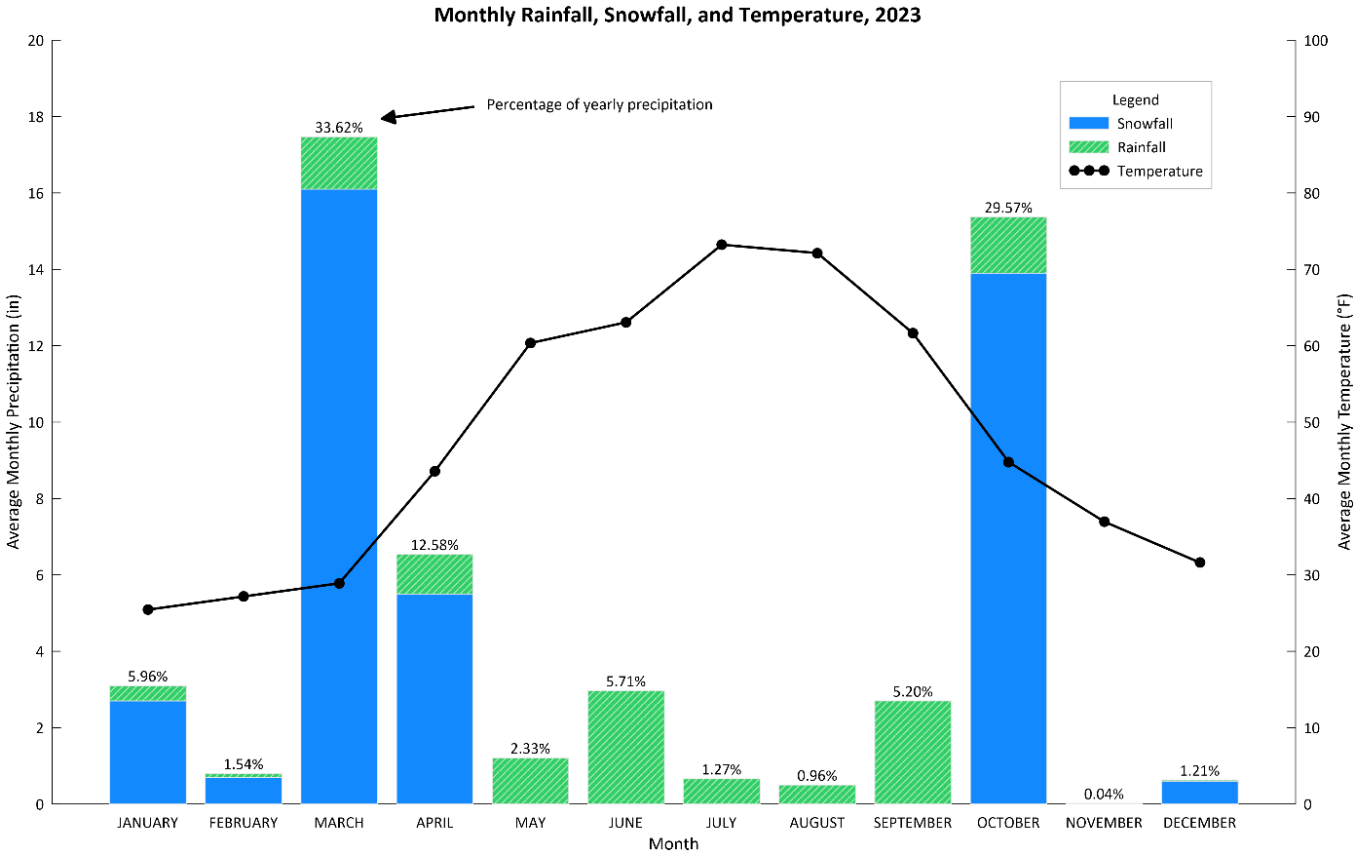

Figure 3: 2023 monthly rainfall, snowfall, and temperature data from the Helena Regional Airport (National Oceanic and Atmospheric Administration, 2025b). Note the precipitation (snowfall and rainfall) is skewed toward the winter and spring months.

Land Use

The Unionville area of Lewis and Clark County is zoned for rural residential mixed use (City of Helena and Lewis and Clark County Geographic Information Services, 2020) which provides for residential development with an opportunity for agricultural activities. The gross density in rural residential mixed use zones in Lewis and Clark County may not exceed one parcel per ten acres, unless the parcel is in a planned development area (Lewis and Clark County, 2022). Unionville is not located in a planned development area. Agricultural activities are limited by the mountainous terrain (Figure 4).

All potable and irrigation water is sourced from groundwater. Each residence relies on an individual well for groundwater and an individual septic system for wastewater. Water use is predominantly domestic (88.5%), with minimal use for stock (4.8%) , irrigation (3.8%), wildlife (1.9%) , and commercial (1%) (Montana Department of Natural Resources and Conservation, 2025).

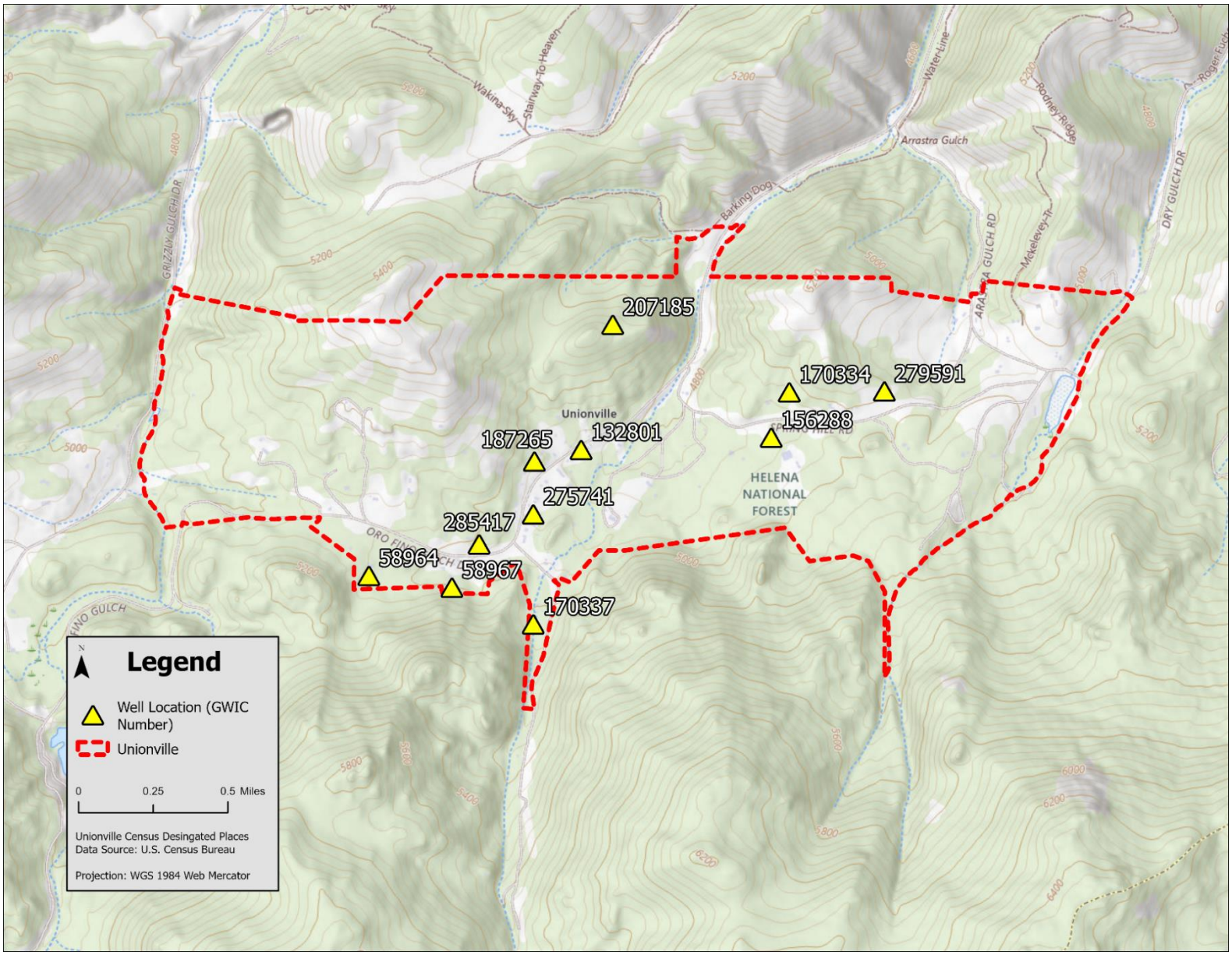

Figure 4: Map showing locations of each well sampled and the topography. The GWIC (Groundwater Information Center at the Montana Bureau of Mines and Geology) unique identification numbers are shown for each well.

Hydrogeology

Unionville is located in the north-central part of the Northern Rocky Mountain physiographic province (Fenneman, 1931). The study area is situated on the northern margin of the Boulder Batholith (Figure 5), a north-south trending 60 mile x 30 mile volcanic intrusion that formed approximately 80 million years ago (Scarberry et al., Unpublished Data; du Bray et al., 2012). A batholith is a body of multiple plutons (irregular shaped intrusions of volcanic rock that solidified below the surface). The northern margin of the Boulder Batholith contains siliceous rocks, principally granodiorites and granites (map units “Kgd” and “Kugd” in Figure 6).

The Boulder Batholith and neighboring igneous bodies intruded into Mesoproterozoic (~1.4 billion years old) to Mesozoic (~160 million years old) age bedrock. The local sedimentary bedrock around Unionville is composed of the Morrison and Swift formations (Caldwell et al., 2014; Stickney and Vuke, 2017). While the Morrison Formation sparsely outcrops (exposes on the surface) in Montana, it has been well studied in other parts of the United States due to the substantial concentration of preserved dinosaur remains found in the formation (Harris and Dodson, 2004). Through these studies, the Morrison Formation has been shown to contain uranium ores in other states in the western United States (Cadigan, 1967).

The primary aquifer within the study area is the Boulder Batholith. Using data from the MBMG’s Groundwater Information Center (GWIC), well depths range from 80 to 422 ft below ground surface (bgs), with a mean depth of 214 ft (N = 9), which is comparable to the broader Boulder Batholith region, where the mean total depth is approximately 200 ft bgs (N = 632). Static water levels range from 20 to 124 ft bgs, with a mean of 54 ft bgs (N = 9), also similar to the regional average static water level of 55 ft bgs (N = 535).

The secondary aquifer is the Morrison Formation, found along the northern boundary of the study area. Across the United States the Morrison Formation is composed of Late Jurassic Period (163 to 145 million years old) sedimentary rocks, namely mudstones, sandstones, and limestones. The Morrison formation is locally metamorphosed due to the heat of the Boulder Batholith. It is composed of hornfels and quartzite; rocks formed from the metamorphosis of mudstones and sandstones (Stickney and Vuke, 2017).

Groundwater storage and flow are through either the pore spaces between the grains making up the bedrock (primary porosity) or the fractures in the bedrock (secondary porosity). Secondary porosity is more influential in crystalline bedrock aquifers, such as the Boulder Batholith and the metamorphosed Morrison Formation. Both aquifers are influenced by faults and fractures resulting in variable groundwater flow. Consequently, well yields can vary widely depending on well completion and localized fracture connectivity.

Both formations are generally considered low-yielding aquifers. Reported yields for the Boulder Batholith range from 0.5 to 562 gallons per minute (gpm), with an average of 18.5gpm (N = 589), while wells completed in the Morrison Formation range from 0.1 to 500gpm, with an average yield of 37gpm (Montana Bureau of Mines and Geology, 2025).

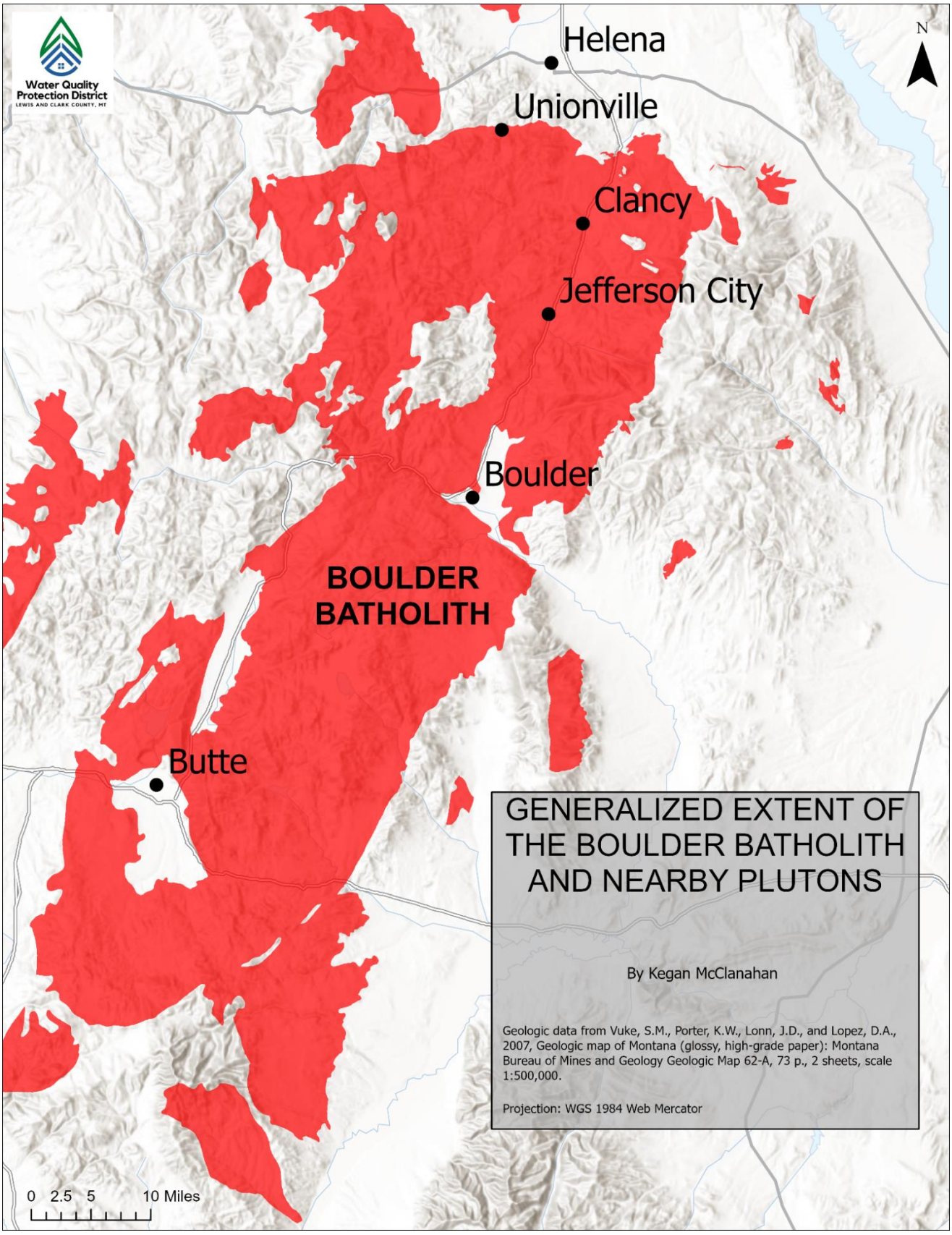

Figure 5: Generalized extent of the Boulder Batholith

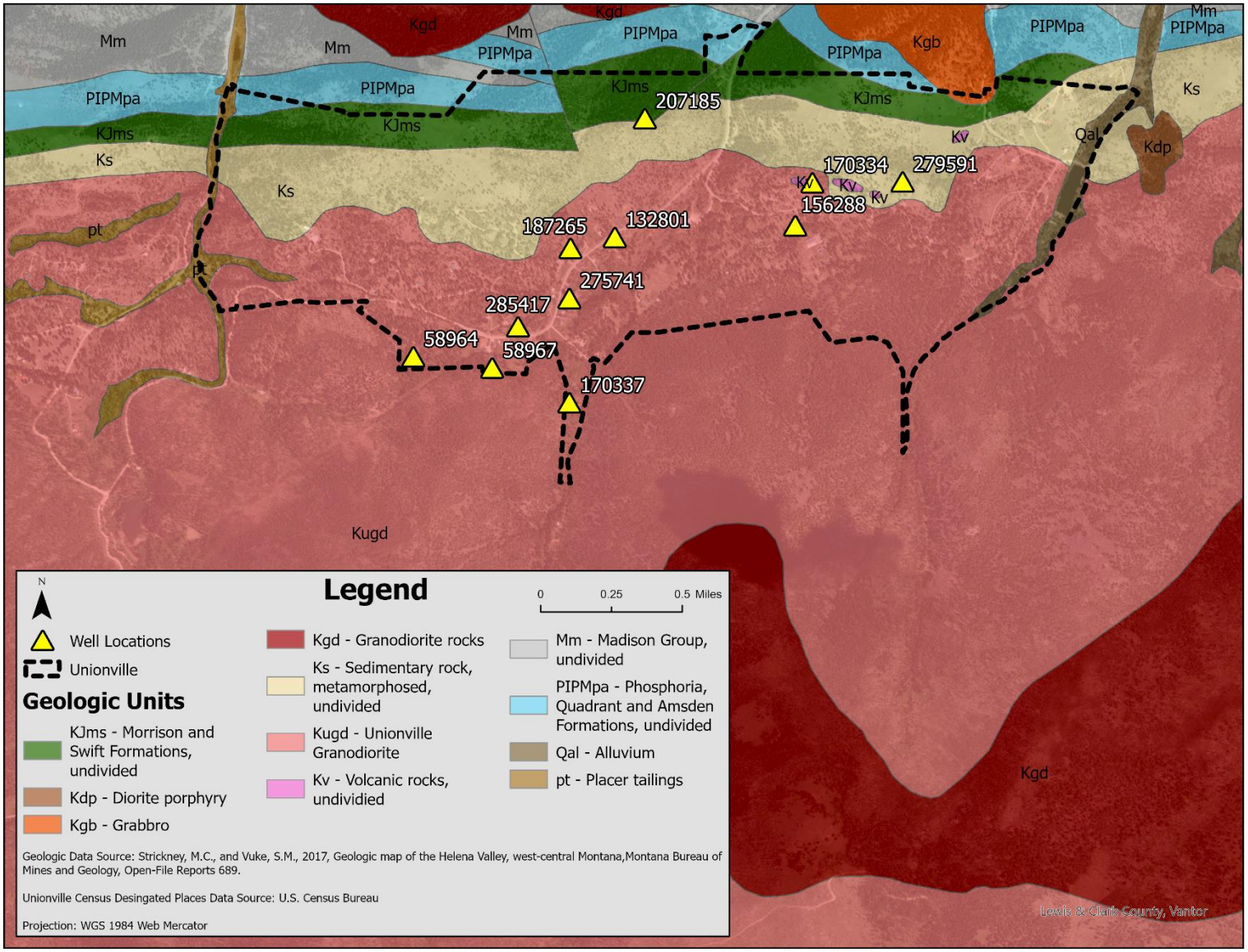

Figure 6: Geologic map of the surrounding area. Unionville is situated on the northern margin of the Boulder Batholith ("Kugd" and "Kgd" map units). Geologic map data source: Stickney and Vuke, 2017.

Regionally, groundwater is flowing northward from the mountains towards the Helena Valley. Recharge is from infiltration of precipitation. Discharge of groundwater is mainly by withdrawals from wells, discharge to the valley-fill aquifer, and seepage to streams (Thamke, 2000; Briar and Madison, 1992; Caldwell et al., 2014).

Geochemistry

As groundwater migrates through the pores and fractures, interactions occur between the groundwater and the minerals within the bedrock. Groundwater can dissolve minerals into the water, precipitate minerals out of the water, exchange chemicals with the minerals, and pick up radioactive elements. These interactions between the groundwater and the surrounding bedrock are dependent on water quality parameters (e.g. pH, temperature, and dissolved oxygen), the minerology of the bedrock, and the length of time the water is in contact with the bedrock minerals, known as residence time (Caldwell et al., 2014). The flow velocities of groundwater can be highly variable between primary and secondary porosity aquifers which impacts the length of time allowed for interactions with the surrounding minerals (Figure 7).

Studies have documented elevated levels of uranium and thorium (both radioactive elements) in the Boulder Batholith (Becraft, 1956a; Becraft, 1956b; Jarrard, 1957; and Tilling and Gottfried, 1969) and uranium in the Morrison formation (Cadigan, 1967). Areas around Boulder, Butte, and Clancy may be more likely to have substantial uranium-bearing mineral deposits (Castor and Robins, 1978). The extent to which uranium and its radiogenic daughter products, such as radon, are present in the groundwater are influenced by the residence time in the aquifer which is a function of recharge rates and domestic production (the rate at which water is introduced to the aquifer and the rate at which water is pulled out of the aquifer, respectively).

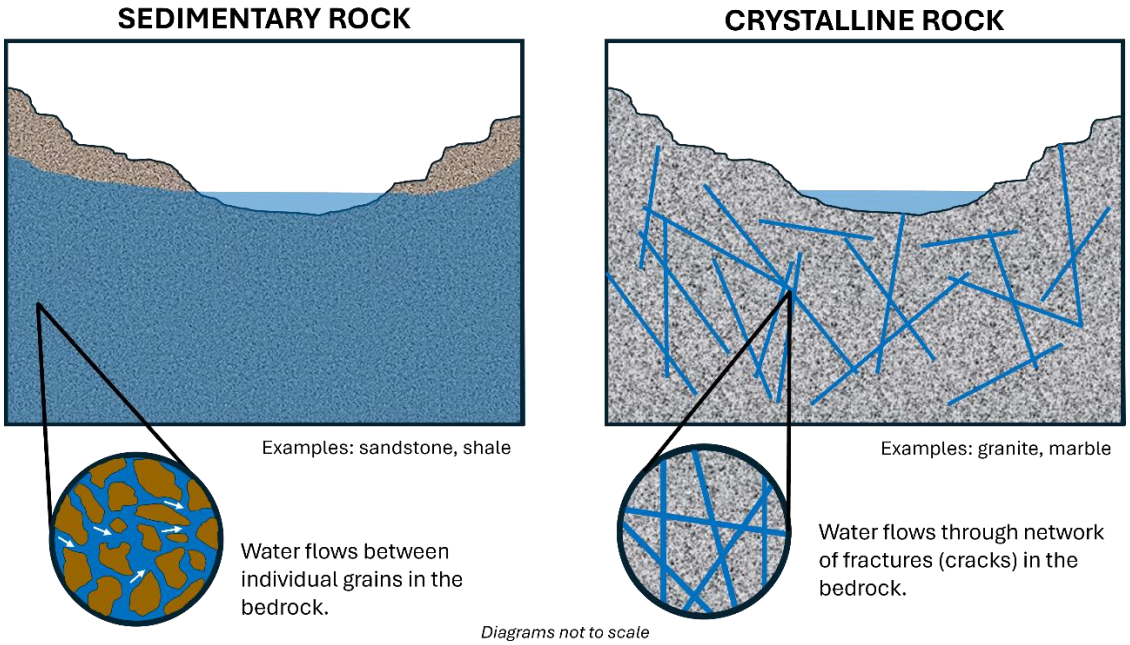

Figure 7: Comparison of groundwater flow through sedimentary rocks vs crystalline rocks such as granodiorites. Adapted from Caldwell et al., 2014.

METHODS

Potable water source wells were selected based on four criteria: (1) wells were sampled as part of the 2019 study, (2) well logs were available to document well construction, (3) wells were spatially distributed throughout the Unionville area to isolate localized land use impacts, and (4) the property owners agreed to provide access. Of the original ten wells that were sampled in 2019, five wells were able to be sampled again in 2023. To supplement the five original wells, an additional five wells were selected, for a total of ten wells (an eleventh well was added for the September sampling event). Table 1 summarizes the well constructions. Sampling events occurred in April and September 2023. Sample sites are noted in Figure 4.

As Table 1 shows, all but one well was drilled into the granite/granodiorite of the Boulder Batholith. Granites and granodiorites have similar physical appearance which potentially leads to well logs labeling both as granites. Only well GWIC 207185 was drilled into the sedimentary (limestone) rock that predated the Boulder Batholith intrusion. The town of Unionville is predominantly situated on top of the granodiorites (map unit “Kugd”), so the well locations provide for a representative water quality assessment for the town.

Prior to sample collection the static water level was measured using a water level meter. All wells were purged until field parameters (pH, specific conductivity, temperature, and dissolved oxygen) stabilized at which time it was assumed that the field parameters represented the surrounding formation (aquifer) water. Water samples were collected in laboratory supplied containers before being chilled to 6°C and transported to the Helena branch of Energy Laboratories, Inc. for analysis. Quality control samples consisted of one field blank and one sample duplicate, each at a random sample site during the April and September events.

The samples were analyzed for the analytes listed in Table 2. Additionally, the laboratory’s reporting and detection limits at the time of the analysis are presented in Table 2. All analyses were conducted following drinking water approved methodologies. The full list of analytical results are presented in Appendix A.

As is common in environmental research, analytes were reported to be below the minimum detection limit (MDL) by the laboratory. Minimum detection limits are the minimum amount of an analyte that an instrument/method is capable of reliably measuring with a strong degree of certainty. Values below the MDL are not necessarily “zero”, as there could still be some small amount of the analyte present. Laboratories, routinely censure and report these values simply as “non-detect”. Treatment of censored data such as these has been extensively investigated (Cohen, 1959; Gleit, 1985; Helsel and Gilliom, 1986; Helsel, 1990; Hornung and Reed, 1990; Lambert et al., 1991; Özkaynak et al., 1991; Finkelstein and Verma, 2001; and Croghan and Egeghy, 2003). For this study, all results reported below the analyte’s minimum detection limit were substituted with the value of $\frac{MDL}{2}$ for the purposes of performing calculations.

Table 1: Summary of well constructions

[1]GWIC ID	Latitude	Longitude	Total Depth (ft)	[2]Elevation (ft asl)	[3]Spring Static Water Level (ft)	Spring Water Table Elevation (ft asl)	[3]Fall Static Water Level (ft)	Fall Water Table Elevation (ft asl)	Primary Lithology
170334	46.546922	-112.071671	238	4,954	-	-	74.93	4879	Granite
285417	46.541513	-112.08538	422	4,982	43.23	4939	44.49	4938	Granite
170337	46.538768	-112.084072	140	5,015	19.00	4996	23.32	4992	Granite
207185	46.548742	-112.080222	120	5,115	24.89	5090	28.78	5086	Limestone
187265	46.544188	-112.084018	230	4,928	87.00	4841	39.7	4888	Granite
58964	46.536023	-112.093228	230	5,025	48.89	4976	-	-	Granite
156288	46.548724	-112.069698	200	4,902	-	-	-	-	Granite
58967	46.539683	-112.087997	80	5,007	114.47	4893	-	-	Granite
132801	46.5444	-112.0808	122	4,867	22.54	4844	23.26	4844	Granite
275741	46.542428	-112.084072	260	4,911	14.19	4897	13.58	4897	Granite
279591	46.5505411	-112.072328	420	5,006	154.90	4851	153.52	4852	Granite

[1]GWIC: Groundwater Information Center located at the Montana Bureau of Mines and Geology.
[2]Elevations interpolated from topographic data. All elevation data reported as feet above sea level (ft asl)
[3]Static water level readings for select sites were not recorded prior to well purging.

Table 2: Laboratory Analyses and Methodologies

Group	Analyte	Unit	Reporting Limit	Minimum Detection Limit/Concentration	Method	Sampling Event
Physical Properties	Solids, Total Dissolved	mg/L	50	7	A2540 C	April and September
Inorganics	Alkalinity	mg/L	4	2	A2320 B	April and September
	Chloride	mg/L	1.00	0.0241	E300.0	April and September
	Sulfate	mg/L	1.00	0.033	E300.0	April and September
	Bromide	mg/L	0.500	0.00122	E300.0	April and September
	Fluoride	mg/L	0.1	0.03	A4500-F C	April and September
	Hardness as $CaCO_3$	mg/L	1	1	A2340 B	April and September
Nutrients	Nitrate + Nitrite, as N	mg/L	0.01	0.01	E352.2	April and September
	Phosphorus, Total as P	mg/L	0.01	0.001	E365.1	April and September
Metals, Dissolved and Total Recoverable	Arsenic	mg/L	0.001	0.0002	E200.8	April and September
	Cadmium	mg/L	0.001	0.00002	E200.8	April and September
	Calcium	mg/L	1	0.2	E200.7	April and September
	Copper	mg/L	0.005	0.0001	E200.8	April and September
	Iron	mg/L	0.02	0.004	E200.8	April and September

Table 2 Continued: Laboratory Analyses and Methodologies

Group	Analyte	Unit	Reporting Limit	Minimum Detection Limit/Concentration	Method	Sampling Event
Metals, Dissolved and Total Recoverable	Lead	mg/L	0.001	0.0001	E200.8	April and September
	Magnesium	mg/L	1	0.05	E200.7	April and September
	Manganese	mg/L	0.001	0.0003	E200.8	April and September
	Potassium	mg/L	1	0.06	E200.7	April and September
	Sodium	mg/L	1	0.03	E200.7	April and September
	Uranium	mg/L	0.0003	0.00002	E200.8	April and September
Radionuclides, Total	Radon-222	pCi/L	-	[1]83.2 - 114	D5072-92	April
	Gross Alpha Adjusted	pCi/L	-	[1]0.91 – 1.9	E900.0	April
	Combined Radium 226/228	pCi/L	-	[1]0.6 – 0.7	A7500 R A	April

[1]The minimum detection activity for the radionuclides varied across the samples due to the samples being analyzed at different dates/times. The total range of detection concentrations is listed here. The specific minimum detection concentrations are listed with the raw laboratory data in Appendix A.

RESULTS AND DISCUSSION

This study focused on nutrients, trace metals, and radionuclides. To supplement these contaminants, a broad suite of parameters was analyzed to develop a full assessment of the groundwater quality. The results are summarized in Tables 3, 4, 5, and 6 with a full listing of all laboratory results in Appendix A.

Physical Properties

Physical properties and field parameters of the groundwater were obtained during sample collection and through laboratory sample analysis. Table 3 summarizes the findings. Across both sampling events a total of 21 samples were collected from 11 different wells. Ten wells were sampled in April. The same ten wells were sampled in September along with one additional well.

Well depths ranged from 80 – 422 feet in total depth with static water levels (SWL) ranging from 13.58 – 153.52 feet. The well logs (Appendix B) indicate the majority of wells were drilled into granites, consistent with the Boulder Batholith (granites and granodiorites have similar chemical compositions and physical appearance). One well (GWIC ID 207185) was drilled into limestone. The range of depths and SWL's provides context to changes in water quality due to land use impacts or groundwater evolution through the aquifer.

Water temperatures ranged from 5.1 – 9.6°C with a median of 8.0°C. No observable patterns were found between the wells drilled in the Boulder Batholith (granodiorites) and the adjacent sedimentary rock. Dissolved oxygen varied from 1.69 – 8.5 mg/L. No correlation between lithologies nor SWL depths and DO were observed. Specific conductance ranged from 247 – 726 µs/cm with negligible differences between April and September. Field pH measurements showed a range from 6.74 – 8.33 S.U with negligible differences between sampling events. Total dissolved solids ranged from 148 – 490 mg/L (median concentration of 250 mg/L). Both sampling events showed consistent field parameters and are consistent with past work done in the area away from active hydrothermal features (Briar and Madison, 1992 and Thamke, 2000).

Nitrate and Nitrate Sourcing

Nitrate is a common pollutant in local groundwaters with typical background concentrations of 0 – 2 mg/L (Mueller and Helsel, 1996). There are no centralized drinking water and wastewater treatment systems due to the remoteness of the individual residences and the terrain. This leads to each residence employing a potable water well and septic system. Groundwater can become contaminated with elevated levels of nitrate from sources such as septic tanks and fertilizer application. For this reason, nitrate samples were analyzed for both concentration and stable isotopes. Nitrate stable isotope samples allow for the probable sources of nitrate (natural soil processes, human/animal waste, fertilizer, etc.) to be identified.

The USEPA has established MCLs for nitrate and nitrite in public drinking water systems of 10 mg/L and 1 mg/L, respectively. Human exposure to drinking water at or above the MCL can pose a serious threat to human health: "Infants below the age of six months who drink water containing nitrate [or nitrite] in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome" (USEPA National Primary Drinking Water Regulations: https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations).

Table 3: Summary of Physical Properties

Analyte	Number of Wells Sampled	Number of Samples	Range of Values	Median Value	Mean Value	Standard Deviation	Drinking Water Standard	Number of Drinking Water Standard Exceedances
Water Temperature (°C)	12	21	5.1 – 9.6	8.0	7.7	1.1	-	-
Dissolved Oxygen (mg/L)	12	21	1.69 – 8.50	6.13	5.59	2.27	-	-
Specific Conductivity (µs/cm)	12	21	247 - 726	388	413	116	-	-
pH (S.U.)	12	21	6.74 – 8.33	7.37	7.18	0.47	6.5 – 8.5	0
Solids, Total Dissolved (mg/L)	12	21	148 - 490	250	268	82	500	0

The Montana Department of Environmental Quality (MDEQ) provides recommendations to public drinking water systems based on the concentrations of nitrate (Figure 8). Because nitrate is naturally occurring in the environment there is an acknowledged background level of 0-2 mg/L. Drinking water with nitrate concentrations above 2 mg/L represent elevated levels of nitrate at which point MDEQ recommends homeowners actively protect the water source, identify the source(s) of nitrates, and develop a list of possible remedies.

Nitrate Concentration (mg/L)	Nitrate Levels	Recommended Action
0 – 2	Normal background	Things are good, keep them this way.
3 – 7	Elevated nitrates	Concerned, be proactive to identify nitrate sources
>7	High nitrates	Need to act now to protect the drinking water and identify nitrate sources
>10	Above safe drinking water limit (MCL)	The drinking water does not meet the safe drinking water limit.

Figure 8: Nitrate Concentration Guide for public drinking water systems. Adapted for private wells from the Montana Department of Environmental Quality. Source: https://deq.mt.gov/water/Programs/dw-rules

During April 2023, nitrate concentrations ranged from 0.1 – 6.4 mg/L with a median concentration of 2.31 mg/L (Table 4). Of the ten sample sites, five sites showed background levels (0 – 2 mg/L) of nitrate.

The remaining five wells showed elevated levels (3 – 7 mg/L); however, no wells were above the safe drinking water limit (10 mg/L). In September 2023, nitrate concentrations ranged from 0.09 – 6.4 mg/L with a median concentration of 1.92 mg/L. Of the eleven wells sampled in September, six wells had background (0-2mg/L) concentrations of nitrate. The same remaining five wells from the spring sampling event showed elevated levels, but all were below the MCL (Figure 9).

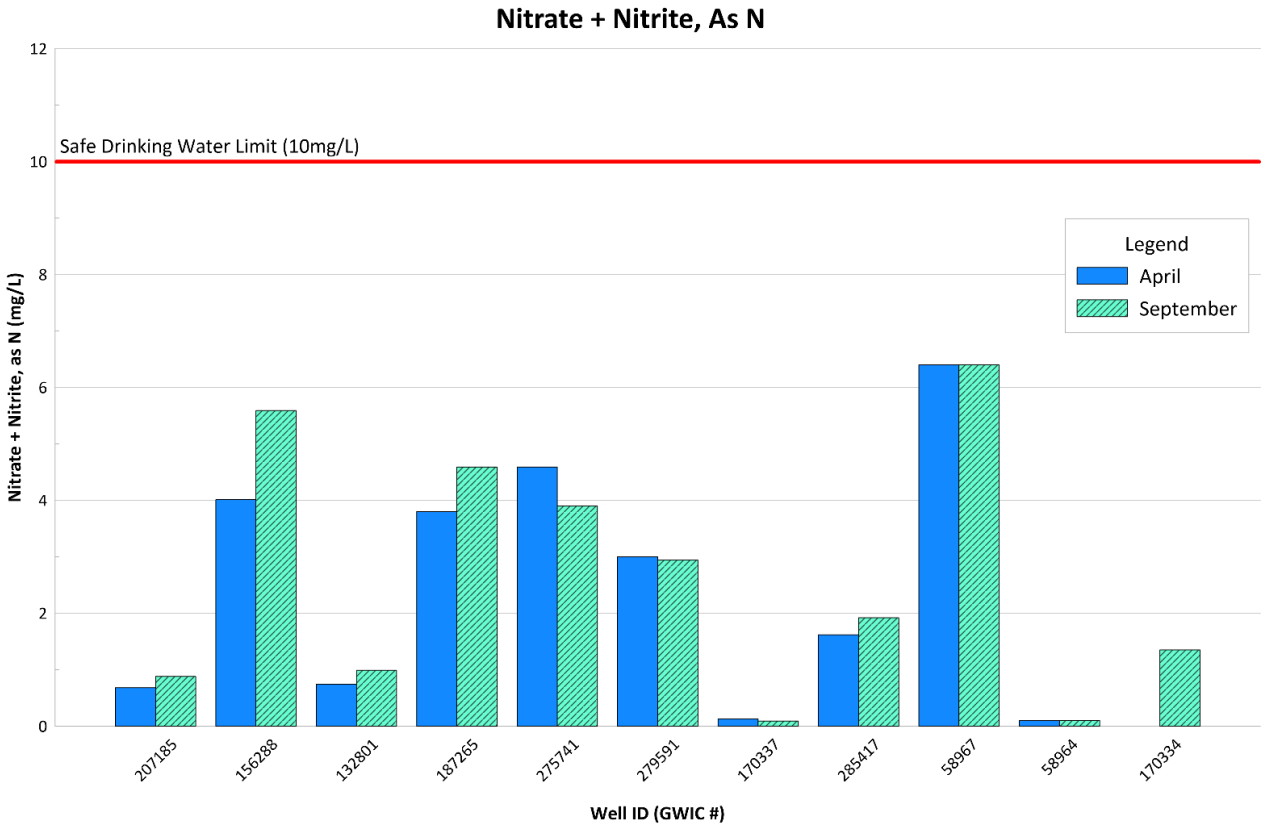

Figure 9: Nitrate concentrations for both sampling events.

Within the context of the local geology, nitrate concentrations vary considerably within the granodiorite underlying most of the wells. The wells drilled in the granodiorite have nitrate concentrations of 0.09 – 6.4 mg/L (median of 2.94 mg/L). The well drilled into the sedimentary bedrock (GWIS 207185) ranged from 0.68 – 0.88 mg/L between the two sampling events (Figure 10). The lack of wells drilled into the sedimentary bedrock north of the Boulder Batholith severely limits the drawing of robust conclusions.

Table 4: Summary of Nitrate + Nitrite, as N (mg/L)

Sampling Event	Number of Wells Sampled	Number of Samples	Range of Values	Median Value	Mean Value	Standard Deviation	Drinking Water Standard	Number of Drinking Water Standard Exceedances
April 2023	10	10	0.1 – 6.4	2.3	2.5	2.1	10	0
September 2023	11	11	0.09 – 6.4	1.9	2.6	2.1	10	0

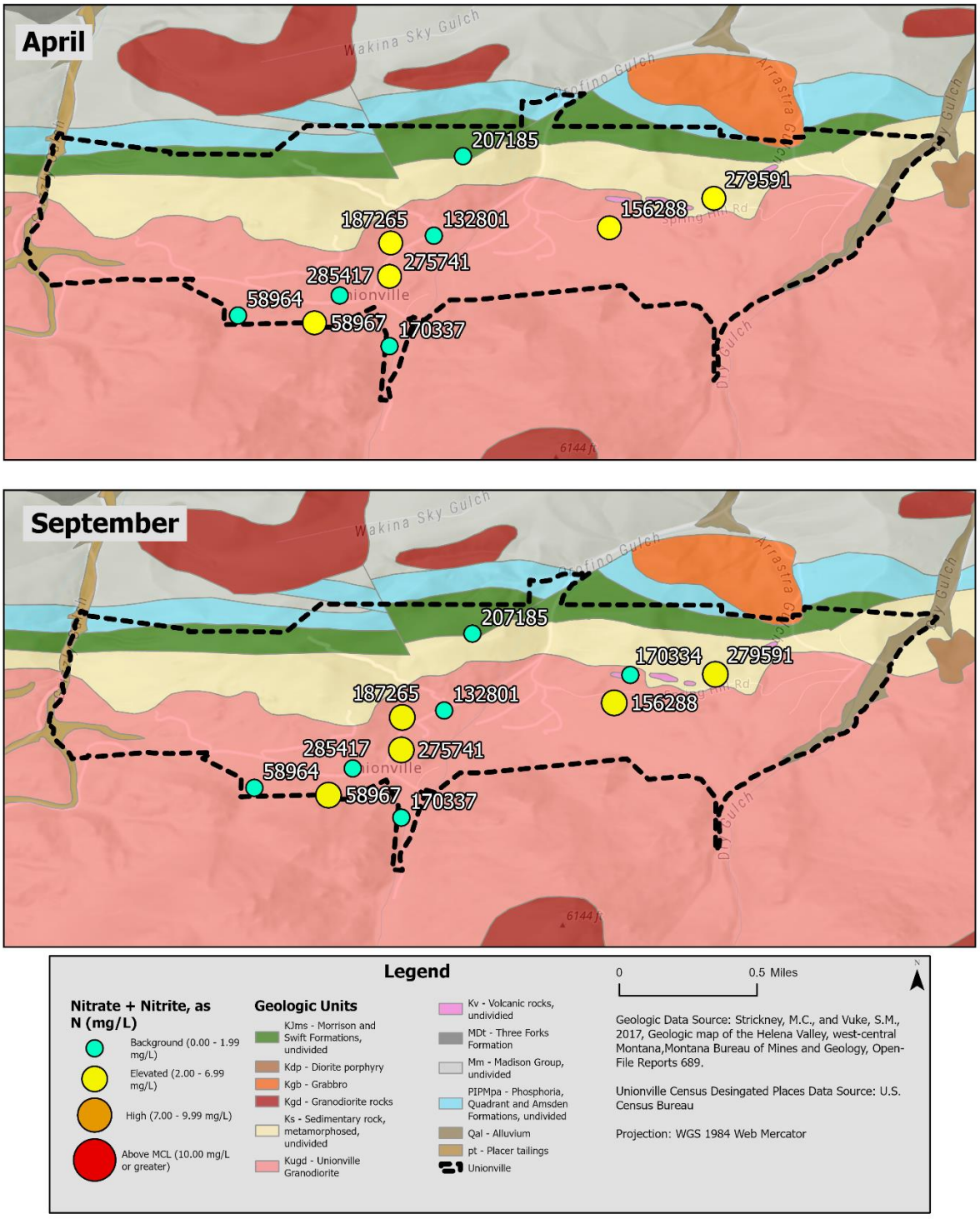

Figure 10: Nitrate concentrations for both sampling events are plotted against surficial geology. Nitrate concentrations range from background (<2.0 mg/L) to elevated (2.0 – 6.99 mg/L) across the study area with no discernable spatial pattern.

Given the data limitations, it is probable that the fracture network more characteristic of the crystalline bedrock (granodiorites) lends itself to be more suspectable to anthropogenic contamination due to the potentially faster infiltration rates of surface water and smaller degree of natural filtration compared to a typical porous media aquifer. The sedimentary bedrock, except where metamorphosis has influenced the secondary porosity, is more likely to retard the infiltration rates of surface water through primary porosity thereby allowing for improved filtration of contaminants.

To confirm the source(s) of nitrate, stable isotope samples were collected during the September sampling event. All isotope samples were collected from wells drilled into the granite/granodiorite. Figure 11 plots the nitrate isotopes against sources delineated by Kendall et al. (2008). The colored boxes represent the common sources of nitrate: nitrate fertilizer, ammonium in fertilizer, ammonium in soil, and animal and septic waste.

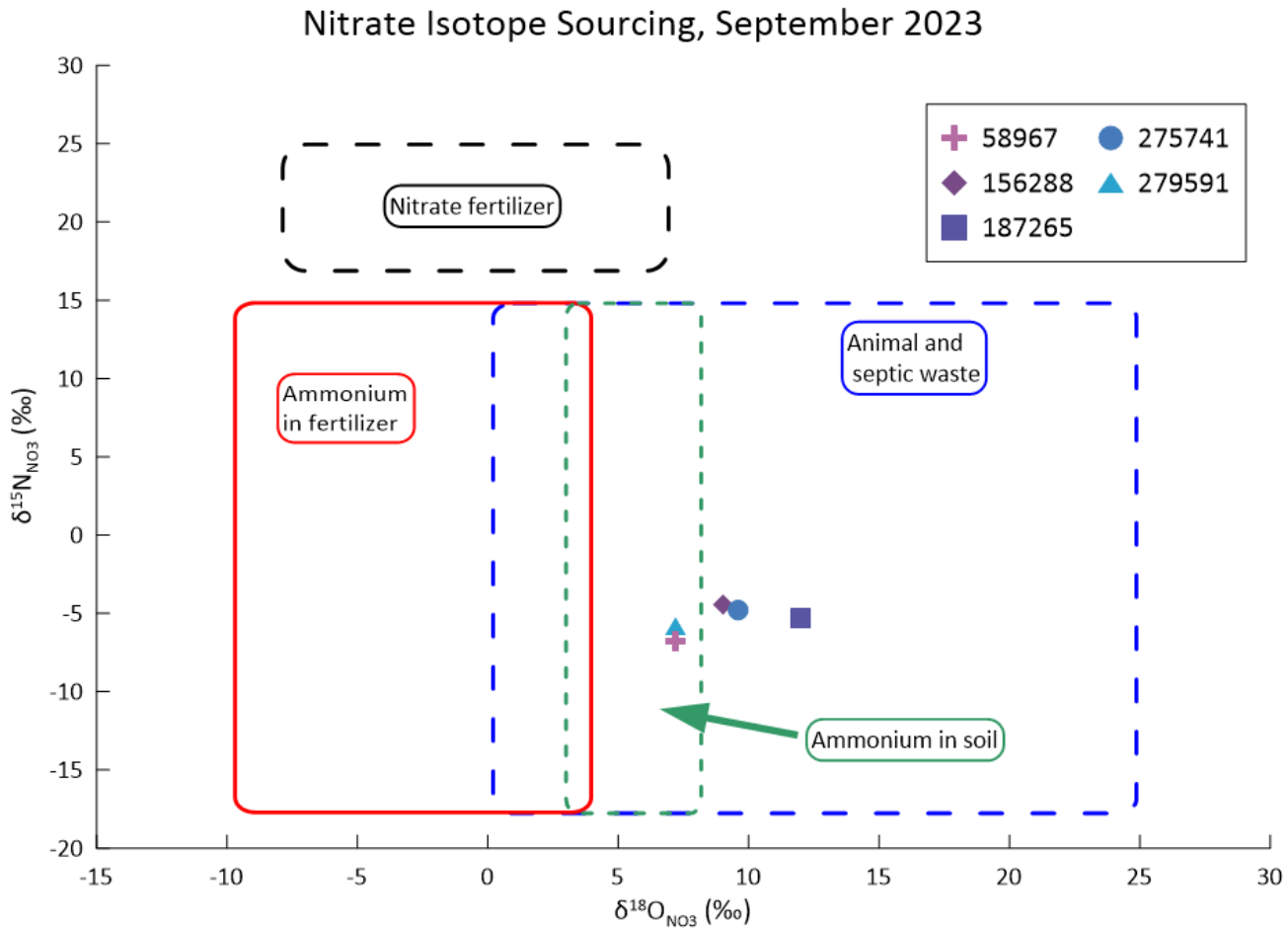

Figure 11: Isotopic compositions of samples collected in September 2023 at five residences. The colored rectangles represent generalized boundaries for various sources of nitrate. The samples (listed by GWIC number) show the nitrates are likely from animal and septic systems. Figure adapted from Kendall et al., 2008, Figure 12.1.

The isotope data show wells 279591 and 58967 have nitrates likely from the ammonium in soils. Once nitrogen is introduced to soils it undergoes a variety of chemical changes. One chemical change is ammonium in the soil can be converted to nitrate by soil microbes. When water infiltrates through the soils and vadose zone, soil nitrate can be mobilized with it to the groundwater. Wells 156288, 275741,

and 187265 show the nitrate is likely from animal and septic waste. Due to the remoteness and dispersion of the residences in this area, each residence has an individual septic system. Additionally, it is common for homeowners in rural communities in Montana to maintain small groups of livestock where manure would be common.

As Caldwell et al. (2014) discussed, groundwater flow through the crystalline (e.g. granites and granodiorites) bedrock is through a network of fractures. Fractures can allow rapid infiltration of water with minimal filtering compared to typical porous media aquifer systems. Fractures can also preferentially direct infiltrating waters along pathways that do not always correlate with the topographic downhill direction. This complicates the process of identifying specific sources of contamination on the surface.

Radionuclides

Radionuclides have been documented in the area through previous work (Leonard and Janzer, 1978; Clark and Briar, 1993; Miller and Coffey, 1998; Caldwell et al., 2014). The presence of radionuclides in the groundwater is a concern for residents relying on the groundwater as their potable water source, as is the case in the Unionville area. A major source of radionuclides in the area is the Boulder Batholith which has been shown to contain elevated levels of uranium and thorium (Tilling and Gottfried, 1969).

The USEPA updated the Radionuclides Rule in 2000 which updated the regulations that had been in effect since 1977. Under this rule community public drinking water systems (e.g. towns and large neighborhoods) are required to conduct regular monitoring of radium, gross alpha, beta emitters, and uranium. While individual residences, like those in Unionville, are not required to adhere to the rules set forth by the USEPA for public drinking water systems, the health guidelines and drinking water standards set by the USEPA can provide guidance to residences. The current drinking water standards are (https://www.epa.gov/dwreginfo/radionuclides-rule#rule-history):

- Combined radium 226/228: 5 pCi/L
- Gross Alpha (excludes radon and uranium): 15 pCi/L
- Beta emitters: 4 mrem/year
- Uranium: 0.030 mg/L (30 µg/L)

The potential health effect from long-term exposure to water above the standard for radium, gross alpha, and beta emitters is an increased risk of cancer. Exposure to uranium above the standard can also lead to an increased risk of cancer and kidney toxicity.

Radionuclide samples were collected in April 2023 at ten wells (Table 5). Uranium was sampled for in both April and September 2023. Beta emitters were not sampled in this study.

Table 5: Summary of Radionuclides

Analyte	Number of Wells Sampled	Number of Samples	Range of Values	Median Value	Mean Value	Standard Deviation	Drinking Water Standard (mg/L)	Number of Drinking Water Standard Exceedances
April Uranium, Total Recoverable (mg/L)	10	10	0.0023 – 0.0269	0.0089	0.0118	0.01	0.03	0
September Uranium, Total Recoverable (mg/L)	11	11	0.0022 – 0.0254	0.0095	0.011	0.01	0.03	0
Radon-222 (pCi/L)	10	10	604 – 5,710	1,425	1,810	1,380	[1]300	10
Adjusted Gross Alpha (pCi/L)	10	10	<0.91 - 17	0.85	3.42	4.85	15	1
Combined Radium-226/228 (pCi/L)	10	10	<0.6 – 0.7	0.3	0.39	0.16	5	0

[1]There is currently no federally enforced standard for radon in drinking water. The USEPA has proposed a limit of 300 pCi/L. This level would contribute approximately 0.4 pCi/L of radon to the air in a home (https://archive.epa.gov/water/archive/web/pdf/radon-proposed-consumer-fact-sheet.pdf)

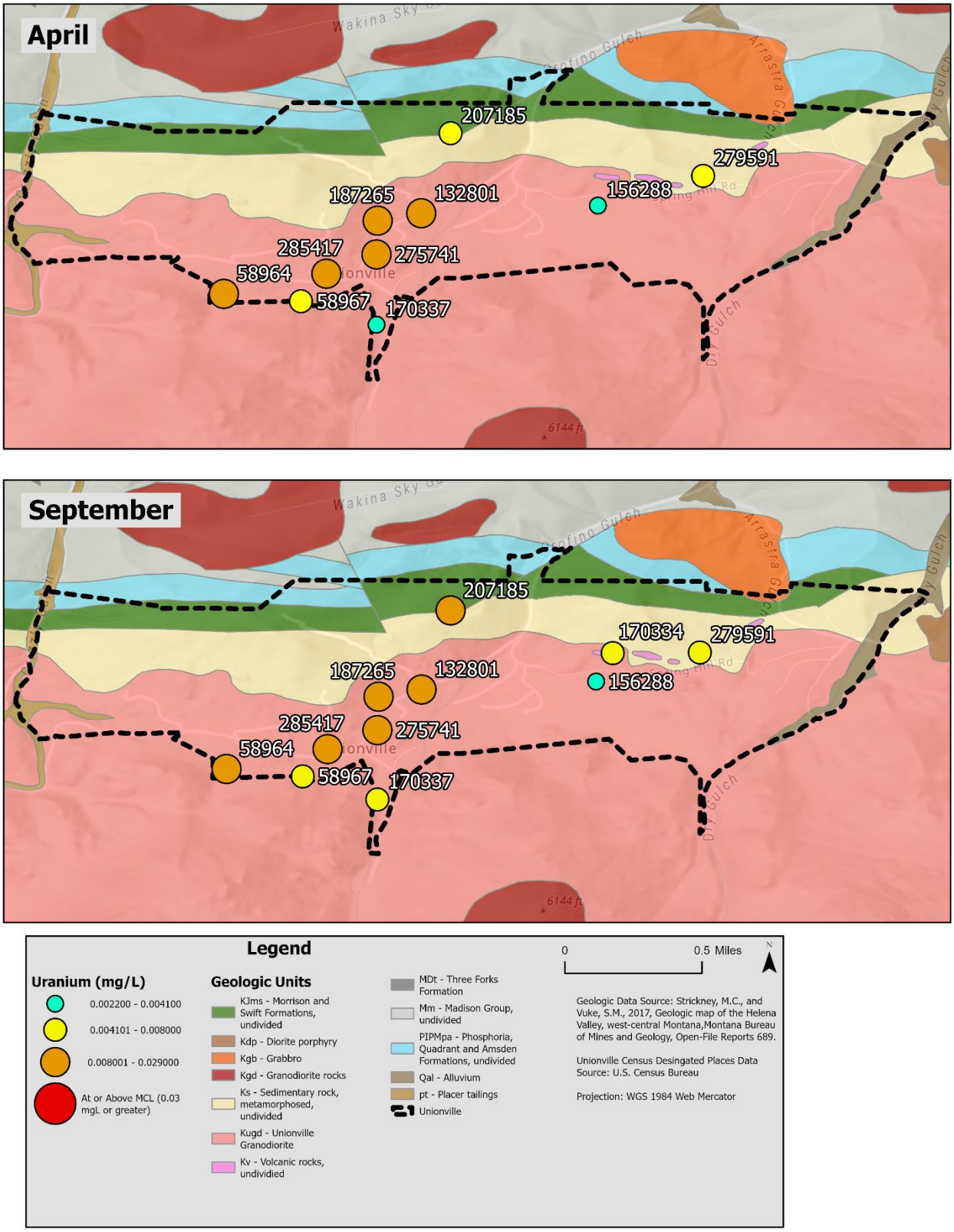

Figure 12: Map of uranium concentrations during the April and September sampling events. The uranium concentrations are elevated across the study area.

Uranium

Uranium is the heaviest naturally occurring element on Earth and appears in the form of several radioactive isotopes, principally uranium-238 and uranium-235. Uranium-235 and its daughter products are typically present is such low concentrations to not warrant investigating. Uranium-238 decays into several radioactive isotopes: Uranium-234, radium-226, and radon-222. Radioactive decay is exhibited by the release of an alpha-particle or a beta-particle. The daughter elements may exhibit different behavior physically and geochemically compared to the parent isotope, but the parent isotope can strongly influence the occurrence and distribution of the daughter isotopes (Zapecza and Szabo, 1988).

Uranium samples were collected in both the April and September sampling events from all wells. Uranium is reported from the total recoverable analysis which includes both the dissolved and precipitated fractions. Uranium was detected in all samples from both sampling events (Figure 12). In April, uranium ranged from 0.0023 – 0.0269 mg/L, and it ranged from 0.0022 – 0.0254 mg/L in September. The median concentrations were 0.0089 mg/L and 0.0095 mg/L, for the April and September events, respectively.

No results were under the MDL. In both sampling events Uranium fell below the drinking water standard of 0.03 mg/L, however the max concentration in both events was above 0.025 mg/L, which is elevated (Figure 13).

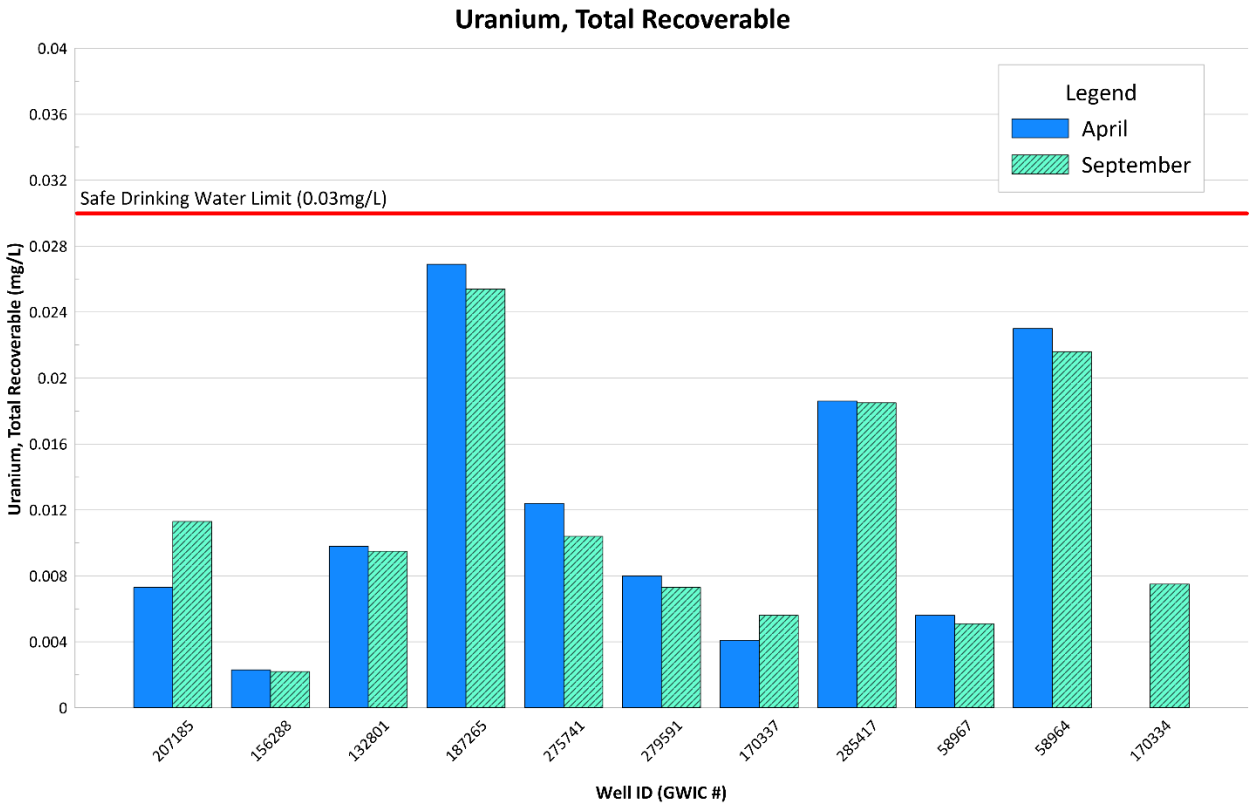

Figure 13: Uranium was detected in all samples.

Ayotte et al. (2011) compiled water quality data for trace elements across the United States between 1992 to 2003. That study found the national median for uranium in groundwater across 3,541 wells to be 0.00052 mg/L. Ayotte et al. (2011) noted that certain trace elements, including uranium, exhibited higher concentrations in dryer climates like that in Unionville. The wells in Unionville, with median values of 0.0089 and 0.0095 mg/L, are elevated one order of magnitude compared to the national median. Of the 21 samples collected for uranium, none of the samples were at or below the national median.

Uranium concentrations increased by an average of 0.00011 mg/L between April and September. While below the drinking water standard, uranium concentrations are elevated throughout the study area.

Gross Alpha

Gross alpha measures the total radioactivity derived from alpha particle decay. Uranium and thorium are the primary alpha particle emitters. The USEPA drinking water standard of 15 pCi/L is set using adjusted gross alpha, which is the alpha particle activity minus the activities of radon and uranium. The results reported in this study are those of adjusted gross alpha.

Samples were collected for gross alpha during April 2023. In total 10 samples were collected, one from each well. Adjusted gross alpha activities were detected in 9 of 10 wells, with one well below the minimum detectable activity of 0.91 pCi/L. Samples showed adjusted gross alpha detectable activities of 1.1 – 17 pCi/L with a median activity of 4.1 pCi/L. Of the ten samples collected, one sample exceeded the drinking water standard with 17 pCi/L.

Local groundwaters affected by the Boulder Batholith have elevated gross alpha activities compared to national values. Caldwell et al. (2014) noted that a national dataset from the U.S. Geological Survey's National Water Quality Assessment (NAWQA) program had a median gross alpha activity of 2.33 pCi/L (range of less than the reporting limit to 654 pCi/L). In contrast to Caldwell et al. (2014), where 40 percent of their sampled wells exceeded the drinking water standard of 15 pCi/L, this study had 10 percent of the wells exceed the drinking water standard.

Combined Radium-226/228

Two of the radioactive isotopes of radium are associated with the decay of uranium and thorium: radium-226 and radium-228. Radium-226 is a daughter product of uranium-238 while radium-228 is a daughter product of thorium-232. The drinking water standard of 5 pCi/L is set for combined radium 226/228.

Samples for combined radium-226/228 were collected from all ten wells. Radium-226/228 activity was detected above the reporting limit in 20% of the samples (GWIC ID: 58964 and 279591). Activities ranged from 0.4 – 0.7 pCi/L (median activity of 0.4 pCi/L). None of the samples exceeded the drinking water standard of 5 pCi/L.

In contrast to the Unionville study, Caldwell et al. (2014) observed that of the 47 wells sampled in the Jefferson County area, ten of the wells exceeded the drinking water standard for combined radium 226/228. The median activity for combined radium 226/228 was 1.40 pCi/L. Caldwell et al. (2014) also noted that the national median across 42 states, assessed by the NAWQA program, was 0.60 pCi/L

(ranging from the reporting limit to 56.0 pCi/L). In this regard, Unionville shows lower concentrations compared to the rest of the region in Montana and the nation.

Radon-222

Radon-222 is one of the natural decay products of uranium; specifically, uranium-238 decays to radon-222. Radon is one of the leading causes of cancer across the nation. Radon was never issued a drinking water standard by the USEPA, however the USEPA proposed a drinking water standard in 1999 (United States Environmental Protection Agency, 2012). Under the proposed rule, the drinking water standard for radon was 300 pCi/L. An alternative drinking water standard of 4,000 pCi/L was included in the proposed rule for community drinking water systems that implemented a multimedia mitigation system to address elevated radon levels.

In addition to being in the groundwater, radon also exists as an airborne contaminant in buildings. Radon in the ground can penetrate through cracks and openings in foundations and enter buildings. The USEPA recommends that airborne radon be mitigated when the airborne radon is at or above 4 pCi/L. Approximately 1/10,000th of the radon in water transitions to the air (Montana Department of Environmental Quality, 2025).

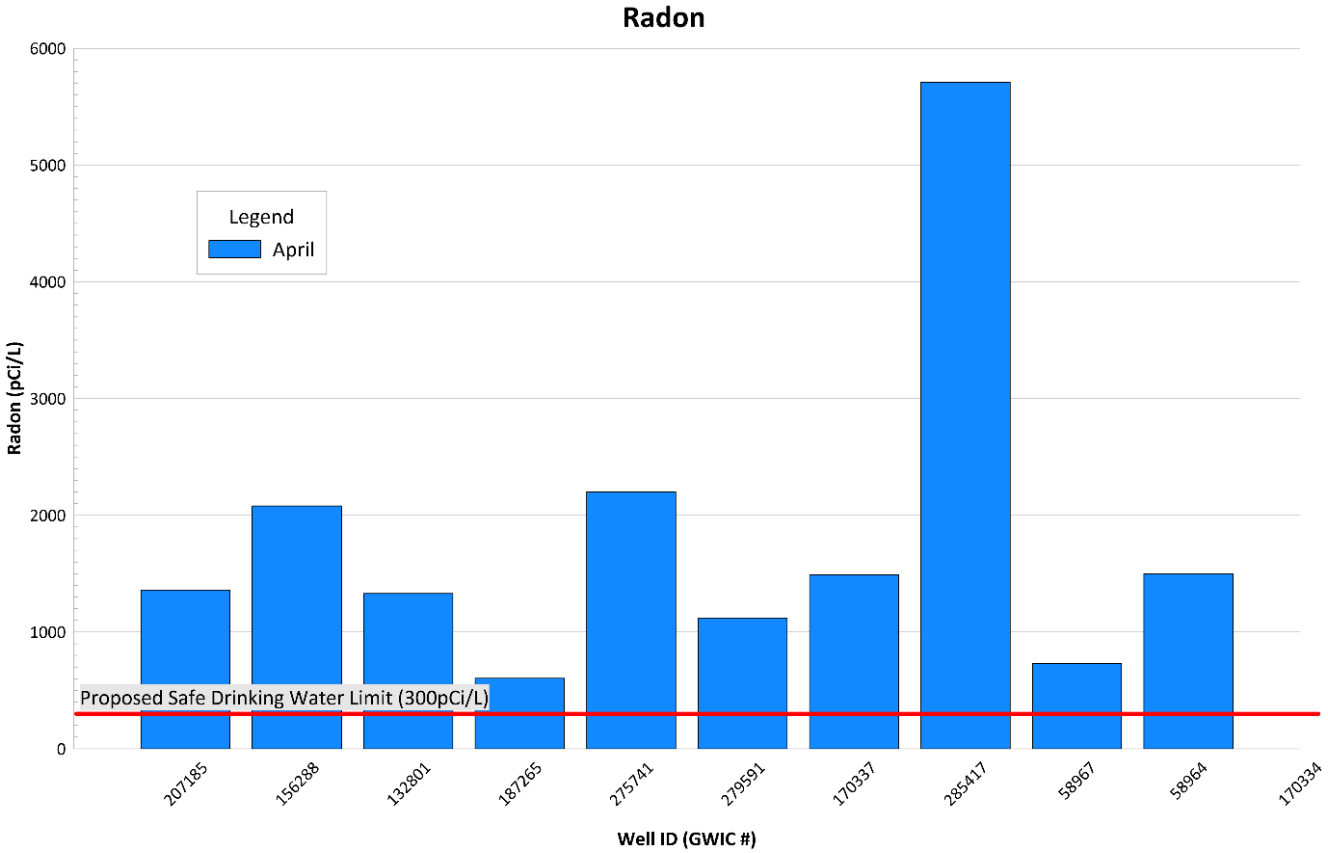

Figure 14: Radon levels exceeded the proposed safe drinking water limit in all samples.

Radon was detected in all 10 samples collected, with all 10 samples exceeding the USEPA proposed drinking water standard of 300 pCi/L (Figure 14). Activities ranged from 604 – 5,710 pCi/L with a median activity of 1,425 pCi/L (Table 3). Geographically, the elevated radon levels are distributed throughout the study area (Figure 15) and are not correlated with a specific lithology.

The Unionville wells appear elevated compared to the rest of the nation with respect to radon. Ayotte et al. (2011) analyzed trace element and radon data from wells across the nation. Their study found that 2,524 out of 3,877 wells (65%) exceeded the proposed drinking water standard. This is compared to 100% of the wells in Unionville exceeded the proposed standard. However, the maximum activity of radon in this study (5,710 pCi/L) is substantially lower than the maximum activities found in past studies of the region. Leonard and Janzer (1978) observed a maximum activity of 37,000 pCi/L while Caldwell et al. (2014) observed a maximum of 45,000 pCi/L.

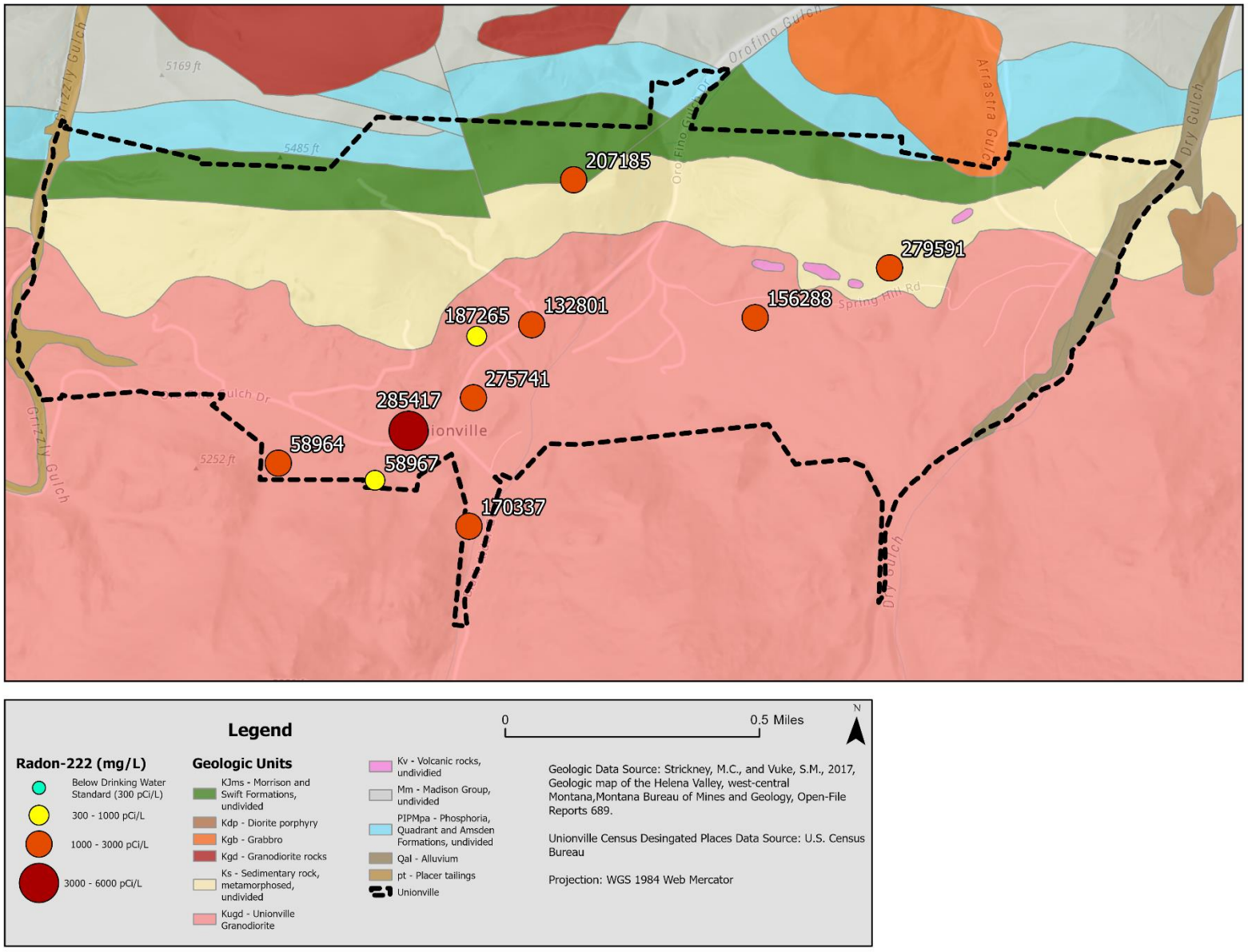

Figure 15: Radon-222 activities are plotted across the study area. No samples were reported below the proposed drinking water standard of 300 pCi/L.

Geochemical Conditions for Radionuclides

The concentration/activity and distribution of radionuclides have been found to be influenced by a number of factors including the underling lithology, aquifer structure, temperature, pH, dissolved oxygen, redox conditions, and total dissolved solids (Leonard and Janzer, 1978; Ayotte et al., 2011). Redox conditions were not investigated during this study.

The previous figures in this study document that the radionuclides are elevated above the nation due to the presence of the Boulder Batholith (Leonard and Janzer, 1978) and potentially the sedimentary rocks (Clark and Briar, 1993). Cadigan (1967) documented uranium ores present in the Morrison Formation in Colorado, though it is not known if the uranium ores are present in the local Morrison Formation near Unionville. Wollenberg (1975) found high levels of radioactivity in Neveda thermal waters were correlated with calcium carbonate dominated hot springs, not silica dominated such as granite or granodiorites. The presence of carbonate bedrock along the northern margin of the Boulder Batholith is potentially providing an additional source of radionuclides to the groundwater, but additional investigating is needed.

The aquifer structure is influenced by a fracture network within the igneous (granites and granodiorites) and metamorphosed bedrock and through the primary pore spaces of the sedimentary bedrock (Caldwell et al., 2014). These fractures provide conduits for infiltrating waters and groundwater movement through the subsurface. Additionally, the fracture zones by their very nature are composed of brecciated rock (Leonard and Janzer, 1978), which can significantly increase the relative surface area of the bedrock and increase the kinetics of the geochemical reactions. Radionuclides native to the bedrock interact with the groundwater through these fracture zones. These interactions can dissolve and add radionuclides into the groundwater thereby increasing the radioactivity of the water.
While other studies have documented relationships between pH, dissolved oxygen, and total dissolved solids, this study did not find those relationships to hold true. Geochemical condition data are plotted against the radionuclide data in Figures 16 and 17. Elevated radionuclides were observed within similar temperature, pH, dissolved oxygen, and total dissolved solid conditions.

Neutral to alkaline pH conditions are reported to be favorable for the presence of uranium in groundwater (Ayotte et al., 2011). This study observed neutral to alkaline pH values between 6.74 – 8.33 which are consistent with natural waters in southwestern Montana (Caldwell et al., 2014). No samples were collected outside of a neutral to alkaline pH condition, so comments on this relationship could not be made in this study.

Uranium in groundwater occurs more frequently in oxic (higher dissolved oxygen) or mixed redox conditions (Ayotte et al., 2011). Dissolved oxygen is generally a poor measure of redox conditions in groundwater, however Morrow (2001) observed that uranium concentrations at or above 0.001 mg/L are more common when dissolved oxygen is above 1 mg/L. This study, which detected uranium in all samples, observed dissolved oxygen concentrations from 1.69 to 8.50 mg/L. The lack of samples below 1mg/L dissolved oxygen prevents any comments on this relationship.

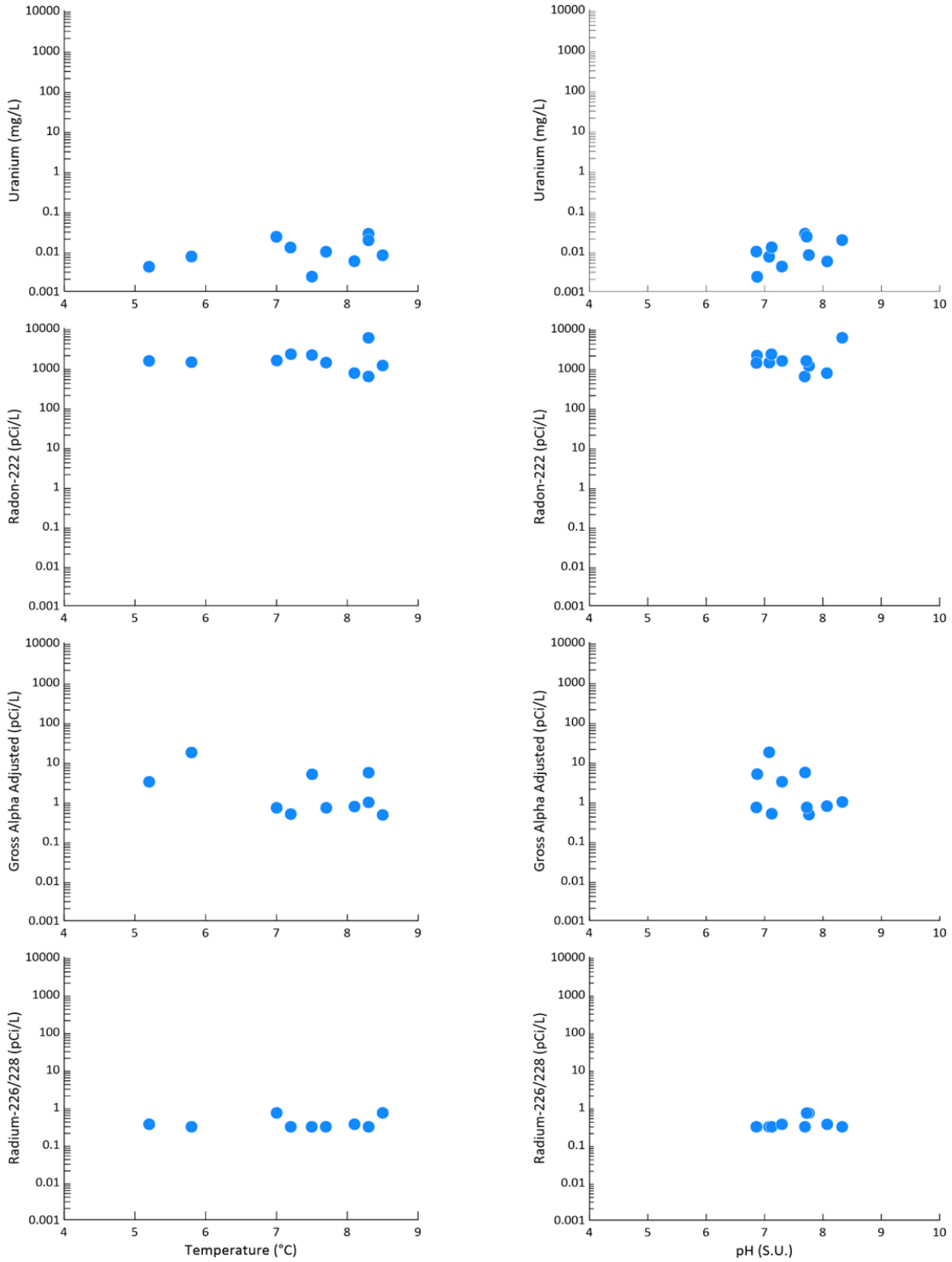

Figure 16: Temperature and pH data are plotted against the concentrations/activities of uranium, radon-222, gross alpha adjusted, and combined radium-226/228. Note the lack of correlations between the variables.

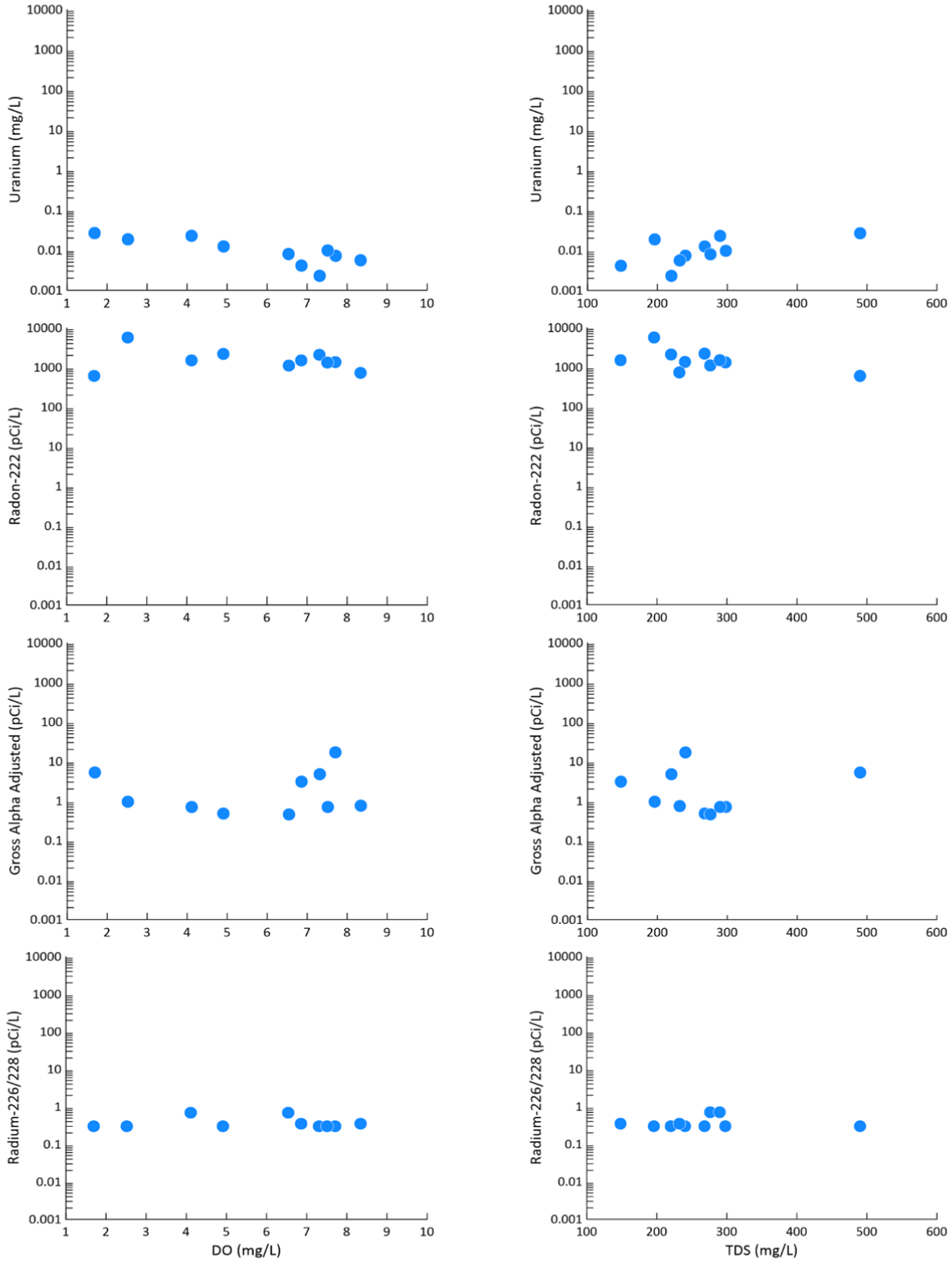

Figure 17: Dissolved oxygen and total dissolved solids are plotted against the concentrations/activities of uranium, radon-222, gross alpha adjusted, and combined radium 226/228.

Trace Elements

While the primary goal of this work was to investigate nitrate and radionuclide contamination, a broad suite of trace elements were also analyzed at each well. These samples were analyzed for both the dissolved and total recoverable fractions. The total recoverable fraction includes particulate solids in the sample. These particulates may normally settle out in the well or pipes of a residence which could prevent them from being consumed. However, this analysis presents a "worse-case scenario" in terms of possible exposure as changing water quality conditions could alter precipitation equilibria toward worsening water quality. Table 6 summarizes the data collected at both the April and September sampling events across dissolved and total recoverable analyses. Appendix A includes a full list of the raw laboratory results.

The list of trace elements includes primary and secondary contaminants based on the USEPA. Primary drinking water contaminants are those that pose a risk to human health while secondary contaminants are regulated based on their ability to impact the aesthetics (tastes and odors), cosmetics (effects that do not damage the human body, but are not desirable), and technical effects (damage to water equipment and reducing the effectiveness of treatment). There are additional contaminants that are not regulated by the USEPA but are important to help homeowners understand the overall water quality.

In April, 10 wells were sampled for trace elements while 11 wells were sampled in September.

Table 6: Summary of Trace Elements (mg/L)

Analyte	Number of Wells Sampled	Number of Samples	Range of Values	Median Value	Mean Value	Standard Deviation	Drinking Water Standard (mg/L)	Number of Drinking Water Standard Exceedances
Arsenic (mg/L)	11	21	0.0002 – 0.037	0.001	0.005	0.009	0.01	[1]2
Cadmium (mg/L)	11	21	0.000008 – 0.0002	0.00002	0.00003	0.00004	0.005	0
Calcium (mg/L)	11	21	<0.1 – 109	55	55	22	-	-
Copper (mg/L)	11	21	0.0007 – 0.378	0.008	0.03	0.08	1.3	0
[1]Iron (mg/L)	11	21	<0.009 – 2.07	0.02	0.2	0.08	0.3	3
Lead (mg/L)	11	21	<0.0001 – 0.003	0.0002	0.0004	0.0006	0.01	0
Magnesium (mg/L)	11	21	<0.05 – 24	12	12	5.0	-	-
[2,3]Manganese (mg/L)	11	21	<0.0003 – 0.026	0.001	0.003	0.006	[4]0.3	0
Potassium (mg/L)	11	21	<0.1 – 6	3	3	2	-	-
Sodium (mg/L)	11	21	6 – 97	7	10	20	-	-

[1]Both drinking water exceedances for arsenic occurred at the same well (GWIC ID 58964).
[2]Secondary Drinking Water Standard. These analytes are regulated for their impacts to the aesthetics, cosmetics, or technical problems with the water. This includes how the water tastes, looks, smells, or if the analyte can impact treatment efficiency.
3Manganese is currently regulated as a secondary contaminant due to aesthetic concerns, however the Montana Department of Environmental Quality is assessing the prevalence of manganese across Montana in response to renewed attention from the USEPA.
[4]The USEPA published a manganese health advisory in 2004 of 0.3 mg/L.

Arsenic

Arsenic is a naturally occurring metal in the bedrock, groundwater, and surface water of Montana. Arsenic is a known contaminant in local ground and surface waters (Tuck, 2001, Ayotte et al., 2011). The USEPA regulates arsenic as a primary drinking water contaminant due to its undesirable health effects. Chronic exposure to arsenic above the drinking water standard of 0.010 mg/L can lead to skin damage, circulatory system problems, and an increased risk of cancer.

Arsenic was analyzed in 21 samples across 11 wells. The range of arsenic was 0.0002 – 0.037 mg/L with a median concentration of 0.001 mg/L. Of the 21 samples, arsenic was detectable in all samples with two samples from one well (GWIC ID 58964) exceeding the drinking water standard of 0.010 mg/L (Figures 18 and 19).

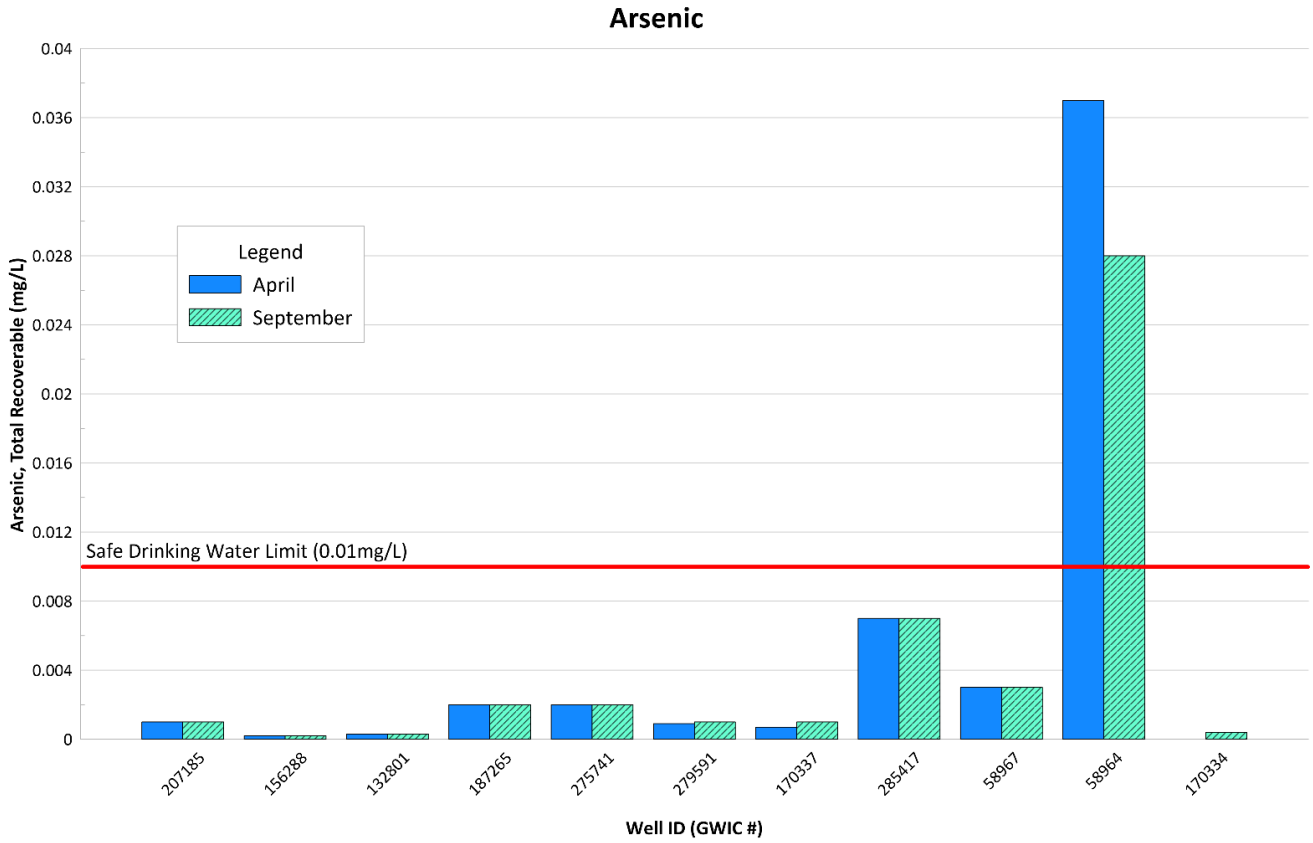

Figure 18: Arsenic concentrations were below the safe drinking water limit in all samples except from Well GWIC ID 58964.

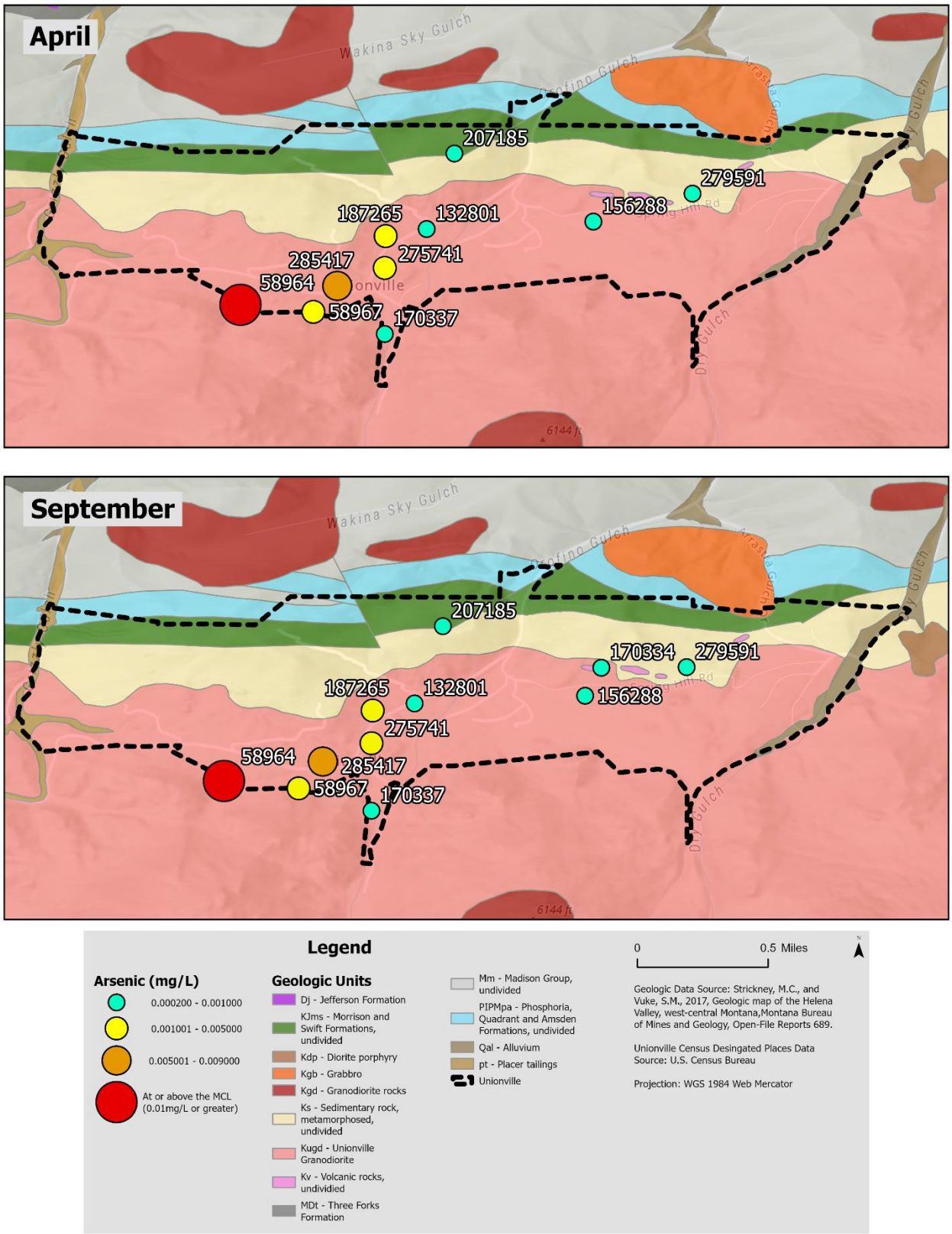

Figure 19: Map of arsenic concentrations for both April and September sampling events. Note well GWIC ID 58964 exceeded the safe drinking water limit in both sampling events. Arsenic was detected in all samples.

Iron

Iron is a naturally occurring metal found in the bedrock, soils, groundwater, and surface water. Iron is regulated as a secondary drinking water contaminant by the USEPA. The secondary drinking water standard for iron is 0.3 mg/L. Iron oxidizes to a brown/red rust color in the presence of the atmosphere which in turn can stain plumbing fixtures and clothes.

Iron was analyzed across 21 samples from 11 wells. Iron concentrations ranged from less than the detection limit to 2.07 mg/L (median concentration of 0.02 mg/L). Three samples exceeded the secondary drinking water standard for iron (0.3 mg/L) across both events. Well GWIC ID 187265 exceeded the standard in both April and September (2.07 mg/L and 0.32 mg/L, respectively). Well GWIC ID 170337 exceeded the standard in September with a concentration of 0.36 mg/L. Of the 21 samples, iron was reported above the detection limit in 16 wells (76%).

Manganese

Manganese is a naturally occurring metal found in soil, bedrock, groundwater, and surface water. Manganese is also commonly found in food products because the human body needs small amounts for proper nutrition, however too much can be a health concern. The USEPA currently regulates manganese as a secondary drinking water contaminant due to its undesired effect of discoloring water a light brown color. In 2004, the USEPA published a lifetime health advisory for manganese of 0.3 mg/L in response to emerging research documenting manganese can have similar health effects to lead, those being neurological effects (United States Environmental Protection Agency, 2004).

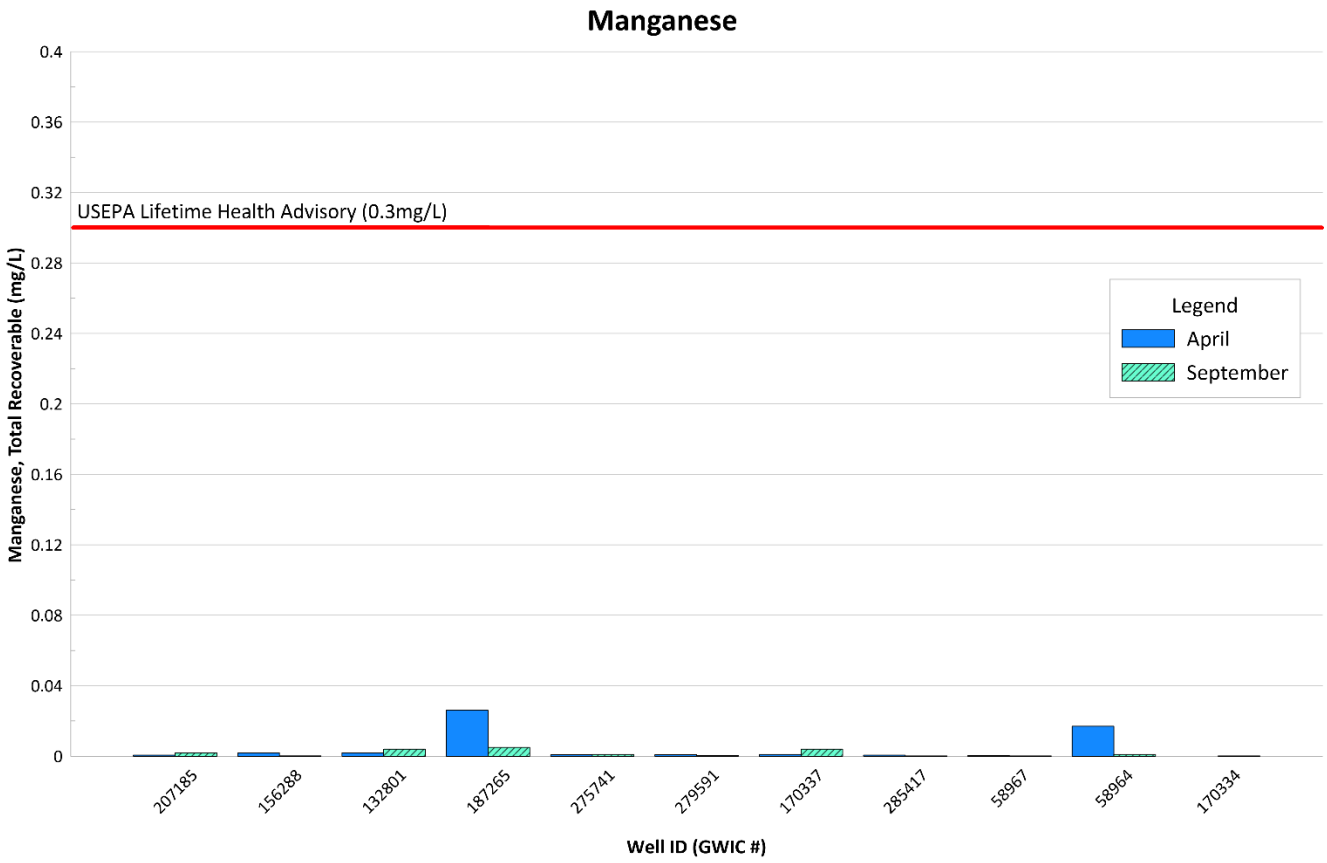

Figure 20: Manganese concentrations were below the health advisory limit in all samples.

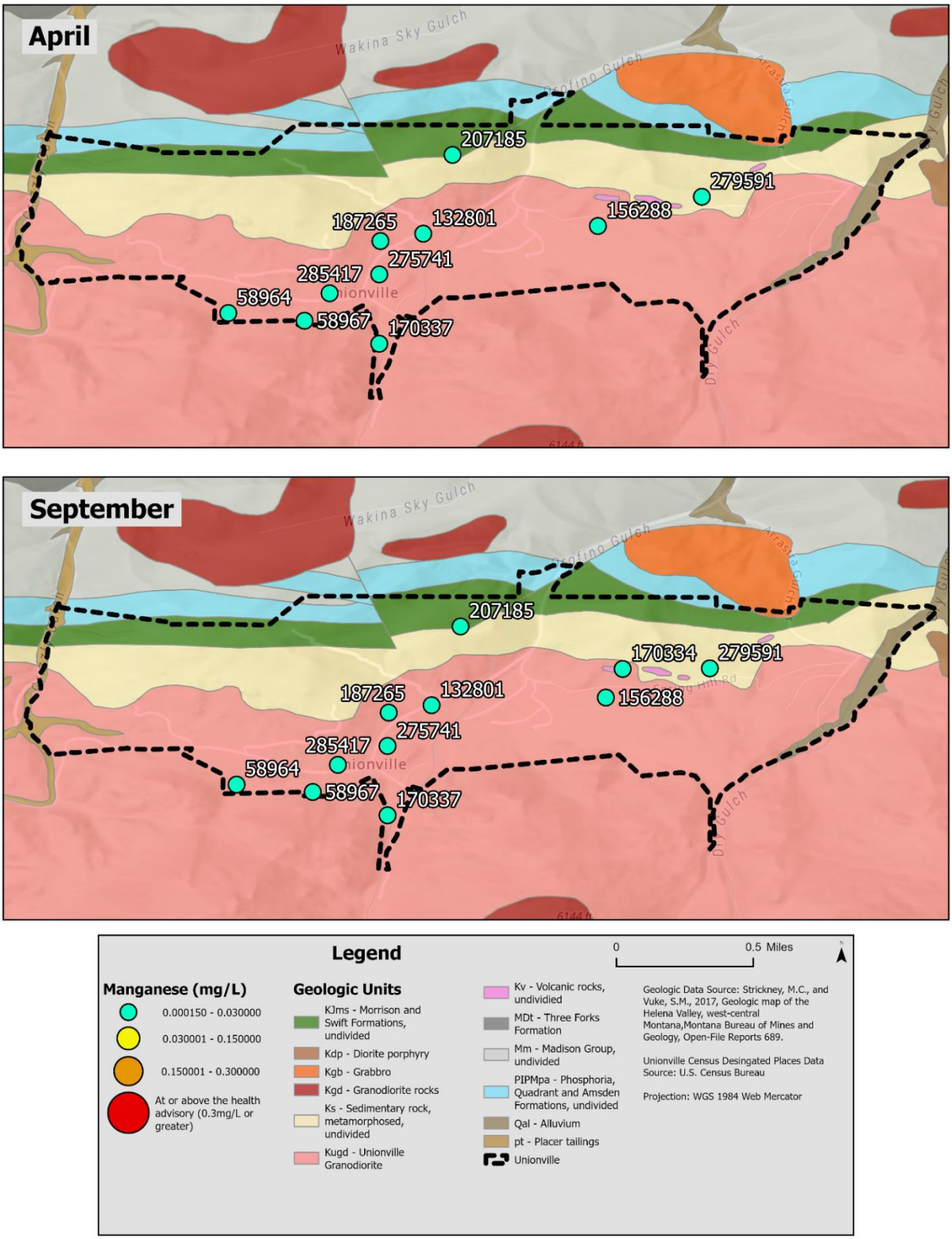

Figure 21: Map of manganese concentrations for both the April and September sampling events.

The Safe Drinking Water Act (SDWA) mandates that the USEPA issue a list of unregulated contaminants every five years to be monitored by public drinking water systems known as the Unregulated Contaminant Monitoring Rule (UCMR). The fourth round of this list was published in December 2016 (to be monitored between 2018 and 2020) and included manganese (https://www.epa.gov/dwucmr/fourth-unregulated-contaminant-monitoring-rule). The UCMR lists allows the USEPA to collect data on the occurrence of various contaminants in drinking water that can be used to direct the development of future drinking water monitoring rules.

A total of 21 manganese samples were collected from 11 wells (Figure 21). The results ranged from less than the detection limit to 0.026 mg/L. The median concentration was 0.001 mg/L. Manganese was reported above the detection limit in 18 of 21 samples (86%). While none of the samples exceeded the health advisory of 0.3 mg/L, one sample (GWIC ID 187265) was just under the health advisory (0.26 mg/L) (Figure 20).

CONCLUSIONS AND RECOMMENDATIONS

Two groundwater quality sampling events in Unionville, Montana, in 2023 focused on assessing the human health impacts of nitrates, trace elements, and radionuclides. The data were evaluated against the local geology, regional data from past studies, and national datasets. The following conclusions and recommendations are drawn from these evaluations:

Nitrates

Nitrate contamination, above the natural 2 mg/L background level, can be a common occurrence in southwestern Montana due to the common use of individual septic systems, agricultural activities, and fertilizer usage. Nitrate samples showed elevated concentrations across the Unionville area with no observable spatial trend across the study area. Though no samples exceeded the drinking water standard, the elevated levels are a concern and should be monitored in the future.

Nitrate stable isotope samples indicate the source of nitrates is likely from animal and septic systems for the majority of samples collected. In the Unionville area this is most likely linked to septic system problems, though the presence livestock and manure is possible as well.

> *Recommendations: perform routine maintenance and inspections of septic systems. Lewis and Clark County Sanitarians are available to answer questions on septic tanks and maintenance. The sanitarians also organize workshops to help homeowners better understand how to maintain their system.*

Radionuclides

Radionuclide samples show elevated levels of uranium and radon. Uranium is naturally occurring in the bedrock of the Boulder Batholith which underlies Unionville. Uranium was present in all wells below the drinking water standard; however, the concentrations were elevated. Being the parent material for most other radioactive materials potentially in the groundwater, the elevated presence of uranium is cause for concern.

Recommendations: test drinking water for uranium and evaluate the need for a household water treatment system.

Arsenic

Arsenic naturally occurs in the groundwater and surface water in Montana. Arsenic was detected in all samples collected in this study. While most samples were below the safe drinking water limit, one well exhibited levels above the limit in both sampling events.

Recommendations: test drinking water for uranium and evaluate the need for a household water treatment system.

Radon

Radon in ground water is also present in all samples collected and exceeded the proposed USEPA drinking water standard in all samples as well. The proposed standard was 300 pCi/L while the range of radon activities in this study was 604 – 5,710 pCi/L with the minimum still more than double the proposed standard. As one of the highest ranked causes of cancer in the county, these data indicate the need to evaluate radon mitigation in households.

Recommendations: all homes in Unionville test the airborne radon levels and evaluate the installation of an airborne radon mitigation system. If the airborne radon is elevated, it is recommended to test the drinking water for radon. The radon in the water can contribute to airborne radon. A water treatment system alone may not be sufficient to reduce the health risks given potentially the high levels of radon.

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Appendix A: Laboratory Data

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-001
Client Sample ID: 207185_042523

Report Date: 05/11/23
Collection Date: 04/25/23 11:05
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.3	s.u.	H	0.1	0.1	A4500-H B	05/02/23 10:10 / ams
pH Measurement Temp	11.3	°C				A4500-H B	05/02/23 10:10 / ams
Conductivity @ 25 C	416	umhos/cm		5	5	A2510 B	05/02/23 10:10 / ams
Solids, Total Dissolved TDS @ 180 C	240	mg/L	D	50	7	A2540 C	05/01/23 15:56 / ljs
INORGANICS							
Alkalinity, Total as CaCO3	130	mg/L		4	2	A2320 B	05/02/23 17:08 / ams
Chloride	18.3	mg/L		1.00		E300.0	05/04/23 22:03 / ljs
Sulfate	48.0	mg/L		1.00		E300.0	05/04/23 22:03 / ljs
Bromide	0.015	mg/L	J	0.500		E300.0	05/04/23 22:03 / ljs
Fluoride	0.09	mg/L	J	0.1	0.03	A4500-F C	05/01/23 12:17 / ljs
Hardness as CaCO3	174	mg/L		1	1	A2340 B	05/03/23 11:21 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.68	mg/L		0.01	0.01	E353.2	05/04/23 17:33 / JAR
Phosphorus, Total as P	0.03	mg/L		0.01	0.001	E365.1	05/02/23 15:25 / JAR
METALS, DISSOLVED							
Arsenic	0.001	mg/L		0.001	0.0002	E200.8	05/02/23 17:19 / dck
Cadmium	0.00003	mg/L	J	0.001	0.00002	E200.8	05/02/23 17:19 / dck
Calcium	52	mg/L		1	0.2	E200.7	05/01/23 13:16 / slj
Copper	0.004	mg/L	J	0.005	0.0001	E200.8	05/02/23 17:19 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	05/02/23 17:19 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 17:19 / dck
Magnesium	11	mg/L		1	0.05	E200.7	05/01/23 13:16 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	05/02/23 17:19 / dck
Potassium	3	mg/L		1	0.06	E200.7	05/01/23 13:16 / slj
Sodium	8	mg/L		1	0.03	E200.7	05/01/23 13:16 / slj
Uranium	0.0066	mg/L		0.0003	0.00002	E200.8	05/02/23 17:19 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.001	mg/L		0.001	0.0001	E200.8	05/02/23 17:22 / dck
Cadmium	0.00004	mg/L	J	0.001	0.00003	E200.8	05/02/23 17:22 / dck
Calcium	55	mg/L		1	0.1	E200.7	05/02/23 15:32 / slj
Copper	0.005	mg/L	J	0.005	0.0003	E200.8	05/02/23 17:22 / dck
Iron	0.01	mg/L	J	0.02	0.009	E200.8	05/02/23 17:22 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 17:22 / dck
Magnesium	12	mg/L		1	0.05	E200.7	05/02/23 15:32 / slj
Manganese	0.0006	mg/L	J	0.001	0.0003	E200.8	05/02/23 17:22 / dck
Potassium	3	mg/L		1	0.1	E200.7	05/02/23 15:32 / slj
Sodium	9	mg/L		1	0.05	E200.7	05/02/23 15:32 / slj
Uranium	0.0073	mg/L		0.0003	0.00003	E200.8	05/02/23 17:22 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time
MDL - Method Detection Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
J - Estimated value - analyte was present but less than the Reporting Limit (RL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-001
Client Sample ID: 207185_042523

Report Date: 05/11/23
Collection Date: 04/25/23 11:05
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radon 222	1360	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 precision (±)	83.4	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 MDC	114	pCi/L				D5072-92	04/29/23 21:19 / eli-c

Report Definitions:
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MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-002
Client Sample ID: 156288_042523

Report Date: 05/11/23
Collection Date: 04/25/23 12:35
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.0	s.u.	H	0.1	0.1	A4500-H B	05/02/23 10:12 / ams
pH Measurement Temp	11.4	°C				A4500-H B	05/02/23 10:12 / ams
Conductivity @ 25 C	360	umhos/cm		5	5	A2510 B	05/02/23 10:12 / ams
Solids, Total Dissolved TDS @ 180 C	220	mg/L	D	50	7	A2540 C	05/01/23 15:56 / ljs
INORGANICS							
Alkalinity, Total as CaCO3	110	mg/L		4	2	A2320 B	05/02/23 17:16 / ams
Chloride	12.4	mg/L		1.00		E300.0	05/04/23 22:47 / ljs
Sulfate	33.4	mg/L		1.00		E300.0	05/04/23 22:47 / ljs
Bromide	0.027	mg/L	J	0.500		E300.0	05/04/23 22:47 / ljs
Fluoride	0.05	mg/L	J	0.1	0.03	A4500-F C	05/01/23 12:30 / ljs
Hardness as CaCO3	155	mg/L		1	1	A2340 B	05/03/23 11:21 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	4.01	mg/L		0.01	0.01	E353.2	05/04/23 17:36 / JAR
Phosphorus, Total as P	0.009	mg/L	J	0.01	0.001	E365.1	05/02/23 15:26 / JAR
METALS, DISSOLVED							
Arsenic	ND	mg/L		0.001	0.0002	E200.8	05/02/23 17:25 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	05/02/23 17:25 / dck
Calcium	46	mg/L		1	0.2	E200.7	05/01/23 13:20 / slj
Copper	0.006	mg/L		0.005	0.0001	E200.8	05/02/23 17:25 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	05/02/23 17:25 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 17:25 / dck
Magnesium	10	mg/L		1	0.05	E200.7	05/01/23 13:20 / slj
Manganese	0.002	mg/L		0.001	0.0003	E200.8	05/02/23 17:25 / dck
Potassium	2	mg/L		1	0.06	E200.7	05/01/23 13:20 / slj
Sodium	7	mg/L		1	0.03	E200.7	05/01/23 13:20 / slj
Uranium	0.0021	mg/L		0.0003	0.00002	E200.8	05/02/23 17:25 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.0002	mg/L	J	0.001	0.0001	E200.8	05/02/23 17:28 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	05/02/23 17:28 / dck
Calcium	43	mg/L		1	0.1	E200.7	05/01/23 18:04 / slj
Copper	0.006	mg/L		0.005	0.0003	E200.8	05/02/23 17:28 / dck
Iron	0.02	mg/L		0.02	0.009	E200.8	05/02/23 17:28 / dck
Lead	0.0002	mg/L	J	0.001	0.0001	E200.8	05/02/23 17:28 / dck
Magnesium	10	mg/L		1	0.05	E200.7	05/02/23 15:43 / slj
Manganese	0.002	mg/L		0.001	0.0003	E200.8	05/02/23 17:28 / dck
Potassium	2	mg/L		1	0.1	E200.7	05/02/23 15:43 / slj
Sodium	8	mg/L		1	0.05	E200.7	05/02/23 15:43 / slj
Uranium	0.0023	mg/L		0.0003	0.00003	E200.8	05/02/23 17:28 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time
MDL - Method Detection Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
J - Estimated value - analyte was present but less than the Reporting Limit (RL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-002
Client Sample ID: 156288_042523

Report Date: 05/11/23
Collection Date: 04/25/23 12:35
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radon 222	2080	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 precision (±)	91.1	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 MDC	114	pCi/L				D5072-92	04/29/23 21:19 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-003
Client Sample ID: 132801_042523

Report Date: 05/11/23
Collection Date: 04/25/23 13:45
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.0	s.u.	H	0.1	0.1	A4500-H B	05/02/23 10:14 / ams
pH Measurement Temp	11.6	°C				A4500-H B	05/02/23 10:14 / ams
Conductivity @ 25 C	487	umhos/cm		5	5	A2510 B	05/02/23 10:14 / ams
Solids, Total Dissolved TDS @ 180 C	298	mg/L	D	50	7	A2540 C	05/01/23 15:57 / ljs
INORGANICS							
Alkalinity, Total as CaCO3	140	mg/L		4	2	A2320 B	05/02/23 17:23 / ams
Chloride	10.3	mg/L		1.00		E300.0	05/04/23 23:01 / ljs
Sulfate	88.6	mg/L		1.00		E300.0	05/04/23 23:01 / ljs
Bromide	0.026	mg/L	J	0.500		E300.0	05/04/23 23:01 / ljs
Fluoride	0.06	mg/L	J	0.1	0.03	A4500-F C	05/01/23 12:36 / ljs
Hardness as CaCO3	212	mg/L		1	1	A2340 B	05/03/23 11:21 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.74	mg/L		0.01	0.01	E353.2	05/04/23 17:37 / JAR
Phosphorus, Total as P	0.02	mg/L		0.01	0.001	E365.1	05/02/23 15:27 / JAR
METALS, DISSOLVED							
Arsenic	0.0002	mg/L	J	0.001	0.0002	E200.8	05/02/23 17:30 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	05/02/23 17:30 / dck
Calcium	64	mg/L		1	0.2	E200.7	05/01/23 13:24 / slj
Copper	0.007	mg/L		0.005	0.0001	E200.8	05/02/23 17:30 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	05/02/23 17:30 / dck
Lead	0.0002	mg/L	J	0.001	0.0001	E200.8	05/02/23 17:30 / dck
Magnesium	13	mg/L		1	0.05	E200.7	05/01/23 13:24 / slj
Manganese	0.0006	mg/L	J	0.001	0.0003	E200.8	05/02/23 17:30 / dck
Potassium	3	mg/L		1	0.06	E200.7	05/01/23 13:24 / slj
Sodium	9	mg/L		1	0.03	E200.7	05/01/23 13:24 / slj
Uranium	0.0093	mg/L		0.0003	0.00002	E200.8	05/02/23 17:30 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.0003	mg/L	J	0.001	0.0001	E200.8	05/02/23 17:33 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	05/02/23 17:33 / dck
Calcium	63	mg/L		1	0.1	E200.7	05/01/23 18:08 / slj
Copper	0.006	mg/L		0.005	0.0003	E200.8	05/02/23 17:33 / dck
Iron	ND	mg/L		0.02	0.009	E200.8	05/02/23 17:33 / dck
Lead	0.0002	mg/L	J	0.001	0.0001	E200.8	05/02/23 17:33 / dck
Magnesium	13	mg/L		1	0.05	E200.7	05/02/23 15:47 / slj
Manganese	0.002	mg/L		0.001	0.0003	E200.8	05/02/23 17:33 / dck
Potassium	3	mg/L		1	0.1	E200.7	05/02/23 15:47 / slj
Sodium	9	mg/L		1	0.05	E200.7	05/02/23 15:47 / slj
Uranium	0.0098	mg/L		0.0003	0.00003	E200.8	05/02/23 17:33 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time
MDL - Method Detection Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
J - Estimated value - analyte was present but less than the Reporting Limit (RL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-003
Client Sample ID: 132801_042523

Report Date: 05/11/23
Collection Date: 04/25/23 13:45
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radon 222	1330	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 precision (±)	83.1	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 MDC	114	pCi/L				D5072-92	04/29/23 21:19 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-004
Client Sample ID: 187265_042523

Report Date: 05/11/23
Collection Date: 04/25/23 15:10
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.7	s.u.	H	0.1	0.1	A4500-H B	05/02/23 10:16 / ams
pH Measurement Temp	11.7	°C				A4500-H B	05/02/23 10:16 / ams
Conductivity @ 25 C	781	umhos/cm		5	5	A2510 B	05/02/23 10:16 / ams
Solids, Total Dissolved TDS @ 180 C	490	mg/L	D	50	7	A2540 C	05/01/23 15:57 / ljs
INORGANICS							
Alkalinity, Total as CaCO3	180	mg/L		4	2	A2320 B	05/02/23 17:30 / ams
Chloride	46.3	mg/L		1.00		E300.0	05/04/23 23:16 / ljs
Sulfate	144	mg/L		1.00		E300.0	05/04/23 23:16 / ljs
Bromide	0.048	mg/L	J	0.500		E300.0	05/04/23 23:16 / ljs
Fluoride	0.08	mg/L	J	0.1	0.03	A4500-F C	05/01/23 12:42 / ljs
Hardness as CaCO3	353	mg/L		1	1	A2340 B	05/03/23 11:21 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	3.80	mg/L		0.01	0.01	E353.2	05/04/23 17:38 / JAR
Phosphorus, Total as P	0.04	mg/L		0.01	0.001	E365.1	05/02/23 15:28 / JAR
METALS, DISSOLVED							
Arsenic	0.001	mg/L		0.001	0.0002	E200.8	05/02/23 17:36 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	05/02/23 17:36 / dck
Calcium	104	mg/L		1	0.2	E200.7	05/01/23 13:28 / slj
Copper	0.001	mg/L	J	0.005	0.0001	E200.8	05/02/23 17:36 / dck
Iron	0.06	mg/L		0.02	0.004	E200.8	05/02/23 17:36 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 17:36 / dck
Magnesium	23	mg/L		1	0.05	E200.7	05/01/23 13:28 / slj
Manganese	0.002	mg/L		0.001	0.0003	E200.8	05/02/23 17:36 / dck
Potassium	6	mg/L		1	0.06	E200.7	05/01/23 13:28 / slj
Sodium	7	mg/L		1	0.03	E200.7	05/01/23 13:28 / slj
Uranium	0.0261	mg/L		0.0003	0.00002	E200.8	05/02/23 17:36 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.002	mg/L		0.001	0.0001	E200.8	05/02/23 17:39 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	05/02/23 17:39 / dck
Calcium	105	mg/L		1	0.1	E200.7	05/01/23 18:27 / slj
Copper	0.004	mg/L	J	0.005	0.0003	E200.8	05/02/23 17:39 / dck
Iron	2.07	mg/L		0.02	0.02	E200.7	05/01/23 18:27 / slj
Lead	0.0002	mg/L	J	0.001	0.0001	E200.8	05/02/23 17:39 / dck
Magnesium	24	mg/L		1	0.05	E200.7	05/02/23 16:05 / slj
Manganese	0.026	mg/L		0.001	0.0003	E200.8	05/02/23 17:39 / dck
Potassium	6	mg/L		1	0.1	E200.7	05/02/23 16:05 / slj
Sodium	7	mg/L		1	0.05	E200.7	05/02/23 16:05 / slj
Uranium	0.0269	mg/L		0.0003	0.00003	E200.8	05/02/23 17:39 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time
MDL - Method Detection Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
J - Estimated value - analyte was present but less than the Reporting Limit (RL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-004
Client Sample ID: 187265_042523

Report Date: 05/11/23
Collection Date: 04/25/23 15:10
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radon 222	604	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 precision (±)	73.9	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 MDC	114	pCi/L				D5072-92	04/29/23 21:19 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-005
Client Sample ID: 275741_042523

Report Date: 05/11/23
Collection Date: 04/25/23 16:45
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.1	s.u.	H	0.1	0.1	A4500-H B	05/02/23 10:18 / ams
pH Measurement Temp	11.9	°C				A4500-H B	05/02/23 10:18 / ams
Conductivity @ 25 C	451	umhos/cm		5	5	A2510 B	05/02/23 10:18 / ams
Solids, Total Dissolved TDS @ 180 C	268	mg/L	D	50	7	A2540 C	05/01/23 15:57 / ljs
INORGANICS							
Alkalinity, Total as CaCO3	130	mg/L		4	2	A2320 B	05/02/23 17:38 / ams
Chloride	25.5	mg/L		1.00		E300.0	05/04/23 23:30 / ljs
Sulfate	32.4	mg/L		1.00		E300.0	05/04/23 23:30 / ljs
Bromide	0.033	mg/L	J	0.500		E300.0	05/04/23 23:30 / ljs
Fluoride	0.07	mg/L	J	0.1	0.03	A4500-F C	05/01/23 12:48 / ljs
Hardness as CaCO3	187	mg/L		1	1	A2340 B	05/03/23 11:21 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	4.59	mg/L		0.01	0.01	E353.2	05/04/23 17:39 / JAR
Phosphorus, Total as P	0.03	mg/L		0.01	0.001	E365.1	05/02/23 15:34 / JAR
METALS, DISSOLVED							
Arsenic	0.002	mg/L		0.001	0.0002	E200.8	05/02/23 17:42 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	05/02/23 17:42 / dck
Calcium	56	mg/L		1	0.2	E200.7	05/01/23 13:50 / slj
Copper	0.028	mg/L		0.005	0.0001	E200.8	05/02/23 17:42 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	05/02/23 17:42 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 17:42 / dck
Magnesium	11	mg/L		1	0.05	E200.7	05/01/23 13:50 / slj
Manganese	0.0005	mg/L	J	0.001	0.0003	E200.8	05/02/23 17:42 / dck
Potassium	3	mg/L		1	0.06	E200.7	05/01/23 13:50 / slj
Sodium	8	mg/L		1	0.03	E200.7	05/01/23 13:50 / slj
Uranium	0.0119	mg/L		0.0003	0.00002	E200.8	05/02/23 17:42 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.002	mg/L		0.001	0.0001	E200.8	05/02/23 17:45 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	05/02/23 17:45 / dck
Calcium	55	mg/L		1	0.1	E200.7	05/01/23 18:30 / slj
Copper	0.029	mg/L		0.005	0.0003	E200.8	05/02/23 17:45 / dck
Iron	0.02	mg/L	J	0.02	0.009	E200.8	05/02/23 17:45 / dck
Lead	0.0004	mg/L	J	0.001	0.0001	E200.8	05/02/23 17:45 / dck
Magnesium	12	mg/L		1	0.05	E200.7	05/02/23 16:09 / slj
Manganese	0.0008	mg/L	J	0.001	0.0003	E200.8	05/02/23 17:45 / dck
Potassium	4	mg/L		1	0.1	E200.7	05/02/23 16:09 / slj
Sodium	9	mg/L		1	0.05	E200.7	05/02/23 16:09 / slj
Uranium	0.0124	mg/L		0.0003	0.00003	E200.8	05/02/23 17:45 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time
MDL - Method Detection Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
J - Estimated value - analyte was present but less than the Reporting Limit (RL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-005
Client Sample ID: 275741_042523

Report Date: 05/11/23
Collection Date: 04/25/23 16:45
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radon 222	2200	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 precision (±)	92.1	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 MDC	113	pCi/L				D5072-92	04/29/23 21:19 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-006
Client Sample ID: FB_042523

Report Date: 05/11/23
Collection Date: 04/25/23 16:20
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	5.8	s.u.	H	0.1	0.1	A4500-H B	05/02/23 10:19 / ams
pH Measurement Temp	12.2	°C				A4500-H B	05/02/23 10:19 / ams
Conductivity @ 25 C	ND	umhos/cm		5	5	A2510 B	05/02/23 10:19 / ams
Solids, Total Dissolved TDS @ 180 C	ND	mg/L	D	20	7	A2540 C	05/01/23 15:58 / ljs
- TDS did not obtain the minimum residue requirement of 2.5 mg residue.							
INORGANICS							
Alkalinity, Total as CaCO3	2	mg/L	J	4	2	A2320 B	05/02/23 17:45 / ams
Chloride	ND	mg/L		1.00		E300.0	05/04/23 23:44 / ljs
Sulfate	ND	mg/L		1.00		E300.0	05/04/23 23:44 / ljs
Bromide	ND	mg/L		0.500		E300.0	05/04/23 23:44 / ljs
Fluoride	ND	mg/L		0.1	0.03	A4500-F C	05/01/23 12:54 / ljs
Hardness as CaCO3	ND	mg/L		1	1	A2340 B	05/03/23 11:21 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.01	0.01	E353.2	05/04/23 17:45 / JAR
Phosphorus, Total as P	ND	mg/L		0.01	0.001	E365.1	05/02/23 15:36 / JAR
METALS, DISSOLVED							
Arsenic	ND	mg/L		0.001	0.0002	E200.8	05/02/23 18:03 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	05/02/23 18:03 / dck
Calcium	ND	mg/L		1	0.2	E200.7	05/01/23 13:54 / slj
Copper	0.0004	mg/L	J	0.005	0.0001	E200.8	05/02/23 18:03 / dck
Iron	0.008	mg/L	J	0.02	0.004	E200.8	05/02/23 18:03 / dck
Lead	0.0002	mg/L	J	0.001	0.0001	E200.8	05/02/23 18:03 / dck
Magnesium	ND	mg/L		1	0.05	E200.7	05/01/23 13:54 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	05/02/23 18:03 / dck
Potassium	ND	mg/L		1	0.06	E200.7	05/01/23 13:54 / slj
Sodium	0.07	mg/L	J	1	0.03	E200.7	05/01/23 13:54 / slj
Uranium	0.00002	mg/L	J	0.0003	0.00002	E200.8	05/02/23 18:03 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	ND	mg/L		0.001	0.0001	E200.8	05/02/23 18:06 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	05/02/23 18:06 / dck
Calcium	ND	mg/L		1	0.1	E200.7	05/01/23 18:34 / slj
Copper	ND	mg/L		0.005	0.0003	E200.8	05/02/23 18:06 / dck
Iron	ND	mg/L		0.02	0.009	E200.8	05/02/23 18:06 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 18:06 / dck
Magnesium	ND	mg/L		1	0.05	E200.7	05/02/23 16:13 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	05/02/23 18:06 / dck
Potassium	ND	mg/L		1	0.1	E200.7	05/02/23 16:13 / slj
Sodium	ND	mg/L		1	0.05	E200.7	05/02/23 16:13 / slj
Uranium	ND	mg/L		0.0003	0.00003	E200.8	05/02/23 18:06 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time
MDL - Method Detection Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
J - Estimated value - analyte was present but less than the Reporting Limit (RL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-006
Client Sample ID: FB_042523

Report Date: 05/11/23
Collection Date: 04/25/23 16:20
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radon 222	-4	pCi/L	U			D5072-92	04/29/23 21:19 / eli-c
Radon 222 precision (±)	65.8	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 MDC	114	pCi/L				D5072-92	04/29/23 21:19 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
U - Not detected at Minimum Detectable Concentration (MDC)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-007
Client Sample ID: 279591_042723

Report Date: 05/11/23
Collection Date: 04/27/23 11:25
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.6	s.u.	H	0.1	0.1	A4500-H B	05/02/23 10:22 / ams
pH Measurement Temp	12.8	°C				A4500-H B	05/02/23 10:22 / ams
Conductivity @ 25 C	465	umhos/cm		5	5	A2510 B	05/02/23 10:22 / ams
Solids, Total Dissolved TDS @ 180 C	276	mg/L	D	50	7	A2540 C	05/01/23 15:58 / ljs
INORGANICS							
Alkalinity, Total as CaCO3	170	mg/L		4	2	A2320 B	05/02/23 17:57 / ams
Chloride	5.58	mg/L		1.00		E300.0	05/04/23 23:59 / ljs
Sulfate	50.7	mg/L		1.00		E300.0	05/04/23 23:59 / ljs
Bromide	0.021	mg/L	J	0.500		E300.0	05/04/23 23:59 / ljs
Fluoride	0.08	mg/L	J	0.1	0.03	A4500-F C	05/01/23 13:00 / ljs
Hardness as CaCO3	218	mg/L		1	1	A2340 B	05/03/23 11:21 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	3.00	mg/L		0.01	0.01	E353.2	05/04/23 17:48 / JAR
Phosphorus, Total as P	0.02	mg/L		0.01	0.001	E365.1	05/02/23 15:37 / JAR
METALS, DISSOLVED							
Arsenic	0.0008	mg/L	J	0.001	0.0002	E200.8	05/02/23 18:09 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	05/02/23 18:09 / dck
Calcium	67	mg/L		1	0.2	E200.7	05/01/23 13:57 / slj
Copper	0.002	mg/L	J	0.005	0.0001	E200.8	05/02/23 18:09 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	05/02/23 18:09 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 18:09 / dck
Magnesium	12	mg/L		1	0.05	E200.7	05/01/23 13:57 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	05/02/23 18:09 / dck
Potassium	2	mg/L		1	0.06	E200.7	05/01/23 13:57 / slj
Sodium	6	mg/L		1	0.03	E200.7	05/01/23 13:57 / slj
Uranium	0.0077	mg/L		0.0003	0.00002	E200.8	05/02/23 18:09 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.0009	mg/L	J	0.001	0.0001	E200.8	05/02/23 18:12 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	05/02/23 18:12 / dck
Calcium	65	mg/L		1	0.1	E200.7	05/01/23 18:45 / slj
Copper	0.003	mg/L	J	0.005	0.0003	E200.8	05/02/23 18:12 / dck
Iron	0.08	mg/L		0.02	0.009	E200.8	05/02/23 18:12 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 18:12 / dck
Magnesium	13	mg/L		1	0.05	E200.7	05/02/23 16:17 / slj
Manganese	0.0008	mg/L	J	0.001	0.0003	E200.8	05/02/23 18:12 / dck
Potassium	2	mg/L		1	0.1	E200.7	05/01/23 18:45 / slj
Sodium	7	mg/L		1	0.05	E200.7	05/01/23 18:45 / slj
Uranium	0.0080	mg/L		0.0003	0.00003	E200.8	05/02/23 18:12 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time
MDL - Method Detection Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
J - Estimated value - analyte was present but less than the Reporting Limit (RL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-007
Client Sample ID: 279591_042723

Report Date: 05/11/23
Collection Date: 04/27/23 11:25
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radon 222	1120	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 precision (±)	62.3	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 MDC	83.2	pCi/L				D5072-92	04/29/23 21:19 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-008
Client Sample ID: 170337_042723

Report Date: 05/11/23
Collection Date: 04/27/23 12:50
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.2	s.u.	H	0.1	0.1	A4500-H B	05/02/23 10:24 / ams
pH Measurement Temp	13.0	°C				A4500-H B	05/02/23 10:24 / ams
Conductivity @ 25 C	246	umhos/cm		5	5	A2510 B	05/02/23 10:24 / ams
Solids, Total Dissolved TDS @ 180 C	148	mg/L	D	50	7	A2540 C	05/01/23 15:59 / ljs
INORGANICS							
Alkalinity, Total as CaCO3	91	mg/L		4	2	A2320 B	05/02/23 18:04 / ams
Chloride	1.41	mg/L		1.00		E300.0	05/05/23 00:13 / ljs
Sulfate	26.9	mg/L		1.00		E300.0	05/05/23 00:13 / ljs
Bromide	ND	mg/L		0.500		E300.0	05/05/23 00:13 / ljs
Fluoride	0.06	mg/L	J	0.1	0.03	A4500-F C	05/01/23 13:06 / ljs
Hardness as CaCO3	108	mg/L		1	1	A2340 B	05/03/23 11:21 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.13	mg/L		0.01	0.01	E353.2	05/04/23 17:49 / JAR
Phosphorus, Total as P	0.02	mg/L		0.01	0.001	E365.1	05/02/23 15:38 / JAR
METALS, DISSOLVED							
Arsenic	0.0006	mg/L	J	0.001	0.0002	E200.8	05/02/23 18:15 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	05/02/23 18:15 / dck
Calcium	34	mg/L		1	0.2	E200.7	05/01/23 14:01 / slj
Copper	0.017	mg/L		0.005	0.0001	E200.8	05/02/23 18:15 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	05/02/23 18:15 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 18:15 / dck
Magnesium	6	mg/L		1	0.05	E200.7	05/01/23 14:01 / slj
Manganese	0.0005	mg/L	J	0.001	0.0003	E200.8	05/02/23 18:15 / dck
Potassium	2	mg/L		1	0.06	E200.7	05/01/23 14:01 / slj
Sodium	6	mg/L		1	0.03	E200.7	05/01/23 14:01 / slj
Uranium	0.0039	mg/L		0.0003	0.00002	E200.8	05/02/23 18:15 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.0007	mg/L	J	0.001	0.0001	E200.8	05/02/23 18:18 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	05/02/23 18:18 / dck
Calcium	32	mg/L		1	0.1	E200.7	05/01/23 18:49 / slj
Copper	0.018	mg/L		0.005	0.0003	E200.8	05/02/23 18:18 / dck
Iron	0.04	mg/L		0.02	0.009	E200.8	05/02/23 18:18 / dck
Lead	0.0003	mg/L	J	0.001	0.0001	E200.8	05/02/23 18:18 / dck
Magnesium	6	mg/L		1	0.05	E200.7	05/02/23 16:28 / slj
Manganese	0.001	mg/L		0.001	0.0003	E200.8	05/02/23 18:18 / dck
Potassium	2	mg/L		1	0.1	E200.7	05/01/23 18:49 / slj
Sodium	6	mg/L		1	0.05	E200.7	05/01/23 18:49 / slj
Uranium	0.0041	mg/L		0.0003	0.00003	E200.8	05/02/23 18:18 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time
MDL - Method Detection Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
J - Estimated value - analyte was present but less than the Reporting Limit (RL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-008
Client Sample ID: 170337_042723

Report Date: 05/11/23
Collection Date: 04/27/23 12:50
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radon 222	1490	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 precision (±)	66.2	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 MDC	82.8	pCi/L				D5072-92	04/29/23 21:19 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-009
Client Sample ID: 285417_042723

Report Date: 05/11/23
Collection Date: 04/27/23 14:25
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	8.0	s.u.	H	0.1	0.1	A4500-H B	05/02/23 10:26 / ams
pH Measurement Temp	12.9	°C				A4500-H B	05/02/23 10:26 / ams
Conductivity @ 25 C	357	umhos/cm		5	5	A2510 B	05/02/23 10:26 / ams
Solids, Total Dissolved TDS @ 180 C	196	mg/L	D	50	7	A2540 C	05/01/23 15:59 / ljs
INORGANICS							
Alkalinity, Total as CaCO3	110	mg/L		4	2	A2320 B	05/02/23 18:11 / ams
Chloride	12.4	mg/L		1.00		E300.0	05/05/23 00:28 / ljs
Sulfate	40.4	mg/L		1.00		E300.0	05/05/23 00:28 / ljs
Bromide	0.031	mg/L	J	0.500		E300.0	05/05/23 00:28 / ljs
Fluoride	0.1	mg/L		0.1	0.03	A4500-F C	05/01/23 13:12 / ljs
Hardness as CaCO3	157	mg/L		1	1	A2340 B	05/03/23 11:21 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	1.62	mg/L		0.01	0.01	E353.2	05/04/23 17:50 / JAR
Phosphorus, Total as P	0.02	mg/L		0.01	0.001	E365.1	05/02/23 15:39 / JAR
METALS, DISSOLVED							
Arsenic	0.007	mg/L		0.001	0.0002	E200.8	05/02/23 18:20 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	05/02/23 18:20 / dck
Calcium	44	mg/L		1	0.2	E200.7	05/01/23 14:05 / slj
Copper	0.0006	mg/L	J	0.005	0.0001	E200.8	05/02/23 18:20 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	05/02/23 18:20 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 18:20 / dck
Magnesium	11	mg/L		1	0.05	E200.7	05/01/23 14:05 / slj
Manganese	0.0004	mg/L	J	0.001	0.0003	E200.8	05/02/23 18:20 / dck
Potassium	5	mg/L		1	0.06	E200.7	05/01/23 14:05 / slj
Sodium	6	mg/L		1	0.03	E200.7	05/01/23 14:05 / slj
Uranium	0.0173	mg/L		0.0003	0.00002	E200.8	05/02/23 18:20 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.007	mg/L		0.001	0.0001	E200.8	05/02/23 18:23 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	05/02/23 18:23 / dck
Calcium	41	mg/L		1	0.1	E200.7	05/01/23 18:53 / slj
Copper	0.0007	mg/L	J	0.005	0.0003	E200.8	05/02/23 18:23 / dck
Iron	ND	mg/L		0.02	0.009	E200.8	05/02/23 18:23 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 18:23 / dck
Magnesium	12	mg/L		1	0.05	E200.7	05/02/23 16:32 / slj
Manganese	0.0006	mg/L	J	0.001	0.0003	E200.8	05/02/23 18:23 / dck
Potassium	5	mg/L		1	0.1	E200.7	05/01/23 18:53 / slj
Sodium	7	mg/L		1	0.05	E200.7	05/01/23 18:53 / slj
Uranium	0.0186	mg/L		0.0003	0.00003	E200.8	05/02/23 18:23 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time
MDL - Method Detection Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
J - Estimated value - analyte was present but less than the Reporting Limit (RL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-009
Client Sample ID: 285417_042723

Report Date: 05/11/23
Collection Date: 04/27/23 14:25
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radon 222	5710	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 precision (±)	101	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 MDC	82.4	pCi/L				D5072-92	04/29/23 21:19 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-010
Client Sample ID: 58967_042723

Report Date: 05/11/23
Collection Date: 04/27/23 15:30
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.9	s.u.	H	0.1	0.1	A4500-H B	05/02/23 12:09 / ams
pH Measurement Temp	16.6	°C				A4500-H B	05/02/23 12:09 / ams
Conductivity @ 25 C	386	umhos/cm		5	5	A2510 B	05/02/23 12:09 / ams
Solids, Total Dissolved TDS @ 180 C	232	mg/L	D	50	7	A2540 C	05/01/23 15:59 / ljs
INORGANICS							
Alkalinity, Total as CaCO3	120	mg/L		4	2	A2320 B	05/02/23 18:17 / ams
Chloride	12.9	mg/L		1.00		E300.0	05/05/23 00:42 / ljs
Sulfate	29.5	mg/L		1.00		E300.0	05/05/23 00:42 / ljs
Bromide	0.021	mg/L	J	0.500		E300.0	05/05/23 00:42 / ljs
Fluoride	0.08	mg/L	J	0.1	0.03	A4500-F C	05/01/23 13:18 / ljs
Hardness as CaCO3	169	mg/L		1	1	A2340 B	05/03/23 11:21 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	6.4	mg/L		0.1	0.08	E353.2	05/05/23 14:19 / JAR
Phosphorus, Total as P	0.02	mg/L		0.01	0.001	E365.1	05/02/23 15:40 / JAR
METALS, DISSOLVED							
Arsenic	0.003	mg/L		0.001	0.0002	E200.8	05/02/23 18:26 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	05/02/23 18:26 / dck
Calcium	48	mg/L		1	0.2	E200.7	05/01/23 14:09 / slj
Copper	0.0008	mg/L	J	0.005	0.0001	E200.8	05/02/23 18:26 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	05/02/23 18:26 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 18:26 / dck
Magnesium	12	mg/L		1	0.05	E200.7	05/01/23 14:09 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	05/02/23 18:26 / dck
Potassium	4	mg/L		1	0.06	E200.7	05/01/23 14:09 / slj
Sodium	6	mg/L		1	0.03	E200.7	05/01/23 14:09 / slj
Uranium	0.0052	mg/L		0.0003	0.00002	E200.8	05/02/23 18:26 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.003	mg/L		0.001	0.0001	E200.8	05/02/23 18:29 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	05/02/23 18:29 / dck
Calcium	47	mg/L		1	0.1	E200.7	05/01/23 18:57 / slj
Copper	0.001	mg/L	J	0.005	0.0003	E200.8	05/02/23 18:29 / dck
Iron	0.02	mg/L		0.02	0.009	E200.8	05/02/23 18:29 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 18:29 / dck
Magnesium	13	mg/L		1	0.05	E200.7	05/02/23 16:36 / slj
Manganese	0.0003	mg/L	J	0.001	0.0003	E200.8	05/02/23 18:29 / dck
Potassium	5	mg/L		1	0.1	E200.7	05/01/23 18:57 / slj
Sodium	7	mg/L		1	0.05	E200.7	05/01/23 18:57 / slj
Uranium	0.0056	mg/L		0.0003	0.00003	E200.8	05/02/23 18:29 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time
MDL - Method Detection Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
J - Estimated value - analyte was present but less than the Reporting Limit (RL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-010
Client Sample ID: 58967_042723

Report Date: 05/11/23
Collection Date: 04/27/23 15:30
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radon 222	730	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 precision (±)	57.2	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 MDC	82.3	pCi/L				D5072-92	04/29/23 21:19 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-011
Client Sample ID: 58967D_042723

Report Date: 05/11/23
Collection Date: 04/27/23 15:35
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.9	s.u.	H	0.1	0.1	A4500-H B	05/02/23 12:11 / ams
pH Measurement Temp	15.7	°C				A4500-H B	05/02/23 12:11 / ams
Conductivity @ 25 C	387	umhos/cm		5	5	A2510 B	05/02/23 12:11 / ams
Solids, Total Dissolved TDS @ 180 C	222	mg/L	D	50	7	A2540 C	05/01/23 15:59 / ljs
INORGANICS							
Alkalinity, Total as CaCO3	120	mg/L		4	2	A2320 B	05/02/23 18:22 / ams
Chloride	12.7	mg/L		1.00		E300.0	05/05/23 01:39 / ljs
Sulfate	29.6	mg/L		1.00		E300.0	05/05/23 01:39 / ljs
Bromide	0.022	mg/L	J	0.500		E300.0	05/05/23 01:39 / ljs
Fluoride	0.08	mg/L	J	0.1	0.03	A4500-F C	05/01/23 13:36 / ljs
Hardness as CaCO3	170	mg/L		1	1	A2340 B	05/03/23 11:21 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	7.0	mg/L		0.1	0.08	E353.2	05/05/23 14:20 / JAR
Phosphorus, Total as P	0.03	mg/L		0.01	0.001	E365.1	05/02/23 15:41 / JAR
METALS, DISSOLVED							
Arsenic	0.003	mg/L		0.001	0.0002	E200.8	05/02/23 18:44 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	05/02/23 18:44 / dck
Calcium	48	mg/L		1	0.2	E200.7	05/01/23 14:12 / slj
Copper	0.0006	mg/L	J	0.005	0.0001	E200.8	05/02/23 18:44 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	05/02/23 18:44 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 18:44 / dck
Magnesium	12	mg/L		1	0.05	E200.7	05/01/23 14:12 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	05/02/23 18:44 / dck
Potassium	4	mg/L		1	0.06	E200.7	05/01/23 14:12 / slj
Sodium	6	mg/L		1	0.03	E200.7	05/01/23 14:12 / slj
Uranium	0.0054	mg/L		0.0003	0.00002	E200.8	05/02/23 18:44 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.003	mg/L		0.001	0.0001	E200.8	05/02/23 18:47 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	05/02/23 18:47 / dck
Calcium	47	mg/L		1	0.1	E200.7	05/01/23 19:01 / slj
Copper	0.001	mg/L	J	0.005	0.0003	E200.8	05/02/23 18:47 / dck
Iron	0.02	mg/L		0.02	0.009	E200.8	05/02/23 18:47 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 18:47 / dck
Magnesium	13	mg/L		1	0.05	E200.7	05/02/23 16:39 / slj
Manganese	0.0003	mg/L	J	0.001	0.0003	E200.8	05/02/23 18:47 / dck
Potassium	5	mg/L		1	0.1	E200.7	05/01/23 19:01 / slj
Sodium	7	mg/L		1	0.05	E200.7	05/01/23 19:01 / slj
Uranium	0.0056	mg/L		0.0003	0.00003	E200.8	05/02/23 18:47 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time
MDL - Method Detection Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
J - Estimated value - analyte was present but less than the Reporting Limit (RL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-011
Client Sample ID: 58967D_042723

Report Date: 05/11/23
Collection Date: 04/27/23 15:35
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radon 222	733	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 precision (±)	57.5	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 MDC	82.8	pCi/L				D5072-92	04/29/23 21:19 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-012
Client Sample ID: 58964_042723

Report Date: 05/11/23
Collection Date: 04/27/23 17:05
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.6	s.u.	H	0.1	0.1	A4500-H B	05/02/23 12:13 / ams
pH Measurement Temp	15.3	°C				A4500-H B	05/02/23 12:13 / ams
Conductivity @ 25 C	484	umhos/cm		5	5	A2510 B	05/02/23 12:13 / ams
Solids, Total Dissolved TDS @ 180 C	290	mg/L	D	50	7	A2540 C	05/01/23 16:00 / ljs
INORGANICS							
Alkalinity, Total as CaCO3	180	mg/L		4	2	A2320 B	05/02/23 18:27 / ams
Chloride	2.35	mg/L		1.00		E300.0	05/05/23 02:23 / ljs
Sulfate	69.4	mg/L		1.00		E300.0	05/05/23 02:23 / ljs
Bromide	0.030	mg/L	J	0.500		E300.0	05/05/23 02:23 / ljs
Fluoride	0.07	mg/L	J	0.1	0.03	A4500-F C	05/01/23 13:48 / ljs
Hardness as CaCO3	233	mg/L		1	1	A2340 B	05/03/23 11:21 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.10	mg/L		0.01	0.01	E353.2	05/04/23 17:53 / JAR
Phosphorus, Total as P	0.03	mg/L		0.01	0.001	E365.1	05/02/23 15:42 / JAR
METALS, DISSOLVED							
Arsenic	0.030	mg/L		0.001	0.0002	E200.8	05/02/23 18:50 / dck
Cadmium	0.0001	mg/L	J	0.001	0.00002	E200.8	05/02/23 18:50 / dck
Calcium	70	mg/L		1	0.2	E200.7	05/01/23 14:16 / slj
Copper	0.008	mg/L		0.005	0.0001	E200.8	05/02/23 18:50 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	05/02/23 18:50 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	05/02/23 18:50 / dck
Magnesium	14	mg/L		1	0.05	E200.7	05/01/23 14:16 / slj
Manganese	0.001	mg/L	J	0.001	0.0003	E200.8	05/02/23 18:50 / dck
Potassium	4	mg/L		1	0.06	E200.7	05/01/23 14:16 / slj
Sodium	7	mg/L		1	0.03	E200.7	05/01/23 14:16 / slj
Uranium	0.0222	mg/L		0.0003	0.00002	E200.8	05/02/23 18:50 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.037	mg/L		0.001	0.0001	E200.8	05/02/23 18:53 / dck
Cadmium	0.0002	mg/L	J	0.001	0.00003	E200.8	05/02/23 18:53 / dck
Calcium	67	mg/L		1	0.1	E200.7	05/01/23 19:04 / slj
Copper	0.011	mg/L		0.005	0.0003	E200.8	05/02/23 18:53 / dck
Iron	0.70	mg/L		0.02	0.009	E200.8	05/02/23 18:53 / dck
Lead	0.003	mg/L		0.001	0.0001	E200.8	05/02/23 18:53 / dck
Magnesium	15	mg/L		1	0.05	E200.7	05/02/23 16:43 / slj
Manganese	0.017	mg/L		0.001	0.0003	E200.8	05/02/23 18:53 / dck
Potassium	5	mg/L		1	0.1	E200.7	05/01/23 19:04 / slj
Sodium	8	mg/L		1	0.05	E200.7	05/01/23 19:04 / slj
Uranium	0.0230	mg/L		0.0003	0.00003	E200.8	05/02/23 18:53 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
H - Analysis performed past the method holding time
MDL - Method Detection Limit
QCL - Quality Control Limit
D - Reporting Limit (RL) increased due to sample matrix
J - Estimated value - analyte was present but less than the Reporting Limit (RL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040698-012
Client Sample ID: 58964_042723

Report Date: 05/11/23
Collection Date: 04/27/23 17:05
DateReceived: 04/28/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
RADIONUCLIDES - TOTAL							
Radon 222	1500	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 precision (±)	66.0	pCi/L				D5072-92	04/29/23 21:19 / eli-c
Radon 222 MDC	82.5	pCi/L				D5072-92	04/29/23 21:19 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040702-001
Client Sample ID: 207185_042523

Revised Date: 06/23/23
Report Date: 05/25/23
Collection Date: 04/25/23 11:05
DateReceived: 04/28/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
METALS, TOTAL (CONTRACT LAB MT00945)							
Uranium	0.0061	mg/L		0.0003	0.00005	E200.8	06/20/23 14:55 / dck
RADIONUCLIDES - TOTAL							
Gross Alpha	21.6	pCi/L				E900.0	05/09/23 08:23 / eli-c
Gross Alpha precision (±)	4.2	pCi/L				E900.0	05/09/23 08:23 / eli-c
Gross Alpha MDC	1.6	pCi/L				E900.0	05/09/23 08:23 / eli-c
Gross Alpha - Adjusted	17	pCi/L	*			E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted precision (±)	4.2	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted MDC	1.6	pCi/L				E900.0	06/22/23 12:41 / eli-c
Radium 226	0.2	pCi/L	U			E903.0	05/18/23 08:31 / eli-ca
Radium 226 precision (±)	0.2	pCi/L				E903.0	05/18/23 08:31 / eli-ca
Radium 226 MDC	0.2	pCi/L				E903.0	05/18/23 08:31 / eli-ca
Radium 228	0.08	pCi/L	U			RA-05	05/11/23 13:33 / eli-c
Radium 228 precision (±)	0.6	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 228 MDC	0.6	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 226 + Radium 228	0.4	pCi/L	U			A7500-RA	05/18/23 14:07 / eli-c
Radium 226 + Radium 228 precision (±)	0.6	pCi/L				A7500-RA	05/18/23 14:07 / eli-c
Radium 226 + Radium 228 MDC	0.6	pCi/L				A7500-RA	05/18/23 14:07 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
U - Not detected at Minimum Detectable Concentration (MDC)
MDL - Method Detection Limit
QCL - Quality Control Limit
* - The result exceeds the Maximum Contaminant Level (MCL)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040702-002
Client Sample ID: 156288_042523

Revised Date: 06/23/23
Report Date: 05/25/23
Collection Date: 04/25/23 12:35
DateReceived: 04/28/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
METALS, TOTAL (CONTRACT LAB MT00945)							
Uranium	0.0022	mg/L		0.0003	0.00005	E200.8	06/20/23 14:58 / dck
RADIONUCLIDES - TOTAL							
Gross Alpha	6.3	pCi/L				E900.0	05/09/23 08:23 / eli-c
Gross Alpha precision (±)	2.0	pCi/L				E900.0	05/09/23 08:23 / eli-c
Gross Alpha MDC	1.2	pCi/L				E900.0	05/09/23 08:23 / eli-c
Gross Alpha - Adjusted	4.8	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted precision (±)	2.0	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted MDC	1.2	pCi/L				E900.0	06/22/23 12:41 / eli-c
Radium 226	0.1	pCi/L	U			E903.0	05/18/23 08:31 / eli-ca
Radium 226 precision (±)	0.2	pCi/L				E903.0	05/18/23 08:31 / eli-ca
Radium 226 MDC	0.3	pCi/L				E903.0	05/18/23 08:31 / eli-ca
Radium 228	-0.1	pCi/L	U			RA-05	05/11/23 13:33 / eli-c
Radium 228 precision (±)	0.5	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 228 MDC	0.6	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 226 + Radium 228	0.4	pCi/L	U			A7500-RA	05/18/23 14:07 / eli-c
Radium 226 + Radium 228 precision (±)	0.6	pCi/L				A7500-RA	05/18/23 14:07 / eli-c
Radium 226 + Radium 228 MDC	0.6	pCi/L				A7500-RA	05/18/23 14:07 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
U - Not detected at Minimum Detectable Concentration (MDC)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040702-003
Client Sample ID: 132801_042523

Revised Date: 06/23/23
Report Date: 05/25/23
Collection Date: 04/25/23 13:45
DateReceived: 04/28/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
METALS, TOTAL (CONTRACT LAB MT00945)							
Uranium	0.0098	mg/L		0.0003	0.00005	E200.8	06/20/23 15:01 / dck
RADIONUCLIDES - TOTAL							
Gross Alpha	3.3	pCi/L				E900.0	05/09/23 08:23 / eli-c
Gross Alpha precision (±)	1.9	pCi/L				E900.0	05/09/23 08:23 / eli-c
Gross Alpha MDC	1.4	pCi/L				E900.0	05/09/23 08:23 / eli-c
Gross Alpha - Adjusted	-3.3	pCi/L	U			E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted precision (±)	1.9	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted MDC	1.4	pCi/L				E900.0	06/22/23 12:41 / eli-c
Radium 226	0.1	pCi/L	U			E903.0	05/18/23 08:31 / eli-ca
Radium 226 precision (±)	0.3	pCi/L				E903.0	05/18/23 08:31 / eli-ca
Radium 226 MDC	0.3	pCi/L				E903.0	05/18/23 08:31 / eli-ca
Radium 228	0.2	pCi/L	U			RA-05	05/11/23 13:33 / eli-c
Radium 228 precision (±)	0.5	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 228 MDC	0.6	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 226 + Radium 228	0.4	pCi/L	U			A7500-RA	05/18/23 14:07 / eli-c
Radium 226 + Radium 228 precision (±)	0.6	pCi/L				A7500-RA	05/18/23 14:07 / eli-c
Radium 226 + Radium 228 MDC	0.6	pCi/L				A7500-RA	05/18/23 14:07 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
U - Not detected at Minimum Detectable Concentration (MDC)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040702-004
Client Sample ID: 187265_042523

Revised Date: 06/23/23
Report Date: 05/25/23
Collection Date: 04/25/23 15:10
DateReceived: 04/28/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
METALS, TOTAL (CONTRACT LAB MT00945)							
Uranium	0.0249	mg/L		0.0003	0.00005	E200.8	06/20/23 15:03 / dck
RADIONUCLIDES - TOTAL							
Gross Alpha	22.0	pCi/L				E900.0	05/09/23 08:23 / eli-c
Gross Alpha precision (±)	4.0	pCi/L				E900.0	05/09/23 08:23 / eli-c
Gross Alpha MDC	1.3	pCi/L				E900.0	05/09/23 08:23 / eli-c
Gross Alpha - Adjusted	5.3	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted precision (±)	4.0	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted MDC	1.3	pCi/L				E900.0	06/22/23 12:41 / eli-c
Radium 226	0.2	pCi/L	U			E903.0	05/18/23 08:31 / eli-ca
Radium 226 precision (±)	0.3	pCi/L				E903.0	05/18/23 08:31 / eli-ca
Radium 226 MDC	0.3	pCi/L				E903.0	05/18/23 08:31 / eli-ca
Radium 228	-0.2	pCi/L	U			RA-05	05/11/23 13:33 / eli-c
Radium 228 precision (±)	0.5	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 228 MDC	0.5	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 226 + Radium 228	0.4	pCi/L	U			A7500-RA	05/18/23 14:07 / eli-c
Radium 226 + Radium 228 precision (±)	0.5	pCi/L				A7500-RA	05/18/23 14:07 / eli-c
Radium 226 + Radium 228 MDC	0.6	pCi/L				A7500-RA	05/18/23 14:07 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
U - Not detected at Minimum Detectable Concentration (MDC)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040702-005
Client Sample ID: 275741_042523

Revised Date: 06/23/23
Report Date: 05/25/23
Collection Date: 04/25/23 16:45
DateReceived: 04/28/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
METALS, TOTAL (CONTRACT LAB MT00945)							
Uranium	0.0146	mg/L		0.0003	0.00005	E200.8	06/20/23 15:06 / dck
RADIONUCLIDES - TOTAL							
Gross Alpha	4.9	pCi/L				E900.0	05/10/23 08:13 / eli-c
Gross Alpha precision (±)	1.6	pCi/L				E900.0	05/10/23 08:13 / eli-c
Gross Alpha MDC	1	pCi/L				E900.0	05/10/23 08:13 / eli-c
Gross Alpha - Adjusted	-5.0	pCi/L	U			E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted precision (±)	1.6	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted MDC	0.97	pCi/L				E900.0	06/22/23 12:41 / eli-c
Radium 226	0.2	pCi/L	U			E903.0	05/18/23 08:31 / eli-ca
Radium 226 precision (±)	0.2	pCi/L				E903.0	05/18/23 08:31 / eli-ca
Radium 226 MDC	0.2	pCi/L				E903.0	05/18/23 08:31 / eli-ca
Radium 228	0.1	pCi/L	U			RA-05	05/11/23 13:33 / eli-c
Radium 228 precision (±)	0.6	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 228 MDC	0.6	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 226 + Radium 228	0.4	pCi/L	U			A7500-RA	05/18/23 14:07 / eli-c
Radium 226 + Radium 228 precision (±)	0.6	pCi/L				A7500-RA	05/18/23 14:07 / eli-c
Radium 226 + Radium 228 MDC	0.6	pCi/L				A7500-RA	05/18/23 14:07 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
U - Not detected at Minimum Detectable Concentration (MDC)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040702-006
Client Sample ID: FB_042523

Revised Date: 06/23/23
Report Date: 05/25/23
Collection Date: 04/25/23 16:20
DateReceived: 04/28/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
METALS, TOTAL (CONTRACT LAB MT00945)							
Uranium	ND	mg/L		0.0003	0.00005	E200.8	06/20/23 15:23 / dck
RADIONUCLIDES - TOTAL							
Gross Alpha	6.0	pCi/L				E900.0	05/10/23 08:13 / eli-c
Gross Alpha precision (±)	2.3	pCi/L				E900.0	05/10/23 08:13 / eli-c
Gross Alpha MDC	1.5	pCi/L				E900.0	05/10/23 08:13 / eli-c
Gross Alpha - Adjusted	6.0	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted precision (±)	2.3	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted MDC	1.5	pCi/L				E900.0	06/22/23 12:41 / eli-c
Radium 226	0.1	pCi/L	U			E903.0	05/18/23 08:31 / eli-ca
Radium 226 precision (±)	0.2	pCi/L				E903.0	05/18/23 08:31 / eli-ca
Radium 226 MDC	0.2	pCi/L				E903.0	05/18/23 08:31 / eli-ca
Radium 228	0.8	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 228 precision (±)	0.6	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 228 MDC	0.6	pCi/L				RA-05	05/11/23 13:33 / eli-c
Radium 226 + Radium 228	0.9	pCi/L				A7500-RA	05/18/23 14:07 / eli-c
Radium 226 + Radium 228 precision (±)	0.7	pCi/L				A7500-RA	05/18/23 14:07 / eli-c
Radium 226 + Radium 228 MDC	0.7	pCi/L				A7500-RA	05/18/23 14:07 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
U - Not detected at Minimum Detectable Concentration (MDC)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040702-007
Client Sample ID: 279591_042723

Revised Date: 06/23/23
Report Date: 05/25/23
Collection Date: 04/27/23 11:25
DateReceived: 04/28/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
METALS, TOTAL (CONTRACT LAB MT00945)							
Uranium	0.0081	mg/L		0.0003	0.00005	E200.8	06/20/23 15:26 / dck
RADIONUCLIDES - TOTAL							
Gross Alpha	-2	pCi/L	U			E900.0	05/10/23 23:00 / eli-ca
Gross Alpha precision (±)	0.8	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha MDC	0.9	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha - Adjusted	-2.1	pCi/L	U			E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted precision (±)	0.81	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted MDC	0.91	pCi/L				E900.0	06/22/23 12:41 / eli-c
Radium 226	0.4	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 226 precision (±)	0.3	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 226 MDC	0.3	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 228	0.5	pCi/L	U			RA-05	05/17/23 11:09 / eli-c
Radium 228 precision (±)	0.5	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 228 MDC	0.5	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 226 + Radium 228	0.7	pCi/L				A7500-RA	05/22/23 10:04 / eli-c
Radium 226 + Radium 228 precision (±)	0.6	pCi/L				A7500-RA	05/22/23 10:04 / eli-c
Radium 226 + Radium 228 MDC	0.6	pCi/L				A7500-RA	05/22/23 10:04 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
U - Not detected at Minimum Detectable Concentration (MDC)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040702-008
Client Sample ID: 170337_042723

Revised Date: 06/23/23
Report Date: 05/25/23
Collection Date: 04/27/23 12:50
DateReceived: 04/28/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
METALS, TOTAL (CONTRACT LAB MT00945)							
Uranium	0.0042	mg/L		0.0003	0.00005	E200.8	06/20/23 15:29 / dck
RADIONUCLIDES - TOTAL							
Gross Alpha	5.9	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha precision (±)	2.6	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha MDC	1.8	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha - Adjusted	3.1	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted precision (±)	2.6	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted MDC	1.8	pCi/L				E900.0	06/22/23 12:41 / eli-c
Radium 226	0.1	pCi/L	U			E903.0	05/19/23 08:48 / eli-ca
Radium 226 precision (±)	0.2	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 226 MDC	0.2	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 228	0.6	pCi/L	U			RA-05	05/17/23 11:09 / eli-c
Radium 228 precision (±)	0.6	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 228 MDC	0.6	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 226 + Radium 228	0.4	pCi/L	U			A7500-RA	05/22/23 10:04 / eli-c
Radium 226 + Radium 228 precision (±)	0.7	pCi/L				A7500-RA	05/22/23 10:04 / eli-c
Radium 226 + Radium 228 MDC	0.7	pCi/L				A7500-RA	05/22/23 10:04 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
U - Not detected at Minimum Detectable Concentration (MDC)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040702-009
Client Sample ID: 285417_042723

Revised Date: 06/23/23
Report Date: 05/25/23
Collection Date: 04/27/23 14:25
DateReceived: 04/28/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
METALS, TOTAL (CONTRACT LAB MT00945)							
Uranium	0.0183	mg/L		0.0003	0.00005	E200.8	06/20/23 15:31 / dck
RADIONUCLIDES - TOTAL							
Gross Alpha	13.6	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha precision (±)	3.5	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha MDC	1.9	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha - Adjusted	1.3	pCi/L	U			E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted precision (±)	3.5	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted MDC	1.9	pCi/L				E900.0	06/22/23 12:41 / eli-c
Radium 226	-0.02	pCi/L	U			E903.0	05/19/23 08:48 / eli-ca
Radium 226 precision (±)	0.2	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 226 MDC	0.2	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 228	0.05	pCi/L	U			RA-05	05/17/23 11:09 / eli-c
Radium 228 precision (±)	0.5	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 228 MDC	0.6	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 226 + Radium 228	0.4	pCi/L	U			A7500-RA	05/22/23 10:04 / eli-c
Radium 226 + Radium 228 precision (±)	0.6	pCi/L				A7500-RA	05/22/23 10:04 / eli-c
Radium 226 + Radium 228 MDC	0.6	pCi/L				A7500-RA	05/22/23 10:04 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MDL - Method Detection Limit
MCL - Maximum Contaminant Level
QCL - Quality Control Limit
ND - Not detected at the Reporting Limit (RL)
U - Not detected at Minimum Detectable Concentration (MDC)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040702-010
Client Sample ID: 58967_042723

Revised Date: 06/23/23
Report Date: 05/25/23
Collection Date: 04/27/23 15:30
DateReceived: 04/28/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
METALS, TOTAL (CONTRACT LAB MT00945)							
Uranium	0.0055	mg/L		0.0003	0.00005	E200.8	06/20/23 15:34 / dck
RADIONUCLIDES - TOTAL							
Gross Alpha	4.8	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha precision (±)	2.2	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha MDC	1.5	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha - Adjusted	1.1	pCi/L	U			E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted precision (±)	2.2	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted MDC	1.5	pCi/L				E900.0	06/22/23 12:41 / eli-c
Radium 226	0.2	pCi/L	U			E903.0	05/19/23 08:48 / eli-ca
Radium 226 precision (±)	0.3	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 226 MDC	0.3	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 228	0.1	pCi/L	U			RA-05	05/17/23 11:09 / eli-c
Radium 228 precision (±)	0.6	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 228 MDC	0.6	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 226 + Radium 228	0.5	pCi/L	U			A7500-RA	05/22/23 10:04 / eli-c
Radium 226 + Radium 228 precision (±)	0.7	pCi/L				A7500-RA	05/22/23 10:04 / eli-c
Radium 226 + Radium 228 MDC	0.7	pCi/L				A7500-RA	05/22/23 10:04 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
U - Not detected at Minimum Detectable Concentration (MDC)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040702-011
Client Sample ID: 58967D_042723

Revised Date: 06/23/23
Report Date: 05/25/23
Collection Date: 04/27/23 15:35
DateReceived: 04/28/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
METALS, TOTAL (CONTRACT LAB MT00945)							
Uranium	0.0056	mg/L		0.0003	0.00005	E200.8	06/20/23 15:37 / dck
RADIONUCLIDES - TOTAL							
Gross Alpha	-0.5	pCi/L	U			E900.0	05/10/23 23:00 / eli-ca
Gross Alpha precision (±)	1.6	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha MDC	1.6	pCi/L				E900.0	05/10/23 23:00 / eli-ca
Gross Alpha - Adjusted	-0.51	pCi/L	U			E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted precision (±)	1.6	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted MDC	1.6	pCi/L				E900.0	06/22/23 12:41 / eli-c
Radium 226	0.1	pCi/L	U			E903.0	05/19/23 08:48 / eli-ca
Radium 226 precision (±)	0.2	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 226 MDC	0.3	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 228	0.4	pCi/L	U			RA-05	05/17/23 11:09 / eli-c
Radium 228 precision (±)	0.6	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 228 MDC	0.6	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 226 + Radium 228	0.4	pCi/L	U			A7500-RA	05/22/23 10:04 / eli-c
Radium 226 + Radium 228 precision (±)	0.7	pCi/L				A7500-RA	05/22/23 10:04 / eli-c
Radium 226 + Radium 228 MDC	0.7	pCi/L				A7500-RA	05/22/23 10:04 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MDL - Method Detection Limit
MCL - Maximum Contaminant Level
QCL - Quality Control Limit
ND - Not detected at the Reporting Limit (RL)
U - Not detected at Minimum Detectable Concentration (MDC)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23040702-012
Client Sample ID: 58964_042723

Revised Date: 06/23/23
Report Date: 05/25/23
Collection Date: 04/27/23 17:05
DateReceived: 04/28/23
Matrix: Drinking Water

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
METALS, TOTAL (CONTRACT LAB MT00945)							
Uranium	0.0219	mg/L		0.0003	0.00005	E200.8	06/20/23 15:40 / dck
RADIONUCLIDES - TOTAL							
Gross Alpha	1.6	pCi/L				E900.0	05/10/23 23:01 / eli-ca
Gross Alpha precision (±)	1.9	pCi/L				E900.0	05/10/23 23:01 / eli-ca
Gross Alpha MDC	1.4	pCi/L				E900.0	05/10/23 23:01 / eli-ca
Gross Alpha - Adjusted	-13	pCi/L	U			E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted precision (±)	1.9	pCi/L				E900.0	06/22/23 12:41 / eli-c
Gross Alpha - Adjusted MDC	1.4	pCi/L				E900.0	06/22/23 12:41 / eli-c
Radium 226	0.04	pCi/L	U			E903.0	05/19/23 08:48 / eli-ca
Radium 226 precision (±)	0.2	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 226 MDC	0.2	pCi/L				E903.0	05/19/23 08:48 / eli-ca
Radium 228	0.6	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 228 precision (±)	0.6	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 228 MDC	0.6	pCi/L				RA-05	05/17/23 11:09 / eli-c
Radium 226 + Radium 228	0.7	pCi/L				A7500-RA	05/22/23 10:04 / eli-c
Radium 226 + Radium 228 precision (±)	0.6	pCi/L				A7500-RA	05/22/23 10:04 / eli-c
Radium 226 + Radium 228 MDC	0.6	pCi/L				A7500-RA	05/22/23 10:04 / eli-c

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
U - Not detected at Minimum Detectable Concentration (MDC)

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090193-001
Client Sample ID: 207185_090623

Report Date: 09/22/23
Collection Date: 09/06/23 09:54
DateReceived: 09/07/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.0	s.u.	H	0.1	0.1	A4500-H B	09/08/23 11:42 / eek
pH Measurement Temp	13.8	°C				A4500-H B	09/08/23 11:42 / eek
Conductivity @ 25 C	498	umhos/cm		5	5	A2510 B	09/08/23 11:42 / eek
Solids, Total Dissolved TDS @ 180 C	310	mg/L		20	7	A2540 C	09/08/23 12:38 / eek
INORGANICS							
Alkalinity, Total as CaCO3	160	mg/L		4	2	A2320 B	09/08/23 14:34 / eek
Chloride	29.4	mg/L		1.00		E300.0	09/09/23 03:22 / SRW
Sulfate	45.7	mg/L		1.00		E300.0	09/09/23 03:22 / SRW
Bromide	0.031	mg/L	J	0.500		E300.0	09/09/23 03:22 / SRW
Fluoride	0.08	mg/L	J	0.1	0.03	A4500-F C	09/10/23 11:47 / ams
Hardness as CaCO3	212	mg/L		1	1	A2340 B	09/14/23 08:36 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.88	mg/L		0.01	0.009	E353.2	09/15/23 13:51 / JAR
Phosphorus, Total as P	0.03	mg/L		0.01	0.001	E365.1	09/14/23 16:56 / JAR
METALS, DISSOLVED							
Arsenic	0.001	mg/L		0.001	0.0002	E200.8	09/12/23 18:44 / dck
Cadmium	0.00004	mg/L	J	0.001	0.00002	E200.8	09/12/23 18:44 / dck
Calcium	62	mg/L		1	0.2	E200.7	09/11/23 23:13 / slj
Copper	0.125	mg/L		0.005	0.0001	E200.8	09/12/23 18:44 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	09/12/23 18:44 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 18:44 / dck
Magnesium	14	mg/L		1	0.05	E200.7	09/11/23 23:13 / slj
Manganese	0.0006	mg/L	J	0.001	0.0003	E200.8	09/12/23 18:44 / dck
Potassium	3	mg/L		1	0.06	E200.7	09/13/23 14:18 / slj
Sodium	11	mg/L		1	0.03	E200.7	09/11/23 23:13 / slj
Uranium	0.0103	mg/L		0.0003	0.00002	E200.8	09/12/23 18:44 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.001	mg/L		0.001	0.0001	E200.8	09/12/23 18:48 / dck
Cadmium	0.00005	mg/L	J	0.001	0.00003	E200.8	09/12/23 18:48 / dck
Calcium	64	mg/L		1	0.1	E200.7	09/11/23 23:01 / slj
Copper	0.378	mg/L		0.005	0.0003	E200.8	09/12/23 18:48 / dck
Iron	0.07	mg/L		0.02	0.009	E200.8	09/12/23 18:48 / dck
Lead	0.0003	mg/L	J	0.001	0.0001	E200.8	09/12/23 18:48 / dck
Magnesium	15	mg/L		1	0.05	E200.7	09/11/23 23:01 / slj
Manganese	0.002	mg/L		0.001	0.0003	E200.8	09/12/23 18:48 / dck
Potassium	3	mg/L		1	0.1	E200.7	09/11/23 23:01 / slj
Sodium	11	mg/L		1	0.05	E200.7	09/11/23 23:01 / slj
Uranium	0.0113	mg/L		0.0003	0.00003	E200.8	09/12/23 18:48 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
J - Estimated value - analyte was present but less than the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090193-002
Client Sample ID: 107334_090623

Report Date: 09/22/23
Collection Date: 09/06/23 10:41
DateReceived: 09/07/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.5	s.u.	H	0.1	0.1	A4500-H B	09/08/23 11:46 / eek
pH Measurement Temp	13.6	°C				A4500-H B	09/08/23 11:46 / eek
Conductivity @ 25 C	383	umhos/cm		5	5	A2510 B	09/08/23 11:46 / eek
Solids, Total Dissolved TDS @ 180 C	242	mg/L		20	7	A2540 C	09/08/23 12:38 / eek
INORGANICS							
Alkalinity, Total as CaCO3	130	mg/L		4	2	A2320 B	09/08/23 15:57 / eek
Chloride	2.95	mg/L		1.00		E300.0	09/09/23 03:37 / SRW
Sulfate	50.9	mg/L		1.00		E300.0	09/09/23 03:37 / SRW
Bromide	0.036	mg/L	J	0.500		E300.0	09/09/23 03:37 / SRW
Fluoride	0.06	mg/L	J	0.1	0.03	A4500-F C	09/10/23 11:53 / ams
Hardness as CaCO3	ND	mg/L		1	1	A2340 B	09/14/23 08:36 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	1.35	mg/L		0.01	0.009	E353.2	09/15/23 13:52 / JAR
Phosphorus, Total as P	0.01	mg/L		0.01	0.001	E365.1	09/19/23 19:20 / JAR
METALS, DISSOLVED							
Arsenic	0.0005	mg/L	J	0.001	0.0002	E200.8	09/12/23 18:51 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	09/12/23 18:51 / dck
Calcium	ND	mg/L		1	0.2	E200.7	09/11/23 23:36 / slj
Copper	0.019	mg/L		0.005	0.0001	E200.8	09/12/23 18:51 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	09/12/23 18:51 / dck
Lead	0.0002	mg/L	J	0.001	0.0001	E200.8	09/12/23 18:51 / dck
Magnesium	ND	mg/L		1	0.05	E200.7	09/11/23 23:36 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	09/12/23 18:51 / dck
Potassium	ND	mg/L		1	0.06	E200.7	09/13/23 14:22 / slj
Sodium	89	mg/L		1	0.7	E200.7	09/11/23 23:36 / slj
Uranium	0.0070	mg/L		0.0003	0.00002	E200.8	09/12/23 18:51 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.0004	mg/L	J	0.001	0.0001	E200.8	09/12/23 18:54 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	09/12/23 18:54 / dck
Calcium	ND	mg/L		1	0.1	E200.7	09/11/23 23:05 / slj
Copper	0.018	mg/L		0.005	0.0003	E200.8	09/12/23 18:54 / dck
Iron	ND	mg/L		0.02	0.02	E200.7	09/11/23 23:05 / slj
Lead	0.0002	mg/L	J	0.001	0.0001	E200.8	09/12/23 18:54 / dck
Magnesium	ND	mg/L		1	0.05	E200.7	09/11/23 23:05 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	09/12/23 18:54 / dck
Potassium	ND	mg/L		1	0.1	E200.7	09/11/23 23:05 / slj
Sodium	97	mg/L		1	0.05	E200.7	09/11/23 23:05 / slj
Uranium	0.0075	mg/L		0.0003	0.00003	E200.8	09/12/23 18:54 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
J - Estimated value - analyte was present but less than the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090193-003
Client Sample ID: 156288_090623

Report Date: 09/22/23
Collection Date: 09/06/23 11:35
DateReceived: 09/07/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	6.9	s.u.	H	0.1	0.1	A4500-H B	09/08/23 11:44 / eek
pH Measurement Temp	13.6	°C				A4500-H B	09/08/23 11:44 / eek
Conductivity @ 25 C	369	umhos/cm		5	5	A2510 B	09/08/23 11:44 / eek
Solids, Total Dissolved TDS @ 180 C	231	mg/L		20	7	A2540 C	09/08/23 12:38 / eek
INORGANICS							
Alkalinity, Total as CaCO3	110	mg/L		4	2	A2320 B	09/08/23 16:04 / eek
Chloride	12.4	mg/L		1.00		E300.0	09/09/23 03:51 / SRW
Sulfate	31.9	mg/L		1.00		E300.0	09/09/23 03:51 / SRW
Bromide	0.037	mg/L	J	0.500		E300.0	09/09/23 03:51 / SRW
Fluoride	0.04	mg/L	J	0.1	0.03	A4500-F C	09/10/23 11:59 / ams
Hardness as CaCO3	150	mg/L		1	1	A2340 B	09/14/23 08:36 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	5.59	mg/L		0.05	0.04	E353.2	09/15/23 13:53 / JAR
Phosphorus, Total as P	0.006	mg/L	J	0.01	0.001	E365.1	09/19/23 19:21 / JAR
METALS, DISSOLVED							
Arsenic	0.0002	mg/L	J	0.001	0.0002	E200.8	09/12/23 18:58 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	09/12/23 18:58 / dck
Calcium	43	mg/L		1	0.2	E200.7	09/11/23 23:40 / slj
Copper	0.038	mg/L		0.005	0.0001	E200.8	09/12/23 18:58 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	09/12/23 18:58 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 18:58 / dck
Magnesium	10	mg/L		1	0.05	E200.7	09/11/23 23:40 / slj
Manganese	0.002	mg/L		0.001	0.0003	E200.8	09/12/23 18:58 / dck
Potassium	2	mg/L		1	0.06	E200.7	09/13/23 14:25 / slj
Sodium	7	mg/L		1	0.7	E200.7	09/11/23 23:40 / slj
Uranium	0.0021	mg/L		0.0003	0.00002	E200.8	09/12/23 18:58 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.0002	mg/L	J	0.001	0.0001	E200.8	09/12/23 19:01 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	09/12/23 19:01 / dck
Calcium	47	mg/L		1	0.1	E200.7	09/11/23 19:49 / slj
Copper	0.024	mg/L		0.005	0.0003	E200.8	09/12/23 19:01 / dck
Iron	0.04	mg/L		0.02	0.009	E200.8	09/12/23 19:01 / dck
Lead	0.0004	mg/L	J	0.001	0.0001	E200.8	09/12/23 19:01 / dck
Magnesium	11	mg/L		1	0.05	E200.7	09/11/23 19:49 / slj
Manganese	0.002	mg/L		0.001	0.0003	E200.8	09/12/23 19:01 / dck
Potassium	2	mg/L		1	0.1	E200.7	09/12/23 15:39 / slj
Sodium	8	mg/L		1	0.6	E200.7	09/11/23 19:49 / slj
Uranium	0.0022	mg/L		0.0003	0.00003	E200.8	09/12/23 19:01 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
J - Estimated value - analyte was present but less than the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090193-004
Client Sample ID: 279591_090623

Report Date: 09/22/23
Collection Date: 09/06/23 12:52
DateReceived: 09/07/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.5	s.u.	H	0.1	0.1	A4500-H B	09/08/23 11:48 / eek
pH Measurement Temp	13.8	°C				A4500-H B	09/08/23 11:48 / eek
Conductivity @ 25 C	450	umhos/cm		5	5	A2510 B	09/08/23 11:48 / eek
Solids, Total Dissolved TDS @ 180 C	277	mg/L		20	7	A2540 C	09/08/23 12:39 / eek
INORGANICS							
Alkalinity, Total as CaCO3	170	mg/L		4	2	A2320 B	09/08/23 16:11 / eek
Chloride	4.92	mg/L		1.00		E300.0	09/09/23 04:05 / SRW
Sulfate	48.2	mg/L		1.00		E300.0	09/09/23 04:05 / SRW
Bromide	0.021	mg/L	J	0.500		E300.0	09/09/23 04:05 / SRW
Fluoride	0.07	mg/L	J	0.1	0.03	A4500-F C	09/10/23 12:05 / ams
Hardness as CaCO3	206	mg/L		1	1	A2340 B	09/14/23 08:36 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	2.94	mg/L		0.02	0.02	E353.2	09/15/23 13:54 / JAR
Phosphorus, Total as P	0.01	mg/L		0.01	0.001	E365.1	09/19/23 19:28 / JAR
METALS, DISSOLVED							
Arsenic	0.001	mg/L		0.001	0.0002	E200.8	09/12/23 19:05 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	09/12/23 19:05 / dck
Calcium	62	mg/L		1	0.2	E200.7	09/11/23 23:44 / slj
Copper	0.008	mg/L		0.005	0.0001	E200.8	09/12/23 19:05 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	09/12/23 19:05 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 19:05 / dck
Magnesium	13	mg/L		1	0.05	E200.7	09/11/23 23:44 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	09/12/23 19:05 / dck
Potassium	2	mg/L		1	0.06	E200.7	09/13/23 14:29 / slj
Sodium	6	mg/L		1	0.7	E200.7	09/11/23 23:44 / slj
Uranium	0.0070	mg/L		0.0003	0.00002	E200.8	09/12/23 19:05 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.001	mg/L		0.001	0.0001	E200.8	09/12/23 19:08 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	09/12/23 19:08 / dck
Calcium	63	mg/L		1	0.1	E200.7	09/11/23 20:16 / slj
Copper	0.008	mg/L		0.005	0.0003	E200.8	09/12/23 19:08 / dck
Iron	0.02	mg/L		0.02	0.009	E200.8	09/12/23 19:08 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 19:08 / dck
Magnesium	13	mg/L		1	0.05	E200.7	09/11/23 20:16 / slj
Manganese	0.0004	mg/L	J	0.001	0.0003	E200.8	09/12/23 19:08 / dck
Potassium	2	mg/L		1	0.1	E200.7	09/12/23 15:58 / slj
Sodium	6	mg/L		1	0.6	E200.7	09/11/23 20:16 / slj
Uranium	0.0073	mg/L		0.0003	0.00003	E200.8	09/12/23 19:08 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
J - Estimated value - analyte was present but less than the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090193-005
Client Sample ID: 132801_090623

Report Date: 09/22/23
Collection Date: 09/06/23 13:57
DateReceived: 09/07/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.0	s.u.	H	0.1	0.1	A4500-H B	09/08/23 11:50 / eek
pH Measurement Temp	14.1	°C				A4500-H B	09/08/23 11:50 / eek
Conductivity @ 25 C	434	umhos/cm		5	5	A2510 B	09/08/23 11:50 / eek
Solids, Total Dissolved TDS @ 180 C	276	mg/L		20	7	A2540 C	09/08/23 12:39 / eek
INORGANICS							
Alkalinity, Total as CaCO3	140	mg/L		4	2	A2320 B	09/08/23 16:18 / eek
Chloride	10.3	mg/L		1.00		E300.0	09/09/23 04:20 / SRW
Sulfate	63.5	mg/L		1.00		E300.0	09/09/23 04:20 / SRW
Bromide	0.027	mg/L	J	0.500		E300.0	09/09/23 04:20 / SRW
Fluoride	0.05	mg/L	J	0.1	0.03	A4500-F C	09/10/23 12:11 / ams
Hardness as CaCO3	190	mg/L		1	1	A2340 B	09/14/23 08:36 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.99	mg/L		0.01	0.009	E353.2	09/15/23 13:55 / JAR
Phosphorus, Total as P	0.01	mg/L		0.01	0.001	E365.1	09/19/23 19:29 / JAR
METALS, DISSOLVED							
Arsenic	0.0004	mg/L	J	0.001	0.0002	E200.8	09/12/23 19:39 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	09/12/23 19:39 / dck
Calcium	57	mg/L		1	0.2	E200.7	09/11/23 23:48 / slj
Copper	0.015	mg/L		0.005	0.0001	E200.8	09/12/23 19:39 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	09/12/23 19:39 / dck
Lead	0.0003	mg/L	J	0.001	0.0001	E200.8	09/12/23 19:39 / dck
Magnesium	12	mg/L		1	0.05	E200.7	09/11/23 23:48 / slj
Manganese	0.0007	mg/L	J	0.001	0.0003	E200.8	09/12/23 19:39 / dck
Potassium	3	mg/L		1	0.06	E200.7	09/13/23 14:45 / slj
Sodium	8	mg/L		1	0.7	E200.7	09/11/23 23:48 / slj
Uranium	0.0091	mg/L		0.0003	0.00002	E200.8	09/12/23 19:39 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.0003	mg/L	J	0.001	0.0001	E200.8	09/12/23 19:43 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	09/12/23 19:43 / dck
Calcium	58	mg/L		1	0.1	E200.7	09/11/23 20:20 / slj
Copper	0.017	mg/L		0.005	0.0003	E200.8	09/12/23 19:43 / dck
Iron	0.01	mg/L	J	0.02	0.009	E200.8	09/12/23 19:43 / dck
Lead	0.0005	mg/L	J	0.001	0.0001	E200.8	09/12/23 19:43 / dck
Magnesium	12	mg/L		1	0.05	E200.7	09/11/23 20:20 / slj
Manganese	0.004	mg/L		0.001	0.0003	E200.8	09/12/23 19:43 / dck
Potassium	3	mg/L		1	0.1	E200.7	09/12/23 16:02 / slj
Sodium	9	mg/L		1	0.6	E200.7	09/11/23 20:20 / slj
Uranium	0.0095	mg/L		0.0003	0.00003	E200.8	09/12/23 19:43 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
J - Estimated value - analyte was present but less than the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090193-006
Client Sample ID: 187265_090623

Report Date: 09/22/23
Collection Date: 09/06/23 14:20
DateReceived: 09/07/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	5.9	s.u.	H	0.1	0.1	A4500-H B	09/08/23 12:10 / eek
pH Measurement Temp	15.2	°C				A4500-H B	09/08/23 12:10 / eek
Conductivity @ 25 C	ND	umhos/cm		5	5	A2510 B	09/08/23 12:10 / eek
Solids, Total Dissolved TDS @ 180 C	ND	mg/L	L	20	7	A2540 C	09/08/23 12:39 / eek
- TDS did not obtain the minimum residue requirement of 2.5 mg residue.							
INORGANICS							
Alkalinity, Total as CaCO3	ND	mg/L		4	2	A2320 B	09/08/23 16:25 / eek
Chloride	ND	mg/L		1.00		E300.0	09/09/23 04:34 / SRW
Sulfate	ND	mg/L		1.00		E300.0	09/09/23 04:34 / SRW
Bromide	ND	mg/L		0.500		E300.0	09/09/23 04:34 / SRW
Fluoride	ND	mg/L		0.1	0.03	A4500-F C	09/10/23 12:29 / ams
Hardness as CaCO3	ND	mg/L		1	1	A2340 B	09/14/23 08:36 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.01	0.009	E353.2	09/15/23 13:56 / JAR
Phosphorus, Total as P	ND	mg/L		0.01	0.001	E365.1	09/19/23 19:30 / JAR
METALS, DISSOLVED							
Arsenic	ND	mg/L		0.001	0.0002	E200.8	09/12/23 19:46 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	09/12/23 19:46 / dck
Calcium	ND	mg/L		1	0.2	E200.7	09/11/23 23:52 / slj
Copper	ND	mg/L		0.005	0.0001	E200.8	09/12/23 19:46 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	09/12/23 19:46 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 19:46 / dck
Magnesium	ND	mg/L		1	0.05	E200.7	09/11/23 23:52 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	09/12/23 19:46 / dck
Potassium	ND	mg/L		1	0.06	E200.7	09/13/23 14:49 / slj
Sodium	ND	mg/L		1	0.7	E200.7	09/11/23 23:52 / slj
Uranium	ND	mg/L		0.0003	0.00002	E200.8	09/12/23 19:46 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	ND	mg/L		0.001	0.0001	E200.8	09/12/23 19:49 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	09/12/23 19:49 / dck
Calcium	ND	mg/L		1	0.1	E200.7	09/11/23 20:24 / slj
Copper	ND	mg/L		0.005	0.0003	E200.8	09/12/23 19:49 / dck
Iron	ND	mg/L		0.02	0.009	E200.8	09/12/23 19:49 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 19:49 / dck
Magnesium	ND	mg/L		1	0.05	E200.7	09/11/23 20:24 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	09/12/23 19:49 / dck
Potassium	ND	mg/L		1	0.1	E200.7	09/12/23 16:06 / slj
Sodium	ND	mg/L		1	0.6	E200.7	09/11/23 20:24 / slj
Uranium	ND	mg/L		0.0003	0.00003	E200.8	09/12/23 19:49 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
L - Lowest available reporting limit for the analytical method used
MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090193-007
Client Sample ID: 187265_090623

Report Date: 09/22/23
Collection Date: 09/06/23 15:10
DateReceived: 09/07/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.5	s.u.	H	0.1	0.1	A4500-H B	09/08/23 12:12 / eek
pH Measurement Temp	15.2	°C				A4500-H B	09/08/23 12:12 / eek
Conductivity @ 25 C	767	umhos/cm		5	5	A2510 B	09/08/23 12:12 / eek
Solids, Total Dissolved TDS @ 180 C	490	mg/L		20	7	A2540 C	09/08/23 12:40 / eek
INORGANICS							
Alkalinity, Total as CaCO3	180	mg/L		4	2	A2320 B	09/08/23 16:29 / eek
Chloride	45.6	mg/L		1.00		E300.0	09/09/23 04:48 / SRW
Sulfate	134	mg/L		1.00		E300.0	09/09/23 04:48 / SRW
Bromide	0.046	mg/L	J	0.500		E300.0	09/09/23 04:48 / SRW
Fluoride	0.06	mg/L	J	0.1	0.03	A4500-F C	09/10/23 12:41 / ams
Hardness as CaCO3	354	mg/L		1	1	A2340 B	09/14/23 08:36 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	4.59	mg/L		0.02	0.02	E353.2	09/15/23 13:57 / JAR
Phosphorus, Total as P	0.02	mg/L		0.01	0.001	E365.1	09/19/23 19:31 / JAR
METALS, DISSOLVED							
Arsenic	0.002	mg/L		0.001	0.0002	E200.8	09/12/23 19:53 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	09/12/23 19:53 / dck
Calcium	104	mg/L		1	0.2	E200.7	09/11/23 23:56 / slj
Copper	0.016	mg/L		0.005	0.0001	E200.8	09/12/23 19:53 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	09/12/23 19:53 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 19:53 / dck
Magnesium	23	mg/L		1	0.05	E200.7	09/11/23 23:56 / slj
Manganese	0.0004	mg/L	J	0.001	0.0003	E200.8	09/12/23 19:53 / dck
Potassium	6	mg/L		1	0.06	E200.7	09/13/23 15:01 / slj
Sodium	7	mg/L		1	0.7	E200.7	09/11/23 23:56 / slj
Uranium	0.0244	mg/L		0.0003	0.00002	E200.8	09/12/23 19:53 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.002	mg/L		0.001	0.0001	E200.8	09/12/23 19:56 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	09/12/23 19:56 / dck
Calcium	109	mg/L		1	0.1	E200.7	09/11/23 20:28 / slj
Copper	0.015	mg/L		0.005	0.0003	E200.8	09/12/23 19:56 / dck
Iron	0.32	mg/L		0.02	0.009	E200.8	09/12/23 19:56 / dck
Lead	0.0006	mg/L	J	0.001	0.0001	E200.8	09/12/23 19:56 / dck
Magnesium	24	mg/L		1	0.05	E200.7	09/11/23 20:28 / slj
Manganese	0.005	mg/L		0.001	0.0003	E200.8	09/12/23 19:56 / dck
Potassium	6	mg/L		1	0.1	E200.7	09/12/23 16:10 / slj
Sodium	7	mg/L		1	0.6	E200.7	09/11/23 20:28 / slj
Uranium	0.0254	mg/L		0.0003	0.00003	E200.8	09/12/23 19:56 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
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MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090193-008
Client Sample ID: 275741_090623

Report Date: 09/22/23
Collection Date: 09/06/23 16:10
DateReceived: 09/07/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.0	s.u.	H	0.1	0.1	A4500-H B	09/08/23 12:14 / eek
pH Measurement Temp	15.6	°C				A4500-H B	09/08/23 12:14 / eek
Conductivity @ 25 C	402	umhos/cm		5	5	A2510 B	09/08/23 12:14 / eek
Solids, Total Dissolved TDS @ 180 C	250	mg/L		20	7	A2540 C	09/08/23 12:40 / eek
INORGANICS							
Alkalinity, Total as CaCO3	130	mg/L		4	2	A2320 B	09/08/23 16:37 / eek
Chloride	20.2	mg/L		1.00		E300.0	09/09/23 06:15 / SRW
Sulfate	28.4	mg/L		1.00		E300.0	09/09/23 06:15 / SRW
Bromide	0.040	mg/L	J	0.500		E300.0	09/09/23 06:15 / SRW
Fluoride	0.06	mg/L	J	0.1	0.03	A4500-F C	09/10/23 12:53 / ams
Hardness as CaCO3	170	mg/L		1	1	A2340 B	09/14/23 08:36 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	3.90	mg/L		0.02	0.02	E353.2	09/15/23 13:58 / JAR
Phosphorus, Total as P	0.02	mg/L		0.01	0.001	E365.1	09/19/23 19:32 / JAR
METALS, DISSOLVED							
Arsenic	0.002	mg/L		0.001	0.0002	E200.8	09/12/23 20:00 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	09/12/23 20:00 / dck
Calcium	50	mg/L		1	0.2	E200.7	09/12/23 00:00 / slj
Copper	0.023	mg/L		0.005	0.0001	E200.8	09/12/23 20:00 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	09/12/23 20:00 / dck
Lead	0.0004	mg/L	J	0.001	0.0001	E200.8	09/12/23 20:00 / dck
Magnesium	11	mg/L		1	0.05	E200.7	09/12/23 00:00 / slj
Manganese	0.0004	mg/L	J	0.001	0.0003	E200.8	09/12/23 20:00 / dck
Potassium	3	mg/L		1	0.06	E200.7	09/13/23 15:05 / slj
Sodium	8	mg/L		1	0.7	E200.7	09/12/23 00:00 / slj
Uranium	0.0099	mg/L		0.0003	0.00002	E200.8	09/12/23 20:00 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.002	mg/L		0.001	0.0001	E200.8	09/12/23 20:03 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	09/12/23 20:03 / dck
Calcium	52	mg/L		1	0.1	E200.7	09/11/23 20:32 / slj
Copper	0.025	mg/L		0.005	0.0003	E200.8	09/12/23 20:03 / dck
Iron	0.17	mg/L		0.02	0.009	E200.8	09/12/23 20:03 / dck
Lead	0.0008	mg/L	J	0.001	0.0001	E200.8	09/12/23 20:03 / dck
Magnesium	11	mg/L		1	0.05	E200.7	09/11/23 20:32 / slj
Manganese	0.001	mg/L		0.001	0.0003	E200.8	09/12/23 20:03 / dck
Potassium	3	mg/L		1	0.1	E200.7	09/12/23 16:54 / slj
Sodium	8	mg/L		1	0.6	E200.7	09/11/23 20:32 / slj
Uranium	0.0104	mg/L		0.0003	0.00003	E200.8	09/12/23 20:03 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
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MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090193-009
Client Sample ID: 285417_090723

Report Date: 09/22/23
Collection Date: 09/07/23 09:50
DateReceived: 09/07/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	8.0	s.u.	H	0.1	0.1	A4500-H B	09/08/23 12:16 / eek
pH Measurement Temp	15.5	°C				A4500-H B	09/08/23 12:16 / eek
Conductivity @ 25 C	361	umhos/cm		5	5	A2510 B	09/08/23 12:16 / eek
Solids, Total Dissolved TDS @ 180 C	227	mg/L		20	7	A2540 C	09/08/23 12:40 / eek
INORGANICS							
Alkalinity, Total as CaCO3	110	mg/L		4	2	A2320 B	09/08/23 16:44 / eek
Chloride	14.5	mg/L		1.00		E300.0	09/09/23 06:29 / SRW
Sulfate	39.3	mg/L		1.00		E300.0	09/09/23 06:29 / SRW
Bromide	0.047	mg/L	J	0.500		E300.0	09/09/23 06:29 / SRW
Fluoride	0.1	mg/L		0.1	0.03	A4500-F C	09/10/23 12:59 / ams
Hardness as CaCO3	150	mg/L		1	1	A2340 B	09/18/23 08:04 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	1.92	mg/L		0.01	0.009	E353.2	09/15/23 13:59 / JAR
Phosphorus, Total as P	0.02	mg/L		0.01	0.001	E365.1	09/19/23 19:33 / JAR
METALS, DISSOLVED							
Arsenic	0.007	mg/L		0.001	6E-06	E200.8	09/14/23 20:55 / dck
Cadmium	ND	mg/L		0.001	7E-06	E200.8	09/14/23 20:55 / dck
Calcium	41	mg/L		1	0.2	E200.7	09/12/23 00:04 / slj
Copper	0.0009	mg/L	J	0.005	0.00004	E200.8	09/14/23 20:55 / dck
Iron	ND	mg/L		0.02	0.0007	E200.8	09/14/23 20:55 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 20:07 / dck
Magnesium	12	mg/L		1	0.05	E200.7	09/12/23 00:04 / slj
Manganese	0.0005	mg/L	J	0.001	0.00005	E200.8	09/14/23 20:55 / dck
Potassium	5	mg/L		1	0.06	E200.7	09/13/23 15:09 / slj
Sodium	6	mg/L		1	0.7	E200.7	09/12/23 00:04 / slj
Uranium	0.0170	mg/L		0.0003	0.00002	E200.8	09/12/23 20:07 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.007	mg/L		0.001	0.0001	E200.8	09/12/23 20:10 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	09/12/23 20:10 / dck
Calcium	43	mg/L		1	0.1	E200.7	09/11/23 20:35 / slj
Copper	0.001	mg/L	J	0.005	0.0003	E200.8	09/12/23 20:10 / dck
Iron	ND	mg/L		0.02	0.009	E200.8	09/12/23 20:10 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 20:10 / dck
Magnesium	12	mg/L		1	0.05	E200.7	09/11/23 20:35 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	09/12/23 20:10 / dck
Potassium	5	mg/L		1	0.1	E200.7	09/12/23 16:58 / slj
Sodium	6	mg/L		1	0.6	E200.7	09/11/23 20:35 / slj
Uranium	0.0185	mg/L		0.0003	0.00003	E200.8	09/12/23 20:10 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
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MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090193-010
Client Sample ID: 58967_090723

Report Date: 09/22/23
Collection Date: 09/07/23 11:05
DateReceived: 09/07/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.8	s.u.	H	0.1	0.1	A4500-H B	09/08/23 12:18 / eek
pH Measurement Temp	15.2	°C				A4500-H B	09/08/23 12:18 / eek
Conductivity @ 25 C	361	umhos/cm		5	5	A2510 B	09/08/23 12:18 / eek
Solids, Total Dissolved TDS @ 180 C	217	mg/L		20	7	A2540 C	09/08/23 12:40 / eek
INORGANICS							
Alkalinity, Total as CaCO3	120	mg/L		4	2	A2320 B	09/08/23 16:53 / eek
Chloride	11.0	mg/L		1.00		E300.0	09/09/23 06:43 / SRW
Sulfate	26.2	mg/L		1.00		E300.0	09/09/23 06:43 / SRW
Bromide	0.022	mg/L	J	0.500		E300.0	09/09/23 06:43 / SRW
Fluoride	0.06	mg/L	J	0.1	0.03	A4500-F C	09/10/23 13:05 / ams
Hardness as CaCO3	153	mg/L		1	1	A2340 B	09/14/23 08:36 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	6.40	mg/L		0.05	0.04	E353.2	09/15/23 14:02 / JAR
Phosphorus, Total as P	0.02	mg/L		0.01	0.001	E365.1	09/19/23 19:34 / JAR
METALS, DISSOLVED							
Arsenic	0.003	mg/L		0.001	0.0002	E200.8	09/12/23 20:20 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	09/12/23 20:20 / dck
Calcium	42	mg/L		1	0.2	E200.7	09/12/23 00:08 / slj
Copper	0.0004	mg/L	J	0.005	0.0001	E200.8	09/12/23 20:20 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	09/12/23 20:20 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 20:20 / dck
Magnesium	12	mg/L		1	0.05	E200.7	09/12/23 00:08 / slj
Manganese	0.003	mg/L		0.001	0.0003	E200.8	09/12/23 20:20 / dck
Potassium	4	mg/L		1	0.06	E200.7	09/13/23 15:12 / slj
Sodium	5	mg/L		1	0.7	E200.7	09/12/23 00:08 / slj
Uranium	0.0049	mg/L		0.0003	0.00002	E200.8	09/12/23 20:20 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.003	mg/L		0.001	0.0001	E200.8	09/12/23 20:24 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	09/12/23 20:24 / dck
Calcium	44	mg/L		1	0.1	E200.7	09/11/23 20:47 / slj
Copper	0.001	mg/L	J	0.005	0.0003	E200.8	09/12/23 20:24 / dck
Iron	0.02	mg/L	J	0.02	0.009	E200.8	09/12/23 20:24 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 20:24 / dck
Magnesium	12	mg/L		1	0.05	E200.7	09/11/23 20:47 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	09/12/23 20:24 / dck
Potassium	4	mg/L		1	0.1	E200.7	09/12/23 17:02 / slj
Sodium	6	mg/L		1	0.6	E200.7	09/11/23 20:47 / slj
Uranium	0.0051	mg/L		0.0003	0.00003	E200.8	09/12/23 20:24 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
J - Estimated value - analyte was present but less than the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090193-011
Client Sample ID: 58964_090723

Report Date: 09/22/23
Collection Date: 09/07/23 12:08
DateReceived: 09/07/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.5	s.u.	H	0.1	0.1	A4500-H B	09/08/23 12:20 / eek
pH Measurement Temp	15.3	°C				A4500-H B	09/08/23 12:20 / eek
Conductivity @ 25 C	449	umhos/cm		5	5	A2510 B	09/08/23 12:20 / eek
Solids, Total Dissolved TDS @ 180 C	269	mg/L		20	7	A2540 C	09/08/23 12:42 / eek
INORGANICS							
Alkalinity, Total as CaCO3	170	mg/L		4	2	A2320 B	09/08/23 17:24 / eek
Chloride	2.00	mg/L		1.00		E300.0	09/09/23 06:58 / SRW
Sulfate	60.3	mg/L		1.00		E300.0	09/09/23 06:58 / SRW
Bromide	0.030	mg/L	J	0.500		E300.0	09/09/23 06:58 / SRW
Fluoride	0.05	mg/L	J	0.1	0.03	A4500-F C	09/10/23 13:11 / ams
Hardness as CaCO3	201	mg/L		1	1	A2340 B	09/14/23 08:36 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.10	mg/L		0.01	0.009	E353.2	09/15/23 14:03 / JAR
Phosphorus, Total as P	0.008	mg/L	J	0.01	0.001	E365.1	09/19/23 19:35 / JAR
METALS, DISSOLVED							
Arsenic	0.027	mg/L		0.001	0.0002	E200.8	09/12/23 20:27 / dck
Cadmium	0.00008	mg/L	J	0.001	0.00002	E200.8	09/12/23 20:27 / dck
Calcium	58	mg/L		1	0.2	E200.7	09/12/23 00:12 / slj
Copper	0.005	mg/L	J	0.005	0.0001	E200.8	09/12/23 20:27 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	09/12/23 20:27 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 20:27 / dck
Magnesium	14	mg/L		1	0.05	E200.7	09/12/23 00:12 / slj
Manganese	0.0005	mg/L	J	0.001	0.0003	E200.8	09/12/23 20:27 / dck
Potassium	5	mg/L		1	0.06	E200.7	09/13/23 15:16 / slj
Sodium	7	mg/L		1	0.7	E200.7	09/12/23 00:12 / slj
Uranium	0.0199	mg/L		0.0003	0.00002	E200.8	09/12/23 20:27 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.028	mg/L		0.001	0.0001	E200.8	09/12/23 20:31 / dck
Cadmium	0.00009	mg/L	J	0.001	0.00003	E200.8	09/12/23 20:31 / dck
Calcium	62	mg/L		1	0.1	E200.7	09/11/23 20:51 / slj
Copper	0.005	mg/L		0.005	0.0003	E200.8	09/12/23 20:31 / dck
Iron	ND	mg/L		0.02	0.009	E200.8	09/12/23 20:31 / dck
Lead	0.0001	mg/L	J	0.001	0.0001	E200.8	09/12/23 20:31 / dck
Magnesium	14	mg/L		1	0.05	E200.7	09/11/23 20:51 / slj
Manganese	0.001	mg/L		0.001	0.0003	E200.8	09/12/23 20:31 / dck
Potassium	5	mg/L		1	0.1	E200.7	09/12/23 17:06 / slj
Sodium	7	mg/L		1	0.6	E200.7	09/11/23 20:51 / slj
Uranium	0.0216	mg/L		0.0003	0.00003	E200.8	09/12/23 20:31 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
J - Estimated value - analyte was present but less than the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090193-012
Client Sample ID: FB_090723

Report Date: 09/22/23
Collection Date: 09/07/23 14:25
DateReceived: 09/07/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	6.1	s.u.	H	0.1	0.1	A4500-H B	09/08/23 12:22 / eek
pH Measurement Temp	15.8	°C				A4500-H B	09/08/23 12:22 / eek
Conductivity @ 25 C	ND	umhos/cm		5	5	A2510 B	09/08/23 12:22 / eek
Solids, Total Dissolved TDS @ 180 C	ND	mg/L	L	20	7	A2540 C	09/08/23 12:42 / eek
- TDS did not obtain the minimum residue requirement of 2.5 mg residue.							
INORGANICS							
Alkalinity, Total as CaCO3	2	mg/L	J	4	2	A2320 B	09/08/23 16:49 / eek
Chloride	ND	mg/L		1.00		E300.0	09/09/23 07:12 / SRW
Sulfate	ND	mg/L		1.00		E300.0	09/09/23 07:12 / SRW
Bromide	ND	mg/L		0.500		E300.0	09/09/23 07:12 / SRW
Fluoride	ND	mg/L		0.1	0.03	A4500-F C	09/10/23 13:17 / ams
Hardness as CaCO3	ND	mg/L		1	1	A2340 B	09/14/23 08:36 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	ND	mg/L		0.01	0.009	E353.2	09/15/23 14:06 / JAR
Phosphorus, Total as P	ND	mg/L		0.01	0.001	E365.1	09/19/23 19:36 / JAR
METALS, DISSOLVED							
Arsenic	ND	mg/L		0.001	0.0002	E200.8	09/12/23 20:34 / dck
Cadmium	ND	mg/L		0.001	0.00002	E200.8	09/12/23 20:34 / dck
Calcium	ND	mg/L		1	0.2	E200.7	09/12/23 00:35 / slj
Copper	ND	mg/L		0.005	0.0001	E200.8	09/12/23 20:34 / dck
Iron	ND	mg/L		0.02	0.004	E200.8	09/12/23 20:34 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 20:34 / dck
Magnesium	ND	mg/L		1	0.05	E200.7	09/12/23 00:35 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	09/12/23 20:34 / dck
Potassium	ND	mg/L		1	0.06	E200.7	09/13/23 15:20 / slj
Sodium	ND	mg/L		1	0.7	E200.7	09/12/23 00:35 / slj
Uranium	ND	mg/L		0.0003	0.00002	E200.8	09/12/23 20:34 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	ND	mg/L		0.001	0.0001	E200.8	09/12/23 20:38 / dck
Cadmium	ND	mg/L		0.001	0.00003	E200.8	09/12/23 20:38 / dck
Calcium	ND	mg/L		1	0.1	E200.7	09/11/23 20:55 / slj
Copper	ND	mg/L		0.005	0.0003	E200.8	09/12/23 20:38 / dck
Iron	ND	mg/L		0.02	0.009	E200.8	09/12/23 20:38 / dck
Lead	ND	mg/L		0.001	0.0001	E200.8	09/12/23 20:38 / dck
Magnesium	ND	mg/L		1	0.05	E200.7	09/11/23 20:55 / slj
Manganese	ND	mg/L		0.001	0.0003	E200.8	09/12/23 20:38 / dck
Potassium	ND	mg/L		1	0.1	E200.7	09/12/23 17:10 / slj
Sodium	ND	mg/L		1	0.6	E200.7	09/11/23 20:55 / slj
Uranium	ND	mg/L		0.0003	0.00003	E200.8	09/12/23 20:38 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
J - Estimated value - analyte was present but less than the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time
L - Lowest available reporting limit for the analytical method used

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LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

Client: Lewis and Clark Co Water Quality Dist
Project: Unionville 2023
Lab ID: H23090224-001
Client Sample ID: 170337_090823

Report Date: 09/22/23
Collection Date: 09/08/23 12:05
DateReceived: 09/08/23
Matrix: Aqueous

Analyses	Result	Units	Qualifiers	RL	MDL	Method	Analysis Date / By
PHYSICAL PROPERTIES							
pH	7.1	s.u.	H	0.1	0.1	A4500-H B	09/11/23 11:38 / eek
pH Measurement Temp	12.6	°C				A4500-H B	09/11/23 11:38 / eek
Conductivity @ 25 C	275	umhos/cm		5	5	A2510 B	09/11/23 11:38 / eek
Solids, Total Dissolved TDS @ 180 C	173	mg/L		20	7	A2540 C	09/08/23 15:11 / eek
INORGANICS							
Alkalinity, Total as CaCO3	120	mg/L		4	2	A2320 B	09/08/23 19:18 / eek
Chloride	1.14	mg/L		1.00		E300.0	09/09/23 12:01 / SRW
Sulfate	20.0	mg/L		1.00		E300.0	09/09/23 12:01 / SRW
Bromide	0.016	mg/L	J	0.500		E300.0	09/09/23 12:01 / SRW
Fluoride	0.05	mg/L	J	0.1	0.03	A4500-F C	09/10/23 13:23 / ams
Hardness as CaCO3	118	mg/L		1	1	A2340 B	09/19/23 20:02 / slj
NUTRIENTS							
Nitrogen, Nitrate+Nitrite as N	0.09	mg/L		0.01	0.009	E353.2	09/21/23 18:29 / JAR
Phosphorus, Total as P	0.02	mg/L		0.01	0.001	E365.1	09/19/23 19:54 / JAR
METALS, DISSOLVED							
Arsenic	0.0007	mg/L	J	0.001	6E-06	E200.8	09/14/23 22:08 / dck
Cadmium	ND	mg/L		0.001	7E-06	E200.8	09/14/23 22:08 / dck
Calcium	35	mg/L		1	0.2	E200.7	09/13/23 17:35 / slj
Copper	0.034	mg/L		0.005	0.00004	E200.8	09/14/23 22:08 / dck
Iron	0.002	mg/L	J	0.02	0.0007	E200.8	09/14/23 22:08 / dck
Lead	0.00004	mg/L	J	0.001	0.00002	E200.8	09/14/23 22:08 / dck
Magnesium	7	mg/L		1	0.05	E200.7	09/13/23 17:35 / slj
Manganese	0.0007	mg/L	J	0.001	0.00005	E200.8	09/14/23 22:08 / dck
Potassium	2	mg/L		1	0.06	E200.7	09/13/23 17:35 / slj
Sodium	7	mg/L		1	0.03	E200.7	09/13/23 17:35 / slj
Uranium	0.0053	mg/L		0.0003	3E-06	E200.8	09/15/23 18:12 / dck
METALS, TOTAL RECOVERABLE							
Arsenic	0.001	mg/L		0.001	0.00001	E200.8	09/14/23 22:14 / dck
Cadmium	8E-06	mg/L	J	0.001	5E-06	E200.8	09/14/23 22:14 / dck
Calcium	39	mg/L		1	0.1	E200.7	09/13/23 13:43 / slj
Copper	0.037	mg/L		0.005	0.0001	E200.8	09/14/23 22:14 / dck
Iron	0.36	mg/L		0.02	0.005	E200.8	09/14/23 22:14 / dck
Lead	0.0006	mg/L	J	0.001	0.00005	E200.8	09/14/23 22:14 / dck
Magnesium	7	mg/L		1	0.05	E200.7	09/13/23 13:43 / slj
Manganese	0.004	mg/L		0.001	0.0002	E200.8	09/14/23 22:14 / dck
Potassium	2	mg/L		1	0.1	E200.7	09/13/23 13:43 / slj
Sodium	6	mg/L		1	0.05	E200.7	09/13/23 13:43 / slj
Uranium	0.0056	mg/L		0.0003	4E-06	E200.8	09/15/23 18:16 / dck

Report Definitions:
RL - Analyte Reporting Limit
MCL - Maximum Contaminant Level
ND - Not detected at the Reporting Limit (RL)
J - Estimated value - analyte was present but less than the Reporting Limit (RL)
MDL - Method Detection Limit
QCL - Quality Control Limit
H - Analysis performed past the method holding time

Appendix B: Well Logs

(sourced from the Montana Bureau of Mines and Geology's Groundwater Information Center)

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Return to menu
Plot this site in State Library Digital Atlas
Plot this site in Google Maps
View scanned well log (8/28/2006 12:18:47 PM)

Site Name: WALTER ALLEN
GWIC Id: 58964

Section 1: Well Owner(s)
1) WALER, ALLEN (MAIL)
UNIONVILLE RTE
HELENA MT 59601 [04/14/1973]

Section 2: Location

Township	Range	Section	Quarter Sections
09N	04W	15	

County	Geocode
LEWIS AND CLARK	

Latitude	Longitude	Geomethod	Datum
46.536023	-112.093228	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY DRILL
Status: NEW WELL

Section 5: Well Completion Date
Date well completed: Saturday, April 14, 1973

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	230	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	21	6	.250			STEEL
15	230	4		200.00		PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
190	230	4			SAW SLOTS

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 230
Static Water Level: 60
Water Temperature:

Air Test *

8 gpm with drill stem set at _ feet for 2 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
211PLNC - PLUTONIC ROCKS (UPPER CRETACEOUS)

From	To	Description
0	15	TOPSOIL AND ROCKS
15	190	FRACTURED AND DECOMPOSED GRANITE
190	230	FRACTURED GRANITE--WATER

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: OKEEFE DRILLING CO
License No: WWC-8
Date Completed: 4/14/1973

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

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Plot this site in State Library Digital Atlas
Plot this site in Google Maps
View scanned well log (8/28/2006 12:18:36 PM)

Site Name: CRANE ROBERT & J.
GWIC Id: 58967

Section 1: Well Owner(s)
1) CRANE, ROBERT (MAIL)
N/A
HELENA MT 59601 [07/16/1964]

Section 2: Location

Township	Range	Section	Quarter Sections
09N	04W	15	NE¼

County	Geocode
LEWIS AND CLARK	

Latitude	Longitude	Geomethod	Datum
46.539683	-112.087997	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)
STOCKWATER (2)

Section 4: Type of Work
Drilling Method: CHURN DRILL
Status: NEW WELL

Section 5: Well Completion Date
Date well completed: Thursday, July 16, 1964

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	80	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	60	6				STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
60	60	6			OPEN BOTTOM

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	0	NONE	

Section 7: Well Test Data

Total Depth: 80
Static Water Level: 30
Water Temperature:

Bailer Test *

6 gpm with _ feet of drawdown after 2 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 75 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
211PLNC - PLUTONIC ROCKS (UPPER CRETACEOUS)

From	To	Description
0	60	DECOMPOSED GRANITE
60	80	HARD GRANITE

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: WALTER RIDDOCK
Company: RIDDOCK CASING AND DRILLING
License No: MWC-49
Date Completed: 7/16/1964

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Return to menu
Plot this site in State Library Digital Atlas
Plot this site in Google Maps
View scanned well log (8/28/2006 7:13:51 PM)

Site Name: SCHAEFER JACK & BETTY
GWIC Id: 170334
DNRC Water Right: 30149263

Section 1: Well Owner(s)

1) SCHAEFER, JACK AND BETTY (MAIL)
6566 E SHOOTING STAR WAY
SCOTTSDALE AZ 85262 [07/09/1998]
2) N/A (WELL)
4126 SPRING HILL RD
HELENA MT 59601 [No Date]

Section 2: Location

Township	Range	Section	Quarter Sections
09N	04W	11	NW¼ NW¼ SW¼ SE¼

County	Geocode
LEWIS AND CLARK	

Latitude	Longitude	Geomethod	Datum
46.54649228315	-112.07167117875	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date

Addition	Block	Lot
		A2

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, July 9, 1998

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	18	10
18	238	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	18	6			WELDED	STEEL
10	238	4			SOLVENT WELD	PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
218	238	4		1X.020	FACTORY SLOTTED

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	18	BENTONITE	

Section 7: Well Test Data

Total Depth: 238
Static Water Level: 75
Water Temperature:

Air Test *

10 gpm with drill stem set at _ feet for 1 hours.
Time of recovery 0.3 hours.
Recovery water level 75 feet.
Pumping water level 195 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	2	TOPSOIL
2	12	WEATHERED GRANITE
12	238	GRANITE

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: SHAWN TONEY
Company: H & L DRILLING INC
License No: WWC-447
Date Completed: 7/9/1998

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Return to menu
Plot this site in State Library Digital Atlas
Plot this site in Google Maps
View hydrograph for this site
View field visits for this site
View scanned well log (8/28/2006 7:12:12 PM)

Site Name: BOOKER DOUG
GWIC Id: 132801

Section 1: Well Owner(s)
1) BOOKER, DOUG (MAIL)
1973 OROFINO GULCH
HELENA MT 59601 [11/03/1992]

Section 2: Location

Township	Range	Section	Quarter Sections
09N	04W	11	NW¼ SW¼ SW¼ SW¼

County	Geocode
LEWIS AND CLARK	

Latitude	Longitude	Geomethod	Datum
46.5444	-112.0808	UNKNOWN	NAD27

Ground Surface Altitude	Ground Surface Method	Datum	Date
4850			

Measuring Point Altitude	MP Method	Datum	Date Applies
4851.5			11/23/2004 8:15:00 AM

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date
Date well completed: Tuesday, November 3, 1992

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	36.6	10
36.6	122	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	36.5	6	.250		WELDED	STEEL
10	122	4		160.00		PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
62	82	4		2X.025	FACTORY SLOTTED
102	122	4		2X.025	FACTORY SLOTTED

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	36.5	CEMENT & BENTONITE	

Section 7: Well Test Data

Total Depth: 122
Static Water Level: 28
Water Temperature:

Air Test *

12 gpm with drill stem set at _ feet for 1 hours.
Time of recovery 12 hours.
Recovery water level 28 feet.
Pumping water level 112 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
211BDBT - BOULDER BATHOLITH

From	To	Description
0	4	TOPSOIL
4	20	WEATHERED GRANITE
20	21	GRAVEL
21	31	WEATHERED GRANITE
31	122	GRANITE

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: SHAWN TONEY
Company: H & L DRILLING INC
License No: WWC-447
Date Completed: 11/3/1992

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

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Plot this site in State Library Digital Atlas
Plot this site in Google Maps
View scanned well log (8/28/2006 7:11:20 PM)

Site Name: DILL TRACY AND JILL
GWIC Id: 156288
DNRC Water Right: 113252

Section 1: Well Owner(s)

1) DILL, TRACY AND JILL (MAIL)
1925 SPRING HILL RD
HELENA MT 59601-9685 [02/05/2001]
2) AHMANN, AL AND JEAN (MAIL)
1935 ORO FINO GULCH
HELENA MT 59601 [03/11/1996]

Section 2: Location

Township	Range	Section	Quarter Sections
09N	04W	11	NW¼ SE¼

County	Geocode
LEWIS AND CLARK	

Latitude	Longitude	Geomethod	Datum
46.548742	-112.069698	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date

Addition	Block	Lot
AHMANN MINOR		B

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: AIR ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Monday, March 11, 1996

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	41	6				STEEL
20	200	4				PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
120	200	4			PERFORATED CASING

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 200
Static Water Level: 52
Water Temperature:

Air Test *

35 gpm with drill stem set at _ feet for 2 hours.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 196 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	3	TOPSOIL
3	37	CLAY & ROCK
37	200	GRANITIC ROCK

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: TERRY LINDSAY
Company: LINDSAY DRILLING CO INC
License No: WWC-253
Date Completed: 3/11/1996

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

Return to menu
Plot this site in State Library Digital Atlas
Plot this site in Google Maps
View scanned well log (8/28/2006 12:21:20 PM)

Site Name: JESTER WALLY
GWIC Id: 187265
DNRC Water Right: 116627

Section 1: Well Owner(s)

1) JESTER, WALLY (MAIL)
1996 ORO FINO GULCH
HELENA MT 59602 [11/16/2000]

Section 2: Location

Township	Range	Section	Quarter Sections
09N	04W	10	SE¼ SE¼ SE¼

County	Geocode
LEWIS AND CLARK	

Latitude	Longitude	Geomethod	Datum
46.544188	-112.084018	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Thursday, November 16, 2000

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	18	10
18	230	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	230	6	0.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
160	180	6	300	5/16X1	MILLS KNIFE
200	230	6	600	5/16X1	MILLS KNIFE

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	18	BENTONITE	

Section 7: Well Test Data

Total Depth: 230
Static Water Level: 124
Water Temperature:

Air Test *

10 gpm with drill stem set at 230 feet for 1 hours.
Time of recovery 0.25 hours.
Recovery water level 124 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	12	CLAY
12	230	FRACTURED GRANITE

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: SHAWN TONEY
Company: H & L DRILLING INC
License No: WWC-447
Date Completed: 11/16/2000

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

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Site Name: RADEMAKER, ARIEL AND LEE
GWIC Id: 170337
DNRC Water Right: 30067912

Section 1: Well Owner(s)

1) RADEMAKER, ARIEL AND LEE (MAIL)
2088 BLACK ALDER GULCH
HELENA MT 59601 [12/31/2013]
2) BLOTKAMP, JOHN (MAIL)
2031 ORO FINE GULCH
HELENA MT 59601 [09/11/1998]

Section 2: Location

Township	Range	Section	Quarter Sections
09N	04W	15	NE¼ SE¼ NE¼

County	Geocode
LEWIS AND CLARK	05178415101080000

Latitude	Longitude	Geomethod	Datum
46.53876801905	-112.084072897	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Friday, September 11, 1998

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	20	8
20	140	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	35	6	.250		WELDED	STEEL
30	140	4				PLASTIC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
60	140	4			PERFORATED CASING

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 140
Static Water Level: 20
Water Temperature:

Air Test *

15 gpm with drill stem set at _ feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 20 feet.
Pumping water level 140 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	2	TOPSOIL
2	35	BOULDERS & GRAVEL
35	140	GRANITE

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: RICK L. MURRAY
Company: TREASURE STATE DRILLING
License No: WWC-351
Date Completed: 9/11/1998

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

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Plot this site in State Library Digital Atlas
Plot this site in Google Maps

Site Name: HAIL, & OAKLAND HAIL, CHARLES K. & VICKI L.
GWIC Id: 275741

Section 1: Well Owner(s)

1) HAIL, & OAKLAND HAIL, CHARLES K. & VICKI L. (MAIL)
2009 ORO FINO GULCH DR.
HELENA MT 59601 [07/16/2013]

Section 2: Location

Township	Range	Section	Quarter Sections
09N	04W	15	NE¼ NE¼ NE¼

County	Geocode
LEWIS AND CLARK	

Latitude	Longitude	Geomethod	Datum
46.54242826905	-112.084072897	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Tuesday, July 16, 2013

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	37	10
37	260	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	37	6	0.25		WELDED	A53B STEEL
20	260	4		200.0	SPLINE	PVC-SDR 17

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
120	140	4	200	1"X5/16"	SAW SLOTS
180	200	4	200	1"X5/16"	SAW SLOTS
240	260	4	200	1"X5/16"	SAW SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	37	BENTONITE	

Section 7: Well Test Data

Total Depth: 260
Static Water Level: 39
Water Temperature:

Air Test *

15 gpm with drill stem set at 260 feet for 1 hours.
Time of recovery 0.37 hours.
Recovery water level 39 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	1	TOPSOIL
1	28	BROWN GRANITE
28	260	GRAY GRANITE

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: SHAWN TONEY
Company: H & L DRILLING INC
License No: WWC-447
Date Completed: 7/16/2013

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

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Site Name: OLSEN ARNOLD
GWIC Id: 207185

Section 1: Well Owner(s)
1) OLSEN, ARNOLD (MAIL)
1830 ORO FINO GULCH
HELENA MT 59601 [10/29/2003]

Section 2: Location

Township	Range	Section	Quarter Sections
09N	04W	11	NW¼ SW¼

County	Geocode
LEWIS AND CLARK	

Latitude	Longitude	Geomethod	Datum
46.548742	-112.080222	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date
Date well completed: Wednesday, October 29, 2003

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	120	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	78	6				STEEL
60	120	4				PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
77	120	4			PERFORATED CASING

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	BENTONITE	

Section 7: Well Test Data

Total Depth: 120
Static Water Level: 35
Water Temperature:

Air Test *

18 gpm with drill stem set at 115 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 35 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
0	4	TOPSOIL
4	12	CLAY AND GRAVEL
12	18	DECOMPOSED LIMESTONE
18	75	BROKEN LIMESTONE
75	120	LIMESTONE BEDROCK

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: TERRY LINDSAY
Company: LINDSAY DRILLING CO INC
License No: WWC-253
Date Completed: 10/29/2003

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Other Options

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View scanned well log (12/2/2015 10:49:30 AM)

Site Name: WALSH, MICHAEL AND APRIL
GWIC Id: 285417

Section 1: Well Owner(s)
1) WALSH, MICHAEL AND APRIL (WELL)
2054 ORO FINO GULCH
HELENA MT 59601 [09/18/2015]

Section 2: Location

Township	Range	Section	Quarter Sections
09N	04W	15	NE¼ NE¼

County	Geocode
LEWIS AND CLARK	

Latitude	Longitude	Geomethod	Datum
46.54151320655	-112.0853808345	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
DOMESTIC (1)

Section 4: Type of Work
Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date
Date well completed: Friday, September 18, 2015

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	25	9
25	422	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	25	6	0.25		WELDED	STEEL
12	422	4		220.0	SOLVENT WELD	PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
342	362	4		0.025	SCREEN-CONTINUOUS-PVC
402	422	4		0.025	SCREEN-CONTINUOUS-PVC

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	25	BENTONITE	

Section 7: Well Test Data

Total Depth: 422
Static Water Level: 54
Water Temperature:

Air Test *

8.5 gpm with drill stem set at 422 feet for 1 hours.
Time of recovery 2 hours.
Recovery water level 54 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
0	6	FILL
6	13	WEATHERED GRANITE
13	422	GRAY GRANITE

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: MARK MILLER
Company: A-10 DRILLING
License No: WWC-611
Date Completed: 9/18/2015

MONTANA WELL LOG REPORT

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Other Options

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Site Name: BAKER, COREY AND ANNA
GWIC Id: 279591

Section 1: Well Owner(s)

1) BAKER, COREY & ANNA (MAIL)
605 3RD STREET
HELENA MONTANA 59601 [08/19/2014]
2) BAKER, COREY & ANNA (WELL)
3996 SPRING HILL ROAD
HELENA MONTANA N/A [08/19/2014]

Section 2: Location

Township	Range	Section	Quarter Sections
09N	04W	11	

County	Geocode	Parcel
LEWIS AND CLARK		

Latitude	Longitude	Geomethod	Datum
46.55054115815	-112.0723288975	TRS-SEC	NAD83

Ground Surface Altitude	Ground Surface Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY
Status: NEW WELL

Section 5: Well Completion Date

Date well completed: Tuesday, August 19, 2014

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	40	8
40	420	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	40	6	0.25		WELDED	A53B STEEL
20	420	4			GLUED	PVC-SCHED 160

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
240	420	4	100	3/8	SAW SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	30	GROUT	

Section 7: Well Test Data

Total Depth: 420
Static Water Level: 180
Water Temperature:

Air Test *

10 gpm with drill stem set at 400 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 180 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	2	TOPSOIL
2	40	DECOMPOSED GRANITE BEDROCK
40	420	GRANITE BEDROCK

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: RYAN LINDSAY
Company: LINDSAY DRILLING CO INC
License No: WWC-607
Date Completed: 8/19/2014