

Montana Bureau of Mines and Geology Open File 401Q

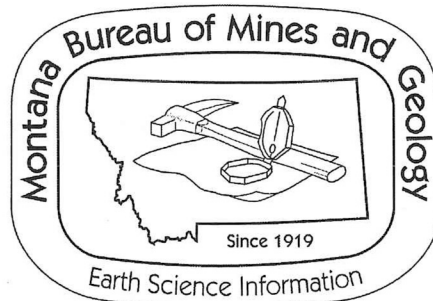
**HYDROGEOLOGIC ASSESSMENT OF THE MILLER COLONY
WATER SYSTEM
FOR
GROUND WATER UNDER THE DIRECT INFLUENCE OF SURFACE
WATER**

**MILLER COLONY WATER SYSTEM
PWSID #01649
P.O. Box 210
Choteau, MT 59422**

**Prepared
for
Montana Department of Environmental Quality
Water Quality Division**

**by
Peter Norbeck
Montana Bureau of Mines and Geology**

July, 1999



INTRODUCTION AND PURPOSE

This report summarizes the hydrogeology of the Miller Colony public water supply system (PWSID #01649) located north of Choteau, Montana. The Montana Bureau of Mines and Geology (MBMG) is under contract with the Montana Department of Environmental Quality (DEQ) to conduct preliminary assessments and hydrogeologic assessments for selected community public water supplies. The project was funded under DEQ contract number 430007, task order 38.

The purpose of conducting this hydrogeologic assessment was to determine if the spring source (Source ID 005) is under the direct influence of surface water as defined in 40 CFR part 141. Completed PA forms (appendix A) indicate that Miller Colony's wells (source IDs 002 and 003) are not under the direct influence of surface water. A field inspection was completed on January 4, 1999 with Mr. David Hofer and Mr. John Waldner. **The results of the hydrogeologic assessment indicate that the spring source may be under the direct influence of surface water as defined in 40 CFR part 141.** Information on system location, construction, geology, hydrology, and water quality is summarized in this report. Conclusions and recommendations are presented at the end of the report. Additional data are provided as appendixes to the report.

BACKGROUND

The Surface Water Treatment Rule (SWTR) of the Federal Safe Drinking Water Act of 1986 requires each state to examine public water supplies which use ground water, to determine if there is a direct surface-water influence. In Montana, the Water Quality Division of DEQ is evaluating public water supplies for the SWTR. This program is known as the **Ground Water Under the Direct Influence of Surface Water (GWUDISW) program**. The SWTR defines ground water under the direct influence of surface water as:

Any water beneath the surface of the ground with:

i) significant occurrence of insects or other macroorganisms, algae, or large diameter pathogens such as *Giardia lamblia*, or *Cryptosporidium*; or

ii) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity or pH, which closely correlate to climatological or surface water conditions.

The evaluation begins with a preliminary assessment (PA). If the PA indicates that the ground-water supply may be under the direct influence of surface water further study is required. Further study is required for the Miller Colony public water supply system.

PRELIMINARY ASSESSMENT

The Miller Colony PWS consists of two separate systems, a potable water system supplied by wells and a soft water system supplied by a developed spring. Completed PA forms for the Miller Colony water supply system are included as appendix A. The wells (source IDs 002 and 003) are not under the direct influence of surface water and are not considered further in this report. The spring (source ID 005) was assigned a score of 40 points for being a spring. The score of 40 points, out of a possible total of over 200, indicates the system is at risk of being under the direct influence of surface water. The site identification number used by the MBMG Ground Water Information Center (GWIC) is M:171113.

SYSTEM DESCRIPTION

The Miller Colony soft water supply system is classified as a community public water supply by DEQ. It serves approximately 100 people. The spring (source ID 005) was developed by means of a buried lateral and collector.

Location

Miller Colony and the water supply system are located in north-central Montana, in Teton County. The location of Teton County and Miller Colony are shown on figure 1. Miller Colony is approximately 9 miles northwest of the community of Choteau. The soft water source spring is located about 1 mile south of the colony. The legal description for the spring is SE $\frac{1}{4}$, NE $\frac{1}{4}$, SE $\frac{1}{4}$, SW $\frac{1}{4}$ sec. 17, T. 25 N., R. 05 W. The location of the spring, along with the topography of the surrounding area is shown on figure 2.

System Configuration

The system (source ID 005) is developed by means of 500 feet of 6 inch perforated PVC pipe buried about 20 feet and feeding to a 6 foot diameter collector. Stock water is conveyed directly to the point of use. Water used for washing is pumped to a 72,000 gallon storage tank with an overflow to an irrigation ditch. From this tank the water is passed through an ion exchange softener to an 18,000 gallon storage tank from which it is distributed to the family units, kitchen, laundry, dairy, and slaughter house.



Figure 1. Montana map showing the location of Teton County and Miller Colony.

GEOLOGY

Local Topography and Land Use

The topography of the area surrounding the sources for the Miller Colony water system is shown in figure 2. The Miller Colony water system source spring is located a few miles west of the Rocky Mountain front. Principal land use near the colony is small grains and cattle.

Geology

The Miller Colony water system spring is located in an ancestral channel of the Teton River referred to as the Ralston Gap. Patton (1991) described the surficial geology of the area. At one or more times during the geologic past, the Teton River drained through Ralston Gap depositing sediments in the gap and creating an alluvial fan to the east of the colony that forms the present-day Burton Bench. These sediments overlie Cretaceous sediments, possibly Telegraph Creek Formation and Colorado Shale. Sediments which supply water to the spring consist of 20 to 25 feet of alluvial sand and gravel overlain by up to 3 feet of silty clay-rich top soil (Patton, 1990). Figures 3a and 3b are geologic cross-sections of Ralston Gap showing the thickness of the sand and gravel aquifer which supplies the Miller Colony spring source.

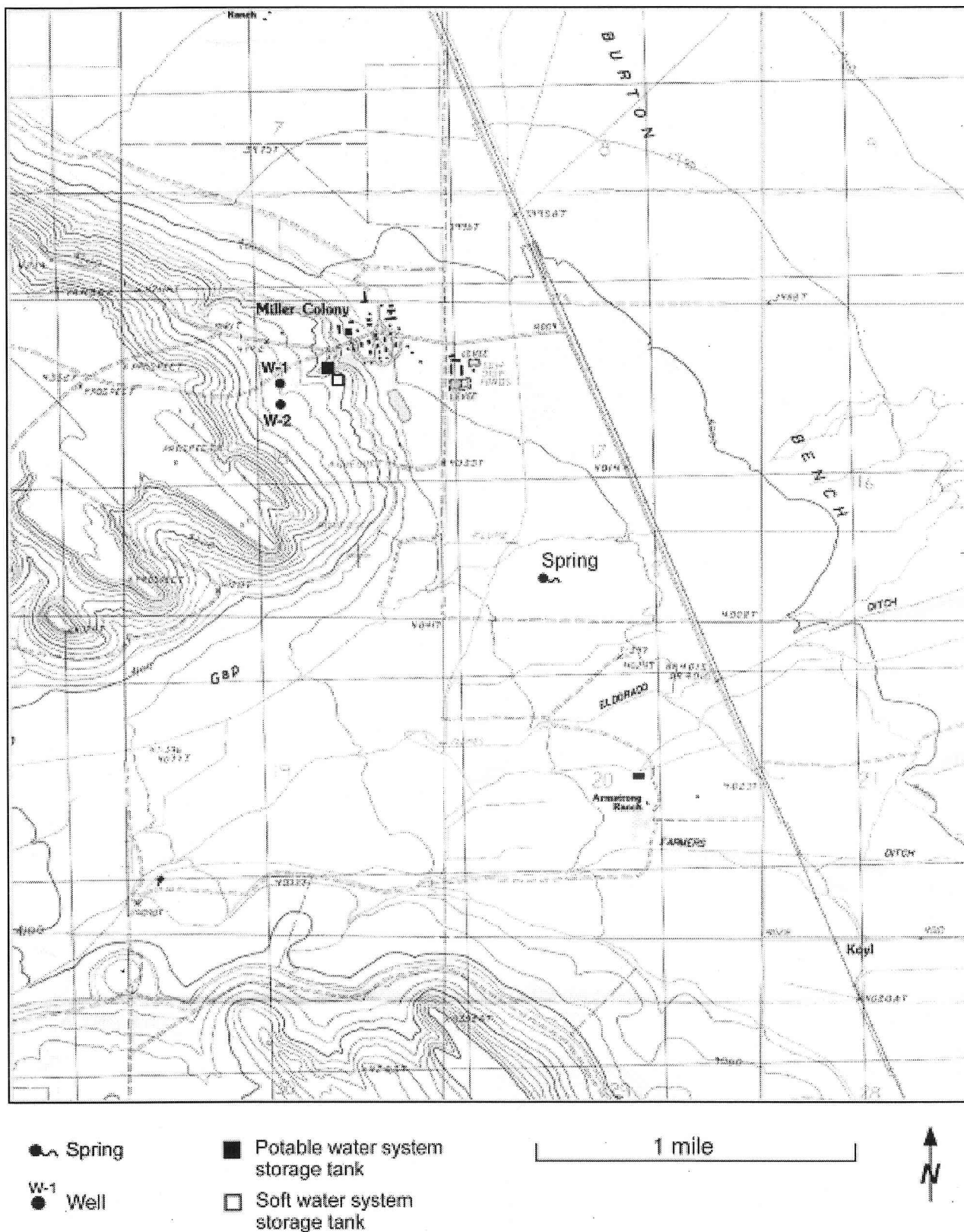


Figure 2. Topographic map of the Miller Colony water system source area showing the locations of the wells and developed spring. Source: U.S.G.S. Bynum 7.5 minute quadrangle map (1987).

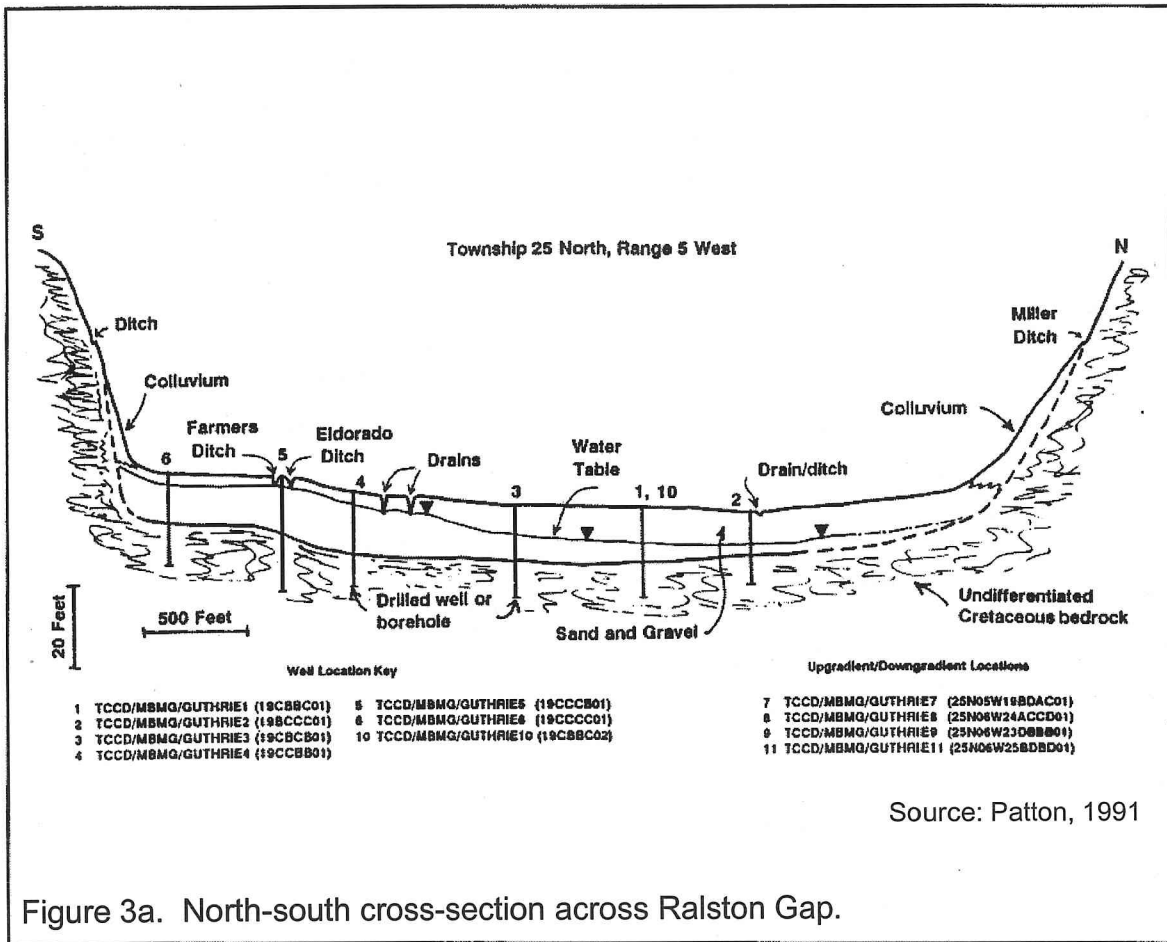


Figure 3a. North-south cross-section across Ralston Gap.

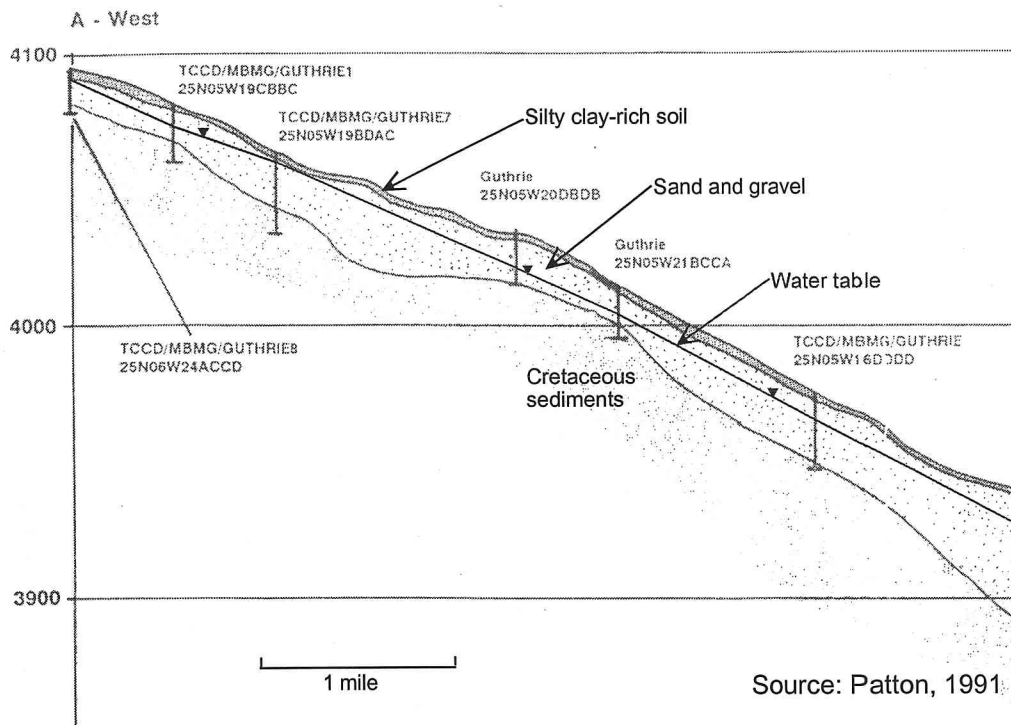


Figure 3b. East-west cross-section axial to Ralston Gap.

Ground-Water Flow

The GWIC database at the MBMG contains records for 28 water-wells near Miller Colony completed in the shallow sand and gravel aquifer which is the source of water for the Miller Colony spring. Hydrogeologic data from Patton (1991) suggests that approximately 167,000 cubic feet per day of water flows through Ralston Gap. Geologic cross-sections on figure 3 (Patton, 1991) show the saturated thickness of the sand and gravel.

Water table elevation contours are shown in figure 4 (Patton, 1991). In the vicinity of the spring ground water flows generally northeast. Based on data published by Patton (1991) the estimated ground-water flow (Q) through Ralston Gap is 167,000 cu.ft./day.

$$Q = KAI = 167,000 \text{ cu ft/day}$$

where K = permeability = 580 ft/day

A = cross-sectional flow area = 26,000 sq. ft.

and I = hydraulic gradient rate = 0.011 ft/ft.

Table 1. Well and spring information, Miller Colony public water supply									
SITE	LOCATION	ELEV- ATION (ft)	DTW (ft)	WL ELEV (ft)	TD (ft)	BOTTOM ELEV (ft)	CASING DIAM (in)	Q (gpm)	Aquifer (1)
Spring 1	T25N R05W Sec17CDBD	4030	10.86	4019.1	18.9	4011.1	60		111ALVF
Well 1	T25N R05W Sec18BCDC	4140	40.19	4099.8	74R	4066	6	R	Kv
Well 2	T25N R05W Sec18CBBD	4150	48.56	4101.4	>58		8	16R	Kv

- (1) 111ALVF - shallow sand and gravel aquifer
Kmr - Marias River Formation

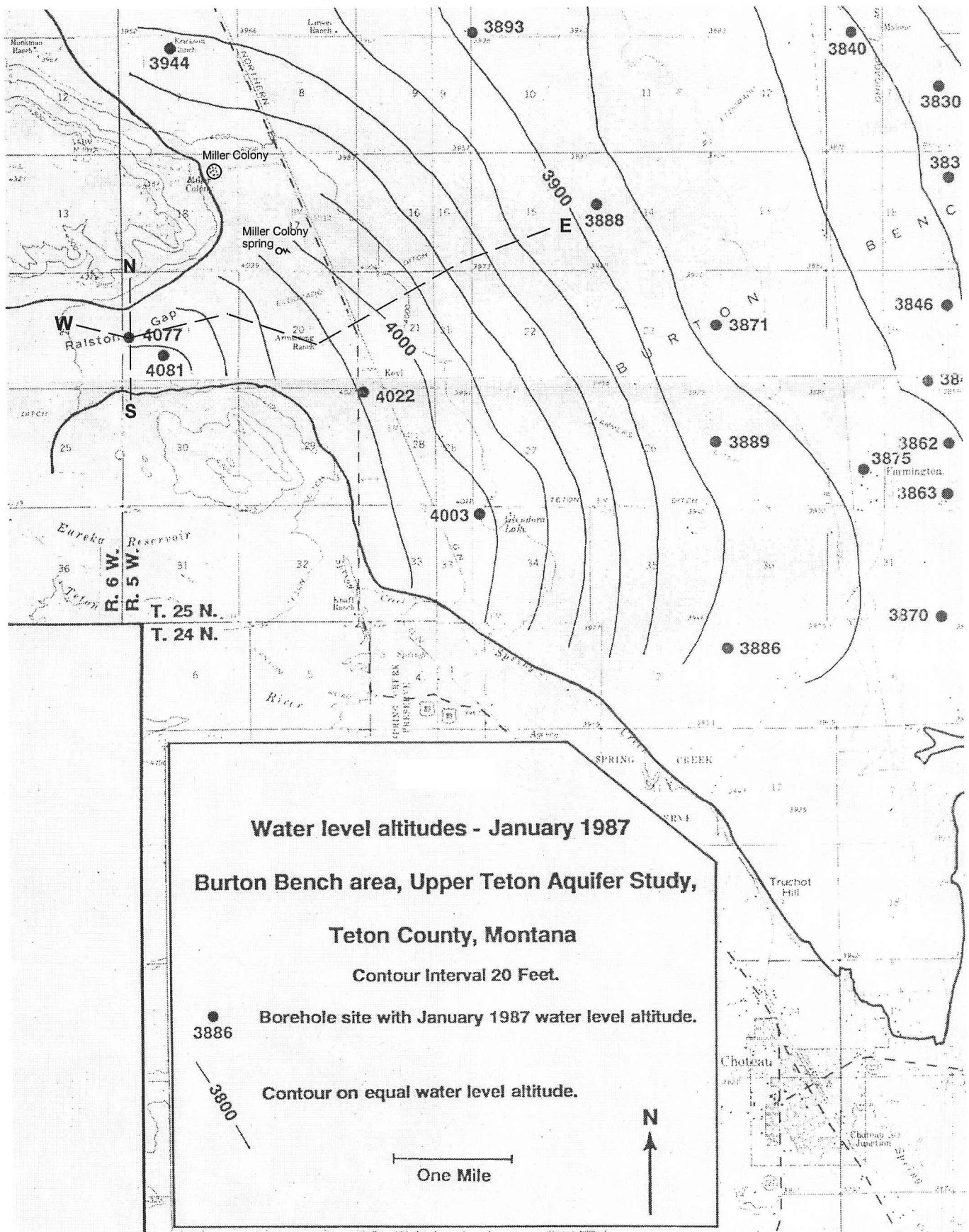


Figure 4. Water table contours for the shallow sand and gravel aquifer (Patton, 1991).

WATER QUALITY

Water quality data for the Miller Colony spring were obtained from the GWIC database at the Montana Bureau of Mines and Geology. Additional data for the Miller Colony Wells were obtained from DEQ and are included in appendix B.

Inorganic and Radiological Chemistry

Based on analytical data gathered by Patton (1991), ground water in the sand and gravel aquifer supplying the Miller Colony spring is dominated by calcium, magnesium, and bicarbonate ions. Water in the sand and gravel aquifer is classified as very hard using the classification of Durfor and Becker (1964). Nitrate-nitrogen levels are low, ranging from 0.05 to 0.61 milligrams per liter (mg/L) with a mean value of 0.26 mg/L for 10 samples collected between June 9, 1983 and April 19, 1990. The analytical data also indicate that metals concentrations are low and within drinking water standards. No chemical constituents were found to exceed any of the National Primary Drinking Water Regulation maximum contaminant levels (EPA, 1998).

Figure 5 is a tri-linear plot showing ionic percentages of major cations and anions in water samples from the Miller Colony water system and from wells completed in the sand and gravel aquifer. Sample site locations are shown on figure 6. Samples numbered from 1 to 7 are from the sand and gravel aquifer, and samples A, B, and C are from the Miller Colony water supply. Although sample A is an incomplete analysis for the purposes of plotting because magnesium (Mg) was not analyzed, it's position on the plot suggests it was likely drawn from the wash water system which comes from the spring. Based on where they plot on figure 5, samples B and C are thought to represent water from a source other than the sand and gravel aquifer supplying the Miller Colony spring. The wells supplying the Miller Colony potable water system are thought to draw water from the Virgelle Sandstone. Total nitrogen (nitrate plus nitrite) was less than 1 mg/L in samples collected from Miller Colony on 06/09/83, 06/26/86, and 04/19/90. The sample collected on 06/09/83 is sample A on figure 5.

Bacteriological Water Quality

Bacterial samples collected through 1996 have all been okay (Brayton, 1999). It is not known whether the wash water system has been sampled, or if bacterial sampling represents only the potable system.

- 1 25N05W16DDD
- 2 25N05W19CBBB
- 3 25N05W20DBAB
- 4 25N05W20DBAC
- 5 25N05W21CCC
- 6 25N05W28BBCB
- 7 25N05W28BBCB
- 8
- 9
- A 25N05W17CDCB
- B 25N05W18AC
- C 25N05W18AC

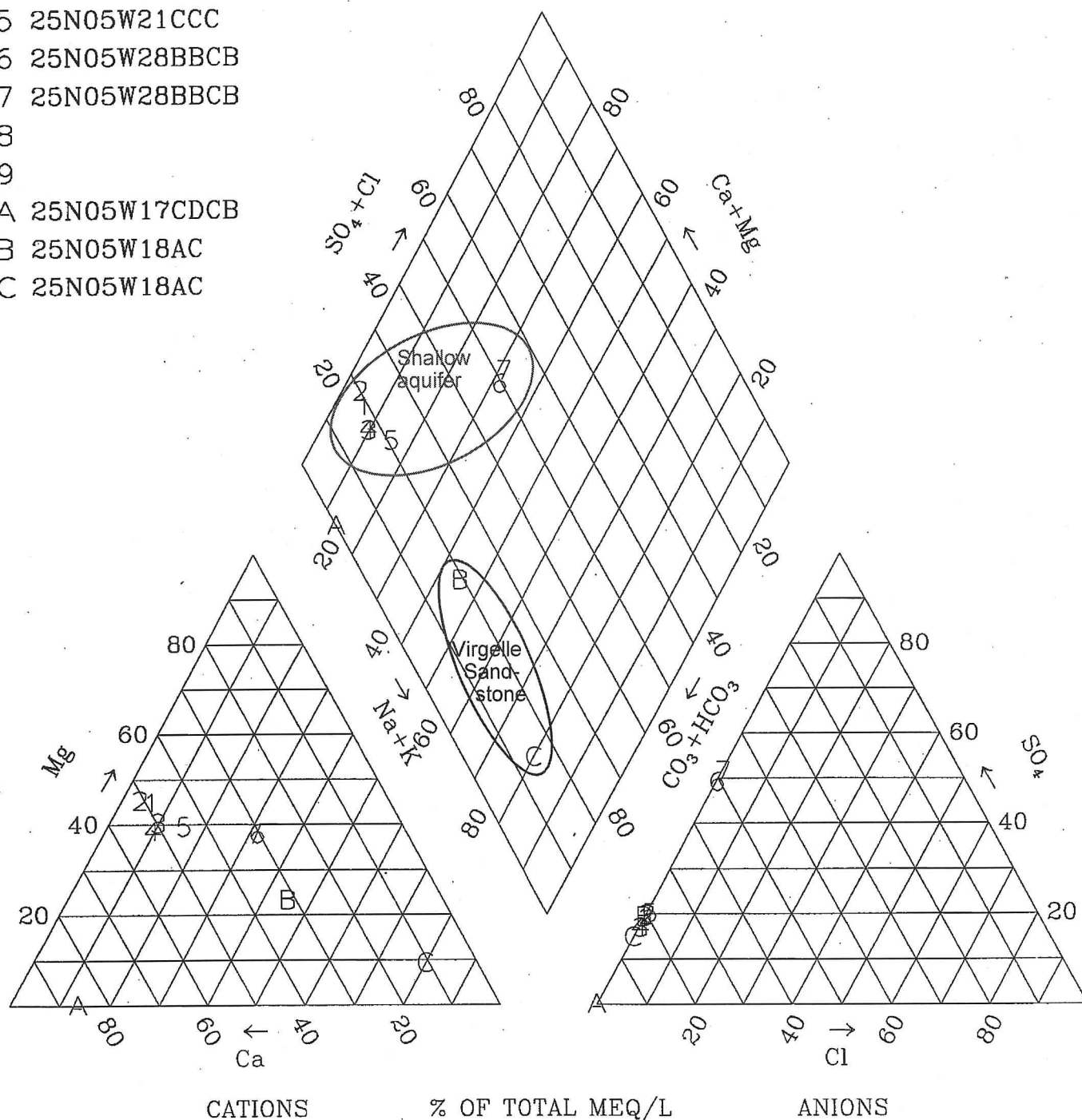


Figure 5. Ionic percentages in water samples from Miller Colony (samples A, B, & C) and from nearby wells (samples 1 - 7).

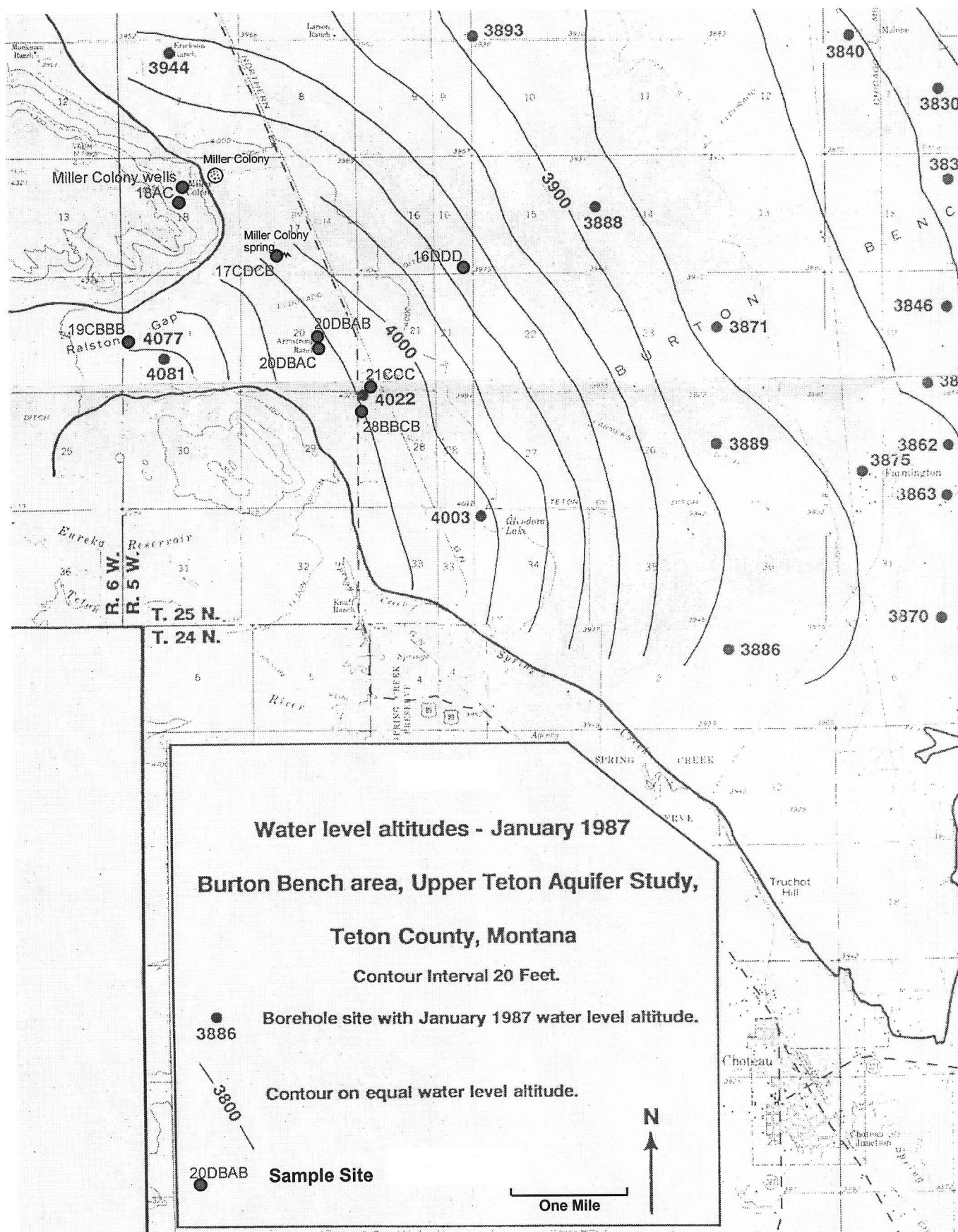


Figure 6. Sample sites for the data shown in figure 5.

CONCLUSIONS AND RECOMMENDATIONS

Determination of Direct Surface Water Influence

Based on the field inspection and literature review, the developed spring supplying the Miller Colony wash water public water supply may be under the direct influence of surface water as defined in 40 CFR part 141. The source of water for the spring supplying the wash water system is the shallow sand and gravel aquifer underlying Ralston Gap. Based on data presented by Patton (1991), the thickness of the aquifer is likely less than 25 feet thick at the spring.

Wells supplying the potable water system at the Colony are completed in the Virgelle Sandstone and are probably not under the direct influence of surface water.

Supporting Evidence for GWUDISW Determination: Miller Colony Spring, 01649-005

The primary evidence supporting the above determination are:

1. The spring is developed in a shallow sand and gravel aquifer that is likely less than 25 feet thick.
2. The depth to water in the spring was 12.3 feet from the top of the culvert on February 22, 1999.
3. Logs of wells completed in the shallow sand and gravel aquifer do not indicate the presence of a continuous aquitard or aquiclude above the water bearing zone.

Supporting Evidence for GWUDISW Determination: Miller Colony Wells, 01649-002 & 003

1. The wells serving the potable system are over 50 ft deep with depths to water greater than 40 feet and are probably completed in the Virgelle Sandstone.

Recommendations

1. The purpose of the spring system is to supply wash water to the Colony, and the system is separate from the potable system. Care should be taken to ensure that the water is not used for drinking or cooking, and to maintain the system as a totally separate non-potable supply.
2. An MPA analysis might resolve the question of whether the spring is actually under the influence of surface water.
3. The fencing around the spring is in good repair and should be maintained in that condition.

References

- Patton, T. W., 1991. Geology and hydrogeology of the Burton and Teton Valley aquifers. Montana Bureau of Mines and Geology Open-File Report 238.
- Durfor, C. N., and Becker, E., 1964. Public Water Supplies of the 100 Largest Cities in the United States, 1962: U.S. Geological Survey Water-Supply Paper 1812.
- EPA, 1998. Current Drinking Water Standards, <http://www.epa.gov/OGWD/wot/appa.html>.
- GWIC, 1998. Montana Bureau of Mines and Geology, Ground Water Information Center, Butte, Montana.
- Waldner, John, 1999. Personal communication during site visit.
- U.S. Geological Survey, 1987. Topographic map, Bynum, Montana-Teton County, 7.5-minute Topographic Quadrangle map; U.S. Geological Survey map; 1:24,000.

Appendix A

Preliminary Assessment Forms for the Miller Colony Water Supply Wells 1 and 2, and spring

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
Metcalf Building
1520 E. 6th St.
Helena, MT 59620-0901

Preliminary Assessment of Groundwater Sources that may be
under the Direct Influence of Surface water

SYSTEM NAME Miller Colony PWS ID # 01649
SOURCE NAME Well #1 (002) COUNTY Teton
DATE 5/27/99 NC NTNC C POPULATION 100

Index Points

A. TYPE OF STRUCTURE (Circle One)

Well	GO TO SECTION B
Spring	40
Infiltration Gallery or horizontal well	40

B. HISTORICAL PATHOGENIC ORGANISM CONTAMINATION

History or suspected outbreak of <i>Giardia</i> , or other pathogenic organisms associated with surface water with current system configuration	40
No history or suspected outbreak of <i>Giardia</i>	0

C. HISTORICAL MICROBIOLOGICAL CONTAMINATION (Circle all that apply)

Record of acute MCL violations of the Total Coliform Rule over the last 3 years (circle the one that applies)	
No violations	0
One violation	5
Two violations	10
Three violations	15

Record of non-acute MCL violations of the Total Coliform Rule over the last 3 years (circle the one that applies)	
One violation or less	0
Two violations	5
Three violations	10

DHES-verified complaints about turbidity	5
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D. HYDROLOGICAL FEATURES

Horizontal distance between a surface water and the source greater than 250 feet	0
175 - 250 feet	5
100 - 175 feet	10
less than 100 feet	15
unknown	15

E. WELL CONSTRUCTION

Poorly constructed well (uncased, or casing not sealed to depth of at least 18 feet below land surface), or casing construction is unknown . . . 15

In wells tapping unconfined or semiconfined aquifers, depth below land surface to top of perforated intervals or screen

greater than 100 feet	0
50 - 100 feet	5
25 - 50 feet	10
0 - 25 feet	15
unknown	15

F. WELL INTAKE CONSTRUCTION

In wells tapping unconfined or semiconfined aquifers, depth to static water level below land surface

greater than 100 feet	0
50 - 100 feet	5
0 - 50 feet	10
unknown	10

Poor sanitary seal, seal without acceptable material, or unknown sanitary seal type 15

TOTAL SCORE 15

PRELIMINARY ASSESSMENT DETERMINATION (Circle the one that applies)

- I) PASS: Well is classified as groundwater.
- ii) FAIL:. Well must undergo further GWUDISW determination.
- iii) FAIL: Spring or Infiltration Gallery; must undergo further GWUDISW determination.
- iv) FAIL: Well will PASS if well construction deficiencies (section E or F) are repaired.
- v) FAIL: Well may PASS if well construction details (section E or F) become available.

ANALYST Peter Norbeck ANALYST AFFILIATION MBMG

COMMENTS: _____

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
Metcalf Building
1520 E. 6th St.
Helena, MT 59620-0901

Preliminary Assessment of Groundwater Sources that may be
under the Direct Influence of Surface water

SYSTEM NAME Town of Kevin PWS ID # 01649
SOURCE NAME Well #2 (003) COUNTY Teton
DATE 5/27/99 NC NTNC C POPULATION 100

Index Points

A. TYPE OF STRUCTURE (Circle One)

Well	<u>GO TO SECTION B</u>
Spring	40
Infiltration Gallery	40

B. HISTORICAL PATHOGENIC ORGANISM CONTAMINATION

History or suspected outbreak of <i>Giardia</i> , or other pathogenic organisms associated with surface water with current system configuration	40
No history or suspected outbreak of <i>Giardia</i>	<u>0</u>

C. HISTORICAL MICROBIOLOGICAL CONTAMINATION (Circle all
that apply)

Record of acute MCL violations of the Total Coliform Rule over the last 3 years (circle the one that applies)	
No violations	<u>0</u>
One violation	5
Two violations	10
Three violations	15

Record of non-acute MCL violations of the Total Coliform Rule over the last 3 years (circle the one that applies)	
One violation or less	<u>0</u>
Two violations	5
Three violations	10

DHES-verified complaints about turbidity	5
--	---

D. HYDROLOGICAL FEATURES

Horizontal distance between a surface water and the source	
greater than 250 feet	<u>0</u>
175 - 250 feet	5
100 - 175 feet	10
less than 100 feet	15
unknown	15

E. WELL CONSTRUCTION

Poorly constructed well (uncased, or casing not sealed to depth of at least 18 feet below land surface), or casing construction is unknown . .	15
--	----

In wells tapping unconfined or semiconfined aquifers, depth below land surface to top of perforated intervals or screen	
greater than 100 feet	0
50 - 100 feet	<u>5</u>
25 - 50 feet	10
0 - 25 feet	15
unknown	15

F. WELL INTAKE CONSTRUCTION

In wells tapping unconfined or semiconfined aquifers, depth to static water level below land surface	
greater than 100 feet	0
50 - 100 feet	5
0 - 50 feet	<u>10</u>
unknown	10

Poor sanitary seal, seal without acceptable material, or unknown sanitary seal type	15
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TOTAL SCORE _____	15
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PRELIMINARY ASSESSMENT DETERMINATION (Circle the one that applies)

- I) PASS: Well is classified as groundwater.
- ii) FAIL: Well must undergo further GWUDISW determination.
- iii) FAIL: Spring or Infiltration Gallery; must undergo further GWUDISW determination.
- iv) FAIL: Well will PASS if well construction deficiencies (section E or F) are repaired.
- v) FAIL: Well may PASS if well construction details (section E or F) become available.

ANALYST <u>Peter Norbeck</u>	ANALYST AFFILIATION <u>MBMG</u>
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COMMENTS: _____

MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY
Metcalf Building
1520 E. 6th St.
Helena, MT 59620-0901

Preliminary Assessment of Groundwater Sources that may be
under the Direct Influence of Surface water

SYSTEM NAME Town of Kevin PWS ID # 01649
SOURCE NAME Spring (005) COUNTY Teton
DATE 5/27/99 NC NTNC C POPULATION 100

Index Points

A. TYPE OF STRUCTURE (Circle One)

Well	GO TO SECTION B
Spring	<u>40</u>
Infiltration Gallery	<u>40</u>

B. HISTORICAL PATHOGENIC ORGANISM CONTAMINATION

History or suspected outbreak of <i>Giardia</i> , or other pathogenic organisms associated with surface water with current system configuration	40
No history or suspected outbreak of <i>Giardia</i>	<u>0</u>

C. HISTORICAL MICROBIOLOGICAL CONTAMINATION (Circle all
that apply)

Record of acute MCL violations of the Total Coliform Rule over the last 3 years (circle the one that applies)	
No violations	<u>0</u>
One violation	5
Two violations	10
Three violations	15

Record of non-acute MCL violations of the Total Coliform Rule over the last 3 years (circle the one that applies)	
One violation or less	<u>0</u>
Two violations	5
Three violations	10

DHES-verified complaints about turbidity	5
--	---

D. HYDROLOGICAL FEATURES

Horizontal distance between a surface water and the source	
greater than 250 feet	<u>0</u>
175 - 250 feet	5
100 - 175 feet	10
less than 100 feet	15
unknown	15

E. WELL CONSTRUCTION

Poorly constructed well (uncased, or casing not

sealed to depth of at least 18 feet below land surface), or casing construction is unknown . .	15
--	----

In wells tapping unconfined or semiconfined aquifers, depth below land surface to top of perforated intervals or screen	
greater than 100 feet	0
50 - 100 feet	5
25 - 50 feet	10
0 - 25 feet	15
unknown	15

F. WELL INTAKE CONSTRUCTION

In wells tapping unconfined or semiconfined aquifers, depth to static water level below land surface	
greater than 100 feet	0
50 - 100 feet	5
0 - 50 feet	10
unknown	10

Poor sanitary seal, seal without acceptable material, or unknown sanitary seal type	15
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TOTAL SCORE_____	40
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PRELIMINARY ASSESSMENT DETERMINATION (Circle the one that applies)

- I) PASS: Well is classified as groundwater.
- ii) FAIL:. Well must undergo further GWUDISW determination.
- iii) FAIL: Spring or Infiltration Gallery; must undergo further GWUDISW determination.
- iv) FAIL: Well will PASS if well construction deficiencies (section E or F) are repaired.
- v) FAIL: Well may PASS if well construction details (section E or F) become available.

ANALYST <u>Peter Norbeck</u>	ANALYST AFFILIATION <u>MBMG</u>
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COMMENTS: The spring is not used for potable water.

Appendix B

Water Quality Assessment Data
Data Source: MDEQ, GWIC

Miller Colony
Ground-water Parameters

Sample ID	M: number	LOCATION	SAMPLE DATE	SAMPLE SOURCE	TDS CALC'D (mg/l)	TDS SUM OF DIS CONST (mg/l)	FLD SC (umho/cm)	LAB SC (umho/cm)	FIELD pH	LAB pH	HRDNS AS CaCO3 (mg/l)	ALK AS CaCO3 (mg/l)	RYZNAR STAB IND	LANGIER SAT IND	SAR
1986Q0971	6346	25N05W16DDD	28-Aug-86	WELL	464	689	715	755		7.66	427	363	6.32	0.67	0.27
		25N05W	09-Jun-83	PWS		651		825		8.5					
		25N05W	26-Jun-86	PWS		567		692		7.75					
		25N05W	19-Apr-90	PWS		713		845		8.82					
1986Q0970	6347	25N05W19CBBBC	26-Aug-86	WELL	272	398		454		7.63	248	204	7.31	0.16	0.10
1985Q0580	6348	25N05W20DBAB	17-Jun-85	WELL	337	503	957	572	8.59	7.84	292	269	6.68	0.58	0.36
1986Q0966	6349	25N05W20DBAC	26-Aug-86	WELL	337	503	556	575		7.52	297	267	6.96	0.28	0.36
1986Q0136	6353	25N05W21CCC	02-Apr-86	WELL		438	456	541	7.54	8.39	246	231	6.44	0.97	0.58
1986Q0969	6354	25N05W28BBCB01	28-Aug-86	WELL	635	806	920	948		7.77	375	276	6.69	0.54	1.78
1986Q0967	6355	25N05W28BBCB02	28-Aug-86	WELL	672	843	975	1000		7.7	398	276	6.7	0.5	1.79

Miller Colony
Major Elements

Sample ID	M: number	LOCATION	SAMPLE DATE	SAMPLE SOURCE	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Fe (mg/l)	Mn (mg/l)	SiO ₂ (mg/l)	HCO ₃ (mg/l)	CO ₃ (mg/l)	Cl (mg/l)	SO ₄ (mg/l)	NO ₃ (mg/l)	F (mg/l)	PO ₄ (mg/l)
1986Q0971	6346	25N05W16DDD	28-Aug-86	WELL	89.4	49.6	12.8	1.1	<.002	<.001	11.	442.	0	0.6	81.7	0.05	0.30	<.1
		25N05W	09-Jun-83	PWS	148.		26.9					474.6				0.21	1.00	
		25N05W	26-Jun-86	PWS	46.1	20.4	75.3					357.5	0		67.	0.61	0.44	
		25N05W	19-Apr-90	PWS	20.4	10.5	174.					445.3	0		60.9	0.54	0.95	
1986Q0970	6347	25N05W19CBBBC	26-Aug-86	WELL	52.8	28.3	3.7	1.3	<.002	<.001	14.2	248.4	0	0.4	48.1	0.07	0.60	<.1
1985Q0580	6348	25N05W20DBAB	17-Jun-85	WELL	64.8	31.7	14.	1.1	<.002	0.001	9.2	328.	0	0.9	52.5	0.21	0.40	<.1
1986Q0966	6349	25N05W20DBAC	26-Aug-86	WELL	68.2	30.7	14.2	0.9	0.010	<.001	8.8	326.	0	0.8	52.6	0.10	0.40	<.1
1986Q0136	6353	25N05W21CCC	02-Apr-86	WELL	52.6	27.9	21.	<.1	<.002	<.001		276.3	2.4	1.5	55.8	0.36	0.30	<.1
1986Q0969	6354	25N05W28BBCB01	28-Aug-86	WELL	67.2	50.3	79.2	1.7	0.021	0.003	11.6	337.	0	1.6	257.	0.26	0.60	<.1
1986Q0967	6355	25N05W28BBCB02	28-Aug-86	WELL	72.2	53.0	81.9	1.8	0.002	0.002	11.4	337.	0	1.6	283.	0.20	0.70	<.1

Miller Colony
Trace Elements

LOCATION	SAMPLE DATE	Sample ID	M: number	Al (ug/l)	As (ug/l)	B (ug/l)	Br (ug/l)	Cd (ug/l)	Cr (ug/l)	Cu (ug/l)	Pb (ug/l)	Li (ug/l)	Mo (ug/l)	Ni (ug/l)	Se (ug/l)	Ag (ug/l)	Sr (ug/l)	Ti (ug/l)	Va (ug/l)	Zn (ug/l)	Zr (ug/l)
25N05W16DDD	28-Aug-86	1986Q0971	6346	<30		<20	<100	<2	<2	<2		17	<20	<10		<2	800	5.	<1.	<3.	<4.
25N05W	09-Jun-83																				
25N05W	26-Jun-86																				
25N05W	19-Apr-90																				
25N05W19CBBBC	26-Aug-86	1986Q0970	6347	<30		<20	<100	<2	<2	<2		6	<20	<10		<2	470	5.	<1.	<3.	<4.
25N05W20DBAB	17-Jun-85	1985Q0580	6348	<30	0.2	50	<100	<2	<2	21.		10	<20	20.	<1	<2	630	15.	1.	100.	<4.
25N05W20DBAC	26-Aug-86	1986Q0966	6349	<30		70	<100	<2	<2	4.		13	<20	<10		<2	580	6.	<1	<3.	<4.
25N05W21CCC	02-Apr-86	1986Q0136	6353	<30		<20	<100	<2	<2	<2		7	<20	10.		<2	620	<1.	<1.	<3.	<4.
25N05W28BBBCB01	28-Aug-86	1986Q0969	6354	<30		110	<100	<2	<2	<2		36	<20	<10		<2	1520	6.	<1.	<3.	<4.
25N05W28BBBCB02	28-Aug-86	1986Q0967	6355	<30		110	<100	<2	<2	<2		36	<20	<10		<2	1640	7.	<1.	94.	<4.

STATE HEALTH DEPT.

WATER QUALITY BUREAU

HELENA, MONTANA 59620

STATE	MONTANA	COUNTY	TETON
LAT.-LONG.		SAMPLE LOCATION	
STATION CODE	0001649	ANALYSIS NUMBER	86W1624
DATE SAMPLED	06-26-86	DRAINAGE BASIN	410
TIME SAMPLED		WATER FLOW RATE	
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE		ALTITUDE OF LAND SURFACE	
WATER USE	PUBLIC SPLY	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SNL ABOVE(+) OR BELOW LS	
SAMPLED BY		SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: MILLER COLONY

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	46.1✓	2.300	DICARBONATE(MCO3)	357.5	8.858
MAGNESIUM (MG)	20.4✓	1.678	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	75.3✓	3.276	CHLORIDE (CL)		
POTASSIUM (K)			SULFATE (SO4)	67✓	1.395
			FLUORIDE (F)	.44✓	0.023
			PHOSPHATE(PO4 AS P)		
			NO3+NO2 (TOT AS N)	.62✓	0.044

SUM CATIONS	141.8	7.254	SUM ANIONS	425.5	7.320
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LABORATORY PH	7.75✓	TOT HARDNESS(MG/L-CACO3)	199
FIELD WATER TEMPERATURE (C)		TOT ALKALINITY(MG/L-CACO3)	293✓
UN-DISS. IONS MEAS.(MG/L)		LABORATORY TURBIDITY (NTU)	
LAB CONDUCTIVITY-UMHOS-25C	692✓	SODIUM ADSORPTION RATIO	2.3

A D D I T I O N A L		P A R A M E T E R S	
ARSENIC, TR (MG/L AS AS)	<.001✓	CADMIUM, TR (MG/L AS CD)	.001✓
LEAD, TR (MG/L AS PB)	<.005✓	MERCURY, TR (MG/L AS HG)	<.0002✓
SELENIUM, TR (MG/L AS SE)	<.002✓	CHROMIUM, TR (MG/L AS CR)	<.005✓
SILVER, TR (MG/L AS AG)	<.01✓	IRON, TR (MG/L AS FE)	<.01✓
MANGANESE, TR (MG/L AS MN)	.005✓	BARIUM, TR (MG/L AS BA)	.04✓

REMARKS: DRINKING WATER PROGRAM BOX 210-RTE 2-CHOTEAU 59422

NOTES: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
 ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
 TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

SAMPLE NO-	SAMPLER- DR	HANDLING-	ANALYST-LAB	LAB-	SCAN-NO				
COMPLETED-07/14/86	COMPUTER RUN-08/12/86	DATA-0684/PGM-0984	FUND-						
STND DEV. ION BALANCE=	CA	MG	NA	K	CL	SO4	MCO3	CO3	NO3
MPDES-	31.7	23.1	45.2	0.0	0.0	19.2	80.8	0.0	0.0
CALC. MEQ/L=	7.037	TO	7.778						86W1624

STATE HEALTH DEPT.

WATER QUALITY BUREAU

HELENA, MONTANA 59620

STATE MONTANA
 LAT.-LONG.
 STATION CODE 1649
 DATE SAMPLED 06-09-83
 TIME SAMPLED
 METHOD SAMPLED GRAB
 SAMPLE SOURCE
 WATER USE PUBLIC SPLY
 AQUIFER(S)
 SAMPLED BY WQB

COUNTY TETON
 SAMPLE LOCATION
 ANALYSIS NUMBER 93W1125
 DRAINAGE BASIN 41 U
 WATER FLOW RATE
 FLOW MEASUREMENT METHOD
 ALTITUDE OF LAND SURFACE
 TOTAL WELL DEPTH BELOW LS
 SWL ABOVE(+) OR BELOW LS
 SAMPLE DEPTH BELOW SURFACE

SAMPLING SITE: MILLER COLONY

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	148.0	7.388	BICARBONATE PLUS		
MAGNESIUM (MG)			CARBONATE (AS HCO3)	474.6	7.778
SODIUM (NA)	26.9	1.170	CHLORIDE (CL)		
POTASSIUM (K)			SULFATE (SO4)		
			FLUORIDE (F)	1.00	0.053
			PHOSPHATE (PO4 AS P)		
			NO3+NO2 (TOT AS N)	0.21	0.015

SUM CATIONS

174.9

8.555

SUM ANIONS

475.6

7.845

LABORATORY PH 8.50
 FIELD WATER TEMPERATURE (C)
 SI DISS. IONS MEAS. (MG/L)
 LA- CONDUCTIVITY-UMHOS-25C 825.0

TOT HARDNESS (MG/L-CACO3)
 TOT ALKALINITY (MG/L-CACO3) 389
 LABORATORY TURBIDITY (NTU)
 SODIUM ADSORPTION RATIO

A D D I T I O N A L

ARSENIC, TR (MG/L AS AS) < .001
 LEAD, TR (MG/L AS PB) < .005
 SELENIUM, TR (MG/L AS SE) < .002
 SILVER, TR (MG/L AS AG) < .01

P A R A M E T E R S

CADMIUM, TR (MG/L AS CD) < .001
 MERCURY, TR (MG/L AS HG) < .0002
 CHROMIUM, TR (MG/L AS CR) < .005
 BARIUM, TR (MG/L AS BA) .04

REMARKS: DRINKING WATER PROGRAM JAKE WIFE RT 2, BOX 110 CHOTEAU MT
 59432

EXPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS PER LITER
 ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
 (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS TR=TOTAL RECOVERABLE

SAMPLE NO- SAMPLER-KEB HANDLING- ANALYST-WAT LAB-WQB SCAN-NO
 COMPLETED-06/30/83 COMPUTER RUN-07/13/83 DATA-0383/PGM-0383 FUND-6254
 STD DEV. 10N BALANCE= CA MG NA K CL SO4 HCO3 CO3 NO3
 MODES- 86.3 0.0 13.7 0.0 0.0 0.0100.0 0.0 0.0
 CALC. MEQ/L= 8.454 TO 9.344 83W1125

STATE HEALTH DEPT.

WATER QUALITY BUREAU

HELENA, MONTANA 59620

STATE MONTANA
 LAT.-LONG.
 STATION CODE 0001649
 DATE SAMPLED 04-19-90
 TIME SAMPLED
 METHOD SAMPLED GRAB
 SAMPLE SOURCE
 WATER USE PUBLIC SPLY
 AQUIFER(S)
 SAMPLED BY

COUNTY TETON
 SAMPLE LOCATION 25N 5W
 ANALYSIS NUMBER 90W0834
 DRAINAGE BASIN
 WATER FLOW RATE
 FLOW MEASUREMENT METHOD
 ALTITUDE OF LAND SURFACE
 TOTAL WELL DEPTH BELOW LS
 SHL ABOVE(+) OR BELOW LS
 SAMPLE DEPTH BELOW SURFACE

SAMPLING SITE: MILLER COLONY

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	20.4✓	1.018	BICARBONATE(HCO3)	449.3	7.298
MAGNESIUM (MG)	10.5✓	0.864	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	174✓	7.569	CHLORIDE (CL)		
POTASSIUM (K)			SULFATE (SO4)	60.9✓	1.268
			FLUORIDE (F)	.98✓	0.050
			PHOSPHATE(PO4 AS P)		
			NO3+NO2 (TOT AS N)	.54✓	0.039

SUM CATIONS	204.9	9.451	SUM ANIONS	507.7	8.654
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LABORATORY PH	8.82✓	TOT HARDNESS(MG/L-CACO3)	94
FIELD WATER TEMPERATURE (C)		TOT ALKALINITY(MG/L-CACO3)	365✓
SUM-DISS. IONS MEAS.(MG/L)		LABORATORY TURBIDITY (NTU)	
LAB CONDUCTIVITY-UMHOS-25C	845✓	SODIUM ADSORPTION RATIO	7.8

A D D I T I O N A L		P A R A M E T E R S	
ARSENIC,TR (MG/L AS AS)	<.001✓	CADMIUM, TR (MG/L AS CD)	<.001✓
LEAD,TR (MG/L AS PB)	<.005✓	MERCURY, TR (MG/L AS HG)	<.0002✓
SELENIUM,TR (MG/L AS SE)	<.001✓	CHROMIUM,TR (MG/L AS CR)	<.005✓
SILVER, TR (MG/L AS AG)	<.001✓	IRON,TR (MG/L AS FE)	.01✓
MANGANESE,TR(MG/L AS MN)	<.005✓	BARIUM, TR. (MG/L AS BA)	.045✓

REMARKS: DRINKING WATER PROGRAM

NOTES: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVALENTS/L UG/L=MICROGRAMS/L
 ALL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
 TR=TOTAL RECOVERABLE (M)=MEASURED (R)=REPORTED (E)=ESTIMATED M=METERS

SAMPLE NO-	SAMPLER-WMG	HANDLING-	ANALYST-LAB	LAB-	SCAN-NO
COMPLETED-05/21/90	COMPUTER RUN-06/11/90	DATA-0684/PGM-0984	FUND-		
STND DEV. ION BALANCE=	CA	MG	NA	K	CL
MPDES-	10.8	9.1	80.1	0.0	0.0
14.8	65.2	0.0	0.0		
CALC. MEQ/L=	8.668 TO	9.581			
					90W0834

RECEIVED
AUG - 5 1998

D.E.O.
FILES

C X N P
01649-502

ENERGY
LABORATORIES

ENERGY LABORATORIES, INC.

AUG - 7 1998

Client: Miller Colony
Date Sampled: 16-JUL-98 12:00
Date Received: 17-JUL-98
Analysis Date: 21-JUL-1998 20:04
File: /chem/IONTRAP2.1/vc072198.b/9846466a.d
Project Info:
Sample Info:

ENTERED

INITIAL

DATE

Lab No.: 98-46465

Report Date: 07/27/98

Extraction Method: EPA 5030

Sample Matrix: WATER pH = < 2

Correspondence

Chlorine/Turbidity

EPA METHOD 524.2 = ND

VOLATILE ORGANICS ANALYSIS REPORT

CONCENTRATION UNITS = ug/L (ppb)

COMPOUNDS	CAS NO.	EPA MCL	RESULT	QUALIFICATION
-----REGULATED VOLATILE ORGANIC CHEMICALS (VOC'S)-----				
Benzene	71-43-2	5	<0.50	U
Carbon Tetrachloride	56-23-5	5	<0.50	U
Chlorobenzene	108-90-7	100	<0.50	U
1,2-Dichlorobenzene	95-50-1	600	<0.50	U
1,4-Dichlorobenzene	106-46-7	75	<0.50	U
1,2-Dichloroethane	107-06-2	5	<0.50	U
1,1-Dichloroethene	75-35-4	7	<0.50	U
cis-1,2-Dichloroethene	156-59-2	70	<0.50	U
trans-1,2-Dichloroethene	156-60-5	100	<0.50	U
1,2-Dichloropropane	78-87-5	5	<0.50	U
Ethylbenzene	100-41-4	700	<0.50	U
Methylene Chloride	75-09-2	5	<0.50	U
Styrene	100-42-5	100	<0.50	U
Tetrachloroethene	127-18-4	5	<0.50	U
Toluene	108-88-3	1000	<0.50	U
1,2,4-Trichlorobenzene	120-82-1	70	<0.50	U
1,1,1-Trichloroethane	71-55-6	200	<0.50	U
1,1,2-Trichloroethane	79-00-5	5	<0.50	U
Trichloroethene	79-01-6	5	<0.50	U
Vinyl Chloride	75-01-4	2	<0.50	U
m+p-Xylenes	108383/106423		<0.50	U
o-Xylene	95-47-6		<0.50	U
Total Xylenes		10000	<0.50	U

-----REGULATED VOC'S: TRIHALOMETHANES-----

Bromodichloromethane	75-27-4	Total	6.2
Bromoform	75-25-2	of all	0.53
Chlorodibromomethane	124-48-1	four	4.5
Chloroform	67-66-3	100	7.4

-----OTHER EPA LISTED VOC'S-----

Bromobenzene	108-86-1	NR	<0.50	U
Bromochloromethane	74-97-5	NR	<0.50	U
Bromomethane	74-83-9	NR	<0.50	U
n-Butylbenzene	104-51-8	NR	<0.50	U
sec-Butylbenzene	135-98-8	NR	<0.50	U
tert-Butylbenzene	98-06-6	NR	<0.50	U
Chloroethane	75-00-3	NR	<0.50	U
Chloromethane	74-87-3	NR	<0.50	U
2-Chlorotoluene	95-49-8	NR	<0.50	U
4-Chlorotoluene	106-43-4	NR	<0.50	U
1,2-Dibromo-3-chloropropane	96-12-8	NA	<0.50	U

(report continued on page 2)

Lab No.: 98-46466
Sample Info:

Page 2

EPA METHOD 524.2
VOLATILE ORGANICS ANALYSIS REPORT (continued)

CONCENTRATION UNITS = ug/L (ppb)				
COMPOUNDS	CAS NO.	EPA MCL	RESULT	QUALIFIER
1,2-Dibromoethane	106-93-4	NA	<0.50	U
Dibromomethane	74-95-3	NR	<0.50	U
1,3-Dichlorobenzene	541-73-1	NR	<0.50	U
Dichlorodifluoromethane	75-71-8	NR	<0.50	U
1,1-Dichloroethane	75-34-3	NR	<0.50	U
1,1-Dichloropropene	563-58-6	NR	<0.50	U
1,3-Dichloropropane	142-28-9	NR	<0.50	U
cis-1,3-Dichloropropene	10061-01-5	NR	<0.50	U
trans-1,3-Dichloropropene	10061-02-6	NR	<0.50	U
2,2-Dichloropropane	594-20-7	NR	<0.50	U
Fluorotrichloromethane	75-69-4	NR	<0.50	U
Hexachlorobutadiene	87-68-3	NR	<0.50	U
Isopropylbenzene	98-82-8	NR	<0.50	U
p-Isopropyltoluene	99-87-6	NR	<0.50	U
Methyl t-butyl ether	1634-04-4	NR	<0.50	U
Naphthalene	91-20-3	NR	<0.50	U
n-Propylbenzene	103-65-1	NR	<0.50	U
1,1,1,2-Tetrachloroethane	630-20-6	NR	<0.50	U
1,1,2,2-Tetrachloroethane	79-34-5	NR	<0.50	U
1,2,3-Trichlorobenzene	87-61-6	NR	<0.50	U
1,2,3-Trichloropropane	96-18-4	NR	<0.50	U
1,2,4-Trimethylbenzene	95-63-6	NR	<0.50	U
1,3,5-Trimethylbenzene	108-67-8	NR	<0.50	U

SURROGATE RECOVERY REPORT

Surrogate Compound	Added ug/L	Measured ug/L	%Rec	QC Limits
1,2-Dichloroethane d4	10.0	10.8	108	80--120
Toluene d8	10.0	9.11	91	80--120
p-Bromofluorobenzene	10.0	9.60	96	80--120

QUALIFIER CODE EXPLANATIONS AND NOTES:

U= Indicates compound was analyzed for but not detected.

NR= No currently regulated amount.

NA= Not applicable to this method. Concentrations are presented for screening purposes. For regulatory compliance, analyze using EPA method 804 which has lower detection limits.

REPORT COMMENTS: None

Analyst: THC Reviewing Supervisor: MTS

REVIEW	
INITIAL	DATE
AUG - 7 1998	
ENTERED	
INITIAL	DATE

APPENDIX C

Field Inspection Photographs



Photograph taken February 22, 1999 of the spring supplying the Miller Colony wash water system, looking north.



Photograph taken February 22, 1999 of Miller Colony potable supply well #1 , looking northeast.



Photograph taken February 22, 1999 of Miller Colony potable supply well #2, looking north.