September 21, 1994

Mr. Paul Lienau
Director
GeoHeat Center
Oregon institute of Technology
Klamath Falls, OR 97601

Dear Paul:

Enclosed is the requested information regarding priority sites in Montana. I regret to say that I will be unable to attend the GRC Annual Meeting since funding for this project terminated in June.

I did not include estimates of project cost. Such costs as drilling and geophysical exploration are difficult to estimate without a more detailed review of the geology and hydrogeology at these sites. I am certainly willing to do this review, but would require more time.

If you need other infomation than what I have provided, please let me know.

Sincerely,

John Metesh

cc: Mr. Howard Ross
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, Utah 84108-1295

PRIORITY AREAS FOR PHASE II STUDIES

The dominant consideration in selecting areas in Montana for future studies is the proximity of the resource area to transportation and population centers. Although there are several resource areas with a relatively high potential for development, limited past and/or current use and low population in the area likely prohibit development. The areas that have the highest potential and are nearest population centers (Figure 1) and transportation routes are as follows:

BOZEMAN

- The Gallatin valley near Bozeman has experienced a steady population growth over the last decade. Data for the Bozeman Hot Springs just west of the city of Bozeman indicates a surface temperature of approximately 55°C and an estimated reservoir temperature of 80°C.
- The springs are currently used to heat a swimming pool at a commercial campground.
- Although little resource development has occurred in the area over the last ten years, the Gallatin valley was identified by Sonderegger and others (1981) as an area expected to contain geothermal resources suitable for development.
- The population near the Bozeman Hot Springs may be large enough to warrant direct use for heating/cooling, As the economic base for the area grows, small-scale applications for greenhouses and light industrial processes may also utilize geothermal resources
- Current knowledge of the resource is restricted to small-scale geophysical and geological studies. Geophysical exploration and deep drilling would be needed to better define the source and extent of this resource area.

BUTTE

The Butte Mining District was extensively mined over a period of nearly 100 years. At the cessation of underground mining in the early 1980's, dewatering of the bedrock was discontinued and water-levels were allowed to rise. Soon after the mines were shut down, the area was listed in the National Priorities List and is designated as a Superfund site. The rising water, which has a low pH and a high dissolved-metals content, is of much to concern to local, state, and federal agencies, and it has been recognized that water-levels will need to be controlled by pumping to prevent discharge into the Clark Fork River drainage.

- The Butte area offers several avenues for low-to-moderate temperature resources. The underground workings were notoriously hot areas to work in while operating. Recent data collected from the mines show water temperatures ranging from 13° to 33°C. Monitoring wells completed in the bedrock aquifer at depths less than 183 meters indicate temperatures of 10 to 18°C, and water quality is quite good. Diamond drill holes with depths up to 610 meters and open mine shafts may provide access to the deeper, warmer waters.
- At present, geothermal resources are not being used in the Butte area.

- An evaluation of depth, temperature, and potential applications of heat-pump technology is needed.

ENNIS

The Ennis area, near Yellowstone Park, is in an area where cottage-industry and tourism are dominant.

- Surface water temperatures range from 81 to 87°C and reservoir temperatures range from 90 to 164°C
- Current use of the geothermal resources is limited to a greenhouse application. Application of the resource for heating of the county-owned hospital was proposed but has not yet been realized.
- Several studies of the geothermal resources near Ennis have been conducted in the past; however, a deep drilling project is needed to fully understand the nature of this resource area. Application of the information derived from previous studies to an investigation of potential direct-heat applications may also be warranted.

BOULDER HOT SPRINGS

The Boulder Hot Springs is within a few miles of Interstate-highway 15 and the town of Boulder is only 1/2 mile from it. Larger cities, Butte to the south and Helena to the north, are within 30 miles.

- The surface temperatures at the three springs sampled range from 54 to 74°C, and flow is approximately 340 L/min. at the larger spring. The site is currently undergoing renovation.
- The likelihood of other geothermal resources in the area is high. An inventory of springs and wells throughout the valley and a deep drilling project is needed to better define this potential resource area.

CAMAS PRAIRIE

There are several previously un-recorded springs in this area; one site, with a surface temperature of 23.7°C and an estimated flow of 2000L/min, was sampled recently.

- Although the area is not near any of the larger population centers, there are some recreational facilities in the area. This particular area of Montana has been especially popular for cottage-industry development. There is no application of geothermal resources at present.

- A more complete well and spring inventory, coupled with a water-chemistry sampling program is needed to better define the occurrence and potential development in this area.

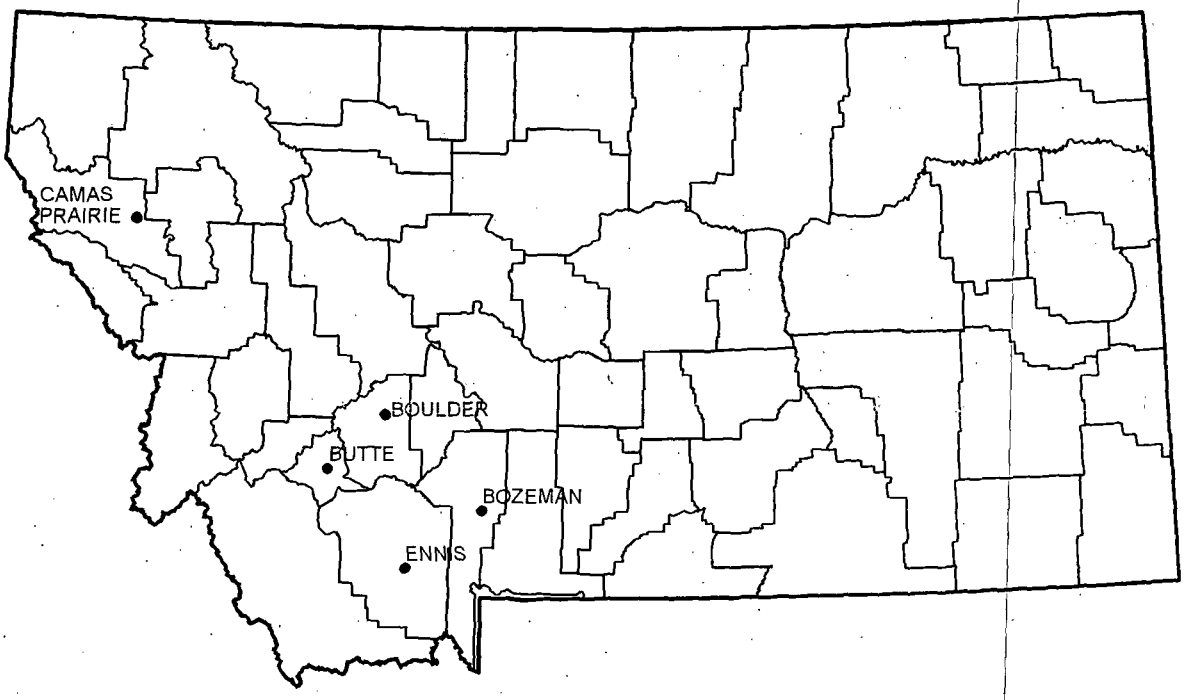

Figure 1 Five areas have been selected as potential areas for additional studies relating to application of direct-use technology.

MONTANA TECH
of The University of Montana

Montana Bureau of Mines and Geology
1300 West Park Street
Butte, Montana 59701-8997
(406) 496-4180

May 9, 1995

Dr. Howard Ross
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, UT 84108-1295

Dear Howard:

Enclosed herewith is a draft report entitled, "Ground Source Heat Pump System Near Helena, Montana - Loop Temperature Analysis" that describes two years of monitoring. The report must be reviewed before receiving approval for release. Would you or someone on your staff review this report and send comments and criticisms to me? Shortly after the responses are in, I will be able to send you the final report. Please let me know, also, how many final copies you would like.

Very truly yours,

Wayne Van Voast

Wayne Van Voast

Enclosure
WVV/bb

GROUND-SOURCE HEAT PUMP SYSTEM

NEAR HELENA, MONTANA

Loop Temperature Analysis

May, 1995

WAYNE VAN VOAST

Montana Bureau of Mines and Geology

Montana Tech of the University of Montana

GROUND-SOURCE HEAT PUMP SYSTEM NEAR HELENA, MONTANA
Loop Temperature Analysis

WAYNE VAN VOAST
MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE

Introduction

Use of ground-source heat pump systems for domestic heating is increasing in Montana, particularly in rural settings where relatively inexpensive natural gas is not available. The systems also provide cooling, but in Montana's climate, this capability is not highly regarded nor used except in commercial installations such as office buildings. In these, it is reported that the cooling option of the systems sees far greater use than the heating.

Heat pumps utilizing ground or water energy have been in common use in temperate parts of the United States for many years. Only within the last decade or so has the technology of design and operation developed to provide adequate heat efficiently in northern states. In Montana, most ground-source heat pump systems have been installed in Flathead and Yellowstone Counties. There, the electric co-ops provide various inducements to encourage use of the systems. The Northern Rockies Ground Source Heat Pump Association estimates that 1300 domestic systems and 50 commercial systems are now in operation in Montana (Jim Maunder, personal communication, May 4, 1995). An additional 100

domestic systems and 1 commercial system are reported by the Montana Power Company (Connie Moran, personal communication, May 8, 1995).

Along with the emergence of the ground-source heat pump as a viable provider of domestic and commercial heating, literature on the technology has evolved. Four publications consulted in this study and thought to be particularly informative, are the "Water Source Heat Pump Handbook", by Dexheimer (1985); "Earth-Coupled Heat Transfer", by Hart and Couvillion (1986); "The Montana House Project", by Jackson (1989); and, "Geothermal Heat-Pump Systems: the ABC's of GHP's", by Wright and Colvin (1993).

A ground-source heat pump system absorbs heat from the ground and transports it to a heat pump which extracts the heat to warm the household air. Excess heat from the pump is used to augment the heat of the home's hot water heater. The heat absorbed from the ground is presumed to be "stored solar heat" by many scientists and engineers, and is declared to be "geothermal heat" by many others.

Ground-source systems are closed systems in which tubing charged with non-freezing fluids is buried near the homes, or in some cases, is submerged in surface-water bodies. The fluid is pumped through a system continuously during operation and through a heat pump which, using a small compressor and a

refrigerant such as freon, extracts heat from the circulating fluid. The systems are "closed" because there is no physical interaction between the loop fluid or the refrigerant and the outside environment, including air, ground, or water. The main advantage to the use of heat pumps is the exceptionally high efficiency (200% to about 400%) afforded by the Carnot Cycle of refrigerant compression and expansion. These efficiencies are commonly expressed in terms of "coefficient of performance" (COP). A COP of four designates 400% efficiency for a system which provides 4 energy units for each energy unit consumed.

A special comment is made here on the non-freezing fluids commonly used in loop systems. In some places the industry standard is a 20% methanol solution, which is highly toxic. Many people in the business respond to questions of toxicity by referring to "non-toxic methanol" in their systems. There is no such thing. A fatal one-time dose of methanol may be as small as 25 milliliters (about 3/4 ounce), according to Kirk-Othmer (1981, p. 411). Blindness is the typical result from less-than-fatal doses. A typical loop system contains about 60 gallons of fluid which, having a 20% methanol content, would include about 12 gallons of methanol. The concentration in the loop would be about 158,000 parts per million. These comments are made partially to discourage use of methanol in loop systems, but primarily to oppose advertising that a 20% methanol solution is "non-toxic". Some states now prohibit use of methanol in the loops, notably Minnesota, North Dakota

and Ohio. A non-toxic fluid, propylene glycol, seems to be a reasonable substitute although somewhat more viscous and more expensive.

Objectives

The Objective of this study has been to evaluate temperature changes in loop fluid at a system near Helena, Montana, through two household heating seasons; the winters of 1992-93 and 1993-94. Specifically, the temperature drawdown of the earth-coupled system during heat extraction has been monitored and evaluated. The temperature declines each season and any residual decline overlapping from the first season to the second were objects of monitoring. In interpreting the data, an objective was to examine a quantitative way to evaluate loop temperatures in order to characterize these systems during normal operating conditions.

Move to just before references.

Acknowledgments

Monitoring and other activities described in this report were funded in part by the U.S. Department of Energy's Low-Temperature Geothermal Resources and Technology Transfer Program, administered through the University of Utah Research Institute, Salt Lake, and through the Geo-Heat Center at the Oregon Institute of Technology, Klamath Falls. Additional funding and power-consumption data were provided by the Montana Power Company, Butte. Support by the

Montana Bureau of Mines and Geology, Butte, and colleagues John Metesh, Sharon Miller and Pat Tamarin is also gratefully acknowledged.

System Description

The house, heat pump, and ground-loop system are generalized below:

House:
5699 Rainbow Drive, Helena, Montana
4056 ft^2 floor area
Super Good Cents Construction

Heat Pump:
Command Aire SWPR 411 GSS (3½ ton)

Loop System:
Verticle (drill holes) construction, three holes, 10-foot spacing, 235 feet deep, fractured shale formation, water table at about 10 feet, two pipes 0.86 I.D. per hole manifolded in parallel to one horizontal main 2 - pipe leg 1.55 I.D. to house. Charged with propylene glycol solution.

The system is generalized in Fig. 1, and detail on sizing and design is provided in APPENDICES A and B, which are the specifications and calculations developed for installation.

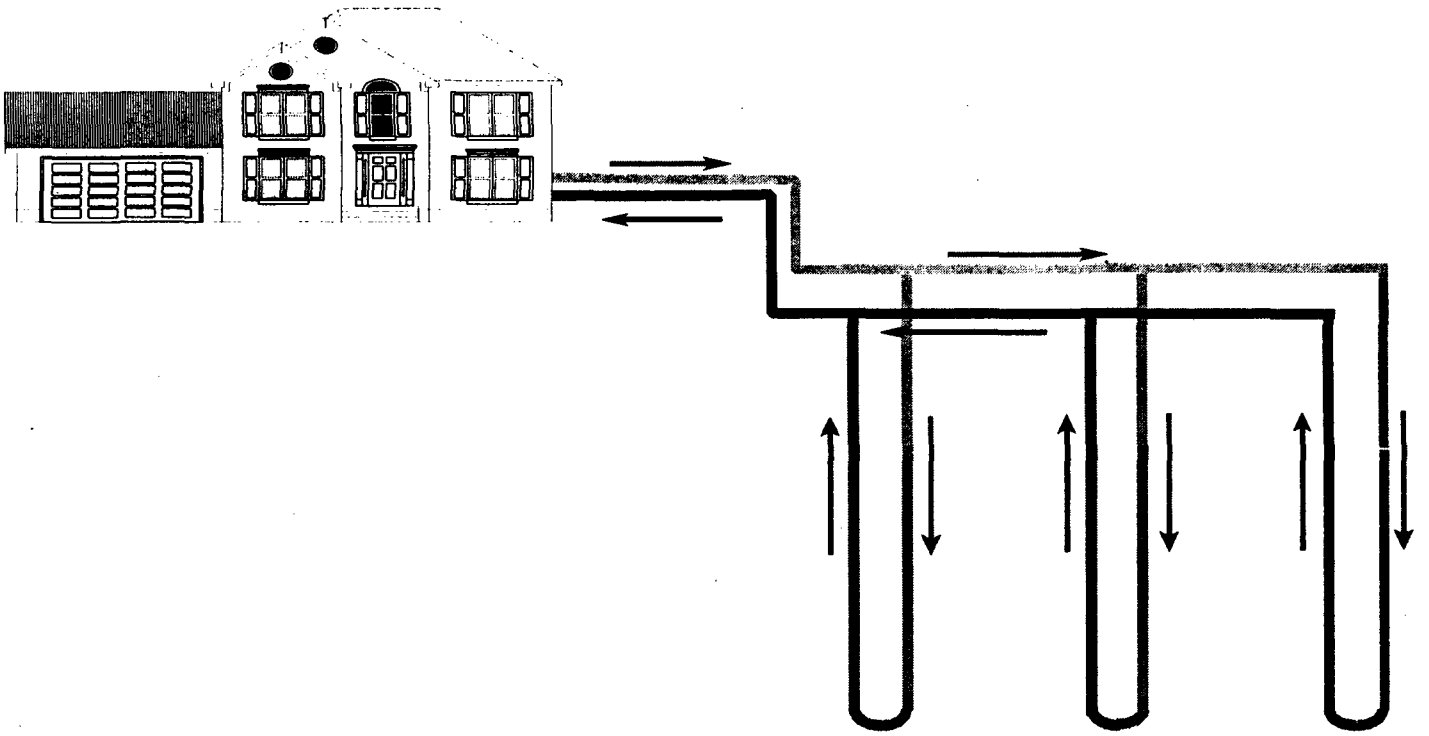

Figure 1. The ground-source heat pump system consists of a heat pump with forced-air distribution within the house, and a vertical loop outside the house. The loop is made from small-diameter polyethylene pipe inserted in three drill holes, each 235-feet deep. The vertical pipes are manifolded in parallel to a 90-foot horizontal pipe leading to the house.

Operating Costs, Owner Satisfaction, Problems

From beginning operation on April 12, 1991 until March 23, 1995, the system has drawn 44,670 KWH (kilowatt-hours) of energy. Of these, 887 KWH were used by a resistance strip heater to augment the heat pump output and the remaining 43,783 KWH served the heat pump providing household heat and supplemental heat for the hot water heater. The strip heater use was mostly frivolous, done in experimentation with various thermostat settings. Over the 3.95 years of operation, energy consumption averaged 11,310 KWH per year, about 20 percent greater than that predicted (9,518 KWH per year) by the installers' computer design program (APPENDIX B). Likewise, the predicted annual heating and cooling cost of $598 was exceeded by 16% in the actual average of $692. The cause for the discrepancy is unknown, and may be unique to this particular installation or may require a different application of general design criteria.

In spite of the less-than-predicted economy, the owner is generally satisfied with the system and particularly the concept. Lack of open-flame or resistance heating provides a clean heat, quietly distributed by the forced-air system.

The system is not entirely trouble free, however, and acknowledging the many more moving parts (pumps, valves, compressor) than conventional systems, the owner expects the inevitable occasional repair. During the first 4 years of operation, only one operational problem has appeared. Chronically, the system

loses pressure to the point where cavitation in the loop's circulating pumps becomes unbearably noisy. The problem occurs regularly, but only once a year. At first a puzzle, its cause became only apparent through this program of monitoring the loop-fluid temperature. The pressure losses occur each spring when loop temperatures begin to warm after having reached their late-winter lowest levels. Expansion of the polyethylene tubing during warming creates the loop pressure deficiencies. The first occurrence prompted a service call for flushing and repressuring the loop. Because of distance and cost for service calls, the owner then devised a simple method of restoring pressure without introducing air to the loop. Reason for fluid loss during subsequent heating (loop-cooling) seasons is not known, but it can only be concluded that a small leak is present in the system. Fluid volume required to replace the loss is small, about a half pint; and pressure needed to resume quiet operation is about one psi. The process is simple enough that it is no major inconvenience, but in the event of sale of the house, realtors and prospective buyers would be troubled by the condition. A small constant-pressure reservoir could be designed and attached as an integral part to a loop, and could require maintenance of a specified range of fluid levels. Adding fluid periodically would then be a normal operation, not intimidating to the owner.

Instrumentation and Methods

Under agreement with the Montana Power Company, separate meters were installed at the residence to monitor energy consumption of the heat pump, the

electric hot-water heater, and the auxiliary strip heater (Fig. 2). Only the records for the heat pump are used in this report. The utilities meter recorded kilowatt-hours of consumption at 15-minute intervals, accessed by data logger. The daily power consumption, as calculated from the 15-minute KWH readings, provided two levels of data for this report. First, the daily KWH usage multiplied by 3413 gave the BTU consumption needed for estimating the system's Coefficient of Performance. A Coefficient of Performance (COP) of 3.10 was estimated using the loop flow rate and differences between entering and exiting loop temperatures. Precision of the estimated COP is not great, and the assumption that it is a constant is only for convenience. Secondly, the percent-time-of-operation was calculated by dividing the actual KWH usage by the energy draw for continuous operation (empirically determined).

To obtain minimum daily loop temperatures the loop was originally monitored continously, creating a major problem of data handling. Examination of the energy consumption records (Fig. 2) showed that the coldest loop temperatures coincided with periods of longest heat-pump operation, and that these were normally in the very early morning hours. The temperature recorder was therefore set to record only during the one-hour interval between 5:30 a.m. and 6:30 a.m. each day. This generated an acceptably workable amount of data and seemed to meet the project

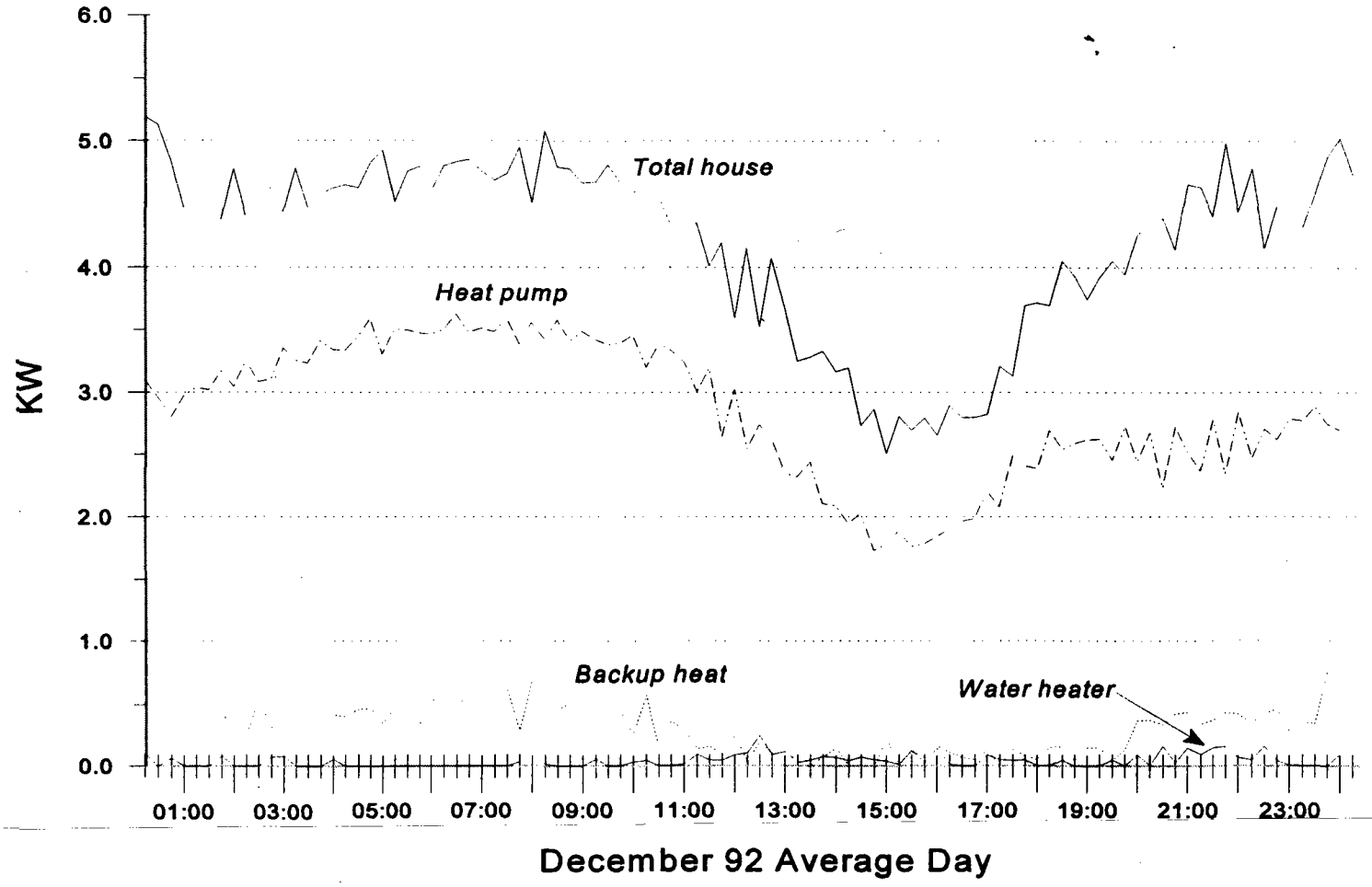

Figure 2. Normally the heat pump operated most continuously between midnight and about 9:00 A.M.. Minimum daily loop temperatures were obtained from data recorded between 5:30 A.M. and 6:30 A.M. each day.

objectives. The recorded temperatures are considered to be daily minimum loop temperatures entering the heat pump system and to represent earth temperatures along the buried vertical and horizontal tubing.

Data

Minimum daily outside air temperatures (Fig. 3) during the 1992-93 heating season fell to about -20°F for brief periods, and during the 1993-94 season dropped below -30°F on one occasion. The first season was generally the colder with most minimum daily temperatures in the range between -20°F and +20°F. In early 1993, the cold weather was interrupted by about six weeks of above-zero temperatures. Only for a few days in the second season, were the minimum daily temperatures below 0°F.

Minimum daily loop temperatures (Fig. 3) corresponded well to outside air temperatures. Lowest loop temperatures occurred during the periods of coldest weather, reflecting greater heat-pump usage. The correlation between loop temperatures and outdoor temperatures is surprisingly good, considering the human factors of thermostat adjustments and other domestic variables. Most important to this report are the periods of more-or-less progressive loop temperature declines at the beginning of each heating season. These are the periods, 11/17/92 through 3/16/93 including the warmer interlude, and 10/16/93 through 2/12/94. These were times of increasing thermal demands on the loop system, separated by

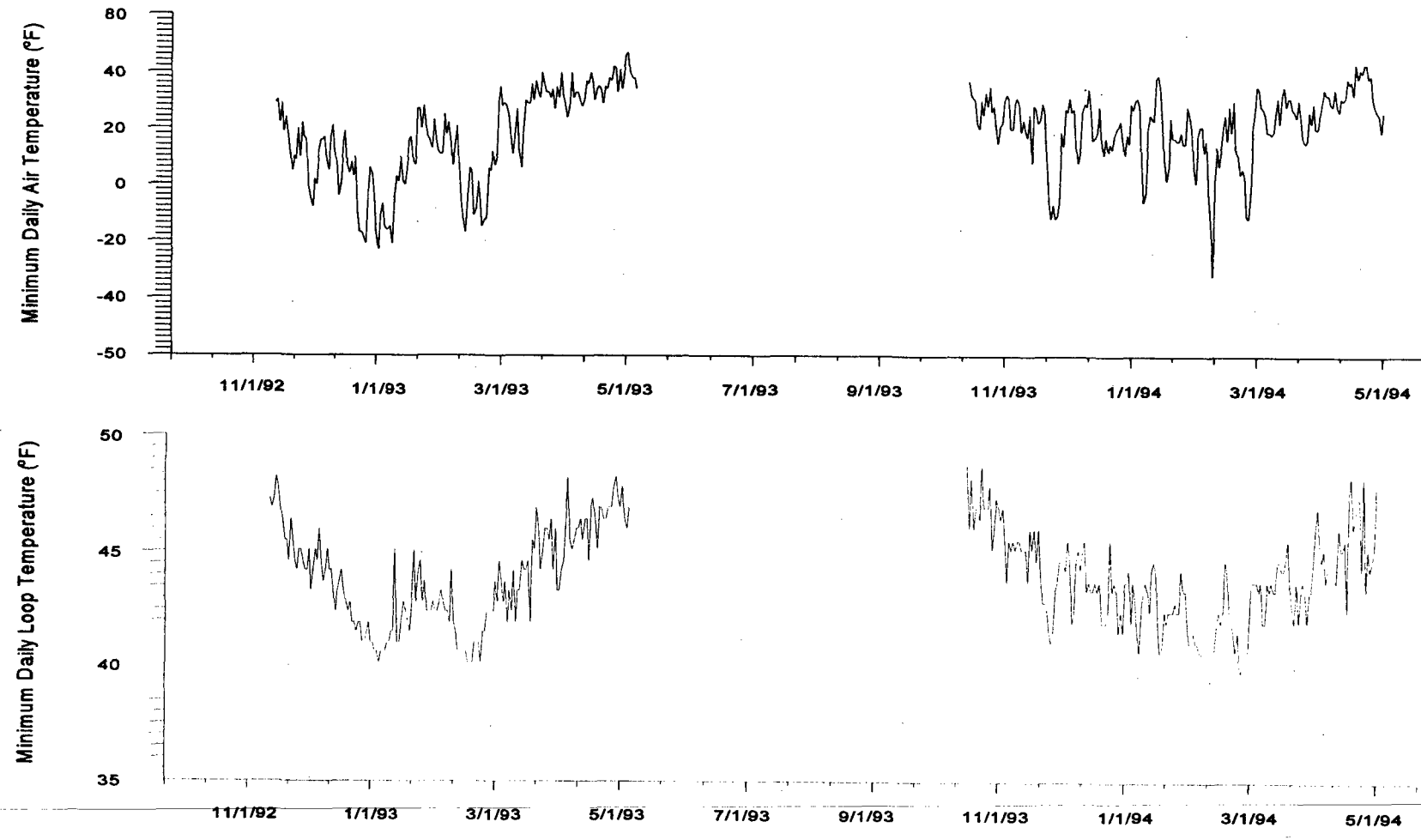

Figure 3. The 1992-93 heating season was generally colder than the 1993-94 season. Loop temperatures correspond to outside air temperatures.

a period of temperature recovery in the summer of 1993. Maximum loop temperature decline for the first season was 8.3^0 F and for the second season was 8.8^{0}F, in spite of the latter's warmer weather. Heat production during the first heating season (120 days) was more that 76 million BTU (Fig. 4) as calculated from metered energy consumption and a COP of 3.10. In the second heating season (also 120 days) heat production was about 71 million BTU. So far as can be seen from the data, loop temperature recovery following each heating season was complete. Following only two cycles however, very precise data would likely be necessary to detect any long-term trend of decline.

Discussion

One objective of the loop-system monitoring was to try to develop a quantitative way to evaluate and compare these systems in situ, after installation and during normal operating conditions. A technique developed for evaluating aquifers and ground-water discharge was examined for this, because of the analogy between heat flow and ground-water flow. The basic equations employed in hydrologic studies were, in fact, developed from thermodynamic equations. The hydrogeologic technique applied to the loop-temperature data is the Jacob (1950) semilogarithmic method of solution for transmissivity of an aquifer from which water is pumped under certain specific conditions.

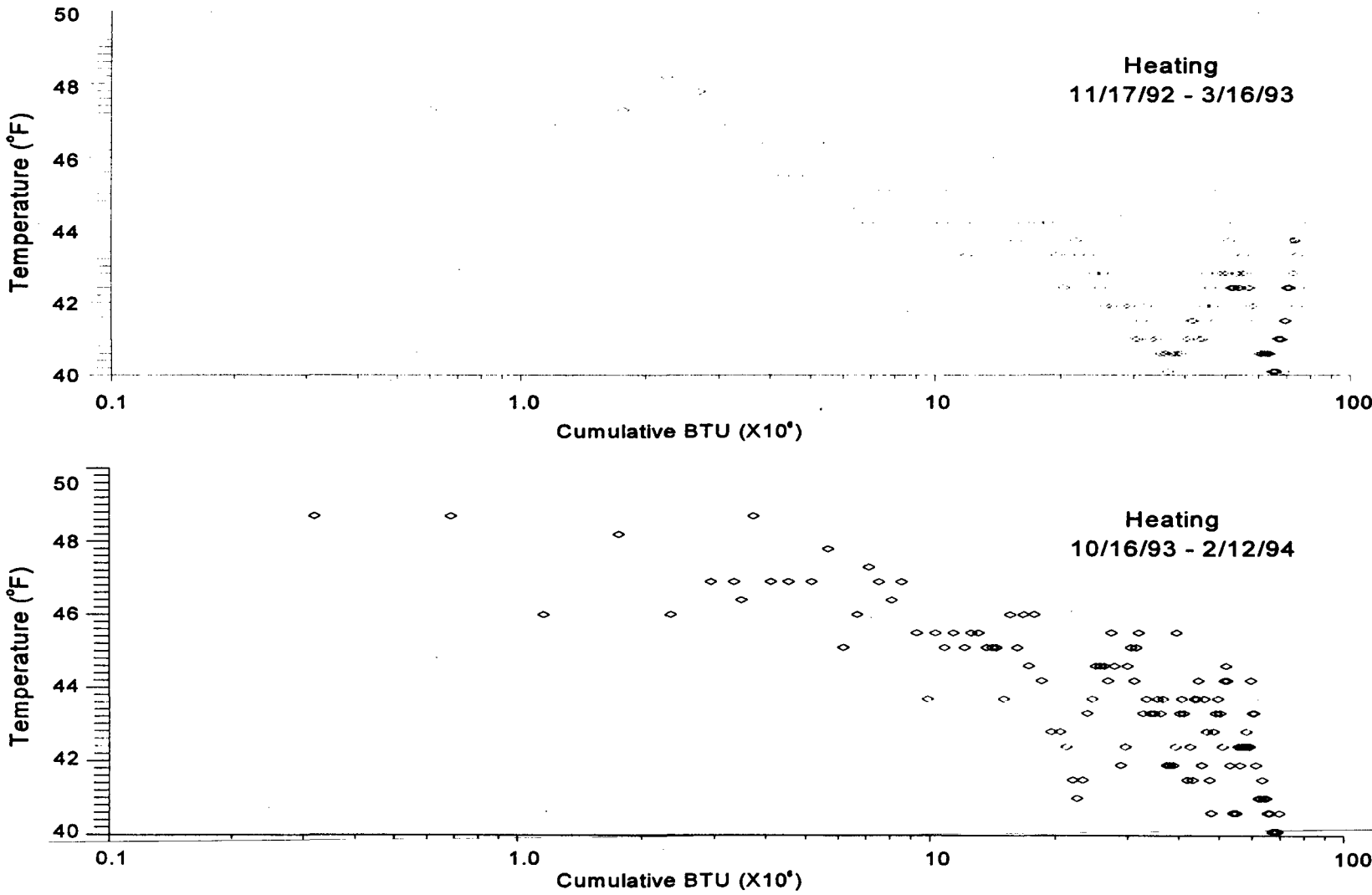

Figure 4. During the 120-day, 1992-93 heating season, 76 million BTU were produced by the system. During the 120-day, 1993-94 heating season, 71 million BTU were produced.

The equation for Jacob's approximation is $K = \frac{2.3Q}{4\pi m(s/\log \text{ cycle } t)}$

where contains the terms:

K = hydraulic conductivity
Q = pumping rate (quantity/time)
m = aquifer thickness
s = drawdown (pressure or water-level decline)
t = time.

The following heat flow terms and units were substituted into Jacob's approximation:

C = thermal conductivity (BTU/hr - ft - °F)
Q = heat withdrawal rate (BTU/hr)
d = length of loop piping (ft)
ΔT = temperature decline (°F)
t = time.

This gives the following approximation for estimating thermal conductivity:

$$C = \frac{2.3Q}{4\pi d(°F/\log \text{ cycle } t)}$$

There is no precedent for developing heat-flow solutions using hydrodynamic equations. The analogies are clear, however, between heat-flow, electricity, and hydrodynamics. Most importantly, the equations for ground-water flow were originally developed from thermodynamics; solutions found in this study suggest that a reverse application should be valid. Jacob's approximation is in fact, a field simulation of the laboratory method of measuring thermal conductivity described by Hart and Couvillion (1981, p. 101), and can be derived from their equation.

1981 or 1986

Temperature declines for the initial parts of the two heating seasons were

Temperature declines for the initial parts of the two heating seasons were plotted against time (days) on semi-logarithmic graph paper (Fig. 5). A key condition for Jacob's approximation could not rigorously be met with the heat pump operation, however. A satisfactory solution requires a constant rate of heat withdrawal. Average daily rates of heat production resulting from the outside temperature extremes (Fig. 3) and the human factors of thermostat adjustments (hopefully kept to a minimum) ranged from about 7,000 BTU/hr to about 40,000 BTU/hr during the first season, and about 5,900 BTU/hr to 41,000 BTU/hr during the second season; average production rates were 26,450 BTU/hr and 24,670 BTU/hr, respectively. The extreme variations of loop temperature caused by variations of heat production gave a scatter to the points on Fig. 5 that discourages any precise quantitative analysis.

not that bad — a fair approximation!

Regardless of the poor data plots, the approximations for both years are presented here to examine whether the technique might have merit under conditions of greater control. Visual best-fit straight lines on the two semi-log plots give temperature declines of 3.60°F and 3.35°F per log cycle, respectively. Combined into Jacob's approximation with the average 120-day heat production rates of 26,450 BTU/hr and 24,670 BTU/hr, the temperature declines indicate a thermal conductivity of 0.89 BTU/hr-ft-°F. The duplicative result for two seasons in spite of broad spreads of data points suggests that the approximation technique may have merit. The implied thermal conductivity of 0.89 BTU/hr-ft-°F compares

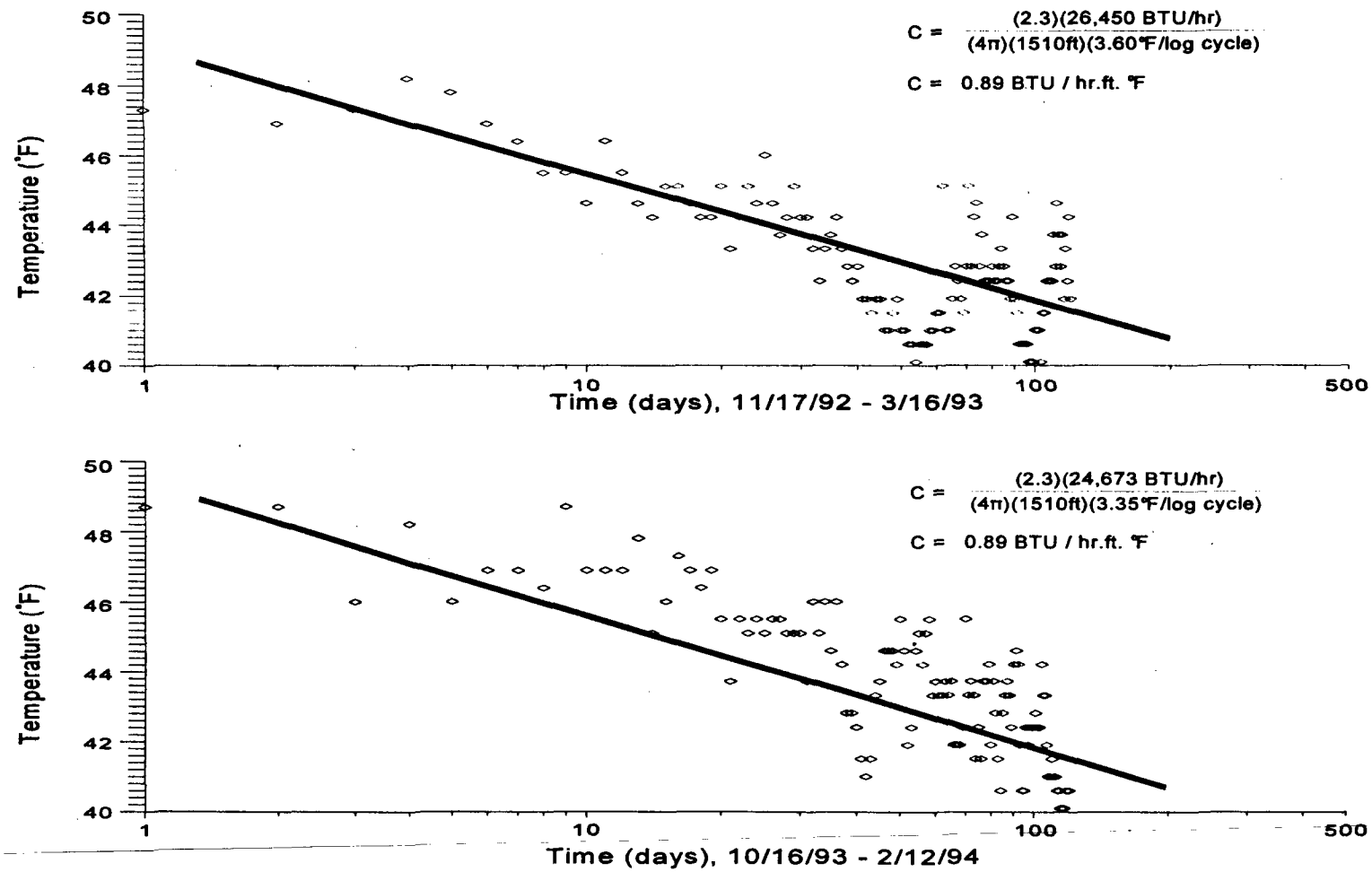

Figure 5. Semi-log plots of loop temperature versus time can be used to estimate thermal conductivity at ground-source heat-pump installations.

reasonably with the values of 0.75 and 0.266 BTU/hr-ft-^{0}F for the soil and the polyethylene pipes, respectively, used in designing the loop system (Appendix B). The 0.89 BTU/hr-ft-°F value is also within the range (0.59 to 3.33 BTU/hr-ft-°F) given by Hart and Couvillion (1986, p. 131) for a shallow water-table condition in sandstone and shale. The 0.89 BTU/hr-ft-°F value is also well within the range of 0.75 to 2.00 BTU/hr-ft-°F given by Dexheimer (1985, p. 79) for bedrock materials. The combination of vertical and horizontal, with pipes of two diameters, and with variations of soil moisture probably preclude any precise calculation for thermal conductivity at any site. The advantage hoped for in this in-situ approximation has been to avoid these specifics to estimate actual operational values. It appears that the approximation method applied here may be useful, but would be greatly improved with more uniform patterns of operation.

Semilog plots of temperature decline may also predict declines for other heat-production rates (Fig. 6). For any selected thermal conductivity value, the temperature decline (°F/log cycle t) in Jacob's approximation, varies directly with the rate (BTU/hr) of heat produced. In 1992-93, the system operated 66% of the time and in 1993-94, the system operated 61% of the time. By simple ratios, the hypothetical temperatures for 100% and 50% operation are shown on Fig. 6; they are identical for each year. Similarly, any other percent-operating time can be projected and will not vary from year-to-year unless changes occur in the earth heat source or in system efficiency.

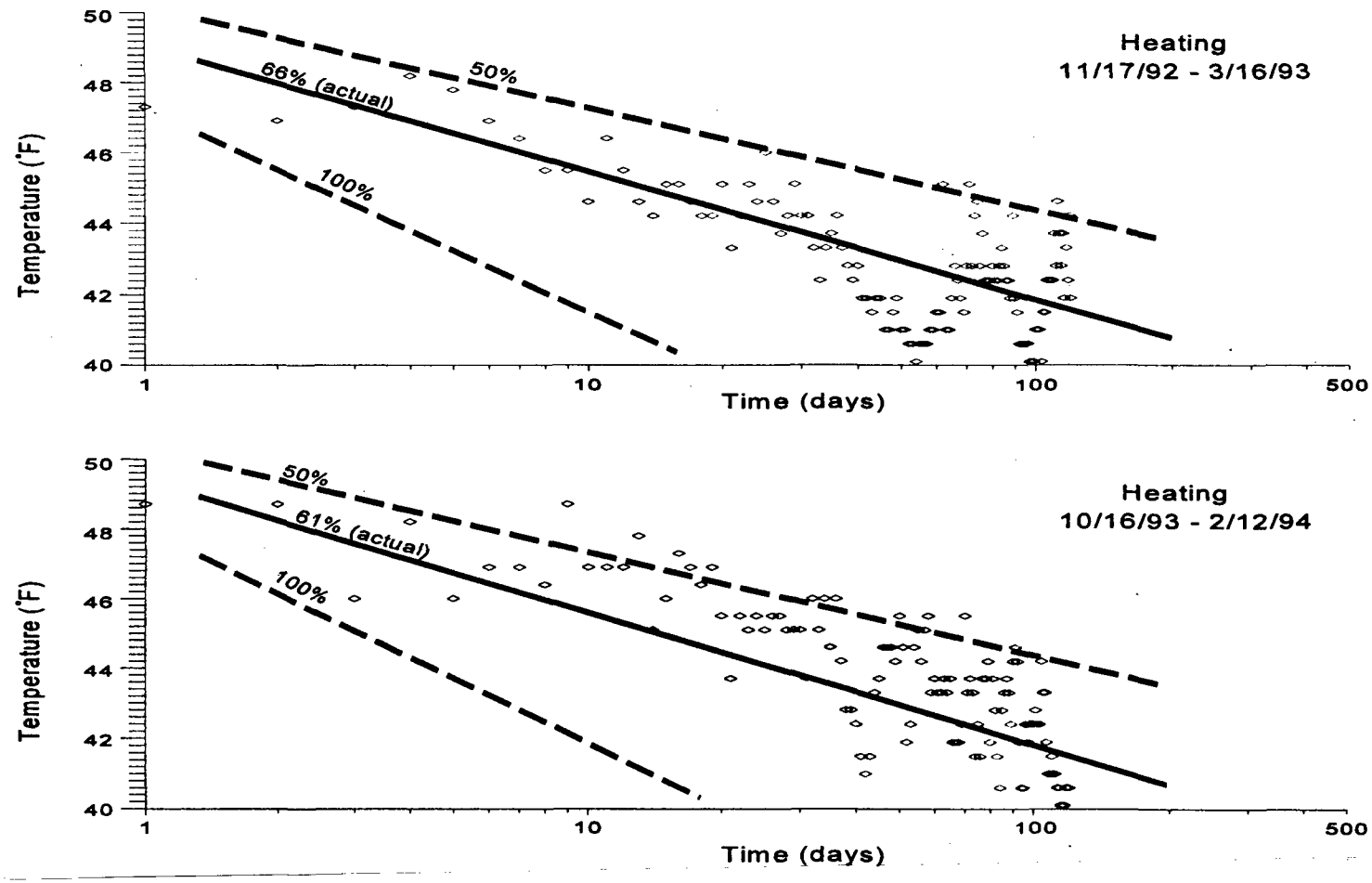

Figure 6. The percent of time that a system operates determines the loop-temperature decline. In these tests, actual performances were 66% and 61% of the time. Hypothetical temperatures are shown (dashed) for 50% and 100% operating conditions.

Conclusions

A vertical-loop, ground-source heat-pump system near Helena, Montana, was instrumented and monitored during the 1992-93 and 1993-94 heating seasons. Continuous records of operating time and energy use, daily minimum loop temperatures, and spot measurements of entering and leaving loop temperatures over a wide operating range were obtained. The latter were used to estimate a COP (Coefficient of Performance) of 3.10, very close to the manufacturer's specification of 3.11 that was used for sizing design. Minimum daily loop temperatures were found to occur between about 4:00 and 6:00 a.m.

Outdoor minimum daily temperatures during the first heating season ranged commonly between -20°F and +20°F; during the second season, they were below 0°F for only a few days. Loop fluid temperatures fluctuated similarly to those of outdoor air, ranging from about 49°F to 40°F each season.

In addition to measuring loop-fluid temperature decline, an objective of this work was to try to use time, energy production, and loop temperatures in a simple relationship to estimate thermal conductivity of the earth and pipe system. Using a semilogarithmic equation borrowed from hydrogeologic technology, thermal conductivity was calculated by using the analogy between heat flow and ground-water flow. The data points are heavily scattered in the plots, making a solution

somewhat subjective. Best-fit lines gave a thermal conductivity of 0.89 BYU/hr-ft-°F. Design thermal conductivities in loop construction were 0.77 and 0.22 BTU/hr-ft-°F for the earth source and the polyethylene piping, respectively. Other values from the literature range between 0.59 to 3.33 BTU/hr-ft-°F. The test results are valid, but are highly subjective because of widely scattered data. The data scatter is reused by from variability of energy production associated with wide variations in outside temperature, and to some degree, factors in thermostat control.

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APPENDIX A

House Thermal Specifications

and

Design Heat Load

HOUSE IDENTIFICATION

House ID:	VAN-VOAST	Utility	: MPC
Address	: MERCURY ST. BUTTE	Analyst	: KG
Builder	: ENERGY RE/CON	Location	: HELENA3
Owner	: WAYNE VAN VOAST	Floor Area	: 4056 ft2

QUALIFICATION CRITERIA

SUPER GOOD CENTS/ NORTHWEST ENERGY CODE	REFERENCE	CURRENT	PROPOSED
Thermal Performance (Btu/hr-F)	628	457	457
Energy Budget (kWh/ft2-yr)	4.44	0.99	2.58

* QUALIFIES *

HEATING AND VENTILATING SYSTEMS

	CURRENT	PROPOSED
Heating System Type	Heat Pump	Furnace
Heat Pump Heating Season Performance Factor	10.20	N/A
Heat Load at 91 F design temp difference (BTU/hr)	44043.7	44043.7
System Size at 150% Design Load (kW (kBTU/hr))	19.5(66.0)	19.5(66.0)
Average Annual Space Heat Requirement (kWh/yr)	5096	13250

Ventilation System Type NHRV: Integrated Spot & Whole House

ECONOMICS

	CURRENT	PROPOSED
Incremental Construction Cost	-------	$ 0.00
Projected Yearly Heating Cost	0.00	0.00
First Year Monthly PITI ($/month)	$ 0.00	$ 0.00
Average Monthly Heating Costs	$ 0.00	$ 0.00
TOTAL FIRST YEAR MONTHLY PAYMENT	$ 0.00	$ 0.00
30 year Life Cycle Cost	$ 0.00	$ 0.00

Actual energy use will vary with climate, lifestyle, and construction.
Economic and energy use estimates should be used for comparative purposes only.

BUILDING COMPONENT SUMMARY

Component	Entries	Area	Curr UA	Prop UA	Cost	$/UA
Below-grade walls	1	124	55.6	55.6		
Slab perimeters	1	95	43.2	43.2		
Floors over crawl spaces	0	0	0.0	0.0		
Walls	1	2295	91.8	91.8		
Windows	1	413	132.2	132.2		
Doors	1	70	23.1	23.1		
Skylights	0	0	0.0	0.0		
Ceilings	1	2028	35.3	35.3		
Air Leakage Control	1	25350	79.6	79.6		
Mass	2	4056	18252.0	18252.0		
TOTALS			460.7	460.7		

GLAZING ORIENTATION

CURRENT Area	CURRENT Effarea	CURRENT %FloorArea	Orientation	PROPOSED Area	PROPOSED Effarea	PROPOSED %FloorArea
0.0	0.0	0.0	South	0.0	0.0	0.0
31.0	25.9	0.8	Southeast	31.0	25.9	0.8
0.0	0.0	0.0	East	0.0	0.0	0.0
83.0	25.0	2.0	Northeast	83.0	25.0	2.0
0.0	0.0	0.0	North	0.0	0.0	0.0
22.0	6.6	0.5	Northwest	22.0	6.6	0.5
0.0	0.0	0.0	West	0.0	0.0	0.0
277.0	231.3	6.8	Southwest	277.0	231.3	6.8
413.0	288.7	10.2	TOTALS	413.0	288.7	10.2

BELOW-GRADE WALLS

	Description	F-value	Pmtr	UA	$/lf	Cost
C>	4' depth/2x4 24" o.c./interior R-11+R-19	0.450	123.5	55.6		
P>	4' depth/2x4 24" o.c./interior R-11+R-19	0.450	123.5	55.6		

SLAB PERIMETERS

	Description	F-value	Pmtr	UA	$/lf	Cost
C>	Slab/R-10 insul. /2' horizontal	0.455	95.0	43.2		
P>	Slab/R-10 insul. /2' horizontal	0.455	95.0	43.2		

WALLS

	Description	U-value	Area	UA	$/sf	Cost
C>	2x6 R-19 advanced + R-7.2 sheath	0.040	2295.0	91.8		
P>	2x6 R-19 advanced + R-7.2 sheath	0.040	2295.0	91.8		

WINDOWS

	Description	U-value	Area	UA	$/sf	Cost
C>	2-glaze, 1/2", wood or vinyl w/storm	0.320	413.0	132.2		
P>	2-glaze, 1/2", wood or vinyl w/storm	0.320	413.0	132.2		

DOORS

	Description	U-value	Area	UA	$/sf	Cost
C>	Wood solid core, flush	0.330	70.0	23.1		
P>	Wood solid core, flush	0.330	70.0	23.1		

CEILINGS

Description	U-value	Area	UA	$/sf	Cost
C> R-60 advanced	0.017	2028.0	35.3		
P> R-60 advanced	0.017	2028.0	35.3		

AIR LEAKAGE CONTROL

Description	ACH	Volume	UA	$	Cost
C> Advanced Air Sealing -above grade volume	0.200	25350.0	79.6		
P> Advanced Air Sealing -above grade volume	0.200	25350.0	79.6		

MASS

Description		M-value	Area	BTU/F	$/sf	Cost
C> Light frame construction	BTU/F-ft2 flr	3.000	2028.0	6084.0		
Slab-carpet, rubber pad	BTU/F-ft2 flr	6.000	2028.0	12168.0		
TOTALS>			4056.0	18252.0		
P> Light frame construction	BTU/F-ft2 flr	3.000	2028.0	6084.0		
Slab-carpet, rubber pad	BTU/F-ft2 flr	6.000	2028.0	12168.0		
TOTALS>			4056.0	18252.0		

Actual energy use will vary with climate, lifestyle, and construction.
Economic and energy use estimates should be used for comparative purposes only.

SYSTEM	CURRENT	PROPOSED
Heating system type	Heat Pump	Furnace
Heat Pump HSPF	10.20	

Ducts	Size	Lgth	Rval	Size	Lgth	Rval
	10"x20"	5ft	R-11	10"x20"	5ft	R-11
	10"	40ft	R-11	10"	40ft	R-11
	8"	60ft	R-11	8"	60ft	R-11

BUILDING HEAT LOSS	CURRENT	PROPOSED
Envelope	460.7 BTU/hr-F	460.7 BTU/hr-F
Ducts	23.3	23.3
TOTALS>	484.0	484.0

DESIGN RESULTS	CURRENT	PROPOSED
Design heat load	44043.7 BTU/hr	44043.7 BTU/hr
	12.9 kW	12.9 kW
System size (150%)	66.0 kBTU/hr	66.0 kBTU/hr
	19.5 kW	19.5 kW
Total Space Heat	5096 kWh/yr	13250 kWh/yr

BASED ON THE FOLLOWING DESIGN CONDITIONS

Winter design wind speed	15 mph
Thermostat set point	70 deg F.
Winter design temperature	-21 deg F.
Design temperature difference	91 deg F.

Actual energy use will vary with climate, lifestyle, and construction.
Economic and energy use estimates should be used for comparative purposes only.

APPENDIX B

Heat Pump

Design Program

****

Closed-Loop/Ground-Source Heat Pump Design Program
Vertical and Horizontal Systems
James E. Bose Ph.D., P.E.
(405) 624-2554 4618 William Court Stillwater, OK 74075

****

Software Licensee
John Dibble Earth Energy
(208) 263-7358
Sandpoint ID 83864

****

PROJECT DESCRIPTION -----VAN VOAST VERTICAL 3 1/2 TON

TEMPERATURE BIN DATA LOCATION ----------HELENA MONTANA
HEAT PUMP MODEL NUMBER ----------411E
MANUFACTURER ----------CA

Annual Cooling Cost ($) ----------	79	@	.05	$/kWh.	26425 Btu/hr
Annual Heating Cost ($) ----------	518	@	.064	$/kWh.	44043 Btu/hr
Total Heating and Cooling Costs ----	598				

Domestic Hot Water Costs ($) for 100 gallons/day at a water temp of 130 F.

Electric resistance -------	441
With desuperheater -------	291
With 100% heat pump -------	145

Heating capacity @ EWTmin =	25	F	is	32000	Btu/hr	COP = 3.11
Cooling Capacity @ EWTmax =	75	F	is	45500	Btu/hr	EER = 12.69

Supplemental Heat Required (kW) ----	5.32	@ -38	F Outdoor Air Temperature
Heat Pump Power (kW) ----------	3.06	@ -38	F Outdoor Air Temperature

---

Heat Pump Power (kW) ----------	3.58	@ 75	F Entering Water Temp

---

BUILDING HEAT LOAD (BTU/HR)---------- 44043
WINTER DESIGN TEMPERATURE (F) ---------- 14

HEAT PUMP HEATING CAPACITY (BTU/HR)----- 32000
MINIMUM EWT (F) ---------- 25
COP @ MIN EWT---------- 3.115
RUN FRACTION (Fh) ---------- .62
SUPPLEMENTAL HEAT REQD (KW)--- 5.3
STRIP HEAT REQD (KWH IN JAN)-- 204

BUILDING HEAT GAIN (BTU/HR)---------- 26425
SUMMER DESIGN TEMP (F)---------- 88
SUMMER INDOOR TEMP (F)---------- 78
SUMMER BALANCE TEMP (F)---------- 70
HEAT PUMP COOLING CAPACITY (BTU/HR)----- 45500
MAXIMUM EWT (F) ---------- 75
EER @ MAX EWT ---------- 12.7
RUN FRACTION (Fc) ---------- .23

SOIL THERMAL PROPERTIES

SOIL DESCRIPTION : HEAVY SOIL DAMP
THERMAL DIFFUSIVITY (FT'2/HR)---------- .025
THERMAL CONDUCTIVITY (BTU/HR-FT-F)------ .75

PIPE PROPERTIES

PIPE IDENTIFICATION : 3/4 INCH PE SDR-11
THERMAL CONDUCTIVITY (BTU/HR-FT-F)------ .226
PIPE INSIDE DIAMETER (INCHES)---------- .86
PIPE OUTSIDE DIAMETER (INCHES)---------- 1.05

PIPE AND SOIL RESISTANCE VALUES

PIPE RESISTANCE (HR-FT-F/BTU)---------- 9.641665E-02
SOIL RESISTANCE (HR-FT-F/BTU)---------- .9361914 @ 463 HRS

SOIL TEMPERATURES

MEAN EARTH TEMP (F) = 50 , ANNUAL SWING (F) = 20 , PHASE SHIFT (DAYS) = 40

SOIL MIN TEMP AT DEPTH = 100 (FT)-------- 49.9
SOIL MAX TEMP AT DEPTH = 100 (FT)-------- 50

********** GROUND HEAT EXCHANGER DESIGN **********

PIPES IN LOOP BUNDLE ---------- 2
BORE LENGTH REQUIRED FOR HEATING REQUIREMENTS (FEET) - 590
BORE LENGTH REQUIRED FOR COOLING REQUIREMENTS (FEET) - 731

BRANCH	LENGTH (FT)	DIA (IN'S)	FLOW (GPM)	REYN NUMBER
1	350	.86	3	2135
2	350	.86	3	2135

HEAD (FEET) = 6.505 12

FLUID -- 20 % PG ** TEMPERATURE -- 23 F ** VISCOSITY (LB/FT-HR) -- 12.94

C -- CONTINUE ESC -- ESCAPE BACK TO MAIN MENU

PIPE BRANCH 1 PIPE DESC--- 4 1-1/2 INCH PE SDR-11
2 PIPE DESC--- 0
3 PIPE DESC--- 0

Pipe Branch Number	SB 1	SB 2	SB 3	HP	Par Brch
Pipe Inside Diameter (inches)--	1.554	0	0		
Flow Rate (gpm)----------	12	0	0	0	12
Fluid Velocity (ft/sec)--------	2	0	0		
Reynolds Number----------	4719	0	0		
Fluid----------	20 % PG				
Fluid Temperature (F) ----------	23.0	0.0	0.0	0.0	
Fluid Density (lb/ft^3)--------	64	0	0		
Fluid Viscosity (lb/ft-hr)-----	12.9	0.0	0.0		
Pipe Length (Feet)----------	180	0	0		
Pressure Drop (feet of head)---	3.4	0.0	0.0	0.0	6.5
(psi)----------	1.4	0.0	0.0	0.0	2.8
Volume (gallons)----------	17.7	0	0		42

Total PD (FT) = Parallel + Series + Heat Pump = 9.9 Volume (Gallons) = 59.9

P-- SB Press Drop A-- Add Loops C -- Clear ESC -- Return to Design Menu

BRANCH	LENGTH (FT)	DIA (IN'S)	FLOW (GPM)	REYN NUMBER
1	466	.86	4	2846
2	466	.86	4	2846
3	466	.86	4	2846

4	350	.86	3	2135

HEAD (FEET) = 6.505 12

FLUID -- 20 % PG ** TEMPERATURE -- 23 F ** VISCOSITY (LB/FT-HR) -- 12.94

C -- CONTINUE ESC -- ESCAPE BACK TO MAIN MENU

PIPE BRANCH 1 PIPE DESC--- 4 1-1/2 INCH PE SDR-11
2 PIPE DESC--- 0
3 PIPE DESC--- 0

Pipe Branch Number	SB 1	SB 2	SB 3	HP	Par Brch
Pipe Inside Diameter (inches)--	1.554	0	0		
Flow Rate (gpm)----------	12	0	0	0	12
Fluid Velocity (ft/sec)--------	2	0	0		
Reynolds Number----------	4719	0	0		
Fluid----------	20 % PG				
Fluid Temperature (F) ---------	23.0	0.0	0.0	0.0	
Fluid Density (lb/ft^3)--------	64	0	0		
Fluid Viscosity (lb/ft-hr)-----	12.9	0.0	0.0		
Pipe Length (Feet)----------	180	0	0		
Pressure Drop (feet of head)---	3.4	0.0	0.0	0.0	6.5
(psi)----------	1.4	0.0	0.0	0.0	2.8
Volume (gallons)----------	17.7 ✓	0	0		42

Total PD (FT) = Parallel + Series + Heat Pump = 9.9 Volume (Gallons) = 59.9

P-- SB Press Drop A-- Add Loops C -- Clear ESC -- Return to Design Menu

BRANCH	LENGTH (FT)	DIA (IN'S)	FLOW (GPM)	REYN NUMBER
1	466	.86	4	2846
2	466	.86	4	2846
3	466	.86	4	2846

BRANCH	LENGTH (FT)	DIA (IN'S)	FLOW (GPM)	REYN NUMBER
1	466	.86	4	2846
2	466	.86	4	2846
3	466	.86	4	2846

HEAD (FEET) = 15.391 12

FLUID -- 20 % PG ** TEMPERATURE -- 23 F ** VISCOSITY (LB/FT-HR) -- 12.94

C -- CONTINUE ESC -- ESCAPE BACK TO MAIN MENU

PIPE BRANCH 1 PIPE DESC--- 4 1-1/2 INCH PE SDR-11
2 PIPE DESC--- 0
3 PIPE DESC--- 0

Pipe Branch Number	SB 1	SB 2	SB 3	HP	Par Brch
Pipe Inside Diameter (inches)--	1.554	0	0		
Flow Rate (gpm)----------	12	0	0	0	12
Fluid Velocity (ft/sec)--------	2	0	0		
Reynolds Number----------	4719	0	0		
Fluid----------	20 % PG				
Fluid Temperature (F) ----------	23.0	0.0	0.0	0.0	
Fluid Density (lb/ft^3)--------	64	0	0		
Fluid Viscosity (lb/ft-hr)-----	12.9	0.0	0.0		
Pipe Length (Feet)----------	180	0	0		
Pressure Drop (feet of head)---	3.4	0.0	0.0	0.0	15.4
(psi)----------	1.4	0.0	0.0	0.0	6.7
Volume (gallons)----------	17.7	0	0		42

Total PD (FT) = Parallel + Series + Heat Pump = 18.8 Volume (Gallons) = 59.9

P-- SB Press Drop A-- Add Loops C -- Clear ESC -- Return to Design Menu

ESRI

Earth Sciences and Resources Institute
(Formerly UURI)
391 Chipeta Way, Suite C
Salt Lake City, UT 84108-1295
USA

Phone: 801-584-4422 FAX: 801-584-4453

Facsimile (FAX) Cover Page

From: Howard Ross Date: June 6, 1995

To: Wayne Van Voast FAX: (406) 496-4451

Number of pages including this one: 3

Message or Comments:

Wayne - I apologize for not getting these comments to you sooner. The draft report arrived just between two lengthy trips and I was somewhat overwhelmed. This is a nice study and should be published in the heat pump literature. Please be sure that Paul Lienau and his heat pump people have an opportunity to review the draft. Good job!

Howard

REWIEW COMMENTS

GROUND SOURCE HEAT PUMP SYSTEM NEAR HELENA, MONTANA

This is a well-written report of a detailed evaluation of a ground-source heat pump system. It should be of interest to contractors, consumer advocates, and other groups, and should be published in an appropriate journal and presented orally. Good job, Wayne.

I have only a few comments on the report itself, and these are minor details. It appears technically correct in all respects, but Paul Lienau and his staff should review it in this regard. Editorial comments follow.

Pg. 4, line 3. The objective of this study - the writting is a little terse in places.

Pg. 4, Acknowledgements - Why not move to just before references as in many reports and papers?

Pg. 6, 10, etc. Figure 1⊙, 2⊙, etc

Pg. 7, line 11. The cause for the discrepancy . .

Pg. 8, heading. Instrumentation and Methods

Pg. 15. The equation for Jacob's approximation is, . . .
where, K = etc.
t = time⊙

Pg. 15, bottom. Hart and Couvillion (1981) - 1986 in references.

partial sentence Temperature declines . . . repeats on next page.

Pg. 16, 2nd para. Yes there is some scatter on the semilog plots, but perhaps it is not as poor as you suggest. You may wish to sound a little more positive about it.

I think your implied value for thermal conductivity at C=0.89 is probably a real good, bulk thermal conductivity value.

Pg. 21. The last sentence is confusing "is reused by from variability of energy production . .". I think this is an excellent, detailed study of heat pump performance with a few problems which will often be present. You have completed a good detailed analysis and have a good in situ value for C. Try to end the conclusions on a more positive note.

DISCLAIMER - The report should have a standard DOE-type disclaimer inside the front cover. ⊙ne is attached.

GEO-HEAT CENTER

Oregon Institute of Technology • Klamath Falls, Oregon 97601 • 503/885-1750 • FAX 503/885-1754

Paul J. Lienau, Director

February 15, 1995

Mr. Wayne Van Voast
Chief, Research Division
Montana Tech
Montana Bureau of Mines and Geology
1300 West Park Street
Butte, MT 59701-8997

Dear Wayne:

Enclosed are two reports on GSHP system that may be useful for your project.

"GSHP Model Development and Validation" by R. L. Douglas Cane, Caneta Research, Inc., 6981 Millcreek Drive, Mississauga, Ontario Canada L5N 6B8, (416) 542-2890, compared actual field test data with models that predicted the results.

The Montana House Project contact is Ken Anderson, Pacific Power, 920 S.W. Sixth Avenue, Portland, OR 97204, (503) 464-5977.

We have reports and monitored data from other ground-coupled heat pump systems. Please let me know if there is a specific aspect of monitoring or presentation of data that you would like to see.

I concur with Howard Ross to submit a report on the data you have collected in a way most useful to people. This could include, as you suggested, temperature drawdowns, heat withdrawals, temperature recoveries and performance.

We are looking forward to receiving your report by the end of March.

Sincerely,

Paul J. Lienau

Paul J. Lienau
Director

PJL/dg

Enclosures

c: Howard Ross

MONTANA TECH

of The University of Montana

Montana Bureau of Mines and Geology
1300 West Park Street
Butte, Montana 59701-8997
(406) 496-4180

February 2, 1995

Howard Ross, Project Manager
Low Temperature Geothermal and
Geothermal Heat Pump Program
University of Utah Research Institute
391 Chepeta Way, Suite C
Salt Lake City, Utah 84108-1295

Dear Howard,

This letter is a request for your advice regarding the Heat Pump Case History portion of our project commitment to you. The contract has long since expired and I still have not submitted a report on the Heat Pump performance.

In designing the work and anticipating the report, I didn't realize the difficulty of making sense out of such a non-controlled experiment. We've tried for months to find mathematical relationships between system temperature, heatflow, and time over two heating seasons (winters 1992-1993 and 1993-1994). The intent is to develop a reasonably simple mathematical technique to test and compare systems of varying design and configuration, such as the vertical and horizontal systems. Hopefully, the technique can also be useful for periodic testing of individual systems to detect long-term heat depletion around the loops. The idea has been to use data from normal heating operations rather than specially designed and controlled tests. The latter would not be possible with most systems.

At any rate, normal day-to-day heat pump operation is highly erratic and the temperature responses are at least equally erratic, but not easily defined. We have good data—recorded loop temperatures, use rates, and COP calculations. We can easily show temperature drawdowns, heat withdrawals, and temperature recoveries, but we sure haven't developed any numeric relationships. My concern over not finishing this study prompts me to ask your advice. We can provide a report describing the system and its performance over two winters. It will show that the system worked well, will show loop temperature declining with time and with heat withdrawal, and will show an apparently full recovery during the intervening summer. I guess I wanted to include a little science as well, but that's the part that hasn't worked out yet.

Would you advise that we submit a report with the basic information in order to clear the books? Or would it be alright to spend a couple more months on it? We still have some things to try, and, I believe either way we'll try them.

My concern here is to let you know this has not been forgotten or set aside and to get your advice on how to proceed. Please give me your thoughts.

Very truly yours,

Wayne Van Voast

Wayne Van Voast
Chief, Research Division

WVV/sm

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108-1295
TELEPHONE 801-524-3422

July 14, 1994

John Metesh
Hydrogeologist
Montana Bureau of Mines and Geology
Montana College of Mineral Science and Technology
Butte, Montana 59701

Dear John:

Thank you for the opportunity to review a draft of your final report "Geothermal Resources of Montana" complete with database and 1:1,000,000 scale map. I certainly enjoyed reading the report and reviewing the map. You and your staff have done a fine job on this project and are to be congratulated.

I believe we discussed the few typos and inconsistencies that I had noted in our telephone conversation. Please do remember to credit yourself as author, and MBMG as the agency on the map, and to date it. A DOE disclaimer on the map may also be worth considering.

I am enclosing a few pages from the Idaho Department of Water Resources report which I referred to regarding the high fluoride content for geothermal waters, and some possible concerns.

Thanks again for the good job on this map and report. We look forward to seeing Wayne's ground-loop application report. Let's hope we find some funding for Phase 2 studies!

Sincerely,

Howard

Howard P. Ross
Project Manager/Low-Temperature Program

encl.

cc: Paul Lienau, OIT
Wayne Van Voast, MBMG

GEO-HEAT CENTER

Oregon Institute of Technology • Klamath Falls, Oregon 97601 • 503/885-1750 • FAX 503/885-1754

Paul J. Lienau, Director

August 10, 1994

Mr. John Metesh
Montana Bureau of Mines and Geology
Montana College of Mineral Science and Technology
Butte, MT 59701

Dear John:

Thank you for the final report "Geothermal Resources of Montana" and the opportunity to review it. The database compilation must have represented a considerable effort, since there was a significant increase in the number of thermal wells and springs over the previous geothermal assessment. The report is an excellent project summary of the work accomplished and reads very well. Please consider the following comments regarding the report.

1. Abstract - 2nd paragraph, 3rd sentence is a little confusing, it may read better by using: "Approximately 12 percent of the wells and springs in the database have temperatures above 50°C, 17% are between 30° an 50°C, 29% are between 20° and 30°C, and 42 percent are between 10° and 20°C.

2. Page 19, 2nd paragraph, 1st sentence - and geothermal resources <u>are</u> most likely...

3. Page 21. Recommendations - it would be useful to have specific recommendations for future work at Bozeman, Butte, Boulder Hot Springs and Camas Prairie; such as presented at Ennis - "a deep drilling project is needed to fully understand the nature of this resource area."

4. General - in the report text units of feet (ft) should be converted to meters (m).

5. Appendix 1

   - Well depths would be very useful.

   - Explain SWL (m) - some are negative and some are positive. For example, MGEOT 210 is flowing with SWL of 5.6 m. Does that mean shut-in pressure is 5.6 m? If so there are some fairly high pressures, 176.4 m = 578.7 ft = 251 psi. On the other hand, MGEOT 059 is listed as flowing with SWL of -56.3 m.

6. Map - The map is very good, the only comment I have is that using symbols to distinguish temperatures may make it easier to reproduce the map than one that uses color.

We would like to send copies of your final report to all the State Teams that participated in this program and of course, the DOE agencies that supported it; therefore, please supply 20 copies. I assume you will make it available to the public as an open-file report.

By the way, we did not receive the diskette of the database as mentioned in the letter. Also, I believe you accidently sent along "Comments Bozeman Solvent Site Irrigation Study Report", which is enclosed.

If you are so inclined, we would very much like to publish a summary paper on Montana in the Geo-Heat Center Quarterly Bulletin. Thus far, Utah, Colorado and Nevada have submitted papers and copies are inclosed for your information.

John - you have done an excellent job of data compilation, report writing and map production. We are looking forward to receiving the report on the ground-loop application.

Sincerely,

Paul J. Lienau
Director

PJL/dg

Enclosures

cc: Howard Ross
Joel Renner

MONTANA BUREAU OF MINES AND GEOLOGY
MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY
BUTTE, MONTANA 59701
(406) 496-4180

November 29, 1993

Paul Lienau
Director
Geo-Heat Center
Oregon Institute of Technology
Klamath Falls, Oregon 97601

Paul:

Enclosed is the preliminary list of resource areas that warrant further study. The sites were selected based on knowledge and lack of knowledge of the resource area, proximity to population centers and transportation. Should you have any questions, please contact me.

Sincerely,

John Metesh
Hydrogeologist

enclosures
cc:
Howard Ross, UURI w/enclosures

Preliminary List of Prioritized Study Areas - Montana

The dominant consideration in selecting areas in Montana for future studies is the proximity of the resource area to transportation and population centers. Although there are several resource areas that indicate a relatively high potential for development, limited past and/or current use and low population in the area likely prohibit development. The areas with the highest potential collocated with population centers and transportation routes are as follows:

Bozeman

The Gallatin Valley near Baseman has experience a steady population growth over the last decade. Data for the Baseman Hot Springs west of the city of Baseman indicates a surface temperature of approximately 55°C and an estimated reservoir temperature of 80°C. The springs are currently used to heat a swimming pool at a commercial campground. Although little resource development has occurred in the area over the last ten years, the Gallatin Valley was identified by Sonderegger and Bergentino (1981) as an area expected to contain geothermal resources suitable for development.

Butte

The Butte Mining District was extensively mined over a period of nearly 100 years. At the cessation of underground mining in the early 1980's dewatering of the bedrock was discontinued and water-levels were allowed to rise; soon after the mines were shut down, the area was listed in the National Priorities List and is designated as a Superfund site. The rising water, which has a low pH and has a high dissolved-metals content, is of much to concern to local, state, and federal agencies and it has been recognized that water-levels will need to be controlled by pumping to prevent discharge to the Clark Fork River drainage.

With respect to geothermal development, the Butte area offers several avenues for low-to-moderate temperature resources. The underground workings were notoriously hot areas to work in while operating and recent data collected from the mines indicate surface temperatures ranging from 12.6 to 33°C. Monitoring wells completed in the bedrock aquifer at depths less than 600 feet indicate temperatures of 10 to 15°C and water quality is quite good.

Ennis

Several studies of the geothermal resources near Ennis have been conducted in the past; however, a deep drilling project is needed to fully understand the nature of this resource area. Recently, one of the areas in which wells were completed was offered for sale to the county government. Application of the information from previous studies to an investigation of potential direct-heat applications may also be warranted.

Boulder Hot Springs

Prior to the current study, little data was collected in this area. The surface temperatures at the three springs sampled range from 54 to 74°C and flow is approximately 10 to 15 gallons per minute at each spring. The site is currently undergoing rehabilitation. Past owners prevented any investigation into the resource area; the current owners, however, appear to be more likely to allow access.

Camas Prairie

There are several previously un-recorded springs in this area; one site was sampled recently. The surface temperature 23.7°C. Although the area has some recreational facilities the area is not very close to any large population centers.

MONTANA BUREAU OF MINES AND GEOLOGY
MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY
1300 West Park Street
Butte, MT 59701-8997

November 18, 1993

Dr. Paul J. Lienau
Director, Geo-Heat Center
Oregon Institute of Technology
Klamath Falls, Oregon 97601

Dear Dr. Lienau:

This letter is a request for a no-cost extension for Montana's contract under the DOE/GD Low Temperature Geothermal Program. We request the extension through June 30, 1994. The additional time will allow additional water sampling and analyses, and will provide an additional heating season for the ground-source heat-pump loop monitoring.

I hope this request is acceptable. If you require additional information, please contact me.

Very truly yours,

Wayne Van Voast

Wayne Van Voast
Chief, Research Division
(406) 496-4169

WVV:mt

cc: Ed Ruppel, Director
John Metesh
John Dunstan
Howard Ross

UNIVERSITY OF UTAH RESEARCH INSTITUTE

UURI

EARTH SCIENCE LABORATORY
391 CHIPETA WAY, SUITE C
SALT LAKE CITY, UTAH 84108—1295
TELEPHONE 801-524-3422

June 15, 1992

Mr. Paul J. Lienau
Geo-Heat Center
Oregon Institute of Technology
3201 Campus Drive
Klamath Falls, OR 97601

Dear Paul:

Enclosed are a letter by Wayne Van Voast, Chief, Research Division of the Montana Bureau of Mines and Geology, a revised Statement of Work, and budget and contractual information for a proposed subcontract for the Montana Bureau of Mines and Geology State Team. Wayne will be the Principal Investigator for this study.

Please contact me, or Wayne Van Voast, MBMG, for any additional information you may require for the contract modification with EG&G.

Sincerely,

Howard

Howard P. Ross
Project Manager

encl.

ADDENDUM TO STANDARD CONTRACT AGREEMENT
for
STATE GEOTHERMAL ENERGY RESEARCH,DEVELOPMENT,
AND DATABASE COMPILATION

between

THE OREGON STATE SYSTEM OF HIGHER EDUCATION
OREGON INSTITUTE OF TECHNOLOGY

and

THE MONTANA BUREAU OF MINES AND GEOLOGY

STATEMENT OF WORK

1.0 INTRODUCTION

The United States Department of Energy - Geothermal Division (DOE/GD) supports the development of indigenous and environmentally advantageous energy alternatives to the traditional fuels. There is a very large, nearly unused supply of low- and moderate-temperature geothermal resources in the United States that could be brought on line over the next decade. The increased use of Geothermal Heat Pumps (GHPs) could also reduce the need for traditional fossil fuel consumption for space heating and cooling.

The U.S. Congress has appropriated funds for a program of Low-Temperature Geothermal Resources and Technology Transfer and DOE/GD has funded EG&G, Idaho to establish contracts with the Oregon Institute of Technology - Geo-Heat Center (OIT-GHC), the Idaho Water Resources Research Institute (IWRRI) and the University of Utah Research Institute (UURI) to implement this program.

Important parts of this program are to bring the inventory of the nation's low- and moderate-temperature resources up to date, to complete a collocation study of these resources and communities and other potential users, and to collect and disseminate information necessary to expand the use of GHPs. OIT-GHC will have the lead role in the collocation study and will establish subcontracts with the state resource teams. UURI will work with the State Teams on gathering, documenting, and assembly of low- and moderate-temperature hydrothermal resource data and will assist in technical monitoring of the State Team efforts and publications. IWRRI will be responsible for establishing the hydrothermal resource data for Idaho and for performing geothermal reservoir evaluations throughout the western United States.

The technical tasks described herein may be considered Phase I of the Low-Temperature Geothermal Resources and Technology Transfer program. If Phase I proves successful, and additional funds are appropriated by Congress, the program may be expanded and continued. Phase II would likely include detailed resource evaluations of priority areas identified in Phase I.

Funding for the Low-Temperature Geothermal Resources and Technology Transfer Program is limited, and the success and continuation of the program is dependent upon a productive Phase I effort. Participating State Teams are encouraged to seek state or organization cost shares (in cost or in-kind) to enhance this contract effort.

2.0 TECHNICAL TASKS

The following technical tasks will be accomplished under this subcontract.

2.1 Complete an updated inventory of low- and moderate-temperature resources for the State of Montana, current to June 1, 1992. Review drilling records and other information to identify new resources and verify temperatures and flow rates of springs and wells which may have changed substantially since the previous statewide geothermal resource inventory. Identify geological, geophysical, geochemical, and hydrologic studies which relate to these resources. The minimum temperature for a low-temperature resource is defined to be 10°C above the mean annual air temperature at the surface and should increase by 25°C/km. Occurrences to 150°C will be included.

2.2 Conduct a fluid geochemistry study of the more important resource areas for which existing data are questionable or unavailable. UURI will provide up to ten (10) quantitative fluid chemical analyses for each state in support of this study.

2.3 Complete a computer database listing compatible with Lotus 123 format tabulating for each occurrence: name, location (T,R,S), county, longitude, latitude, depth, flow, temperature, chemistry, and other data as appropriate and available.

2.4 Review OIT-GHC geothermal resource and demographic data for the State of Montana for accuracy and completeness, as part of the collocation study.

2.5 Assist OIT-GHC, UURI, and IWRRI in studies to prioritize low- and moderate-temperature resource areas for new development. Develop conceptual geologic models and groundwater data for selected resources.

2.6 Prepare a report describing a case study of a recent Geothermal Heal Pump installation in Montana, indicating temperature changes in the loop, projected cost benefits, etc.

3.0 REPORTS, DATA, AND OTHER DELIVERABLES

3.1 A geothermal database listing in hardcopy and diskette form will be submitted to UURI. The listing will include all known low- and moderate- temperature spring and well occurrences in the State of Montana. Principal facts will include location, depth (well), flow rate (if known), etc.

3.2 Letter reports and memoranda reviewing collocation data and priority rankings will be submitted to OIT-GHC and UURI.

3.3 A final summary report, not to exceed 50 pages, describing all tasks and their results, and documenting any new temperature, geologic, geochemical or geophysical data will be submitted to UURI, OIT-GHC, and IWRRI. This report may incorporate interim letter reports and memoranda as appendices. The report will include a geothermal resource occurrence map of the state, black and white, scale 1:1,000,000 or acceptable alternative.

3.4 A technical report describing the Geothermal Heat Pump case study.

3.5 Interim progress reports will be submitted to UURI quarterly.

4.0 SCHEDULE OF PERFORMANCE AND REPORTING

4.1 The period of performance for this agreement will terminate on December 31, 1993, unless modified by letter agreement and signed by the Montana Bureau of Mines and Geology, OIT-GHC, and UURI.

4.2 A review of the OIT-GHC collocation study will be completed and a letter report or memorandum of comment submitted to OIT-GHC and UURI within one month after receipt of the draft document from OIT-GHC.

4.3 A preliminary database listing of geothermal resource occurrences will be submitted to UURI within four months after the execution of this agreement.

4.4 A final database listing of geothermal resource occurrences will be submitted to UURI within twelve months after the execution of this agreement.

4.5 A final report documenting all new data and activities completed under this agreement will be submitted to UURI and OIT-GHC not later than December 31, 1993.

5.0 RESPONSIBLE PARTIES

5.1 The Principal Investigator for this agreement will be Wayne Van Voast, Montana Bureau of Mines and Geology.

5.2 The Technical Project Managers for this agreement will be Howard P. Ross, UURI and Paul J. Lienau, OIT-GHC.

5.3 The Contracting Officer for this agreement will be Douglas Yates, OIT.

6.0 FUNDING

This contract agreement provides for funding not to exceed $30,000.00 for the completion of all technical tasks and submittal of all required deliverables.

MONTANA BUREAU OF MINES AND GEOLOGY
MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY
BUTTE, MONTANA 59701
(406) 496-4180

June 12, 1992

Howard P. Ross
Project Manager
University of Utah Research Institute
Earth Science Laboratory
391 Chipeta Way, Suite C
Salt Lake City, Utah 84108-1295

Dear Howard:

Enclosed herewith is a proposed budget along with supporting information for our participation in the Department of Energy-Geothermal Division's Low Temperature Geothermal Resources and Technology Transfer Program. A brief resume for myself is included because my work on the project will be part of our cost share. In response to one specific request you had, we have never been audited by a U.S. Government audit agency.

I agree with you that four months rather than three would be more appropriate for completion of the preliminary data base. Please let me know if additional information is needed.

Very truly yours,

Wayne Van Voast
Chief, Research Division

Enclosures
WVV/et

MONTANA BUREAU OF MINES AND GEOLOGY
LOW–TEMPERATURE GEOTHERMAL RESOURCES
AND TECHNOLOGY TRANSFER PROGRAM

SALARIES	
John Metesh (3mo @ $15.54/hr)	8100.00
BENEFITS (33% salaries)	2673.00
Student Assistant (900 hrs @ $5/hr)	4500.00
INDIRECT COSTS (48% salaries + benefits)	7331.00
SUBTOTAL	22604.00
COMPUTER COST/ SOFTWARE	2000.00
SUPPLIES (reagents, bottles, etc.)	1000.00
EQUIPMENT (meters, probes, etc.)	1000.00
TRAVEL ($0.36/mi, per diem $15.50/day, lodging $31.20/day)	2127.00
PRINTING (reports, maps)	1000.00
SUBTOTAL	7127.00
TOTAL	29731.00

DEPARTMENT OF HEALTH & HUMAN SERVICES

Office of the
Regional Director

Region VIII
Federal Office Building
1961 Stout Street
Denver CO 80294

February 22, 1990

JOHN DUNSTAN
DIRECTOR OF ACCOUNTING
MONTANA COLLEGE OF MINERAL SCIENCE & TECHNOLOGY
BUTTE, MT 59701-

Dear JOHN DUNSTAN:

The original and one copy of an indirect cost Rate Agreement are enclosed. This Agreement reflects an understanding reached between your organization and a member of my staff concerning the rate(s) that may be used to support your claim for indirect costs on grants and contracts with the Federal Government.

Please have the original signed by an authorized representative of your organization and return it to me, retaining the copy for your files. We will reproduce and distribute the Agreement to the appropriate awarding organizations of the Federal Government for their use.

An indirect cost proposal, together with the supporting information, are required to substantiate your claim for indirect costs under grants and contracts awarded by the Federal Government. Thus, your next proposal based on actual costs for the fiscal year ending 06/30/92, is due in our office by 12/31/92.

Sincerely,

Henry J. Bomba
Director
Division of Cost Allocation

Enclosures

PLEASE SIGN AND RETURN THE ORIGINAL OF THE RATE AGREEMENT

EIN: 181-6001654

RATE AGREEMENT
COLLEGES AND UNIVERSITIES

DATE: February 20, 1990

INSTITUTION: Montana College of Mineral
Science and Technology
Butte, Montana 59701

FILING REF: The preceding
Agreement was dated
May 11, 1987

The rates approved in this agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions in Section II.

SECTION I: INDIRECT COST RATES

Type	Effective Period From	To	Rate*	Location	Applicable To
Predetermined	7/1/90	6/30/93	48.0%	All	All Programs
Provisional	7/1/93	Until Amended	48.0%	All	All Programs

*BASE: Direct salaries and wage including all fringe benefits.

Treatment of Fringe Benefits: Fringe benefits applicable to direct salaries and wages are treated as direct costs.

SEE SPECIAL REMARKS

SECTION II: General

A. LIMITATIONS: The rates in this Agreement are subject to any statutory or administrative limitations and apply to a given grant, contract, or other agreement only to the extent that funds are available. Acceptance of the rates is subject to the following conditions: (1) Only costs incurred by the organization were included in its indirect cost pool as finally accepted; such costs are legal obligations of the organization and are allowable under the governing cost principles. (2) The same costs that have been treated as indirect costs are not claimed as direct costs. (3) Similar types of costs have been accorded consistent accounting treatment. (4) The information provided by the organization which was used to establish the rates is not later found to be materially incomplete or inaccurate.

B. ACCOUNTING CHANGES: If a fixed or predetermined rate is contained in this Agreement, it is based on the accounting system in effect at the time the agreement was negotiated. Changes to the method of accounting for costs which affect the amount of reimbursement resulting from the use of this Agreement require prior approval of the authorized representative of the cognizant agency. Such changes include, but are not limited to, changes in the charging of a particular type of cost from indirect to direct. Failure to obtain such approval may result in cost disallowances.

C. FIXED RATES: If a fixed rate is contained in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made in a subsequent Agreement to compensate for the difference between the costs used to establish the fixed rate and actual costs.

D. USE BY OTHER FEDERAL AGENCIES: The rates in this Agreement were approved in accordance with the authority in Office of Management and Budget Circular A-88, and should be applied to grants, contracts and other agreements covered by Office of Management and Budget Circular A-21, subject to any limitations in A above. The organization may provide copies of this Agreement to other Federal Agencies to give them early notification of the Agreement.

E. SPECIAL REMARKS:

The cost of vacation, holiday, sick leave and other paid absences are included in salaries and wages and are charged to grants and contracts as part of the normal charge for salaries and wages. Separate charges for the costs of these absences are not made.

This organization uses a fringe benefit rate for estimating direct fringe benefit costs in grant applications and contract proposals. For final reporting, the costs of each benefit id specifically identified to each employee and charged individually. The current rate used for estimating purposes is 20.0 percent of direct salaries and wages. The following fringe benefits are included in the fringe benefit rate:

FICA
Health Insurance
Workmen's Compensation
Unemployment Compensation
TRS or PERS Retirement

ACCEPTANCE

By the Institution

John Alexander /s/

Director of Accounting Contracts & Grants
Title

3/21/90
Date

By the Department of
Health and Human Services

Henry J. Bomba /s/

Henry J. Bomba
Name
Director,
Division of Cost Allocation
Title

February 20, 1990
Date

HHS Representative: Henry J. Bomba

(303) 844-5566 FTS 564-5566
Telephone

DEPARTMENT OF ADMINISTRATION

ACCOUNTING AND MANAGEMENT SUPPORT DIVISION

STAN STEPHENS, GOVERNOR

MITCHELL BUILDING

STATE OF MONTANA

Accounting Bureau
Rm. 255 (406) 444-3092

Management Support Bureau
Rm. 176 (406) 444-4644

Helena, Montana
59620-0102

TO: All State Agencies

FROM: Accounting Bureau
Department of Administration

DATE: May 29, 1991

SUBJECT: TRAVEL REIMBURSEMENT RATE CHANGES

Effective **October 1, 1991**, the in-state morning meal reimbursement rate will increase from $3.00 to $3.50 and the midday meal from $3.50 to $4.00. The out-of-state rate for the morning meal will increase from $4.00 to $5.00. The travel reimbursement rates will be as follows:

	IN-STATE	OUT-OF-STATE
Morning Meal	**$ 3.50**	**$ 5.00**
Midday Meal	**4.00**	**6.50**
Evening Meal	**8.00**	**12.00**
Total for the day	**$15.50**	**$23.50**

The per diem rate for in-state lodging (with receipt) will also change **October 1, 1991.** This will increase from $24.00 to $30.00 plus the 4% bed tax. Lodging rates will be as follows:

	IN-STATE	OUT-OF-STATE
Lodging (with receipt)	**$30.00**	**$50.00**
Lodging (without receipt)	**12.00**	**12.00**

The instructions that accompany the Travel Expense Vouchers will reflect these changes at a later date. If you have any questions, please call the Accounting Bureau at 444-3092.

RESUME

NAME: John J. Metesh

EDUCATION

Montana College of Mineral Science and Technology
Master's of Science in Geological Engineering - Hydrogeology
Thesis: Aquifer Testing and Evaluation at the Travona Mine and Marget Ann Mine, Butte, Montana
Awarded Funds: U.S. Bureau of Mines (Title III)

Montana State University
Bachelor of Science in Geology

CERTIFICATES

Mine Safety Training, U.S. Department of Labor, Mine Safety and Health Administration

40-Hour Hazardous Waste Training as per 29 CFR 1910.120 (e)2

8-Hour Supervisor Training as per 29 CFR 1910.120 (e) 3
Radiation Safety and Use of Nuclear Soil Gauges

Monitoring Well Constructor's License, State of Montana
Board of Water Well Contractors Title 37, Chapter 43, MCA

RELATED WORK EXPERIENCE

Assistant Research Hydrogeologist, Montana Bureau of Mines and Geology, 1990 - present

* Conducted research in mine hydrology as related to open pit coal mining.
* Presently conducting a comprehensive hydrologic impact assessment for a coal strip mine in south-central Montana
* Presently participating in Superfund projects related to mining impacted areas in the vicinity of Butte, Montana

Hydrogeologist/Site Director, Montana Bureau of Mines and Geology, 1989-1990

* Site Director for operation of a groundwater recovery system at the Montana Pole NPL Site, Butte, Montana
* Participated in other Superfund related to mining in the Butte area

Graduate Research Assistant, Montana Bureau of Mines and Geology, 1987-1989
* Participated in Superfund projects related to mining impacted areas
* Instructor in Field Hydrogeology Course offered by the Montana College of Mineral Science and Technology

PUBLICATIONS

Metesh, J.J., and Esp, D.L., 1985, Montana Hazards and Vulnerability Analysis, Section: Earthquakes, Montana Disaster and Emergency Services, 21pp.

Metesh, J.J., Duaime, T.E., Sonderegger, J.S., 1989, Final Report: Travona Mine Aquifer Test - Water-level Observations and Aquifer Characteristics Interpretation, Silver Bow County Montana, MBMG OF-219, 112pp.

Metesh, J.J., 1991, Hydrogeologic Controls on Coal Strip Mine Spoils, Water Resources Center, 42pp.

ABSTRACTS

Metesh, J.J., 1990, Aquifer Testing and Evaluation at the Travona Mine and Marget Ann Mine, Butte Montana, JOURNAL OF GROUNDWATER, National Water Well Association. [This abstract was also presented at the Rocky Mountain Groundwater Conference, August 1990, Butte, Montana]

Metesh, J.J., 1990, Hydrogeologic Controls on Coal Strip Mine Spoils, Rocky Mountain Groundwater Conference, Butte, Montana.

Resume

Wayne Adams Van Voast

EDUCATION

Montana State University, Bozeman. B.S., 1961. M.S., 1964.

PROFESSIONAL EXPERIENCE

10/1990 to Present: Chief of Research Division, Research Professor
Montana Bureau of Mines and Geology
Montana College of Mineral Science and Technology, Butte

7/1989 to 10/1990: Chief of Hydrology Division, Research Professor, Montana Bureau of Mines & Geology, Butte. Supervision of research projects, budgets, and operations. Active participation in projects on mining and hydrogeology.

7/1974 to 7/1989: Senior Hydrogeologist, and Chief of Billings Office
7/1971 to 7/1974: Hydrogeologist
7/1969 to 7/1971: Mineral Fuels Geologist Montana Bureau of Mines & Geology, Butte and Billings. Research on coal reserves and on hydrologic effects of mining. Member of numerous Federal and State committees on hydrologic research and planning.

11/1965 to 7/1969: Hydrologist, US Geological Survey, WRD, St. Paul, MN. Evaluation of ground-water in large drainage basins, and evaluation of ground-water for irrigation.

6/1965 to 10/1965: Geologist, Montana Highway Department, Helena, MT. Engineering geology, for interstate highways construction.

7/1964 to 4/1965: Well-site Geologist, Continental Laboratories, Inc., Billings, Montana. Well-site geology. Canada.

1/1962 to 6/1964: Research Assistant, Department of Earth Sciences, Montana State University, Bozeman, Montana.

6/1961 to 1/1962: Geologist, Continental Laboratories, Inc., Billings, MT. Well-site hydrocarbon gas analysis.

HONORS, AWARDS, PROFESSIONAL ACTIVITIES

May 1975: Delegate to Joint Poland-USA Symposium on Open-Pit Coal Mining".

September 1978: Joint USSR-USA Scientist Exchange on Surface Mining; 14-day USSR study and speaking tour.

1979-1981: National Acad. of Sci. Committee on "Hydrologic Effects of Mining."

1981: Montana Steering and Advisory Committee for the Tongue River Unsuitability (for mining) Petition filed against MT Dept of State Lands and U.S. OSM.

1982-1989: MT Water Well Cont. (State Dept of Ntrl Res. and Cons.).

1983: Advisory Group on Mining Hydrology for Alberta Research Council.

April 1984: Co-organizer of the Rocky Mountain Ground-Water Conference.

1983, 1985: Report reviewer for Office of Technology Assessment.

1985, 1986: International Joint Commission Study Team on proposed mining in British Columbia.

1985, 1986: Wrote pre-leasing Hydrologic Data Standards for the Joint BLM, Montana, and Wyoming Powder River Coal Team.

1987, 1988: Wrote pre-leasing Hydrologic Data Standards for Joint BLM, Montana, and North Dakota Fort Union Coal Team.

1989 to present: Appointed to Western Regional Advisory Committee for the National Mine Land Reclamation Center.

SELECTED PUBLICATIONS ON COAL AND MINING HYDROLOGY

Matson, R.E., and Van Voast, W.A., 1970, Preliminary summary report of strippable low-sulfur coals of southeastern Montana: Montana Bureau of Mines & Geology, open-file report, 91 p.

Van Voast, W.A., 1974, Hydrologic effects of strip coal mining in southeastern Montana-emphasis: one year of mining near Decker: Montana Bureau of Mines & Geology, Bull. 93, 24 p.

Van Voast, W.A., Hedges, R.B., and Pagenkopf, G.K., 1975, Hydrologic impacts of coal-mine effluents and spoils leachates: Montana Acad. Sci. Proc. of Fort Union Coal Symp. v. 3, Reclamation section, p. 289-303.

Van Voast, W.A., Hedges, R.B., and Pagenkopf, G.K., 1975, Hydrologic research in strip-mined areas of southeastern Montana: Proc. of Polish-U.S. Symp. on "Environmental Protection in Open-Pit Coal Mining", U. of Denver Res. Inst., Denver, May 1975, p. 47-57.

Van Voast, W.A., and Hedges, R.B., 1975, Hydrogeologic aspects of existing an proposed strip coal mines near Decker, southeastern Montana: Montana Bureau of Mines & Geology Bull. 97, 31 p.

Van Voast, W.A., Hedges, R.B., and McDermott, J.J., 1976, Hydrologic aspects of strip mining in the subbituminous coal fields of Montana: Proc. of 4th Symp. on Surface Mining and Reclamation, Natl. Coal Assoc. and Bituminous Coal Res. Inc., Louisville, Ky., Oct. 1976.

Pagenkopf, G.K., Whitworth, C., and Van Voast, W.A., 1977, Influence of spoil material on ground-water quality: Energy Communications, 3 (2), p. 107-126.

Van Voast, W.A., Hedges, R.B., and McDermott, J.J., 1977, Hydrologic conditions and projections related to mining near Colstrip, southeastern Montana: Montana Bureau of Mines & Geology, Bull. 102, 43 p.

Van Voast, W.A., Hedges, R.B., and McDermott, J.J., 1977, Hydrologic aspects of surface mining-western situation: Proc. of Soc. Amer. Foresters 1977 Natl. Conv.,Albuquerque, New Mexico.

Van Voast, W.A., Hedges, R.B., and McDermott, J.J., 1978, Hydrologic aspects of strip mining in the subbituminous coal fields of Montana: Transactions of SME/Amer. Inst. Mining Engineers, vol. 266, pp. 1949-1955.

Van Voast, W.A., Hedges, R.B., and McDermott, J.J., 1978, Hydrologic characteristics of coal-mine spoils, southeastern Montana: Montana Univ. Joint Water Resources Res. Center Rept. 94, Montana State University, Bozeman, 34 p.

Van Voast, W.A., Hedges, R.D., and McDermott, J.J., 1978, Strip coal mining and mined-land reclamation in the hydrologic system, southeastern Montana: Proj. compl. rept. for Old West Regional Comm., OWRC Grant No. 10570165, 122 p., avail. from NTIS, Springfield, VA, 22161, rept. no. PB 301253/AS.

Hedges, R.B., Van Voast, W.A., and McDermott, J.J., 1980, Hydrogeology of an area of proposed surface mining near lower Youngs Creek, southeastern Montana: Montana Bureau of Mines & Geology, open-file report, MBMG 43, 46 p.

Thompson, K.S., and Van Voast, W.A., 1981, Hydrology of the lower Squirrel Creek drainage, southeastern Montana, with special reference to surface coal mining:Montana Bureau of Mines & Geology, open-file report, MBMG 84, 47 p.

Van Voast, W.A., 1981, Theoretical effects of hypothetical mine spoils on quality of ground-water in alluvium along the Tongue River, in Montana Dept. State Lands and U.S. Off. Surface Mining, 1982, Tongue River, Montana, petition evaluation document: DLS/OSM-PE-2, 307 p.

Van Voast, W.A., and Thompson, K.S., 1982, Estimations of postmining water quality for the Tongue River, Montana and Wyoming, upstream from Tongue River Dam: Montana Bureau of Mines & Geology Hydrogeologic Map no. 5, 2 sheets, 10 p.

Noble, R.A., Van Voast, W.A., and Sonderegger, J.L., 1984, Some hydrologic aspects of proposed coal mining in the North Fork of the Flathead River Headwaters area, northwest Montana and southeast British Columbia: Montana Water Res. Research Center proj. compl. rept., project no. 372805.

Van Voast, W.A., 1985, Ground-water reactions to surface coal mining in semiarid lands: Proc. Second International Congress on Mine Water, Dept. of Hydrogeology, School of Mines, Madrid, Spain pp. 861-873.

Van Voast, W.A., and Reiten, Jon C., 1986, Ground-water changes associated with surface coal mining in the northern Powder River Basin: in Innovative Approaches to Mined Land Reclamation, Southern Illinois Univ. Press, p. 331-356.

Van Voast, W.A., and Reiten, Jon C., 1988, Hydrogeologic responses: Twenty years of surface coal mining in southeastern Montana: Montana Bureau of Mines & Geology, Memoir 62, 30 p.

Van Voast, W.A., 1991, Hydrogeologic aspects of coal-bed methane occurrence, Powder River Basin [abs.]: Am. Assoc. Petroleum Geologists Rocky Mtn. sect. mtng, 1991, Billings, MT.

MONTANA BUREAU OF MINES AND GEOLOGY
MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY
BUTTE, MONTANA 59701
(406) 496-4180

john @ (406)- 496 -4159

July 5, 1994

Mr. Howard Ross
University of Utah Research Institute
391 Chipeta Way, Suite C
Salt Lake City, Utah 84108-1295

Dear Howard:

Enclosed is the final report for the Montana portion of the geothermal assessment. I have also provided, on the enclosed diskette, the database table in PARADOX and LOTUS123 format and a spreadsheet with chemistry and temperatures from geothermometers also in LOTUS123 format. The 1:1,000,000-scale map of resources is being mailed separately. This map is currently in an ARC/INFO GIS format, but can be exported to several other formats including HPGL, a generic plotting language.

Please let me know of any format changes you would like and any comments regarding the report.

The report on the ground-loop application is in preparation and will be sent under separate cover when it is complete.

Sincerely,

John Metesh 496-4159
Hydrogeologist

cc: Wayne Van Voast - MBMG

GEOTHERMAL RESOURCES OF MONTANA

Submitted to:

University of Utah Research Institute

Submitted by:

John Metesh
Montana Bureau of Mines and Geology

June, 1994

GEOTHERMAL RESOURCES OF MONTANA

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ACKNOWLEDGMENTS

The author greatfuly acknowledges the advise and guidance provided by Howard Ross of the University of Utah Research Institute, Paul Lienau of the Oregon Institute of Technology - GeoHeat Center. The cooperation of the owners of the springs and wells that were sampled as part of this assessment is also greatly appreciated.

DISCLAIMER

Notice

ABSTRACT

Montana's Geothermal Resources

The Montana Bureau of Mines and Geology has updated its inventory of low- and moderate temperature resources for the state and has assisted the Oregon Institute of Technology - GeoHeat Center and the University of Utah Research Institute in prioritizing and collocating important geothermal resource areas.

The database compiled for this assessment contains information on location, flow, water chemistry, and estimated reservoir temperatures for 267 geothermal wells and springs in Montana. For this assessment, the minimum temperature for low-temperature resource is defined as 10° C above the mean annual air temperature at the surface. The maximum temperature for a moderate-temperature resource is defined as greater than 50° C. Approximately 12 percent of the wells and springs in the database have temperatures above 50° C, 29 percent are between 20° and 30° C, and 58 percent are above 20° C. Low- and moderate-temperature wells and springs can be found in nearly all areas of Montana, but most are in the western third of the state. Information sources for the current database include the MBMG Ground Water Information Center, the USGS statewide database, the USGS GEOTHERM database, and new information collected as part of this program.

Five areas of Montana were identified for consideration in future investigations of geothermal development. The areas identified are those near Bozeman, Ennis, Butte, Boulder, and Camas Prairie. These areas were chosen based on the temperature of the resource and and its proximity to population centers.

1.0 INTRODUCTION

Previous Geothermal Assessments

Two state-wide geothermal assessments have been conducted in the past. Allen (1980) collocated geothermal resources and cities for eight western states including Montana. Allen's study focused on resource temperatures greater than 50°C and did not include low-temperature resources. Sonderegger and others (1981) produced a 1:1,000,000-scale map and associated table of geothermal resource areas in Montana based on a compilation of various published reports and theses. Although the compilation included temperatures below 50°C, these data were not stored in a digital format because electronic databases were not available then for retrieval or storage. These reports, however, provided a good basis for updating information which has now been stored in a digital format.

Overview of Program

The Montana Bureau of Mines and Geology (MBMG) entered into a cooperative agreement with the Oregon Institute of Technology GeoHeat Center (OIT-GHC) and the University of Utah Research Institute (UURI) to conduct several tasks related to Montana's geothermal resources. These tasks included:

- preparation of a comprehensive digital geothermal-resources database containing temperature, location (latitude/longitude, Township/Range/Section/tract, and county) and chemistry (pH, TDS, and selected chemistry). The minimum temperature for a low-temperature resource was defined to be 10°C above the mean annual air temperature at the surface.

- preparation of a 1:1,000,000-scale map of occurrences within Montana. The map was compiled in a digital format.

- collecting samples from areas lacking information; analyses of the samples were conducted by UURI Earth Science Laboratory.

- a final summary report describing all tasks and their results.

- assisting OIT-GHC and UURI to prioritize low- and moderate-temperature resource areas.

Funding for this program was provided by the Department of Energy through a task agreement with OIT GHC and UURI. The tasks performed under this agreement may be considered Phase I of the Low-Temperature Geothermal Resources and Technology Transfer Program. Phase II, if funded, will include a detailed study of priority sites.

2.0 DATA SOURCES

References Used and Selection Criteria

Ground Water Information Center

The criteria for selecting sites that were to be included in the database depended on the source of the data. For the initial search of the Montana Bureau of Mines Ground Water Information Center (GWIC) database, a minimum temperature of 13° Celsius was used (10° degrees above the lowest mean annual temperature officially reported anywhere in Montana) to ensure that all low-temperature sites were included. This query produced approximately 600 records. Each record included any information that was available on location , site name, well depth, flow, temperature, and chemistry. These records were then transferred to a PARADOX database where more restrictive queries could be made that would eliminate records while allowing for a review of the eliminated records. For example, after sorting and separating the data into five geographic areas for which the mean annual air temperature was better defined and running a query based on that temperature, approximately 250 sites were eliminated, leaving approximately 350 sites to be considered further. Each of the remaining 350 sites was assigned a 3-digit identification number with a prefix of MGEOT. The rejected records were reviewed for other geothermal indicators such as high chloride, silica, and/or arsenic concentrations and close proximity to known geothermal areas.

GEOTHERM

A digital version of the GEOTHERM database was obtained from the Department of Energy Geothermal Division. These data had been compiled in an earlier, region-wide inventory (Reed and others, 1983). Although no new records were added to the MGEOT database, the GEOTHERM records were compared to those in the MGEOT database for accuracy and completeness. Since there were few changes, it was not necessary to merge the databases; any necessary changes to the MGEOT database were made manually.

Published Data

The tables of geothermal wells and springs produced by Mariner and others (1976), Leonard and others (1978), and Sonderegger and others (1981), were also used to ensure the completeness and accuracy of the MGEOT database. Any additional sites or information from these reports were entered manually into the database. The same approach was taken with other published sources.

Twelve Master's theses were reviewed for additional information on geothermal resource areas. Many of the investigations focused on the geologic or geophysical aspects of a known geothermal area. Little chemistry data was gleaned from these reports; however, temperature and location of many sites were verified as a result of the review.

Error and Duplicate Records

The most common error encountered was high temperatures reported for wells and springs in areas where geothermal sources are known **not** to exist. The most probable cause for the high temperature is "warm-day" sampling or improper purging of shallow wells. These sites were eliminated based on the personal knowledge of the investigators or on data collected at that same site at another time. Another common error was in the units used for concentration data. Trace-metals such as boron, arsenic, and lithium were often in error as a result of converting between parts-per-billion (μg/L) and parts-per-million (mg/L). The original publication was used, if possible, to correct these. In other cases, a calculation of ionic balance was used to determine if a problem existed.

With some exceptions, duplicate records in the form of data for two or more samples from the same site were eliminated and the most recent, most complete data were used. The exceptions were the site that had been re-sampled as part of this inventory (Symes Hotel, MGEOT352) and sites where samples had been collected several years apart. The intent was to provide information on changes in

temperature and chemistry over time. The other exception were those sites where information was limited with respect to chemistry. In these cases, two data sets provided more useful information on the site. There is a total of 24 duplicate sites.

Reference/Bibliography

A reference is given for each record in the database. The reports published by Mariner and others (1976), Leonard and others (1978), and Sonderegger and others (1981) provided most of the information for previously identified geothermal areas. The GWIC database provided more recent data for previously identified sites. GWIC also provided information for areas near previously identified resource areas and for low-temperature sites in geothermal areas not previously identified.

The references/bibliography listed in Section 8.0 also includes the theses and other publications that pertain to geothermal resource areas in Montana. As noted in Section 2.0, some of these references provided confirmation of location and temperature. Rautio and Sonderegger (1980) also provided a bibliography of geothermal resources in Montana. This is reproduced in this report as a useful supplement to the bibliography.

3.0 DATA FORMAT

Organization of Tables

The data fields used in the database were recommended by program leaders at OIT-GHC and UURI, and agreed upon by state team members. The final version of the data was exported from the PARADOX database to a LOTUS-123 format. The spreadsheet enabled an evaluation of the distribution of sites, the calculation of reservoir temperature, and provided a means of graphical output.

State Geothermal Resource Map

The location (latitude/longitude), temperature, resource type (well or spring), and ID number of all sites in the database were imported from the spreadsheet to an ARC/INFO based Geographical Information System. The data were then plotted at 1:1,000,000 scale with county boundaries. Each data-point indicated the ID-number, the temperature range (by color), and resource type (well or spring, by symbol) as well as location. This initial plot was used to verify the accuracy of the location, to give an indication of the density of sites in a given area, and to identify any sites that were plotted in areas where geothermal resources are known **not** to exist. The final map uses the same format and presents each of the individual sites listed in the database. A listing of selected fields for all sites is presented in Appendix I. The large number of sites in the Camas-Lonepine area made it impractical to plot the ID number for each site; these are repeated in a separate table in Appendix I.

Procedures for using the data

The database listing in Appendix I is sorted by location (ascending latitude). This format is also used in the listing of maximum temperatures based on selected geothermometers in Appendix II. The information for each site is listed with reference to the ID number on the 1:1,000,000-scale map.

In the repetitive process of adding and deleting sites based on a multitude of criteria, it was found that maintaining the database in a PARADOX (or similar) format was best. This format enables searches using the an ID-number or location from the map or general information, such as site name, and is contained in a single database-table. This single table can be separated into several tables as the need arises.

4.0 FLUID CHEMISTRY

Samples collected in this assessment

Eight water samples were collected from five areas in Montana; seven of these sample sites had not been sampled previously or had only limited information prior to this investigation. The eighth site was selected to provide a comparison of data collected approximately 10 years apart.

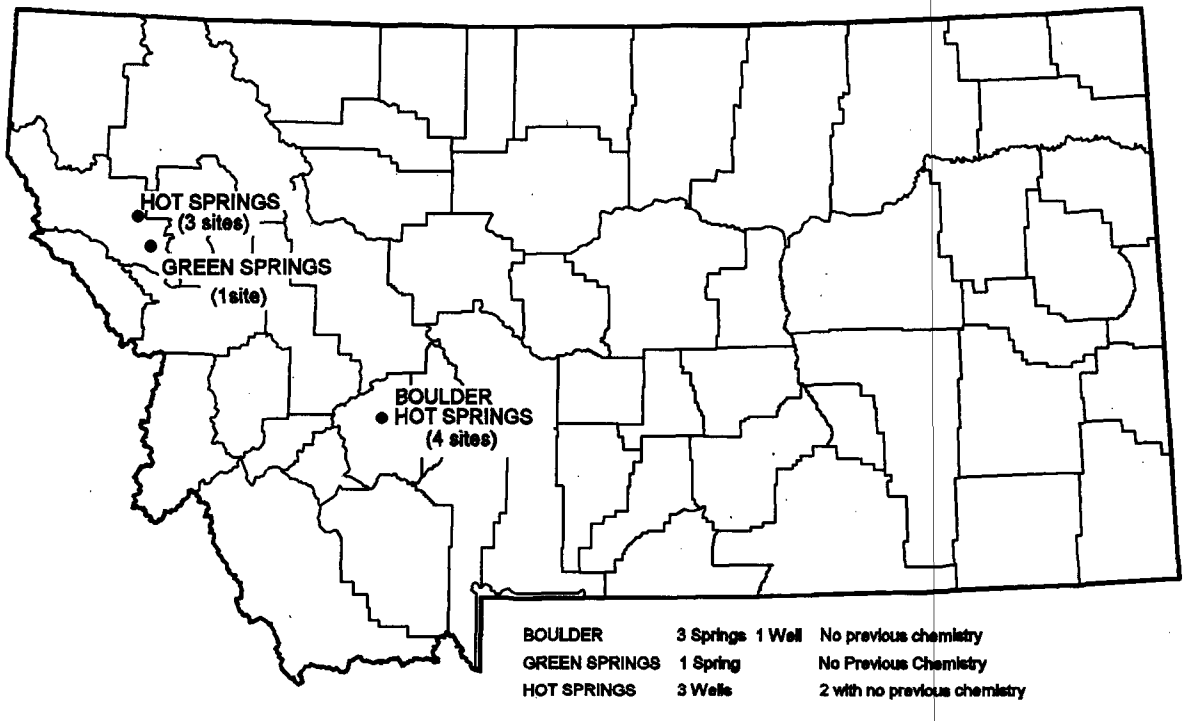

Figure 1 Eight samples were collected from three areas of Montana. Seven of the sites had little or no chemistry data.

Boulder Hot Springs, south of Boulder, MT

The Boulder Hot Springs resort is approximately 3 miles south of the town of Boulder within the Boulder Hot Springs KGRA. Previous owners of the resort would not grant access for sample collection during previous investigations. The

current owners, however, kindly allowed access, and each of the three springs near the resort were sampled (MGEOT349, MGEOT350, and MGEOT351). A fourth sample (MGEOT356) was collected from a well that had been intended as a drinking-water supply for the hotel, but produced "hot water" according to the owner.

Symes Hotel, Hot Springs, MT

The Symes Hotel uses a well for domestic water use. This well had been sampled in previous investigations, the sample date being 1980. The area has since undergone a moderate amount of development, and several additional wells have been completed in the area. Thus, this site (MGEOT352) was chosen to provide a comparison.

Koepling Well (MGEOT355) and Ostranger Well (MGEOT 354) , north of Hot Springs, MT

These wells are in the Little Bitteroot Valley 3 to 5 miles north of the town of Hot Springs. Although previously identified to be within a geothermal resource area, these wells had not been sampled in previous investigations.

Green Springs Area (MGEOT353), southwest of Camas Prairie, MT

Local residents identified 3 to 4 "hot" springs in the area south of the town of Camas Prairie. Nearby, Green Springs had been identified by Sonderegger and others (1981) as a geothermal area, but only limited data were available.

Sample collection/analytical methods

Water samples were collected from wells and springs in accordance with the Standard Operating Procedures provided by UURI (Kroneman, 1992). Each sample consisted of a 60-ml bottle filtered and preserved with 20% HNO_3, and

250-ml bottle filtered and preserved with 1% HCL, and a 500-ml bottle filtered with no preservative. Upon collection of each sample, specific conductance, pH, water temperature and air temperature were obtained at the sample source. Spring samples were collected as close as possible to the source. Wells were sampled after pumping or bailing a minimum of three casing volumes and after field-parameters (pH, SC, Eh, and temperature) had stabilized to a range of less than 10%.

Samples were shipped within 48-hours of collection, via overnight delivery, to the UURI Analytical Laboratory in Salt Lake City, Utah. The samples were analyzed for major cations, major anions, and selected trace-metals.

Reservoir Temperatures

Several methods to estimate the reservoir temperature have been proposed; the most widely used are those using dissolved concentrations of silica (as SiO_2), Na-K-Ca, Na-K-Ca with a correction for Mg, and Na-K and are summarized by Fournier (1981). These methods represent empirical, equilibrium equations for which the water temperature at the reservoir is calculated. As noted by the authors of the methods, these calculations should be interpreted in consideration of the geologic and hydrogeologic setting.

Analytical Results

The analytical results for selected analytes are presented in Table 1. These sites are also included in the listing in Appendix I, in the listing of temperatures from geothermometers in Appendix II, and in the MGEOT database.

TABLE 1
ANALYTICAL RESULTS
1993 SAMPLING

ID	Site Name	Temp (°C)	Flow (L/m)	TDS (mg/L)	pH	Cl (mg/L)	SO_4 (mg/L)
MGEOT349	BOULDER (UPPER)	54.0	340*	419.5	8.89	21.0	76.0
MGEOT351	BOULDER (LOWER)	64.5	75.7*	401.4	8.80	22.0	73.0
MGEOT350	BOULDER (MIDDLE)	74.0	75**	421.1	8.89	22.0	80.0
MGEOT356	BOULDER (WELL)	34.5		373.1	8.46	16.0	54.0
MGEOT352	SYMES HOTEL	33.3		297.2	9.66	11.0	30.0
MGEOT355	WELL 138	26.5		275.0	8.23	10.0	5.1
MGEOT354	WELL 56	17.2		290.9	8.05	14.0	3.8
MGEOT353	GREEN SPRINGS	23.7	2000**	208.4	9.86	12.0	17.0

* Flow measured with bucket/stopwatch **Flow estimated

ID	Site Name	F (mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L	K (mg/L)	Fe (mg/L)
MGEOT349	BOULDER (UPPER)	11.8	2.7	0.4	122.0	3.8	ND
MGEOT351	BOULDER (LOWER)	11.0	3.2	ND	111.4	6.1	0.31
MGEOT350	BOULDER (MIDDLE)	11.1	2.0	0.3	118.2	ND	0.08
MGEOT356	BOULDER (WELL)	5.7	4.09	ND	108.2	3.7	0.09
MGEOT352	SYMES HOTEL	5.6	0.6	0.7	89.4	2.2	ND
MGEOT355	WELL 138	3.4	4.5	ND	95.6	2.9	0.06
MGEOT354	WELL 56	5.4	5.5	2.5	109.3	ND	0.39
MGEOT353	GREEN SPRINGS	2.1	0.8	1.2	57.1	2.1	0.27

TABLE 1 - Continued

ID	Site Name	SiO_2 (mg/L)	As (mg/L)	B (mg/L)	Li (mg/L)
MGEOT349	BOULDER (UPPER)	93.2	0.7*	0.6	0.23
MGEOT351	BOULDER (LOWER)	90.0	ND	0.5	0.22
MGEOT350	BOULDER (MIDDLE)	98.5	ND	0.5	0.23
MGEOT356	BOULDER (WELL)	86.55	ND	0.49	0.21
MGEOT352	SYMES HOTEL	73.08	ND	0.2	0.04
MGEOT355	WELL 138	36.64	ND	0.4	0.04
MGEOT354	WELL 56	12.96	ND	0.3	ND
MGEOT353	GREEN SPRINGS	55.8	ND	0.1	ND

* Because of the high As concentration, this spring was re-sampled and analyzed by MBMG. The second analysis indicated a concentration of 0.02ug/L As.
ND = Not Detected

Boulder Hot Springs

The Boulder Hot Springs area lies approximately 3 miles south of the town of Boulder near the Interstate 15 highway. The area lies within the Boulder Batholith about 4 miles from its eastern edge. Until this investigation, only limited chemistry data and field parameters were publicly available for this area (Robertson and others, 1976, published limited chemistry and a reservoir temperature, but the location of the sample was not made clear). Other hot-springs and warm-water wells are known to exist in the area around Boulder; however, access was not gained either because the owner denied access or could not be contacted.

The samples were collected from three springs that have been developed to supply the Boulder Hot Springs resort. At present, the primary use of the hot water is a naturally heated swimming pool. As renovation of the hotel continues, the water may also be used for space heating as was the case in the past. Samples were collected at the supply pipe at each spring-box. Water-flow, which was difficult to measure because of the structures, was measured at two of the

springs using a bucket and stopwatch; the flow of the middle springs could only be estimated. The combined flow of all three springs is on the order of 490 L/min.

The field-temperatures of the springs vary by 20°C; the upper spring had the lowest temperature (54°C) and the middle spring, which was not being used, had the highest temperature (74°C). The variance in temperature suggests that the water supplying the springs is undergoing mixing. Conversely, the chemistry of the waters from each of the three springs is similar (all are strongly a sodium-potassium type water) and the estimated reservoir temperature for each of the springs tend to agree regardless of the geothermometer used (Table 2). Thus, the variance in temperature may result from the way the spring was developed and fed to the spring boxes.

TABLE 2
Selected Geothermometer Temperatures*
Boulder Hot Springs

ID	Site Name	Na-K-Ca (corrected)	Na-K-Ca (uncorr.)	Qtz (no steam)	Qtz (steam)
MGEOT349	BOULDER (UPPER)	110°C	134°C	133°C	129°C
MGEOT351	BOULDER (LOWER)		158°C	131°C	128°C
MGEOT350	BOULDER (MIDDLE)	120°C	141°C	136°C	132°C
MGEOT356	BOULDER (WELL)		134°C	129°C	126°C

*Geothermometer temperatures for all sites are presented in Appendix II.

The well, with a depth of 123 feet and a static-water-level of 2.8 feet, is downhill from the resort and the springs. The chemistry of its water (Table 1) is similar to that of the springs; and the geothermometer temperatures (Table 2) are in good agreement with those calculated for the springs. The water temperature (34.5°C) was 20°C lower than the spring with the lowest temperature. A small pond near the well had a temperature of 21°C.

Hot Springs Area

Three water samples were collected from the Hot Springs area: two from wells north of Hot Springs and one from a well in Hot Springs. As noted previously, temperature and chemistry data were not available for three of these sites, and the fourth, the Symes Hotel, had a sample collected in 1972 .

The Koepling well and the Ostranger well are completed in the Lonepine aquifer approximately 1.5 miles apart and approximately 5 miles northeast of Hot Springs. The Symes Hotel is located in Hot Springs.

Water temperature and the concentration of several of the dissolved constituents varies between the three wells (Table 1). The geothermometer temperatures (Table 3) also indicate a range of temperatures wider than would be expected for a system with little or no mixing. Donovan (1985) suggested that the chemistry (and geothermometers) reflected the relative position of the well in a deep-circulating flow system.

TABLE 3
Selected Geothermometer Temperatures*
Hot Springs Area

ID	Site Name	Na-K-Ca (corrected)	Na-K-Ca (uncorr.)	Qtz (no steam)	Qtz (steam)
MGEOT352	SYMES HOTEL	35°C	131°C	120°C	118°C
MGEOT355	KOEPLING (WELL 138)			48°C	55°C
MGEOT354	OSTRANGER (WELL 56)		126°C	88°C	90°C

*Geothermometer temperaturesfor all sites are presented in Appendix II.

A time-comparison of geothermometer temperatures for the Symes Hotel well (Table 3) suggests a 3 to 5°C drop in temperature, perhaps the result of continued development of ground-water resources in the area. None of this

development, however, has been of the geothermal resources. This area could easily provide for applications of heat-transfer technology.

Green Springs

Green Springs is approximately 12 miles south of Hot Springs and approximately 2.5 miles southwest of Camas Prairie. Green Springs consists of 3 to 4 thermal springs feeding a wetlands/pond area. Elsewhere in the area, several small springs have been described by local citizens. A sample was collected from the largest of the springs at its source (Table 1). Although the site was documented by Sonderegger and others (1981), only a few chemical parameters were measured. The new data enabled a calculation of geothermometer temperatures (Table 4).

TABLE 4
Selected Geothermometer Temperatures*
Green Springs Area

ID	Site Name	Na-K-Ca (corrected)	Na-K-Ca (uncorr.)	Qtz (no steam)	Qtz (steam)
MGEOT353	GREEN SPRINGS		140°C	107°C	107°C

*Geothermometer temperatures for all sites are presented in Appendix II.

The differences between geothermometer temperatures suggests that mixing may be occuring and the difference in surface temperature and the geothermometer temperatures suggests either a high heat transfer or a slow circulation rate for this area.

Observations From Other Database Entries

Incorporating low-temperature sites in the inventory produced a new perspective of geothermal resources in the state. Areas such as Butte became more important with respect to potential development. The same may be true for the area near the city of Great Falls in Cascade County where wells 420- to 1200-feet deep in the Madison Group produce water that ranges from 15 to 19°C; the water is used for irrigation and public water supply. Wells 900- to 1300-feet deep) in southern Treasure County and northern Big Horn County produce water whose temperatures range from 16.5°C to nearly 20°C.

The lower temperatures used in the selection criteria also had the effect of enlarging some of the areas identified by Sonderegger and others (1981). An example of this is in southern Broadwater County and northwestern Gallatin County where wells and springs had been identified in previous investigations. Updating the database provided additional information that may indicate a larger area for potential development.

5.0 DISCUSSION

Resource Potential

There are 291 records in the current database; these represent 267 individual sites (wells and springs). Approximately 62% of these sites exhibit water temperatures between 10 and 30° Celsius (Figure 2). — 71%

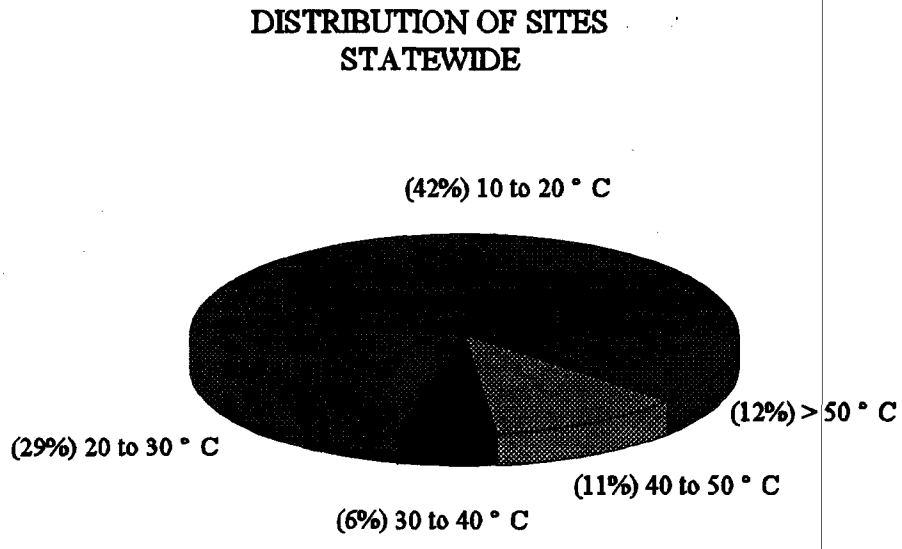

Figure 2 Over 60% of the geothermal sites in Montana have water temperatures less than 40° Celsius; 12% of the sites have temperatures greater than 50° Celsius.

Collocation of Resources and Users

Montana's population centers are generally small (<50,000 people) and

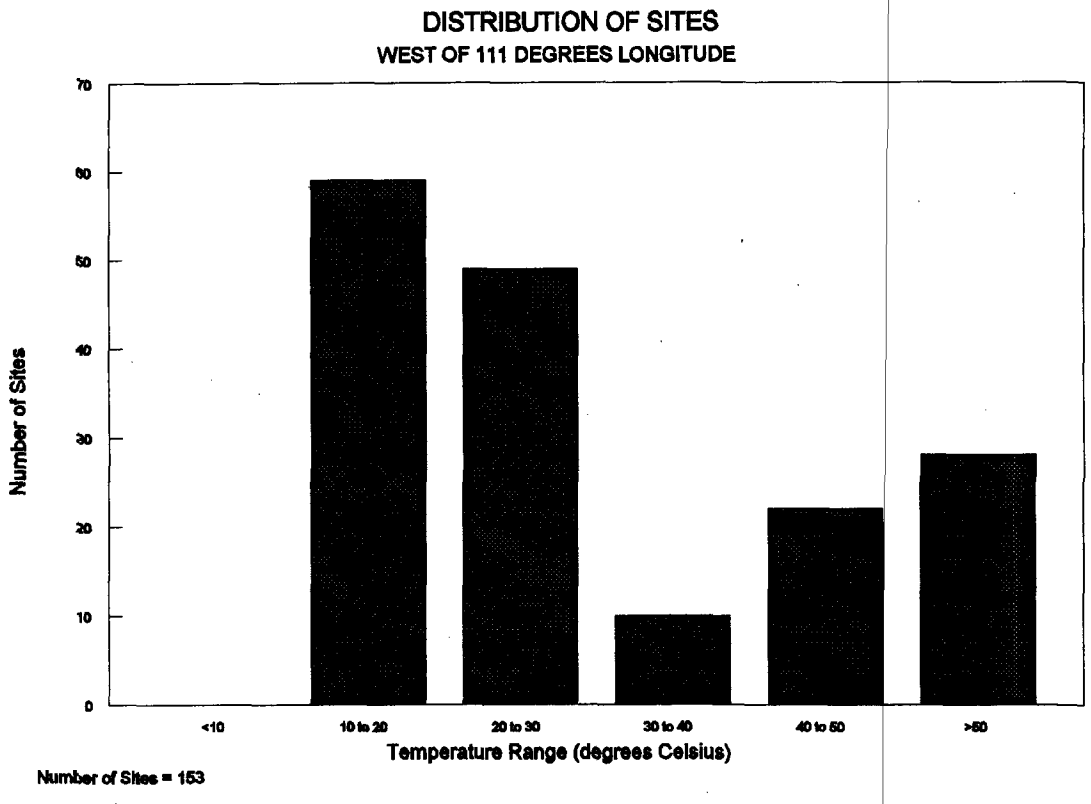

Figure 3 The western third of the state has 153 sites. About a third of those (approximately 100)have temperatures greater than 30°C.

widely distributed. The western third of the state has more of the larger population centers and a slightly higher overall population than the eastern two-thirds.

The distribution of geothermal resources mimics, but does not correlate, to that of the population; 153 of the 267 sites occur in the mountainous area of the western third (generally west of 111° longitude) whereas 115 sites are in the plains area of the eastern two-thirds of the state. Similarly, the number of warm and hot springs is much higher in the west.

A comparison of the distribution within the western (Figure 3) and eastern (Figure 4) parts of the state shows that the western third has a larger number of sites with temperatures greater than 30°C.

Collocation of population centers, albeit small, and geothermal resources is most likely to occur in the western third of the state. It should be noted, however, that deep wells into the Madison Formation in the eastern part of Montana have the potential to produce low- to moderate-temperature water as demonstrated in Treasure County and northern Big Horn County.

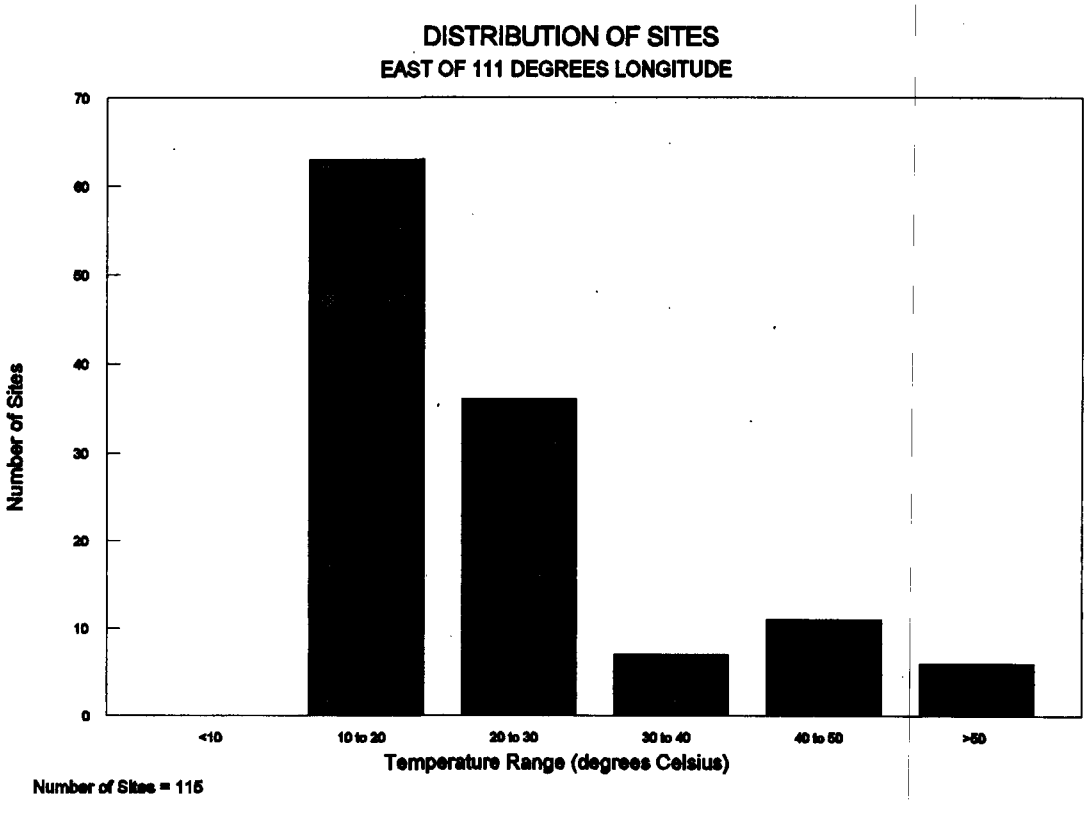

Figure 4 Most of the sites in the eastern third of the state. About 20 sites have temperatures greater than 30°C.

6.0 SUMMARY

Each of the tasks outlined in the agreement between the Montana Bureau of Mines and Geology and the Oregon Institute of Technology / University of Utah Research Institute have been completed. The database described here represents the most current information on geothermal resources in the state of Montana. The database also contains the information collected from eight sites that lacked information prior to this inventory. A 1:1,000,000 scale map, which accompanies this report, shows the location, temperature group, distribution, and type of geothermal resources in the state.

The distribution of geothermal resources and population in Montana suggests a good potential for development of these resources. Although Montana has only a few large population centers, smaller cities and towns near the resources could benefit from development. Although the low temperature of the resources (most are less than 50°C) restricts the type of development, small-scale direct-heat or heat-pump applications, aquiculture, and other development may be economical in some areas.

7.0 RECOMMENDATIONS

Priority Areas for Phase II Studies

The dominant consideration in selecting areas in Montana for future studies is the proximity of the resource area to transportation and population centers. Although there are several resource areas with a relatively high potential for development, limited past and/or current use and low population in the area likely prohibit development. The areas that have the highest potential and are nearest population centers (Figure 5) and transportation routes are as follows:

Bozeman

The Gallatin valley near Bozeman has experienced a steady population growth over the last decade. Data for the Bozeman Hot Springs just west of the city of Bozeman indicates a surface temperature of approximately 55°C and an estimated reservoir temperature of 80°C. The springs are currently used to heat a swimming pool at a commercial campground. Although little resource development has occurred in the area over the last ten years, the Gallatin valley was identified by Sonderegger and others (1981) as an area expected to contain geothermal resources suitable for development.

Butte

The Butte Mining District was extensively mined over a period of nearly 100 years. At the cessation of underground mining in the early 1980's, dewatering of the bedrock was discontinued and water-levels were allowed to rise. Soon after the mines were shut down, the area was listed in the National Priorities List and is designated as a Superfund site. The rising water, which has a low pH and a high dissolved-metals content, is of much to concern to local, state, and federal agencies, and it has been recognized that water-levels will need to be controlled by pumping to prevent discharge into the Clark Fork River drainage.

With respect to geothermal development, the Butte area offers several avenues for low-to-moderate temperature resources. The underground workings were notoriously hot areas to work in while operating and recent data collected from the mines show water temperatures ranging from 13° to 33°C. Monitoring wells completed in the bedrock aquifer at depths less than 600 feet indicate temperatures of 10 to 18°C, and water quality is quite good (for example, see MGEOT341 and MGEOT342).

Ennis

Several studies of the geothermal resources near Ennis have been conducted in the past; however, a deep drilling project is needed to fully understand the nature of this resource area. Recently, one of the areas in which

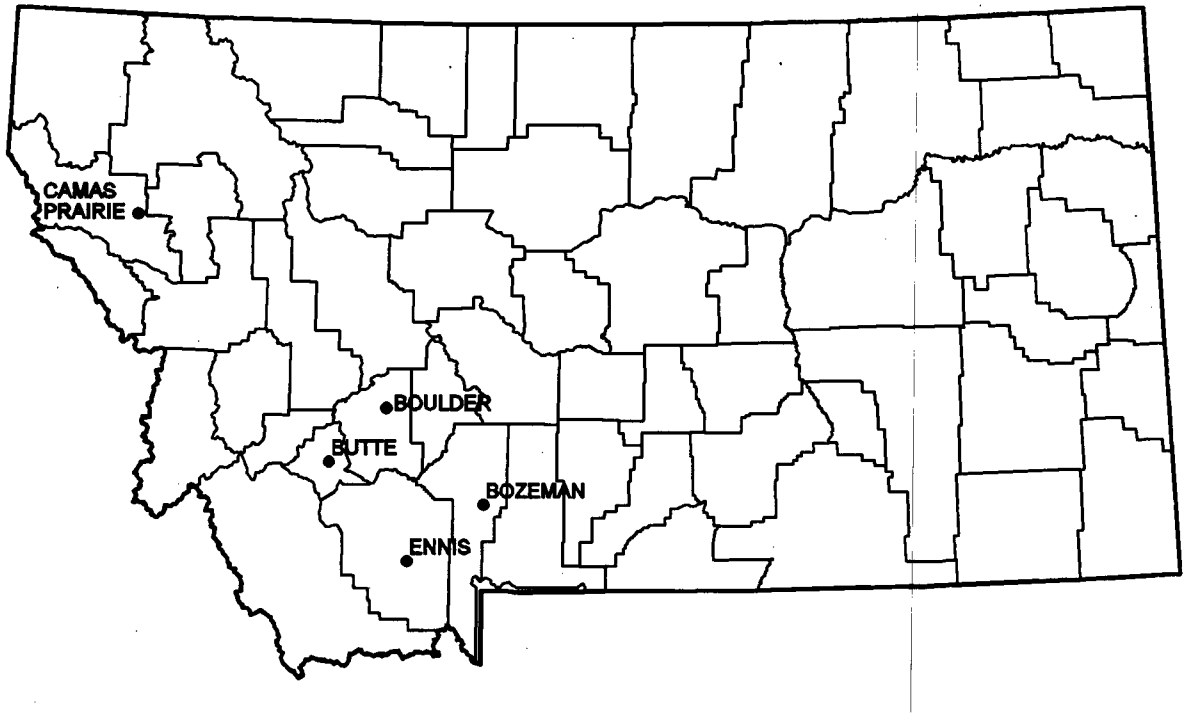

Figure 5 Five areas have been selected as potential areas for additional studies relating to application of direct-use technology.

wells were completed was offered for sale to the county government. Application of the information derived from previous studies to an investigation of potential direct-heat applications may also be warranted.

Boulder Hot Springs

The Boulder Hot Springs is within a few miles of Interstate-highway 15 and the town of Boulder is only 1/2 mile from it. Larger cities, Butte to the south and Helena to the north, are within 30 miles. The surface temperatures at the three springs sampled range from 54 to 74°C, and flow is approximately 340 L/min. at the larger spring. The site is currently undergoing renovation. The likelihood of other geothermal resources in the area is high.

Camas Prairie

There are several previously un-recorded springs in this area; one site was sampled recently (MGEOT353). Although the area is not near any of the larger population centers, there are some recreational facilities in the area. This particular area of Montana has been especially popular for cottage-industry development.

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APPENDIX I
DATABASE LISTING
GEOTHERMAL RESOURCES OF MONTANA

AND

SEPARATE LIST OF 33 SITES
IDENTIFIED ON MAP AS THE CAMAS-LONEPINE AREA

Selected Chemistry

ID	Site name	Reference	Type	Latitude	Longitude	Temp (deg C)	Chloride mg/l	Sulfate mg/l	Fluoride mg/l	Std dev balance	Lab pH	SC mmohs	TDS mg/l	HCO3 mg/l
MGEOT209	TARGHEE SULPHUR SPRING*6MI W W YELLOWSTONE	Sonderegger et.al. 1981	SPRING	44.6775	111.2180	18.0	1.7	156.0	1.1	-10.57	8.03	305.5	316.41	63.30
MGEOT127	LOWER EAST SPRING-STAUDENMEYER RANCH	MBMG-GWIC	SPRING	44.6988	111.8780	28.0	9.8	114.0	1.8	0.22	7.48	628.3	400.37	251.00
MGEOT125	LOWER WEST SPRINGS-STAUDENMEYER RANCH	MBMG-GWIC	SPRING	44.6988	111.8780	31.0	9.4	116.0	1.8	0.32	7.44	625.5	400.95	251.00
MGEOT124	UPPER WEST SPRING-STAUDENMEYER RANCH	MBMG-GWIC	SPRING	44.6988	111.8780	29.0	9.8	114.0	1.8	0.55	7.52	617.2	395.24	249.00
MGEOT177	UPPER WEST SPRING-STAUDENMEYER RANCH	MBMG-GWIC	SPRING	44.6988	111.8780	28.8	16.0	107.9	1.6	0.51	8.29	607.0	395.15	249.00
MGEOT123	UPPERMOST SPRING-STAUDENMEYER RANCH	Sonderegger et.al. 1981	SPRING	44.6988	111.8780	28.0								
MGEOT126	UPPER-EAST SPRING-STAUDENMEYER RANCH	MBMG-GWIC	SPRING	44.6988	111.8780	29.0								
MGEOT121	ANDERSONS PASTURE SPRING #1	MBMG-GWIC	SPRING	44.7025	111.8855	28.0								
MGEOT122	ANDERSONS PASTURE SPRING #2	MBMG-GWIC	SPRING	44.7030	111.8822	23.5	9.0	118.0	1.8	-0.08	7.47	627.0	400.75	247.00
MGEOT210	USFS* BAKERS HOLE* 3MI N WEST YELLOWSTONE	Sonderegger et.al. 1981	WELL-FLOWING	44.7080	111.0991	16.0	17.0	8.8	3.7	0.20	7.76	310.8	256.64	152.00
MGEOT115	SLOAN COW CAMP SPRING	Sonderegger et.al. 1981	SPRING	44.7686	111.6487	29.5	8.0	4.0	3.1		10.10		262.00	
MGEOT120	WEST FORK SWIMMING HOLE	Sonderegger et.al. 1981	SPRING	44.7863	111.6550	25.5	2.8	11.8	0.4	-0.38	7.88	320.6	179.02	194.00
MGEOT118	CURLEW CREEK WARM SPRING	MBMG-GWIC	SPRING	44.8730	111.5455	23.0								
MGEOT119	WALL CANYON WARM SPRING	Sonderegger et.al. 1981	SPRING	44.9763	111.6508	24.0	49.2	80.8	14.4	-0.09	8.06	1097.0	703.41	493.00
MGEOT229	WOLF CREEK HOT SPRING	Leonard et.al. 1978	SPRING	44.9838	111.6155	60.0	19.0	43.0	18.0	0.83	8.81	492.9	331.67	157.00
MGEOT129	LOWELL HILDRETH SPRING*15 MI SW DILLON	MBMG-GWIC	SPRING	45.0275	112.8452	19.6	16.2	191.0	0.7	0.17	7.44	722.0	480.70	217.00
MGEOT016	BEAR CREEK SPRINGS	Sonderegger et.al. 1981	SPRING	45.0353	110.6653	24.0					9.50			
MGEOT132	VIGILANTE WARM SPRING	Sonderegger et.al. 1981	SPRING	45.0369	111.9522	23.5	1.9	174.0	0.9	-0.49	7.74	617.7	403.41	182.00
MGEOT041	LA DUKE HOT SPRINGS	Mariner et.al. 1976	SPRING	45.0930	110.7737	65.0	45.0	1200.0	3.6		6.50		2230.00	
MGEOT012	BROWNS SPRINGS	Sonderegger et.al. 1981	SPRING	45.1047	112.7508	23.7					7.40		480.00	
MGEOT010	PULLER HOT SPRINGS	Leonard et.al. 1978	SPRING	45.1717	112.1520	44.4	91.0	350.0	2.2		7.70		1160.00	
MGEOT019	TRUDAU SPRINGS	Sonderegger et.al. 1981	SPRING	45.2350	112.1347	22.7	18.0	102.0	0.8		8.40		540.00	
MGEOT040	CHICO HOT SPRINGS	Mariner et.al. 1976	SPRING	45.3370	110.6913	42.0	10.0	41.0	0.9		7.40		342.00	
MGEOT032	GROUNDWATER*4.7 MI NE FT SMITH MT	MBMG-GWIC	WELL	45.3447	107.8627	20.0	7.9	125.0	1.4	-0.20	8.00	825.0	489.30	319.00
MGEOT074	BROWN CATTLE CO* 3.1 MI N. BIRNEY MT	MBMG-GWIC	WELL	45.3663	106.5322	15.5	4.6	79.4	2.0	-0.70	8.53	1020.0	619.10	519.70
MGEOT276	JARDINE HOT SPRINGS 0.25 MI E OF JACKSON	MBMG-GWIC	SPRING	45.3675	113.4033	60.0	8.0	45.5	1.8	1.99	7.73	967.5	655.43	615.00
MGEOT289	MBMG GEOTHERMAL TEST * THEXTON TX-12	MBMG-GWIC	WELL	45.3677	111.7247	87.0	116.0	224.0	10.0	2.27	7.69	1338.0	1030.15	449.00
MGEOT026	JACKSON HOT SPRINGS	Mariner et.al. 1976	SPRING	45.3678	113.4030	58.0	8.0	45.0	2.0		6.77		986.00	
MGEOT293	PRIVATE GEOTHERMAL TEST*ENNIS HOT SPRINGS*	MBMG-GWIC	WELL	45.3702	111.7252	87.0	111.0	203.0	10.9	0.84	7.84	1442.0	966.38	404.00
MGEOT277	LAPHAM DOMESTIC WELL 1 MI NW JACKSON, MT.	MBMG-GWIC	WELL	45.3825	113.4222	17.0	7.8	40.4	1.4	0.54	7.63	953.3	575.10	558.00
MGEOT117	ENNIS HOT SPRINGS	MBMG-GWIC	SPRING	45.3852	111.7788	61.0								
MGEOT058	BROWN CATTLE CO * 9.5MI SW BIRNEY DAY SCH.	MBMG-GWIC	WELL	45.3869	106.5330	16.5	9.0	71.0	2.3	-0.64	8.26	992.0	600.36	531.00
MGEOT031	BEAVERHEAD ROCK SPRINGS	Sonderegger et.al. 1981	SPRING	45.3918	112.4512	27.0					7.20			
MGEOT133	APEX WARM SPRING	Sonderegger et.al. 1981	SPRING	45.4205	112.6911	25.0	11.6	135.0	0.6	-0.33	7.78	519.5	340.92	140.00
MGEOT323	ELKHORN HOT SPRINGS	Mariner et.al. 1976	SPRING	45.4576	113.1087	48.5	2.0	27.0	2.6		8.94		180.00	
MGEOT292	MARTIN, KIETH	MBMG-GWIC	SPRING	45.4594	109.8758	20.5	0.7	216.0	0.8	-1.03	7.87	666.1	443.87	170.80
MGEOT326	NEW BILTMORE HOT SPRINGS	Mariner et.al. 1976	SPRING	45.4620	112.4750	53.0	46.0	1100.0	3.3		6.80		1970.00	
MGEOT306	NEWMAN, JOHN * JOLIET, MT	MBMG-GWIC	WELL	45.4663	108.9800	16.0	15.2	2820.0	0.2	-0.99	7.72	6184.0	4639.66	486.00
MGEOT006	ANDERSON'S SPRING	Sonderegger et.al. 1981	SPRING	45.5530	110.1422	25.0	1.0	139.0	0.4		7.40		270.00	
MGEOT280	ANDERSON SPRING	MBMG-GWIC	SPRING	45.5530	110.1422	25.0	0.1	129.0	0.5	0.32	7.67	524.9	328.33	179.60
MGEOT043	NORRIS HOT SPRINGS	Leonard et.al. 1978	SPRING	45.5750	111.6833	50.0	22.0	130.0	8.1		7.80		651.00	
MGEOT015	POTOSI HOT SPRINGS	Mariner et.al. 1976	SPRING	45.5892	111.8987	49.5	6.0	140.0	6.2		8.60		333.00	
MGEOT187	GROSS, PETE * 4 MI S PONY MT	MBMG-GWIC	SPRING	45.6016	111.9002	37.5	6.2	166.0	6.1	1.29	8.36	474.4	368.76	67.30
MGEOT311	MCFERRAN, EUGENE * BILLINGS, MT	MBMG-GWIC	WELL	45.6033	108.4019	15.5	39.8	71.7	5.8	0.85	7.36	1864.0	1140.20	1098.00
MGEOT179	CARTER'S BRIDGE * 4 MI SE LIVINGSTON MT.	Sonderegger et.al. 1981	SPRING	45.6091	110.5686	28.0								
MGEOT011	AVON WARM SPRING	Sonderegger et.al. 1981	SPRING	45.6103	112.5547	25.5					6.90			
MGEOT264	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	MBMG-GWIC	WELL	45.6602	111.1861	59.0	50.0	131.0	10.1	6.43	9.41	715.1	434.40	52.50
MGEOT265	BOZEMAN HOT SPRINGS * OLD WELL	MBMG-GWIC	WELL	45.6602	111.1861	54.0	50.0	132.0	10.1	0.11	9.43	713.9	462.34	53.70
MGEOT266	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	MBMG-GWIC	WELL	45.6602	111.1861	55.0	50.3	133.0	10.2	1.73	9.41	716.8	456.86	55.10
MGEOT263	BOZEMAN HOT SPRINGS * ORIGINAL SPRING	MBMG-GWIC	SPRING	45.6605	111.1861	54.0	49.7	130.0	9.9	0.73	9.29	711.9	455.41	62.50
MGEOT335	BOZEMAN HOT SPRINGS	Leonard et.al. 1978	SPRING	45.6605	111.1862	54.5	48.0	120.0	12.0		9.50		436.00	
MGEOT269	RANCA * MCLEOD	MBMG-GWIC	WELL	45.6647	110.1141	49.0	2.0	1331.0	2.8	-0.41	7.58	2221.0	1983.42	118.30
MGEOT259	SCOTT FEED LOT	Sonderegger et.al. 1981	WELL	45.6819	108.1566	43.0	60.3	119.0	7.1	0.96	8.93	2001.0	1269.15	1016.00
MGEOT260	SCOTT FEED LOT	Sonderegger et.al. 1981	WELL	45.6836	108.1552	44.0	72.0	83.4	9.0	0.82	8.78	2521.0	1363.91	1169.00
MGEOT230	BLUE JOINT CREEK HOT SPRING	Sonderegger et.al. 1981	SPRING	45.6963	114.3633	29.4	3.0	5.0	9.5		8.22		179.00	
MGEOT002	BRIDGER CANYON WARM SPRING	Sonderegger et.al. 1981	SPRING	45.7073	110.9755	20.2	1.0	60.0	0.5		7.70		275.00	
MGEOT334	LOVE, MELVIN*THREE FORKS, MT	MBMG-GWIC	WELL	45.7269	111.4997	15.9	20.5	18.4	1.4	2.08	7.92	396.5	317.30	264.70
MGEOT033	GROUNDWATER*5.3 MI W HARDIN MT	MBMG-GWIC	WELL	45.7305	107.7311	39.4	4.0	1960.0	4.0	-1.55	7.60	3040.0	2935.17	180.00
MGEOT332	SHIPTON, HAROLD * THREE FORKS MT	MBMG-GWIC	WELL	45.7350	111.4825	16.9	32.0	24.9	1.4	-0.43	8.07	593.9	369.54	264.90
MGEOT256	HERMAN, T.E. * ROCKY RANCH 7.4 M W HARDIN	MBMG-GWIC	WELL-FLOWING	45.7369	107.7347	42.0	4.3	2130.0	3.1	0.18	7.76	3294.0	3061.89	150.10
MGEOT344	GALLOGLY HOT SPRING	Sonderegger et.al. 1981	SPRING	45.7495	113.9395	48.9	1.0	12.0	5.8		9.12		190.00	
MGEOT245	LOST TRAIL * WARM AND HOT SPRINGS	MBMG-GWIC	SPRING	45.7497	113.9394	41.7								
MGEOT069	CAIN MIKE*6.6 MI S VOLBERG	MBMG-GWIC	WELL	45.7533	105.7283	18.0	51.0	5.5	4.0	-0.39	8.30	1472.0	886.02	894.00
MGEOT018	HUNTERS HOT SPRINGS	Mariner et.al. 1976	SPRING	45.7572	110.2572	60.0	18.0	11.0	5.6		9.10		384.00	
MGEOT328	JORGENSON, JACK * THREE FORKS MT	MBMG-GWIC	WELL	45.7736	111.4686	16.0								
MGEOT346	RENOVA HOT SPRINGS	Leonard et.al. 1978	SPRING	45.7917	112.1283	50.0	34.0	200.0	3.0		7.50		655.00	
MGEOT339	WESTMORELAND * 9.1 M W SARPY SCHOOL	MBMG-GWIC	WELL	45.8027	107.0827	37.7	20.1	996.0	2.7	0.77	7.67	1837.8	1526.37	80.80
MGEOT095	LISCOM RANCH * 5.5 MI NW OF N STACY SCHOOL	MBMG-GWIC	WELL	45.8144	105.9705	15.5	13.2	61.3	1.0	-0.71	8.61	1140.0	709.03	636.70
MGEOT331	TINDER, L. MARIE * THREE FORKS MT	MBMG-GWIC	WELL	45.8219	111.4672	21.9	18.6	40.4	2.2	0.34	7.84	658.6	421.53	334.00
MGEOT327	WILCOX, RALPH * THREE FORKS MT	MBMG-GWIC	WELL	45.8269	111.4638	16.5								
MGEOT333	RICHARDSON, DEIRDRE * THREE FORKS	MBMG-GWIC	WELL	45.8300	111.4594	16.8	25.0	60.5	2.4	0.31	8.05	754.1	485.04	360.00
MGEOT347	MEDICINE HOT SPRINGS	Mariner et.al. 1976	SPRING	45.8456	114.0347	45.0	7.0	33.0	14.0		8.60		322.00	
MGEOT092	WESTERN ENERGY * 2 MI N COLSTRIP MT.	MBMG-GWIC	WELL	45.8663	106.6194	96.1	79.0	736.9	4.9	0.75	7.45	1900.0	1394.90	162.50
MGEOT020	PIPESTONE HOT SPRINGS	Mariner et.al. 1976	SPRING	45.8963	112.2428	57.0	20.0	94.0	5.3		8.70		396.00	
MGEOT062	FRED WETSTEON SPRING DEVELOP	MBMG-GWIC	SPRING	45.9147	113.7606	19.0								
MGEOT330	HART, FRANK * THREE FORKS, MT	MBMG-GWIC	WELL	45.9166	111.4975	15.9								

Note: A negative concentration value indicates the detection limit for that analyte

Selected Chemistry

ID	Site name	Reference	Type	Latitude	Longitude	Temp (deg C)	Chloride mg/l	Sulfate mg/l	Fluoride mg/l	Std dev balance	Lab pH	SC mmohs	TDS mg/l	HCO3 mg/l
MGEOT083	ANADARKO PROD*6 MI E FOSTER MT	MBMG-GWIC	WELL	45.9463	107.4588	26.7	7860.0	30.0	0.7	-2.31	8.75	22150.0	13237.22	0.00
MGEOT053	SPRING * 29 M NE OF FOSTER MT	MBMG-GWIC	SPRING	45.9580	107.0625	29.0								
MGEOT126	COWAN SPRING*9MI NW THREE FORKS MT	MBMG-GWIC	SPRING	45.9606	111.7227	23.0								
MGEOT178	WOLF CREEK HOT SPRING	MBMG-GWIC	SPRING	45.9838	111.6155	60.0								
MGEOT343	WILLIAMSBURG SPRING	MBMG-GWIC	SPRING	45.9916	112.5611	17.4								
MGEOT030	OIL WELL (TENSLEEP FORMATION)	Sonderegger et.al. 1981	WELL	46.0082	109.3977	69.0							2810.00	
MGEOT341	MONTANA RESOURCES MONITORING WELL C	MBMG-GWIC	WELL	46.0088	112.4875	17.8	3.5	336.0	1.2	-0.48	5.85	735.5	556.37	30.00
MGEOT342	MONTANA RESOURCES MONITORING WELL D2	MBMG-GWIC	WELL	46.0161	112.4902	16.0	5.8	652.1	1.0	0.58	6.36	1230.7	994.70	31.80
MGEOT055	HOWARD SPRING * 25 M SE OF BIGHORN MT	MBMG-GWIC	SPRING	46.0233	107.1233	23.0	36.0	1516.0	0.2	0.02	8.42	3237.0	2527.59	490.00
MGEOT246	WENDT, FRED * .75 MI S GREGSON (FAIRMONT)	Sonderegger et.al. 1981	WELL	46.0322	112.8116	23.9	4.9	17.4	1.1	-0.95	8.30	243.1	173.34	106.80
MGEOT298	MBMG RESEARCH WELL * FAIRMONT HOT SPRINGS	MBMG-GWIC	WELL	46.0383	112.8094	20.0	18.7	214.0	21.0	-0.40	8.29	829.0	478.32	90.90
MGEOT165	NELSON, HARVEY * 5 MI S BROADVIEW MT	MBMG-GWIC	WELL	46.0383	108.8822	16.0	56.0	1562.0	1.6	0.74	8.56	3921.0	2954.21	602.00
MGEOT061	BRADBROOK * 10 M S BROADVIEW MT	MBMG-GWIC	WELL	46.0411	109.1502	32.9	197.0	1736.0	3.8	0.90	7.34	3726.0	3144.31	455.00
MGEOT279	FAIRMONT HOT SPRINGS, ANACONDA	MBMG-GWIC	SPRING	46.0425	112.8111	61.5								
MGEOT247	SPANGLER, HAZEL * 2 MI E-NE GREGSON MT	MBMG-GWIC	SPRING	46.0508	112.7691	15.5	21.0	48.5	0.6	0.79	7.71	433.0	294.23	156.20
MGEOT214	HUNSAKER SPRING	Sonderegger et.al. 1981	SPRING	46.0530	111.5011	24.5	11.0	30.0	0.8	-0.51	7.78	586.9	349.67	325.00
MGEOT150	MONT. HIGHWAY DEPT * .75 MI SE WACO MT.	MBMG-GWIC	WELL	46.0633	107.7102	15.5	15.1	1660.0	1.4	0.55	8.07	3775.0	2806.74	379.00
MGEOT213	PLUNKET LAKE WARM SPRINGS	Sonderegger et.al. 1981	SPRING	46.0744	111.5844	17.0								
MGEOT237	SPRINGS FROM JOINTS IN MISS CYN*SW PLUNKET	MBMG-GWIC	SPRING	46.0750	111.5833	17.0	8.9	86.9	0.7	-0.82	8.48	497.3	299.55	183.00
MGEOT151	MONTANA DEPT HIGHWAYS * 2.5 MI NE WACO MT	MBMG-GWIC	WELL	46.0891	107.6611	16.5	23.9	615.0	3.0	-0.55	8.50	2120.0	1416.54	504.00
MGEOT216	HUNSAKER, MAURICE	Sonderegger et.al. 1981	WELL	46.1022	111.5230	15.0	9.6	34.1	1.5	-0.54	8.21	385.8	244.65	179.00
MGEOT135	ANACONDA RED TRAVETINE MOUND-GEYSER	Sonderegger et.al. 1981	SPRING	46.1047	112.7772	21.7	7.0	1362.0	2.5	0.27	7.31	2624.0	2306.75	439.00
MGEOT325	SLEEPING CHILD HOT SPRINGS	Mariner et.al. 1976	SPRING	46.1048	114.0042	43.0	9.0	61.0	14.0		8.10		445.00	
MGEOT236	BRUCE, N * IRRIGATION WELL WITH BOOSTER	MBMG-GWIC	WELL	46.1166	111.5972	18.0	21.7	133.0	0.5	0.02	7.86	651.3	434.57	194.00
MGEOT218	TOSTON WARM SPRING	Sonderegger et.al. 1981	SPRING	46.1258	111.3911	15.5								
MGEOT294	TOSTON WARM SPRING	MBMG-GWIC	SPRING	46.1258	111.3911	45.5	6.6	50.0	0.7	-0.44	7.54	421.1	258.63	200.10
MGEOT217	BRUCE, NORMAN	Sonderegger et.al. 1981	WELL	46.1330	111.6033	16.0	59.2	850.0	1.2	-0.06	7.05	1798.0	1374.26	30.70
MGEOT215	KIMPTON SPRING	MBMG-GWIC	SPRING	46.1708	111.5855	18.0	1.8	16.4	0.2	-0.30	8.43	203.3	125.18	101.00
MGEOT134	WARNER WARM SPRING	Sonderegger et.al. 1981	SPRING	46.1725	111.5855	18.0								
MGEOT172	STEELE, WILLIAM * 12.5 MI SE PINEVIEW MT.	MBMG-GWIC	WELL	46.1769	107.7380	16.0	124.7	1879.0	1.7	0.77	7.98	4583.0	3293.74	362.00
MGEOT284	MBMG TEST WELL*WARM SPRINGS STATE HOSPITAL	MBMG-GWIC	WELL	46.1780	112.7919	48.0	6.0	622.0	3.0	-3.59	7.54	1497.0	1178.78	283.50
MGEOT009	WARM SPRINGS	Mariner et.al. 1976	SPRING	46.1787	112.7942	77.0	5.0	670.0	3.9		6.46		1310.00	
MGEOT233	WARM SPRINGS STATE HOSPITAL	MBMG-GWIC	WELL	46.1808	112.7930	67.0	7.1	685.0	3.7	0.48	7.03	1662.0	1273.39	290.00
MGEOT231	WARM SPRINGS STATE HOSPITAL	MBMG-GWIC	WELL	46.1808	112.7930	54.0	5.1	666.0	0.2	-1.04	7.34	1534.0	1258.29	301.60
MGEOT351	BOULDER HOT SPRINGS - LOWER SPRING	MBMG/UURI	SPRING	46.1981	112.0947	64.5	22.0	73.0	11.0	-0.30	8.80	430.0	401.44	
MGEOT350	BOULDER HOT SPRINGS - MIDDLE SPRING	MBMG/UURI	SPRING	46.1981	112.0947	74.0	22.0	80.0	11.1	-0.26	8.89	428.0	421.14	
MGEOT349	BOULDER HOT SPRINGS - UPPER SPRING	MBMG/UURI	SPRING	46.1981	112.0947	54.0	21.0	76.0	11.8	-0.62	8.89	434.0	419.46	
MGEOT232	WARM SPRINGS STATE HOSPITAL * SPRING	MBMG-GWIC	SPRING	46.2000	112.8833	79.0								
MGEOT185	M-B NO. 12 * 5 MI NE HAMILTON MT	MBMG-GWIC	WELL	46.2836	114.0694	18.5	10.3	19.8	0.4	0.68	7.37	497.1	338.30	290.00
MGEOT171	GRIERSON, J.B.*2.5MI NE RANCHERS CEMETARY.	MBMG-GWIC	WELL	46.2922	107.3958	21.0	997.9	9.4	2.1	-0.23	7.97	4171.0	2385.96	813.00
MGEOT130	PRISON RANCH SPRING SITE NO. 4	MBMG-GWIC	SPRING	46.3333	112.8872	26.0								
MGEOT113	DEER LODGE PRISON RANCH WELL	Sonderegger et.al. 1981	WELL	46.3342	112.8863	26.0	3.0	33.0	7.5		8.96		172.00	
MGEOT044	BEDFORD SPRINGS	Sonderegger et.al. 1981	SPRING	46.3542	111.5667	23.6	9.0	103.0	0.7		7.20		350.00	
MGEOT101	GRIERSON, J.B. * 23 MI NW HYSHAM MT	MBMG-GWIC	WELL	46.3852	107.6394	15.6	92.0	1698.3	2.5	1.05	8.09	4508.0	3201.72	638.70
MGEOT274	MBMG RESEARCH WELL * WEED CREEK-1A	MBMG-GWIC	WELL	46.3952	107.7819	17.0	34.7	1017.0	3.8	2.64	8.93	3054.5	2002.53	463.00
MGEOT275	MBMG RESEARCH WELL * WEED CREEK-1B	MBMG-GWIC	WELL	46.3952	107.7819	20.0	43.6	952.0	4.3	2.04	9.82	3202.0	2022.05	294.30
MGEOT255	HANSER, BILL * 3 MI SW TWO DOT MT	Sonderegger et.al. 1981	WELL-FLOWING	46.4136	110.1394	18.0	6.6	20.6	1.4	-0.42	9.22	1165.0	691.12	604.00
MGEOT256	FOX INC * 1.5 MI W-SW TWO DOT	Sonderegger et.al. 1981	WELL-FLOWING	46.4208	110.1036	19.0	4.4	31.4	0.5	0.96	9.39	838.0	489.59	368.00
MGEOT257	HOMER, RAY * TWO DOT WATER SUPPLY	Sonderegger et.al. 1981	WELL-FLOWING	46.4261	110.0713	20.0	2.4	43.1	0.4	-0.12	9.35	755.0	443.51	312.00
MGEOT296	HARLOWTON * SOUTH MUNICIPAL WELL	MBMG-GWIC	WELL	46.4344	109.8325	15.6	16.1	87.9	1.2	-0.95	8.94	909.9	558.33	383.00
MGEOT013	HILLBROOK FLOWING WELL	Leonard et.al. 1978	WELL	46.4478	111.9872	30.0	25.0	170.0	8.7		6.90		1060.00	
MGEOT014	WALLS HOT SPRING	Leonard et.al. 1978	SPRING	46.4480	111.9805	55.6	11.0	88.0	6.9				651.00	
MGEOT001	ALHAMBRA HOT SPRINGS NORTH	Mariner et.al. 1976	SPRING	46.4497	111.9805	56.5	10.0	89.0	8.4		7.23		909.00	
MGEOT278	TOWNSEND,HERB*2.5 MI SW WHITE SULPHUR SPGS	MBMG-GWIC	WELL	46.5055	110.9347	46.5	4.3	45.0	0.4	0.72	7.89	409.7	237.25	192.50
MGEOT290	RALPH JOHNSON,P.O.BOX 65,WHITE SULPHUR SPR	MBMG-GWIC	WELL	46.5444	110.9061	15.3	827.0	1332.0	7.7	1.58	8.63	7878.0	5700.36	2533.00
MGEOT004	WHITE SULPHUR SPRINGS	Mariner et.al. 1976	SPRING	46.5473	110.9036	46.0	180.0	310.0	7.4		6.80		1950.00	
MGEOT282	WHITE SULPHUR SPRINGS BANK WELL	MBMG-GWIC	WELL	46.5477	110.9063	43.3	147.0	211.0	6.3	-0.77	7.82	2169.0	1298.88	791.00
MGEOT186	WATTS, JAMES * 16 MI NE KINSEY MT	MBMG-GWIC	WELL	46.5706	105.6960	15.0	61.4	0.4	1.7	-0.19	9.03	1303.0	805.43	709.00
MGEOT184	M-B NO 8 WELL*2.5 MI SE CORVALLIS MT	MBMG-GWIC	WELL	46.5722	114.0363	18.3	5.8	34.3	0.6	0.29	7.31	269.8	222.97	113.00
MGEOT007	BROADWATER HOT SPRINGS WELL	Leonard et.al. 1978	WELL	46.5955	112.1117	65.5	34.0	180.0	11.0				598.00	
MGEOT008	GLOEGE WELL	Leonard et.al. 1978	WELL	46.5956	112.1042	19.4	12.0	84.0	0.7		7.40		403.00	
MGEOT003	GARRISON WARM SPRINGS	Sonderegger et.al. 1981	SPRING	46.6066	112.7747	25.0	3.0	335.0	1.3		7.30		556.00	
MGEOT206	USGS OBS WELL * 4 MI SW EAST HELENA, MT.	MBMG-GWIC	WELL	46.6177	111.9961	25.0	59.0	44.5	0.2	-0.62	7.76	802.0	453.89	316.00
MGEOT242	FLORENCE TEST WELL A	Sonderegger et.al. 1981	WELL	46.6461	114.0625	15.0	4.5	20.1	3.1	-1.36	8.80	354.9	207.65	164.50
MGEOT187	CHERRY CK SHEEP CO.*1.35MI SE HAGEN RANCH.	MBMG-GWIC	WELL	46.6619	107.2030	36.0	19.0	309.0	10.8	-1.07	8.08	3106.0	2137.33	1828.00
MGEOT329	SIVERTE MYSSE * BOX 315 * INGOMAR MT 59039	MBMG-GWIC	WELL	46.6619	107.2030	37.0	40.1	296.0	11.5	0.71	8.19	3105.0	2104.12	1795.00
MGEOT261	MOORE, THOMAS * 6.5 MI SW ANGELA MT	Sonderegger et.al. 1981	WELL-FLOWING	46.6680	106.3225	62.0	2060.0	1360.0	5.3	-5.96	7.28	9968.0	5918.73	293.00
MGEOT322	BYRNE WARM SPRING * WEST OF BEARMOUTH	MBMG-GWIC	SPRING	46.7036	113.4536	20.0								
MGEOT116	NIMROD SPRINGS	Sonderegger et.al. 1981	SPRING	46.7057	113.4568	20.5	3.0	340.0	0.8		7.63		630.00	
MGEOT026	BEARMOUTH SPRINGS	Sonderegger et.al. 1981	SPRING	46.7168	113.3032	20.2	2.0	163.0	0.5		7.69		420.00	
MGEOT345	LOLO HOT SPRINGS	Mariner et.al. 1976	SPRING	46.7522	114.5328	44.0	6.0	18.0	6.4		9.30		224.00	
MGEOT089	MARYSVILLE DEEP WELL DEPTH 5750	Sonderegger et.al. 1981	WELL	46.7544	112.3750	96.7	51.0	176.0	20.0	3.01	6.62	1004.0	672.39	264.00
MGEOT170	CHERRY CREEK SHEEP CO*26 MI N VANANDA MT	MBMG-GWIC	WELL	46.7675	106.9194	44.0	240.0	2469.0	3.4	0.23	7.25	5062.0	4245.76	346.00
MGEOT162	OLSEN, JONAS * 9 MI NW FLATWILLOW MT.	MBMG-GWIC	WELL	46.8956	106.5597	27.0	1.7	228.0	1.5	0.08	8.04	1005.0	656.12	360.00
MGEOT201	OLSEN JONAS * 14 MI NE N-BAR RANCH	MBMG-GWIC	WELL	46.8983	106.6122	16.0	3.7	275.0	0.6	0.15	8.41	710.6	585.82	239.00
MGEOT164	REYNOLDS, KEITH * 6 MI NE FLATWILLOW MT.	MBMG-GWIC	WELL	46.9141	106.3602	24.5	12.3	477.0	1.4	1.20	8.36	1670.0	1117.44	436.00

Note: A negative concentration value indicates the detection limit for that analyte

Selected Chemistry

ID	Site name	Reference	Type	Latitude	Longitude	Temp (deg C)	Chloride mg/l	Sulfate mg/l	Fluoride mg/l	Std dev balance	Lab pH	SC mmohs	TDS mg/l	HCO3 mg/l
MGEOT163	HILL, FLOYD * 7 MI N FLATWILLOW MT.	MBMG-GWIC	WELL	46.9330	108.3825	15.0	11.3	475.0	0.9	0.83	8.23	1606.0	1078.47	402.00
MGEOT180	M-B 4 (BUTLER CK) * 6 MI NW MISSOULA MT	MBMG-GWIC	WELL	46.9597	114.0644	16.0	9.5	13.9	0.7	-2.54	7.66	919.5	707.83	651.00
MGEOT254	KING, JOE & SONS INC. * 5 MI SSW WINNET MT	MBMG-GWIC	WELL	46.9677	108.4500	16.0	57.2	820.0	10.0	0.99	8.41	3276.0	2056.04	828.00
MGEOT159	SHAW, BUD * 1.7 MI SW MOSBY MT.	MBMG-GWIC	WELL	46.9866	107.9158	29.0	16.4	337.0	3.2	-0.02	8.40	1512.0	995.54	509.00
MGEOT160	EAGER, REX * 2 MI SW WINNETT MT.	MBMG-GWIC	WELL	47.0008	108.3997	15.5	18.6	207.0	1.4	-0.77	8.27	1134.0	727.86	429.00
MGEOT161	BRATTON, WAYNE * 2 MI SE WINNETT MT.	MBMG-GWIC	WELL	47.0022	108.3244	24.2	16.0	495.0	1.5	0.37	8.30	1659.0	1128.06	411.00
MGEOT305	BURLY VISTA TRACTS	MBMG-GWIC	WELL	47.0275	109.3691	46.0	0.8	95.1	0.4	0.46	7.51	602.1	355.09	280.60
MGEOT157	TEIGEN, PETER * 9 MI E GRASSRANGE MT.	MBMG-GWIC	WELL	47.0347	108.6100	17.9	26.5	552.0	0.8	0.46	7.59	1571.0	1138.23	411.00
MGEOT196	MATOVICH * 4.5 MI E GRASSRANGE MT	MBMG-GWIC	WELL	47.0491	108.7083	21.8	6.4	90.0	0.6	-0.64	7.96	592.3	365.71	267.00
MGEOT181	HOLE NO 2 M-B DRILLING PROJECT	MBMG-GWIC	WELL	47.0525	114.2816	15.0		16.9	0.4	-0.62	7.86	675.6	435.76	450.00
MGEOT240	MSU AG EXPERIMENT STATION * MOCCASIN MT	MBMG-GWIC	WELL	47.0561	109.9516	15.0	2.1	53.0	0.3	0.14	7.69	443.9	258.92	215.00
MGEOT155	BRADY, EARL*4 MI NW WINNETT, MT	MBMG-GWIC	WELL	47.0575	108.3575	15.8	9.0	203.0	2.2	0.31	8.30	1125.0	715.94	444.00
MGEOT203	GERDRUM, RONALD * 3 MI NE GRASS RANGE, MT.	MBMG-GWIC	WELL	47.0638	108.7750	15.9	9.6	120.0	1.4	-0.15	8.72	780.0	503.98	334.00
MGEOT152	CENEX*15 MI NE WINNETT MT	MBMG-GWIC	WELL	47.0788	108.0405	16.0	16.5	331.0	2.6	0.58	8.63	1461.0	953.62	426.00
MGEOT158	BASSETT, EARL * 7.5 MI NW TEIGEN MT.	MBMG-GWIC	WELL	47.1233	108.6758	17.0	1.7	117.0	0.5	-0.21	8.29	643.0	400.64	251.00
MGEOT059	HEDMAN, J. * 40 MI NE LEWISTOWN MT.	MBMG-GWIC	WELL-FLOWING	47.1416	108.5933	21.0	3.6	123.0	0.7	-0.17	8.13	725.0	432.21	269.00
MGEOT156	HARRIS FLOYD * 11 MI NW TEIGEN MT	MBMG-GWIC	WELL	47.1577	108.7322	19.2	2.2	240.0	2.4	-1.02	8.19	1167.0	747.06	429.00
MGEOT194	FOX, DENNIS * 7 MI NW GRASSRANGE MT	MBMG-GWIC	WELL	47.1711	108.9486	20.8	1.2	186.0	0.5	-1.07	8.14	615.5	434.82	188.00
MGEOT239	LAURENCE HESS * 1 MI N MOCCASIN MT	MBMG-GWIC	WELL	47.2058	109.9363	15.0	2.7	67.2	0.3	-0.55	7.78	576.5	330.32	276.00
MGEOT204	DELANEY, DOUGLAS*7 MI NW (WILD HORSE UNIT)	MBMG-GWIC	WELL	47.2105	108.7277	23.0	30.2	141.0	0.9	0.30	8.29	862.0	532.05	309.00
MGEOT050	BROOKS WARM SPRING * 2.5 MI NW BROOKS MT.	MBMG-GWIC	SPRING	47.2191	109.4733	20.0								
MGEOT195	DELANEY, DOUGLAS * 11 MI NW ROY MT	MBMG-GWIC	WELL	47.2333	108.7694	21.3	12.8	342.0	2.9	-0.93	8.41	1373.0	877.76	374.00
MGEOT154	MILLER RANCH * 14 MI SE VALENTINE MT.	MBMG-GWIC	WELL	47.2486	108.1394	19.5	1825.0		2.3	0.57	8.02	7535.0	4429.86	1630.00
MGEOT045	CARDINAL PET CO * 10 M E HILGER MT	MBMG-GWIC	WELL	47.2816	109.1686	26.7	18.8	60.0	6.1	0.77	8.52	1017.0	577.63	487.00
MGEOT153	BUSENBARK, MERLIN*1 MI S VALENTINE MT*	MBMG-GWIC	WELL	47.2991	108.4208	27.0	63.4	1.9	6.7	-0.83	8.45	2587.0	1608.34	1639.00
MGEOT268	QUINN'S HOT SPRINGS * JIM AND DONNA BROWN	Sonderegger et.al. 1981	WELL-FLOWING	47.3300	114.7872	45.1	2.3	28.8	2.3	0.71	8.70	206.1	185.68	51.20
MGEOT005	QUINN'S HOT SPRINGS	Sonderegger et.al. 1981	SPRING	47.3300	114.7872	43.3	3.0	29.0	2.1		8.90		224.00	
MGEOT197	YEAGER * 8 MI EAST MOULTON, MT.	MBMG-GWIC	WELL	47.3333	109.1836	15.0	6.2	450.0	0.5	1.05	8.29	1510.0	985.70	359.00
MGEOT079	FINLEY, R.S.*1 MI NW ST. IGNATIUS	MBMG-GWIC	WELL	47.3350	114.1175	19.0	3.5	15.6	-0.1	0.32	7.82	510.6	293.17	322.30
MGEOT205	SIROKY, FRANK * 9 MI EAST ROY, MT.	MBMG-GWIC	WELL	47.3402	108.7672	19.0	2.6	280.0	0.4	-0.05	9.12	1274.0	828.12	381.00
MGEOT192	HORYNA, JAMES * 6 MI E ROY MT	MBMG-GWIC	WELL	47.3533	108.8513	18.4	4.3	415.0	0.4	1.08	9.18	1586.0	1036.58	398.00
MGEOT131	CORPS OF ENGINEERS SOUTH WELL AFTER PERFS	MBMG-GWIC	WELL	47.3611	114.3119	15.0	85.8	0.2	4.9	0.30	8.17	1101.0	648.15	574.00
MGEOT090	BRYSON, HAROLD*1 MI W MOISE MT	MBMG-GWIC	WELL	47.3730	114.2830	15.5	37.0	1.0	2.0	-0.97	7.60	950.9	553.38	553.80
MGEOT070	YARGER, ROBERT * 13 MI W CIRCLE MT	MBMG-GWIC	WELL	47.3830	105.8597	25.0	3.3	670.7	-0.1	-1.06	8.38	1818.0	1280.09	410.40
MGEOT287	SAND COULEE WTR USERS BENCH W ABV SAND COU	MBMG-GWIC	WELL	47.3972	110.1763	15.0	12.3	71.0	1.1	0.31	7.69	789.2	453.57	444.00
MGEOT193	TAYLOR, JAMES * 8 MI E CHRISTINA MT	MBMG-GWIC	WELL	47.4005	109.1400	21.0	5.4	642.0	0.5	-0.82	9.01	2032.0	1349.59	389.00
MGEOT288	CHARLES ENTSMINGER*TOWN OF NUMBER SEVEN	MBMG-GWIC	WELL	47.4038	110.1547	16.0	4.0	132.0	0.4	0.41	7.94	596.3	393.48	246.90
MGEOT295	CUSTER, EVERETT* EDEN RT, GREAT FALLS, MT	MBMG-GWIC	WELL	47.4061	111.2605	15.5	30.1	215.0	1.1	0.49	7.48	808.0	557.40	255.00
MGEOT297	TOWN OF TRACY	MBMG-GWIC	WELL	47.4133	111.1533	16.0	6.9	145.0	0.6	0.23	7.57	623.8	407.36	236.20
MGEOT054	SLOGSVOLD, A. K. * 17 M SE RITCHEY MT	MBMG-GWIC	WELL	47.4211	105.1347	21.1	29.0	1154.0	0.1	-0.57	7.64	2770.0	2402.46	1014.00
MGEOT211	GOVER * 2.5 MI TRAVIS SCHOOL	MBMG-GWIC	WELL	47.4308	111.5052	17.5	18.3	360.0	1.0	-0.04	7.95	1557.0	1048.74	574.00
MGEOT200	VILLAGE INN * 2.5 MI NE TRAVIS SCHOOL	MBMG-GWIC	WELL	47.4355	111.5016	18.5	13.5	120.0	4.9	0.91	8.16	1295.0	798.12	680.00
MGEOT299	STONE, GENE	MBMG-GWIC	WELL	47.4411	114.6500	25.0	2.5	6.6	2.3	0.81	9.78	238.2	181.70	3.20
MGEOT082	WEBB RES * 17.5 MI SE GERALDINE MT.	MBMG-GWIC	WELL	47.4469	110.3044	20.0	6.4	57.0	0.8	-0.88	9.01	462.7	285.19	157.00
MGEOT353	HOLLAND, JIM - GREEN SPRINGS	MBMG/UURI	SPRING	47.4513	114.6478	23.7	12.0	17.0	2.1	-0.11	9.86	195.0	208.38	
MGEOT248	GREEN SPRINGS * HOLLAND RANCH	Sonderegger et.al. 1981	SPRING	47.4513	114.6478	26.0	5.0	18.0	2.2		9.20		280.00	
MGEOT191	TACKE, ROBERT * 2 MI SW GREAT FALLS MT	MBMG-GWIC	WELL	47.4605	111.3475	15.0	125.0	575.0	2.3	-0.55	7.57	1775.0	1280.10	348.00
MGEOT198	PAUL, MICHAEL(ROBINSON)*9.5M SW GREATFALLS	MBMG-GWIC	WELL	47.4619	111.3516	17.0	145.0	582.0	2.6	-0.39	7.67	1926.0	1375.49	385.00
MGEOT318	BUTTE CREEK SPRING * SQUARE BUTTE	MBMG-GWIC	SPRING	47.4650	110.2000	18.8								
MGEOT319	BUTTE CREEK SPRING - NORTH * SQUARE BUTTE	MBMG-GWIC	SPRING	47.4650	110.2000	17.0								
MGEOT189	CHAMBERLAIN, CURTIS * 2 MI W LLER SCHOOL	MBMG-GWIC	WELL	47.4686	107.4780	16.0	14.1	1337.0	2.1	-0.41	8.43	3633.0	2587.91	640.00
MGEOT321	MELTON, LARUE * LOWER AQUIFER	MBMG-GWIC	WELL	47.4691	114.4033	16.0	8.8	10.3	0.6	-1.07	7.34	399.2	259.61	244.90
MGEOT314	USGS - MELTON, LEON	MBMG-GWIC	WELL	47.4763	114.4091	18.5	10.6	5.8	3.4	0.06	8.18	367.4	215.58	191.80
MGEOT256	SCHMIDT, LLOYD * 3.5 MI SE SQUARE BUTTE	MBMG-GWIC	WELL	47.4897	110.1581	21.8	40.2	85.9	1.3	0.19	7.85	910.0	524.17	385.00
MGEOT190	USGS OBS WELL * .5 MI S VALLEY SCHOOL	MBMG-GWIC	WELL	47.5144	104.7750	27.1	2.5	735.0	0.2	-13.71	8.12	1656.0	1284.72	252.00
MGEOT199	EIDEL * .5 MI S SUNSET MEMORIAL CEMETARY	MBMG-GWIC	WELL	47.5230	111.4633	16.0	49.1	1220.0	0.6	-1.24	7.90	3182.0	2362.20	651.00
MGEOT078	WEBSTER, BONITA*BOX 443 RONAN MT	MBMG-GWIC	WELL	47.5441	114.1563	15.5	1.7	0.5	0.1	-0.15	7.91	286.4	173.21	188.30
MGEOT099	DEMARS,TOM J.* 10 MI W OF WINIFRED MT.	MBMG-GWIC	WELL	47.5650	109.5925	17.0	13.0	511.3	0.8	0.89	7.51	1463.0	1045.40	390.40
MGEOT249	HOMESTEAD ACRES COUNTY WATER DISTRICT	MBMG-GWIC	WELL	47.5802	111.3077	15.0	14.7	201.0	0.9	-0.03	7.76	813.0	505.57	250.00
MGEOT250	HOMESTEAD ACRES COUNTY WATER DISTRICT	MBMG-GWIC	WELL	47.5808	111.3075	15.0	15.9	210.0	1.0	-0.89	8.35	777.0	501.93	223.00
MGEOT241	MCCOLLUM, JIM * 10 MI NW MATHISON RANCH	MBMG-GWIC	WELL	47.5822	108.7183	18.8	16.9	71.0	1.9	-0.65	8.97		962.79	807.00
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT	MBMG-GWIC	WELL	47.5827	114.5063	21.5	6.0	8.1	0.6	0.09	7.96	330.2	195.26	196.90
MGEOT047	* RYFFEL BROS. * 5MI S & 3 MI E HIGHWOOD	MBMG-GWIC	SPRING	47.5863	110.6802	16.6								
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.	MBMG-GWIC	WELL	47.5952	114.5302	22.5	17.5	8.6	3.5	0.56	7.63	622.3	374.62	366.90
MGEOT088	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	MBMG-GWIC	WELL	47.6063	114.6744	18.5	2.2	12.1	1.6	-0.46	6.74	245.6	156.07	127.80
MGEOT307	HOT SPRINGS CITY	MBMG-GWIC	WELL	47.6063	114.6736	21.0	3.1	10.7	0.2	0.76	7.99	253.6	172.15	149.30
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	Sonderegger et.al. 1981	WELL	47.6075	114.6713	29.8	7.8	21.2	5.2	-0.63	9.46	383.5	286.58	64.60
MGEOT291	SOUTH EAST OF CAMP AQUA	MBMG-GWIC	WELL	47.6147	114.6655	51.5	9.9	9.6	5.7	-0.59	9.34	361.8	270.89	109.30
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS	MBMG-GWIC	SPRING	47.6147	114.6658	44.0								
MGEOT017	CAMAS HOT SPRINGS	Mariner et.al. 1976	SPRING	47.6155	114.6663	45.0	9.0	38.0	5.6		9.40		399.00	
MGEOT080	HOT SPRINGS MONTANA	MBMG-GWIC	SPRING	47.6155	114.6477	43.0								
MGEOT352	SYMES HOTEL IN HOT SPRINGS	MBMG/UURI	WELL	47.6163	114.6763	33.3	11.0	30.0	5.6	-0.01	9.66	280.0	297.16	
MGEOT029	SYMES HOT SPRINGS WELL	Sonderegger et.al. 1981	WELL	47.6163	114.6763	36.0	9.0	40.0	5.8		9.80		367.00	
MGEOT081	HOT SPRING GEOTHERM WELL - UNNAMED	MBMG-GWIC	WELL	47.6169	114.6555	15.0	3.6	61.2	2.3	-0.67	7.06	341.3	220.43	101.00
MGEOT355	KOEPLING, DELBERT * WELL 136	MBMG/UURI	WELL	47.6170	114.6781	26.5	10.00	5.1	3.4	0.04	8.23	286.0	275.02	
MGEOT354	OSTRANGER, DAVE * WELL 56	MBMG/UURI	WELL	47.6171	114.6775	17.2	14.00	3.8	5.4	-0.07	8.05	312.0	290.91	

Note: A negative concentration value indicates the detection limit for that analyte

Selected Chemistry

ID	Site name	Reference	Type	Latitude	Longitude	Temp (deg C)	Chloride mg/l	Sulfate mg/l	Fluoride mg/l	Std dev balance	Lab pH	SC mmohs	TDS mg/l	HCO3 mg/l
MGEOT077	VERNER, ROSE*3.75 MI W PABLO MT	MBMG-GWIC	WELL	47.6180	114.2108	17.5	7.5	17.8	0.4	-0.54	8.06	726.8	436.13	472.30
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS	MBMG-GWIC	WELL	47.6297	114.6236	19.5	25.3	0.3	0.8	-0.76	7.51	471.8	283.29	264.50
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	MBMG-GWIC	WELL	47.6302	114.5550	19.0	27.0	1.4	4.3	-0.67	8.06	592.9	375.46	324.00
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	MBMG-GWIC	WELL	47.6311	114.5813	15.2	2.4	14.0	5.4	-0.29	8.12	404.8	244.61	221.00
MGEOT042	SUN RIVER SPRINGS	Sonderegger et.al. 1981	SPRING	47.6325	112.8542	30.4					7.20		890.00	
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	MBMG-GWIC	WELL	47.6347	114.5619	42.7	34.8	21.5	3.1	0.62	8.32	663.9	405.72	321.00
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	MBMG-GWIC	WELL	47.6361	114.5750	32.6	16.0	1.5	7.6	-0.98	8.71	472.4	304.15	237.00
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	MBMG-GWIC	WELL	47.6372	114.5611	28.8	34.8	0.6	4.2	0.99	7.89	656.7	403.19	348.00
MGEOT266	JACKOLA AP.100 FT E. OF CAMP AQUA BATH SPA	MBMG-GWIC	WELL	47.6411	114.5700	51.0	34.0	0.6	5.0	0.53	8.53	651.2	413.14	327.00
MGEOT027	CAMP AQUA AREA TEST WELL	Sonderegger et.al. 1981	WELL-FLOWING	47.6422	114.5713	50.0	33.0	4.0	3.9		8.40		420.00	
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	MBMG-GWIC	WELL	47.6422	114.5713	43.7	35.3	0.7	4.3	2.03	8.21	655.6	390.02	343.00
MGEOT202	OLSEN, EDWIN * 8.4 MI NE WINIFRED MT	MBMG-GWIC	WELL	47.6425	109.3113	22.0	2850.0	2.0	2.0	-2.48	8.09	9117.0	5325.18	608.00
MGEOT251	SMELSER, JAMES A. * POWER MT	MBMG-GWIC	WELL	47.6427	111.5830	16.0	765.0	13.8	1.5	0.37	7.83	3596.0	1981.91	807.00
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	MBMG-GWIC	WELL	47.6433	114.5638	30.6	35.5	0.6	4.5	0.38	8.28	668.4	419.64	354.00
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	MBMG-GWIC	WELL	47.6438	114.5741	38.9	31.3	1.3	7.8	-0.38	8.38	593.7	394.41	314.00
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	MBMG-GWIC	WELL	47.6452	114.5688	32.5	30.9	0.6	5.0	0.52	8.40	635.6	384.72	328.00
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	MBMG-GWIC	WELL	47.6472	114.5761	34.4	23.1	2.1	4.8	-0.87	8.63	633.6	395.26	326.00
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT	MBMG-GWIC	WELL	47.6516	114.5836	24.0	28.3	1.2	6.1	0.49	8.18	617.2	381.08	331.80
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	MBMG-GWIC	WELL	47.6536	114.5813	25.8	10.9	1.8	4.4	-0.21	9.16	470.6	338.76	280.00
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	MBMG-GWIC	WELL	47.6619	114.5838	20.3	19.0	2.1	4.8	-0.89	8.48	537.0	345.30	287.00
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	MBMG-GWIC	WELL	47.6700	114.5880	22.8	2.2	6.9	3.2	-0.54	9.45	442.3	273.01	188.00
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	MBMG-GWIC	WELL	47.6736	114.6027	23.6	7.8	5.8	3.4	-0.95	7.90	446.7	276.24	255.00
MGEOT149	MATOVICH,JOHN * 23 MI SW SUN PRAIRIE MT	MBMG-GWIC	WELL	47.6830	108.0702	16.0	56.8	521.0	3.7	0.90	8.50	2496.0	1697.93	845.00
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	MBMG-GWIC	WELL	47.6880	114.6538	16.6	2.1	12.0	1.2	-0.69	7.89	289.7	174.80	164.00
MGEOT075	LONEPINE OBSERVATION WELL	MBMG-GWIC	WELL	47.7141	114.6477	16.5	6.3	12.2	0.9	-0.25	7.93	396.8	240.03	235.90
MGEOT110	STREIT, GEORGE * 4MI E-- 1MI S FT BENTON MT.	MBMG-GWIC	WELL	47.6030	110.5769	15.0	94.0	1164.0	3.0	0.25	7.38	2662.0	2252.84	620.00
MGEOT243	WHITMAYER ASSOC * 4.5MI SE SUN PRAIRIE SCH	MBMG-GWIC	WELL	47.8194	107.6294	15.6	920.0	102.0	2.7	-3.15	8.90	4549.0	2646.37	669.00
MGEOT109	CLARK, BRAD * 25 MI E FT. BENTON MT.	MBMG-GWIC	WELL	47.8297	110.1706	20.0	146.0	1174.0	1.2	-0.59	8.45	3737.0	2608.24	702.00
MGEOT114	LANDUSKY PLUNGE SPRINGS	Sonderegger et.al. 1981	SPRING	47.8432	108.5987	24.0	10.0	620.0	1.6		8.10		960.00	
MGEOT072	LANDUSKY, I*8.5 MI S HAYS, MONTANA	Sonderegger et.al. 1981	SPRING	47.8763	108.6572	20.3	13.7	871.0	1.4	-0.07	7.88	1724.0	1366.89	170.50
MGEOT046	BLACK COULEE * E OF TEST AREA	MBMG-GWIC	SPRING	47.9069	110.6586	28.8	276.0	8230.0	0.4	1.20	8.24	14300.0	13093.99	461.00
MGEOT313	ALZHEIMER, PAUL * SW OF BRADY, MT	MBMG-GWIC	WELL	47.9097	111.9400	25.0	25.2	646.0	0.6	0.42	7.78	1678.0	1219.10	326.00
MGEOT312	REVERE, LEE	MBMG-GWIC	WELL	47.9261	111.9533	25.0	12.4	61.2	0.5	0.69	7.85	744.8	439.94	402.00
MGEOT049	LITTLE WARM SPRINGS*9 MI SE LODGEPOLE	Sonderegger et.al. 1981	SPRING	47.9691	108.3963	26.1	59.0	1144.0	1.4	0.53	8.06	2082.0	1754.58	101.00
MGEOT324	LODGEPOLE WARM SPRINGS	Sonderegger et.al. 1981	SPRING	47.9938	108.4443	30.0	57.0	1060.0	1.1		8.10		1630.00	
MGEOT048	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	MBMG-GWIC	SPRING	47.9955	108.4486	30.6	57.0	1062.0	1.1	0.51	8.06	1960.0	1628.32	81.00
MGEOT051	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	MBMG-GWIC	SPRING	47.9958	108.4506	26.0	38.0	650.0	0.9	-0.90	7.96	1430.0	1096.15	153.00
MGEOT052	KIRKALDIE, BRUCE*7 MI SW LODGEPOLE MT	MBMG-GWIC	SPRING	47.9963	108.4491	24.5	50.0	893.0	0.7	0.86	7.14	1800.0	1433.87	148.00
MGEOT037	LARGE CAPACITY WELL*4 MI SW WOLF POINT, MT	MBMG-GWIC	WELL	48.0313	105.7422	51.0		522.0		9.22	7.80	1960.0	1234.47	627.00
MGEOT024	CITY OF WOLF POINT * WELL IN WOLF POINT	MBMG-GWIC	WELL	48.0847	105.6433	18.3	1850.0	1.9	1.0	-0.25	7.80	6510.0	3552.21	544.00
MGEOT023	SHERMAN HOTEL OF WOLF POINT	MBMG-GWIC	WELL	48.0936	105.6363	17.2	2050.0	5.8	1.0	-0.19	8.30	7080.0	3862.29	482.00
MGEOT038	USGS TEST WELL * 1 MILE SOUTH POPLAR, MT	MBMG-GWIC	WELL	48.0950	105.2050	13.9	9.2	261.0	0.5	0.87	7.80	1350.0	871.89	541.00
MGEOT025	FOSS ELMER * 5.8 MI SE BROCTON	MBMG-GWIC	WELL	48.1116	104.7975	16.1	116.0	5.8	4.8	-1.60	8.50	1950.0	1114.67	864.00
MGEOT317	LANDTECH WATER DISPOSAL SERVICE	MBMG-GWIC	WELL	48.1463	104.1969	17.9	242.0	-0.2	5.2	-0.25	8.38	2428.0	1429.18	1121.00
MGEOT315	THORNESS, RICK * 4 MILES NW OF BAINVILLE	MBMG-GWIC	WELL	48.2013	104.2452	15.0	9.5	640.0	0.5	-0.23	7.62	2028.0	1445.27	598.00
MGEOT108	CLAWITER, MILT * 4MI N-4MI E BIG SANDY MT.	MBMG-GWIC	WELL	48.2313	110.0288	16.0	156.0	617.0	1.9	-1.33	8.36	3076.0	2011.28	912.00
MGEOT303	SIMS SPRING	MBMG-GWIC	SPRING	48.3325	105.4552	15.0	4.2	34.8	0.1	0.04	7.65	465.6	280.28	263.00
MGEOT140	TEXACO INC * 1.7 MI NW CENTRAL SCHOOL	MBMG-GWIC	WELL	48.4819	109.2083	35.5	307.0	5.8	6.5	-0.76	8.29	3236.0	1918.59	1551.00
MGEOT252	MATOVAICH, MARTIN*17 MI E MALTA NEAR SACO	MBMG-GWIC	WELL	48.4847	107.5275	42.0	183.0	2120.0	1.9	0.53	8.35	4046.0	3333.97	112.50
MGEOT111	SLEEPING BUF REC AREA * 4MI NNW ASHFIELD	Sonderegger et.al. 1981	WELL	48.4852	107.5327	41.3	195.5	2147.0	2.9	0.79	7.38	3915.0	3419.37	151.00
MGEOT145	SHIRLE, WALTER * 3 MI S FRESNO DAM.	MBMG-GWIC	WELL	48.5563	109.9288	17.5	182.8	865.0	1.8	-0.58	8.37	3736.0	2500.21	1005.00
MGEOT106	PIMLEY, DON * 4 MI NW JOPLIN MT.	MBMG-GWIC	WELL	48.5994	110.8166	15.0	184.0	2668.0	0.4	-0.10	8.02	6323.0	4762.08	588.00
MGEOT105	CADY, ELWIN * 7.5 MI NW JOPLIN MT.	MBMG-GWIC	WELL	48.6747	110.7955	25.0	18.0	1060.0	0.1	0.59	7.59	5936.0	4245.74	3065.00
MGEOT309	FRANCIS, CLARA	MBMG-GWIC	WELL	48.6875	104.4552	29.0	86.8	1400.0	0.9	-0.79	7.65	3286.0	2808.00	851.00
MGEOT107	WELSH, ORVILLE * 13 MI N-3MI E HINGHAM MT.	MBMG-GWIC	WELL	48.7405	110.3447	16.0	47.0	1657.0	0.4	0.65	8.09	4544.0	3249.73	542.00
MGEOT310	EDWARDS, MARVIN / MIKE DUSTERHOFF	MBMG-GWIC	WELL	48.7694	112.4555	25.0	44.0	1010.0	0.3	0.87	8.24	3044.0	2077.47	596.00
MGEOT039	BIG WEST OIL CO * 2 MI NE MTN VIEW SCHOOL	MBMG-GWIC	WELL	48.8397	112.0869	46.0	8.0	190.0		27.69			483.06	427.00
MGEOT104	RYGH, KEN * 22 MI N -- 5 MI W JOPLIN MT.	MBMG-GWIC	WELL	48.8783	110.8813	21.0	14.5	0.1	0.9	0.77	8.72	1484.0	913.88	941.00
MGEOT142	BRADBURY, ALFRED * 11 MI E WILD HORSE MT	MBMG-GWIC	WELL	48.9130	110.1056	15.5		823.0	2.3	1.67	8.15	2706.0	1845.46	730.00
MGEOT144	NAGEHUS, ORVILLE * 3 MI N SIMPSON MT.	MBMG-GWIC	WELL	48.9686	110.2102	15.5		312.0	2.6	0.07	8.38	1650.0	1055.12	652.00

Note: A negative concentration value indicates the detection limit for that analyte

Selected Chemistry

ID	Site name	Alkalinity	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (SiO2) mg/l	Arsenic ug/l	Boron ug/l	Lithium ug/l	H2s
MGEOT209	TARGHEE SULPHUR SPRING*6MI W W YELLOWSTONE		72.9	27.5	7.1	4.5	0.01	14.4	15.10	60.00	30.00	
MGEOT127	LOWER EAST SPRING– STAUDENMEYER RANCH		68.0	24.6	27.8	7.4	–0.01	23.3				
MGEOT125	LOWER WEST SPRINGS – STAUDENMEYER RANCH		68.0	24.0	29.0	7.7	–0.01	21.4				
MGEOT124	UPPER WEST SPRING– STAUDENMEYER RANCH		67.0	24.0	27.9	7.2	0.02	20.8				
MGEOT177	UPPER WEST SPRING– STAUDENMEYER RANCH		67.3	25.0	26.9	6.9	0.02	20.8				
MGEOT123	UPPERMOST SPRING– STAUDENMEYER RANCH		67.5	24.5	25.8	6.8	0.01	20.1				
MGEOT126	UPPER – EAST SPRING– STAUDENMEYER RANCH		69.0	25.2	28.1	7.4	–0.01	22.7				
MGEOT121	ANDERSONS PASTURE SPRING #1		66.5	24.0	27.7	7.3	–0.01	21.4				
MGEOT122	ANDERSONS PASTURE SPRING #2		71.0	24.0	26.9	7.3	0.01	21.0				
MGEOT210	USFS* BAKERS HOLE* 3MI N WEST YELLOWSTONE		11.2	6.0	48.0	7.0	0.01	79.9	21.80	120.00	150.00	
MGEOT115	SLOAN COW CAMP SPRING	215	0.9	0.1	88.0	1.1	0.17	50.9		160.00		0.9
MGEOT120	WEST FORK SWIMMING HOLE		19.0	29.0	4.8	1.9	–0.01	13.7				
MGEOT118	CURLEW CREEK WARM SPRING		12.5	1.3	33.0	1.2	1.11	19.7				
MGEOT119	WALL CANYON WARM SPRING		6.6	1.7	260.0	6.0	0.08	41.7				
MGEOT229	WOLF CREEK HOT SPRING		8.0	1.4	104.0	1.8	–0.01	50.7				
MGEOT129	LOWELL HILDRETH SPRING*15 MI SW DILLON		66.0	27.5	26.3	4.5	–0.01	17.5				
MGEOT016	BEAR CREEK SPRINGS											
MGEOT132	VIGILANTE WARM SPRING		84.5	27.0	6.7	3.1	–0.01	15.5				
MGEOT041	LA DUKE HOT SPRINGS	299	320.0	56.0	230.0	23.0		49.0		500.00		1.0
MGEOT012	BROWNS SPRINGS											
MGEOT010	PULLER HOT SPRINGS	511	56.0	19.0	330.0	24.0		33.0		700.00		
MGEOT019	TRUDAU SPRINGS	425	78.0	30.0	70.0	11.1		19.0				
MGEOT040	CHICO HOT SPRINGS	172	35.0	6.8	35.0	6.8		34.0		100.00		0.6
MGEOT032	GROUNDWATER *4.7 MI NE FT SMITH MT		0.3	0.4	186.0	0.9	0.23	10.0		80.00		
MGEOT074	BROWN CATTLE CO* 3.1 MI N. BIRNEY MT		1.9	0.4	250.0	1.3	0.04	10.1				
MGEOT276	JARDINE HOT SPRINGS 0.25 MI E OF JACKSON		10.3	3.0	226.0	8.5	0.02	49.3	53.20	–20.00	290.00	
MGEOT269	MBMG GEOTHERMAL TEST * THEXTON TX– 12		5.2	0.2	331.0	15.2	0.22	107.0	22.40	680.00	230.00	
MGEOT028	JACKSON HOT SPRINGS	614	10.0	3.7	240.0	10.0		52.0		800.00		0.6
MGEOT293	PRIVATE GEOTHERMAL TEST*ENNIS HOT SPRINGS*		5.0	0.2	314.0	14.9	0.01	108.0	22.70	620.00	220.00	
MGEOT277	LAPHAM DOMESTIC WELL 1 MI NW JACKSON, MT.		27.3	3.4	192.0	9.0	0.83	16.2	37.00		230.00	
MGEOT117	ENNIS HOT SPRINGS											
MGEOT058	BROWN CATTLE CO * 9.5MI SW BIRNEY DAY SCH.		2.2	0.1	243.0	1.4	0.05	9.7				
MGEOT031	BEAVERHEAD ROCK SPRINGS											
MGEOT133	APEX WARM SPRING		62.0	16.2	23.4	3.2	–0.01	19.8				
MGEOT323	ELKHORN HOT SPRINGS	85	1.9	0.1	48.0	0.7		55.0				0.9
MGEOT292	MARTIN, KIETH		94.5	33.4	1.7	1.7	–0.00	10.7		60.00	6.00	
MGEOT326	NEW BILTMORE HOT SPRINGS	232	290.0	73.0	160.0	24.0		46.0		900.00		1.1
MGEOT306	NEWMAN, JOHN * JOLIET, MT		20.1	12.9	1520.0	2.7	–0.00	7.8				
MGEOT006	ANDERSON'S SPRING	88	47.0	23.0	2.0	1.3		12.2				
MGEOT280	ANDERSON SPRING		73.6	22.3	1.4	1.4	–0.00	11.5			–2.00	
MGEOT043	NORRIS HOT SPRINGS	383	19.0	3.2	190.0	11.0		78.0		100.00		
MGEOT015	POTOSI HOT SPRINGS	67	10.0	0.1	91.0	1.6		46.0				0.5
MGEOT187	GROSS, PETE * 4 MI S PONY MT		13.2	0.1	94.6	1.7	0.01	47.7		30.00	56.00	
MGEOT311	MCFERRAN, EUGENE * BILLINGS, MT		0.9	0.3	471.0	0.4	0.15	9.1				
MGEOT179	CARTER'S BRIDGE * 4 MI SE LIVINGSTON MT.		129.0	35.4	7.3	4.1	–0.01	19.4	1.10	110.00	30.00	
MGEOT011	AVON WARM SPRING											
MGEOT264	BOZEMAN HOT SPRINGS * OWNER – CHARLES PAGE		2.3	0.1	115.0	2.4	0.01	71.2	5.00	260.00	38.00	
MGEOT265	BOZEMAN HOT SPRINGS * OLD WELL		1.3	–0.0	144.0	2.8	0.00	70.3	5.40	260.00	38.00	
MGEOT266	BOZEMAN HOT SPRINGS * OWNER – CHARLES PAGE		2.7	–0.0	136.0	2.5	–0.00	70.2	5.00	250.00	38.00	
MGEOT263	BOZEMAN HOT SPRINGS * ORIGINAL SPRING		5.1	0.6	135.0	2.8	0.03	69.3	5.00	260.00	37.00	
MGEOT335	BOZEMAN HOT SPRINGS	113	7.0	2.4	130.0	3.1		57.0		200.00		
MGEOT269	RANCA * MCLEOD		454.0	79.1	13.4	11.5	0.70	30.6			110.00	
MGEOT259	SCOTT FEED LOT		1.2	0.2	512.0	1.2	0.22	19.4		1650.00	65.00	
MGEOT260	SCOTT FEED LOT		1.2	0.2	559.0	1.1	0.08	20.0		2290.00	74.00	
MGEOT230	BLUE JOINT CREEK HOT SPRING	67	2.6	0.1	38.0	0.3		54.0				
MGEOT002	BRIDGER CANYON WARM SPRING	209	54.8	22.7	4.0	1.4		8.2				
MGEOT334	LOVE, MELVIN*THREE FORKS, MT		62.1	13.8	23.4	4.5	0.00	32.1	26.00	220.00	110.00	
MGEOT033	GROUNDWATER *5.3 MI W HARDIN MT		665.0	136.0	14.0	24.0	1.50	18.0		140.00		
MGEOT332	SHIPTON, HAROLD * THREE FORKS MT		59.0	26.4	27.0	5.2	–0.00	50.7	45.00	190.00	130.00	
MGEOT258	HERMAN, T.E. * ROCKY RANCH 7.4 M W HARDIN		669.0	143.0	14.6	26.4	0.32	17.2		420.00	280.00	
MGEOT344	GALLOGLY HOT SPRING	89	3.0		43.0	0.7		43.7	0.80	50.00		
MGEOT245	LOST TRAIL * WARM AND HOT SPRINGS		3.0	–0.1	42.6	0.7	0.01	43.7	0.80	50.00	90.00	
MGEOT089	CAIN MIKE*6.6 MI S VOLBERG		3.5	0.8	374.0	1.4	0.22	7.1				
MGEOT018	HUNTERS HOT SPRINGS	227	0.9	0.1	85.0	0.6		65.0		700.00		5.3
MGEOT328	JORGENSON, JACK * THREE FORKS MT								61.00			
MGEOT346	RENOVA HOT SPRINGS	310	51.0	13.0	150.0	13.0		37.0		500.00		
MGEOT339	WESTMORELAND * 9.1 M W SARPY SCHOOL		300.0	44.6	48.3	53.0	0.23	21.0		281.00	309.00	
MGEOT095	LISCOM RANCH * 5.5 MI NW OF N STACY SCHOOL		2.6	0.9	291.0	1.4	0.05	7.7				
MGEOT331	TINDER, L. MARIE * THREE FORKS MT		46.5	13.0	74.6	11.3	–0.00	49.5	116.00	390.00	160.00	
MGEOT327	WILCOX, RALPH * THREE FORKS MT								130.00			
MGEOT333	RICHARDSON, DEIRDRE * THREE FORKS		56.5	14.7	84.8	12.0	–0.00	50.2	76.00	730.00	190.00	
MGEOT347	MEDICINE HOT SPRINGS	126	1.9	0.1	80.0	1.4		60.0		0.10		0.6
MGEOT092	WESTERN ENERGY * 2 MI N COLSTRIP MT.		213.0	25.0	131.0	65.8	2.29	56.6			600.00	
MGEOT020	PIPESTONE HOT SPRINGS	108	2.6	0.1	98.0	1.9		66.0		0.30		2.3
MGEOT062	FRED WETSTEON SPRING DEVELOP		4.5		95.8	2.3	–0.01	59.5				
MGEOT330	HART, FRANK * THREE FORKS, MT											

Note: A negative concentration value indicates the detection limit for that analyte

Selected Chemistry

ID	Site name	Alkalinity	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (SiO2) mg/l	Arsenic ug/l	Boron ug/l	Lithium ug/l	H2s
MGEOT063	ANADARKO PROD*6 MI E FOSTER MT		87.0	29.0	5160.0	16.9	0.06	12.3				
MGEOT053	SPRING * 29 M NE OF FOSTER MT		40.0	40.8	28.8	1.4	−0.01	1.6				
MGEOT128	COWAN SPRING*9MI NW THREE FORKS MT		14.5	6.8	41.6	3.6	0.12	3.0			−10.00	
MGEOT178	WOLF CREEK HOT SPRING					0.0	−0.01		8.00		70.00	
MGEOT343	WILLIAMSBURG SPRING		19.9	5.3	8.1	2.3	0.09	9.7	1.89	350.00	12.00	
MGEOT030	OIL WELL (TENSLEEP FORMATION)											
MGEOT341	MONTANA RESOURCES MONITORING WELL C		86.3	17.1	24.5	10.0	9.61	51.6	2.00	−100.00	13.00	
MGEOT342	MONTANA RESOURCES MONITORING WELL D2		139.0	47.4	37.8	16.4	19.70	56.6	10.00	−100.00	33.00	
MGEOT055	HOWARD SPRING * 25 M SE OF BIGHORN MT		56.0	238.0	420.0	6.3	0.02	9.9				
MGEOT246	WENDT, FRED * .75 MI S GREGSON (FAIRMONT)		20.7	1.0	29.1	2.8	0.22	43.1	3.30	70.00	39.00	
MGEOT298	MBMG RESEARCH WELL * FAIRMONT HOT SPRINGS		9.5	0.2	163.0	3.3	−0.00	3.8		240.00	600.00	
MGEOT165	NELSON, HARVEY * 5 MI S BROADVIEW MT		4.7	1.4	1004.0	1.7	0.02	9.0		930.00	110.00	
MGEOT061	BRADBROOK * 10 M S BROADVIEW MT		446.0	117.0	352.0	49.8	0.04	17.6		40.00	960.00	
MGEOT279	FAIRMONT HOT SPRINGS, ANACONDA		4.0	0.3	165.0	4.4	0.01	80.6	8.60	340.00	650.00	
MGEOT247	SPANGLER, HAZEL * 2 MI E–NE GREGSON MT		33.2	9.9	36.9	7.3	0.02	56.8		60.00	28.00	
MGEOT214	HUNSAKER SPRING		71.2	18.8	22.3	11.4	0.56	23.3	3.40	100.00	19.00	
MGEOT150	MONT. HIGHWAY DEPT * .75 MI SE WACO MT.		14.2	5.0	914.0	2.4	0.02	7.1			110.00	
MGEOT213	PLUNKET LAKE WARM SPRINGS		38.5	23.5	22.4	2.4		15.5	1.70	110.00	32.00	
MGEOT237	SPRINGS FROM JOINTS IN MISS CYN*SW PLUNKET		48.0	23.0	22.7	2.7	−0.01	14.1	1.40	120.00	20.00	
MGEOT151	MONTANA DEPT HIGHWAYS * 2.5 MI NE WACO MT		16.8	11.1	477.0	1.7	0.01	7.5			60.00	
MGEOT216	HUNSAKER, MAURICE		21.6	12.5	44.4	2.5	0.02	29.9		180.00	25.00	
MGEOT135	ANACONDA RED TRAVETINE MOUND–GEYSER		470.0	67.0	147.0	10.6	1.21	22.7				
MGEOT325	SLEEPING CHILD HOT SPRINGS	162	6.2	0.2	110.0	2.6		60.0		0.30		1.0
MGEOT236	BRUCE, N * IRRIGATION WELL WITH BOOSTER		53.8	18.5	55.7	4.7	−0.01	48.4	6.00	180.00	20.00	
MGEOT218	TOSTON WARM SPRING		48.7	20.2	13.6	3.6	−0.01	19.8		120.00	47.00	
MGEOT294	TOSTON WARM SPRING		46.6	18.8	16.1	2.5	−0.00	18.4	4.10	70.00	39.00	
MGEOT217	BRUCE, NORMAN		279.0	3.0	129.0	5.5	0.03	31.9	1.30	380.00	70.00	
MGEOT215	KIMPTON SPRING		25.8	7.2	5.3	0.8	0.01	17.1	0.90	−20.00	5.00	
MGEOT134	WARNER WARM SPRING		25.6	6.8	5.4	0.9	−0.01	16.0				
MGEOT172	STEELE, WILLIAM * 12.5 MI SE PINEVIEW MT.		19.0	4.6	1074.0	3.8	0.02	7.0			70.00	
MGEOT284	MBMG TEST WELL*WARM SPRINGS STATE HOSPITAL		196.0	23.1	124.0	24.4	21.40	28.4	0.30	110.00	370.00	
MGEOT009	WARM SPRINGS	258	220.0	22.0	120.0	26.0		56.0		0.10		0.7
MGEOT233	WARM SPRINGS STATE HOSPITAL		216.0	24.5	114.0	31.5	10.80	37.7			430.00	
MGEOT231	WARM SPRINGS STATE HOSPITAL		218.0	24.5	128.0	32.9	0.36	33.6	14.90	170.00	450.00	
MGEOT351	BOULDER HOT SPRINGS – LOWER SPRING	158	3.2	−0.0	111.4	6.1	0.31	90.0		0.49	0.22	
MGEOT350	BOULDER HOT SPRINGS – MIDDLE SPRING	153	2.0	0.3	116.2	4.1	0.08	96.5		0.46	0.23	
MGEOT349	BOULDER HOT SPRINGS – UPPER SPRING	161	2.7	0.4	122.0	3.8	−0.01	93.2	0.74	0.57	0.23	
MGEOT232	WARM SPRINGS STATE HOSPITAL * SPRING		225.6	23.1	121.4	23.8	0.06	55.8	23.00	110.00	400.00	
MGEOT185	M–B NO. 12 * 5 MI NE HAMILTON MT		68.2	11.8	20.7	4.4	0.03	59.3			10.00	
MGEOT171	GRIERSON, J.B.*2.5MI NE RANCHERS CEMETARY.		4.3	0.8	956.0	2.6	0.06	12.4			140.00	
MGEOT130	PRISON RANCH SPRING SITE NO. 4		3.9	0.1	45.8	0.5	−0.01	45.8			70.00	
MGEOT113	DEER LODGE PRISON RANCH WELL	66	3.9	0.1	46.0	0.5		45.8				
MGEOT044	BEDFORD SPRINGS	155	57.0	22.0								
MGEOT101	GRIERSON, J.B. * 23 MI NW HYSHAM MT		21.6	11.0	1050.0	4.1	0.05	6.0		140.00	70.00	
MGEOT274	MBMG RESEARCH WELL * WEED CREEK– 1A		2.0	1.3	674.0	1.9	0.05	7.5			53.00	
MGEOT275	MBMG RESEARCH WELL * WEED CREEK– 1B		2.4	0.7	700.0	1.8	0.03	0.8			60.00	
MGEOT255	HANSER, BILL * 3 MI SW TWO DOT MT		1.1	0.2	290.0	0.9	0.01	12.5		280.00	98.00	
MGEOT256	FOX INC * 1.5 MI W–SW TWO DOT		0.6	−0.1	197.0	0.4	0.01	14.0		160.00	55.00	
MGEOT257	HOMER, RAY * TWO DOT WATER SUPPLY		1.1	0.1	178.0	0.5	0.05	13.2		100.00	52.00	
MGEOT296	HARLOWTON * SOUTH MUNICIPAL WELL		2.0	0.1	223.0	0.2	0.01	10.2		250.00	16.00	
MGEOT013	HILLBROOK FLOWING WELL	788	32.0	5.6	340.0	20.0		67.0		500.00		
MGEOT014	WALLS HOT SPRING	489	18.0	3.5	210.0	10.0		60.0		200.00		
MGEOT001	ALHAMBRA HOT SPRINGS NORTH	484	18.0	3.5	220.0	9.5		66.0		200.00		
MGEOT276	TOWNSEND,HERB*2.5 MI SW WHITE SULPHUR SPGS		48.0	15.1	16.9	2.0	0.01	15.9	1.60	−20.00	−2.00	
MGEOT290	RALPH JOHNSON,P.O.BOX 65,WHITE SULPHUR SPR		2.5	3.4	2130.0	19.0	0.01	44.0	11.80	25200.00	2020.00	
MGEOT004	WHITE SULPHUR SPRINGS	835	44.0	12.0	480.0	20.0		51.0		9.10		0.7
MGEOT282	WHITE SULPHUR SPRINGS BANK WELL		41.0	9.5	433.0	17.5	0.10	43.7	−1.00	7900.00	1150.00	
MGEOT188	WATTS, JAMES * 16 MI NE KINSEY MT		1.0	0.2	340.0	0.6	0.03	10.0		674.00	29.00	
MGEOT184	M–B NO 8 WELL*2.5 MI SE CORVALLIS MT		20.8	5.3	25.1	4.9	0.51	70.0			50.00	
MGEOT007	BROADWATER HOT SPRINGS WELL	193	13.0	0.8	180.0	5.9		93.0		0.80		
MGEOT008	GLOEGE WELL	289	78.0	16.0	38.0	3.4		26.0		0.10		
MGEOT003	GARRISON WARM SPRINGS	59	77.0	35.0	24.0	5.2		18.2				
MGEOT206	USGS OBS WELL * 4 MI SW EAST HELENA, MT.		98.0	31.5	30.8	4.7	−0.01	15.8			13.00	
MGEOT242	FLORENCE TEST WELL A		1.0	0.2	81.3	2.9	2.70	4.9			17.00	
MGEOT167	CHERRY CK SHEEP CO.*1.35MI SE HAGEN RANCH.		3.5	0.8	871.0	2.4	0.03	20.4			180.00	
MGEOT329	SIVERTE MYSSE * BOX 315 * INGOMAR MT 59039		3.0	0.5	843.0	1.8	0.02	21.8		1320.00	140.00	
MGEOT261	MOORE, THOMAS * 6.5 MI SW ANGELA MT		394.0	65.2	1684.0	115.0	0.08	50.8		2820.00	1880.00	
MGEOT322	BYRNE WARM SPRING * WEST OF BEARMOUTH		137.0	35.3	12.2	3.3	−0.00	20.7	8.30	140.00	30.00	
MGEOT116	NIMROD SPRINGS	168	126.0	36.0	16.0	3.4		21.0				
MGEOT026	BEARMOUTH SPRINGS	220	89.0	28.0	8.0	1.8		16.0				
MGEOT345	LOLO HOT SPRINGS	86	1.8	0.1	52.0	1.2		72.0		100.00		0.5
MGEOT069	MARYSVILLE DEEP WELL DEPTH 5750		7.7	0.4	208.0	10.4	0.02	68.5		100.00	2000.00	
MGEOT170	CHERRY CREEK SHEEP CO*26 MI N VANANDA MT		456.0	101.0	705.0	78.6	0.78	21.5				
MGEOT162	OLSEN, JONAS * 9 MI NW FLATWILLOW MT.		28.2	11.5	190.0	4.9	0.01	13.1			200.00	
MGEOT201	OLSEN JONAS * 14 MI NE N–BAR RANCH		79.2	39.0	53.5	7.1	0.12	9.8		121.00	126.00	
MGEOT164	REYNOLDS, KEITH * 6 MI NE FLATWILLOW MT.		5.9	1.6	364.0	2.6	0.15	13.5			310.00	

Note: A negative concentration value indicates the detection limit for that analyte

Selected Chemistry

ID	Site name	Alkalinity	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (SiO2) mg/l	Arsenic ug/l	Boron ug/l	Lithium ug/l	H2s
MGEOT163	HILL, FLOYD * 7 MI N FLATWILLOW MT.		6.6	1.8	368.0	3.1	0.12	13.0			390.00	
MGEOT180	M-B 4 (BUTLER CK) * 6 MI NW MISSOULA MT		10.4	5.4	237.0	9.0	6.90	91.9			30.00	
MGEOT254	KING, JOE & SONS INC. * 5 MI SSW WINNET MT		8.3	2.9	726.0	4.2	0.93	12.6		1640.00	290.00	
MGEOT159	SHAW, BUD * 1.7 MI SW MOSBY MT.		3.9	0.9	363.0	2.1	0.35	13.8			200.00	
MGEOT160	EAGER, REX * 2 MI SW WINNETT MT.		6.0	2.0	267.0	2.7	0.02	11.9			170.00	
MGEOT161	BRATTON, WAYNE * 2 MI SE WINNETT MT.		6.9	2.0	387.0	2.7	0.39	14.2			230.00	
MGEOT305	BURLY VISTA TRACTS		73.4	29.9	5.7	4.4	0.42	6.7		40.00	29.00	
MGEOT157	TEIGEN, PETER * 9 MI E GRASSRANGE MT.		162.0	74.8	98.1	11.2	0.83	9.6			220.00	
MGEOT196	MATOVICH * 4.5 MI E GRASSRANGE MT		51.2	20.9	50.1	4.7	-0.01	10.2		86.00	91.00	
MGEOT181	HOLE NO 2 M-B DRILLING PROJECT		5.7	1.1	171.0	2.0	0.35	16.6			-10.00	
MGEOT240	MSU AG EXPERIMENT STATION * MOCCASIN MT		51.5	14.4	16.3	4.3	1.86	9.1		60.00	33.00	
MGEOT155	BRADY, EARL*4 MI NW WINNETT, MT		8.9	3.1	252.0	3.4	0.82	14.6		170.00	200.00	
MGEOT203	GERDRUM, RONALD * 3 MI NE GRASS RANGE, MT.		24.7	10.6	148.0	3.5	0.54	11.5		109.00	115.00	
MGEOT152	CEN EX*15 MI NE WINNETT MT		2.1	0.4	347.0	1.3	0.17	13.5		220.00	150.00	
MGEOT158	BASSETT, EARL * 7.5 MI NW TEIGEN MT.		9.6	4.6	130.0	2.4	1.57	9.7			120.00	
MGEOT059	HEDMAN, J. * 40 MI NE LEWISTOWN MT.		3.2	1.9	154.5	1.7	1.35	9.6				
MGEOT156	HARRIS FLOYD * 11 MI NW TEIGEN MT		18.0	7.3	251.0	2.7	0.21	11.9		270.00	260.00	
MGEOT194	FOX, DENNIS * 7 MI NW GRASSRANGE MT		60.8	17.9	60.4	3.0	0.27	12.1		97.00	69.00	
MGEOT239	LAURENCE HESS * 1 MI N MOCCASIN MT		54.7	20.6	33.8	5.2	1.47	8.3		-20.00	63.00	
MGEOT204	DELANEY, DOUGLAS*7 MI NW (WILD HORSE UNIT)		10.9	5.6	178.0	2.6	0.26	10.3		-20.00	123.00	
MGEOT050	BROOKS WARM SPRING * 2.5 MI NW BROOKS MT.		114.0	39.0	3.6	1.4	-0.01	10.7			20.00	
MGEOT195	DELANEY, DOUGLAS * 11 MI NW ROY MT		9.6	4.0	305.0	2.4	0.44	11.0		159.00	149.00	
MGEOT154	MILLER RANCH * 14 MI SE VALENTINE MT.		5.9	2.1	1770.0	5.3	0.10	16.3			290.00	
MGEOT045	CARDINAL PET CO * 10 M E HILGER MT		7.1	1.6	219.0	5.4	4.09	1.3				
MGEOT153	BUSENBARK, MERLIN*1 MI S VALENTINE MT*		1.4	0.3	688.0	2.1	-100.00	16.5				
MGEOT268	QUINN'S HOT SPRINGS * JIM AND DONNA BROWN		2.7	-0.1	39.3	1.3	0.03	73.5	0.60	250.00	10.00	
MGEOT005	QUINN'S HOT SPRINGS	71	3.6	0.2	39.0	1.5		76.6				
MGEOT197	YEAGER * 8 MI EAST MOULTON, MT.		10.7	6.0	322.0	2.5	0.01	10.9		133.00	120.00	
MGEOT079	FINLEY, R.S.*1 MI NW ST. IGNATIUS		72.0	18.8	12.2	0.7	-0.01	11.0			-10.00	
MGEOT205	SIROKY, FRANK * 9 MI EAST ROY, MT.		1.1	0.1	304.0	0.6	0.02	18.0		70.00	28.00	
MGEOT192	HORYNA, JAMES * 6 MI E ROY MT		1.9	0.4	366.0	1.2	0.13	16.6		140.00	54.00	
MGEOT131	CORPS OF ENGINEERS SOUTH WELL AFTER PERFS		24.6	10.1	221.0	6.6	3.05	8.9			150.00	
MGEOT090	BRYSON, HAROLD*1 MI W MOIESE MT		35.6	15.2	167.0	3.8	2.04	16.8				
MGEOT070	YARGER, ROBERT * 13 MI W CIRCLE MT		32.2	142.4	190.0	10.6	-0.01	12.2				
MGEOT287	SAND COULEE WTR USERS BENCH W ABV SAND COU		51.7	69.9	17.2	2.9	0.01	7.5		50.00	42.00	
MGEOT193	TAYLOR, JAMES * 8 MI E CHRISTINA MT		2.4	0.2	476.0	1.2	0.06	11.5		120.00	55.00	
MGEOT288	CHARLES ENTSMINGER*TOWN OF NUMBER SEVEN		79.6	28.7	11.4	2.5	-0.00	12.3		240.00	16.00	
MGEOT295	CUSTER, EVERETT* EDEN RT, GREAT FALLS, MT		100.0	36.1	30.7	4.4	0.00	14.1	0.20	120.00	67.00	
MGEOT297	TOWN OF TRACY		82.2	29.1	12.4	2.3	0.02	11.8	0.90	90.00	19.00	
MGEOT054	SLOGSVOLD, A. K. * 17 M SE RITCHEY MT		362.0	266.0	32.0	7.9	0.01	13.2				
MGEOT211	GOVER * 2.5 MI TRAVIS SCHOOL		57.9	34.2	264.0	7.5	1.57	20.8			70.00	
MGEOT200	VILLAGE INN * 2.5 MI NE TRAVIS SCHOOL		24.0	8.2	274.0	7.5	0.23	10.8	1.70		221.00	
MGEOT299	STONE, GENE		0.8	-0.1	50.9	0.6	-0.00	56.4		120.00	12.00	
MGEOT062	WEBB RES * 17.5 MI SE GERALDINE MT.		47.0	13.6	36.0	5.7	0.01	10.3				
MGEOT353	HOLLAND, JIM - GREEN SPRINGS	73	0.8	1.2	57.1	2.1	0.27	55.8	-490.00	120.00	-40.00	
MGEOT248	GREEN SPRINGS * HOLLAND RANCH	125										
MGEOT191	TACKE, ROBERT * 2 MI SW GREAT FALLS MT		182.0	75.4	132.0	13.5	3.37		1.10		300.00	
MGEOT198	PAUL, MICHAEL(ROBINSON)*3.5M SW GREATFALLS		224.0	71.1	124.0	13.4	2.22	20.6	0.30		277.00	
MGEOT316	BUTTE CREEK SPRING * SQUARE BUTTE		36.6	7.9	23.9	3.6	0.03	18.1	0.60	80.00	5.00	
MGEOT319	BUTTE CREEK SPRING - NORTH * SQUARE BUTTE		32.2	8.4	26.5	2.9	0.01	16.8	0.40	80.00	4.00	
MGEOT169	CHAMBERLAIN, CURTIS * 2 MI W LLER SCHOOL		10.2	2.0	889.0	2.5	0.16	8.2				
MGEOT321	MELTON, LARUE * LOWER AQUIFER		11.1	1.1	83.5	6.6	0.83	15.5		80.00	-2.00	
MGEOT314	USGS - MELTON, LEON		12.2	5.2	61.4	1.2	-0.00	21.1		160.00	12.00	
MGEOT236	SCHMIDT, LLOYD * 3.5 MI SE SQUARE BUTTE		45.8	14.2	126.0	7.7	0.33	11.0		-20.00	100.00	
MGEOT190	USGS OBS WELL * .5 MI S VALLEY SCHOOL		210.0	151.0	43.4	7.1	1.32	19.8		241.00	47.00	
MGEOT199	EIDEL * .5 MI S SUNSET MEMORIAL CEMETARY		112.0	114.0	523.0	11.9	0.14	10.6	2.00		251.00	
MGEOT078	WEBSTER, BONITA*BOX 443 RONAN MT		29.8	10.9	17.6	1.0	-0.01	18.8			-10.00	
MGEOT099	DEMARS,TOM J.* 10 MI W OF WINIFRED MT.		163.5	57.5	94.5	4.1	0.03	7.9	-2.00	220.00	110.00	
MGEOT249	HOMESTEAD ACRES COUNTY WATER DISTRICT		66.0	38.1	26.4	4.4	0.33	10.6		150.00	56.00	
MGEOT250	HOMESTEAD ACRES COUNTY WATER DISTRICT		63.2	39.0	27.7	4.8	0.21	10.2		150.00	53.00	
MGEOT241	MCCOLLUM, JIM * 10 MI NW MATHISON RANCH		1.2	0.2	401.0	1.0	0.05	11.0		630.00	35.00	
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT		32.3	13.0	19.9	1.4	-0.01	16.2			-10.00	
MGEOT047	* RYFFEL BROS. * 3MI S & 3 MI E HIGHWOOD		57.0	19.0	52.0	3.6		29.0			20.00	
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.		20.0	9.4	113.0	3.5	0.02	17.5			20.00	
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH		15.2	3.6	33.0	3.0	0.17	22.0				
MGEOT307	HOT SPRINGS CITY		17.2	4.0	32.0	3.1	0.07	26.1		70.00	13.00	
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS		0.9	-0.1	92.3	0.0	0.61	67.0	-1.00	460.00	18.00	
MGEOT291	SOUTH EAST OF CAMP AQUA		0.6	-0.1	85.8	1.7	-0.00	69.6	-1.00	350.00	51.00	
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS		1.1	0.3	83.0	1.8	-0.01	58.0				
MGEOT017	CAMAS HOT SPRINGS	169	0.9	0.1	85.0	1.7		70.0		300.00		7.4
MGEOT060	HOT SPRINGS MONTANA		1.0	0.1	83.5	1.8	0.01	59.0				
MGEOT352	SYMES HOTEL IN HOT SPRINGS	131	0.6	0.7	89.4	2.2	-0.02	73.1	-490.00	160.00	40.00	
MGEOT029	SYMES HOT SPRINGS WELL	156	1.2	0.2	91.0	1.7		68.0				
MGEOT081	HOT SPRING GEOTHERM WELL - UNNAMED		18.4	5.2	43.2	5.6	0.07	32.8				
MGEOT355	KOEPLING, DELBERT * WELL 136	236	4.5	-0.2	95.6	2.9	0.06	36.64	-490.0	380.0	40.00	
MGEOT354	OSTRANGER, DAVE * WELL 56	276	5.5	2.5	109.3	-0.6	0.39	12.96	-490.0	330.0	-40.00	

Note: A negative concentration value indicates the detection limit for that analyte

Selected Chemistry

ID	Site name	Alkalinity	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (SiO2) mg/l	Arsenic ug/l	Boron ug/l	Lithium ug/l	H2s
MGEOT077	VERNER, ROSE*3.75 MI W PABLO MT		33.7	36.1	86.5	3.1	0.01	14.8			-10.00	
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS		37.0	11.9	46.0	3.9	5.80	21.9			30.00	
MGEOT220	JACOBSEN, R * HOT SPRINGS MT		5.5	1.0	139.0	2.1	0.28	35.0	19.50	844.00	61.00	
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT		6.6	1.6	88.1	1.9	0.39	14.3	100.00	690.00	20.00	
MGEOT042	SUN RIVER SPRINGS											
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA		15.5	2.6	129.0	3.8	0.16	36.8	2.60	500.00	73.00	
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT		2.1	0.3	117.0	1.5	0.22	32.4	2.40	914.00	58.00	
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT		4.0	0.7	147.7	2.8	0.26	34.9	14.60	968.00	80.00	
MGEOT266	JACKOLA AP.100 FT E. OF CAMP AQUA BATH SPA		2.9	0.2	152.0	3.1	-0.00	43.2	0.20	540.00	76.00	
MGEOT027	CAMP AQUA AREA TEST WELL	351	3.2	0.3	152.0	4.0		42.2		640.00		
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA		12.6	2.4	127.0	3.3	0.11	35.3	0.80	550.00	59.00	
MGEOT202	OLSEN, EDWIN * 8.4 MI NE WINIFRED MT		10.0	3.3	2141.0	4.7	0.12	12.4		121.00	126.00	
MGEOT251	SMELSER, JAMES A. * POWER MT		25.6	9.5	750.0	10.6	0.06	7.8		1000.00	450.00	
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT		3.3	0.4	154.4	2.6	0.13	43.6	5.60	934.00	80.00	
MGEOT227	KEMP * .25 MI N CAMPAQUA MT		4.8	1.0	144.0	2.8	0.65	41.4	0.70	910.00	81.00	
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA		4.4	0.4	142.0	2.1	0.12	36.6	3.30	885.00	74.00	
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *		3.6	0.6	150.0	3.4	0.02	36.5	1.00	870.00	100.00	
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT		5.7	0.6	139.0	3.7	0.11	32.9				
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT		4.6	0.7	127.0	2.7	0.03	29.3	6.70	710.00	80.00	
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT		3.3	0.4	134.0	1.7	0.09	28.6	4.20	849.00	65.00	
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT		5.8	0.7	101.0	2.3	0.20	21.0	23.00	540.00	40.00	
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT		5.7	0.7	105.0	1.3	0.17	19.5	27.70	511.00	24.00	
MGEOT149	MATOVICH,JOHN * 23 MI SW SUN PRAIRIE MT		2.4	0.6	606.0	1.6	0.07	10.5			110.00	
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT		28.4	7.8	23.6	2.2	0.30	15.9	7.00	91.00	-8.00	
MGEOT075	LONEPINE OBSERVATION WELL		39.8	11.6	32.8	1.7	-0.01	18.2			-10.00	
MGEOT110	STREIT, GEORGE * 4MI E-1MI S FT BENTON MT.		207.0	180.0	253.0	34.4	0.09	11.8				
MGEOT243	WHITMAYER ASSOC * 4.5MI SE SUN PRAIRIE SCH		11.6	3.2	1076.0	6.7	0.04	10.5			170.00	
MGEOT109	CLARK, BRAD * 25 MI E FT. BENTON MT.		19.4	16.0	885.0	3.3	0.03	7.5				
MGEOT114	LANDUSKY PLUNGE SPRINGS	101	161.0	65.0	24.0	6.7		17.8				
MGEOT072	LANDUSKY, I*8.5 MI S HAYS, MONTANA		250.9	86.8	35.2	9.1	0.01	14.7				
MGEOT046	BLACK COULEE * E OF TEST AREA		329.0	508.0	3250.0	24.8		6.1			2100.00	
MGEOT313	ALZHEIMER, PAUL * SW OF BRADY, MT		118.0	58.0	193.0	3.2	4.82	8.3				
MGEOT312	REVERE, LEE		42.9	22.8	89.4	1.7	2.36	8.3				
MGEOT049	LITTLE WARM SPRINGS*9 MI SE LODGEPOLE		289.0	110.0	72.0	13.3	0.10	16.0			140.00	
MGEOT324	LODGEPOLE WARM SPRINGS	81	266.0	96.0	75.0	13.0		16.3				
MGEOT048	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT		268.0	96.0	75.0	13.0	-0.01	16.3			140.00	
MGEOT051	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT		187.0	69.0	52.5	8.5	-0.01	14.5				
MGEOT052	KIRKALDIE, BRUCE*7 MI SW LODGEPOLE MT		242.0	83.0	67.0	11.1	-0.01	14.1				
MGEOT037	LARGE CAPACITY WELL*4 MI SW WOLF POINT, MT				402.0		1.60					
MGEOT024	CITY OF WOLF POINT * WELL IN WOLF POINT		15.0	36.0	1330.0	19.0	0.13	13.0		5160.00		
MGEOT023	SHERMAN HOTEL OF WOLF POINT		24.0	5.2	1500.0	1.6	0.05	13.0		5070.00		
MGEOT038	USGS TEST WELL * 1 MILE SOUTH POPLAR, MT		54.0	31.0	214.0	4.7	0.67	9.9				
MGEOT025	FOSS ELMER * 5.8 MI SE BROCTON		6.8	2.0	463.0	5.2	0.10	16.0		970.00		
MGEOT317	LANDTECH WATER DISPOSAL SERVICE		2.3	0.6	595.0	1.4	0.06	15.7	0.20	2520.00	96.00	
MGEOT315	THORNESS, RICK * 4 MILES NW OF BAINVILLE		70.6	62.8	337.0	5.5	0.17	24.4		220.00	65.00	
MGEOT108	CLAWITER, MILT * 4MI N-4MI E BIG SANDY MT.		25.4	13.0	710.0	7.1	0.06	21.4	2.90	1100.00	70.00	
MGEOT303	SIMS SPRING		49.5	23.3	17.1	1.7	-0.00	19.7				
MGEOT140	TEXACO INC * 1.7 MI NW CENTRAL SCHOOL		2.3	0.7	800.0	4.5	0.35	25.5		2690.00	300.00	
MGEOT252	MATOVAICH, MARTIN*17 MI E MALTA NEAR SACO		521.0	156.0	254.0	25.1	0.46	17.1		950.00	260.00	
MGEOT111	SLEEPING BUF REC AREA * 4MI NNW ASHFIELD		490.0	174.0	293.0	25.4	0.03	17.1				
MGEOT145	SHIRLE, WALTER * 3 MI S FRESNO DAM.		6.2	2.5	922.0	2.5	0.02	7.4			160.00	
MGEOT106	PIMLEY, DON * 4 MI NW JOPLIN MT.		26.0	11.2	1570.0	3.8	0.06	7.5				
MGEOT105	CADY, ELWIN * 7.5 MI NW JOPLIN MT.		27.0	13.2	1600.0	4.4	0.05	13.0				
MGEOT309	FRANCIS, CLARA		516.0	192.0	138.0	8.2	0.02	19.1		1170.00	130.00	
MGEOT107	WELSH, ORVILLE * 13 MI N-3MI E HINGHAM MT.		17.4	4.6	1095.0	3.4	0.05	9.8				
MGEOT310	EDWARDS, MARVIN / MIKE DUSTERHOFF		7.1	1.8	713.0	1.1	0.03	6.4		490.00	76.00	
MGEOT039	BIG WEST OIL CO * 2 MI NE MTN VIEW SCHOOL		32.0	37.0			5.72					
MGEOT104	RYGH, KEN * 22 MI N - 5 MI W JOPLIN MT.		0.8	0.9	385.0	1.0	0.03	8.7				
MGEOT142	BRADBURY, ALFRED * 11 MI E WILD HORSE MT		7.8	1.6	640.0	2.6	0.03	7.3			160.00	
MGEOT144	NAGEHUS, ORVILLE * 3 MI N SIMPSON MT.		5.5	1.3	394.0	1.8	0.01	9.0			80.00	

Note: A negative concentration value indicates the detection limit for that analyte

CAMAS–LONEPINE AREA (33 Sites)

ID	Site name	Reference	Type	Flow (l/min)	Latitude	Longitude	Temp (deg c)	Status/use	SWL (M)	Date	Chloride mg/l	Sulfate mg/l	Fluoride mg/l	Std dev balance	Lab ph
MGEOT017	CAMAS HOT SPRINGS	Mariner et.al. 1976	SPRING	200.0	47.6155	114.6663	45				9.0	38.0	5.6		9.40
MGEOT029	SYMES HOT SPRINGS WELL	Sonderegger et.al. 1981	WELL	76.0	47.6163	114.6763	38				9.0	40.0	5.8		9.80
MGEOT068	*TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH*	MBMG–GWIC	WELL		47.6063	114.6744	18.5	PUBLIC SUPPLY	2.74	27 AUG 1975	2.2	12.1	1.6	−0.46	6.74
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS	MBMG–GWIC	SPRING		47.6147	114.6658	44	RECREATIONAL		15 SEP 1975					
MGEOT075	LONEPINE OBSERVATION WELL	MBMG–GWIC	WELL		47.7141	114.6477	16.5	DOMESTIC	33.22	04 MAR 1976	6.3	12.2	0.9	−0.25	7.93
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT	MBMG–GWIC	WELL		47.5827	114.5063	21.5	UNUSED		04 MAR 1976	6.0	8.1	0.6	0.09	7.96
MGEOT080	HOT SPRINGS MONTANA	MBMG–GWIC	SPRING		47.6155	114.6477	43	RECREATIONAL		19 APR 1976					
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT	MBMG–GWIC	WELL	0.4	47.6516	114.5836	24	STOCK		02 JUL 1976	28.3	1.2	6.1	0.49	8.18
MGEOT096	IRRIGATION EQUIPMENT SALES*HOT SPRINGS	MBMG–GWIC	WELL		47.6297	114.6236	19.5	DOMESTIC		17 AUG 1976	25.3	0.3	0.8	−0.76	7.51
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	MBMG–GWIC	WELL		47.6472	114.5761	34.4	DOMESTIC		07 SEP 1978	23.1	2.1	4.6	−0.87	8.63
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	MBMG–GWIC	WELL		47.6536	114.5813	25.8	IRRIGATION		06 SEP 1978	10.9	1.8	4.4	−0.21	9.16
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	MBMG–GWIC	WELL		47.6311	114.5813	15.2			08 SEP 1978	2.4	14.0	5.4	−0.29	8.12
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	MBMG–GWIC	WELL	94.9	47.6619	114.5836	20.3	IRRIGATION		02 DEC 1979	19.0	2.1	4.8	−0.89	8.48
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	MBMG–GWIC	WELL	40.0	47.6302	114.555	19	IRRIGATION		04 DEC 1979	27.0	1.4	4.3	−0.67	8.06
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	MBMG–GWIC	WELL	30.0	47.6372	114.5611	26.8	IRRIGATION		05 DEC 1979	34.6	0.6	4.2	0.99	7.89
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	MBMG–GWIC	WELL		47.688	114.6536	16.6	DOMESTIC	22.86	06 DEC 1979	2.1	12.0	1.2	−0.69	7.89
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	MBMG–GWIC	WELL		47.6736	114.6027	23.6	DOMESTIC	18.29	30 NOV 1979	7.8	5.8	3.4	−0.95	7.90
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	MBMG–GWIC	WELL	40.0	47.6452	114.5688	32.5	IRRIGATION		02 DEC 1979	30.9	0.6	5.0	0.52	8.40
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	MBMG–GWIC	WELL	20.0	47.6433	114.5638	30.6	IRRIGATION		02 DEC 1979	35.5	0.6	4.5	0.38	8.28
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	MBMG–GWIC	WELL	10.0	47.6361	114.575	32.6	IRRIGATION		29 NOV 1979	16.0	1.5	7.6	−0.98	8.71
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	MBMG–GWIC	WELL	94.8	47.6436	114.5741	36.9	IRRIGATION		29 NOV 1979	31.3	1.3	7.8	−0.38	8.38
MGEOT262	*MBMG GEO. TEST WELL #1 * CAMPAQUA AREA*	MBMG–GWIC	WELL	75.0	47.6422	114.5713	43.7	RESEARCH		18 DEC 1980	35.3	0.7	4.3	2.03	8.21
MGEOT286	JACKOLA AP. 100 FT E. OF CAMP AQUA BATH SPA	MBMG–GWIC	WELL	416.5	47.6411	114.57	51	INDUSTRIAL/COMM	1.83	04 JUN 1982	34.0	0.6	5.0	0.53	8.53
MGEOT027	CAMP AQUA AREA TEST WELL	Sonderegger et.al. 1981	WELL–FLOWING	1300.0	47.6422	114.5713	50	RESEARCH			33.0	4.0	3.9		8.40
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.	MBMG–GWIC	WELL		47.5952	114.5302	22.5	UNUSED	−0.01	17 AUG 1976	17.5	8.6	3.5	0.56	7.83
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	MBMG–GWIC	WELL	35.1	47.67	114.586	22.8	IRRIGATION		08 SEP 1978	2.2	6.9	3.2	−0.54	9.45
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	Sonderegger et.al. 1981	WELL	9.1	47.6075	114.6713	29.8	DOMESTIC		03 DEC 1979	7.8	21.2	5.2	−0.63	9.46
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	MBMG–GWIC	WELL	303.1	47.6347	114.5619	42.7	RESEARCH	−0.08	15 JAN 1981	34.8	21.5	3.1	0.62	8.32
MGEOT291	SOUTH EAST OF CAMP AQUA	MBMG–GWIC	WELL	10.1	47.6147	114.6655	51.5	RESEARCH		19 AUG 1982	9.9	9.6	5.7	−0.59	9.34
MGEOT307	HOT SPRINGS CITY	MBMG–GWIC	WELL		47.6063	114.6736	21	PUBLIC SUPPLY		31 MAY 1984	3.1	10.7	0.2	0.76	7.99
MGEOT352	SYMES HOTEL WELL	MBMG/UURI	WELL		47.6163	114.6763	33.3	DOMESTIC		02 NOV 1993	11.0	30.0	5.6	−0.01	9.66
MGEOT355	KOEPLING, DELBERT * WELL 138	MBMG/UURI	WELL		47.6170	114.6781	26.5	IRRIGATION		03 NOV 1993	10.0	5.1	3.4	0.04	8.23
MGEOT354	OSTRANGER, DAVE * WELL 56	MBMG/UURI	WELL		47.6171	114.6775	17.2	IRRIGATION		03 NOV 1993	14.0	3.8	5.4	−0.07	8.05

NOTE: A negative value for concentration indicates the detection limit for that analyte.

CAMAS–LONEPINE AREA (33 Sites)

ID	Site name	SC mmohs	TDS mg/l	Hco3 mg/l	Alkalinity	Sample type	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (SiO2) mg/l	Arsenic ug/l	Boron ug/l	Lithium ug/l	H2S
MGEOT017	CAMAS HOT SPRINGS		399.00		169		0.9	0.1	85.0	1.7		70.0		300.0		7.4
MGEOT029	SYMES HOT SPRINGS WELL		367.00		158		1.2	0.2	91.0	1.7		68.0				
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	245.60	156.07	127.8			15.2	3.6	33.0	3.0	0.17	22.0				
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS						1.1	0.3	83.0	1.8	−0.01	58.0				
MGEOT075	LONEPINE OBSERVATION WELL	396.80	240.03	235.9		Dissolved	39.8	11.6	32.8	1.7	−0.01	18.2			−10.0	
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT	330.20	195.26	196.9		Dissolved	32.3	13.0	19.9	1.4	−0.01	16.2			−10.0	
MGEOT080	HOT SPRINGS MONTANA						1.0	0.1	83.5	1.8	0.01	59.0				
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT	617.20	381.08	331.8			5.7	0.6	139.0	3.7	0.11	32.9				
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS	471.80	283.29	264.5		Dissolved	37.0	11.9	46.0	3.9	5.80	21.9			30.0	
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	633.60	395.26	326.0		Dissolved	3.6	0.6	150.0	3.4	0.02	36.5	1.0	870.0	100.0	
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	470.60	338.76	280.0		Dissolved	4.6	0.7	127.0	2.7	0.03	29.3	6.7	710.0	80.0	
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	404.80	244.61	221.0		Dissolved	6.6	1.6	88.1	1.9	0.39	14.3	100.0	690.0	20.0	
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	537.00	345.30	267.0		Dissolved	3.3	0.4	134.0	1.7	0.09	26.6	4.2	849.0	65.0	
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	592.90	375.46	324.0		Dissolved	5.5	1.0	139.0	2.1	0.26	35.0	19.5	844.0	61.0	
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	656.70	403.19	348.0		Dissolved	4.0	0.7	147.7	2.8	0.26	34.9	14.6	968.0	80.0	
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	269.70	174.80	164.0		Dissolved	28.4	7.8	23.6	2.2	0.30	15.9	7.0	91.0	−8.0	
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	446.70	276.24	255.0		Dissolved	5.7	0.7	105.0	1.3	0.17	19.5	27.7	511.0	24.0	
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	635.60	384.72	328.0		Dissolved	4.4	0.4	142.0	2.1	0.12	36.6	3.3	885.0	74.0	
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	668.40	419.64	354.0		Dissolved	3.3	0.4	154.4	2.6	0.13	43.6	5.6	934.0	80.0	
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	472.40	304.15	237.0		Dissolved	2.1	0.3	117.0	1.5	0.22	32.4	2.4	914.0	58.0	
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	593.70	394.41	314.0		Dissolved	4.8	1.0	144.0	2.8	0.65	41.4	0.7	910.0	81.0	
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	655.60	390.02	343.0		Dissolved	12.6	2.4	127.0	3.3	0.11	35.3	0.8	550.0	59.0	
MGEOT266	JACKOLA AP.100 FT E. OF CAMP AQUA BATH SPA	651.20	413.14	327.0		Dissolved	2.9	0.2	152.0	3.1	−0.00	43.2	0.2	540.0	78.0	
MGEOT027	CAMP AQUA AREA TEST WELL		420.00		351		3.2	0.3	152.0	4.0		42.2		640.0		
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.	622.30	374.62	366.9		Dissolved	20.0	9.4	113.0	3.5	0.02	17.5			20.0	
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	442.30	273.01	186.0		Dissolved	5.8	0.7	101.0	2.3	0.20	21.0	23.0	540.0	40.0	
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	383.50	286.58	84.6		Dissolved	0.9	−0.1	92.3	0.0	0.61	67.0	−1.0	460.0	18.0	
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	663.90	405.72	321.0		Dissolved	15.5	2.8	129.0	3.8	0.16	36.8	2.6	500.0	73.0	
MGEOT291	SOUTH EAST OF CAMP AQUA	381.80	270.89	109.3		Dissolved	0.6	−0.1	85.8	1.7	−0.00	69.6	−1.0	350.0	51.0	
MGEOT307	HOT SPRINGS CITY	253.60	172.15	149.3		Dissolved	17.2	4.0	32.0	3.1	0.07	28.1		70.0	13.0	
MGEOT352	SYMES HOTEL WELL	280.00	297.16		131	Dissolved	0.6	0.7	89.4	2.2	−0.02	73.1	−0.5	0.2	0.0	
MGEOT355	KOEPLING, DELBERT * WELL 136	266.00	275.02		236	Dissolved	4.5	−0.2	95.6	2.9	0.06	36.6	−0.5	0.4	0.0	
MGEOT354	OSTRANGER, DAVE * WELL 56	312.00	290.91		278	Dissolved	5.5	2.5	109.3	−0.6	0.39	13.0	−0.5	0.3	−0.0	

NOTE: A negative value for concentration indicates the detection limit for the analyte.

CAMAS–LONEPINE AREA (33 Sites)

ID	Site name	Location	County
MGEOT017	CAMAS HOT SPRINGS	21N 24W 3BBDB	SANDERS
MGEOT029	SYMES HOT SPRINGS WELL	21N 24W 4ADCA	SANDERS
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	21N 24W 04 DBDA	SANDERS
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS	21N 24W 03 BBB	SANDERS
MGEOT075	*LONEPINE OBSERVATION WELL*		SANDERS
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT	21N 23W 14 ACB	SANDERS
MGEOT080	HOT SPRINGS MONTANA		SANDERS
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT		SANDERS
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS	22N 24W 36 BBB	SANDERS
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	22N 23W 20 CDBC	LAKE
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT		SANDERS
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT		LAKE
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	22N 23W 18 DDAD	SANDERS
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	22N 23W 33 BABB	LAKE
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	22N 23W 28 CBBB	LAKE
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	22N 24W 10 ABAB	SANDERS
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	22N 23W 18 BBBB	SANDERS
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	22N 23W 20 DCDB	LAKE
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	22N 23W 29 AADB	LAKE
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	22N 23W 29 CACA	LAKE
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	22N 23W 29 BAAC	LAKE
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	22N 23W 29 BADD	LAKE
MGEOT266	JACKOLA AP.100 FT E. OF CAMP AQUA BATH SPA	22N 23W 29 ACAB	LAKE
MGEOT027	CAMP AQUA AREA TEST WELL	22N 23W 29 AC	LAKE
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.	21N 23W 10 BDD	SANDERS
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT		SANDERS
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	21N 24W 04 DABD	SANDERS
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	22N 23W 29 DADD	SANDERS
MGEOT291	SOUTH EAST OF CAMP AQUA	21N 24W 03 BBB	SANDERS
MGEOT307	HOT SPRINGS CITY	21N 24W 04 DBDA	SANDERS
MGEOT352	SYMES HOTEL WELL	21N 24W 04ADB	SANDERS
MGEOT355	KOEPLING, DELBERT * WELL 136	22N 24W 13DADD	SANDERS
MGEOT354	OSTRANGER, DAVE * WELL 56	22N 23W 17BBC	SANDERS

NOTE: A negative value for concentration indicates the detection limit for that analyte.

APPENDIX II

GEOTHERMOMETER TEMPERATURES FOR SELECTED SITES

GEOTHERMOMETERS FOR SELECTED SITES

Site name	Surface Temp	Mg CORRECTION Na-K-Ca (B=4/3)	Na-K-Ca (B=1/3)	Log(sqrtCa/Na)	Temperature Corrected	R Coefficient	Delta T (Mg Corr.)	Na-K-Ca Corrected	Na-K-Ca Uncorrected	Quartz (no steam)	Quartz (steam loss)	Chalcedony	a-Cristobalite	B-Cristobalite	Amorphous Silica	Published Estimates
MGEOT209 TARGHEE SULPHUR SPRING*6MI W W YELLOWSTONE	16	25.14	213.95	2.14	25.14	37.62	-61.25	25.14	213.95	51.53	58.32	19.07				16
MGEOT127 LOWER EAST SPRING-STAUDENMEYER RANCH	28	50.56	190.06	1.53	50.56	36.10	-20.25	50.56	190.06	69.26	74.13	37.45				
MGEOT125 LOWER WEST SPRINGS-STAUDENMEYER RANCH	31	52.05	190.72	1.51	52.05	35.49	-18.99	52.05	190.72	66.01	71.23	34.03				
MGEOT124 UPPER WEST SPRING-STAUDENMEYER RANCH	29	50.11	188.52	1.53	50.11	35.89	-21.38	50.11	188.52	64.92	70.27	32.91				
MGEOT177 UPPER WEST SPRING-STAUDENMEYER RANCH	28.8	48.53	187.46	1.54	48.53	36.79	-22.28	48.53	187.46	64.92	70.27	32.91				
MGEOT123 UPPERMOST SPRING-STAUDENMEYER RANCH	28	47.70	186.17	1.56	47.70	36.27	-24.82	47.70	186.17	63.63	69.12	31.56				45
MGEOT126 UPPER-EAST SPRING-STAUDENMEYER RANCH	29	50.39	189.52	1.53	50.39	36.34	-20.08	50.39	189.52	68.27	73.23	36.39				
MGEOT121 ANDERSONS PASTURE SPRING #1	28	50.56	189.64	1.53	50.56	36.04	-20.37	50.56	189.64	66.01	71.23	34.03				45
MGEOT122 ANDERSONS PASTURE SPRING #2	23.5	49.09	190.13	1.56	49.09	34.82	-25.49	49.09	190.13	65.29	70.59	33.28				45
MGEOT210 USFS* BAKERS HOLE* 3MI N WEST YELLOWSTONE	16	91.96	183.40	0.90	91.96	40.09	48.22	43.74	183.40	125.03	122.44	97.06	74.38	26.38	6.13	45
MGEOT115 SLOAN COW CAMP SPRING	29.5	93.08	100.79	0.09	93.08	10.12	-19.50	93.08	100.79	102.64	103.28	72.78	52.24			85
MGEOT120 WEST FORK SWIMMING HOLE	25.5	22.90	191.44	2.02	22.90	70.54	-12.10	22.90	191.44	49.80	56.77	17.29				30
MGEOT118 CURLEW CREEK WARM SPRING	23	33.96	112.31	1.09	33.96	14.05	-86.94	33.96	112.31	62.88	68.45	30.78				
MGEOT119 WALL CANYON WARM SPRING	24	120.82	126.06	0.05	126.06	22.46	50.23	75.83	126.06	93.53	95.39	63.02	43.32			
MGEOT229 WOLF CREEK HOT SPRING	60	63.55	101.42	0.49	63.55	20.56	-32.25	63.55	101.42	102.46	103.12	72.58	52.05			
MGEOT129 LOWELL HILDRETH SPRING*15 MI SW DILLON	19.6	33.21	160.79	1.58	33.21	33.43	-55.00	33.21	160.79	58.50	64.55	26.24	9.58			
MGEOT016 BEAR CREEK SPRINGS	24															
MGEOT132 VIGILANTE WARM SPRING	23.5	14.06	192.50	2.20	14.06	34.09	-69.48	14.06	192.50	54.13	60.65	21.74				30
MGEOT041 LA DUKE HOT SPRINGS	65	74.46	161.74	0.95	74.46	22.38	-12.71	74.46	161.74	100.87	101.74	70.87				73
MGEOT012 BROWNS SPRINGS	23.7															30
MGEOT010 PULLER HOT SPRINGS	44.4	122.49	166.37	0.42	166.37	31.45	116.37	50.00	166.37	83.38	86.53	52.25				90
MGEOT019 TRUDAU SPRINGS	22.7	68.70	177.23	1.16	68.70	37.15	10.00	58.69	177.23	61.53	67.25	29.36				45
MGEOT040 CHICO HOT SPRINGS	42	63.04	182.95	1.29	63.04	27.38	-18.12	63.04	182.95	84.64	87.64	53.59				58
MGEOT032 GROUNDWATER*4.7 MI NE FT SMITH MT	20	122.94	82.65	-0.47	82.65	46.42	45.21	37.44	82.65	39.26	47.27					
MGEOT074 BROWN CATTLE CO* 3.1 MI N. BIRNEY MT	15.5	93.87	78.14	-0.20	78.14	20.45	-12.29	78.14	78.14	39.58	47.56					
MGEOT276 JARDINE HOT SPRINGS 0.25 MI E OF JACKSON	60	121.03	142.13	0.21	142.13	25.23	75.24	66.89	142.13	101.15	101.99	71.18				
MGEOT289 MBMG GEOTHERMAL TEST * THEXTON TX-12	87	175.27	183.18	-0.10	183.18	2.48	-0.45	163.18	163.18	141.01	135.92	114.73	90.40			
MGEOT028 JACKSON HOT SPRINGS	58	129.49	148.01	0.18	148.01	28.74	91.06		148.01	103.65	104.14	73.86				125
MGEOT293 PRIVATE GEOTHERMAL TEST*ENNIS HOT SPRINGS*	87	174.67	164.28	-0.09	164.28	2.54	0.01	164.27	164.28	141.54	136.37	115.32	90.94			
MGEOT277 LAPHAM DOMESTIC WELL 1 MI NW JACKSON, MT.	17	96.20	142.30	0.49	96.20	14.94	-4.51	96.20	142.30	55.70	62.06	23.36				
MGEOT117 ENNIS HOT SPRINGS	81															129
MGEOT058 BROWN CATTLE CO * 9.5MI SW BIRNEY DAY SCH.	16.5	92.50	80.39	-0.15	80.39	5.35	-30.60	80.39	80.39	38.28	46.38					
MGEOT031 BEAVERHEAD ROCK SPRINGS	27															
MGEOT133 APEX WARM SPRING	25	29.04	153.19	1.59	29.04	29.57	-70.94	29.04	153.19	63.07	68.62	30.98				76
MGEOT323 ELKHORN HOT SPRINGS	48.5	56.42	94.55	0.52	56.42	6.60	-53.06	56.42	94.55	106.31	106.44	76.72	55.84			
MGEOT292 MARTIN, KIETH	20.5	-8.62	210.02	2.82	-8.62	36.61	-130.60		210.02	41.47	49.27					
MGEOT326 NEW BILTMORE HOT SPRINGS	53	74.05	177.28	1.09	74.05	28.48	0.54	73.51	177.28	97.96	99.23	67.75				
MGEOT306 NEWMAN, JOHN * JOLIET, MT	16	85.34	52.06	-0.47	52.06	49.75	4.98	47.08	52.06	31.42	40.15					
MGEOT006 ANDERSON'S SPRING	25	-3.89	194.51	2.60	-3.89	44.31	-102.80		194.51	45.84	53.20					30
MGEOT280 ANDERSON SPRING	25	-10.31	208.61	2.85	-10.31	33.10	-142.90		208.61	43.85	51.42					
MGEOT043 NORRIS HOT SPRINGS	50	112.68	154.87	0.42	154.87	17.84	61.48	93.39	154.87	123.77	121.36	95.70	73.12			107
MGEOT015 POTOSI HOT SPRINGS	49.5	54.51	99.00	0.60	54.51	1.50	-14.81	54.51	99.00	97.96	99.23	67.75				60
MGEOT187 GROSS, PETE * 4 MI S PONY MT	37.5	51.38	98.58	0.64	51.38	1.16	-5.15	51.38	98.58	99.63	100.67	69.54	49.28			
MGEOT311 MCFERRAN, EUGENE * BILLINGS, MT	15.5	77.73	35.87	-0.64	35.87	30.92	-55.34	35.87	35.87	36.24	44.53					
MGEOT179 CARTER'S BRIDGE * 4 MI SE LIVINGSTON MT.	28	14.63	201.35	2.25	14.63	30.81	-95.22		201.35	62.30	67.94	30.18				
MGEOT011 AVON WARM SPRING	25.5															
MGEOT264 BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	59	101.91	117.96	0.16	117.96	2.28	-10.03	117.96	117.96	119.06	117.35	90.55	68.44			
MGEOT265 BOZEMAN HOT SPRINGS * OLD WELL	54	125.96	122.00	-0.04	122.00	0.00			122.00	118.41	116.80	89.84	67.79			
MGEOT266 BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	55	101.72	114.11	0.14	114.11	0.00			114.11	118.34	116.74	89.76	67.72			
MGEOT263 BOZEMAN HOT SPRINGS * ORIGINAL SPRING	54	90.29	114.55	0.26	90.29	15.15	-15.52	90.29	114.55	117.68	116.16	89.05	67.07			
MGEOT335 BOZEMAN HOT SPRINGS	54.6	86.10	117.51	0.37	86.10	31.54	24.04	62.06	117.51	108.02	107.91	78.57	57.52			80
MGEOT269 RANCA * MCLEOD	49	23.53	227.45	2.26	23.53	22.10	-94.90		227.45	80.23	83.77	48.92				50
MGEOT259 SCOTT FEED LOT	43	110.94	63.14	-0.61	63.14	15.66	-48.36	63.14	63.14	62.30	67.94					46
MGEOT260 SCOTT FEED LOT	44	108.71	58.65	-0.66	58.65	15.75	-48.51	58.65	58.65	63.44	68.95					46
MGEOT230 BLUE JOINT CREEK HOT SPRING	29.4	28.65	69.62	0.69	28.65	5.85	-74.20		69.62	105.44	105.68	75.78	54.98			45
MGEOT002 BRIDGER CANYON WARM SPRING	20.2	0.03	171.81	2.33	0.03	40.27	-104.10		171.81	32.96	41.56					25
MGEOT334 LOVE, MELVIN*THREE FORKS, MT	15.9	37.46	170.17	1.59	37.46	26.11	-62.30	37.46	170.17	82.22	85.52	51.02	32.33			
MGEOT033 GROUNDWATER*5.3 MI W HARDIN MT	39.4	35.50	273.88	2.35	35.50	24.68	-66.16		273.88	59.53	65.47					
MGEOT332 SHIPTON, HAROLD * THREE FORKS MT	16.9	43.32	173.16	1.51	43.32	41.36	-22.49	43.32	173.16	102.46	103.12	72.58	52.05			
MGEOT258 HERMAN, T.E. * ROCKY RANCH 7.4 M W HARDIN	42	36.17	279.16	2.31	36.17	25.66	-61.92		279.16	57.87	63.99					
MGEOT344 GALLOGLY HOT SPRING	48.9	46.93	94.45	0.67	46.93	0.00			94.45	95.63	97.21	65.26				56
MGEOT245 LOST TRAIL * WARM AND HOT SPRINGS	41.7	46.69	94.56	0.67	46.69	0.00			94.56	95.63	97.21	65.26	45.37			
MGEOT089 CAIN MIKE*6.6 MI S VOLBERG	16	86.75	68.76	-0.24	68.76	23.83	-17.46	68.76	68.76	28.55	37.54					
MGEOT018 HUNTERS HOT SPRINGS	60	72.46	80.46	0.11	72.46	12.01	-37.46	72.46	80.46	114.46	113.43	85.55	63.88			78
MGEOT328 JORGENSON, JACK * THREE FORKS MT	16															
MGEOT346 RENOVA HOT SPRINGS	50	91.54	162.75	0.74	91.54	27.10	21.49	70.06	162.75	88.27	90.81	57.43	38.20			90
MGEOT339 WESTMORELAND * 9.1 M W SARPY SCHOOL	37.7	86.26	281.79	1.61	86.26	18.35	-7.06	86.26	281.79	65.29	70.59					
MGEOT095 LISCOM RANCH * 5.5 MI NW OF N STACY SCHOOL	15.5	90.70	75.57	-0.20	75.57	30.91	7.91	67.67	75.57	31.02	39.79					
MGEOT331 TINDER, L. MARIE * THREE FORKS MT	21.9	80.95	180.54	1.02	80.95	29.08	11.61	69.34	180.54	101.34	102.15	71.38	50.96			
MGEOT327 WILCOX, RALPH * THREE FORKS MT	16.5															
MGEOT333 RICHARDSON, DEIRDRE * THREE FORKS	16.6	80.06	177.43	1.01	80.06	27.90	7.77	72.29	177.43	102.00	102.72	72.08	51.60			
MGEOT347 MEDICINE HOT SPRINGS	45	83.15	107.55	0.30	83.15	5.93	-30.04	83.15	107.55	110.51	110.05	81.26	59.96			82
MGEOT092 WESTERN ENERGY * 2 MI N COLSTRIP MT.	96.1	114.82	251.67	1.11	251.67	14.52	109.95	141.72	251.67	107.69	107.62					100
MGEOT020 PIPESTONE HOT SPRINGS	57	86.72	112.11	0.26	86.72	4.41	-24.40	86.72	112.11	115.22	114.06	86.37	64.64			86
MGEOT082 FRED WETSTEON SPRING DEVELOP	19	62.54	116.66	0.41	62.54	0.00			116.66	110.10	109.70	80.82	59.56			
MGEOT330 HART, FRANK * THREE FORKS, MT	15.9															
MGEOT063 ANADARKO PROD*6 MI E FOSTER MT	26.7	134.01	75.21	-0.68	75.21	33.33	12.31	62.90	75.21	46.11	53.45					
MGEOT053 SPRING * 20 M NE OF FOSTER MT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	18.24	114.33							

GEOTHERMOMETERS FOR SELECTED SITES

Site name	Surface Temp	Na–K–Ca (B=4/3)	Na–K–Ca (B=1/3)	Mg CORRECTION Log(sqrtCa/Na)	Temperature Corrected	R Coefficient	Delta T (Mg Corr.)	Na–K–Ca Corrected	Na–K–Ca Uncorrected	Quartz (no steam)	Quartz (steam loss)	Chalcedony	a–Cristobalite	B–Cristobalite	Amorphous Silica	Published Estimates
MGEOT128 COWAN SPRING*9MI NW THREE FORKS MT	23	63.30	152.04	1.02	63.30	40.59	6.10	55.21	152.04							
MGEOT178 WOLF CREEK HOT SPRING	60															
MGEOT343 WILLIAMSBURG SPRING	17.4	30.83	162.20	1.80	30.83	29.31	−67.60	30.83	162.20	38.28	46.38					
MGEOT030 OIL WELL (TENSLEEP FORMATION)	69															
MGEOT341 MONTANA RESOURCES MONITORING WELL C	17.8	53.38	210.53	1.84	53.38	25.57	−41.16	53.38	210.53	103.29	103.83	73.47	52.86			
MGEOT342 MONTANA RESOURCES MONITORING WELL D2	16	62.65	218.39	1.55	62.65	34.65	−3.86	62.65	218.39	107.69	107.62	78.21	57.19			
MGEOT055 HOWARD SPRING * 25 M SE OF BIGHORN MT	23	76.61	101.54	0.31	76.61	66.09	66.11	10.51	101.34	38.94	46.98					
MGEOT246 WENDT, FRED * .75 MI S GREGSON (FAIRMONT)	23.9	46.09	148.63	1.25	46.09	6.93	−63.27	46.09	148.63	95.01	96.67	64.60	44.76			
MGEOT298 MBMG RESEARCH WELL * FAIRMONT HOT SPRINGS	20	83.88	111.99	0.34	83.88	2.86	−22.61	83.88	111.99		21.23					
MGEOT165 NELSON, HARVEY * 5 MI S BROADVIEW MT	16	56.25	53.63	−0.61	53.63	29.30	−28.79	53.63	53.63	35.89	44.21					
MGEOT061 BRADBROOK * 10 M S BROADVIEW MT	32.9	98.03	184.48	0.84	98.03	29.04	34.40	63.63	184.48	58.71	64.74					
MGEOT279 FAIRMONT HOT SPRINGS, ANACONDA	61.5	115.66	129.30	0.14	129.30	7.53	1.09	128.21	129.30	125.49	122.63	97.58	74.84			
MGEOT247 SPANGLER, HAZEL * 2 MI E–NE GREGSON MT	15.5	66.77	185.41	1.25	66.77	30.65	−5.60	66.77	185.41	107.85	107.76	78.39	57.36			
MGEOT214 HUNSAKER SPRING	24.5	59.89	224.82	1.64	59.89	28.69	−20.17	59.89	224.82	69.26	74.13	37.45				40
MGEOT150 MONT. HIGHWAY DEPT * .75 MI SE WACO MT.	15.5	63.47	60.04	−0.32	60.04	34.63	−7.58	60.04	60.04	28.55	37.54					
MGEOT213 PLUNKET LAKE WARM SPRINGS	17	29.41	144.77	1.50	29.41	49.56	−32.09	29.41	144.77	54.13	60.65	21.74				20
MGEOT237 SPRINGS FROM JOINTS IN MISS CYN*SW PLUNKET	17	28.82	148.12	1.54	28.82	45.44	−43.52	28.82	148.12	50.80	57.66	18.31				
MGEOT151 MONTANA DEPT HIGHWAYS * 2.5 MI NE WACO MT	16.5	62.23	61.83	−0.01	61.83	50.68	21.34	40.50	61.83	30.21	39.06					
MGEOT216 HUNSAKER, MAURICE	15	46.07	130.57	1.06	46.07	47.39	−7.99	46.07	130.57	79.27	82.93	47.91	29.48			45
MGEOT135 ANACONDA RED TRAVETINE MOUND–GEYSER	21.7	40.53	136.37	1.23	40.53	18.86	−70.75	40.53	136.37	68.27	73.23	36.39				75
MGEOT325 SLEEPING CHILD HOT SPRINGS	43	81.05	115.74	0.41	81.05	4.19	−28.46	81.05	115.74	110.51	110.05	81.26	59.96			125
MGEOT236 BRUCE, N * IRRIGATION WELL WITH BOOSTER	18	48.74	145.18	1.16	48.74	35.18	−25.00	48.74	145.18	100.30	101.25	70.26	49.94			
MGEOT218 TOSTON WARM SPRING	15.5	31.42	179.66	1.77	31.42	59.72	−45.86	31.42	179.66	63.07	68.62	30.98				20
MGEOT294 TOSTON WARM SPRING	45.5	24.75	155.61	1.69	24.75	39.30	−58.65		155.61	60.34	66.19					20
MGEOT217 BRUCE, NORMAN	18	31.66	116.11	1.17	31.66	1.73	−25.96	31.66	116.11	81.96	85.29	50.75	32.08			
MGEOT215 KIMPTON SPRING	18	0.75	141.55	2.04	0.75	31.18	−122.99		141.55	57.66	63.80	25.37				
MGEOT134 WARNER WARM SPRING	18	3.33	146.44	2.03	3.33	30.06	−119.85		146.44	55.26	61.66	22.90				
MGEOT172 STEELE, WILLIAM * 12.5 MI SE PINEVIEW MT.	16	94.50	69.17	−0.53	69.17	26.58	−10.71	69.17	69.17	28.12	37.15					
MGEOT284 MBMG TEST WELL*WARM SPRINGS STATE HOSPITAL	48	80.29	191.17	1.11	80.29	15.45	−21.47	80.29	191.17	77.16	81.08	45.70				
MGEOT009 WARM SPRINGS	77	79.49	194.96	1.15	79.49	13.46	−26.80	79.49	194.96	107.17	107.18	77.65				79
MGEOT233 WARM SPRINGS STATE HOSPITAL	67	85.73	208.59	1.17	85.73	14.82	−16.53	85.73	208.59	89.09	91.52	58.29				79
MGEOT231 WARM SPRINGS STATE HOSPITAL	54	88.33	206.44	1.12	88.33	14.68	−13.93	88.33	206.44	84.14	87.20	53.05				79
MGEOT350 BOULDER HOT SPRINGS – LOWER SPRING	64.5	130.10	157.93	0.26	157.93	0.00			157.93	131.37	127.80	104.05	80.71			
MGEOT349 BOULDER HOT SPRINGS – MIDDLE SPRING	74	126.61	141.13	0.14	141.13	10.85	21.54	119.59	141.13	136.34	131.99	109.54	85.70			
MGEOT348 BOULDER HOT SPRINGS – UPPER SPRING	54	115.54	134.06	0.19	134.06	12.64	24.04	110.02	134.06	133.32	129.45	106.20	82.67			
MGEOT232 WARM SPRINGS STATE HOSPITAL * SPRING	79	76.20	189.23	1.15	76.20	15.81	−29.92		189.23	107.00	107.03					79
MGEOT185 M–B NO. 12 * 5 MI NE HAMILTON MT	18.5	34.29	172.45	1.66	34.29	21.64	−76.40	34.29	172.45	109.94	109.56	80.64	59.41			
MGEOT171 GRIERSON, J.B.*2.5MI NE RANCHERS CEMETARY.	21	116.09	67.49	−0.60	67.49	18.98	−30.12	67.49	67.49	46.36	53.70					
MGEOT130 PRISON RANCH SPRING SITE NO. 4	26	84.21	80.00	0.89	84.21	3.82	−58.24	84.21	80.00	97.76	99.06	67.54	47.45			40
MGEOT113 DEER LODGE PRISON RANCH WELL	26	84.25	79.90	0.89	84.25	3.82	−58.21	84.25	79.90	97.76	99.06	67.54	47.45			
MGEOT044 BEDFORD SPRINGS	23.6					56.89										30
MGEOT101 GRIERSON, J.B. * 23 MI NW HYSHAM MT	15.6	95.90	71.33	−0.29	71.33	43.35	24.47	46.86	71.33	23.55	32.97					
MGEOT274 MBMG RESEARCH WELL * WEED CREEK–1A	17	119.32	68.93	−0.62	68.93	41.89	18.57	50.36	68.93	30.21	39.06					
MGEOT275 MBMG RESEARCH WELL * WEED CREEK–1B	20	112.61	65.56	−0.59	65.56	25.78	−17.76	65.56	65.56							
MGEOT255 HANSER, BILL * 3 MI SW TWO DOT MT	18	65.51	66.32	−0.38	66.32	17.44	−35.02	66.32	66.32	46.66	53.94					
MGEOT256 FOX INC * 1.5 MI W–SW TWO DOT	19	77.06	53.12	−0.55	53.12	0.00			53.12	50.55	57.44					22
MGEOT257 HOMER, RAY * TWO DOT WATER SUPPLY	20	70.27	58.54	−0.17	58.54	10.64	−54.82	58.54	58.54	48.52	55.62					
MGEOT296 HARLOWTON * SOUTH MUNICIPAL WELL	15.6	35.61	27.64	−0.14	27.64	7.27	−84.39	27.64	27.64	39.90	47.85					
MGEOT013 HILLBROOK FLOWING WELL	30	130.95	160.89	0.28	160.89	17.04	67.79	93.10	160.89	115.98	114.73	87.19	65.38			
MGEOT014 WALLS HOT SPRING	55.6	111.67	147.60	0.37	147.60	19.97	65.64	83.96	147.60	110.51	110.05	81.26	59.98			
MGEOT001 ALHAMBRA HOT SPRINGS NORTH	56.5	110.28	143.79	0.35	143.79	20.15	60.68	83.11	143.79	115.22	114.08	86.37	64.64			96
MGEOT278 TOWNSEND,HERB*2.5 MI SW WHITE SULPHUR SPGS	48.5	16.27	157.17	1.86	16.27	33.68	−86.02		157.17	55.04	61.46					
MGEOT290 RALPH JOHNSON,P.O.BOX 65,WHITE SULPHUR SPR	15.3	250.05	122.38	−1.07	122.38	31.42	69.80	52.77	122.38	95.94	97.48	65.59	45.67			
MGEOT004 WHITE SULPHUR SPRINGS	46	126.79	147.27	0.20	147.27	26.73	84.78	62.50	147.27	102.74	103.36	72.88	52.33			125
MGEOT282 WHITE SULPHUR SPRINGS BANK WELL	43.3	121.76	144.81	0.23	144.81	23.87	73.53	70.98	144.81	95.63	97.21	65.26	45.37			
MGEOT188 WATTS, JAMES * 16 MI NE KINSEY MT	15	85.25	51.90	−0.47	51.90	20.14	−50.45	51.90	51.90	39.26	47.27					
MGEOT184 M–B NO 8 WELL*2.5 MI SE CORVALLIS MT	18.3	60.33	181.90	1.82	60.33	27.27	−22.90	60.33	181.90	118.19	116.62	89.60	67.58			
MGEOT007 BROADWATER HOT SPRINGS WELL	65.5	98.03	130.98	0.36	98.03	7.81	−19.47	98.03	130.98	133.18	129.33	106.05	82.53			
MGEOT008 GLOEGE WELL	19.4	30.72	139.24	1.45	30.72	24.86	−76.87	30.72	139.24	76.58	80.57	45.09	26.89			
MGEOT003 GARRISON WARM SPRINGS	25	37.70	174.98	1.62	37.70	42.01	−30.80	37.70	174.98	59.93	65.83	27.73				
MGEOT206 USGS OBS WELL * 4 MI SW EAST HELENA, MT.	25	33.21	159.26	1.57	33.21	34.09	−53.67	33.21	159.26	54.81	61.26					
MGEOT242 FLORENCE TEST WELL A	15	128.79	141.90	0.15	141.90	11.71	26.55	115.35	141.90	17.75	27.65					70
MGEOT167 CHERRY CK SHEEP CO.*1.35MI SE HAGEN RANCH.	36	117.14	67.99	−0.61	67.99	21.81	−23.10	67.99	67.99	64.19	69.61					
MGEOT329 SIVERTE MYSSE * BOX 315 * INGOMAR MT 59039	37	100.45	60.78	−0.63	60.78	17.37	−42.84	60.78	60.78	66.71	71.85					
MGEOT261 MOORE, THOMAS * 6.5 MI SW ANGELA MT	62	158.97	174.41	0.13	174.41	19.18	84.02	90.39	174.41	102.55	103.20					
MGEOT322 BYRNE WARM SPRING * WEST OF BEARMOUTH	20	12.77	169.78	2.04	12.77	29.56	−101.51		169.78	64.74	70.10	32.72				
MGEOT116 NIMROD SPRINGS	20.5	16.61	162.80	1.91	16.61	31.73	−89.43	16.61	162.80	65.29	70.59	33.28				30
MGEOT026 BEARMOUTH SPRINGS	20.2	5.20	157.08	2.13	5.20	35.95	−111.70		157.08	55.26	61.66	22.90				35
MGEOT345 LOLO HOT SPRINGS	44	74.60	113.07	0.47	74.60	6.59	−36.98	74.60	113.07	119.63	117.84	91.17	69.00			83
MGEOT069 MARYSVILLE DEEP WELL DEPTH 5750	96.7	136.70	156.51	0.19	156.51	4.82	8.00	148.51	156.51	117.09	115.68					122
MGEOT170 CHERRY CREEK SHEEP CO*26 MI N VANANDA MT	44	124.20	168.90	0.54	168.90	25.15	118.90	69.99	168.90	66.18	71.38					
MGEOT162 OLSEN, JONAS * 9 MI NW FLATWILLOW MT.	27	74.75	116.42	0.51	74.75	36.18	20.78	53.97	116.42	48.26	55.38					
MGEOT201 OLSEN JONAS * 14 MI NE N–BAR RANCH	16	52.65	163.23	1.28	52.65	45.70	−3.43	52.65	163.23	38.61	46.68					
MGEOT164 REYNOLDS, KEITH * 6 MI NE FLATWILLOW MT.	24.5	85.56	85.39	−0.14	85.39	28.73	12.43	72.96	85.39	49.29	56.31					
MGEOT163 HILL, FLOYD * 7 MI N FLATWILLOW MT.	15	99.00	91.62	−0.09	91.62	26.15	19.29	72.32	91.62	47.99	55.15	15.44				
MGEOT160 M–B 4 (BUTLER CK) * 6 MI NW MISSOULA MT	16	123.77	149.22	0.19	149.22	37.23	105.41	37.82	149.22	132.53	128.78	105.33	81.66	33.52		
MGEOT254 KING, JOE & SONS INC. * 5 MI SSW WINNET MT	16	114.09	85.32	−0.34	85.32	31.39	22.64	62.68	85.32	46.93	54.19					
MGEOT159 SHAW, BUD * 1.7 MI SW MOSBY MT.	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	81.79	81.79	50.05	56.99					

GEOTHERMOMETERS FOR SELECTED SITES

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MGEOT160 EAGER, REX * 2 MI SW WINNETT MT.	15.5	93.19	95.04	0.02	93.19	30.87	32.17	61.02	95.04	45.00	52.45					
MGEOT161 BRATTON, WAYNE * 2 MI SE WINNETT MT.	24.2	94.27	85.61	−0.11	85.61	28.48	16.70	68.90	85.61	51.04	57.88					
MGEOT305 BURLY VISTA TRACTS	46	22.81	221.76	2.24	22.81	39.48	−61.88		221.76	26.81	35.95					
MGEOT157 TEIGEN, PETER * 9 MI E GRASSRANGE MT.	17.9	57.79	159.85	1.17	57.79	42.37	2.44	55.35	159.85	37.94	46.08					
MGEOT196 MATOVICH * 4.5 MI E GRASSRANGE MT	21.8	48.68	148.85	1.21	48.68	39.13	−17.71	48.68	148.85	39.90	47.85					
MGEOT181 HOLE NO 2 M–B DRILLING PROJECT	15	79.09	95.24	0.20	79.09	21.24	−9.11	79.09	95.24	56.58	62.84	24.27				
MGEOT240 MSU AG EXPERIMENT STATION * MOCCASIN MT	15	36.41	182.25	1.70	36.41	30.66	−54.91	36.41	182.25	36.24	44.53					
MGEOT155 BRADY, EARL*4 MI NW WINNETT, MT	15.8	91.37	102.46	0.13	91.37	32.45	33.08	58.30	102.46	52.02	58.76	19.56				
MGEOT203 GERDRUM, RONALD * 3 MI NE GRASS RANGE, MT.	15.9	64.48	110.59	0.59	64.48	39.75	8.28	56.20	110.59	43.85	51.42					
MGEOT152 CENEX*15 MI NE WINNETT MT	16	95.18	70.64	−0.32	70.64	19.25	−25.17	70.64	70.64	49.29	56.31	16.76				
MGEOT158 BASSETT, EARL * 7.5 MI NW TEIGEN MT.	17	70.90	105.48	0.44	70.90	41.19	20.33	50.57	105.48	38.28	46.38					
MGEOT059 HEDMAN, J. * 40 MI NE LEWISTOWN MT.	21	85.37	95.29	0.12	85.37	43.49	44.67	40.69	95.29	37.94	46.08					
MGEOT156 HARRIS FLOYD * 11 MI NW TEIGEN MT	19.2	68.35	90.04	0.29	68.35	38.31	11.58	56.77	90.04	45.00	52.45					
MGEOT194 FOX, DENNIS * 7 MI NW GRASSRANGE MT	20.8	35.54	122.35	1.17	35.54	32.13	−53.47	35.54	122.35	45.56	52.95					
MGEOT239 LAURENCE HESS * 1 MI N MOCCASIN MT	15	46.67	166.08	1.40	46.67	37.19	−24.59	46.67	166.08	33.34	41.90					
MGEOT204 DELANEY, DOUGLAS*7 MI NW (WILD HORSE UNIT)	23	74.05	99.87	0.33	74.05	43.02	27.90	46.15	99.87	40.22	48.14					
MGEOT050 BROOKS WARM SPRING * 2.5 MI NW BROOKS MT.	20	−9.89	169.12	2.53	−9.89	35.92	−135.23		169.12	41.47	49.27					
MGEOT195 DELANEY, DOUGLAS * 11 MI NW ROY MT	21.3	80.00	85.13	0.07	80.00	37.85	27.75	52.25	85.13	42.38	50.09					
MGEOT154 MILLER RANCH * 14 MI SE VALENTINE MT.	19.5	146.52	75.27	−0.80	75.27	28.67	2.70	72.58	75.27	55.93	62.25	23.59				
MGEOT045 CARDINAL PET CO * 10 M E HILGER MT	26.7	112.37	125.93	0.15	125.93	21.10	45.93	80.01	125.93							
MGEOT153 BUSENBARK, MERLIN*1 MI S VALENTINE MT*	27	133.83	73.49	−0.70	73.49	16.65	−27.23	73.49	73.49	56.36	62.65					
MGEOT268 QUINN'S HOT SPRINGS * JIM AND DONNA BROWN	45.1	65.79	121.07	0.88	65.79	0.00			121.07	120.69	118.74	92.33	70.05			99
MGEOT005 QUINN'S HOT SPRINGS	43.3	64.25	125.22	0.75	64.25	7.02	−46.66	64.25	125.22	122.82	120.56	94.66				99
MGEOT197 YEAGER * 8 MI EAST MOULTON, MT.	15	79.55	84.68	0.07	79.55	45.23	39.16	40.40	84.68	42.08	49.82					
MGEOT079 FINLEY, R.S.*1 MI NW ST. IGNATIUS	19	−9.53	105.88	1.90	−9.53	29.99	−148.28		105.88	42.38	50.09					
MGEOT205 SIROKY, FRANK * 9 MI EAST ROY, MT.	19	81.86	53.55	−0.40	53.55	10.49	−80.86	53.55	53.55	59.53	65.47	27.31				
MGEOT192 HORYNA, JAMES * 6 MI E ROY MT	18.4	95.34	67.59	−0.36	67.59	20.78	−25.99	67.59	67.59	56.58	62.84	24.27				
MGEOT131 CORPS OF ENGINEERS SOUTH WELL AFTER PERFS	15	89.35	125.42	0.41	89.35	37.31	39.81	49.54	125.42	35.53	43.89					
MGEOT090 BRYSON, HAROLD*1 MI W MOIESE MT	15.5	60.88	108.31	0.61	60.88	40.03	3.25	57.63	108.31	57.01	63.23	24.71				
MGEOT070 YARGER, ROBERT * 13 MI W CIRCLE MT	25	98.01	148.92	0.54	98.01	86.19	90.69		148.92	45.84	53.20					
MGEOT287 SAND COULEE WTR USERS BENCH W ABV SAND COU	15	27.13	159.87	1.68	27.13	68.43	−8.62	27.13	159.87	30.21	39.06					
MGEOT193 TAYLOR, JAMES * 8 MI E CHRISTINA MT	21	92.92	61.16	−0.43	61.16	9.86	−52.08	61.16	61.16	43.85	51.42					
MGEOT288 CHARLES ENTSMINGER*TOWN OF NUMBER SEVEN	16	14.10	162.56	1.95	14.10	36.91	−83.47	14.10	162.56	46.11	53.45					
MGEOT295 CUSTER, EVERETT* EDEN RT, GREAT FALLS, MT	15.5	31.23	155.98	1.57	31.23	36.80	−51.86	31.23	155.98	50.80	57.66	18.31				
MGEOT297 TOWN OF TRACY	16	12.44	155.43	1.92	12.44	36.53	−87.52	12.44	155.43	44.71	52.19					
MGEOT054 SLCGSVOLD, A. K. * 17 M SE RITCHEY MT	21.1	25.05	173.33	1.83	25.05	56.30	−28.20	25.05	173.33	48.52	55.62					
MGEOT211 GOVER * 2.5 MI TRAVIS SCHOOL	17.5	76.53	119.91	0.52	76.53	47.74	38.45	38.08	119.91	64.92	70.27	32.91				
MGEOT200 VILLAGE INN * 2.5 MI NE TRAVIS SCHOOL	18.5	96.99	124.94	0.31	96.99	32.69	41.02	55.97	124.94	41.77	49.54					
MGEOT299 STONE, GENE	25	69.58	92.80	0.30	69.58	0.00			92.80	107.51	107.47	78.02	57.02			
MGEOT062 WEBB RES * 17.5 MI SE GERALDINE MT.	20	52.54	169.93	1.34	52.54	31.00	−27.05	52.54	169.93	40.22	48.14					
MGEOT353 HOLLAND, JIM – GREEN SPRINGS	23.7	116.03	139.80	0.24	139.80	51.73	123.24	16.56	139.80	107.00	107.03	77.47	56.52			
MGEOT248 GREEN SPRINGS * HOLLAND RANCH	26															
MGEOT191 TACKE, ROBERT * 2 MI SW GREAT FALLS MT	15	63.90	158.35	1.07	63.90	39.69	7.30	56.61	158.35							
MGEOT198 PAUL, MICHAEL(ROBINSON)*3.5M SW GREATFALLS	17	58.99	158.33	1.14	58.99	33.68	−11.45	58.99	158.33	64.56	69.94	32.53				
MGEOT318 BUTTE CREEK SPRING * SQUARE BUTTE	18.8	40.96	162.57	1.46	40.96	25.31	−57.86	40.96	162.57	59.73	65.65	27.52				
MGEOT319 BUTTE CREEK SPRING – NORTH * SQUARE BUTTE	17	38.47	149.75	1.39	38.47	29.14	−54.40	38.47	149.75	57.01	63.23	24.71				
MGEOT169 CHAMBERLAIN, CURTIS * 2 MI W LLER SCHOOL.	16	92.13	63.42	−0.36	63.42	22.31	−28.59	63.42	63.42	32.96	41.56					
MGEOT321 MELTON, LARUE * LOWER AQUIFER	16	96.64	161.09	0.66	96.64	11.13	−13.96	96.64	161.09	54.13	60.65	21.74				
MGEOT314 USGS – MELTON, LEON	18.5	39.61	96.88	0.82	39.61	40.09	−31.05	39.61	96.88	65.47	70.75	33.47				
MGEOT238 SCHMIDT, LLOYD * 3.5 MI SE SQUARE BUTTE	21.8	74.66	143.59	0.78	74.66	32.01	8.85	65.81	143.59	42.38	50.09					
MGEOT190 USGS OBS WELL * .5 MI S VALLEY SCHOOL	27.1	33.68	162.09	1.58	33.68	53.82	−16.07	33.68	162.09	63.07	68.62	30.98				
MGEOT199 EIDEL * .5 MI S SUNSET MEMORIAL CEMETARY	16	84.77	115.71	0.37	84.77	61.42	64.71	20.06	115.71	41.16	48.99					
MGEOT078 WEBSTER, BONITA*BOX 443 RONAN MT	15.5	11.58	115.98	1.55	11.58	37.22	−67.75		115.96	61.13	66.90	28.97				
MGEOT099 DEMARS,TOM J.* 10 MI W OF WINIFRED MT.	17	30.65	116.22	1.19	30.65	36.41	−53.66	30.65	116.22	31.81	40.51					
MGEOT249 HOMESTEAD ACRES COUNTY WATER DISTRICT	15	32.47	162.17	1.61	32.47	41.59	−40.57	32.47	162.17	41.16	48.99					
MGEOT250 HOMESTEAD ACRES COUNTY WATER DISTRICT	15	35.58	165.22	1.58	35.58	42.88	−32.85	35.58	165.22	39.90	47.85					
MGEOT241 MCCOLLUM, JIM * 10 MI NW MATHISON RANCH	18.8	100.95	62.56	−0.50	62.56	18.15	−42.71	62.56	62.56	42.38	50.09					
MGEOT076 CARR, FRANK*BOX 456 HOT SPRINGS MT	21.5	18.67	125.83	1.52	18.67	39.37	−89.72		125.83	55.70	62.06	23.36				
MGEOT047 * RYFFEL BROS. * 3MI S & 3 MI E HIGHWOOD	18.6	40.02	134.81	1.22	40.02	34.74	−40.50	40.02	134.81	78.01	81.83	46.59	28.27			
MGEOT097 CHRISTIANSON, BOB*HOT SPRINGS MT.	22.5	66.02	119.13	0.68	66.02	41.56	13.68	52.34	119.13	58.50	64.55	26.24				
MGEOT068 TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	18.5	54.84	150.35	1.13	54.84	26.18	−33.36	54.84	150.35	67.06	72.16	35.13				
MGEOT307 HOT SPRINGS CITY	21	53.15	151.90	1.17	53.15	25.98	−36.43	53.15	151.90	76.73	80.70	45.24	27.03			
MGEOT228 LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	29.8									115.98	114.73	87.19	65.38			
MGEOT291 SOUTH EAST OF CAMP AQUA	51.5	119.51	120.98	0.02	120.98	0.00				117.90	116.37	89.29	67.29			
MGEOT071 CORN HOLE* CAMAS HOT SPRINGS	44	105.48	120.10	0.16	120.10	19.65	35.28	84.82	120.10	108.86	108.63	79.48	58.35			
MGEOT017 CAMAS HOT SPRINGS	45	108.70	118.49	0.11	118.49	8.52	−2.55	118.49	118.49	118.19	116.62	89.60	67.58			100
MGEOT080 HOT SPRINGS MONTANA	43	107.98	120.58	0.14	120.58	7.90	−2.85	120.58	120.58	109.69	109.34	80.38	59.17			
MGEOT351 SYMES HOTEL IN HOT SPRINGS	33.3	132.15	130.82	−0.01	130.82	39.49	95.70	35.12	130.82	120.39	118.49	92.00	69.76			
MGEOT029 SYMES HOT SPRINGS WELL	38	102.31	114.75	0.14	114.75	13.73	10.78	103.97	114.75	116.72	115.36	88.01	66.12			
MGEOT061 HOT SPRING GEOTHERM WELL – UNNAMED	15	74.80	171.81	1.09	74.80	30.79	6.55	68.25	171.81	83.13	86.31	51.98	33.21			
MGEOT144 KOEPLING, DELBERT * WELL 138	15.5	90.38	126.34	0.41	90.38	0.00			126.34	87.85	90.44					
MGEOT144 OSTRANGER, DAVE * WELL 56	15.5			0.39		42.78	−98.53			47.89	55.05					
MGEOT077 VERNER, ROSE*3.75 MI W PABLO MT	17.5	50.10	117.31	0.88	50.10	62.78	18.18	31.93	117.31	52.49	59.18	20.05				
MGEOT098 IRRIGATION EQUIPMENT SALES*HOT SPRINGS	19.5	48.72	145.33	1.18	48.72	33.47	−28.35	48.72	145.33	66.89	72.01	34.95				
MGEOT220 JACOBSEN, R * HOT SPRINGS MT	19	79.21	102.28	0.29	79.21	20.05	−11.84	79.21	102.28	85.88	88.72	54.89	35.68			
MGEOT176 KOPP, ARVID * HOT SPRINGS, MT	15.2	67.39	108.85	0.52	67.39	25.84	−14.97	67.39	108.85	51.29	58.10	18.82				
MGEOT042 SUN RIVER SPRINGS	30.4															
MGEOT267 MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	42.7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	75.25	120.61	88.04	90.60	57.18				

GEOTHERMOMETERS FOR SELECTED SITES

Site name	Surface Temp	Na-K-Ca (B=4/3)	Na-K-Ca (B=1/3)	Mg CORRECTION Log(sqrtCa/Na)	Temperature Corrected	R Coefficient	Delta T (Mg Corr.)	Na-K-Ca Corrected	Na-K-Ca Uncorrected	Quartz (no steam)	Quartz (steam loss)	Chalcedony	a-Cristobalite	B-Cristobalite	Amorphous Silica	Published Estimates
MGEOT226 KOPP, ARVID * .25 MI S CAMPAQUA MT	32.6	87.52	100.02	0.15	87.52	14.71	-14.78	87.52	100.02	82.61	85.86	51.43	32.71			
MGEOT221 KEMP * .5 MI SE CAMPAQUA MT	28.8	97.10	113.78	0.19	97.10	17.52	-3.82	93.48	113.78	85.76	88.61	54.76	35.76			
MGEOT266 JACKOLA AP. 100 FT E. OF CAMP AQUA BATH SPA	51	109.26	119.23	0.11	119.23	6.84	-6.36	119.23	119.23	95.11	96.76	64.71				
MGEOT027 CAMP AQUA AREA TEST WELL	50	116.70	129.16	0.13	129.16	8.61	5.22	123.93	129.16	94.06	95.85	63.59				100
MGEOT262 MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	43.7	74.99	116.72	0.51	74.99	21.69	-13.50	74.99	116.72	86.25	89.04	55.26				
MGEOT202 OLSEN, EDWIN * 8.4 MI NE WINIFRED MT	22	128.37	64.87	-0.77	64.87	30.48	-6.80	64.87	64.87	46.38	53.70	13.79				
MGEOT251 SMELSER, JAMES A. * POWER MT	16	121.58	111.36	-0.11	111.36	33.55	61.05	50.31	111.36	31.42	40.15					
MGEOT225 KEMP * 0.3 MI E CAMPAQUA MT	30.6	99.61	110.97	0.13	99.61	12.46	-7.70	99.61	110.97	95.53	97.12	65.15	45.27			
MGEOT227 KEMP * .25 MI N CAMPAQUA MT	38.9	92.48	113.25	0.24	92.48	20.92	7.26	85.20	113.25	93.21	95.11	62.68	43.01			
MGEOT224 KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	32.5	84.39	103.13	0.23	84.39	10.75	-26.72	84.39	103.13	87.80	90.40	56.93	37.75			
MGEOT173 KEMP, ANNA * HOT SPRINGS, MT *	34.4	107.11	121.90	0.16	121.90	15.62	25.95	97.95	121.90	87.68	90.29	56.80	37.63			
MGEOT091 KEMP, ANNA* 5 MI N HOT SPRINGS, MT	24	97.92	124.33	0.29	97.92	11.52	-11.78	97.92	124.33	83.25	86.42	52.11	33.33			
MGEOT174 HUGHES, RAY * HOT SPRINGS, MT	25.8	90.72	115.41	0.29	90.72	16.17	-7.38	90.72	115.41	78.44	82.20	47.04	28.68			
MGEOT219 BAXTER, C * 1.5 MI N CAMPAQUA MT	20.3	83.08	98.53	0.19	83.08	13.65	-22.28	83.08	98.53	77.45	81.33	46.00	27.73			
MGEOT175 BAXTER, CHARLES * HOT SPRINGS, MT	22.8	77.55	113.58	0.44	77.55	14.19	-27.52	77.55	113.58	65.29	70.59	33.28				
MGEOT223 LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	23.6	60.70	91.51	0.42	60.70	15.95	-46.68	60.70	91.51	62.49	68.11	30.38				
MGEOT149 MATOVICH,JOHN * 23 MI SW SUN PRAIRIE MT	16	106.44	64.86	-0.53	64.86	23.50	-23.85	64.86	64.86	40.85	48.71					
MGEOT222 GAIL PATTON RANCH * 1 MI SW LONEPINE MT	15.6	32.66	141.52	1.41	32.66	30.34	-62.21	32.66	141.52	55.04	61.46	22.67				
MGEOT075 LONEPINE OBSERVATION WELL	16.5	23.73	118.66	1.34	23.73	31.99	-75.29	23.73	118.66	59.93	65.83	27.73				
MGEOT110 STREIT, GEORGE * 4MI E- 1MI S FT BENTON MT.	15	99.19	183.28	0.61	99.19	56.92	79.55	19.64	183.28	44.71	52.19					
MGEOT243 WHITMAYER ASSOC * 4.5MI SE SUN PRAIRIE SCH	15.6	129.50	90.43	-0.44	90.43	25.98	17.38	73.06	90.43	40.85	48.71					
MGEOT109 CLARK, BRAD * 25 MI E FT. BENTON MT.	20	66.84	68.69	-0.24	68.69	55.57	37.05	31.63	68.69	30.21	39.06					
MGEOT114 LANDUSKY PLUNGE SPRINGS	24	91.75	182.01	1.75	91.75	39.46	-45.80	31.75	182.01	59.12	65.10	26.89				30
MGEOT072 LANDUSKY, I*6.5 MI S HAYS, MONTANA	20.3	35.17	180.75	1.71	35.17	35.90	-48.85	35.17	180.75	52.25	58.97					
MGEOT046 BLACK COULEE * E OF TEST AREA	28.8	107.18	90.94	-0.19	90.94	71.05	78.79		90.94	24.03	33.42					
MGEOT313 ALZHEIMER, PAUL * SW OF BRADY, MT	25	35.78	91.16	0.81	35.78	44.43	-29.79	35.78	91.16	33.34	41.90					
MGEOT312 REVERE, LEE	25	30.48	92.90	0.92	30.48	46.21	-35.70	30.48	92.90	33.34	41.90					
MGEOT049 LITTLE WARM SPRINGS*9 MI SE LODGEPOLE	26.1	48.86	174.25	1.43	48.86	38.01	-19.45	48.86	174.25	55.26	61.66					
MGEOT324 LODGEPOLE WARM SPRINGS	30	48.82	171.71	1.41	48.82	35.10	-25.01	48.82	171.71	55.93	62.25					35
MGEOT048 BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	30.6	50.01	172.28	1.40	50.01	36.56	-20.28	50.01	172.28	55.93	62.25					
MGEOT051 BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	26	41.85	185.73	1.48	41.85	37.29	-32.47	41.85	185.73	51.77	58.54					
MGEOT052 KIRKALDIE, BRUCE*7 MI SW LODGEPOLE MT	24.5	46.53	168.86	1.43	46.53	35.59	-27.85	46.53	168.86	50.80	57.66					
MGEOT037 LARGE CAPACITY WELL*4 MI SW WOLF POINT, MT	51															
MGEOT024 CITY OF WOLF POINT * WELL IN WOLF POINT	18.3	174.23	123.03	-0.48	123.03	70.56	117.01		123.03	47.99	55.15					
MGEOT023 SHERMAN HOTEL OF WOLF POINT	17.2	84.71	37.56	-0.43	37.56	25.66	-62.97	37.56	37.56	47.99	55.15					
MGEOT038 USGS TEST WELL * 1 MILE SOUTH POPLAR, MT	13.9	61.39	107.46	0.60	61.39	47.54	16.02	45.37	107.46	36.94	46.98					
MGEOT025 FOSS ELMER * 5.8 MI SE BROCTON	16.1	122.02	104.85	-0.19	104.85	25.84	35.26	69.59	104.85	55.26	61.66	22.90				
MGEOT317 LANDTECH WATER DISPOSAL SERVICE	17.9	102.22	61.52	-0.53	61.52	24.69	-26.23	61.52	61.52	54.56	61.05	22.20				
MGEOT315 THORNESS, RICK * 4 MILES NW OF BAINVILLE	15	65.27	100.32	0.46	65.27	58.52	35.39	29.86	100.32	71.09	75.72	39.33	21.61			
MGEOT108 CLAWITER, MILT * 4MI N-4MI E BIG SANDY MT.	16	105.28	97.71	-0.09	97.71	42.47	59.78	37.94	97.71	66.01	71.23	34.03	16.74			
MGEOT303 SIMS SPRING	15	15.54	195.47	1.67	15.54	43.27	-67.72	15.54	195.47	62.86	68.45	30.78				
MGEOT140 TEXACO INC * 1.7 MI NW CENTRAL SCHOOL	35.5	156.01	92.86	-0.66	92.86	20.04	5.43	87.43	92.86	72.83	77.26	41.15				
MGEOT252 MATOVAICH, MARTIN*17 MI E MALTA NEAR SACO	42	68.06	158.77	1.01	68.06	32.52	0.18	67.90	158.77	57.66	63.80					
MGEOT111 SLEEPING BUF REC AREA * 4MI NNW ASHFIELD	41.3	71.17	155.20	0.94	71.17	36.32	12.18	59.02	155.20	57.66	63.80					45
MGEOT145 SHIRLE, WALTER * 3 MI S FRESNO DAM.	17.5	104.64	65.18	-0.51	65.18	35.53	1.67	63.51	65.18	29.81	38.69					
MGEOT106 PIMLEY, DON * 4 MI NW JOPLIN MT.	15	91.58	59.96	-0.43	59.96	39.79	1.44	58.54	59.96	30.21	39.06					
MGEOT105 CADY, ELWIN * 7.5 MI NW JOPLIN MT.	25	96.12	63.76	-0.43	63.76	42.68	12.08	51.68	63.76	47.99	55.15					
MGEOT309 FRANCIS, CLARA	29	91.69	126.42	1.28	91.69	37.75	-46.85	31.89	126.42	61.72	67.42	29.58				
MGEOT107 WELSH, ORVILLE * 13 MI N-3MI E HINGHAM MT.	16	92.66	65.82	-0.36	65.82	28.38	-11.79	65.82	65.82	36.61	46.66					
MGEOT310 EDWARDS, MARVIN / MIKE DUSTERHOFF	25	70.51	46.04	-0.57	46.04	27.92	-44.01	46.04	46.04	25.45	34.71					
MGEOT039 BIG WEST OIL CO * 2 MI NE MTN VIEW SCHOOL	46															
MGEOT104 RYGH, KEN * 22 MI N - 5 MI W JOPLIN MT.	21	110.67	65.40	-0.57	65.40	53.07	29.37	36.02	65.40	34.82	43.24					
MGEOT142 BRADBURY, ALFRED * 11 MI E WILD HORSE MT	15.5	95.99	72.73	-0.50	72.73	22.41	-15.08	72.73	72.73	29.39	38.31					
MGEOT144 NAGEHUS, ORVILLE * 3 MI N SIMPSON MT.	15.5	85.64	73.17	-0.17	73.17	25.02	-8.42	73.17	73.17	35.89	44.21					

GEOTHERMAL RESOURCES OF MONTANA

Submitted to:

Oregon Institute of Technology
Geo Heat Center

and

University of Utah Research Institute

Submitted by:

John Metesh
Montana Bureau of Mines and Geology

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ACKNOWLEDGMENTS

The author gratefully acknowledges the advise and guidance provided by Howard Ross of the University of Utah Research Institute, Paul Lienau of the Oregon Institute of Technology - GeoHeat Center. The cooperation of the owners of the springs and wells that were sampled as part of this assessment is also greatly appreciated.

DISCLAIMER

Notice

ABSTRACT

Montana's Geothermal Resources

The Montana Bureau of Mines and Geology has updated its inventory of low- and moderate temperature resources for the state and has assisted the Oregon Institute of Technology - GeoHeat Center and the University of Utah Research Institute in prioritizing and collocating important geothermal resource areas.

The database compiled for this assessment contains information on location, flow, water chemistry, and estimated reservoir temperatures for 267 geothermal wells and springs in Montana. For this assessment, the minimum temperature for low-temperature resource is defined as 10° C above the mean annual air temperature at the surface. The maximum temperature for a moderate-temperature resource is defined as greater than 50° C. Approximately 12% of the wells and springs in the database have temperatures above 50° C, 17% are between 30° and 50°C, 29% are between 20° and 30°C, and 42% are between 10° and 20° C. Low- and moderate-temperature wells and springs can be found in nearly all areas of Montana, but most are in the western third of the state. Information sources for the current database include the MBMG Ground Water Information Center, the USGS statewide database, the USGS GEOTHERM database, and new information collected as part of this program.

Five areas of Montana were identified for consideration in future investigations of geothermal development. The areas identified are those near Bozeman, Ennis, Butte, Boulder, and Camas Prairie. These areas were chosen based on the potential of the resource and its proximity to population centers.

1.0 INTRODUCTION

Previous Geothermal Assessments

Two state-wide geothermal assessments have been conducted in the past. Allen (1980) collocated geothermal resources and cities for eight western states including Montana. Allen's study focused on resource temperatures greater than 50°C and did not include low-temperature resources. Sonderegger and others (1981) produced a 1:1,000,000-scale map and associated table of geothermal resource areas in Montana based on a compilation of various published reports and theses. Although the compilation included temperatures below 50°C, these data were not stored in a digital format because electronic databases were not available then for retrieval or storage. These reports, however, provided a good basis for updating information which has now been stored in a digital format.

Overview of Program

The Montana Bureau of Mines and Geology (MBMG) entered into a cooperative agreement with the Oregon Institute of Technology GeoHeat Center (OIT-GHC) and the University of Utah Research Institute (UURI) to conduct several tasks related to Montana's geothermal resources. These tasks included:

- preparation of a comprehensive digital geothermal-resources database containing temperature, location (latitude/longitude, Township/Range/Section/tract, and county) and chemistry (pH, TDS, and selected chemistry). The minimum temperature for a low-temperature resource was defined to be 10°C above the mean annual air temperature at the surface.

- preparation of a 1:1,000,000-scale map of occurrences within Montana. The map was compiled in a digital format.

- collecting samples from areas lacking information; analyses of the samples were conducted by UURI Earth Science Laboratory.

- a final summary report describing all tasks and their results.

- assisting OIT-GHC and UURI to prioritize low- and moderate-temperature resource areas.

Funding for this program was provided by the Department of Energy through a task agreement with OIT GHC and UURI. The tasks performed under this agreement may be considered Phase I of the Low-Temperature Geothermal Resources and Technology Transfer Program. Phase II, if funded, will include a detailed study of priority sites.

2.0 DATA SOURCES

References Used and Selection Criteria

Ground Water Information Center

The criteria for selecting sites that were to be included in the database depended on the source of the data. For the initial search of the Montana Bureau of Mines Ground Water Information Center (GWIC) database, a minimum temperature of 13° Celsius was used (10° degrees above the lowest mean annual temperature officially reported anywhere in Montana) to ensure that all low-temperature sites were included. This query produced approximately 600 records. Each record included any information that was available on location , site name, well depth, flow, temperature, and chemistry. These records were then transferred to a PARADOX database where more restrictive queries could be made that would eliminate records while allowing for a review of the eliminated records. For example, after sorting and separating the data into five geographic areas for which the mean annual air temperature was better defined and running a query based on that temperature, approximately 250 sites were eliminated, leaving approximately 350 sites to be considered further. Each of the remaining 350 sites was assigned a 3-digit identification number with a prefix of MGEOT. The rejected records were reviewed for other geothermal indicators such as high chloride, silica, and/or arsenic concentrations and close proximity to known geothermal areas.

GEOTHERM

A digital version of the GEOTHERM database was obtained from the Department of Energy Geothermal Division. These data had been compiled in an earlier, region-wide inventory (Reed and others, 1983). Although no new records were added to the MGEOT database, the GEOTHERM records were compared to those in the MGEOT database for accuracy and completeness. Since there were few changes, it was not necessary to merge the databases; any necessary changes to the MGEOT database were made manually.

Published Data

The tables of geothermal wells and springs produced by Mariner and others (1976), Leonard and others (1978), and Sonderegger and others (1981), were also used to ensure the completeness and accuracy of the MGEOT database. Any additional sites or information from these reports were entered manually into the database. The same approach was taken with other published sources.

Twelve Master's theses were reviewed for additional information on geothermal resource areas. Many of the investigations focused on the geologic or geophysical aspects of a known geothermal area. Little chemistry data was gleaned from these reports; however, temperature and location of many sites were verified as a result of the review.

Error and Duplicate Records

The most common error encountered was high temperatures reported for wells and springs in areas where geothermal sources are known **not** to exist. The most probable cause for the high temperature is "warm-day" sampling or improper purging of shallow wells. These sites were eliminated based on the personal knowledge of the investigators or on data collected at that same site at another time. Another common error was in the units used for concentration data. Trace-metals such as boron, arsenic, and lithium were often in error as a result of converting between parts-per-billion (μg/L) and parts-per-million (mg/L). The original publication was used, if possible, to correct these. In other cases, a calculation of ionic balance was used to determine if a problem existed.

With some exceptions, duplicate records in the form of data for two or more samples from the same site were eliminated and the most recent, most complete data were used. The exceptions were the site that had been re-sampled as part of this inventory (Symes Hotel, MGEOT352) and sites where samples had been collected several years apart. The intent was to provide information on changes in temperature and chemistry over time. The other exception were those sites where

information was limited with respect to chemistry. In these cases, two data sets provided more useful information on the site. There is a total of 24 duplicate sites.

Reference/Bibliography

A reference is given for each record in the database. The reports published by Mariner and others (1976), Leonard and others (1978), and Sonderegger and others (1981) provided most of the information for previously identified geothermal areas. The GWIC database provided more recent data for previously identified sites. GWIC also provided information for areas near previously identified resource areas and for low-temperature sites in geothermal areas not previously identified.

The references/bibliography listed in Section 8.0 also includes the theses and other publications that pertain to geothermal resource areas in Montana. As noted in Section 2.0, some of these references provided confirmation of location and temperature. Rautio and Sonderegger (1980) also provided a bibliography of geothermal resources in Montana. This is reproduced in this report as a useful supplement to the bibliography.

3.0 DATA FORMAT

Organization of Tables

The data fields used in the database were recommended by program leaders at OIT-GHC and UURI, and agreed upon by state team members. The final version of the data was exported from the PARADOX database to a LOTUS-123 format. The spreadsheet enabled an evaluation of the distribution of sites, the calculation of reservoir temperature, and provided a means of graphical output.

State Geothermal Resource Map

The location (latitude/longitude), temperature, resource type (well or spring), and ID number of all sites in the database were imported from the spreadsheet to an ARC/INFO based Geographical Information System. The data were then plotted at 1:1,000,000 scale with county boundaries. Each data-point indicated the ID-number, the temperature range (by color), and resource type (well or spring, by symbol) as well as location. This initial plot was used to verify the accuracy of the location, to give an indication of the density of sites in a given area, and to identify any sites that were plotted in areas where geothermal resources are known **not** to exist. The final map uses the same format and presents each of the individual sites listed in the database. A listing of selected fields for all sites is presented in Appendix I. The large number of sites in the Camas-Lonepine area made it impractical to plot the ID number for each site; these are repeated in a separate table in Appendix I.

Procedures for using the data

The database listing in Appendix I is sorted by location (ascending latitude). This format is also used in the listing of maximum temperatures based on selected geothermometers in Appendix II. The information for each site is listed with reference to the ID number on the 1:1,000,000-scale map.

In the repetitive process of adding and deleting sites based on a multitude of criteria, it was found that maintaining the database in a PARADOX (or similar)

format was best. This format enables searches using the an ID-number or location from the map or general information, such as site name, and is contained in a single database-table. This single table can be separated into several tables as the need arises.

4.0 FLUID CHEMISTRY

Samples collected in this assessment

Eight water samples were collected from five areas in Montana; seven of these sample sites had not been sampled previously or had only limited information prior to this investigation. The eighth site was selected to provide a comparison of data collected approximately 10 years apart.

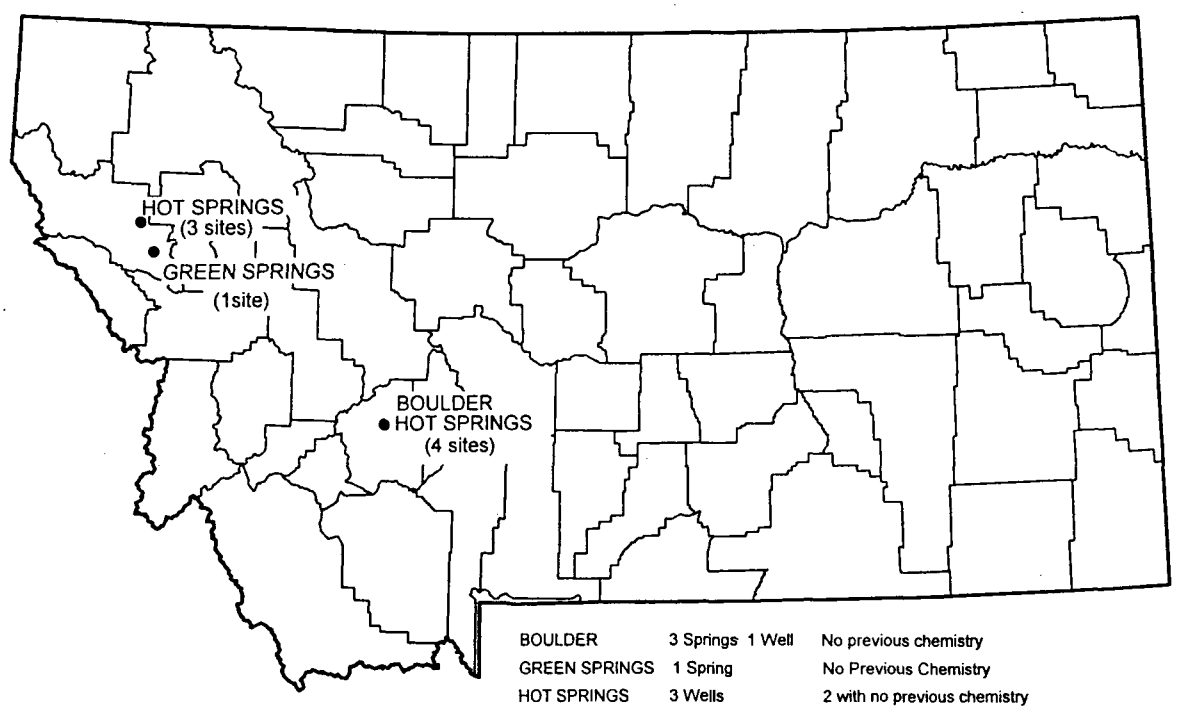

Figure 1 Eight samples were collected from three areas of Montana. Seven of the sites had little or no chemistry data.

Boulder Hot Springs, south of Boulder, MT

The Boulder Hot Springs resort is approximately 3 miles south of the town of Boulder within the Boulder Hot Springs KGRA. Previous owners of the resort would not grant access for sample collection during previous investigations. The

current owners, however, kindly allowed access, and each of the three springs near the resort were sampled (MGEOT349, MGEOT350, and MGEOT351). A fourth sample (MGEOT356) was collected from a well that had been intended as a drinking-water supply for the hotel, but produced "hot water" according to the owner.

Symes Hotel, Hot Springs, MT

The Symes Hotel uses a well for domestic water use. This well had been sampled in previous investigations, the sample date being 1980. The area has since undergone a moderate amount of development, and several additional wells have been completed in the area. Thus, this site (MGEOT352) was chosen to provide a comparison.

Koepling Well (MGEOT355) and Ostranger Well (MGEOT 354) , north of Hot Springs, MT

These wells are in the Little Bitteroot Valley 3 to 5 miles north of the town of Hot Springs. Although previously identified to be within a geothermal resource area, these wells had not been sampled in previous investigations.

Green Springs Area (MGEOT353), southwest of Camas Prairie, MT

Local residents identified 3 to 4 "hot" springs in the area south of the town of Camas Prairie. Nearby, Green Springs had been identified by Sonderegger and others (1981) as a geothermal area, but only limited data were available.

Sample collection/analytical methods

Water samples were collected from wells and springs in accordance with the Standard Operating Procedures provided by UURI (Kroneman, 1992). Each sample consisted of a 60-ml bottle filtered and preserved with 20% HNO_3, and 250-ml bottle filtered and preserved with 1% HCL, and a 500-ml bottle filtered with no

preservative. Upon collection of each sample, specific conductance, pH, water temperature and air temperature were obtained at the sample source. Spring samples were collected as close as possible to the source. Wells were sampled after pumping or bailing a minimum of three casing volumes and after field-parameters (pH, SC, Eh, and temperature) had stabilized to a range of less than 10%.

Samples were shipped within 48-hours of collection, via overnight delivery, to the UURI Analytical Laboratory in Salt Lake City, Utah. The samples were analyzed for major cations, major anions, and selected trace-metals.

Reservoir Temperatures

Several methods to estimate the reservoir temperature have been proposed; the most widely used are those using dissolved concentrations of silica (as SiO_2), Na-K-Ca, Na-K-Ca with a correction for Mg, and Na-K and are summarized by Fournier (1981). These methods represent empirical, equilibrium equations for which the water temperature at the reservoir is calculated. As noted by the authors of the methods, these calculations should be interpreted in consideration of the geologic and hydrogeologic setting.

Analytical Results

The analytical results for selected analytes are presented in Table 1. These sites are also included in the listing in Appendix I, in the listing of temperatures from geothermometers in Appendix II, and in the MGEOT database.

TABLE 1
ANALYTICAL RESULTS
1993 SAMPLING

ID	Site Name	Temp (°C)	Flow (L/m)	TDS (mg/L)	pH	Cl (mg/L)	SO_4 (mg/L)
MGEOT349	BOULDER (UPPER)	54.0	340*	419.5	8.89	21.0	76.0
MGEOT351	BOULDER (LOWER)	64.5	75.7*	401.4	8.80	22.0	73.0
MGEOT350	BOULDER (MIDDLE)	74.0	75**	421.1	8.89	22.0	80.0
MGEOT356	BOULDER (WELL)	34.5		373.1	8.46	16.0	54.0
MGEOT352	SYMES HOTEL	33.3		297.2	9.66	11.0	30.0
MGEOT355	WELL 138	26.5		275.0	8.23	10.0	5.1
MGEOT354	WELL 56	17.2		290.9	8.05	14.0	3.8
MGEOT353	GREEN SPRINGS	23.7	2000**	208.4	9.86	12.0	17.0

* Flow measured with bucket/stopwatch **Flow estimated

ID	Site Name	F* (mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L	K (mg/L)	Fe** (mg/L)
MGEOT349	BOULDER (UPPER)	11.8	2.7	0.4	122.0	3.8	ND
MGEOT351	BOULDER (LOWER)	11.0	3.2	ND	111.4	6.1	0.31
MGEOT350	BOULDER (MIDDLE)	11.1	2.0	0.3	118.2	ND	0.08
MGEOT356	BOULDER (WELL)	5.7	4.09	ND	108.2	3.7	0.09
MGEOT352	SYMES HOTEL	5.6	0.6	0.7	89.4	2.2	ND
MGEOT355	WELL 138	3.4	4.5	ND	95.6	2.9	0.06
MGEOT354	WELL 56	5.4	5.5	2.5	109.3	ND	0.39
MGEOT353	GREEN SPRINGS	2.1	0.8	1.2	57.1	2.1	0.27

* The drinking water standard (primary) for fluoride is 4mg/L.

** The drinking water standard (secondary) for iron is 0.3 mg/L; the aquatic life standard (acute) is 1mg/L.

TABLE 1 - Continued

ID	Site Name	SiO_2 (mg/L)	As (mg/L)	B (mg/L)	Li (mg/L)
MGEOT349	BOULDER (UPPER)	93.2	0.7*	0.6	0.23
MGEOT351	BOULDER (LOWER)	90.0	ND	0.5	0.22
MGEOT350	BOULDER (MIDDLE)	98.5	ND	0.5	0.23
MGEOT356	BOULDER (WELL)	86.55	ND	0.49	0.21
MGEOT352	SYMES HOTEL	73.08	ND	0.2	0.04
MGEOT355	WELL 138	36.64	ND	0.4	0.04
MGEOT354	WELL 56	12.96	ND	0.3	ND
MGEOT353	GREEN SPRINGS	55.8	ND	0.1	ND

* Because of the high As concentration, this spring was re-sampled and analyzed by MBMG. The second analysis indicated a concentration of 0.02ug/L As.
ND = Not Detected

Boulder Hot Springs

The Boulder Hot Springs area lies approximately 3 miles south of the town of Boulder near the Interstate 15 highway. The area lies within the Boulder Batholith about 4 miles from its eastern edge. Until this investigation, only limited chemistry data and field parameters were publicly available for this area (Robertson and others, 1976, published limited chemistry and a reservoir temperature, but the location of the sample was not made clear). Other hot-springs and warm-water wells are known to exist in the area around Boulder; however, access was not gained either because the owner denied access or could not be contacted.

The samples were collected from three springs that have been developed to supply the Boulder Hot Springs resort. At present, the primary use of the hot water is a naturally heated swimming pool. As renovation of the hotel continues, the water may also be used for space heating as was the case in the past. Samples were collected at the supply pipe at each spring-box. Water-flow, which was difficult to measure because of the structures, was measured at two of the

springs using a bucket and stopwatch; the flow of the middle springs could only be estimated. The combined flow of all three springs is on the order of 490 L/min.

The field-temperatures of the springs vary by 20°C; the upper spring had the lowest temperature (54°C) and the middle spring, which was not being used, had the highest temperature (74°C). The variance in temperature suggests that the water supplying the springs is undergoing mixing. Conversely, the chemistry of the waters from each of the three springs is similar (all are strongly a sodium-potassium type water) and the estimated reservoir temperature for each of the springs tend to agree regardless of the geothermometer used (Table 2). Thus, the variance in temperature may result from the way the spring was developed and fed to the spring boxes.

TABLE 2
Selected Geothermometer Temperatures*
Boulder Hot Springs

ID	Site Name	Na-K-Ca (corrected)	Na-K-Ca (uncorr.)	Qtz (no steam)	Qtz (steam)
MGEOT349	BOULDER (UPPER)	110°C	134°C	133°C	129°C
MGEOT351	BOULDER (LOWER)		158°C	131°C	128°C
MGEOT350	BOULDER (MIDDLE)	120°C	141°C	136°C	132°C
MGEOT356	BOULDER (WELL)		134°C	129°C	126°C

*Geothermometer temperatures for all sites are presented in Appendix II.

The well, with a depth of 37.5 meters and a static-water-level of 0.85 meters, is downhill from the resort and the springs. The chemistry of its water (Table 1) is similar to that of the springs; and the geothermometer temperatures (Table 2) are in good agreement with those calculated for the springs. The water temperature (34.5°C) was 20°C lower than the spring with the lowest temperature. A small pond near the well had a temperature of 21°C.

Hot Springs Area

Three water samples were collected from the Hot Springs area: two from wells north of Hot Springs and one from a well in Hot Springs. As noted previously, temperature and chemistry data were not available for three of these sites, and the fourth, the Symes Hotel, had a sample collected in 1972 .

The Koepling well and the Ostranger well are completed in the Lonepine aquifer approximately 1.5 miles apart and approximately 5 miles northeast of Hot Springs. The Symes Hotel is located in Hot Springs.

Water temperature and the concentration of several of the dissolved constituents varies between the three wells (Table 1). The geothermometer temperatures (Table 3) also indicate a range of temperatures wider than would be expected for a system with little or no mixing. Donovan (1985) suggested that the chemistry (and geothermometers) reflected the relative position of the well in a deep-circulating flow system.

TABLE 3
Selected Geothermometer Temperatures*
Hot Springs Area

ID	Site Name	Na-K-Ca (corrected)	Na-K-Ca (uncorr.)	Qtz (no steam)	Qtz (steam)
MGEOT352	SYMES HOTEL	35°C	131°C	120°C	118°C
MGEOT355	KOEPLING (WELL 138)			48°C	55°C
MGEOT354	OSTRANGER (WELL 56)		126°C	88°C	90°C

*Geothermometer temperatures for all sites are presented in Appendix II.

A time-comparison of geothermometer temperatures for the Symes Hotel well (Table 3) suggests a 3 to 5°C drop in temperature, perhaps the result of continued development of ground-water resources in the area. None of this

development, however, has been of the geothermal resources. This area could easily provide for applications of heat-transfer technology.

Green Springs

Green Springs is approximately 12 miles south of Hot Springs and approximately 2.5 miles southwest of Camas Prairie. Green Springs consists of 3 to 4 thermal springs feeding a wetlands/pond area. Elsewhere in the area, several small springs have been described by local citizens. A sample was collected from the largest of the springs at its source (Table 1). Although the site was documented by Sonderegger and others (1981), only a few chemical parameters were measured. The new data enabled a calculation of geothermometer temperatures (Table 4).

TABLE 4
Selected Geothermometer Temperatures*
Green Springs Area

ID	Site Name	Na-K-Ca (corrected)	Na-K-Ca (uncorr.)	Qtz (no steam)	Qtz (steam)
MGEOT353	GREEN SPRINGS		140°C	107°C	107°C

*Geothermometer temperatures for all sites are presented in Appendix II.

The differences between geothermometer temperatures suggests that mixing may be occurring and the difference in surface temperature and the geothermometer temperatures suggests either a high heat transfer or a slow circulation rate for this area.

Observations From Other Database Entries

Incorporating low-temperature sites in the inventory produced a new perspective of geothermal resources in the state. Areas such as Butte became more important with respect to potential development. The same may be true for the area near the city of Great Falls in Cascade County where wells 128- to 366-meters deep in the Madison Group produce water that ranges from 15 to 19°C; the water is used for irrigation and public water supply. Wells 274- to 396-meters deep in southern Treasure County and northern Big Horn County produce water whose temperatures range from 16.5°C to nearly 20°C.

The lower temperatures used in the selection criteria also had the effect of enlarging some of the areas identified by Sonderegger and others (1981). An example of this is in southern Broadwater County and northwestern Gallatin County where wells and springs had been identified in previous investigations. Updating the database provided additional information that may indicate a larger area for potential development.

5.0 DISCUSSION

Resource Potential

There are 291 records in the current database; these represent 267 individual sites (wells and springs). Approximately 71% of these sites exhibit water temperatures between 10 and 30° Celsius (Figure 2).

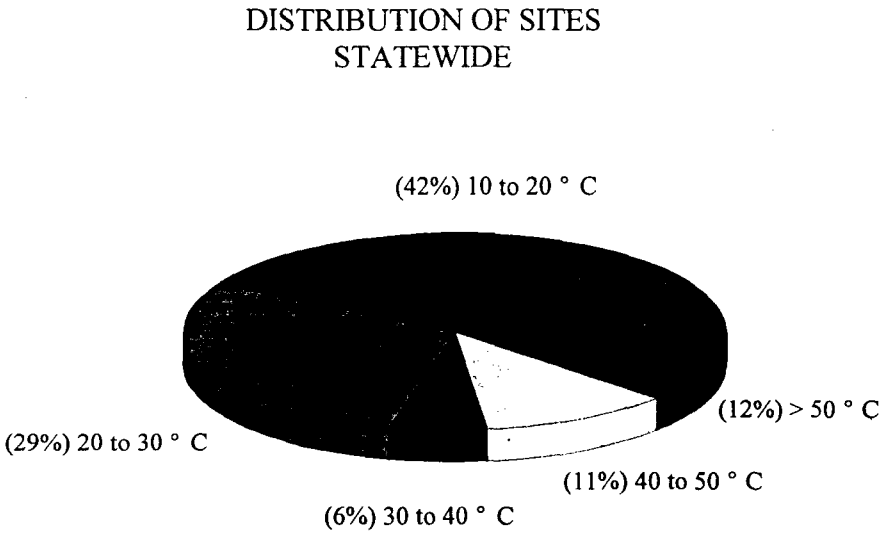

Figure 2 About 77% of the geothermal sites in Montana have water temperatures less than 40° Celsius; 12% of the sites have temperatures greater than 50° Celsius.

Collocation of Resources and Users

Montana's population centers are generally small (<50,000 people) and

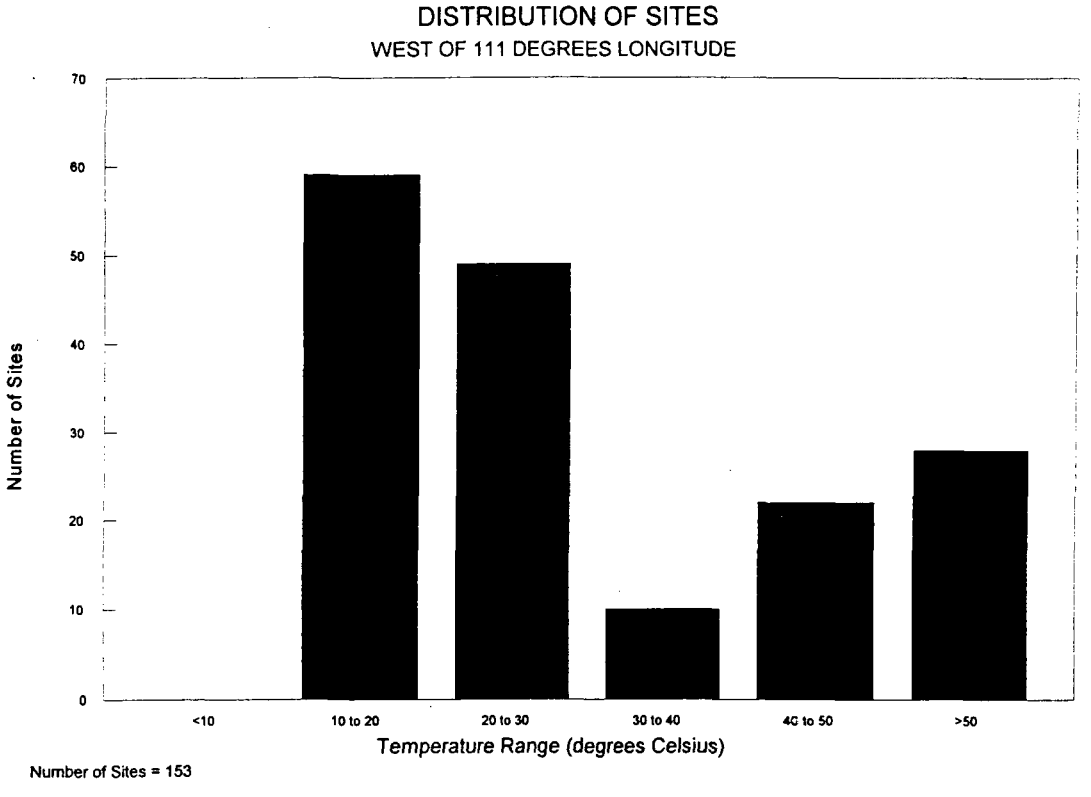

Figure 3 The western third of the state has 153 sites. About a third of those (approximately 100)have temperatures greater than 30°C.

widely distributed. The western third of the state has more of the larger population centers and a slightly higher overall population than the eastern two-thirds.

The distribution of geothermal resources mimics, but does not correlate, to that of the population; 152 of the 267 sites occur in the mountainous area of the western third (generally west of 111° longitude) whereas 115 sites are in the plains area of the eastern two-thirds of the state. Similarly, the number of warm and hot springs is much higher in the west.

A comparison of the distribution within the western (Figure 3) and eastern (Figure 4) parts of the state shows that the western third has a larger number of sites with temperatures greater than 30°C.

Collocation of population centers, albeit small, and geothermal resources are most likely to occur in the western third of the state. It should be noted, however, that deep wells into the Madison Formation in the eastern part of Montana have the potential to produce low- to moderate-temperature water as demonstrated in Treasure County and northern Big Horn County.

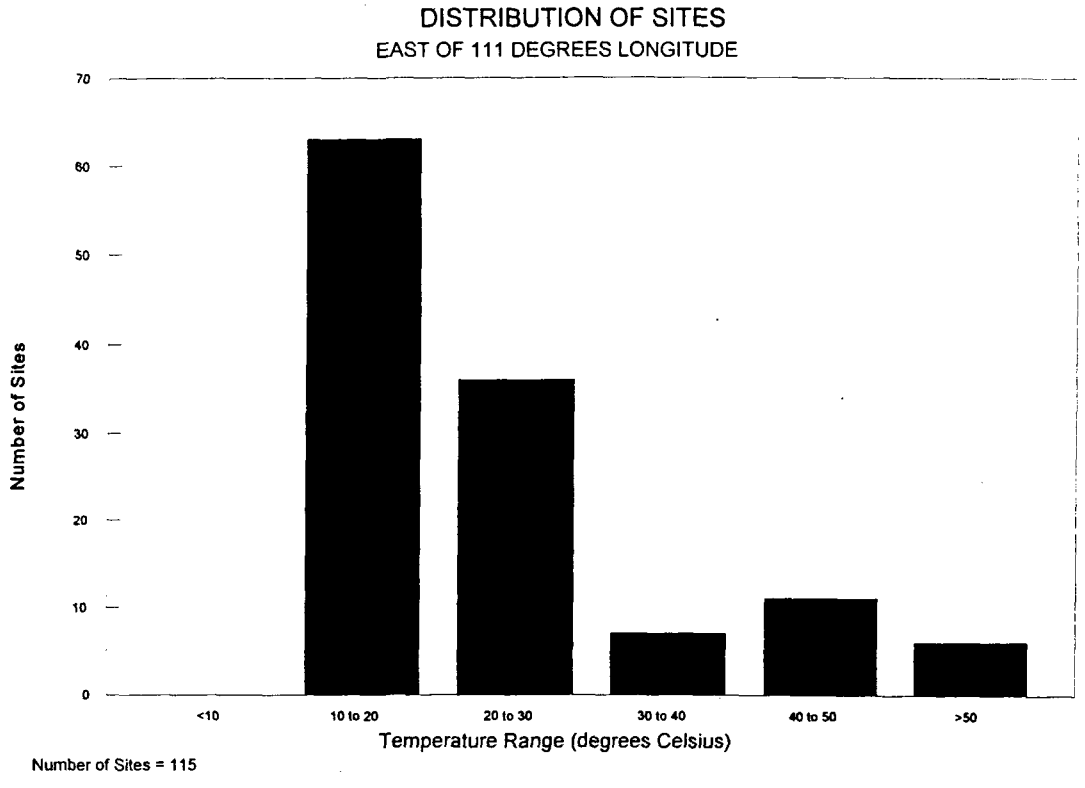

Figure 4 Most of the sites in the eastern third of the state. About 20 sites have temperatures greater than 30°C.

6.0 SUMMARY

Each of the tasks outlined in the agreement between the Montana Bureau of Mines and Geology and the Oregon Institute of Technology / University of Utah Research Institute have been completed. The database described here represents the most current information on geothermal resources in the state of Montana. The database also contains the information collected from eight sites that lacked information prior to this inventory. A 1:1,000,000 scale map, which accompanies this report, shows the location, temperature group, distribution, and type of geothermal resources in the state.

The distribution of geothermal resources and population in Montana suggests a good potential for development of these resources. Although Montana has only a few large population centers, smaller cities and towns near the resources could benefit from development. Although the low temperature of the resources (most are less than 50°C) restricts the type of development, small-scale direct-heat or heat-pump applications, aquaculture, and other development may be economical in some areas.

Whereas the information presented in this report reflects the current knowledge and information on geothermal resources across the state, funding and time limitations would not permit an evaluation of each site. Individuals or groups with the intention of developing any of the sites or areas identified in this assessment should conduct a more thorough investigation and confirm the temperatures, chemistry, and flows.

7.0 RECOMMENDATIONS

Priority Areas for Phase II Studies

The dominant consideration in selecting areas in Montana for future studies is the proximity of the resource area to transportation and population centers. Although there are several resource areas with a relatively high potential for development, limited past and/or current use and low population in the area likely prohibit development. The areas that have the highest potential and are nearest population centers (Figure 5) and transportation routes are as follows:

Bozeman

The Gallatin valley near Bozeman has experienced a steady population growth over the last decade. Data for the Bozeman Hot Springs just west of the city of Bozeman indicates a surface temperature of approximately 55°C and an estimated reservoir temperature of 80°C. The springs are currently used to heat a swimming pool at a commercial campground. Although little resource development has occurred in the area over the last ten years, the Gallatin valley was identified by Sonderegger and others (1981) as an area expected to contain geothermal resources suitable for development. Geophysical exploration and deep drilling would better define the source and extent of this resource area.

Butte

The Butte Mining District was extensively mined over a period of nearly 100 years. At the cessation of underground mining in the early 1980's, dewatering of the bedrock was discontinued and water-levels were allowed to rise. Soon after the mines were shut down, the area was listed in the National Priorities List and is designated as a Superfund site. The rising water, which has a low pH and a high dissolved-metals content, is of much to concern to local, state, and federal agencies, and it has been recognized that water-levels will need to be controlled by pumping to prevent discharge into the Clark Fork River drainage.

With respect to geothermal development, the Butte area offers several avenues for low-to-moderate temperature resources. The underground workings were notoriously hot areas to work in while operating and recent data collected from the mines show water temperatures ranging from 13° to 33°C. Monitoring wells completed in the bedrock aquifer at depths less than 183 meters indicate temperatures of 10 to 18°C, and water quality is quite good (for example, see MGEOT341 and MGEOT342). Diamond drill holes with depths up to 610 meters and open mine shafts may provide access to the deeper, warmer waters. An evaluation of depth, temperature, and potential applications of heat-pump technology is needed.

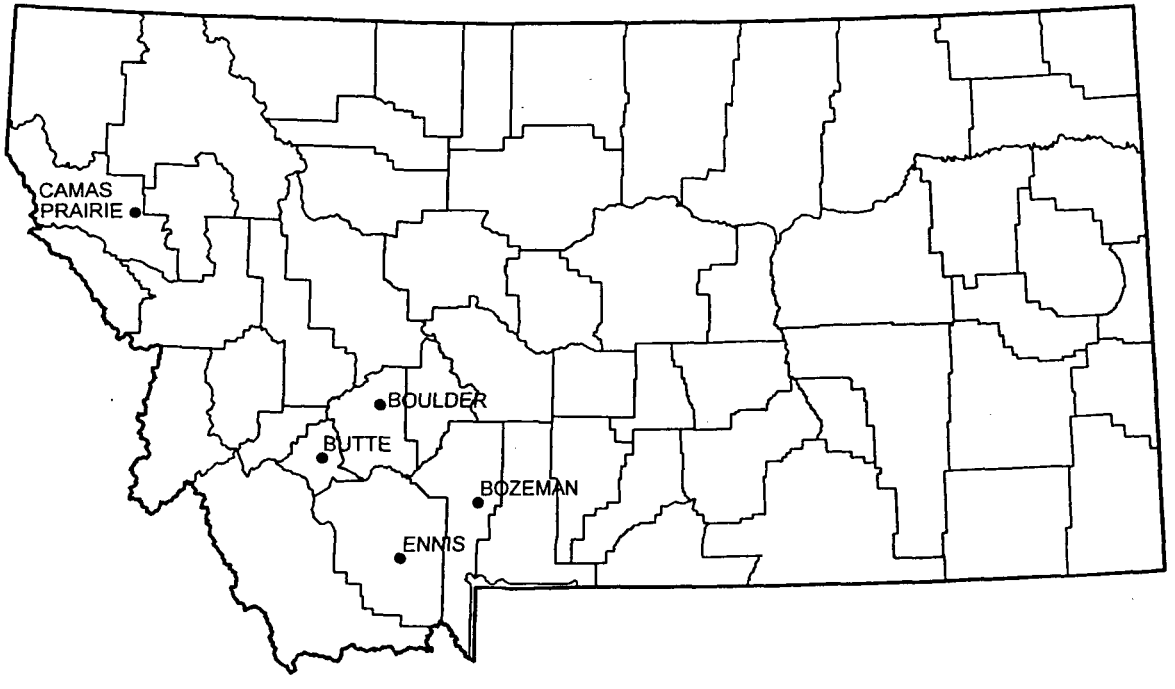

Figure 5 Five areas have been selected as potential areas for additional studies relating to application of direct-use technology.

Ennis

Several studies of the geothermal resources near Ennis have been conducted in the past; however, a deep drilling project is needed to fully understand the nature of this resource area. Recently, one of the areas in which wells were completed was offered for sale to the county government. Application of the information derived from previous studies to an investigation of potential direct-heat applications may also be warranted.

Boulder Hot Springs

The Boulder Hot Springs is within a few miles of Interstate-highway 15 and the town of Boulder is only 1/2 mile from it. Larger cities, Butte to the south and Helena to the north, are within 30 miles. The surface temperatures at the three springs sampled range from 54 to 74°C, and flow is approximately 340 L/min. at the larger spring. The site is currently undergoing renovation. The likelihood of other geothermal resources in the area is high. An inventory of springs and wells throughout the valley and a deep drilling project is needed to better define this potential resource area.

Camas Prairie

There are several previously un-recorded springs in this area; one site was sampled recently (MGEOT353). Although the area is not near any of the larger population centers, there are some recreational facilities in the area. This particular area of Montana has been especially popular for cottage-industry development. A more complete well and spring inventory, coupled with a water-chemistry sampling program is needed to better define the occurrence and potential development in this area.

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APPENDIX I
DATABASE LISTING
GEOTHERMAL RESOURCES OF MONTANA

AND

SEPARATE LIST OF 33 SITES
IDENTIFIED ON MAP AS THE CAMAS-LONEPINE AREA

MGEOT DATABASE

ID	Site name	Reference	Type	Flow (l/min)	Latitude	Longitude	Temp (deg c)	Status/use	SWL (M)	Sample Depth (M)	Date	Chloride mg/l	Sulfate mg/l	Fluoride mg/l
MGEOT209	TARGHEE SULPHUR SPRING*6MI W W YELLOWSTONE	Sonderegger et.al. 1981	SPRING		44.6775	111.2180	18.0	STOCK			23 AUG 1979	1.70	156.0	1.1
MGEOT177	UPPER WEST SPRING-STAUDENMEYER RANCH	MBMG-GWIC	SPRING		44.6988	111.8780	28.8	STOCK			02 OCT 1978	16.00	107.9	1.6
MGEOT123	UPPERMOST SPRING-STAUDENMEYER RANCH	Sonderegger et.al. 1981	SPRING		44.6988	111.8780	28.0	OTHER			03 OCT 1977			
MGEOT126	UPPER-EAST SPRING-STAUDENMEYER RANCH	MBMG-GWIC	SPRING		44.6988	111.8780	29.0	OTHER			04 OCT 1977			
MGEOT125	LOWER WEST SPRINGS-STAUDENMEYER RANCH	MBMG-GWIC	SPRING		44.6988	111.8780	31.0	OTHER			03 OCT 1977	9.35	116.0	1.8
MGEOT127	LOWER EAST SPRING-STAUDENMEYER RANCH	MBMG-GWIC	SPRING		44.6988	111.8780	28.0	OTHER			04 OCT 1977	9.80	114.0	1.8
MGEOT124	UPPER WEST SPRING-STAUDENMEYER RANCH	MBMG-GWIC	SPRING		44.6988	111.8780	29.0	OTHER			03 OCT 1977	9.80	114.0	1.8
MGEOT121	ANDERSONS PASTURE SPRING #1	MBMG-GWIC	SPRING		44.7025	111.8855	28.0	STOCK			03 OCT 1977			
MGEOT122	ANDERSONS PASTURE SPRING #2	MBMG-GWIC	SPRING		44.7030	111.8822	23.5	STOCK			03 OCT 1977	9.00	116.0	1.8
MGEOT210	USFS* BAKERS HOLE* 3MI N WEST YELLOWSTONE	Sonderegger et.al. 1981	WELL-FLOWING	16.0	44.7080	111.0991	16.0	PUBLIC SUPPLY	5.6	18.75	22 AUG 1979	17.00	8.6	3.7
MGEOT115	SLOAN COW CAMP SPRING	Sonderegger et.al. 1981	SPRING	1306.0	44.7686	111.6487	29.5				29 SEP 1977	8.00	4.0	3.1
MGEOT120	WEST FORK SWIMMING HOLE	Sonderegger et.al. 1981	SPRING	1690.0	44.7863	111.6550	25.5	OTHER			29 SEP 1977	2.75	11.8	0.4
MGEOT118	CURLEW CREEK WARM SPRING	MBMG-GWIC	SPRING		44.8730	111.5455	23.0	UNUSED			09 SEP 1977			
MGEOT119	WALL CANYON WARM SPRING	Sonderegger et.al. 1981	SPRING		44.9763	111.6508	24.0	UNUSED			13 SEP 1977	49.20	80.6	14.4
MGEOT229	WOLF CREEK HOT SPRING	Leonard et.al. 1978	SPRING	201.0	44.9636	111.6155	60.0	STOCK			29 SEP 1978	19.00	43.0	18.0
MGEOT129	LOWELL HILDRETH SPRING*15 MI SW DILLON	MBMG-GWIC	SPRING		45.0275	112.6452	19.6	DOMESTIC			24 MAR 1978	16.15	191.0	0.7
MGEOT016	BEAR CREEK SPRINGS	Sonderegger et.al. 1981	SPRING	36.0	45.0353	110.6653	24.0							
MGEOT132	VIGILANTE WARM SPRING	Sonderegger et.al. 1981	SPRING	8330.0	45.0369	111.9522	23.5	UNUSED			24 MAY 1978	1.90	174.0	0.9
MGEOT041	LA DUKE HOT SPRINGS	Mariner et.al. 1976	SPRING	500.0	45.0930	110.7737	65.0					45.00	1200.0	3.6
MGEOT012	BROWNS SPRINGS	Sonderegger et.al. 1981	SPRING	4160.0	45.1047	112.7508	23.7							
MGEOT010	PULLER HOT SPRINGS	Leonard et.al. 1978	SPRING	189.0	45.1717	112.1520	44.4					91.00	350.0	2.2
MGEOT019	TRUDAU SPRINGS	Sonderegger et.al. 1981	SPRING	660.0	45.2350	112.1347	22.7	UNUSED			25 MAY 1978	16.00	102.0	0.6
MGEOT040	CHICO HOT SPRINGS	Mariner et.al. 1976	SPRING	500.0	45.3370	110.6913	42.0					10.00	41.0	0.9
MGEOT032	GROUNDWATER*4.7 MI NE FT SMITH MT	MBMG-GWIC	WELL		45.3447	107.8627	20.0	OTHER		314.86	24 AUG 1960	7.90	125.0	1.4
MGEOT074	BROWN CATTLE CO* 3.1 MI N. BIRNEY MT	MBMG-GWIC	WELL	0.5	45.3663	106.5322	15.5	STOCK			11 NOV 1975	4.55	79.4	2.0
MGEOT276	JARDINE HOT SPRINGS 0.25 MI E OF JACKSON	MBMG-GWIC	SPRING		45.3675	113.4033	60.0	DOMESTIC			30 MAY 1981	8.00	45.5	1.8
MGEOT289	MBMG GEOTHERMAL TEST * THEXTON TX-12	MBMG-GWIC	WELL	28.6	45.3677	111.7247	67.0	RESEARCH		291.39	30 JUN 1982	116.00	224.0	10.0
MGEOT028	JACKSON HOT SPRINGS	Mariner et.al. 1976	SPRING	1000.0	45.3678	113.4030	58.0					8.00	45.0	2.0
MGEOT293	PRIVATE GEOTHERMAL TEST*ENNIS HOT SPRINGS*	MBMG-GWIC	WELL		45.3702	111.7252	67.0	INDUSTRIAL/COMM		371.86	06 JAN 1983	111.00	203.0	10.9
MGEOT277	LAPHAM DOMESTIC WELL 1 MI NW JACKSON, MT.	MBMG-GWIC	WELL		45.3825	113.4222	17.0	DOMESTIC		30.48	31 MAY 1981	7.80	40.4	1.4
MGEOT117	ENNIS HOT SPRINGS	MBMG-GWIC	SPRING		45.3852	111.7788	61.0	UNUSED			18 AUG 1977			
MGEOT058	BROWN CATTLE CO * 9.5MI SW BIRNEY DAY SCH.	MBMG-GWIC	WELL	0.2	45.3869	106.5330	16.5	STOCK	0.9	252.98	01 MAR 1974	9.00	71.0	2.3
MGEOT031	BEAVERHEAD ROCK SPRINGS	Sonderegger et.al. 1981	SPRING	380.0	45.3918	112.4512	27.0							
MGEOT133	APEX WARM SPRING	Sonderegger et.al. 1981	SPRING	2640.0	45.4205	112.6911	25.0	IRRIGATION			25 MAY 1978	11.55	135.0	0.6
MGEOT323	ELKHORN HOT SPRINGS	Mariner et.al. 1976	SPRING	400.0	45.4578	113.1087	48.5					2.00	27.0	2.6
MGEOT292	MARTIN, KIETH	MBMG-GWIC	SPRING	1589.8	45.4594	109.8758	20.5	DOMESTIC			22 SEP 1982	0.70	216.0	0.8
MGEOT326	NEW BILTMORE HOT SPRINGS	Mariner et.al. 1976	SPRING	280.0	45.4620	112.4750	53.0					46.00	1100.0	3.3
MGEOT308	NEWMAN, JOHN * JOLIET, MT	MBMG-GWIC	WELL		45.4663	108.9800	16.0	DOMESTIC	70.3	225.55	07 AUG 1984	15.20	2820.0	0.2
MGEOT280	ANDERSON SPRING	MBMG-GWIC	SPRING	159.9	45.5530	110.1422	25.0	RECREATIONAL			06 OCT 1981	0.10	129.0	0.5
MGEOT006	ANDERSON'S SPRING	Sonderegger et.al. 1981	SPRING	280.0	45.5530	110.1422	25.0					1.00	139.0	0.4
MGEOT043	NORRIS HOT SPRINGS	Leonard et.al. 1978	SPRING	424.0	45.5750	111.6833	50.0					22.00	130.0	8.1
MGEOT015	POTOSI HOT SPRINGS	Mariner et.al. 1976	SPRING	197.0	45.5892	111.8987	49.5					6.00	140.0	6.2
MGEOT187	GROSS, PETE * 4 MI S PONY MT	MBMG-GWIC	SPRING	64.4	45.6016	111.9002	37.5	OTHER			25 JUN 1979	6.20	166.0	6.1
MGEOT311	MCFERRAN, EUGENE * BILLINGS, MT	MBMG-GWIC	WELL		45.6033	108.4019	15.5	DOMESTIC	92.5	181.66	19 NOV 1984	39.80	71.7	5.8
MGEOT179	CARTER'S BRIDGE * 4 MI SE LIVINGSTON MT.	Sonderegger et.al. 1981	SPRING		45.6091	110.5686	28.0	UNUSED			22 DEC 1978			
MGEOT011	AVON WARM SPRING	Sonderegger et.al. 1981	SPRING	91.0	45.6103	112.5547	25.5							
MGEOT264	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	MBMG-GWIC	WELL	11.5	45.6602	111.1861	59.0	RESEARCH		164.59	16 DEC 1980	50.00	131.0	10.1
MGEOT266	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	MBMG-GWIC	WELL	1000.0	45.6602	111.1861	55.0	RESEARCH		140.21	17 DEC 1980	50.30	133.0	10.2
MGEOT265	BOZEMAN HOT SPRINGS * OLD WELL	MBMG-GWIC	WELL		45.6602	111.1861	54.0	RECREATIONAL	6.9	164.59	17 DEC 1980	50.00	132.0	10.1
MGEOT263	BOZEMAN HOT SPRINGS * ORIGINAL SPRING	MBMG-GWIC	SPRING		45.6605	111.1861	54.0	RECREATIONAL			17 DEC 1980	49.70	130.0	9.9
MGEOT335	BOZEMAN HOT SPRINGS	Leonard et.al. 1978	SPRING	284.0	45.6605	111.1862	54.6					48.00	120.0	12.0
MGEOT269	RANCA * MCLEOD	MBMG-GWIC	WELL		45.6647	110.1141	49.0	UNUSED			02 APR 1981	2.00	1331.0	2.8
MGEOT259	SCOTT FEED LOT	Sonderegger et.al. 1981	WELL	45.0	45.6819	108.1566	43.0	DOMESTIC			25 NOV 1980	60.30	119.0	7.1
MGEOT260	SCOTT FEED LOT	Sonderegger et.al. 1981	WELL	50.0	45.6838	108.1552	44.0	DOMESTIC			25 NOV 1980	72.00	83.4	9.0
MGEOT230	BLUE JOINT CREEK HOT SPRING	Sonderegger et.al. 1981	SPRING	849.0	45.6963	114.3633	29.4					3.00	5.0	9.5
MGEOT002	BRIDGER CANYON WARM SPRING	Sonderegger et.al. 1981	SPRING	379.0	45.7073	110.9755	20.2					1.00	80.0	0.5
MGEOT334	LOVE, MELVIN*THREE FORKS, MT	MBMG-GWIC	WELL		45.7269	111.4997	15.9	DOMESTIC		18.59	11 MAY 1989	20.50	16.4	1.4
MGEOT033	GROUNDWATER*5.3 MI W HARDIN MT	MBMG-GWIC	WELL		45.7305	107.7311	39.4	OTHER		1219.20	17 NOV 1960	4.00	1980.0	4.0
MGEOT332	SHIPTON, HAROLD * THREE FORKS MT	MBMG-GWIC	WELL		45.7350	111.4825	16.9	DOMESTIC		54.86	09 MAY 1989	32.00	24.9	1.4
MGEOT258	HERMAN, T.E. * ROCKY RANCH 7.4 M W HARDIN	MBMG-GWIC	WELL-FLOWING	2000.0	45.7369	107.7347	42.0	RECREATIONAL		1203.96	25 NOV 1980	4.30	2130.0	3.1
MGEOT344	GALLOGLY HOT SPRING	Sonderegger et.al. 1981	SPRING	454.0	45.7495	113.9395	48.9				05 AUG 1964	1.00	12.0	5.8
MGEOT245	LOST TRAIL * WARM AND HOT SPRINGS	MBMG-GWIC	SPRING		45.7497	113.9394	41.7	RECREATIONAL			07 OCT 1980			
MGEOT069	CAIN MIKE*6.6 MI S VOLBERG	MBMG-GWIC	WELL	2.2	45.7533	105.7263	16.0	DOMESTIC	54.9		01 JUL 1976	51.00	5.5	4.0
MGEOT018	HUNTERS HOT SPRINGS	Mariner et.al. 1976	SPRING	5000.0	45.7572	110.2572	60.0					18.00	11.0	5.6
MGEOT328	JORGENSON, JACK * THREE FORKS MT	MBMG-GWIC	WELL		45.7736	111.4686	16.0	IRRIGATION		16.76	20 MAY 1988			
MGEOT346	RENOVA HOT SPRINGS	Leonard et.al. 1978	SPRING	151.0	45.7917	112.1263	50.0					34.00	200.0	3.0
MGEOT339	WESTMORELAND * 9.1 M W SARPY SCHOOL	MBMG-GWIC	WELL		45.8027	107.0827	37.7	INDUSTRIAL	-0.5		24 AUG 1990	20.10	996.0	2.7
MGEOT095	LISCOM RANCH * 5.5 MI NW OF N STACY SCHOOL	MBMG-GWIC	WELL	0.1	45.8144	105.9705	15.5	STOCK	121.9	228.60	21 JUL 1975	13.15	61.3	1.0
MGEOT331	TINDER, L. MARIE * THREE FORKS MT	MBMG-GWIC	WELL		45.8219	111.4672	21.9	DOMESTIC		32.92	05 MAY 1989	18.60	40.4	2.2
MGEOT327	WILCOX, RALPH * THREE FORKS MT	MBMG-GWIC	WELL		45.8269	111.4638	16.5	DOMESTIC		22.25	19 MAY 1988			
MGEOT333	RICHARDSON, DEIRDRE * THREE FORKS	MBMG-GWIC	WELL		45.8300	111.4594	16.8	DOMESTIC		17.68	10 MAY 1989	25.00	60.5	2.4
MGEOT347	MEDICINE HOT SPRINGS	Mariner et.al. 1976	SPRING	400.0	45.8458	114.0347	45.0					7.00	33.0	14.0
MGEOT092	WESTERN ENERGY * 2 MI N COLSTRIP MT.	MBMG-GWIC	WELL	18.6	45.8863	106.6194	96.1	UNUSED	170.7	2645.61	09 JUL 1976	79.00	736.9	4.9
MGEOT020	PIPESTONE HOT SPRINGS	Mariner et.al. 1976	SPRING	300.0	45.8963	112.2426	57.0					20.00	94.0	5.3
MGEOT062	FRED WETSTEON SPRING DEVELOP	MBMG-GWIC	SPRING		45.9147	113.7608	19.0	OTHER			06 MAY 1976			
MGEOT330	HART, FRANK * THREE FORKS, MT	MBMG-GWIC	WELL		45.9188	111.4975	15.9	DOMESTIC	1.2	16.76	04 MAY 1989			
MGEOT063	ANADARKO PROD*6 MI E FOSTER MT	MBMG-GWIC	WELL		45.9463	107.4588	26.7	UNUSED		781.51	17 JUN 1974	7860.00	30.0	0.7
MGEOT053	UN-NAMED SPRING * 29 M NE OF FOSTER MT	MBMG-GWIC	SPRING		45.9580	107.0625	29.0	STOCK			03 SEP 1973			
MGEOT128	COWAN SPRING*9MI NW THREE FORKS MT	MBMG-GWIC	SPRING		45.9606	111.7227	23.0	STOCK			26 AUG 1977			

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Reference	Type	Flow (l/min)	Latitude	Longitude	Temp (deg c)	Status/use	SWL (M)	Sample Depth (M)	Date	Chloride mg/l	Sulfate mg/l	Fluoride mg/l
MGEOT178	WOLF CREEK HOT SPRING	MBMG-GWIC	SPRING		45.9836	111.6155	60.0	STOCK			29 SEP 1978			
MGEOT343	WILLIAMSBURG SPRING	MBMG-GWIC	SPRING	15.1	45.9916	112.5611	17.4				22 AUG 1991			
MGEOT030	*OIL WELL (TENSLEEP FORMATION)*	*Sonderegger et.al. 1981*	WELL	1100.0	46.0062	109.3977	69.0							
MGEOT341	MONTANA RESOURCES MONITORING WELL C	MBMG-GWIC	WELL		46.0066	112.4875	17.6	RESEARCH		244.14	29 MAY 1991	3.50	336.0	1.2
MGEOT342	MONTANA RESOURCES MONITORING WELL D2	MBMG-GWIC	WELL		46.0161	112.4902	16.0	RESEARCH	176.4	236.22	31 MAY 1991	5.80	652.1	1.0
MGEOT055	HOWARD SPRING * 25 M SE OF BIGHORN MT	MBMG-GWIC	SPRING		46.0233	107.1233	23.0	STOCK			25 JUN 1973	36.00	1516.0	0.2
MGEOT246	*WENDT, FRED * .75 MI S GREGSON (FAIRMONT)*	Sonderegger et.al. 1981	WELL	15.0	46.0322	112.8116	23.9	*DOMESTIC*	30.8	91.44	08 OCT 1980	4.90	17.4	1.1
MGEOT298	MBMG RESEARCH WELL * FAIRMONT HOT SPRINGS	MBMG-GWIC	WELL	30.1	46.0383	112.8094	20.0	RESEARCH	10.2	180.75	26 AUG 1983	18.70	214.0	21.0
MGEOT165	NELSON, HARVEY * 5 MI S BROADVIEW MT	MBMG-GWIC	WELL	6.9	46.0383	108.8822	16.0	DOMESTIC	45.7	182.88	26 SEP 1978	56.00	1562.0	1.6
MGEOT061	BRADBROOK * 10 M S BROADVIEW MT	MBMG-GWIC	WELL		46.0411	109.1502	32.9	STOCK	-0.0		11 OCT 1974	197.00	1736.0	3.8
MGEOT279	FAIRMONT HOT SPRINGS, ANACONDA	MBMG-GWIC	SPRING	946.3	46.0425	112.8111	61.5	INDUSTRIAL/COMM			29 SEP 1981			
MGEOT247	SPANGLER, HAZEL * 2 MI E-NE GREGSON MT	MBMG-GWIC	SPRING	151.4	46.0508	112.7691	15.5	STOCK			08 OCT 1980	21.00	48.5	0.6
MGEOT214	HUNSAKER SPRING	Sonderegger et.al. 1981	SPRING		46.0530	111.5011	24.5	UNUSED			26 JUN 1979	11.00	30.0	0.8
MGEOT150	MONT. HIGHWAY DEPT * .75 MI SE WACO MT.	MBMG-GWIC	WELL	9.9	46.0633	107.7102	15.5	DOMESTIC	45.7	91.14	23 SEP 1978	15.10	1660.0	1.4
MGEOT213	PLUNKET LAKE WARM SPRINGS	Sonderegger et.al. 1981	SPRING		46.0744	111.5844	17.0	IRRIGATION			17 JUL 1979			
MGEOT237	SPRINGS FROM JOINTS IN MISS CYN*SW PLUNKET	MBMG-GWIC	SPRING		46.0750	111.5833	17.0	IRRIGATION			10 NOV 1979	8.90	86.9	0.7
MGEOT151	MONTANA DEPT HIGHWAYS * 2.5 MI NE WACO MT	MBMG-GWIC	WELL	5.0	46.0891	107.6611	16.5	DOMESTIC	46.6		23 SEP 1978	23.90	615.0	3.0
MGEOT216	HUNSAKER, MAURICE	Sonderegger et.al. 1981	WELL	17.1	46.1022	111.5230	15.0	STOCK	21.3		12 JUN 1979	9.60	34.1	1.5
MGEOT135	ANACONDA RED TRAVETINE MOUND-GEYSER	Sonderegger et.al. 1981	SPRING	11.0	46.1047	112.7772	21.7	UNUSED			23 JUN 1978	7.00	1362.0	2.5
MGEOT325	SLEEPING CHILD HOT SPRINGS	Mariner et.al. 1976	SPRING	2000.0	46.1048	114.0042	43.0					9.00	81.0	14.0
MGEOT236	BRUCE, N * IRRIGATION WELL WITH BOOSTER	MBMG-GWIC	WELL	160.9	46.1188	111.5972	18.0	IRRIGATION	44.0	100.58	02 MAY 1980	21.70	133.0	0.5
MGEOT294	TOSTON WARM SPRING	MBMG-GWIC	SPRING		46.1258	111.3911	45.5	UNUSED			07 MAY 1983	6.60	50.0	0.7
MGEOT218	TOSTON WARM SPRING	Sonderegger et.al. 1981	SPRING		46.1258	111.3911	15.5	INDUSTRIAL/COMM			29 JUN 1979			
MGEOT217	BRUCE, NORMAN	Sonderegger et.al. 1981	WELL		46.1330	111.5033	18.0	IRRIGATION	35.9		29 JUN 1979	59.20	850.0	1.2
MGEOT215	KIMPTON SPRING	MBMG-GWIC	SPRING		46.1708	111.5855	18.0	UNUSED			16 JUN 1979	1.80	16.4	0.2
MGEOT134	WARNER WARM SPRING	Sonderegger et.al. 1981	SPRING		46.1725	111.5855	18.0	IRRIGATION			02 JUN 1978			
MGEOT172	STEELE, WILLIAM * 12.5 MI SE PINEVIEW MT.	MBMG-GWIC	WELL	0.5	46.1769	107.7380	16.0	STOCK	65.5	112.78	06 OCT 1978	124.70	1879.0	1.7
MGEOT284	MBMG TEST WELL*WARM SPRINGS STATE HOSPITAL	MBMG-GWIC	WELL		46.1780	112.7919	48.0	RESEARCH	4.0	92.66	17 FEB 1982	6.00	622.0	3.0
MGEOT009	WARM SPRINGS	Mariner et.al. 1976	SPRING	600.0	46.1787	112.7942	77.0					5.00	670.0	3.9
MGEOT233	WARM SPRINGS STATE HOSPITAL	MBMG-GWIC	WELL	2.3	46.1808	112.7930	67.0	RESEARCH	6.1		16 APR 1980	7.10	685.0	3.7
MGEOT231	WARM SPRINGS STATE HOSPITAL	MBMG-GWIC	WELL	2.2	46.1808	112.7930	54.0	RESEARCH	6.1		04 APR 1980	5.10	666.0	0.2
MGEOT349	BOULDER HOT SPRINGS - UPPER SPRING	MBMG/UURI	SPRING	340.0	46.1981	112.0947	54.0	RECREATION		38.10	02 NOV 1993	21.00	76.0	11.8
MGEOT351	BOULDER HOT SPRINGS - LOWER SPRING	MBMG/UURI	SPRING	75.7	46.1981	112.0947	64.5	RECREATION			02 NOV 1993	22.00	73.0	11.0
MGEOT350	BOULDER HOT SPRINGS - MIDDLE SPRING	MBMG/UURI	SPRING		46.1981	112.0947	74.0	RECREATION			02 NOV 1993	22.00	80.0	11.1
MGEOT232	WARM SPRINGS STATE HOSPITAL * SPRING	MBMG-GWIC	SPRING	68.9	46.2000	112.8833	79.0	RESEARCH			04 APR 1980			
MGEOT185	M-B NO. 12 * 5 MI NE HAMILTON MT	MBMG-GWIC	WELL	3.2	46.2836	114.0694	18.5	UNUSED	20.4	338.33	30 JUL 1979	10.30	19.8	0.4
MGEOT171	GRIERSON, J.B.*2.5MI NE RANCHERS CEMETARY.	MBMG-GWIC	WELL	0.5	46.2922	107.3958	21.0	STOCK		329.18	07 OCT 1978	997.90	9.4	2.1
MGEOT130	PRISON RANCH SPRING SITE NO. 4	MBMG-GWIC	SPRING		46.3333	112.8872	26.0	OTHER			27 MAR 1978			
MGEOT113	DEER LODGE PRISON RANCH WELL	Sonderegger et.al. 1981	WELL	57.0	46.3342	112.8863	26.0					3.00	33.0	7.5
MGEOT044	BEDFORD SPRINGS	Sonderegger et.al. 1981	SPRING	5680.0	46.3542	111.5667	23.6					9.00	103.0	0.7
MGEOT101	GRIERSON, J.B. * 23 MI NW HYSHAM MT	MBMG-GWIC	WELL	2.5	46.3652	107.6394	15.6	DOMESTIC	9.1	33.22	10 AUG 1976	92.00	1698.3	2.5
MGEOT275	MBMG RESEARCH WELL * WEED CREEK-1B	MBMG-GWIC	WELL		46.3952	107.7819	20.0	RESEARCH	64.3		10 MAR 1981	43.60	952.0	4.3
MGEOT274	MBMG RESEARCH WELL * WEED CREEK-1A	MBMG-GWIC	WELL		46.3952	107.7819	17.0	RESEARCH	65.9		11 MAR 1981	34.70	1017.0	3.8
MGEOT255	HANSER, BILL * 3 MI SW TWO DOT MT	Sonderegger et.al. 1981	WELL-FLOWING	200.0	46.4136	110.1394	18.0	STOCK		255.12	31 OCT 1980	6.80	20.8	1.4
MGEOT256	FOX INC * 1.5 MI W-SW TWO DOT	Sonderegger et.al. 1981	WELL-FLOWING	5.0	46.4208	110.1036	19.0	STOCK		216.41	31 OCT 1980	4.40	31.4	0.5
MGEOT257	*HOMER, RAY * TWO DOT WATER SUPPLY*	*Sonderegger et.al. 1981*	WELL-FLOWING	20.0	46.4261	110.0713	20.0	PUBLIC SUPPLY		274.32	31 OCT 1980	2.40	43.1	0.4
MGEOT296	HARLOWTON * SOUTH MUNICIPAL WELL	MBMG-GWIC	WELL	143.8	46.4344	109.8325	15.6	PUBLIC SUPPLY		280.72	25 MAY 1983	18.10	87.9	1.2
MGEOT013	HILLBROOK FLOWING WELL	Leonard et.al. 1978	WELL	57.0	46.4478	111.9872	30.0					25.00	170.0	8.7
MGEOT014	WALLS HOT SPRING	Leonard et.al. 1978	SPRING	110.0	46.4480	111.9805	55.6					11.00	88.0	6.9
MGEOT001	*ALHAMBRA HOT SPRINGS NORTH*	*Mariner et.al. 1976*	*SPRING*	380.0	46.4497	111.9805	56.5					10.00	89.0	8.4
MGEOT278	TOWNSEND,HERB*2.5 MI SW WHITE SULPHUR SPGS	MBMG-GWIC	WELL	180.1	46.5055	110.9347	48.5	IRRIGATION	4.6	76.20	21 JUL 1981	4.30	45.0	0.4
MGEOT290	RALPH JOHNSON,P.O.BOX 65,WHITE SULPHUR SPR	MBMG-GWIC	WELL		46.5444	110.9061	15.3	IRRIGATION	9.6	53.34		627.00	1332.0	7.7
MGEOT004	WHITE SULPHUR SPRINGS	Mariner et.al. 1976	SPRING	1500.0	46.5473	110.9038	46.0					180.00	310.0	7.4
MGEOT282	WHITE SULPHUR SPRINGS BANK WELL	MBMG-GWIC	WELL	5.1	46.5477	110.9063	43.3	*OTHER*	2.0	100.58	06 DEC 1981	147.00	211.0	6.3
MGEOT188	WATTS, JAMES * 16 MI NE KINSEY MT	MBMG-GWIC	WELL	0.4	46.5708	105.6980	15.0	DOMESTIC		259.08	06 AUG 1979	61.40	0.4	1.7
MGEOT184	M-B NO 8 WELL*2.5 MI SE CORVALLIS MT	MBMG-GWIC	WELL	1.8	46.5722	114.0363	18.3	OTHER	63.7	829.97	23 JUL 1979	5.79	34.3	0.6
MGEOT007	BROADWATER HOT SPRINGS WELL	Leonard et.al. 1978	WELL	227.0	46.5955	112.1117	65.5					34.00	180.0	11.0
MGEOT008	GLOEGE WELL	Leonard et.al. 1978	WELL	49.0	46.5958	112.1042	19.4					12.00	84.0	0.7
MGEOT003	GARRISON WARM SPRINGS	Sonderegger et.al. 1981	SPRING	204.0	46.6088	112.7747	25.0					3.00	335.0	1.3
MGEOT337	CHADWICK, GREG	MBMG-GWIC	WELL		46.6169	111.9883	15.0	DOMESTIC	9.0	23.16	17 JUL 1990	14.30		
MGEOT208	USGS OBS WELL * 4 MI SW EAST HELENA, MT.	MBMG-GWIC	WELL		46.6177	111.9961	25.0	RESEARCH	11.1	13.32	05 SEP 1979	59.00	44.5	0.2
MGEOT336	MUELLER BUZZ	MBMG-GWIC	WELL		46.6308	112.1025	15.0	STOCK	16.5	27.13	/ /19	16.00		
MGEOT242	FLORENCE TEST WELL A	Sonderegger et.al. 1981	WELL	1.1	46.6461	114.0625	15.0	RESEARCH	2.1		25 AUG 1980	4.50	20.1	3.1
MGEOT329	SIVERTE MYSSE * BOX 315 * INGOMAR MT 59039	MBMG-GWIC	WELL		46.6819	107.2030	37.0	STOCK	30.2	839.72	12 OCT 1988	40.10	298.0	11.5
MGEOT167	CHERRY CK SHEEP CO.*1.35MI SE HAGEN RANCH.	MBMG-GWIC	WELL	1.1	46.6819	107.2030	36.0	DOMESTIC	-0.3	842.47	13 OCT 1978	19.00	309.0	10.8
MGEOT261	MOORE, THOMAS * 6.5 MI SW ANGELA MT	Sonderegger et.al. 1981	WELL-FLOWING	120.1	46.6860	106.3225	82.0	RECREATIONAL		2529.84	20 NOV 1980	2080.00	1380.0	5.3
MGEOT322	BYRNE WARM SPRING * WEST OF BEARMOUTH	MBMG-GWIC	SPRING		46.7036	113.4536	20.0	UNUSED			30 JUL 1987			
MGEOT116	NIMROD SPRINGS	Sonderegger et.al. 1981	SPRING	12100.0	46.7057	113.4568	20.5					3.00	340.0	0.8
MGEOT026	BEARMOUTH SPRINGS	Sonderegger et.al. 1981	SPRING	4160.0	46.7168	113.3032	20.2					2.00	163.0	0.5
MGEOT338	GARRICK GALEN	MBMG-GWIC	WELL		46.7191	112.0536	15.0	DOMESTIC	36.5	53.64	19 JUL 1990	73.20		
MGEOT345	LOLO HOT SPRINGS	Mariner et.al. 1976	SPRING	100.0	46.7522	114.5328	44.0					6.00	18.0	6.4
MGEOT069	MARYSVILLE DEEP WELL DEPTH 5750	Sonderegger et.al. 1981	WELL		46.7544	112.3750	96.7	UNUSED	161.5	2069.59	29 AUG 1975	51.00	176.0	20.0
MGEOT170	CHERRY CREEK SHEEP CO*26 MI N VANANDA MT	MBMG-GWIC	WELL	23.0	46.7675	106.9194	44.0	STOCK	90.2	1433.17	14 OCT 1978	240.00	2469.0	3.4
MGEOT162	OLSEN, JONAS * 9 MI NW FLATWILLOW MT.	MBMG-GWIC	WELL	1.9	46.8958	108.5597	27.0	STOCK		353.57	28 SEP 1978	1.65	226.0	1.5
MGEOT201	OLSEN JONAS * 14 MI NE N-BAR RANCH	MBMG-GWIC	WELL	2.3	46.8983	108.6122	16.0	STOCK		166.12	15 AUG 1979	3.70	275.0	0.6
MGEOT164	REYNOLDS, KEITH * 6 MI NE FLATWILLOW MT.	MBMG-GWIC	WELL	0.6	46.9141	108.3602	24.5	DOMESTIC	-49.3	518.16	30 SEP 1978	12.30	477.0	1.4
MGEOT163	HILL, FLOYD * 7 MI N FLATWILLOW MT.	MBMG-GWIC	WELL	1.6	46.9330	108.3825	15.0	STOCK		456.72	28 SEP 1978	11.30	475.0	0.9
MGEOT160	M-B 4 (BUTLER CK) * 6 MI NW MISSOULA MT	MBMG-GWIC	WELL	1.1	46.9597	114.0644	16.0	RESEARCH	0.8	686.05	09 FEB 1979	9.50	13.9	0.7
MGEOT254	KING, JOE & SONS INC. * 5 MI SSW WINNET MT	MBMG-GWIC	WELL	0.2	46.9677	108.4500	16.0	STOCK	-95.1	644.35	29 OCT 1980	57.20	820.0	10.0

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Reference	Type	Flow (l/min)	Latitude	Longitude	Temp (deg c)	Status/use	SWL (M)	Sample Depth (M)	Date	Chloride mg/l	Sulfate mg/l	Fluoride mg/l
MGEOT159	SHAW, BUD * 1.7 MI SW MOSBY MT.	MBMG-GWIC	WELL	21.0	46.9866	107.9158	29.0	DOMESTIC	-35.2	550.16	01 OCT 1978	16.35	337.0	3.2
MGEOT160	EAGER, REX * 2 MI SW WINNETT MT.	MBMG-GWIC	WELL	2.3	47.0008	108.3997	15.5	DOMESTIC	-42.2	518.16	30 SEP 1978	18.60	207.0	1.4
MGEOT161	BRATTON, WAYNE * 2 MI SE WINNETT MT.	MBMG-GWIC	WELL	0.8	47.0022	108.3244	24.2	DOMESTIC		643.74	01 OCT 1978	16.00	495.0	1.5
MGEOT305	BURLY VISTA TRACTS	MBMG-GWIC	WELL	6.8	47.0275	109.3691	46.0	DOMESTIC	10.7	120.40	27 NOV 1983	0.80	95.1	0.4
MGEOT157	TEIGEN, PETER * 9 MI E GRASSRANGE MT.	MBMG-GWIC	WELL	1.3	47.0347	108.6100	17.9	DOMESTIC		310.90	26 SEP 1978	26.50	552.0	0.8
MGEOT196	MATOVICH * 4.5 MI E GRASSRANGE MT	MBMG-GWIC	WELL	0.9	47.0491	108.7083	21.8	STOCK		312.72	15 AUG 1979	6.40	90.0	0.6
MGEOT181	HOLE NO 2 M-B DRILLING PROJECT	MBMG-GWIC	WELL	1.1	47.0525	114.2816	15.0	UNUSED	47.2	766.57	03 MAY 1979		16.9	0.4
MGEOT240	MSU AG EXPERIMENT STATION * MOCCASIN MT	MBMG-GWIC	WELL	0.5	47.0561	109.9516	15.0	IRRIGATION	21.9	493.78	31 JUL 1980	2.10	53.0	0.3
MGEOT155	BRADY, EARL*4 MI NW WINNETT, MT	MBMG-GWIC	WELL	0.8	47.0575	108.3575	15.8	STOCK	-14.1		27 SEP 1978	9.00	203.0	2.2
MGEOT203	GERDRUM, RONALD * 3 MI NE GRASS RANGE, MT.	MBMG-GWIC	WELL	0.7	47.0636	108.7750	15.9	DOMESTIC		297.18	15 AUG 1979	9.60	120.0	1.4
MGEOT152	CENEX*15 MI NE WINNETT MT	MBMG-GWIC	WELL	2.6	47.0788	108.0405	16.0	INDUSTRIAL/COMM	91.4		21 SEP 1978	16.45	331.0	2.6
MGEOT158	BASSETT, EARL * 7.5 MI NW TEIGEN MT.	MBMG-GWIC	WELL	0.2	47.1233	108.6758	17.0	STOCK	-28.2	347.47	26 SEP 1978	1.70	117.0	0.5
MGEOT059	HEDMAN, J.* 40 MI NE LEWISTOWN MT.	MBMG-GWIC	WELL-FLOWING	30.5	47.1416	108.5933	21.0	DOMESTIC	-56.3	336.19	07 MAY 1974	3.60	123.0	0.7
MGEOT156	HARRIS FLOYD * 11 MI NW TEIGEN MT	MBMG-GWIC	WELL	1.7	47.1577	108.7322	19.2	STOCK	-14.1	572.72	25 SEP 1978	2.20	240.0	2.4
MGEOT194	FOX, DENNIS * 7 MI NW GRASSRANGE MT	MBMG-GWIC	WELL	0.4	47.1711	108.9486	20.8	STOCK	15.5	436.17	16 AUG 1979	1.20	186.0	0.5
MGEOT239	LAURENCE HESS * 1 MI N MOCCASIN MT	MBMG-GWIC	WELL	0.8	47.2058	109.9363	15.0	STOCK	28.8	527.61	29 JUL 1980	2.70	67.2	0.3
MGEOT204	DELANEY, DOUGLAS*7 MI NW (WILD HORSE UNIT)	MBMG-GWIC	WELL	1.2	47.2105	108.7277	23.0	STOCK		335.28	16 AUG 1979	30.20	141.0	0.9
MGEOT050	BROOKS WARM SPRING * 2.5 MI NW BROOKS MT.	MBMG-GWIC	SPRING		47.2191	109.4733	20.0	IRRIGATION			17 AUG 1973			
MGEOT195	DELANEY, DOUGLAS * 11 MI NW ROY MT	MBMG-GWIC	WELL		47.2333	108.7694	21.3	STOCK		426.72	16 AUG 1979	12.80	342.0	2.9
MGEOT154	MILLER RANCH * 14 MI SE VALENTINE MT.	MBMG-GWIC	WELL	0.3	47.2486	108.1394	19.5	STOCK		603.20	23 SEP 1978	1825.00		2.3
MGEOT045	CARDINAL PET CO * 10 M E HILGER MT	MBMG-GWIC	WELL		47.2816	109.1686	26.7	UNUSED		1392.94	10 APR 1972	18.80	60.0	6.1
MGEOT153	BUSENBARK, MERLIN*1 MI S VALENTINE MT*	MBMG-GWIC	WELL	7.0	47.2991	108.4208	27.0	STOCK	-45.8	637.64	20 SEP 1978	63.40	1.9	6.7
MGEOT005	QUINN'S HOT SPRINGS	Sonderegger et.al. 1981	SPRING	284.0	47.3300	114.7872	43.3					3.00	29.0	2.1
MGEOT268	QUINN'S HOT SPRINGS * JIM AND DONNA BROWN	Sonderegger et.al. 1981	WELL-FLOWING	75.0	47.3300	114.7872	45.1	INDUSTRIAL/COMM	11.4	44.20	16 JAN 1981	2.30	28.8	2.3
MGEOT197	YEAGER * 8 MI EAST MOULTON, MT.	MBMG-GWIC	WELL	0.6	47.3333	109.1836	15.0	STOCK	0.9	258.47	17 AUG 1979	6.20	450.0	0.5
MGEOT079	FINLEY, R.S.*1 MI NW ST. IGNATIUS	MBMG-GWIC	WELL		47.3350	114.1175	19.0	DOMESTIC	8.7	16.15	05 MAR 1976	3.50	15.6	-0.1
MGEOT205	SIROKY, FRANK * 9 MI EAST ROY, MT.	MBMG-GWIC	WELL	0.6	47.3402	108.7672	19.0	DOMESTIC	7.9	636.42	16 AUG 1979	2.60	280.0	0.4
MGEOT192	HORYNA, JAMES * 6 MI E ROY MT	MBMG-GWIC	WELL	5.5	47.3533	108.8513	18.4	DOMESTIC	36.6	611.12	19 AUG 1979	4.30	415.0	0.4
MGEOT131	CORPS OF ENGINEERS SOUTH WELL AFTER PERFS	MBMG-GWIC	WELL	24.9	47.3611	114.3119	15.0	UNUSED	0.1	56.39	03 MAY 1978	85.80	0.2	4.9
MGEOT090	BRYSON, HAROLD*1 MI W MOIESE MT	MBMG-GWIC	WELL		47.3730	114.2830	15.5	STOCK	33.7	91.44	01 JUL 1976	36.95	1.0	2.0
MGEOT070	YARGER, ROBERT * 13 MI W CIRCLE MT	MBMG-GWIC	WELL	0.3	47.3830	105.8597	25.0	STOCK	30.5		23 JUL 1975	3.30	670.7	-0.1
MGEOT287	SAND COULEE WTR USERS BENCH W ABV SAND COU	MBMG-GWIC	WELL		47.3972	110.1763	15.0	PUBLIC SUPPLY	45.7	64.01	19 JUN 1982	12.30	71.0	1.1
MGEOT193	TAYLOR, JAMES * 8 MI E CHRISTINA MT	MBMG-GWIC	WELL	3.0	47.4005	109.1400	21.0	STOCK		435.86	19 AUG 1979	5.40	642.0	0.5
MGEOT288	CHARLES ENTSMINGER*TOWN OF NUMBER SEVEN	MBMG-GWIC	WELL	1.0	47.4036	110.1547	16.0	DOMESTIC	36.9	56.39	22 JUN 1982	4.00	132.0	0.4
MGEOT295	CUSTER, EVERETT* EDEN RT, GREAT FALLS, MT	MBMG-GWIC	WELL		47.4061	111.2605	15.5	DOMESTIC	9.8		13 MAY 1983	30.10	215.0	1.1
MGEOT297	TOWN OF TRACY	MBMG-GWIC	WELL		47.4133	111.1533	16.0	PUBLIC SUPPLY	27.4	60.96	15 JUN 1983	6.90	145.0	0.6
MGEOT054	SLOGSVOLD, A. K. * 17 M SE RITCHEY MT	MBMG-GWIC	WELL	0.4	47.4211	105.1347	21.1	STOCK	39.6		15 OCT 1973	29.00	1154.0	0.1
MGEOT211	GOVER * 2.5 MI TRAVIS SCHOOL	MBMG-GWIC	WELL	1.2	47.4308	111.5052	17.5	DOMESTIC	6.7	54.86	12 SEP 1979	18.30	360.0	1.0
MGEOT200	VILLAGE INN * 2.5 MI NE TRAVIS SCHOOL	MBMG-GWIC	WELL	1.5	47.4355	111.5016	18.5	PUBLIC SUPPLY	15.9	140.21	23 AUG 1979	13.50	120.0	4.9
MGEOT299	STONE, GENE	MBMG-GWIC	WELL		47.4411	114.6500	25.0	DOMESTIC		101.19	13 SEP 1983	2.50	6.6	2.3
MGEOT062	WEBB RES * 17.5 MI SE GERALDINE MT.	MBMG-GWIC	WELL		47.4469	110.3044	20.0	UNUSED		793.70	28 NOV 1973	6.40	57.0	0.8
MGEOT353	HOLLAND, JIM - GREEN SPRINGS	MBMG/UURI	SPRING		47.4513	114.6478	23.7	UNUSED			02 NOV 1993	12.00	17.0	2.1
MGEOT248	GREEN SPRINGS * HOLLAND RANCH	Sonderegger et.al. 1981	SPRING		47.4513	114.6478	26.0					5.00	18.0	2.2
MGEOT191	TACKE, ROBERT * 2 MI SW GREAT FALLS MT	MBMG-GWIC	WELL	6.0	47.4605	111.3475	15.0	DOMESTIC	35.4	168.25	21 AUG 1979	125.00	575.0	2.3
MGEOT198	PAUL, MICHAEL(ROBINSON)*3.5M SW GREATFALLS	MBMG-GWIC	WELL	34.1	47.4619	111.3516	17.0	DOMESTIC	111.9	259.69	22 AUG 1979	145.00	582.0	2.6
MGEOT318	BUTTE CREEK SPRING * SQUARE BUTTE	MBMG-GWIC	SPRING	764.6	47.4650	110.2000	18.8	STOCK			07 JUN 1985			
MGEOT319	BUTTE CREEK SPRING - NORTH * SQUARE BUTTE	MBMG-GWIC	SPRING		47.4650	110.2000	17.0	RESEARCH			07 JUN 1985			
MGEOT169	CHAMBERLAIN, CURTIS * 2 MI W LLER SCHOOL.	MBMG-GWIC	WELL	1.0	47.4686	107.4780	16.0	DOMESTIC	146.3	158.50	06 OCT 1978	14.05	1337.0	2.1
MGEOT321	MELTON, LARUE * LOWER AQUIFER	MBMG-GWIC	WELL		47.4691	114.4033	16.0	UNUSED		202.69	15 AUG 1985	8.60	10.3	0.6
MGEOT314	USGS - MELTON, LEON	MBMG-GWIC	WELL	3.7	47.4763	114.4091	16.5	UNUSED	33.4	100.89	15 OCT 1984	10.60	5.8	3.4
MGEOT238	SCHMIDT, LLOYD * 3.5 MI SE SQUARE BUTTE	MBMG-GWIC	WELL		47.4897	110.1591	21.8		175.8	526.39	10 JUL 1980	40.20	85.9	1.3
MGEOT190	USGS OBS WELL * .5 MI S VALLEY SCHOOL	MBMG-GWIC	WELL	3.9	47.5144	104.7750	27.1	RESEARCH	13.3	67.06	12 AUG 1979	2.50	735.0	0.2
MGEOT199	EIDEL * .5 MI S SUNSET MEMORIAL CEMETARY	MBMG-GWIC	WELL	4.0	47.5230	111.4633	16.0	DOMESTIC	28.5	39.62	23 AUG 1979	49.10	1220.0	0.6
MGEOT078	WEBSTER, BONITA*BOX 443 RONAN MT	MBMG-GWIC	WELL		47.5441	114.1563	15.5	DOMESTIC	0.3	138.07	05 MAR 1976	1.70	0.5	0.1
MGEOT099	DEMARS,TOM J.* 10 MI W OF WINIFRED MT.	MBMG-GWIC	WELL		47.5650	109.5925	17.0	DOMESTIC		27.43	22 SEP 1976	13.00	511.3	0.8
MGEOT249	HOMESTEAD ACRES COUNTY WATER DISTRICT	MBMG-GWIC	WELL		47.5802	111.3077	15.0	PUBLIC SUPPLY	137.2	328.57	24 OCT 1980	14.70	201.0	0.9
MGEOT250	HOMESTEAD ACRES COUNTY WATER DISTRICT	MBMG-GWIC	WELL	20.0	47.5808	111.3075	15.0	PUBLIC SUPPLY	152.4	328.57	24 OCT 1980	15.90	210.0	1.0
MGEOT241	MCCOLLUM, JIM * 10 MI NW MATHISON RANCH	MBMG-GWIC	WELL	6.5	47.5822	108.7183	18.8	DOMESTIC	71.0	496.82	26 AUG 1980	16.90	71.0	1.9
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT	MBMG-GWIC	WELL		47.5827	114.5063	21.5	UNUSED		84.12	04 MAR 1976	6.00	8.1	0.6
MGEOT047	* RYFFEL BROS. * 3MI S & 3 MI E HIGHWOOD	MBMG-GWIC	SPRING	757.1	47.5883	110.6802	18.6	DOMESTIC			04 AUG 1972			
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.	MBMG-GWIC	WELL		47.5952	114.5302	22.5	UNUSED	-0.0	60.96	17 AUG 1976	17.45	8.6	3.5
MGEOT307	HOT SPRINGS CITY	MBMG-GWIC	WELL		47.6063	114.6736	21.0	PUBLIC SUPPLY		116.74	31 MAY 1984	3.10	10.7	0.2
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	MBMG-GWIC	WELL		47.6063	114.6744	18.5	PUBLIC SUPPLY	2.7	116.74	27 AUG 1975	2.20	12.1	1.6
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	Sonderegger et.al. 1981	WELL	9.1	47.6075	114.6713	29.8	DOMESTIC		128.02	03 DEC 1979	7.80	21.2	5.2
MGEOT291	SOUTH EAST OF CAMP AQUA	MBMG-GWIC	WELL	10.1	47.6147	114.6655	51.5	RESEARCH			19 AUG 1982	9.90	9.6	5.7
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS	MBMG-GWIC	SPRING		47.6147	114.6658	44.0	RECREATIONAL			15 SEP 1975			
MGEOT080	HOT SPRINGS MONTANA	MBMG-GWIC	SPRING		47.6155	114.6477	43.0	RECREATIONAL			19 APR 1976			
MGEOT017	CAMAS HOT SPRINGS	Mariner et.al. 1976	SPRING	200.0	47.6155	114.6663	45.0					9.00	36.0	5.6
MGEOT352	SYMES HOTEL WELL	MBMG/UURI	WELL		47.6163	114.6763	33.3	DOMESTIC			02 NOV 1993	11.00	30.0	5.6
MGEOT029	SYMES HOT SPRINGS WELL	Sonderegger et.al. 1981	WELL	76.0	47.6163	114.6763	38.0					9.00	40.0	5.8
MGEOT081	HOT SPRING GEOTHERM WELL - UNNAMED	MBMG-GWIC	WELL		47.6169	114.6555	15.0	UNUSED			23 APR 1976	3.60	61.2	2.3
MGEOT355	KOEPLING, DELBERT * WELL 136	MBMG/UURI	WELL		47.6170	114.6761	26.5	IRRIGATION			03 NOV 1993	10.00	5.1	3.4
MGEOT354	OSTRANGER, DAVE * WELL 56	MBMG/UURI	WELL		47.6171	114.6775	17.2	IRRIGATION			03 NOV 1993	14.00	3.8	5.4
MGEOT077	VERNER, ROSE*3.75 MI W PABLO MT	MBMG-GWIC	WELL		47.6180	114.2108	17.5	DOMESTIC	16.2	45.72	05 MAR 1976	7.50	17.8	0.4
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS	MBMG-GWIC	WELL		47.6297	114.6236	19.5	DOMESTIC		69.80	17 AUG 1976	25.25	0.3	0.8
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	MBMG-GWIC	WELL	40.0	47.6302	114.5550	19.0	IRRIGATION		87.17	04 DEC 1979	27.00	1.4	4.3
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	MBMG-GWIC	WELL		47.6311	114.5613	15.2				08 SEP 1978	2.40	14.0	5.4
MGEOT042	SUN RIVER SPRINGS	Sonderegger et.al. 1981	SPRING	2690.0	47.6325	112.8542	30.4							
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	MBMG-GWIC	WELL	303.1	47.6347	114.5619	42.7	RESEARCH	-0.1	305.41	15 JAN 1981	34.80	21.5	3.1

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Reference	Type	Flow (l/min)	Latitude	Longitude	Temp (deg c)	Status/use	SWL (M)	Sample Depth (M)	Date	Chloride mg/l	Sulfate mg/l	Fluoride mg/l
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	MBMG-GWIC	WELL	10.0	47.6361	114.5750	32.6	IRRIGATION		73.15	29 NOV 1979	16.00	1.5	7.6
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	MBMG-GWIC	WELL	30.0	47.6372	114.5611	28.8	IRRIGATION		79.25	05 DEC 1979	34.60	0.6	4.2
MGEOT266	JACKOLA AP. 100 FT E. OF CAMP AQUA BATH SPA	MBMG-GWIC	WELL	416.5	47.6411	114.5700	51.0	INDUSTRIAL/COMM	1.8	79.55	04 JUN 1982	34.00	0.6	5.0
MGEOT027	CAMP AQUA AREA TEST WELL	Sonderegger et.al. 1981	WELL-FLOWING	1300.0	47.6422	114.5713	50.0	RESEARCH				33.00	4.0	3.9
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	MBMG-GWIC	WELL	75.0	47.6422	114.5713	43.7	RESEARCH		98.76	16 DEC 1980	35.30	0.7	4.3
MGEOT202	OLSEN, EDWIN * 8.4 MI NE WINIFRED MT	MBMG-GWIC	WELL	0.1	47.6425	109.3113	22.0	STOCK		495.00	19 AUG 1979	2650.00	2.0	2.0
MGEOT251	SMELSER, JAMES A. * POWER MT	MBMG-GWIC	WELL		47.6427	111.5830	16.0	STOCK	137.2	369.72	24 OCT 1980	765.00	13.8	1.5
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	MBMG-GWIC	WELL	20.0	47.6433	114.5636	30.6	IRRIGATION		76.20	02 DEC 1979	35.50	0.6	4.5
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	MBMG-GWIC	WELL	94.8	47.6436	114.5741	38.9	IRRIGATION		82.30	29 NOV 1979	31.30	1.3	7.8
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	MBMG-GWIC	WELL	40.0	47.6452	114.5686	32.5	IRRIGATION		76.20	02 DEC 1979	30.90	0.6	5.0
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	MBMG-GWIC	WELL		47.6472	114.5761	34.4	DOMESTIC		71.63	07 SEP 1978	23.10	2.1	4.6
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT	MBMG-GWIC	WELL	0.4	47.6516	114.5836	24.0	STOCK			02 JUL 1976	26.25	1.2	6.1
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	MBMG-GWIC	WELL		47.6536	114.5813	25.8	IRRIGATION			06 SEP 1978	10.90	1.8	4.4
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	MBMG-GWIC	WELL	94.9	47.6619	114.5838	20.3	IRRIGATION		79.25	02 DEC 1979	19.00	2.1	4.8
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	MBMG-GWIC	WELL	35.1	47.6700	114.5880	22.8	IRRIGATION			08 SEP 1978	2.20	6.9	3.2
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	MBMG-GWIC	WELL		47.6736	114.6027	23.6	DOMESTIC	18.3	91.44	30 NOV 1979	7.80	5.8	3.4
MGEOT149	MATOVICH,JOHN * 23 MI SW SUN PRAIRIE MT	MBMG-GWIC	WELL	0.8	47.6830	108.0702	16.0	STOCK	71.1		15 SEP 1978	56.80	521.0	3.7
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	MBMG-GWIC	WELL		47.6880	114.6538	16.6	DOMESTIC	22.9	95.71	06 DEC 1979	2.10	12.0	1.2
MGEOT075	LONEPINE OBSERVATION WELL	MBMG-GWIC	WELL		47.7141	114.6477	16.5	DOMESTIC	33.2		04 MAR 1976	6.30	12.2	0.9
MGEOT110	STREIT, GEORGE * 4MI E-1MI S FT BENTON MT.	MBMG-GWIC	WELL	0.6	47.8030	110.5769	15.0	STOCK		616.31	16 JAN 1977	94.00	1164.0	3.0
MGEOT243	WHITMAYER ASSOC * 4.5MI SE SUN PRAIRIE SCH	MBMG-GWIC	WELL	1.0	47.8194	107.6294	15.6	STOCK	152.4	583.69	13 SEP 1980	920.00	102.0	2.7
MGEOT109	CLARK, BRAD * 25 MI E FT. BENTON MT.	MBMG-GWIC	WELL		47.8297	110.1708	20.0	DOMESTIC	15.2	146.61	15 JAN 1977	146.00	1174.0	1.2
MGEOT114	LANDUSKY PLUNGE SPRINGS	Sonderegger et.al. 1981	SPRING	11000.0	47.8432	108.5987	24.0	DOMESTIC			16 AUG 1973	10.00	620.0	1.6
MGEOT072	LANDUSKY, I*8.5 MI S HAYS, MONTANA	Sonderegger et.al. 1981	SPRING	2378.0	47.8763	108.6572	20.3	IRRIGATION			23 SEP 1975	13.65	871.0	1.4
MGEOT046	BLACK COULEE * E OF TEST AREA	MBMG-GWIC	SPRING	56.8	47.9069	110.6586	28.8	UNUSED			03 AUG 1972	276.00	8230.0	0.4
MGEOT313	ALZHEIMER, PAUL * SW OF BRADY, MT	MBMG-GWIC	WELL		47.9097	111.9400	25.0	DOMESTIC		53.34	14 JAN 1985	25.20	646.0	0.6
MGEOT312	REVERE, LEE	MBMG-GWIC	WELL		47.9261	111.9533	25.0	DOMESTIC	0.3		14 JAN 1985	12.40	61.2	0.5
MGEOT049	LITTLE WARM SPRINGS*9 MI SE LODGEPOLE	Sonderegger et.al. 1981	SPRING	4542.4	47.9691	108.3963	26.1	DOMESTIC			16 AUG 1973	59.00	1144.0	1.4
MGEOT324	LODGEPOLE WARM SPRINGS	Sonderegger et.al. 1981	SPRING	10200.0	47.9936	108.4443	30.0					57.00	1060.0	1.1
MGEOT048	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	MBMG-GWIC	SPRING		47.9955	108.4466	30.6	DOMESTIC			16 AUG 1973	57.00	1062.0	1.1
MGEOT051	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	MBMG-GWIC	SPRING		47.9958	108.4508	26.0	IRRIGATION			04 OCT 1973	38.00	650.0	0.9
MGEOT052	KIRKALDIE, BRUCE*7 MI SW LODGEPOLE MT	MBMG-GWIC	SPRING	10363.7	47.9963	108.4491	24.5	IRRIGATION			28 NOV 1973	50.00	893.0	0.7
MGEOT037	LARGE CAPACITY WELL*4 MI SW WOLF POINT, MT	MBMG-GWIC	WELL	100.1	48.0313	105.7422	51.0	OTHER		32.00	22 OCT 1963		522.0	
MGEOT024	CITY OF WOLF POINT * WELL IN WOLF POINT	MBMG-GWIC	WELL	6.6	48.0847	105.6433	18.3	DOMESTIC		335.28	10 OCT 1947	1850.00	1.9	1.0
MGEOT023	SHERMAN HOTEL OF WOLF POINT	MBMG-GWIC	WELL	9.4	48.0936	105.6363	17.2	DOMESTIC		300.23	10 OCT 1947	2050.00	5.8	1.0
MGEOT038	USGS TEST WELL * 1 MILE SOUTH POPLAR, MT	MBMG-GWIC	WELL		48.0950	105.2050	13.9	OTHER			07 SEP 1963	9.20	281.0	0.5
MGEOT025	FOSS ELMER * 5.8 MI SE BROCTON	MBMG-GWIC	WELL	0.9	48.1116	104.7975	16.1	STOCK		208.48	05 OCT 1947	116.00	5.8	4.8
MGEOT317	LANDTECH WATER DISPOSAL SERVICE	MBMG-GWIC	WELL	2.6	48.1463	104.1969	17.9	INDUSTRIAL/COMM			25 MAY 1985	242.00	-0.2	5.2
MGEOT315	THORNESS, RICK * 4 MILES NW OF BAINVILLE	MBMG-GWIC	WELL		48.2013	104.2452	15.0	DOMESTIC	10.7	14.94	01 MAY 1985	9.50	640.0	0.5
MGEOT106	CLAWITER, MILT * 4MI N-4MI E BIG SANDY MT.	MBMG-GWIC	WELL		48.2313	110.0288	16.0	DOMESTIC	6.1	72.24	14 JAN 1977	156.00	617.0	1.9
MGEOT303	SIMS SPRING	MBMG-GWIC	SPRING		48.3325	105.4552	15.0				10 SEP 1983	4.20	34.6	0.1
MGEOT140	TEXACO INC * 1.7 MI NW CENTRAL SCHOOL.	MBMG-GWIC	WELL	0.9	48.4819	109.2083	35.5	INDUSTRIAL/COMM	-8.1	1027.48	21 AUG 1978	307.00	5.8	8.5
MGEOT252	MATOVAICH, MARTIN*17 MI E MALTA NEAR SACO	MBMG-GWIC	WELL	9.1	48.4847	107.5275	42.0	RECREATIONAL		975.36	27 OCT 1980	183.00	2120.0	1.9
MGEOT111	SLEEPING BUF REC AREA * 4MI NNW ASHFIELD	Sonderegger et.al. 1981	WELL		48.4852	107.5327	41.3	RECREATIONAL		971.70	10 MAY 1977	195.50	2147.0	2.9
MGEOT145	SHIRLE, WALTER * 3 MI S FRESNO DAM.	MBMG-GWIC	WELL	0.4	48.5563	109.9288	17.5	DOMESTIC	52.7	65.53	02 SEP 1978	182.60	665.0	1.8
MGEOT106	PIMLEY, DON * 4 MI NW JOPLIN MT.	MBMG-GWIC	WELL		48.5994	110.8166	15.0	DOMESTIC	54.9	85.34	05 DEC 1978	184.00	2668.0	0.4
MGEOT105	CADY, ELWIN * 7.5 MI NW JOPLIN MT.	MBMG-GWIC	WELL		48.6747	110.7955	25.0	DOMESTIC	24.4	30.48	05 DEC 1978	18.00	1060.0	0.1
MGEOT309	FRANCIS, CLARA	MBMG-GWIC	WELL		48.6875	104.4552	29.0	IRRIGATION	7.6		29 SEP 1984	85.80	1400.0	0.9
MGEOT107	WELSH, ORVILLE * 13 MI N-3MI E HINGHAM MT.	MBMG-GWIC	WELL	3.2	48.7405	110.3447	16.0	DOMESTIC	41.8	62.48	12 JAN 1977	47.00	1657.0	0.4
MGEOT310	EDWARDS, MARVIN / MIKE DUSTERHOFF	MBMG-GWIC	WELL		48.7694	112.4555	25.0	DOMESTIC		24.38	16 NOV 1984	44.00	1010.0	0.3
MGEOT039	BIG WEST OIL CO * 2 MI NE MTN VIEW SCHOOL	MBMG-GWIC	WELL		48.8397	112.0869	46.0	UNUSED	38.1		24 SEP 1965	8.00	190.0	
MGEOT104	RYGH, KEN * 22 MI N - 5 MI W JOPLIN MT.	MBMG-GWIC	WELL		48.8763	110.8813	21.0	DOMESTIC		149.35	04 DEC 1978	14.50	0.1	0.9
MGEOT142	BRADBURY, ALFRED * 11 MI E WILD HORSE MT	MBMG-GWIC	WELL	2.8	48.9130	110.1058	15.5	STOCK	12.2		07 SEP 1978		823.0	2.3
MGEOT144	NAGEHUS, ORVILLE * 3 MI N SIMPSON MT.	MBMG-GWIC	WELL	0.8	48.9686	110.2102	15.5	STOCK	21.3	59.74	04 SEP 1978		312.0	2.6

NOTE A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Std dev balance	Lab ph	Sc mmohs	Tds mg/l	Hco3 mg/l	Alkalinity	Sample type	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (sio2) mg/l	Arsenic ug/l
MGEOT209	TARGHEE SULPHUR SPRING*6MI W W YELLOWSTONE	-10.57	8.03	305.5	316.41	63.3		Dissolved	72.9	27.5	7.1	4.5	0.01	14.4	15.1
MGEOT177	UPPER WEST SPRING-STAUDENMEYER RANCH	0.51	8.29	607.0	395.15	249.0			67.3	25.0	26.9	6.9	0.02	20.6	
MGEOT123	UPPERMOST SPRING-STAUDENMEYER RANCH								67.5	24.5	25.8	6.8	0.01	20.1	
MGEOT126	UPPER-EAST SPRING-STAUDENMEYER RANCH								69.0	25.2	28.1	7.4	-0.01	22.7	
MGEOT125	LOWER WEST SPRINGS-STAUDENMEYER RANCH	0.32	7.44	625.5	400.95	251.0			68.0	24.0	29.0	7.7	-0.01	21.4	
MGEOT127	LOWER EAST SPRING-STAUDENMEYER RANCH	0.22	7.48	626.3	400.37	251.0		Dissolved	68.0	24.6	27.8	7.4	-0.01	23.3	
MGEOT124	UPPER WEST SPRING-STAUDENMEYER RANCH	0.55	7.52	617.2	395.24	249.0			67.0	24.0	27.9	7.2	0.02	20.8	
MGEOT121	ANDERSONS PASTURE SPRING #1								66.5	24.0	27.7	7.3	-0.01	21.4	
MGEOT122	ANDERSONS PASTURE SPRING #2	-0.08	7.47	627.0	400.75	247.0			71.0	24.0	26.9	7.3	0.01	21	
MGEOT210	USFS* BAKERS HOLE* 3MI N WEST YELLOWSTONE	0.20	7.76	310.8	256.64	152.0		Dissolved	11.2	6.0	46.0	7.0	0.01	79.9	21.8
MGEOT115	SLOAN COW CAMP SPRING		10.10		262		215		0.9	0.1	66.0	1.1	0.17	50.9	
MGEOT120	WEST FORK SWIMMING HOLE	-0.38	7.86	320.8	179.02	194.0			19.0	29.0	4.8	1.9	-0.01	13.7	
MGEOT118	CURLEW CREEK WARM SPRING								12.5	1.3	33.0	1.2	1.11	19.7	
MGEOT119	WALL CANYON WARM SPRING	-0.09	8.06	1097.0	703.41	493.0		Dissolved	6.6	1.7	260.0	6.0	0.06	41.7	
MGEOT229	WOLF CREEK HOT SPRING	0.83	6.81	492.9	331.67	157.0			8.0	1.4	104.0	1.6	-0.01	50.7	
MGEOT129	LOWELL HILDRETH SPRING*15 MI SW DILLON	0.17	7.44	722.0	480.7	217.0			66.0	27.5	26.3	4.5	-0.01	17.5	
MGEOT016	BEAR CREEK SPRINGS		9.50												
MGEOT132	VIGILANTE WARM SPRING	-0.49	7.74	617.7	403.41	182.0		Dissolved	64.5	27.0	6.7	3.1	-0.01	15.5	
MGEOT041	LA DUKE HOT SPRINGS		6.50		2230		299		320.0	58.0	230.0	23.0		49	
MGEOT012	BROWNS SPRINGS		7.40		480										
MGEOT010	PULLER HOT SPRINGS		7.70		1160		511		56.0	19.0	330.0	24.0		33	
MGEOT019	TRUDAU SPRINGS		8.40		540		425		78.0	30.0	70.0	11.1		19	
MGEOT040	CHICO HOT SPRINGS		7.40		342		172		35.0	6.8	35.0	6.8		34	
MGEOT032	GROUNDWATER*4.7 MI NE FT SMITH MT	-0.20	8.00	825.0	489.3	319.0		Dissolved	0.3	0.4	186.0	0.9	0.23	10	
MGEOT074	BROWN CATTLE CO* 3.1 MI N. BIRNEY MT	-0.70	8.53	1020.0	619.1	519.7			1.9	0.4	250.0	1.3	0.04	10.1	
MGEOT276	JARDINE HOT SPRINGS 0.25 MI E OF JACKSON	1.99	7.73	967.5	655.43	615.0		Dissolved	10.3	3.0	226.0	8.5	0.02	49.3	53.2
MGEOT289	MBMG GEOTHERMAL TEST * THEXTON TX-12	2.27	7.69	1338.0	1030.15	449.0		Dissolved	5.2	0.2	331.0	15.2	0.22	107	22.4
MGEOT028	JACKSON HOT SPRINGS		6.77		986		614		10.0	3.7	240.0	10.0		52	
MGEOT293	PRIVATE GEOTHERMAL TEST*ENNIS HOT SPRINGS*	0.84	7.84	1442.0	966.36	404.0		Dissolved	5.0	0.2	314.0	14.9	0.01	108	22.7
MGEOT277	LAPHAM DOMESTIC WELL 1 MI NW JACKSON, MT.	0.54	7.63	953.3	575.1	558.0		Dissolved	27.3	3.4	192.0	9.0	0.83	16.2	37.0
MGEOT117	ENNIS HOT SPRINGS														
MGEOT058	BROWN CATTLE CO * 9.5MI SW BIRNEY DAY SCH.	-0.64	8.26	992.0	600.36	531.0			2.2	0.1	243.0	1.4	0.05	9.7	
MGEOT031	BEAVERHEAD ROCK SPRINGS		7.20												
MGEOT133	APEX WARM SPRING	-0.33	7.78	519.5	340.92	140.0		Dissolved	62.0	16.2	23.4	3.2	-0.01	19.8	
MGEOT323	ELKHORN HOT SPRINGS		8.94		160		65		1.9	0.1	48.0	0.7		55	
MGEOT292	MARTIN, KIETH	-1.03	7.87	666.1	443.87	170.8		Dissolved	94.5	33.4	1.7	1.7	-0.00	10.7	
MGEOT326	NEW BILTMORE HOT SPRINGS		6.80		1970		232		290.0	73.0	160.0	24.0		46	
MGEOT308	NEWMAN, JOHN * JOLIET, MT	-0.99	7.72	6164.0	4639.66	486.0		Dissolved	20.1	12.9	1520.0	2.7	-0.00	7.8	
MGEOT280	ANDERSON SPRING	0.32	7.67	524.9	328.33	179.6		Dissolved	73.6	22.3	1.4	1.4	-0.00	11.5	
MGEOT006	ANDERSON'S SPRING		7.84	414.0	270		86		47.0	23.0	2.0	1.3		12.2	
MGEOT043	NORRIS HOT SPRINGS		7.60		651		383		19.0	3.2	190.0	11.0		78	
MGEOT015	POTOSI HOT SPRINGS		8.60		333		67		10.0	0.1	91.0	1.6		46	
MGEOT187	GROSS, PETE * 4 MI S PONY MT	1.29	8.36	474.4	368.76	67.3		Dissolved	13.2	0.1	94.6	1.7	0.01	47.7	
MGEOT311	MCFERRAN, EUGENE * BILLINGS, MT	0.85	7.36	1864.0	1140.2	1098.0		Dissolved	0.9	0.3	471.0	0.4	0.15	9.1	
MGEOT179	CARTER'S BRIDGE * 4 MI SE LIVINGSTON MT.								129.0	35.4	7.3	4.1	-0.01	19.4	1.1
MGEOT011	AVON WARM SPRING		6.90												
MGEOT264	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	6.43	9.41	715.1	434.4	52.5		Dissolved	2.3	0.1	115.0	2.4	0.01	71.2	5.0
MGEOT266	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	1.73	9.41	716.8	456.66	55.1		Dissolved	2.7	-0.0	136.0	2.5	-0.00	70.2	5.0
MGEOT265	BOZEMAN HOT SPRINGS * OLD WELL	0.11	9.43	713.9	462.34	53.7		Dissolved	1.3	-0.0	144.0	2.6	0.00	70.3	5.4
MGEOT263	BOZEMAN HOT SPRINGS * ORIGINAL SPRING	0.73	9.29	711.9	455.41	62.5		Dissolved	5.1	0.6	135.0	2.6	0.03	69.3	5.0
MGEOT335	BOZEMAN HOT SPRINGS		9.50		436		113		7.0	2.4	130.0	3.1		57	
MGEOT269	RANCA * MCLEOD	-0.41	7.58	2221.0	1983.42	118.3		Dissolved	454.0	79.1	13.4	11.5	0.70	30.6	
MGEOT259	SCOTT FEED LOT	0.98	8.93	2001.0	1269.15	1016.0		Dissolved	1.2	0.2	512.0	1.2	0.22	19.4	
MGEOT260	SCOTT FEED LOT	0.82	8.78	2521.0	1363.91	1169.0		Dissolved	1.2	0.2	559.0	1.1	0.06	20	
MGEOT230	BLUE JOINT CREEK HOT SPRING		8.22		179		67		2.6	0.1	38.0	0.3		54	
MGEOT002	BRIDGER CANYON WARM SPRING		7.70		275		209		54.8	22.7	4.0	1.4		8.2	
MGEOT334	LOVE, MELVIN*THREE FORKS, MT	2.06	7.92	396.5	317.3	264.7		Dissolved	62.1	13.8	23.4	4.5	0.00	32.1	26.0
MGEOT033	GROUNDWATER*5.3 MI W HARDIN MT	-1.55	7.60	3040.0	2935.17	160.0		Dissolved	665.0	136.0	14.0	24.0	1.50	16	
MGEOT332	SHIPTON, HAROLD * THREE FORKS MT	-0.43	8.07	593.9	369.54	264.9		Dissolved	59.0	26.4	27.0	5.2	-0.00	50.7	45.0
MGEOT258	HERMAN, T.E. * ROCKY RANCH 7.4 M W HARDIN	0.18	7.76	3294.0	3061.89	150.1		Dissolved	669.0	143.0	14.6	26.4	0.32	17.2	
MGEOT344	GALLOGLY HOT SPRING		9.12		190		89		3.0		43.0	0.7		43.7	
MGEOT245	LOST TRAIL * WARM AND HOT SPRINGS								3.0	-0.1	42.8	0.7	0.01	43.7	0.8
MGEOT089	CAIN MIKE*6.6 MI S VOLBERG	-0.39	8.30	1472.0	868.02	894.0			3.5	0.8	374.0	1.4	0.22	7.1	
MGEOT018	HUNTERS HOT SPRINGS		9.10		384		227		0.9	0.1	85.0	0.6		65	
MGEOT328	JORGENSON, JACK * THREE FORKS MT							Dissolved							61.0
MGEOT346	RENOVA HOT SPRINGS		7.50		655		310		51.0	13.0	150.0	13.0		37	
MGEOT339	WESTMORELAND * 9.1 M W SARPY SCHOOL	0.77	7.67	1837.8	1526.37	80.6		Dissolved	300.0	44.6	48.3	53.0	0.23	21	
MGEOT095	LISCOM RANCH * 5.5 MI NW OF N STACY SCHOOL	-0.71	8.61	1140.0	709.03	636.7			2.6	0.9	291.0	1.4	0.05	7.7	
MGEOT331	TINDER, L. MARIE * THREE FORKS MT	0.34	7.84	658.6	421.53	334.0		Dissolved	46.5	13.0	74.6	11.3	-0.00	49.5	116.0
MGEOT327	WILCOX, RALPH * THREE FORKS MT							Dissolved							130.0
MGEOT333	RICHARDSON, DEIRDRE * THREE FORKS	0.31	8.05	754.1	485.04	360.0		Dissolved	56.5	14.7	84.8	12.0	-0.00	50.2	78.0
MGEOT347	MEDICINE HOT SPRINGS		8.60		322		126		1.9	0.1	60.0	1.4		60	
MGEOT092	WESTERN ENERGY * 2 MI N COLSTRIP MT.	0.75	7.45	1900.0	1394.9	162.5		Dissolved	213.0	25.0	131.0	65.8	2.29	36.6	
MGEOT020	PIPESTONE HOT SPRINGS		8.70		396		108		2.6	0.1	98.0	1.9		66	
MGEOT082	FRED WETSTEON SPRING DEVELOP								4.5		95.8	2.3	-0.01	59.5	
MGEOT330	HART, FRANK * THREE FORKS, MT														
MGEOT063	ANADARKO PROD*6 MI E FOSTER MT	-2.31	8.75	22150.0	13237.2	0.0		Dissolved	87.0	29.0	5160.0	16.9	0.06	12.3	
MGEOT053	UN-NAMED SPRING * 29 M NE OF FOSTER MT								40.0	40.8	28.8	1.4	-0.01	1.6	
MGEOT128	COWAN SPRING*9MI NW THREE FORKS MT								14.5	6.8	41.6	3.6	0.12	3	

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Std dev balance	Lab ph	Sc mmohs	Tds mg/l	Hco3 mg/l	Alkalinity	Sample type	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (sio2) mg/l	Arsenic ug/l
MGEOT178	WOLF CREEK HOT SPRING							Dissolved				0.0	-0.01		8.0
MGEOT343	WILLIAMSBURG SPRING								19.9	5.3	6.1	2.3	0.09	9.7	1.9
MGEOT030	OIL WELL (TENSLEEP FORMATION)				2810										
MGEOT341	MONTANA RESOURCES MONITORING WELL C	-0.48	5.65	735.5	556.37	30.0		Dissolved	86.3	17.1	24.5	10.0	9.61	51.6	2.0
MGEOT342	MONTANA RESOURCES MONITORING WELL D2	0.58	6.36	1230.7	994.7	31.8		Dissolved	139.0	47.4	37.8	16.4	19.70	56.6	10.0
MGEOT055	HOWARD SPRING * 25 M SE OF BIGHORN MT	0.02	8.42	3237.0	2527.59	490.0			56.0	238.0	420.0	6.3	0.02	9.9	
MGEOT246	WENDT, FRED * .75 MI S GREGSON (FAIRMONT)	-0.95	8.30	243.1	173.34	106.8		Dissolved	20.7	1.0	29.1	2.8	0.22	43.1	3.3
MGEOT298	MBMG RESEARCH WELL * FAIRMONT HOT SPRINGS	-0.40	8.29	829.0	476.32	90.9		Dissolved	9.5	0.2	163.0	3.3	-0.00	3.8	
MGEOT165	NELSON, HARVEY * 5 MI S BROADVIEW MT	0.74	8.56	3921.0	2954.21	602.0		Dissolved	4.7	1.4	1004.0	1.7	0.02	9	
MGEOT061	BRADBROOK * 10 M S BROADVIEW MT	0.90	7.34	3726.0	3144.31	455.0		Dissolved	446.0	117.0	352.0	49.8	0.04	17.6	
MGEOT279	FAIRMONT HOT SPRINGS, ANACONDA								4.0	0.3	165.0	4.4	0.01	80.6	8.6
MGEOT247	SPANGLER, HAZEL * 2 MI E-NE GREGSON MT	0.79	7.71	433.0	294.23	156.2		Dissolved	33.2	9.9	36.9	7.3	0.02	56.8	
MGEOT214	HUNSAKER SPRING	-0.51	7.78	586.9	349.67	325.0		Dissolved	71.2	16.8	22.3	11.4	0.58	23.3	3.4
MGEOT150	*MONT. HIGHWAY DEPT * .75 MI SE WACO MT.*	0.55	8.07	3775.0	2806.74	379.0		Dissolved	14.2	5.0	914.0	2.4	0.02	7.1	
MGEOT213	PLUNKET LAKE WARM SPRINGS								38.5	23.5	22.4	2.4		15.5	1.7
MGEOT237	SPRINGS FROM JOINTS IN MISS CYN*SW PLUNKET	-0.82	8.48	497.3	299.55	183.0		Dissolved	48.0	23.0	22.7	2.7	-0.01	14.1	1.4
MGEOT151	MONTANA DEPT HIGHWAYS * 2.5 MI NE WACO MT	-0.55	8.50	2120.0	1416.54	504.0		Dissolved	16.8	11.1	477.0	1.7	0.01	7.5	
MGEOT216	HUNSAKER, MAURICE	-0.54	8.21	385.6	244.65	179.0		Dissolved	21.6	12.5	44.4	2.5	0.02	29.9	
MGEOT135	ANACONDA RED TRAVETINE MOUND-GEYSER	0.27	7.31	2624.0	2306.75	439.0		Dissolved	470.0	67.0	147.0	10.6	1.21	22.7	
MGEOT325	SLEEPING CHILD HOT SPRINGS		8.10		445		162		6.2	0.2	110.0	2.6		60	
MGEOT236	BRUCE, N *-IRRIGATION WELL WITH BOOSTER	0.02	7.66	651.3	434.57	194.0		Dissolved	53.8	18.5	55.7	4.7	-0.01	48.4	6.0
MGEOT294	TOSTON WARM SPRING	-0.44	7.54	421.1	258.63	200.1		Dissolved	46.6	16.8	16.1	2.5	-0.00	18.4	4.1
MGEOT218	TOSTON WARM SPRING								48.7	20.2	13.6	3.8	-0.01	19.8	
MGEOT217	BRUCE, NORMAN	-0.06	7.05	1798.0	1374.26	30.7		Dissolved	279.0	3.0	129.0	5.5	0.03	31.9	1.3
MGEOT215	KIMPTON SPRING	-0.30	8.43	203.3	125.18	101.0		Dissolved	25.8	7.2	5.3	0.8	0.01	17.1	0.9
MGEOT134	*WARNER WARM SPRING*								25.6	6.8	5.4	0.9	*-0.01*	18	
MGEOT172	STEELE, WILLIAM * 12.5 MI SE PINEVIEW MT.	0.77	7.98	4583.0	3293.74	362.0		Dissolved	19.0	4.6	1074.0	3.8	0.02	7	
MGEOT284	MBMG TEST WELL*WARM SPRINGS STATE HOSPITAL	-3.59	7.54	1497.0	1178.78	263.5		Total Recovere	196.0	23.1	124.0	24.4	21.40	28.4	0.3
MGEOT009	WARM SPRINGS		8.48		1310		258		220.0	22.0	120.0	26.0		56	
MGEOT233	WARM SPRINGS STATE HOSPITAL	0.48	7.03	1662.0	1273.39	290.0		Dissolved	216.0	24.5	114.0	31.5	10.80	37.7	
MGEOT231	WARM SPRINGS STATE HOSPITAL	-1.04	7.34	1534.0	1256.29	301.6		Dissolved	218.0	24.5	126.0	32.9	0.36	33.6	14.9
MGEOT349	BOULDER HOT SPRINGS - UPPER SPRING	-0.62	6.69	434.0	419.46		161	Dissolved	2.7	0.4	122.0	3.8	-0.01	93.2	0.7
MGEOT351	*BOULDER HOT SPRINGS - LOWER SPRING*	-0.30	6.80	430.0	*401.44*		158	Dissolved	3.2	-0.0	111.4	6.1	0.31	90	-0.5
MGEOT350	BOULDER HOT SPRINGS - MIDDLE SPRING	-0.26	6.89	426.0	421.14		153	Dissolved	2.0	0.3	116.2	4.1	0.08	96.5	-0.5
MGEOT232	WARM SPRINGS STATE HOSPITAL * SPRING								225.6	23.1	121.4	23.8	0.06	55.8	23.0
MGEOT185	M-B NO. 12 * 5 MI NE HAMILTON MT	0.68	7.37	497.1	338.3	290.0		Dissolved	68.2	11.8	20.7	4.4	0.03	59.3	
MGEOT171	*GRIERSON, J.B.*2.5MI NE RANCHERS CEMETARY.*	-0.23	7.97	4171.0	2365.96	613.0		*Dissolved*	4.3	0.8	956.0	2.6	0.06	12.4	
MGEOT130	PRISON RANCH SPRING SITE NO. 4								3.9	0.1	45.8	0.5	-0.01	45.8	
MGEOT113	DEER LODGE PRISON RANCH WELL		8.98		172		66		3.9	0.1	46.0	0.5		45.8	
MGEOT044	BEDFORD SPRINGS		7.20		350		155		57.0	22.0					
MGEOT101	GRIERSON, J.B. * 23 MI NW HYSHAM MT	1.05	8.09	4508.0	3201.72	638.7		Dissolved	21.6	11.0	1050.0	4.1	0.05	6	
MGEOT275	MBMG RESEARCH WELL * WEED CREEK-1B	2.04	9.82	3202.0	2022.05	294.3		Dissolved	2.4	0.7	700.0	1.8	0.03	0.8	
MGEOT274	MBMG RESEARCH WELL * WEED CREEK-1A	2.64	8.93	3054.5	2002.53	463.0		Dissolved	2.0	1.3	674.0	1.9	0.05	7.5	
MGEOT255	HANSER, BILL * 3 MI SW TWO DOT MT	-0.42	9.22	1165.0	691.12	604.0		Dissolved	1.1	0.2	290.0	0.9	0.01	12.5	
MGEOT256	FOX INC * 1.5 MI W-SW TWO DOT	0.96	9.39	836.0	489.59	368.0		Dissolved	0.6	-0.1	197.0	0.4	0.01	14	
MGEOT257	HOMER, RAY * TWO DOT WATER SUPPLY	-0.12	9.35	755.0	443.51	312.0		Dissolved	1.1	0.1	178.0	0.5	0.05	13.2	
MGEOT296	HARLOWTON * SOUTH MUNICIPAL WELL	-0.95	8.94	909.9	558.33	383.0		Dissolved	2.0	0.1	223.0	0.2	0.01	10.2	
MGEOT013	HILLBROOK FLOWING WELL		6.90		1060		788		32.0	5.6	340.0	20.0		67	
MGEOT014	WALLS HOT SPRING				651		489		18.0	3.5	210.0	10.0		60	
MGEOT001	ALHAMBRA HOT SPRINGS NORTH		7.23		909		484		18.0	3.5	220.0	9.5		66	
MGEOT278	TOWNSEND,HERB*2.5 MI SW WHITE SULPHUR SPGS	0.72	7.89	409.7	237.25	192.5		Dissolved	48.0	15.1	10.9	2.0	0.01	15.9	1.6
MGEOT290	*RALPH JOHNSON,P.O.BOX 65,WHITE SULPHUR SPR*	1.58	8.63	7678.0	5700.36	2533.0		*Dissolved*	2.5	3.4	2130.0	19.0	*0.01*	44	11.8
MGEOT004	WHITE SULPHUR SPRINGS		6.80		1950		835		44.0	12.0	480.0	20.0		51	
MGEOT282	WHITE SULPHUR SPRINGS BANK WELL	-0.77	7.82	2169.0	1298.68	791.0		Dissolved	41.0	9.5	433.0	17.5	0.10	43.7	-1.0
MGEOT168	WATTS, JAMES * 16 MI NE KINSEY MT	-0.19	9.03	1303.0	805.43	709.0		Dissolved	1.0	0.2	340.0	0.6	0.03	10	
MGEOT184	M-B NO 8 WELL*2.5 MI SE CORVALLIS MT	0.29	7.31	269.8	222.97	113.0		Dissolved	20.8	5.3	25.1	4.9	0.51	70	
MGEOT007	BROADWATER HOT SPRINGS WELL				598		193		13.0	0.8	180.0	5.9		93	
MGEOT008	GLOEGE WELL		7.40		403		269		78.0	16.0	38.0	3.4		28	
MGEOT003	GARRISON WARM SPRINGS		7.30		556		59		77.0	35.0	24.0	5.2		18.2	
MGEOT337	CHADWICK, GREG							Dissolved				0.0			
MGEOT206	USGS OBS WELL * 4 MI SW EAST HELENA, MT.	-0.82	7.76	802.0	453.89	316.0		Dissolved	96.0	31.5	30.8	4.7	-0.01	15.8	
MGEOT336	MUELLER BUZZ							Dissolved							
MGEOT242	FLORENCE TEST WELL A	-1.38	8.80	354.9	207.65	164.5		Dissolved	1.0	0.2	61.3	2.9	2.70	4.9	
MGEOT329	SIVERTE MYSSE * BOX 315 * INGOMAR MT 59039	0.71	8.19	3105.0	2104.12	1795.0		Dissolved	3.0	0.5	643.0	1.8	0.02	21.8	
MGEOT167	CHERRY CK SHEEP CO.*1.35MI SE HAGEN RANCH.	-1.07	8.08	3106.0	2137.33	1828.0		Dissolved	3.5	0.8	871.0	2.4	0.03	20.4	
MGEOT261	MOORE, THOMAS * 6.5 MI SW ANGELA MT	-5.96	7.28	9968.0	5918.73	293.0		Dissolved	394.0	65.2	1684.0	115.0	0.08	50.8	
MGEOT322	BYRNE WARM SPRING * WEST OF BEARMOUTH								137.0	35.3	12.2	3.3	-0.00	20.7	8.3
MGEOT116	NIMROD SPRINGS		7.63		630		168		126.0	36.0	16.0	3.4		21	
MGEOT026	BEARMOUTH SPRINGS		7.69		420		220		89.0	28.0	8.0	1.8		16	
MGEOT338	GARRICK GALEN							Dissolved							
MGEOT345	*LOLO HOT SPRINGS*		9.30		224		86		1.8	0.1	52.0	1.2		72	
MGEOT069	MARYSVILLE DEEP WELL DEPTH 5750	3.01	6.62	1004.0	672.39	264.0		Dissolved	7.7	0.4	208.0	10.4	0.02	68.5	
MGEOT170	CHERRY CREEK SHEEP CO*26 MI N VANANDA MT	0.23	7.25	5062.0	4245.76	346.0			456.0	101.0	705.0	78.6	0.78	21.5	
MGEOT162	OLSEN, JONAS * 9 MI NW FLATWILLOW MT.	0.08	8.04	1005.0	656.12	360.0		Dissolved	28.2	11.5	190.0	4.9	0.01	13.1	
MGEOT201	OLSEN JONAS * 14 MI NE N-BAR RANCH	0.15	8.41	710.6	585.82	233.0		Dissolved	79.2	39.0	53.5	7.1	0.12	9.8	
MGEOT164	REYNOLDS, KEITH * 6 MI NE FLATWILLOW MT.	1.20	8.36	1670.0	1117.44	436.0		Dissolved	5.9	1.8	384.0	2.6	0.15	13.5	
MGEOT163	HILL, FLOYD * 7 MI N FLATWILLOW MT.	0.83	8.23	1606.0	1078.47	402.0		Dissolved	6.8	1.8	368.0	3.1	0.12	13	
MGEOT180	M-B 4 (BUTLER CK) * 6 MI NW MISSOULA MT	-2.54	7.66	919.5	707.83	651.0		Dissolved	10.4	5.4	237.0	9.0	8.90	91.9	
MGEOT254	KING, JOE & SONS INC. * 5 MI SSW WINNET MT	0.99	8.41	3276.0	2056.04	626.0		Dissolved	8.3	2.9	726.0	4.2	0.93	12.6	

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Std dev balance	Lab ph	Sc mmohs	Tds mg/l	Hco3 mg/l	Alkalinity	Sample type	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (sio2) mg/l	Arsenic ug/l
MGEOT159	SHAW, BUD * 1.7 MI SW MOSBY MT.	-0.02	8.40	1512.0	995.54	509.0		Dissolved	3.9	0.9	363.0	2.1	0.35	13.8	
MGEOT160	EAGER, REX * 2 MI SW WINNETT MT.	-0.77	8.27	1134.0	727.86	429.0		Dissolved	6.0	2.0	267.0	2.7	0.02	11.9	
MGEOT161	BRATTON, WAYNE * 2 MI SE WINNETT MT.	0.37	8.30	1659.0	1126.06	411.0		Dissolved	6.9	2.0	387.0	2.7	0.39	14.2	
MGEOT305	BURLY VISTA TRACTS	0.46	7.51	602.1	355.09	280.6		Dissolved	73.4	29.9	5.7	4.4	0.42	6.7	
MGEOT157	TEIGEN, PETER * 9 MI E GRASSRANGE MT.	0.46	7.59	1571.0	1138.23	411.0		Dissolved	162.0	74.8	98.1	11.2	0.83	9.6	
MGEOT196	MATOVICH * 4.5 MI E GRASSRANGE MT	-0.64	7.96	592.3	365.71	267.0		Dissolved	51.2	20.9	50.1	4.7	-0.01	10.2	
MGEOT181	*HOLE NO 2 M-8 DRILLING PROJECT*	-0.62	7.86	675.6	435.76	450.0		*Dissolved*	5.7	1.1	171.0	2.0	0.35	16.6	
MGEOT240	MSU AG EXPERIMENT STATION * MOCCASIN MT	0.14	7.69	443.9	256.92	215.0		Dissolved	51.5	14.4	16.3	4.3	1.86	9.1	
MGEOT155	BRADY, EARL*4 MI NW WINNETT, MT	0.31	8.30	1125.0	715.94	444.0		Dissolved	8.9	3.1	252.0	3.4	0.82	14.6	
MGEOT203	GERDRUM, RONALD * 3 MI NE GRASS RANGE, MT.	-0.15	8.72	780.0	503.98	334.0		Dissolved	24.7	10.6	148.0	3.5	0.54	11.5	
MGEOT152	CENEX*15 MI NE WINNETT MT	0.58	8.63	1461.0	953.62	426.0		Dissolved	2.1	0.4	347.0	1.3	0.17	13.5	
MGEOT158	BASSETT, EARL * 7.5 MI NW TEIGEN MT.	-0.21	8.29	643.0	400.64	251.0		Dissolved	9.6	4.6	130.0	2.4	1.57	9.7	
MGEOT059	HEDMAN, J. * 40 MI NE LEWISTOWN MT.	-0.17	8.13	725.0	432.21	269.0			3.2	1.9	154.5	1.7	1.35	9.6	
MGEOT156	*HARRIS FLOYD * 11 MI NW TEIGEN MT*	-1.02	8.19	1167.0	747.06	429.0		Dissolved	18.0	7.3	251.0	2.7	0.21	11.9	
MGEOT194	FOX, DENNIS * 7 MI NW GRASSRANGE MT	-1.07	8.14	615.5	434.82	188.0		Dissolved	60.8	17.9	60.4	3.0	0.27	12.1	
MGEOT239	LAURENCE HESS * 1 MI N MOCCASIN MT	-0.55	7.78	576.5	330.32	276.0		Dissolved	54.7	20.6	33.8	5.2	1.47	8.3	
MGEOT204	DELANEY, DOUGLAS*7 MI NW (WILD HORSE UNIT)	0.30	8.29	862.0	532.05	309.0		Dissolved	10.9	5.6	178.0	2.6	0.26	10.3	
MGEOT050	BROOKS WARM SPRING * 2.5 MI NW BROOKS MT.								114.0	39.0	3.6	1.4	-0.01	10.7	
MGEOT195	DELANEY, DOUGLAS * 11 MI NW ROY MT	-0.93	8.41	1373.0	877.78	374.0		Dissolved	9.6	4.0	305.0	2.4	0.44	11	
MGEOT154	MILLER RANCH * 14 MI SE VALENTINE MT.	0.57	8.02	7535.0	4429.88	1630.0		Dissolved	5.9	2.1	1770.0	5.3	0.10	16.3	
MGEOT045	CARDINAL PET CO * 10 M E HILGER MT	0.77	8.52	1017.0	577.63	487.0			7.1	1.6	219.0	5.4	4.09	1.3	
MGEOT153	BUSENBARK, MERLIN*1 MI S VALENTINE MT*	-0.63	8.45	2587.0	1608.34	1639.0		Total Recovera	1.4	0.3	668.0	2.1	-100.00	16.5	
MGEOT005	QUINN'S HOT SPRINGS		8.90		224		71		3.6	0.2	39.0	1.5		76.6	
MGEOT268	QUINN'S HOT SPRINGS * JIM AND DONNA BROWN	0.71	8.70	206.1	185.68	51.2		Dissolved	2.7	-0.1	39.3	1.3	0.03	73.5	0.6
MGEOT197	YEAGER * 8 MI EAST MOULTON, MT.	1.05	8.29	1510.0	985.7	359.0		Dissolved	10.7	6.0	322.0	2.5	0.01	10.9	
MGEOT079	FINLEY, R.S.*1 MI NW ST. IGNATIUS	0.32	7.82	510.6	293.17	322.3		Dissolved	72.0	18.8	12.2	0.7	-0.01	11	
MGEOT205	SIROKY, FRANK * 9 MI EAST ROY, MT.	-0.05	9.12	1274.0	828.12	381.0		Dissolved	1.1	0.1	304.0	0.6	0.02	18	
MGEOT192	HORYNA, JAMES * 6 MI E ROY MT	1.08	9.18	1586.0	1036.58	398.0		Dissolved	1.9	0.4	366.0	1.2	0.13	16.6	
MGEOT131	CORPS OF ENGINEERS SOUTH WELL AFTER PERFS	0.30	8.17	1101.0	646.15	574.0		Dissolved	24.6	10.1	221.0	6.6	3.05	8.9	
MGEOT090	BRYSON, HAROLD*1 MI W MOIESE MT	-0.97	7.60	950.9	553.38	553.6			35.6	15.2	167.0	3.8	2.04	16.8	
MGEOT070	YARGER, ROBERT * 13 MI W CIRCLE MT	-1.06	8.38	1818.0	1260.09	410.4		Dissolved	32.2	142.4	190.0	10.6	-0.01	12.2	
MGEOT267	SAND COULEE WTR USERS BENCH W ABV SAND COU	0.31	7.69	789.2	453.57	444.0		Dissolved	51.7	69.9	17.2	2.9	0.01	7.5	
MGEOT193	TAYLOR, JAMES * 8 MI E CHRISTINA MT	-0.62	9.01	2032.0	1349.59	389.0		Dissolved	2.4	0.2	476.0	1.2	0.06	11.5	
MGEOT266	CHARLES ENTSMINGER*TOWN OF NUMBER SEVEN	0.41	7.94	596.3	393.48	246.9		Dissolved	79.6	28.7	11.4	2.5	-0.00	12.3	
MGEOT295	*CUSTER, EVERETT* EDEN RT, GREAT FALLS, MT*	0.49	7.48	808.0	557.4	255.0		Dissolved	100.0	36.1	30.7	4.4	0.00	14.1	0.2
MGEOT297	TOWN OF TRACY	0.23	7.57	623.8	407.36	236.2		Dissolved	82.2	29.1	12.4	2.3	0.02	11.8	0.9
MGEOT054	SLOGSVOLD, A. K. * 17 M SE RITCHEY MT	-0.57	7.64	2770.0	2402.46	1014.0			362.0	286.0	32.0	7.9	0.01	13.2	
MGEOT211	GOVER * 2.5 MI TRAVIS SCHOOL	-0.04	7.95	1557.0	1048.74	574.0		Dissolved	57.9	34.2	264.0	7.5	1.57	20.8	
MGEOT200	VILLAGE INN * 2.5 MI NE TRAVIS SCHOOL	0.91	8.16	1295.0	798.12	680.0		Dissolved	24.0	8.2	274.0	7.5	0.23	10.8	1.7
MGEOT299	STONE, GENE	0.81	9.78	236.2	181.7	3.2		Dissolved	0.6	-0.1	50.9	0.6	-0.00	56.4	
MGEOT062	WEBB RES * 17.5 MI SE GERALDINE MT.	-0.68	9.01	462.7	285.19	157.0			47.0	13.6	36.0	5.7	0.01	10.3	
MGEOT353	HOLLAND, JIM - GREEN SPRINGS	-0.11	9.86	195.0	208.38		73	Dissolved	0.8	1.2	57.1				
MGEOT246	GREEN SPRINGS * HOLLAND RANCH		9.20		280		125								
MGEOT191	TACKE, ROBERT * 2 MI SW GREAT FALLS MT	-0.55	7.57	1775.0	1280.1	348.0		Dissolved	182.0	75.4	132.0	13.5	3.37		1.1
MGEOT198	PAUL, MICHAEL(ROBINSON)*3.5M SW GREATFALLS	-0.39	7.67	1926.0	1375.49	385.0		Dissolved	224.0	71.1	124.0	13.4	2.22	20.6	0.3
MGEOT318	BUTTE CREEK SPRING * SQUARE BUTTE								36.6	7.9	23.9	3.6	0.03	18.1	0.6
MGEOT319	BUTTE CREEK SPRING - NORTH * SQUARE BUTTE								32.2	8.4	26.5	2.9	0.01	16.8	0.4
MGEOT169	CHAMBERLAIN, CURTIS * 2 MI W LLER SCHOOL.	-0.41	8.43	3633.0	2587.91	640.0			10.2	2.0	889.0	2.5	0.16	8.2	
MGEOT321	MELTON, LARUE * LOWER AQUIFER	-1.07	7.34	399.2	259.61	244.9		Dissolved	11.1	1.1	83.5	6.6	0.83	15.5	
MGEOT314	USGS - MELTON, LEON	0.06	8.18	367.4	215.58	191.8		Dissolved	12.2	5.2	61.4	1.2	-0.00	21.1	
MGEOT236	SCHMIDT, LLOYD * 3.5 MI SE SQUARE BUTTE	0.19	7.85	910.0	524.17	365.0		Dissolved	45.6	14.2	128.0	7.7	0.33	11	
MGEOT190	USGS OBS WELL * .5 MI S VALLEY SCHOOL	-13.71	8.12	1656.0	1284.72	232.0		Dissolved	210.0	151.0	43.4	7.1	1.32	19.8	
MGEOT199	EIDEL * .5 MI S SUNSET MEMORIAL CEMETARY	-1.24	7.90	3182.0	2362.2	651.0		Dissolved	112.0	114.0	523.0	11.9	0.14	10.6	2.0
MGEOT078	WEBSTER, BONITA*BOX 443 RONAN MT	-0.15	7.91	286.4	173.21	188.3		Dissolved	29.8	10.9	17.6	1.0	-0.01	18.8	
MGEOT099	DEMARS,TOM J.* 10 MI W OF WINIFRED MT.	0.69	7.51	1463.0	1045.4	390.4		Dissolved	183.5	57.5	94.5	4.1	0.03	7.9	-2.0
MGEOT249	*HOMESTEAD ACRES COUNTY WATER DISTRICT*	-0.03	7.76	813.0	505.57	250.0		*Dissolved*	86.0	38.1	26.4	4.4	0.33	10.6	
MGEOT250	HOMESTEAD ACRES COUNTY WATER DISTRICT	-0.69	8.35	777.0	501.93	223.0		Dissolved	83.2	39.0	27.7	4.8	0.21	10.2	
MGEOT241	MCCOLLUM, JIM * 10 MI NW MATHISON RANCH	-0.65	8.97		962.79	607.0		Dissolved	1.2	0.2	401.0	1.0	0.05	11	
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT	0.09	7.96	330.2	195.26	196.9		Dissolved	32.3	13.0	19.9	1.4	-0.01	16.2	
MGEOT047	* RYFFEL BROS. * 3MI S & 3 MI E HIGHWOOD								57.0	19.0	52.0	3.6		29	
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.	0.56	7.83	622.3	374.62	366.9		Dissolved	20.0	9.4	113.0	3.5	0.02	17.5	
MGEOT307	HOT SPRINGS CITY	0.76	7.99	253.6	172.15	149.3		Dissolved	17.2	4.0	32.0	3.1	0.07	28.1	
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	-0.46	8.74	245.6	156.07	127.8			15.2	3.6	33.0	3.0	0.17	22	
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	-0.63	9.46	383.5	286.58	84.6		Dissolved	0.9	-0.1	92.3	0.0	0.61	67	-1.0
MGEOT291	SOUTH EAST OF CAMP AQUA	-0.59	9.34	381.8	270.69	109.3		Dissolved	0.6	-0.1	85.8	1.7	-0.00	69.6	-1.0
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS								1.1	0.3	83.0	1.8	-0.01	58	
MGEOT080	HOT SPRINGS MONTANA								1.0	0.1	83.5	1.8	0.01	59	
MGEOT017	CAMAS HOT SPRINGS		9.40		399		189		0.9	0.1	85.0	1.7		70	
MGEOT352	SYMES HOTEL WELL	-0.01	9.66	280.0	297.16		131	Dissolved	0.6	0.7	89.4	2.2	-0.02	73.06	-0.5
MGEOT029	SYMES HOT SPRINGS WELL		9.80		367		156		1.2	0.2	91.0	1.7		68	
MGEOT081	HOT SPRING GEOTHERM WELL - UNNAMED	-0.67	7.08	341.3	220.43	101.0			16.4	5.2	43.2	5.6	0.07	32.8	
MGEOT355	KOEPLING, DELBERT * WELL 138	0.04	8.23	266.0	275.02		236	Dissolved	4.5	-0.2	95.6	2.9	0.06	36.64	-0.5
MGEOT354	OSTRANGER, DAVE * WELL 56	-0.07	8.05	312.0	290.91		278	Dissolved	5.5	2.5	109.3	-0.6	0.39	12.96	-0.5
MGEOT077	VERNER, ROSE*3.75 MI W PABLO MT	-0.54	8.06	726.8	436.13	472.3		Dissolved	33.7	36.1	88.5	3.1	0.01	14.8	
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS	-0.78	7.51	471.8	283.29	264.5		Dissolved	37.0	11.9	48.0	3.9	5.80	21.9	
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	-0.67	8.06	592.9	375.46	324.0		Dissolved	5.5	1.0	139.0	2.1	0.26	35	19.5
MGEOT178	*KOPP, ARVID * HOT SPRINGS, MT*	-0.29	8.12	404.8	244.61	221.0		Dissolved	6.6	1.6	88.1	1.9	0.39	14.3	100.0
MGEOT042	SUN RIVER SPRINGS		7.20		890										
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	0.62	8.32	663.9	405.72	321.0		Dissolved	15.5	2.8	129.0	3.8	0.16	36.8	2.6

NOTE: *A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).*

MGEOT DATABASE

ID	Site name	Std dev balance	Lab ph	Sc mmohs	Tds mg/l	Hco3 mg/l	Alkalinity	Sample type	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (sio2) mg/l	Arsenic ug/l
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	-0.96	8.71	472.4	304.15	237.0		Dissolved	2.1	0.3	117.0	1.5	0.22	32.4	2.4
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	0.99	7.89	656.7	403.19	348.0		Dissolved	4.0	0.7	147.7	2.8	0.26	34.9	14.6
MGEOT286	JACKOLA AP 100 FT E. OF CAMP AQUA BATH SPA	0.53	8.53	651.2	413.14	327.0		Dissolved	2.9	0.2	152.0	3.1	-0.00	43.2	0.2
MGEOT027	CAMP AQUA AREA TEST WELL		8.40		420		351		3.2	0.3	152.0	4.0		42.2	
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	2.03	8.21	555.6	390.02	343.0		Dissolved	12.6	2.4	127.0	3.3	0.11	35.3	0.6
MGEOT202	OLSEN, EDWIN * 8.4 MI NE WINIFRED MT	-2.48	8.09	9117.0	5325.18	608.0		Dissolved	10.0	3.3	2141.0	4.7	0.12	12.4	
MGEOT251	SMELSER, JAMES A. * POWER MT	0.37	7.83	3596.0	1981.91	807.0		Dissolved	25.6	9.5	750.0	10.6	0.06	7.8	
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	0.38	8.26	668.4	419.64	354.0		Dissolved	3.3	0.4	154.4	2.6	0.13	43.6	5.6
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	-0.38	8.38	593.7	394.41	314.0		Dissolved	4.8	1.0	144.0	2.8	0.65	41.4	0.7
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	0.52	8.40	635.6	384.72	328.0		Dissolved	4.4	0.4	142.0	2.1	0.12	36.6	3.3
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	-0.87	8.63	633.6	395.26	326.0		Dissolved	3.6	0.6	150.0	3.4	0.02	36.5	1.0
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT	0.49	8.18	617.2	381.08	331.8			5.7	0.6	139.0	3.7	0.11	32.9	
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	-0.21	9.16	470.6	338.76	280.0		Dissolved	4.6	0.7	127.0	2.7	0.03	29.3	6.7
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	-0.89	8.48	537.0	345.3	287.0		Dissolved	3.3	0.4	134.0	1.7	0.09	28.6	4.2
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	-0.54	9.45	442.3	273.01	188.0		Dissolved	5.8	0.7	101.0	2.3	0.20	21	23.0
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	-0.95	7.90	446.7	276.24	255.0		Dissolved	5.7	0.7	105.0	1.3	0.17	19.5	27.7
MGEOT149	MATOVICH,JOHN * 23 MI SW SUN PRAIRIE MT	0.90	8.50	2496.0	1637.93	845.0		Dissolved	2.4	0.6	608.0	1.6	0.07	10.5	
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	-0.69	7.89	269.7	174.8	164.0		Dissolved	28.4	7.8	23.6	2.2	0.30	15.9	7.0
MGEOT075	LONEPINE OBSERVATION WELL	-0.25	7.93	396.8	240.03	235.9		Dissolved	39.8	11.6	32.8	1.7	-0.01	18.2	
MGEOT110	STREIT, GEORGE * 4MI E- 1MI S FT BENTON MT.	0.25	7.38	2862.0	2252.84	620.0			207.0	180.0	253.0	34.4	0.09	11.8	
MGEOT243	WHITMAYER ASSOC * 4.5MI SE SUN PRAIRIE SCH	-3.15	8.90	4649.0	2646.37	869.0		Dissolved	11.6	3.2	1076.0	6.7	0.04	10.5	
MGEOT109	CLARK, BRAD * 25 MI E FT. BENTON MT.	-0.59	8.45	3737.0	2608.24	702.0			19.4	16.0	885.0	3.3	0.03	7.5	
MGEOT114	LANDUSKY PLUNGE SPRINGS		8.10		960		101		161.0	65.0	24.0	6.7		17.8	
MGEOT072	LANDUSKY, I*8.5 MI S HAYS, MONTANA	-0.07	7.88	1724.0	1366.89	170.5			250.9	86.8	35.2	9.1	0.01	14.7	
MGEOT046	BLACK COULEE * E OF TEST AREA	1.20	8.24	14300.0	13094	461.0		Total Recovera	329.0	508.0	3250.0	24.8		6.1	
MGEOT313	ALZHEIMER, PAUL * SW OF BRADY, MT	0.42	7.78	1678.0	1219.1	328.0		Dissolved	118.0	58.0	193.0	3.2	4.82	8.3	
MGEOT312	REVERE, LEE	0.69	7.85	744.8	439.94	402.0		Dissolved	42.9	22.8	89.4	1.7	2.36	8.3	
MGEOT049	LITTLE WARM SPRINGS*9 MI SE LODGE POLE	0.53	8.06	2082.0	1754.58	101.0		Dissolved	289.0	110.0	72.0	13.3	0.10	16	
MGEOT324	LODGEPOLE WARM SPRINGS		8.10		1630		81		286.0	96.0	75.0	13.0		16.3	
MGEOT048	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	0.51	8.06	1980.0	1628.32	81.0		Dissolved	268.0	96.0	75.0	13.0	-0.01	16.3	
MGEOT051	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	-0.90	7.96	1430.0	1096.15	153.0			187.0	69.0	52.5	8.5	-0.01	14.5	
MGEOT052	KIRKALDIE, BRUCE*7 MI SW LODGEPOLE MT	0.86	7.14	1800.0	1433.87	148.0			242.0	83.0	67.0	11.1	-0.01	14.1	
MGEOT037	LARGE CAPACITY WELL*4 MI SW WOLF POINT, MT	9.22	7.80	1960.0	1234.47	627.0		Dissolved			402.0		1.60		
MGEOT024	CITY OF WOLF POINT * WELL IN WOLF POINT	-0.25	7.80	6510.0	3552.21	544.0		Dissolved	15.0	36.0	1330.0	19.0	0.13	13	
MGEOT023	SHERMAN HOTEL OF WOLF POINT	-0.19	8.30	7080.0	3862.29	462.0		Dissolved	24.0	5.2	1500.0	1.6	0.05	13	
MGEOT038	USGS TEST WELL * 1 MILE SOUTH POPLAR, MT	0.87	7.80	1350.0	871.69	541.0			54.0	31.0	214.0	4.7	0.67	9.9	
MGEOT025	FOSS ELMER * 5.8 MI SE BROCTON	-1.60	8.50	1950.0	1114.67	884.0		Dissolved	6.8	2.0	463.0	5.2	0.10	16	
MGEOT317	LANDTECH WATER DISPOSAL SERVICE	-0.25	8.38	2428.0	1429.18	1121.0		Dissolved	2.3	0.6	595.0	1.4	0.06	15.7	0.2
MGEOT315	THORNESS, RICK * 4 MILES NW OF BAINVILLE	-0.23	7.62	2028.0	1445.27	598.0		Dissolved	70.6	62.8	337.0	5.5	0.17	24.4	
MGEOT108	CLAWITER, MILT * 4MI N-4MI E BIG SANDY MT.	-1.33	8.36	3076.0	2011.28	912.0		Dissolved	25.4	13.0	710.0	7.1	0.06	21.4	2.9
MGEOT303	SIMS SPRING	0.04	7.65	465.6	280.28	263.0			49.5	23.3	17.1	1.7	-0.00	19.7	
MGEOT140	TEXACO INC * 1.7 MI NW CENTRAL SCHOOL	-0.76	8.29	3236.0	1918.59	1551.0		Dissolved	2.3	0.7	800.0	4.5	0.35	25.5	
MGEOT252	MATOVAICH, MARTIN*17 MI E MALTA NEAR SACO	0.53	8.35	4046.0	3333.97	112.5		Dissolved	521.0	156.0	254.0	25.1	0.46	17.1	
MGEOT111	SLEEPING BUF REC AREA * 4MI NNW ASHFIELD	0.79	7.38	3915.0	3419.37	151.0			490.0	174.0	293.0	25.4	0.03	17.1	
MGEOT145	SHIRLE, WALTER * 3 MI S FRESNO DAM.	-0.58	8.37	3736.0	2500.21	1005.0		Dissolved	8.2	2.5	922.0	2.5	0.02	7.4	
MGEOT106	PIMLEY, DON * 4 MI NW JOPLIN MT.	-0.10	8.02	6323.0	4762.08	588.0			26.0	11.2	1570.0	3.8	0.06	7.5	
MGEOT105	CADY, ELWIN * 7.5 MI NW JOPLIN MT.	0.59	7.59	5936.0	4245.74	3065.0			27.0	13.2	1600.0	4.4	0.05	13	
MGEOT309	FRANCIS, CLARA	-0.73	7.65	3286.0	2808	851.0		Dissolved	518.0	192.0	138.0	8.2	0.02	19.1	
MGEOT107	WELSH, ORVILLE * 13 MI N-3MI E HINGHAM MT.	0.85	8.09	4544.0	3249.73	842.0			17.4	4.6	1095.0	3.4	0.05	9.8	
MGEOT310	EDWARDS, MARVIN / MIKE DUSTERHOFF	0.87	8.24	3044.0	2077.47	596.0		Dissolved	7.1	1.8	713.0	1.1	0.03	6.4	
MGEOT039	BIG WEST OIL CO * 2 MI NE MTN VIEW SCHOOL	27.89			483.06	427.0		Dissolved	32.0	37.0			5.72		
MGEOT104	RYGH, KEN * 22 MI N - 5 MI W JOPLIN MT.	0.77	8.72	1484.0	913.68	941.0			0.8	0.9	385.0	1.0	0.03	8.7	
MGEOT142	BRADBURY, ALFRED * 11 MI E WILD HORSE MT	1.67	8.15	2706.0	1845.46	730.0		Dissolved	7.8	1.6	640.0	2.6	0.03	7.3	
MGEOT144	NAGEHUS, ORVILLE * 3 MI N SIMPSON MT.	0.07	8.38	1650.6	1055.12	652.0		Dissolved	5.5	1.3	394.0	1.8	0.01	9	

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MGEOT DATABASE

ID	Site name	Boron ug/l	Lithium ug/l	H_2S	Location	County
MGEOT209	TARGHEE SULPHUR SPRING*6MI W W YELLOWSTONE	60.0	30.0		13S 04E 27 AACA	GALLATIN
MGEOT177	UPPER WEST SPRING - STAUDENMEYER RANCH				13S 02W 17 CBD	BEAVERHEAD
MGEOT123	UPPERMOST SPRING - STAUDENMEYER RANCH				13S 02W 17 CBD	BEAVERHEAD
MGEOT126	UPPER - EAST SPRING - STAUDENMEYER RANCH				13S 02W 17 CBD	BEAVERHEAD
MGEOT125	LOWER WEST SPRINGS - STAUDENMEYER RANCH				13S 02W 17 CBD	BEAVERHEAD
MGEOT127	LOWER EAST SPRING - STAUDENMEYER RANCH				13S 02W 17 CBD	BEAVERHEAD
MGEOT124	UPPER WEST SPRING - STAUDENMEYER RANCH				13S 02W 17 CBD	BEAVERHEAD
MGEOT121	ANDERSONS PASTURE SPRING #1				13S 2W 18AC	BEAVERHEAD
MGEOT122	ANDERSONS PASTURE SPRING #2				13S 2W 18AC	BEAVERHEAD
MGEOT210	USFS* BAKERS HOLE* 3MI N WEST YELLOWSTONE	120.0	150.0		13S 05E 15 ABAB	GALLATIN
MGEOT115	SLOAN COW CAMP SPRING	0.2		0.9	12S 1E 19CDA	MADISON
MGEOT120	WEST FORK SWIMMING HOLE				12S 01E 18 CB	MADISON
MGEOT118	*CURLEW CREEK WARM SPRING*				11S 01E 13 DBC	MADISON
MGEOT119	WALL CANYON WARM SPRING				10S 01E 07 CAB	MADISON
MGEOT229	WOLF CREEK HOT SPRING				10S 01E 9 BBBB	MADISON
MGEOT129	LOWELL HILDRETH SPRING*15 MI SW DILLON				09S 10W 29 AAAC	BEAVERHEAD
MGEOT016	BEAR CREEK SPRINGS				9S 9E 19CAA	PARK
MGEOT132	VIGILANTE WARM SPRING				09S 03W 22 BDDD	MADISON
MGEOT041	LA DUKE HOT SPRINGS	0.5		1.0	8S 8E 32 CDBA	PARK
MGEOT012	BROWNS SPRINGS				6S 9W 30DCB	*BEAVERHEAD*
MGEOT010	PULLER HOT SPRINGS	0.7			8S 5W 1AACC	MADISON
MGEOT019	TRUDAU SPRINGS				7S 4W 7DCAD	*MADISON*
MGEOT040	CHICO HOT SPRINGS	0.1		0.6	6S 6E 1CDCD	PARK
MGEOT032	GROUNDWATER*4.7 MI NE FT SMITH MT	60.0			05S 31E 35 CCC2	BIG HORN
MGEOT074	BROWN CATTLE CO* 3.1 MI N. BIRNEY MT					ROSEBUD
MGEOT276	JARDINE HOT SPRINGS 0.25 MI E OF JACKSON	-20.0	290.0		05S 15W 25 CBAA	BEAVERHEAD
MGEOT289	MBMG GEOTHERMAL TEST * THEXTON TX - 12	680.0	230.0		05S 01W 28 DCA	MADISON
MGEOT028	JACKSON HOT SPRINGS	0.8		0.6	5S 15W 25CBBB	BEAVERHEAD
MGEOT293	*PRIVATE GEOTHERMAL TEST*ENNIS HOT SPRINGS**	*620.0*	*220.0*		05S 01W 28 DBAA	MADISON
MGEOT277	LAPHAM DOMESTIC WELL 1 MI NW JACKSON, MT.		230.0		05S 15W 23 CABA	BEAVERHEAD
MGEOT117	ENNIS HOT SPRINGS				05S 01W 21 BB	MADISON
MGEOT058	BROWN CATTLE CO * 9.5MI SW BIRNEY DAY SCH.				05S 42E 22 DBBC	ROSEBUD
MGEOT031	BEAVERHEAD ROCK SPRINGS				5S 7W 22ABBD	MADISON
MGEOT133	APEX WARM SPRING				05S 09W 11 AADADD	BEAVERHEAD
MGEOT323	ELKHORN HOT SPRINGS			0.9	4S 12W 29ACAD	BEAVERHEAD
MGEOT292	*MARTIN, KIETH*	*60.0*	*6.0*			SWEET GRASS
MGEOT326	NEW BILTMORE HOT SPRINGS	*0.9*		1.1	4S 7W 28BDA	MADISON
MGEOT308	NEWMAN, JOHN * JOLIET, MT				04S 22E 23 CCDB	CARBON
MGEOT280	ANDERSON SPRING		-2.0		3S 13E 29ABA	SWEET GRASS
MGEOT006	ANDERSON'S SPRING				3S 13E 29ABAB	SWEET GRASS
MGEOT043	NORRIS HOT SPRINGS	0.1			3S 1W 14DAB	MADISON
MGEOT015	POTOSI HOT SPRINGS			0.5	3S 2W 6CACC	MADISON
MGEOT187	GROSS, PETE * 4 MI S PONY MT	30.0	56.0		03S 02W 06 CBDD	MADISON
MGEOT311	*MCFERRAN, EUGENE * BILLINGS, MT*				03S 27E 04 BCDD	YELLOWSTONE
MGEOT179	CARTER'S BRIDGE * 4 MI SE LIVINGSTON MT.	*110.0*	*30.0*			PARK
MGEOT011	AVON WARM SPRING				10N 8W 24BBC	POWELL
MGEOT264	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	260.0	38.0		02S 04E 14 DAD	GALLATIN
MGEOT266	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	250.0	38.0		02S 04E 14 DAD	GALLATIN
MGEOT265	BOZEMAN HOT SPRINGS * OLD WELL	260.0	38.0		02S 04E 14 DAD	GALLATIN
MGEOT263	BOZEMAN HOT SPRINGS * ORIGINAL SPRING	260.0	37.0		02S 04E 14 DAD	GALLATIN
MGEOT335	BOZEMAN HOT SPRINGS	0.2			2S 4E 14DDBAA	GALLATIN
MGEOT269	*RANCA * MCLEOD*		110.0			SWEET GRASS
MGEOT259	SCOTT FEED LOT	1650.0	65.0		2S 13E 15 BCB	YELLOWSTONE
MGEOT260	SCOTT FEED LOT	2290.0	74.0		2S 13E 15 BC	YELLOWSTONE
MGEOT230	BLUE JOINT CREEK HOT SPRING				2S 23W 1ABB	RAVALLI
MGEOT002	BRIDGER CANYON WARM SPRING				1S 6E 34BCDD	GALLATIN
MGEOT334	LOVE, MELVIN*THREE FORKS, MT	220.0	110.0		01S 02E 29 AAC	GALLATIN
MGEOT033	GROUNDWATER*5.3 MI W HARDIN MT	140.0			01S 32E 23 BD	BIG HORN
MGEOT332	*SHIPTON, HAROLD * THREE FORKS MT*	*190.0*	*130.0*		*01S 02E 21 DBDB*	*GALLATIN*
MGEOT258	HERMAN, T.E. * ROCKY RANCH 7.4 M W HARDIN	420.0	280.0		01S 32E 14 CCDD	BIG HORN
MGEOT344	GALLOGLY HOT SPRING	0.1			01S 19W 15BCCCA	RAVALLI
MGEOT245	LOST TRAIL * WARM AND HOT SPRINGS	50.0	90.0		01S 19W 15 BCC	RAVALLI
MGEOT089	CAIN MIKE*6.6 MI S VOLBERG					CUSTER
MGEOT018	HUNTERS HOT SPRINGS	0.7		5.3	1S 12E 9CCAD	PARK
MGEOT328	JORGENSON, JACK * THREE FORKS MT				01S 02E 03 DCC	GALLATIN
MGEOT346	*RENOVA HOT SPRINGS*	0.5			01N 4W 32DBC	*JEFFERSON*
MGEOT339	WESTMORELAND * 9.1 M W SARPY SCHOOL	281.0	309.0			TREASURE
MGEOT095	LISCOM RANCH * 5.5 MI NW OF N STACY SCHOOL				01N 46E 26 ABCB	CUSTER
MGEOT331	TINDER, L. MARIE * THREE FORKS MT	390.0	160.0		01N 02E 22 CABD	GALLATIN
MGEOT327	WILCOX, RALPH * THREE FORKS MT				01N 02E 22 CA	GALLATIN
MGEOT333	RICHARDSON, DEIRDRE * THREE FORKS	730.0	190.0		01N 02E 22 ABBB	GALLATIN
MGEOT347	MEDICINE HOT SPRINGS	0.1		0.6	01N 20W 12CCA	RAVALLI
MGEOT092	WESTERN ENERGY * 2 MI N COLSTRIP MT.		600.0		02N 41E 34 BADC	ROSEBUD
MGEOT020	PIPESTONE HOT SPRINGS	0.3		2.3	2N 5W 28BDDD	JEFFERSON
MGEOT082	*FRED WETSTEON SPRING DEVELOP*				*02N 17W 19 ABB*	*RAVALLI*
MGEOT330	HART, FRANK * THREE FORKS, MT				02N 02E 17 DDCC	GALLATIN
MGEOT063	ANADARKO PROD*6 MI E FOSTER MT				02N 34E 2 CACD	BIG HORN
MGEOT053	UN-NAMED SPRING * 29 M NE OF FOSTER MT					BIGHORN
MGEOT128	COWAN SPRING*9MI NW THREE FORKS MT		-10.0		02N 01W 04 AAAD	JEFFERSON

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MGEOT DATABASE

ID	Site name	Boron ug/l	Lithium ug/l	H_2S	Location	County
MGEOT178	WOLF CREEK HOT SPRING		70.0		10S 01E 9 BBBB	MADISON
MGEOT343	WILLIAMSBURG SPRING	350.0	12.0		03N 08W 23 CDBD	SILVER BOW
MGEOT030	OIL WELL (TENSLEEP FORMATION)					STILLWATER
MGEOT341	MONTANA RESOURCES MONITORING WELL C	-100.0	13.0		03N 07W 17 DAD	SILVER BOW
MGEOT342	MONTANA RESOURCES MONITORING WELL D2	-100.0	33.0		03N 07W 17 AAC	SILVER BOW
MGEOT055	HOWARD SPRING * 25 M SE OF BIGHORN MT					TREASURE
MGEOT246	WENDT, FRED * .75 MI S GREGSON (FAIRMONT)	70.0	39.0		03N 10W 11 BABD	SILVER BOW
MGEOT298	MBMG RESEARCH WELL * FAIRMONT HOT SPRINGS	240.0	600.0		03N 10W 02 CAD	SILVER BOW
MGEOT165	NELSON, HARVEY * 5 MI S BROADVIEW MT	930.0	110.0		03N 23E 4 CBBC	YELLOWSTONE
MGEOT061	BRADBROOK * 10 M S BROADVIEW MT	40.0	960.0			STILLWATER
MGEOT279	FAIRMONT HOT SPRINGS, ANACONDA	340.0	650.0		3N 10W 2BDCA	SILVER BOW
MGEOT247	SPANGLER, HAZEL * 2 MI E-NE GREGSON MT	60.0	28.0		04N 09W 31 CDAC	SILVER BOW
MGEOT214	HUNSAKER SPRING	100.0	19.0		4N 2E 32DBDB	BROADWATER
MGEOT150	MONT. HIGHWAY DEPT * .75 MI SE WACO MT.		110.0		04N 32E 35 BABA	YELLOWSTONE
MGEOT213	PLUNKET LAKE WARM SPRINGS	110.0	32.0		4N 1E 27AA	BROADWATER
MGEOT237	SPRINGS FROM JOINTS IN MISS CYN*SW PLUNKET	120.0	20.0		04N 01E 27 ABDD	BROADWATER
MGEOT151	MONTANA DEPT HIGHWAYS * 2.5 MI NE WACO MT		60.0			YELLOWSTONE
MGEOT216	HUNSAKER, MAURICE	180.0	25.0		4N 2E 18ACAC	BROADWATER
MGEOT135	ANACONDA RED TRAVETINE MOUND--GEYSER				04N 11W 13 AADA	DEER LODGE
MGEOT325	SLEEPING CHILD HOT SPRINGS	0.3		1.0	4N 19W 7DCDD	RAVALLI
MGEOT236	BRUCE, N * IRRIGATION WELL WITH BOOSTER	180.0	20.0		04N 01E 10 BCBB	BROADWATER
MGEOT294	TOSTON WARM SPRING	70.0	39.0		04N 03E 06 DAD	BROADWATER
MGEOT218	TOSTON WARM SPRING	120.0	47.0		04N 03E 06 DAD	BROADWATER
MGEOT217	BRUCE, NORMAN	380.0	70.0		4N 1E 4ADDC	BROADWATER
MGEOT215	KIMPTON SPRING	-20.0	5.0			BROADWATER
MGEOT134	WARNER WARM SPRING				05N 01E 22 DBB	BROADWATER
MGEOT172	STEELE, WILLIAM * 12.5 MI SE PINEVIEW MT.		70.0		05N 32E 20 AAAC	YELLOWSTONE
MGEOT284	MBMG TEST WELL*WARM SPRINGS STATE HOSPITAL	110.0	370.0		05N 10W 24 ABAD	DEER LODGE
MGEOT009	WARM SPRINGS	0.1		0.7	5N 1E 22 DBBC	DEER LODGE
MGEOT233	WARM SPRINGS STATE HOSPITAL		430.0		5N 10W 24ABBD	DEER LODGE
MGEOT231	WARM SPRINGS STATE HOSPITAL	170.0	450.0		5N 10W 24A	DEER LODGE
MGEOT349	BOULDER HOT SPRINGS - UPPER SPRING	0.6	0.2		05N 04W 10CBA	JEFFERSON
MGEOT351	BOULDER HOT SPRINGS - LOWER SPRING	0.5	0.2		05N 04W 10CBA	JEFFERSON
MGEOT350	BOULDER HOT SPRINGS - MIDDLE SPRING	0.5	0.2		05N 04W 10CBA	JEFFERSON
MGEOT232	WARM SPRINGS STATE HOSPITAL * SPRING	110.0	400.0		05N 10W 24 ABBD	DEER LODGE
MGEOT185	M-B NO. 12 * 5 MI NE HAMILTON MT		10.0		06N 20W 14 BBBB	RAVALLI
MGEOT171	GRIERSON, J.B.*2.5MI NE RANCHERS CEMETARY.		140.0		06N 35E 07 BAAC	TREASURE
MGEOT130	PRISON RANCH SPRING SITE NO. 4		70.0		07N 10W 29 BC	POWELL
MGEOT113	DEER LODGE PRISON RANCH WELL					POWEL
MGEOT044	BEDFORD SPRINGS				7N 1E 23BAAD	BROADWATER
MGEOT101	GRIERSON, J.B. * 23 MI NW HYSHAM MT	140.0	70.0		07N 33E 06 DBD	TREASURE
MGEOT275	MBMG RESEARCH WELL * WEED CREEK-- 1B		60.0			YELLOWSTONE
MGEOT274	MBMG RESEARCH WELL * WEED CREEK-- 1A		53.0			YELLOWSTONE
MGEOT255	HANSER, BILL * 3 MI SW TWO DOT MT	280.0	98.0		08N 13E 31 AACC	WHEATLAND
MGEOT256	FOX INC * 1.5 MI W-SW TWO DOT	160.0	55.0		08N 13E 28 CADD	WHEATLAND
MGEOT257	HOMER, RAY * TWO DOT WATER SUPPLY	100.0	52.0		08N 13E 27 ADAD	WHEATLAND
MGEOT296	HARLOWTON * SOUTH MUNICIPAL WELL	250.0	16.0		08N 15E 22 CDDA	WHEATLAND
MGEOT013	HILLBROOK FLOWING WELL	0.5				JEFFERSON
MGEOT014	WALLS HOT SPRING	0.2				JEFFERSON
MGEOT001	ALHAMBRA HOT SPRINGS NORTH	0.2			8N 3W 16ACAA	JEFFERSON
MGEOT278	TOWNSEND,HERB*2.5 MI SW WHITE SULPHUR SPGS	-20.0	-2.0		09N 06E 26 DCC	MEAGHER
MGEOT290	RALPH JOHNSON,P.O.BOX 65,WHITE SULPHUR SPR	25200.0	2020.0		09N 06E 13 ADAA	MEAGHER
MGEOT004	WHITE SULPHUR SPRINGS	9.1		0.7	9N 7E 18BB	MEAGHER
MGEOT282	WHITE SULPHUR SPRINGS BANK WELL	7900.0	1150.0		09N 06E 13 AAAA	MEAGHER
MGEOT188	WATTS, JAMES * 16 MI NE KINSEY MT	674.0	29.0		09N 46E 04 BBBA	CUSTER
MGEOT164	M-B NO 6 WELL*2.5 MI SE CORVALLIS MT		50.0		09N 19W 6 BAAC	RAVALLI
MGEOT007	BROADWATER HOT SPRINGS WELL	0.8			10N 4W 28ACA	LEWIS AND CLARK
MGEOT008	GLOEGE WELL	0.1			10N 4W 28AC	LEWIS AND CLARK
MGEOT003	GARRISON WARM SPRINGS				10N 9W 19ACB.	POWELL
MGEOT337	CHADWICK, GREG				10N 03W 16 CDDD	LEWIS AND CLARK
MGEOT208	USGS OBS WELL * 4 MI SW EAST HELENA, MT.		13.0		10N 03W 16 CCDC	LEWIS AND CLARK
MGEOT336	MUELLER BUZZ				10N 04W 10 CCC	LEWIS AND CLARK
MGEOT242	FLORENCE TEST WELL A		17.0		10N 20W 12BBBA	RAVALLI
MGEOT329	SIVERTE MYSSE * BOX 315 * INGOMAR MT 59039	1320.0	140.0		11N 36E 28 BAC	ROSEBUD
MGEOT167	CHERRY CK SHEEP CO.*1.35MI SE HAGEN RANCH.		180.0		11N 36E 28 BAC	ROSEBUD
MGEOT261	MOORE, THOMAS * 6.5 MI SW ANGELA MT	2620.0	1880.0		11N 43E 21 CDCA	ROSEBUD
MGEOT322	BYRNE WARM SPRING * WEST OF BEARMOUTH	140.0	30.0		11N 15W 14 CAC	GRANITE
MGEOT116	NIMROD SPRINGS				11N 15W 14CDAA	GRANITE
MGEOT026	BEARMOUTH SPRINGS				11N 14W 12CD	GRANITE
MGEOT338	GARRICK GALEN				11N 04W 12 CDD	LEWIS AND CLARK
MGEOT345	LOLO HOT SPRINGS	0.1		0.5	11N 23W 7ADCC	MISSOULA
MGEOT069	MARYSVILLE DEEP WELL DEPTH 5750	100.0	2000.0		12N 06W 32 ABDC	LEWIS AND CLARK
MGEOT170	CHERRY CREEK SHEEP CO*26 MI N VANANDA MT				12N 38E 27 AD	ROSEBUD
MGEOT162	OLSEN, JONAS * 9 MI NW FLATWILLOW MT.		200.0		13N 25E 09 CD	PETROLEUM
MGEOT201	OLSEN JONAS * 14 MI NE N-BAR RANCH	121.0	126.0		13N 24E 12 DDA	FERGUS
MGEOT164	REYNOLDS, KEITH * 6 MI NE FLATWILLOW MT.		310.0		13N 26E 01 DA	PETROLEUM
MGEOT163	HILL, FLOYD * 7 MI N FLATWILLOW MT.		330.0		14N 26E 35 AD	PETROLEUM
MGEOT180	M-B 4 (BUTLER CK) * 6 MI NW MISSOULA MT		30.0		14N 20W 24 ADBC	MISSOULA
MGEOT254	KING, JOE & SONS INC. * 5 MI SSW WINNET MT	1640.0	290.0		14N 26E 20 ABCC	PETROLEUM

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Boron ug/l	Lithium ug/l	H_2S	Location	County
MGEOT159	SHAW, BUD * 1.7 MI SW MOSBY MT.		200.0		14N 30E 09 DACD	PETROLEUM
MGEOT160	EAGER, REX * 2 MI SW WINNETT MT.		170.0		14N 26E 02 CAD	PETROLEUM
MGEOT161	BRATTON, WAYNE * 2 MI SE WINNETT MT.		230.0		14N 27E 05 DBB	PETROLEUM
MGEOT305	BURLY VISTA TRACTS	40.0	29.0		15N 19E 30 CCDD	FERGUS
MGEOT157	TEIGEN, PETER * 9 MI E GRASSRANGE MT.		220.0		15N 25E 30 BBC	PETROLEUM
MGEOT198	MATOVICH * 4.5 MI E GRASSRANGE MT	66.0	91.0		15N 24E 20 BDB	FERGUS
MGEOT181	HOLE NO 2 M-B DRILLING PROJECT		-10.0		15N 21W 17 DCCC	MISSOULA
MGEOT240	MSU AG EXPERIMENT STATION * MOCCASIN MT	60.0	33.0		15N 14E 16 DCDD	JUDITH BASIN
MGEOT155	BRADY, EARL*4 MI NW WINNETT, MT	170.0	200.0			PETROLEUM
MGEOT203	GERDRUM, RONALD * 3 MI NE GRASS RANGE, MT.	109.0	115.0		15N 23E 14 BCA	FERGUS
MGEOT152	CENEX*15 MI NE WINNETT MT	220.0	150.0			PETROLEUM
MGEOT158	BASSETT, EARL * 7.5 MI NW TEIGEN MT.		120.0		16N 24E 28 AAC	PETROLEUM
MGEOT059	HEDMAN, J. * 40 MI NE LEWISTOWN MT.				16N 25E 18 DDB	PETROLEUM
MGEOT156	HARRIS FLOYD * 11 MI NW TEIGEN MT	270.0	260.0		16N 24E 7 CC	PETROLEUM
MGEOT194	FOX, DENNIS * 7 MI NW GRASSRANGE MT	97.0	69.0		16N 22E 05 DDB	FERGUS
MGEOT239	LAURENCE HESS * 1 MI N MOCCASIN MT	-20.0	63.0		17N 14E 28 DAAD	JUDITH BASIN
MGEOT204	DELANEY, DOUGLAS*7 MI NW (WILD HORSE UNIT)	-20.0	123.0		17N 23E 25 ABB	FERGUS
MGEOT050	BROOKS WARM SPRING * 2.5 MI NW BROOKS MT.		20.0		17N 18E 19 DBDB	FERGUS
MGEOT195	DELANEY, DOUGLAS * 11 MI NW ROY MT	159.0	149.0		17N 23E 15 DBA	FERGUS
MGEOT154	MILLER RANCH * 14 MI SE VALENTINE MT.		290.0		17N 28E 09 DB	PETROLEUM
MGEOT045	CARDINAL PET CO * 10 M E HILGER MT				18N 20E 34 BCAC	FERGUS
MGEOT153	BUSENBARK, MERLIN*1 MI S VALENTINE MT*				18N 26E 29 AAA	PETROLEUM
MGEOT005	QUINN'S HOT SPRINGS				18N 25W 9CDADA	SANDERS
MGEOT268	QUINN'S HOT SPRINGS * JIM AND DONNA BROWN	250.0	-2.0		18N 25W 09 DCBB	SANDERS
MGEOT197	YEAGER * 8 MI EAST MOULTON, MT.	133.0	120.0		18N 20E 16 BBB	FERGUS
MGEOT079	FINLEY, R.S.*1 MI NW ST. IGNATIUS		-10.0		18N 20W 10 ADD	LAKE
MGEOT205	SIROKY, FRANK * 9 MI EAST ROY, MT.	70.0	26.0		18N 23E 10 ABA	FERGUS
MGEOT192	HORYNA, JAMES * 6 MI E ROY MT	140.0	54.0		18N 22E 01 AAC	FERGUS
MGEOT131	CORPS OF ENGINEERS SOUTH WELL AFTER PERFS		150.0		19N 21W 31 DAB	LAKE
MGEOT090	BRYSON, HAROLD*1 MI W MOIESE MT				19N 21W 26 CCA	LAKE
MGEOT070	YARGER, ROBERT * 13 MI W CIRCLE MT					MCCONE
MGEOT267	SAND COULEE WTR USERS BENCH W ABV SAND COU	50.0	42.0		19N 04E 14 DADA	CASCADE
MGEOT193	TAYLOR, JAMES * 6 MI E CHRISTINA MT	120.0	55.0		19N 20E 23 BCB	FERGUS
MGEOT288	CHARLES ENTSMINGER*TOWN OF NUMBER SEVEN	240.0	16.0		19N 04E 13 AADD	CASCADE
MGEOT295	CUSTER, EVERETT* EDEN RT, GREAT FALLS, MT	120.0	67.0			CASCADE
MGEOT297	TOWN OF TRACY	90.0	19.0		19N 05E 07 CBBD1	CASCADE
MGEOT054	SLOGSVOLD, A. K. * 17 M SE RITCHEY MT					DAWSON
MGEOT211	GOVER * 2.5 MI TRAVIS SCHOOL		70.0		19N 02E 5 ACBC	CASCADE
MGEOT200	VILLAGE INN * 2.5 MI NE TRAVIS SCHOOL		221.0		19N 02E 5 ABAA	CASCADE
MGEOT299	STONE, GENE	120.0	12.0		19N 24W 04 AADB	SANDERS
MGEOT062	WEBB RES * 17.5 MI SE GERALDINE MT.				20N 11E 35 BCDA	CHOUTEAU
MGEOT353	HOLLAND, JIM - GREEN SPRINGS				21N 24W 04ADB	SANDERS
MGEOT246	GREEN SPRINGS * HOLLAND RANCH					SANDERS
MGEOT191	TACKE, ROBERT * 2 MI SW GREAT FALLS MT		300.0		20N 03E 27 BCBB	CASCADE
MGEOT198	PAUL, MICHAEL(ROBINSON)*3.5M SW GREATFALLS		277.0		20N 03E 28 AACD	CASCADE
MGEOT316	BUTTE CREEK SPRING * SQUARE BUTTE	80.0	5.0		20N 12E 27 BBAC	CHOUTEAU
MGEOT319	BUTTE CREEK SPRING - NORTH * SQUARE BUTTE	80.0	4.0		20N 12E 27 BBAC	CHOUTEAU
MGEOT169	CHAMBERLAIN, CURTIS * 2 MI W LLER SCHOOL.				20N 33E 26 BA	GARFIELD
MGEOT321	MELTON, LARUE * LOWER AQUIFER	80.0	-2.0		20N 22W 28 ABCB	SANDERS
MGEOT314	USGS - MELTON, LEON	160.0	12.0		20N 22W 21 CBDA	SANDERS
MGEOT238	SCHMIDT, LLOYD * 3.5 MI SE SQUARE BUTTE	-20.0	100.0		20N 12E 13 BCDB	CHOUTEAU
MGEOT190	USGS OBS WELL * .5 MI S VALLEY SCHOOL	241.0	47.0		20N 54E 1 DCDD	DAWSON
MGEOT199	EIDEL * .5 MI S SUNSET MEMORIAL CEMETARY		251.0		20N 02E 3 BAAD	CASCADE
MGEOT078	WEBSTER, BONITA*BOX 443 RONAN MT		-10.0		21N 20W 33 AAA	LAKE
MGEOT099	DEMARS,TOM J.* 10 MI W OF WINIFRED MT.	220.0	110.0		21N 17E 30 BDBA	FERGUS
MGEOT249	HOMESTEAD ACRES COUNTY WATER DISTRICT	150.0	56.0		21N 03E 14 AABC	CASCADE
MGEOT250	HOMESTEAD ACRES COUNTY WATER DISTRICT	150.0	53.0		21N 03E 14 AABC	CASCADE
MGEOT241	MCCOLLUM, JIM * 10 MI NW MATHISON RANCH	630.0	35.0		21N 23E 13 CBBB	FERGUS
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT		-10.0		21N 23W 14 ACB	SANDERS
MGEOT047	* RYFFEL BROS. * 3MI S & 3 MI E HIGHWOOD		20.0		21N 08E 11 CB	CHOUTEAU
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.		20.0		21N 23W 10 BDD	SANDERS
MGEOT307	HOT SPRINGS CITY	70.0	13.0		21N 24W 04 DBDA	SANDERS
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH				21N 24W 04 DBDA	SANDERS
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	460.0	18.0		21N 24W 04 DABD	SANDERS
MGEOT291	SOUTH EAST OF CAMP AQUA	350.0	51.0		21N 24W 03 BBB	SANDERS
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS				21N 24W 03 BBB	SANDERS
MGEOT080	HOT SPRINGS MONTANA					SANDERS
MGEOT017	CAMAS HOT SPRINGS	0.3		7.4	21N 24W 3BBDB	SANDERS
MGEOT352	SYMES HOTEL WELL	0.2	0.0		21N 24W 04ADB	SANDERS
MGEOT029	SYMES HOT SPRINGS WELL				21N 24W 4ADCA	SANDERS
MGEOT081	HOT SPRING GEOTHERM WELL - UNNAMED					SANDERS
MGEOT355	KOEPLING, DELBERT * WELL 138	0.4	0.0		22N 24W 13DADD	SANDERS
MGEOT354	OSTRANGER, DAVE * WELL 56	0.3	-0.0		22N 23W 17BBC	SANDERS
MGEOT077	VERNER, ROSE*3.75 MI W PABLO MT		-10.0		22N 20W 31 CDD	LAKE
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS		30.0		22N 24W 36 BBB	SANDERS
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	844.0	61.0		22N 23W 33 BABB	LAKE
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	690.0	20.0			LAKE
MGEOT042	SUN RIVER SPRINGS				22N 10W 26CAB	LEWIS AND CLARK
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	500.0	73.0		22N 23W 29 DADD	SANDERS

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Boron ug/l	Lithium ug/l	H_2S	Location	County
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	914.0	58.0		22N 23W 29 CACA	LAKE
MGEOT221	KEMP * 5 MI SE CAMPAQUA MT	968.0	80.0		22N 23W 28 CBBB	LAKE
MGEOT286	JACKOLA AP 100 FT E. OF CAMP AQUA BATH SPA	540.0	78.0		22N 23W 29 ACAB	LAKE
MGEOT027	CAMP AQUA AREA TEST WELL	0.6			22N 23W 29 AC	LAKE
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	550.0	59.0		22N 23W 29 BADD	LAKE
MGEOT202	OLSEN, EDWIN * 8.4 MI NE WINIFRED MT	121.0	126.0		22N 19E 32 ABBC	FERGUS
MGEOT251	SMELSER, JAMES A. * POWER MT	1000.0	450.0		22N 01E 22 DDAC	CASCADE
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	934.0	80.0		22N 23W 29 AADB	LAKE
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	910.0	81.0		22N 23W 29 BAAC	LAKE
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	885.0	74.0		22N 23W 20 DCDB	LAKE
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	870.0	100.0		22N 23W 20 CDBC	LAKE
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT					SANDERS
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	710.0	80.0			SANDERS
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	849.0	65.0		22N 23W 18 DDAD	SANDERS
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	540.0	40.0			SANDERS
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	511.0	24.0		22N 23W 18 BBBB	SANDERS
MGEOT149	MATOVICH,JOHN * 23 MI SW SUN PRAIRIE MT		110.0			PETROLEUM
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	91.0	-8.0		22N 24W 10 ABAB	SANDERS
MGEOT075	LONEPINE OBSERVATION WELL		-10.0			SANDERS
MGEOT110	STREIT, GEORGE * 4MI E- 1MI S FT BENTON MT.				24N 09E 28 DDAA	CHOUTEAU
MGEOT243	WHITMAYER ASSOC * 4.5MI SE SUN PRAIRIE SCH		170.0		24N 32E 29 AAAC	VALLEY
MGEOT109	CLARK, BRAD * 25 MI E FT. BENTON MT.				24N 12E 22 AAAD	CHOUTEAU
MGEOT114	LANDUSKY PLUNGE SPRINGS				24N 24E 12CDDA	BLAINE
MGEOT072	LANDUSKY, I*8.5 MI S HAYS, MONTANA				25N 24E 32 DBAD	PHILLIPS
MGEOT046	BLACK COULEE * E OF TEST AREA		2100.0			CHOUTEAU
MGEOT313	ALZHEIMER, PAUL * SW OF BRADY, MT				25N 03W 24 BBCB	TETON
MGEOT312	REVERE, LEE				25N 03W 14 BAAB	TETON
MGEOT049	LITTLE WARM SPRINGS*9 MI SE LODGE POLE		140.0			BLAINE
MGEOT324	LODGEPOLE WARM SPRINGS				26N 25E 24CABD	BLAINE
MGEOT048	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT		140.0		26N 25E 24 BCD	BLAINE
MGEOT051	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT				26N 25E 24 BCD	BLAINE
MGEOT052	KIRKALDIE, BRUCE*7 MI SW LODGEPOLE MT				26N 25E 24 BDBC	BLAINE
MGEOT037	LARGE CAPACITY WELL*4 MI SW WOLF POINT, MT				26N 46E 02 DCD	ROOSEVELT
MGEOT024	CITY OF WOLF POINT * WELL IN WOLF POINT	5160.0			27N 47E 22 BBBB	ROOSEVELT
MGEOT023	SHERMAN HOTEL OF WOLF POINT	5070.0			27N 47E 15 BDCA	ROOSEVELT
MGEOT038	USGS TEST WELL * 1 MILE SOUTH POPLAR, MT					ROOSEVELT
MGEOT025	FOSS ELMER * 5.8 MI SE BROCTON	970.0			27N 54E 07 BACA	RICHLAND
MGEOT317	LANDTECH WATER DISPOSAL SERVICE	2520.0	96.0			RICHLAND
MGEOT315	THORNESS, RICK * 4 MILES NW OF BAINVILLE	220.0	65.0			ROOSEVELT
MGEOT108	CLAWITER, MILT * 4MI N-4MI E BIG SANDY MT.	1100.0	70.0		29N 13E 34 ABCB	CHOUTEAU
MGEOT303	SIMS SPRING					ROOSEVELT
MGEOT140	TEXACO INC * 1.7 MI NW CENTRAL SCHOOL.	2890.0	300.0		32N 19E 36 CDCA	BLAINE
MGEOT252	MATOVAICH, MARTIN*17 MI E MALTA NEAR SACO	950.0	260.0		32N 32E 35 DCBC	PHILLIPS
MGEOT111	SLEEPING BUF REC AREA * 4MI NNW ASHFIELD				32N 32E 35 CDB	PHILLIPS
MGEOT145	SHIRLE, WALTER * 3 MI S FRESNO DAM.		160.0		32N 14E 04 CCBC	HILL
MGEOT106	PIMLEY, DON * 4 MI NW JOPLIN MT.				33N 07E 21 DADC	LIBERTY
MGEOT105	CADY, ELWIN * 7.5 MI NW JOPLIN MT.				34N 07E 27 DAAB	LIBERTY
MGEOT309	FRANCIS, CLARA	1170.0	130.0			SHERIDAN
MGEOT107	WELSH, ORVILLE * 13 MI N-3MI E HINGHAM MT.				35N 11E 31 DCCC	HILL
MGEOT310	EDWARDS, MARVIN / MIKE DUSTERHOFF	490.0	76.0		35N 07W 24 DCDD	GLACIER
MGEOT039	BIG WEST OIL CO * 2 MI NE MTN VIEW SCHOOL					TOOLE
MGEOT104	RYGH, KEN * 22 MI N - 5 MI W JOPLIN MT.				36N 06E 13 ADDD	LIBERTY
MGEOT142	BRADBURY, ALFRED * 11 MI E WILD HORSE MT		160.0			HILL
MGEOT144	NAGEHUS, ORVILLE * 3 MI N SIMPSON MT.		80.0		37N 12E 18 BBDD	HILL

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

CAMAS – LONEPINE AREA (33 Sites)

ID	Site name	Reference	Type	Flow (l/min)	Latitude	Longitude	Temp (deg c)	Status/use	SWL (M)	Date	Chloride mg/l	Sulfate mg/l	Fluoride mg/l
MGEOT017	CAMAS HOT SPRINGS	Mariner et.al. 1976	SPRING	200.0	47.6155	114.6663	45				9.0	38.0	5.6
MGEOT029	SYMES HOT SPRINGS WELL	Sonderegger et.al. 1981	WELL	76.0	47.6163	114.6763	38				9.0	40.0	5.8
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	MBMG-GWIC	WELL		47.6063	114.6744	18.5	PUBLIC SUPPLY	2.74	27 AUG 1975	2.2	12.1	1.6
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS	MBMG-GWIC	SPRING		47.6147	114.6658	44	RECREATIONAL		15 SEP 1975			
MGEOT075	LONEPINE OBSERVATION WELL	MBMG-GWIC	WELL		47.7141	114.6477	16.5	DOMESTIC	33.22	04 MAR 1976	6.3	12.2	0.9
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT	MBMG-GWIC	WELL		47.5827	114.5063	21.5	UNUSED		04 MAR 1976	6.0	8.1	0.6
MGEOT080	HOT SPRINGS MONTANA	MBMG-GWIC	SPRING		47.6155	114.6477	43	RECREATIONAL		19 APR 1976			
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT	MBMG-GWIC	WELL	0.4	47.6516	114.5836	24	STOCK		02 JUL 1976	28.3	1.2	6.1
MGEOT098	*IRRIGATION EQUIPMENT SALES*HOT SPRINGS*	MBMG-GWIC	WELL		47.6297	114.6236	19.5	DOMESTIC		17 AUG 1976	25.3	0.3	0.8
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	MBMG-GWIC	WELL		47.6472	114.5761	34.4	DOMESTIC		07 SEP 1978	23.1	2.1	4.6
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	MBMG-GWIC	WELL		47.6536	114.5813	25.8	IRRIGATION		06 SEP 1978	10.9	1.8	4.4
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	MBMG-GWIC	WELL		47.6311	114.5813	15.2			08 SEP 1978	2.4	14.0	5.4
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	MBMG-GWIC	WELL	94.9	47.6619	114.5836	20.3	IRRIGATION		02 DEC 1979	19.0	2.1	4.8
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	MBMG-GWIC	WELL	40.0	47.6302	114.555	19	IRRIGATION		04 DEC 1979	27.0	1.4	4.3
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	MBMG-GWIC	WELL	30.0	47.6372	114.5611	28.8	IRRIGATION		05 DEC 1979	34.8	0.6	4.2
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	MBMG-GWIC	WELL		47.688	114.6538	16.6	DOMESTIC	22.86	06 DEC 1979	2.1	12.0	1.2
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	MBMG-GWIC	WELL		47.6736	114.6027	23.6	DOMESTIC	18.29	30 NOV 1979	7.8	5.8	3.4
MGEOT224	*KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA*	MBMG-GWIC	WELL	40.0	47.6452	114.5688	32.5	IRRIGATION		02 DEC 1979	30.9	0.6	5.0
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	MBMG-GWIC	WELL	20.0	47.6433	114.5638	30.6	IRRIGATION		02 DEC 1979	35.5	0.6	4.5
MGEOT226	*KOPP, ARVID * .25 MI S CAMPAQUA MT*	MBMG-GWIC	WELL	10.0	47.6361	114.575	32.6	IRRIGATION		29 NOV 1979	16.0	1.5	7.6
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	MBMG-GWIC	WELL	94.6	47.6438	114.5741	38.9	IRRIGATION		29 NOV 1979	31.3	1.3	7.8
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	MBMG-GWIC	WELL	75.0	47.6422	114.5713	43.7	RESEARCH		18 DEC 1980	35.3	0.7	4.3
MGEOT286	JACKOLA AP. 100 FT E. OF CAMP AQUA BATH SPA	MBMG-GWIC	WELL	416.5	47.6411	114.57	51	INDUSTRIAL/COMM	1.83	04 JUN 1982	34.0	0.6	5.0
MGEOT027	CAMP AQUA AREA TEST WELL	Sonderegger et.al. 1981	WELL-FLOWING	1300.0	47.6422	114.5713	50	RESEARCH			33.0	4.0	3.9
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.	MBMG-GWIC	WELL		47.5952	114.5302	22.5	UNUSED	-0.01	17 AUG 1976	17.5	6.6	3.5
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	MBMG-GWIC	WELL	35.1	47.67	114.588	22.8	IRRIGATION		08 SEP 1978	2.2	6.9	3.2
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	Sonderegger et.al. 1981	WELL	9.1	47.6075	114.6713	29.6	DOMESTIC		03 DEC 1979	7.8	21.2	5.2
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	MBMG-GWIC	WELL	303.1	47.6347	114.5619	42.7	RESEARCH	-0.06	15 JAN 1981	34.8	21.5	3.1
MGEOT291	*SOUTH EAST OF CAMP AQUA*	MBMG-GWIC	WELL	10.1	47.6147	114.6655	51.5	RESEARCH		19 AUG 1982	9.9	9.6	5.7
MGEOT307	HOT SPRINGS CITY	MBMG-GWIC	WELL		47.6063	114.6736	21	PUBLIC SUPPLY		31 MAY 1984	3.1	10.7	0.2
MGEOT352	SYMES HOTEL WELL	MBMG/UURI	WELL		47.6163	114.6763	33.3	DOMESTIC		02 NOV 1993	11.0	30.0	5.6
MGEOT355	KOEPLING, DELBERT * WELL 138	MBMG/UURI	WELL		47.6170	114.6781	26.5	IRRIGATION		03 NOV 1993	10.0	5.1	3.4
MGEOT354	OSTRANGER, DAVE * WELL 56	MBMG/UURI	WELL		47.6171	114.6775	17.2	IRRIGATION		03 NOV 1993	14.0	3.8	5.4

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

CAMAS – LONEPINE AREA (33 Sites)

ID	Site name	Std dev balance	Lab ph	SC mmohs	TDS mg/l	Hco3 mg/l	Alkalinity	Sample type	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (SiO2) mg/l	Arsenic ug/l
MGEOT017	CAMAS HOT SPRINGS		9.40		399.00		189		0.9	0.1	85.0	1.7		70.0	
MGEOT029	SYMES HOT SPRINGS WELL		9.80		367.00		158		1.2	0.2	91.0	1.7		68.0	
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	-0.46	8.74	245.60	156.07	127.6			15.2	3.6	33.0	3.0	0.17	22.0	
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS								1.1	0.3	83.0	1.8	-0.01	58.0	
MGEOT075	LONEPINE OBSERVATION WELL	-0.25	7.93	396.80	240.03	235.9		Dissolved	39.8	11.6	32.8	1.7	-0.01	18.2	
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT	0.09	7.96	330.20	195.26	196.9		Dissolved	32.3	13.0	19.9	1.4	-0.01	16.2	
MGEOT080	HOT SPRINGS MONTANA								1.0	0.1	83.5	1.8	0.01	59.0	
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT	0.49	8.16	617.20	381.06	331.8			5.7	0.6	139.0	3.7	0.11	32.9	
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS	-0.78	7.51	471.80	283.29	264.5		Dissolved	37.0	11.9	46.0	3.9	5.80	21.9	
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	-0.87	8.63	633.60	395.26	326.0		Dissolved	3.6	0.6	150.0	3.4	0.02	36.5	1.0
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	-0.21	9.16	470.60	338.76	260.0		Dissolved	4.6	0.7	127.0	2.7	0.03	29.3	6.7
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	-0.29	8.12	404.80	244.61	221.0		Dissolved	6.6	1.6	88.1	1.9	0.39	14.3	100.0
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	-0.89	8.48	537.00	345.30	287.0		Dissolved	3.3	0.4	134.0	1.7	0.09	28.6	4.2
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	-0.67	8.06	592.90	375.46	324.0		Dissolved	5.5	1.0	139.0	2.1	0.26	35.0	19.5
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	0.99	7.89	656.70	403.19	348.0		Dissolved	4.0	0.7	147.7	2.8	0.26	34.9	14.6
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	-0.69	7.69	289.70	174.60	164.0		Dissolved	28.4	7.8	23.6	2.2	0.30	15.9	7.0
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	-0.95	7.90	446.70	276.24	255.0		Dissolved	5.7	0.7	105.0	1.3	0.17	19.5	27.7
MGEOT224	KEMP RR WELL (RUNAWAY) * .5 MI N CAMPAQUA	0.52	8.40	635.60	384.72	328.0		Dissolved	4.4	0.4	142.0	2.1	0.12	36.6	3.3
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	0.38	8.26	668.40	419.64	354.0		Dissolved	3.3	0.4	154.4	2.6	0.13	43.6	5.6
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	-0.98	8.71	472.40	304.15	237.0		Dissolved	2.1	0.3	117.0	1.5	0.22	32.4	2.4
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	-0.38	8.38	593.70	394.41	314.0		Dissolved	4.8	1.0	144.0	2.8	0.65	41.4	0.7
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	2.03	8.21	655.60	390.02	343.0		Dissolved	12.6	2.4	127.0	3.3	0.11	35.3	0.8
MGEOT286	JACKOLA AP. 100 FT E. OF CAMP AQUA BATH SPA	0.53	8.53	651.20	413.14	327.0		Dissolved	2.9	0.2	152.0	3.1	-0.00	43.2	0.2
MGEOT027	CAMP AQUA AREA TEST WELL		8.40		420.00		351		3.2	0.3	152.0	4.0		42.2	
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.	0.56	7.83	622.30	374.62	366.9		Dissolved	20.0	9.4	113.0	3.5	0.02	17.5	
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	-0.54	9.45	442.30	273.01	188.0		Dissolved	5.8	0.7	101.0	2.3	0.20	21.0	23.0
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	-0.63	9.46	383.50	286.58	84.6		Dissolved	0.9	-0.1	92.3	0.0	0.61	67.0	-1.0
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	0.62	8.32	663.90	405.72	321.0		Dissolved	15.5	2.8	129.0	3.8	0.16	36.8	2.8
MGEOT291	SOUTH EAST OF CAMP AQUA	-0.59	9.34	381.60	270.89	109.3		Dissolved	0.6	-0.1	85.8	1.7	-0.00	69.6	-1.0
MGEOT307	HOT SPRINGS CITY	0.76	7.99	253.60	172.15	149.3		Dissolved	17.2	4.0	32.0	3.1	0.07	28.1	
MGEOT352	SYMES HOTEL WELL	-0.01	9.66	280.00	297.16		131	Dissolved	0.6	0.7	89.4	2.2	-0.02	73.1	-0.5
MGEOT355	KOEPLING, DELBERT * WELL 138	0.04	8.23	266.00	275.02		236	Dissolved	4.5	-0.2	95.6	2.9	0.06	36.6	-0.5
MGEOT354	OSTRANGER, DAVE * WELL 56	-0.07	8.05	312.00	290.91		278	Dissolved	5.5	2.5	109.3	-0.6	0.39	13.0	0.5

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

CAMAS – LONEPINE AREA (33 Sites)

ID	Site name	Boron ug/l	Lithium ug/l	H_2S	Location	County
MGEOT017	CAMAS HOT SPRINGS	300.0		7.4	21N 24W 3BBDB	SANDERS
MGEOT029	SYMES HOT SPRINGS WELL				21N 24W 4ADCA	SANDERS
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH				21N 24W 04 DBDA	SANDERS
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS				21N 24W 03 BBB	SANDERS
MGEOT075	LONEPINE OBSERVATION WELL		-10.0			SANDERS
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT		-10.0		21N 23W 14 ACB	SANDERS
MGEOT080	HOT SPRINGS MONTANA					SANDERS
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT					SANDERS
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS		30.0		22N 24W 36 BBB	SANDERS
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	870.0	100.0		22N 23W 20 CDBC	LAKE
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	710.0	80.0			SANDERS
MGEOT175	KOPP, ARVID * HOT SPRINGS, MT	690.0	20.0			LAKE
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	849.0	65.0		22N 23W 18 DDAD	SANDERS
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	844.0	61.0		22N 23W 33 BABB	LAKE
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	968.0	80.0		22N 23W 28 CBBB	LAKE
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	91.0	-8.0		22N 24W 10 ABAB	SANDERS
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	511.0	24.0		22N 23W 18 BBBB	SANDERS
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	885.0	74.0		22N 23W 20 DCDB	LAKE
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	934.0	80.0		22N 23W 29 AADB	LAKE
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	914.0	58.0		22N 23W 29 CACA	LAKE
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	910.0	81.0		22N 23W 29 BAAC	LAKE
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	550.0	59.0		22N 23W 29 BADD	LAKE
MGEOT266	JACKOLA AP. 100 FT E. OF CAMP AQUA BATH SPA	540.0	76.0		22N 23W 29 ACAB	LAKE
MGEOT027	CAMP AQUA AREA TEST WELL	640.0			22N 23W 29 AC	LAKE
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.		20.0		21N 23W 10 BDD	SANDERS
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	540.0	40.0			SANDERS
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	460.0	18.0		21N 24W 04 DABD	SANDERS
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	500.0	73.0		22N 23W 29 DADD	SANDERS
MGEOT291	SOUTH EAST OF CAMP AQUA	350.0	51.0		21N 24W 03 BBB	SANDERS
MGEOT307	HOT SPRINGS CITY	70.0	13.0		21N 24W 04 DBDA	SANDERS
MGEOT352	SYMES HOTEL WELL	0.2	0.0		21N 24W 04ADB	SANDERS
MGEOT355	KOEPLING, DELBERT * WELL 138	0.4	0.0		22N 24W 13DADD	SANDERS
MGEOT354	OSTRANGER, DAVE * WELL 56	0.3	-0.0		22N 23W 17BBC	SANDERS

NOTE A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

APPENDIX II

GEOTHERMOMETER TEMPERATURES FOR SELECTED SITES

TEMPERATURES BASED ON SELECTED GEOTHERMOMETERS

Site name	Surface Temp	Na-K-Ca (B=4/3)	Na-K-Ca (B=1/3)	Mg CORRECTION Log(sqrtCa/Na)	Temperature Corrected	R Coefficient	Delta T (Mg Corr.)	Na-K-Ca Corrected	Na-K-Ca Uncorrected	Quartz (no steam)	Quartz (steam loss)	Chalcedony	a-Cristobalite	B-Cristobalite	Amorphous Silica	Published Estimates
MGEOT209 TARGHEE SULPHUR SPRING*6MI W W YELLOWSTONE	18	25.14	213.95	2.14	25.14	37.62	-61.25	25.14	213.95	51.53	58.32	19.07				18
MGEOT127 LOWER EAST SPRING-STAUDENMEYER RANCH	28	50.56	190.06	1.53	50.56	36.10	-20.25	50.56	190.06	69.28	74.13	37.45				
MGEOT125 LOWER WEST SPRINGS-STAUDENMEYER RANCH	31	52.05	190.72	1.51	52.05	35.49	-18.99	52.05	190.72	66.01	71.23	34.03				
MGEOT124 UPPER WEST SPRING-STAUDENMEYER RANCH	29	50.11	188.52	1.53	50.11	35.89	-21.38	50.11	188.52	64.92	70.27	32.91				
MGEOT177 UPPER WEST SPRING-STAUDENMEYER RANCH	28.8	48.53	187.46	1.54	48.53	36.79	-22.28	48.53	187.46	64.92	70.27	32.91				
MGEOT123 UPPERMOST SPRING-STAUDENMEYER RANCH	28	47.70	188.17	1.56	47.70	36.27	-24.62	47.70	188.17	63.63	69.12	31.56				45
MGEOT126 UPPER-EAST SPRING-STAUDENMEYER RANCH	29	50.39	189.52	1.53	50.39	36.34	-20.08	50.39	189.52	68.27	73.23	36.39				
MGEOT121 ANDERSONS PASTURE SPRING #1	28	50.56	189.64	1.53	50.56	36.04	-20.37	50.56	189.64	66.01	71.23	34.03				45
MGEOT122 ANDERSONS PASTURE SPRING #2	23.5	49.09	190.13	1.56	49.09	34.62	-25.49	49.09	190.13	65.29	70.59	33.28				45
MGEOT210 USFS* BAKERS HOLE* 3MI N WEST YELLOWSTONE	16	91.96	183.40	0.90	91.96	40.09	48.22	43.74	183.40	125.03	122.44	97.08	74.38	26.38	6.13	45
MGEOT115 SLOAN COW CAMP SPRING	29.5	93.08	100.79	0.09	93.08	10.12	-19.50	93.08	100.79	102.64	103.28	72.78	52.24			85
MGEOT120 WEST FORK SWIMMING HOLE	25.5	22.90	191.44	2.02	22.90	70.54	-12.10	22.90	191.44	49.80	56.77	17.29				30
MGEOT118 CURLEW CREEK WARM SPRING	23	33.96	112.31	1.09	33.96	14.05	-86.94	33.96	112.31	62.88	68.45	30.78				
MGEOT119 WALL CANYON WARM SPRING	24	120.82	126.06	0.05	126.06	22.46	50.23	75.83	126.06	93.53	95.39	63.02	43.32			
MGEOT229 WOLF CREEK HOT SPRING	60	63.55	101.42	0.49	63.55	20.56	-32.25	63.55	101.42	102.46	103.12	72.58	52.05			
MGEOT129 LOWELL HILDRETH SPRING*15 MI SW DILLON	19.6	33.21	160.79	1.58	33.21	33.43	-55.00	33.21	160.79	58.50	64.55	26.24	9.58			
MGEOT016 BEAR CREEK SPRINGS	24															
MGEOT132 VIGILANTE WARM SPRING	23.5	14.06	192.50	2.20	14.06	34.09	-89.48	14.06	192.50	54.13	60.65	21.74				30
MGEOT041 LA DUKE HOT SPRINGS	65	74.46	161.74	0.95	74.46	22.38	-12.71	74.46	161.74	100.87	101.74	70.87				73
MGEOT012 BROWNS SPRINGS	23.7															30
MGEOT010 PULLER HOT SPRINGS	44.4	122.49	166.37	0.42	166.37	31.45	116.37	50.00	166.37	83.38	86.53	52.25				90
MGEOT019 TRUDAU SPRINGS	22.7	68.70	177.23	1.16	68.70	37.15	10.00	58.69	177.23	61.53	67.25	29.38				45
MGEOT040 CHICO HOT SPRINGS	42	63.04	182.95	1.29	63.04	27.38	-18.12	63.04	182.95	84.64	87.64	53.59				58
MGEOT032 GROUNDWATER*4.7 MI NE FT SMITH MT	20	122.94	82.65	-0.47	82.65	46.42	45.21	37.44	82.65	39.26	47.27					
MGEOT074 BROWN CATTLE CO* 3.1 MI N. BIRNEY MT	15.5	93.67	78.14	-0.20	78.14	20.45	-12.29	78.14	78.14	39.58	47.56					
MGEOT276 JARDINE HOT SPRINGS 0.25 MI E OF JACKSON	60	121.03	142.13	0.21	142.13	25.23	75.24	66.89	142.13	101.15	101.99	71.18				
MGEOT289 MBMG GEOTHERMAL TEST * THEXTON TX-12	87	175.27	163.18	-0.10	163.18	2.48	-0.45	163.18	163.18	141.01	135.92	114.73	90.40			
MGEOT028 JACKSON HOT SPRINGS	58	129.49	148.01	0.18	148.01	28.74	91.06		148.01	103.65	104.14	73.86				125
MGEOT293 PRIVATE GEOTHERMAL TEST*ENNIS HOT SPRINGS*	87	174.57	164.28	-0.09	164.28	2.54	0.01	164.27	164.28	141.54	136.37	115.32	90.94			
MGEOT277 LAPHAM DOMESTIC WELL 1 MI NW JACKSON, MT.	17	96.20	142.30	0.49	96.20	14.94	-4.51	96.20	142.30	55.70	62.06	23.36				
MGEOT117 ENNIS HOT SPRINGS	81															129
MGEOT058 BROWN CATTLE CO * 9.5MI SW BIRNEY DAY SCH.	16.5	92.50	80.39	-0.15	80.39	5.35	-30.60	80.39	80.39	38.28	46.38					
MGEOT031 BEAVERHEAD ROCK SPRINGS	27															
MGEOT133 APEX WARM SPRING	25	29.04	153.19	1.59	29.04	29.57	-70.34	29.04	153.19	63.07	68.62	30.98				76
MGEOT323 ELKHORN HOT SPRINGS	48.5	56.42	94.55	0.52	56.42	6.80	-53.08	56.42	94.55	105.31	106.44	76.72	55.84			
MGEOT292 MARTIN, KIETH	20.5	-8.62	210.02	2.82	-8.62	36.61	-130.80		210.02	41.47	49.27					
MGEOT326 NEW BILTMORE HOT SPRINGS	53	74.05	177.28	1.09	74.05	28.48	0.54	73.51	177.28	97.96	99.23	67.75				
MGEOT308 NEWMAN, JOHN * JOLIET, MT	16	85.34	52.06	-0.47	52.06	49.75	4.98	47.08	52.06	31.42	40.15					
MGEOT006 ANDERSON'S SPRING	25	-3.89	194.51	2.60	-3.89	44.31	-102.80		194.51	45.84	53.20					30
MGEOT280 ANDERSON SPRING	25	-10.31	208.61	2.85	-10.31	33.10	-142.90		208.61	43.85	51.42					
MGEOT043 NORRIS HOT SPRINGS	50	112.68	154.87	0.42	154.87	17.64	61.48	93.39	154.87	123.77	121.36	95.70	73.12			107
MGEOT015 POTOSI HOT SPRINGS	49.5	54.51	99.00	0.60	54.51	1.50	-14.81	54.51	99.00	97.96	99.23	67.75				60
MGEOT187 GROSS, PETE * 4 MI S PONY MT	37.5	51.38	98.58	0.64	51.38	1.16	-5.13	51.38	98.58	99.63	100.67	69.54	49.28			
MGEOT311 MCFERRAN, EUGENE * BILLINGS, MT	15.5	77.73	35.87	-0.64	35.87	30.92	-55.34	35.87	35.87	36.24	44.53					
MGEOT179 CARTER'S BRIDGE * 4 MI SE LIVINGSTON MT.	28	14.63	201.35	2.25	14.63	30.81	-95.22		201.35	62.30	67.94	30.18				
MGEOT011 AVON WARM SPRING	25.5															
MGEOT264 BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	59	101.91	117.96	0.18	117.96	2.28	-10.03	117.96	117.96	119.06	117.35	90.55	68.44			
MGEOT265 BOZEMAN HOT SPRINGS * OLD WELL	54	125.96	122.00	-0.04	122.00	0.00			122.00	118.41	116.80	89.84	67.79			
MGEOT266 BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	55	101.72	114.11	0.14	114.11	0.00			114.11	118.34	116.74	89.76	67.72			
MGEOT263 BOZEMAN HOT SPRINGS * ORIGINAL SPRING	54	90.29	114.55	0.28	90.29	13.15	-15.52	90.29	114.55	117.68	116.18	89.05	67.07			
MGEOT335 BOZEMAN HOT SPRINGS	54.6	86.10	117.51	0.37	86.10	31.54	24.04	62.06	117.51	108.02	107.91	78.57	57.52			80
MGEOT269 RANCA * MCLEOD	49	23.53	227.45	2.26	23.53	22.10	-94.90		227.45	80.23	83.77	48.92				50
MGEOT259 SCOTT FEED LOT	43	110.94	63.14	-0.61	63.14	15.38	-43.36	63.14	63.14	62.30	67.94					46
MGEOT260 SCOTT FEED LOT	44	108.71	58.85	-0.65	58.85	15.75	-48.51	58.85	58.85	63.44	68.95					46
MGEOT230 BLUE JOINT CREEK HOT SPRING	29.4	26.85	69.82	0.69	26.85	5.65	-74.20		69.82	105.44	105.68	75.78	54.98			45
MGEOT002 BRIDGER CANYON WARM SPRING	20.2	0.03	171.81	2.33	0.03	40.27	-104.10		171.81	32.96	41.56					25
MGEOT334 LOVE, MELVIN*THREE FORKS, MT	15.9	37.46	170.17	1.59	37.46	26.11	-62.30	37.46	170.17	82.22	85.52	51.02	32.33			
MGEOT033 GROUNDWATER*5.3 MI W HARDIN MT	39.4	35.50	273.88	2.33	35.50	24.88	-68.16		273.88	59.53	65.47					
MGEOT332 SHIPTON, HAROLD * THREE FORKS MT	16.9	43.32	173.18	1.51	43.32	41.38	-22.49	43.32	173.18	102.46	103.12	72.58	52.05			
MGEOT258 HERMAN, T.E. * ROCKY RANCH 7.4 M W HARDIN	42	38.17	279.16	2.31	38.17	25.68	-61.92		279.16	57.87	63.99					
MGEOT344 GALLOGLY HOT SPRING	48.9	46.93	94.45	0.67	46.93	0.00			94.45	95.63	97.21	65.26				56
MGEOT245 LOST TRAIL * WARM AND HOT SPRINGS	41.7	46.89	94.56	0.67	46.89	0.00			94.56	95.63	97.21	65.26	45.37			
MGEOT089 CAIN MIKE*6.6 MI S VOLBERG	18	86.75	68.76	-0.24	68.76	23.83	-17.46	68.76	68.76	28.55	37.54					
MGEOT018 HUNTERS HOT SPRINGS	60	72.46	80.46	0.11	72.46	12.01	-37.46	72.46	80.46	114.46	113.43	85.55	63.88			78
MGEOT328 JORGENSON, JACK * THREE FORKS MT	16															
MGEOT346 RENOVA HOT SPRINGS	50	91.54	162.75	0.74	91.54	27.10	21.49	70.06	162.75	88.27	90.81	57.43	38.20			90
MGEOT339 WESTMORELAND * 9.1 M W SARPY SCHOOL	37.7	86.26	281.79	1.61	86.26	18.35	-7.06	86.26	281.79	65.29	70.59					
MGEOT095 LISCOM RANCH * 5.5 MI NW OF N STACY SCHOOL	15.5	90.70	75.57	-0.20	75.57	30.91	7.91	67.67	75.57	31.02	39.79					
MGEOT331 TINDER, L. MARIE * THREE FORKS MT	21.9	80.95	180.54	1.02	80.95	29.08	11.61	69.34	180.54	101.34	102.15	71.38	50.96			
MGEOT327 WILCOX, RALPH * THREE FORKS MT	16.5															
MGEOT333 RICHARDSON, DEIRDRE * THREE FORKS	16.8	80.06	177.43	1.01	80.06	27.90	7.77	72.29	177.43	102.00	102.72	72.08	51.60			
MGEOT347 MEDICINE HOT SPRINGS	45	83.15	107.55	0.30	83.15	5.93	-30.04	83.15	107.55	110.51	110.05	81.26	59.98			82
MGEOT092 WESTERN ENERGY * 2 MI N COLSTRIP MT.	96.1	114.82	251.67	1.11	251.67	14.32	109.95	141.72	251.67	107.69	107.62					100
MGEOT020 PIPESTONE HOT SPRINGS	57	88.72	112.11	0.28	88.72	4.41	-24.40	88.72	112.11	115.22	114.08	86.37	64.64			88
MGEOT082 FRED WETSTEON SPRING DEVELOP	19	82.54	116.66	0.41	82.54	0.00			116.66	110.10	109.70	80.82	59.58			
MGEOT330 HART, FRANK * THREE FORKS, MT	15.9															
MGEOT063 ANADARKO PROD*6 MI E FOSTER MT	26.7	134.01	75.21	-0.68	75.21	33.33	12.31	62.90	75.21	46.11	53.45					
MGEOT053 SPRING * 29 M NE OF FOSTER MT	29	18.24	114.33	1.40	18.24	62.30	-29.92	18.24	114.33							

TEMPERATURES BASED ON SELECTED GEOTHERMOMETERS

Site name	Surface Temp	Na-K-Ca (B=4/3)	Na-K-Ca (B=1/3)	Mg CORRECTION Log(sqrtCa/Na)	Temperature Corrected	R Coefficient	Delta T (Mg Corr.)	Na-K-Ca Corrected	Na-K-Ca Uncorrected	Quartz (no steam)	Quartz (steam loss)	Chalcedony	a-Cristobalite	B-Cristobalite	Amorphous Silica	Published Estimates
MGEOT128 COWAN SPRING*9MI NW THREE FORKS MT	23	63.30	152.04	1.02	63.30	40.69	8.10	55.21	152.04							
MGEOT178 WOLF CREEK HOT SPRING	60															
MGEOT343 WILLIAMSBURG SPRING	17.4	30.83	182.20	1.80	30.83	29.31	-67.60	30.83	182.20	38.28	46.38					
MGEOT030 OIL WELL (TENSLEEP FORMATION)	69															
MGEOT341 MONTANA RESOURCES MONITORING WELL C	17.8	53.38	210.53	1.64	53.38	23.57	-41.16	53.38	210.53	103.29	103.83	73.47	52.86			
MGEOT342 MONTANA RESOURCES MONITORING WELL D2	16	62.65	218.39	1.55	62.65	34.65	-3.88	62.65	218.39	107.69	107.62	78.21	57.19			
MGEOT055 HOWARD SPRING * 25 M SE OF BIGHORN MT	23	76.61	101.34	0.31	76.61	86.89	66.11	10.51	101.34	38.94	46.98					
MGEOT246 WENDT, FRED * .75 MI S GREGSON (FAIRMONT)	23.9	46.09	148.63	1.25	46.09	6.93	-63.27	46.09	148.63	95.01	96.67	64.60	44.76			
MGEOT298 MBMG RESEARCH WELL * FAIRMONT HOT SPRINGS	20	83.88	111.99	0.34	83.88	2.86	-22.61	83.88	111.99		21.23					
MGEOT165 NELSON, HARVEY * 5 MI S BROADVIEW MT	16	98.25	53.63	-0.61	53.63	29.30	-28.79	53.63	53.63	35.89	44.21					
MGEOT061 BRADBROOK * 10 M S BROADVIEW MT	32.9	98.03	184.48	0.84	98.03	29.04	34.40	63.63	184.48	58.71	64.74					
MGEOT279 FAIRMONT HOT SPRINGS, ANACONDA	61.5	115.66	129.30	0.14	129.30	7.33	1.09	128.21	129.30	125.49	122.83	97.58	74.84			
MGEOT247 SPANGLER, HAZEL * 2 MI E-NE GREGSON MT	15.5	66.77	185.41	1.25	66.77	30.65	-5.60	66.77	185.41	107.85	107.76	78.39	57.36			
MGEOT214 HUNSAKER SPRING	24.5	59.89	224.82	1.64	59.89	28.69	-20.17	59.89	224.82	69.28	74.13	37.45				40
MGEOT150 MONT. HIGHWAY DEPT * .75 MI SE WACO MT.	15.5	83.47	60.04	-0.32	60.04	34.83	-7.58	60.04	60.04	28.55	37.54					
MGEOT213 PLUNKET LAKE WARM SPRINGS	17	29.41	144.77	1.50	29.41	49.38	-32.09	29.41	144.77	54.13	60.65	21.74				20
MGEOT237 SPRINGS FROM JOINTS IN MISS CYN*SW PLUNKET	17	28.82	148.12	1.54	28.82	43.44	-43.52	28.82	148.12	50.80	57.66	18.31				
MGEOT151 MONTANA DEPT HIGHWAYS * 2.5 MI NE WACO MT	16.5	62.23	61.83	-0.01	61.83	50.88	21.34	40.50	61.83	30.21	39.06					
MGEOT216 HUNSAKER, MAURICE	15	46.07	130.57	1.08	46.07	47.39	-7.99	46.07	130.57	79.27	82.93	47.91	29.48			45
MGEOT135 ANACONDA RED TRAVETINE MOUND - GEYSER	21.7	40.53	136.37	1.23	40.53	18.86	-70.75	40.53	136.37	68.27	73.23	36.39				75
MGEOT325 SLEEPING CHILD HOT SPRINGS	43	81.05	115.74	0.41	81.05	4.19	-28.46	81.05	115.74	110.51	110.05	81.26	59.98			125
MGEOT236 BRUCE, N * IRRIGATION WELL WITH BOOSTER	18	48.74	145.18	1.18	48.74	35.18	-25.00	48.74	145.18	100.30	101.25	70.26	49.94			
MGEOT218 TOSTON WARM SPRING	15.5	31.42	179.66	1.77	31.42	39.72	-45.88	31.42	179.66	63.07	68.62	30.98				20
MGEOT294 TOSTON WARM SPRING	45.5	24.75	155.61	1.69	24.75	39.30	-58.65		155.61	60.34	66.19					20
MGEOT217 BRUCE, NORMAN	18	31.66	116.11	1.17	31.66	1.73	-25.96	31.66	116.11	81.96	85.29	50.75	32.08			
MGEOT215 KIMPTON SPRING	18	0.75	141.55	2.04	0.75	31.18	-122.99		141.55	57.66	63.80	25.37				
MGEOT134 WARNER WARM SPRING	18	3.33	146.44	2.03	3.33	30.08	-119.85		146.44	55.26	61.66	22.90				
MGEOT172 STEELE, WILLIAM * 12.5 MI SE PINEVIEW MT.	16	94.50	69.17	-0.33	69.17	26.58	-10.71	69.17	69.17	28.12	37.15					
MGEOT284 MBMG TEST WELL*WARM SPRINGS STATE HOSPITAL	48	80.29	191.17	1.11	80.29	15.45	-21.47	80.29	191.17	77.16	81.08	45.70				
MGEOT009 WARM SPRINGS	77	79.49	194.96	1.15	79.49	13.46	-26.80	79.49	194.96	107.17	107.18	77.65				79
MGEOT233 WARM SPRINGS STATE HOSPITAL	67	85.73	208.59	1.17	85.73	14.82	-16.53	85.73	208.59	89.09	91.52	58.29				79
MGEOT231 WARM SPRINGS STATE HOSPITAL	54	88.33	206.44	1.12	88.33	14.68	-13.93	88.33	206.44	84.14	87.20	53.05				79
MGEOT350 BOULDER HOT SPRINGS - LOWER SPRING	64.5	130.10	157.93	0.26	157.93	0.00			157.93	131.37	127.80	104.05	80.71			
MGEOT349 BOULDER HOT SPRINGS - MIDDLE SPRING	74	126.81	141.13	0.14	141.13	10.65	21.54	119.59	141.13	136.34	131.99	109.54	85.70			
MGEOT348 BOULDER HOT SPRINGS - UPPER SPRING	54	115.54	134.06	0.19	134.06	12.64	24.04	110.02	134.06	133.32	129.45	106.20	82.67			
MGEOT232 WARM SPRINGS STATE HOSPITAL * SPRING	79	76.20	189.23	1.15	76.20	13.81	-29.92		189.23	107.00	107.03					79
MGEOT185 M-8 NO. 12 * 5 MI NE HAMILTON MT	18.5	34.29	172.45	1.66	34.29	21.64	-76.40	34.29	172.45	109.94	109.56	80.64	59.41			
MGEOT171 GRIERSON, J.B.*2.5MI NE RANCHERS CEMETARY.	21	116.09	67.49	-0.60	67.49	18.98	-30.12	67.49	67.49	46.38	53.70					
MGEOT130 PRISON RANCH SPRING SITE NO. 4	26	34.21	80.00	0.69	34.21	3.82	-58.24	34.21	80.00	97.76	99.06	67.54	47.45			40
MGEOT113 DEER LODGE PRISON RANCH WELL	26	34.25	79.90	0.69	34.25	3.82	-58.21	34.25	79.90	97.76	99.06	67.54	47.45			
MGEOT044 BEDFORD SPRINGS	23.6					38.89										30
MGEOT101 GRIERSON, J.B. * 23 MI NW HYSHAM MT	15.6	93.90	71.33	-0.29	71.33	43.35	24.47	46.86	71.33	23.55	32.97					
MGEOT274 MBMG RESEARCH WELL * WEED CREEK-1A	17	119.32	68.93	-0.62	68.93	41.89	18.57	50.36	68.93	30.21	39.06					
MGEOT275 MBMG RESEARCH WELL * WEED CREEK-1B	20	112.81	65.58	-0.59	65.58	25.78	-17.76	65.58	65.58							
MGEOT255 HANSER, BILL * 3 MI SW TWO DOT MT	18	95.31	66.32	-0.38	66.32	17.44	-35.02	66.32	66.32	46.66	53.94					
MGEOT256 FOX INC * 1.5 MI W-SW TWO DOT	19	77.08	53.12	-0.35	53.12	0.00			53.12	50.55	57.44					22
MGEOT257 HOMER, RAY * TWO DOT WATER SUPPLY	20	70.27	58.54	-0.17	58.54	10.84	-54.82	58.54	58.54	48.52	55.62					
MGEOT296 HARLOWTON * SOUTH MUNICIPAL WELL	15.6	35.61	27.84	-0.14	27.84	7.27	-84.39	27.84	27.84	39.90	47.85					
MGEOT013 HILLBROOK FLOWING WELL	30	130.95	160.89	0.28	160.89	17.94	67.79	93.10	160.89	115.98	114.73	87.19	65.38			
MGEOT014 WALLS HOT SPRING	55.6	111.67	147.60	0.37	147.60	19.97	63.64	83.96	147.60	110.51	110.05	81.26	59.98			
MGEOT001 ALHAMBRA HOT SPRINGS NORTH	56.5	110.28	143.79	0.35	143.79	20.15	60.68	83.11	143.79	115.22	114.08	86.37	64.64			96
MGEOT278 TOWNSEND,HERB*2.5 MI SW WHITE SULPHUR SPGS	48.5	16.27	157.17	1.86	16.27	33.68	-86.02		157.17	55.04	61.46					
MGEOT290 RALPH JOHNSON,P.O.BOX 65,WHITE SULPHUR SPR	15.3	259.05	122.38	-1.07	122.38	31.42	69.60	52.77	122.38	95.94	97.48	65.59	45.67			
MGEOT004 WHITE SULPHUR SPRINGS	46	126.79	147.27	0.20	147.27	26.73	84.76	62.50	147.27	102.74	103.36	72.88	52.33			125
MGEOT282 WHITE SULPHUR SPRINGS BANK WELL	43.3	121.76	144.81	0.23	144.81	23.87	73.83	70.98	144.81	95.63	97.21	65.26	45.37			
MGEOT188 WATTS, JAMES * 16 MI NE KINSEY MT	15	85.25	51.90	-0.47	51.90	20.14	-50.45	51.90	51.90	39.26	47.27					
MGEOT184 M-8 NO 8 WELL*2.5 MI SE CORVALLIS MT	18.3	60.33	181.90	1.32	60.33	27.27	-22.50	60.33	181.90	118.19	116.62	89.60	67.58			
MGEOT007 BROADWATER HOT SPRINGS WELL	65.5	98.03	130.98	0.36	98.03	7.61	-19.47	98.03	130.98	133.18	129.33	106.05	82.53			
MGEOT008 GLOEGE WELL	19.4	30.72	139.24	1.43	30.72	24.86	-76.67	30.72	139.24	76.58	80.57	45.09	26.89			
MGEOT003 GARRISON WARM SPRINGS	25	37.70	174.98	1.62	37.70	42.01	-30.80	37.70	174.98	59.93	65.83	27.73				
MGEOT208 USGS OBS WELL * 4 MI SW EAST HELENA, MT.	25	33.21	159.26	1.57	33.21	34.09	-53.67	33.21	159.26	54.81	61.26					
MGEOT242 FLORENCE TEST WELL A	15	126.79	141.90	0.15	141.90	11.71	26.55	115.35	141.90	17.75	27.65					70
MGEOT167 CHERRY CK SHEEP CO.*1.35MI SE HAGEN RANCH.	36	117.14	67.99	-0.61	67.99	21.81	-23.10	67.99	67.99	64.19	69.61					
MGEOT329 SIVERTE MYSSE * BOX 315 * INGOMAR MT 59039	37	109.43	60.78	-0.63	60.78	17.37	-42.84	60.78	60.78	66.71	71.85					
MGEOT261 MOORE, THOMAS * 6.5 MI SW ANGELA MT	82	158.97	174.41	0.13	174.41	19.18	84.02	90.39	174.41	102.55	103.20					
MGEOT322 BYRNE WARM SPRING * WEST OF BEARMOUTH	20	12.77	169.78	2.04	12.77	29.56	-101.51		169.78	64.74	70.10	32.72				
MGEOT116 NIMROD SPRINGS	20.5	16.61	162.80	1.91	16.61	31.73	-89.43	16.61	162.80	65.29	70.59	33.28				30
MGEOT026 BEARMOUTH SPRINGS	20.2	3.20	157.08	2.13	3.20	33.93	-111.79		157.08	55.26	61.66	22.90				35
MGEOT345 LOLO HOT SPRINGS	44	74.60	113.07	0.47	74.60	6.39	-36.98	74.60	113.07	119.63	117.84	91.17	69.00			83
MGEOT069 MARYSVILLE DEEP WELL DEPTH 5750	96.7	136.70	156.51	0.19	156.51	4.82	8.00	148.51	156.51	117.09	115.68					122
MGEOT170 CHERRY CREEK SHEEP CO.*26 MI N VANANDA MT	44	124.20	183.90	0.54	183.90	25.13	113.90	69.99	183.90	66.18	71.38					
MGEOT162 OLSEN, JONAS * 9 MI NW FLATWILLOW MT.	27	74.75	116.42	0.51	74.75	38.18	20.78	53.97	116.42	48.26	55.38					
MGEOT201 OLSEN JONAS * 14 MI NE N-BAR RANCH	16	52.65	163.23	1.28	52.65	43.70	-3.43	52.65	163.23	38.61	46.68					
MGEOT164 REYNOLDS, KEITH * 6 MI NE FLATWILLOW MT	24.5	96.56	85.39	-0.14	85.39	26.73	12.43	72.96	85.39	49.29	56.31					
MGEOT163 HILL, FLOYD * 7 MI N FLATWILLOW MT.	15	99.00	91.62	-0.09	91.62	26.13	19.29	72.32	91.62	47.99	55.15	15.44				
MGEOT180 M-B 4 (BUTLER CK) * 6 MI NW MISSOULA MT	16	123.77	143.22	0.19	143.22	37.23	105.41	37.82	143.22	132.53	128.78	105.33	81.88	33.52		
MGEOT254 KING, JOE & SONS INC. * 5 MI SSW WINNET MT	16	114.09	85.32	-0.34	85.32	31.39	22.64	62.68	85.32	46.93	54.19					
MGEOT159 SHAW, BUD * 1.7 MI SW MOSBY MT.	29	98.14	81.79	-0.20	81.79	22.97	-1.32	81.79	81.79	50.05	56.99					

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MGEOT160 EAGER, REX * 2 MI SW WINNETT MT.	15.5	93.19	95.04	0.02	93.19	30.87	32.17	61.02	95.04	45.00	52.45					
MGEOT161 BRATTON, WAYNE * 2 MI SE WINNETT MT.	24.2	94.27	85.61	-0.11	85.61	28.48	16.70	68.90	85.61	51.04	57.88					
MGEOT305 BURLY VISTA TRACTS	46	22.81	221.76	2.24	22.81	39.46	-61.88		221.76	26.81	35.95					
MGEOT157 TEIGEN, PETER * 9 MI E GRASSRANGE MT.	17.9	57.79	159.85	1.17	57.79	42.37	2.44	55.35	159.85	37.94	46.08					
MGEOT196 MATOVICH * 4.5 MI E GRASSRANGE MT	21.8	48.68	148.85	1.21	48.68	39.13	-17.71	48.68	148.85	39.90	47.85					
MGEOT181 HOLE NO 2 M-B DRILLING PROJECT	15	79.09	95.24	0.20	79.09	21.24	-9.11	79.09	95.24	56.58	62.84	24.27				
MGEOT240 MSU AG EXPERIMENT STATION * MOCCASIN MT	15	36.41	182.25	1.70	36.41	30.66	-54.91	36.41	182.25	36.24	44.53					
MGEOT155 BRADY, EARL*4 MI NW WINNETT, MT	15.8	91.37	102.46	0.13	91.37	32.45	33.08	58.30	102.46	52.02	58.76	19.56				
MGEOT203 GERDRUM, RONALD * 3 MI NE GRASS RANGE, MT.	15.9	64.48	110.59	0.59	64.48	39.75	8.28	56.20	110.59	43.85	51.42					
MGEOT152 CENEX*15 MI NE WINNETT MT	16	95.18	70.64	-0.32	70.64	19.25	-25.17	70.64	70.64	49.29	56.31	16.76				
MGEOT158 BASSETT, EARL * 7.5 MI NW TEIGEN MT.	17	70.90	105.48	0.44	70.90	41.19	20.33	50.57	105.48	38.28	46.38					
MGEOT059 HEDMAN, J. * 40 MI NE LEWISTOWN MT.	21	85.37	95.29	0.12	85.37	43.49	44.67	40.69	95.29	37.94	46.08					
MGEOT156 HARRIS FLOYD * 11 MI NW TEIGEN MT	19.2	68.35	90.04	0.29	68.35	38.31	11.58	56.77	90.04	45.00	52.45					
MGEOT194 FOX, DENNIS * 7 MI NW GRASSRANGE MT	20.8	35.54	122.35	1.17	35.54	32.13	-53.47	35.54	122.35	45.56	52.95					
MGEOT239 LAURENCE HESS * 1 MI N MOCCASIN MT	15	46.67	166.08	1.40	46.67	37.19	-24.59	46.67	166.08	33.34	41.90					
MGEOT204 DELANEY, DOUGLAS*7 MI NW (WILD HORSE UNIT)	23	74.05	99.87	0.33	74.05	43.02	27.90	46.15	99.87	40.22	48.14					
MGEOT050 BROOKS WARM SPRING * 2.5 MI NW BROOKS MT.	20	-9.89	169.12	2.53	-9.89	35.92	-135.23		169.12	41.47	49.27					
MGEOT195 DELANEY, DOUGLAS * 11 MI NW ROY MT	21.3	80.00	85.13	0.07	80.00	37.85	27.75	52.25	85.13	42.38	50.09					
MGEOT154 MILLER RANCH * 14 MI SE VALENTINE MT.	19.5	146.52	75.27	-0.80	75.27	28.67	2.70	72.58	75.27	55.93	62.25	23.59				
MGEOT045 CARDINAL PET CO * 10 M E HILGER MT	26.7	112.37	125.93	0.15	125.93	21.10	45.93	80.01	125.93							
MGEOT153 BUSENBARK, MERLIN*1 MI S VALENTINE MT*	27	133.83	73.49	-0.70	73.49	16.65	-27.23	73.49	73.49	56.36	62.65					
MGEOT268 QUINN'S HOT SPRINGS * JIM AND DONNA BROWN	45.1	65.79	121.07	0.68	65.79	0.00			121.07	120.69	118.74	92.33	70.05			99
MGEOT005 QUINN'S HOT SPRINGS	43.3	64.25	125.22	0.75	64.25	7.02	-46.66	64.25	125.22	122.82	120.56	94.66				99
MGEOT197 YEAGER * 8 MI EAST MOULTON, MT.	15	79.55	84.68	0.07	79.55	45.23	39.16	40.40	84.68	42.08	49.82					
MGEOT079 FINLEY, R.S.*1 MI NW ST. IGNATIUS	19	-9.53	105.88	1.90	-9.53	29.99	-148.28		105.88	42.38	50.09					
MGEOT205 SIROKY, FRANK * 9 MI EAST ROY, MT.	19	81.86	53.55	-0.40	53.55	10.49	-60.86	53.55	53.55	59.53	65.47	27.31				
MGEOT192 HORYNA, JAMES * 6 MI E ROY MT	18.4	95.34	67.59	-0.36	67.59	20.78	-25.99	67.59	67.59	56.58	62.84	24.27				
MGEOT131 CORPS OF ENGINEERS SOUTH WELL AFTER PERFS	15	89.35	125.42	0.41	89.35	37.31	39.81	49.54	125.42	35.53	43.89					
MGEOT090 BRYSON, HAROLD*1 MI W MOIESE MT	15.5	60.88	108.31	0.61	60.88	40.03	3.25	57.63	108.31	57.01	63.23	24.71				
MGEOT070 YARGER, ROBERT * 13 MI W CIRCLE MT	25	98.01	148.92	0.54	98.01	86.19	90.69		148.92	45.84	53.20					
MGEOT287 SAND COULEE WTR USERS BENCH W ABV SAND COU	15	27.13	159.87	1.68	27.13	68.43	-8.62	27.13	159.87	30.21	39.06					
MGEOT193 TAYLOR, JAMES * 8 MI E CHRISTINA MT	21	92.92	61.16	-0.43	61.16	9.86	-52.08	61.16	61.16	43.85	51.42					
MGEOT288 CHARLES ENTSMINGER*TOWN OF NUMBER SEVEN	16	14.10	162.56	1.95	14.10	36.91	-83.47	14.10	162.56	46.11	53.45					
MGEOT295 CUSTER, EVERETT* EDEN RT, GREAT FALLS, MT	15.5	31.23	155.98	1.57	31.23	36.80	-51.86	31.23	155.98	50.80	57.66	18.31				
MGEOT297 TOWN OF TRACY	16	12.44	155.43	1.92	12.44	36.53	-87.52	12.44	155.43	44.71	52.19					
MGEOT054 SLOGSVOLD, A. K. * 17 M SE RITCHEY MT	21.1	25.05	173.33	1.83	25.05	56.30	-28.20	25.05	173.33	48.52	55.62					
MGEOT211 GOVER * 2.5 MI TRAVIS SCHOOL	17.5	76.53	119.91	0.52	76.53	47.74	38.45	38.08	119.91	64.92	70.27	32.91				
MGEOT200 VILLAGE INN * 2.5 MI NE TRAVIS SCHOOL	18.5	96.99	124.94	0.31	96.99	32.69	41.02	55.97	124.94	41.77	49.54					
MGEOT299 STONE, GENE	25	69.58	92.80	0.30	69.58	0.00			92.80	107.51	107.47	78.02	57.02			
MGEOT062 WEBB RES * 17.5 MI SE GERALDINE MT.	20	52.54	169.93	1.34	52.54	31.00	-27.05	52.54	169.93	40.22	48.14					
MGEOT353 HOLLAND, JIM - GREEN SPRINGS	23.7	116.03	139.80	0.24	139.80	51.73	123.24	16.56	139.80	107.00	107.03	77.47	56.52			
MGEOT248 GREEN SPRINGS * HOLLAND RANCH	26															
MGEOT191 TACKE, ROBERT * 2 MI SW GREAT FALLS MT	15	63.90	158.35	1.07	63.90	39.69	7.30	56.61	158.35							
MGEOT198 PAUL, MICHAEL(ROBINSON)*3.5M SW GREATFALLS	17	58.99	158.33	1.14	58.99	33.68	-11.45	58.99	158.33	64.56	69.94	32.53				
MGEOT318 BUTTE CREEK SPRING * SQUARE BUTTE	18.8	40.96	162.57	1.46	40.96	25.31	-57.88	40.96	162.57	59.73	65.65	27.52				
MGEOT319 BUTTE CREEK SPRING - NORTH * SQUARE BUTTE	17	38.47	149.75	1.39	38.47	29.14	-54.40	38.47	149.75	57.01	63.23	24.71				
MGEOT169 CHAMBERLAIN, CURTIS * 2 MI W LLER SCHOOL.	16	92.13	63.42	-0.38	63.42	22.31	-28.59	63.42	63.42	32.96	41.56					
MGEOT321 MELTON, LARUE * LOWER AQUIFER	16	96.64	161.09	0.66	96.64	11.13	-13.96	96.64	161.09	54.13	60.65	21.74				
MGEOT314 USGS - MELTON, LEON	18.5	39.61	96.88	0.82	39.61	40.09	-31.05	39.61	96.88	65.47	70.75	33.47				
MGEOT238 SCHMIDT, LLOYD * 3.5 MI SE SQUARE BUTTE	21.8	74.66	143.59	0.78	74.66	32.01	8.85	65.81	143.59	42.38	50.09					
MGEOT190 USGS OBS WELL * .5 MI S VALLEY SCHOOL	27.1	33.68	162.09	1.58	33.68	53.82	-18.07	33.68	162.09	63.07	68.62	30.98				
MGEOT199 EIDEL * .5 MI S SUNSET MEMORIAL CEMETARY	16	84.77	115.71	0.37	84.77	61.42	64.71	20.06	115.71	41.16	48.99					
MGEOT078 WEBSTER, BONITA*BOX 443 RONAN MT	15.5	11.58	115.96	1.55	11.58	37.22	-87.73		115.96	61.13	66.90	28.97				
MGEOT099 DEMARS,TOM J.* 10 MI W OF WINIFRED MT.	17	30.65	116.22	1.19	30.65	36.41	-53.66	30.65	116.22	31.81	40.51					
MGEOT249 HOMESTEAD ACRES COUNTY WATER DISTRICT	15	32.47	162.17	1.61	32.47	41.59	-40.57	32.47	162.17	41.16	48.99					
MGEOT250 HOMESTEAD ACRES COUNTY WATER DISTRICT	15	35.58	165.22	1.58	35.58	42.88	-32.85	35.58	165.22	39.90	47.65					
MGEOT241 MCCOLLUM, JIM * 10 MI NW MATHISON RANCH	18.8	100.95	62.56	-0.50	62.56	16.15	-42.71	62.56	62.56	42.38	50.09					
MGEOT076 CARR, FRANK*BOX 456 HOT SPRINGS MT	21.5	18.67	125.83	1.52	18.67	39.37	-69.72		125.83	55.70	62.06	23.36				
MGEOT047 * RYFFEL BROS. * 3MI S & 3 MI E HIGHWOOD	18.6	40.02	134.81	1.22	40.02	34.74	-40.50	40.02	134.81	78.01	81.83	46.59	28.27			
MGEOT097 CHRISTIANSON, BOB*HOT SPRINGS MT.	22.5	66.02	119.13	0.66	66.02	41.56	13.68	52.34	119.13	58.50	64.55	26.24				
MGEOT068 TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	18.5	54.84	150.35	1.13	54.84	26.18	-33.36	54.84	150.35	67.06	72.16	35.13				
MGEOT307 HOT SPRINGS CITY	21	53.15	151.90	1.17	53.15	25.98	-36.45	53.15	151.90	76.73	80.70	45.24	27.03			
MGEOT228 LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	29.8									115.98	114.73	87.19	65.38			
MGEOT291 SOUTH EAST OF CAMP AQUA	51.5	119.51	120.98	0.02	120.98	0.00				117.90	116.37	89.29	67.29			
MGEOT071 CORN HOLE* CAMAS HOT SPRINGS	44	105.48	120.10	0.16	120.10	19.65	35.28	84.82	120.10	108.86	108.63	79.48	58.35			
MGEOT017 CAMAS HOT SPRINGS	45	108.70	118.49	0.11	118.49	8.52	-2.55	118.49	118.49	118.19	116.62	89.60	67.58			100
MGEOT080 HOT SPRINGS MONTANA	43	107.98	120.58	0.14	120.58	7.90	-2.83	120.58	120.58	109.69	109.34	80.38	59.17			
MGEOT351 SYMES HOTEL IN HOT SPRINGS	33.3	132.15	130.82	-0.01	130.82	39.49	95.70	35.12	130.82	120.39	118.49	92.00	69.76			
MGEOT029 SYMES HOT SPRINGS WELL	38	102.31	114.75	0.14	114.75	13.73	10.78	103.97	114.75	116.72	115.36	88.01	66.12			
MGEOT081 HOT SPRING GEOTHERM WELL - UNNAMED	15	74.80	171.81	1.03	74.80	30.79	6.55	68.25	171.81	83.13	86.31	51.98	33.21			
MGEOT144 KOEPLING, DELBERT * WELL 138	15.5	90.38	126.34	0.41	90.38	0.00			126.34	87.85	90.44					
MGEOT144 OSTRANGER, DAVE * WELL 56	15.5			0.39		42.78	-98.53			47.89	55.05					
MGEOT077 VERNER, ROSE*3.75 MI W PABLO MT	17.5	50.10	117.31	0.88	50.10	62.78	18.18	31.93	117.31	52.49	59.18	20.05				
MGEOT098 IRRIGATION EQUIPMENT SALES*HOT SPRINGS	19.5	48.72	145.33	1.18	48.72	33.47	-28.35	48.72	145.33	66.89	72.01	34.95				
MGEOT220 JACOBSEN, R * HOT SPRINGS MT	19	79.21	102.28	0.29	79.21	20.05	-11.84	79.21	102.28	85.88	88.72	54.89	35.88			
MGEOT176 KOPP, ARVID * HOT SPRINGS, MT	15.2	67.39	108.85	0.52	67.39	25.84	-14.97	67.39	108.85	51.29	58.10	18.82				
MGEOT042 SUN RIVER SPRINGS	30.4															
MGEOT267 MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	42.7	75.25	120.61	0.54	75.25	20.93	-15.03	75.25	120.61	88.04	90.60	57.18				

TEMPERATURES BASED ON SELECTED GEOTHERMOMETERS

Site name	Surface Temp	Na - K - Ca (B = 4/3)	Na - K - Ca (B = 1/3)	Mg CORRECTION Log(sqrtCa/Na)	Temperature Corrected	R Coefficient	Delta T (Mg Corr.)	Na - K - Ca Corrected	Na - K - Ca Uncorrected	Quartz (no steam)	Quartz (steam loss)	Chalcedony	a - Cristobalite	B - Cristobalite	Amorphous Silica	Published Estimates
MGEOT226 KOPP, ARVID * .25 MI S CAMPAQUA MT	32.6	87.52	100.02	0.15	87.52	14.71	-14.78	87.52	100.02	82.61	85.86	51.43	32.71			
MGEOT221 KEMP * .5 MI SE CAMPAQUA MT	28.8	97.10	113.78	0.19	97.10	17.52	3.62	93.48	113.78	85.76	88.61	54.76	35.76			
MGEOT286 JACKOLA AP.100 FT E. OF CAMP AQUA BATH SPA	51	109.26	119.23	0.11	119.23	6.84	-6.36	119.23	119.23	95.11	96.76	64.71				
MGEOT027 CAMP AQUA AREA TEST WELL	50	116.70	129.16	0.13	129.16	8.61	5.22	123.93	129.16	94.06	95.85	63.59				100
MGEOT262 MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	43.7	74.99	116.72	0.51	74.99	21.69	-13.60	74.99	116.72	86.25	89.04	55.28				
MGEOT202 OLSEN, EDWIN * 8.4 MI NE WINIFRED MT	22	128.37	64.87	-0.77	64.87	30.48	-8.80	64.87	64.87	46.38	53.70	13.79				
MGEOT251 SMELSER, JAMES A. * POWER MT	16	121.58	111.36	-0.11	111.36	33.55	61.05	50.31	111.36	31.42	40.15					
MGEOT225 KEMP * 0.3 MI E CAMPAQUA MT	30.6	99.61	110.97	0.13	99.61	12.46	-7.70	99.61	110.97	95.53	97.12	65.15	45.27			
MGEOT227 KEMP * .25 MI N CAMPAQUA MT	38.9	92.46	113.25	0.24	92.46	20.92	7.26	85.20	113.25	93.21	95.11	62.68	43.01			
MGEOT224 KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	32.5	84.39	103.13	0.23	84.39	10.75	-26.72	84.39	103.13	87.80	90.40	56.93	37.75			
MGEOT173 KEMP, ANNA * HOT SPRINGS, MT *	34.4	107.11	121.90	0.16	121.90	15.62	23.95	97.95	121.90	87.68	90.29	56.80	37.63			
MGEOT091 KEMP, ANNA* 5 MI N HOT SPRINGS, MT	24	97.92	124.33	0.29	97.92	11.52	-11.78	97.92	124.33	83.25	86.42	52.11	33.33			
MGEOT174 HUGHES, RAY * HOT SPRINGS, MT	25.8	90.72	115.41	0.29	90.72	16.17	-7.38	90.72	115.41	78.44	82.20	47.04	28.68			
MGEOT219 BAXTER, C * 1.5 MI N CAMPAQUA MT	20.3	83.08	98.53	0.19	83.08	13.65	-22.28	83.08	98.53	77.45	81.33	46.00	27.73			
MGEOT175 BAXTER, CHARLES * HOT SPRINGS, MT	22.8	77.55	113.58	0.44	77.55	14.19	-27.52	77.55	113.58	65.29	70.59	33.28				
MGEOT223 LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	23.6	60.70	91.51	0.42	60.70	15.35	-46.68	60.70	91.51	62.49	68.11	30.38				
MGEOT149 MATOVICH,JOHN * 23 MI SW SUN PRAIRIE MT	16	106.44	64.86	-0.53	64.86	23.50	-23.85	64.86	64.86	40.85	48.71					
MGEOT222 GAIL PATTON RANCH * 1 MI SW LONEPINE MT	16.6	32.66	141.52	1.41	32.66	30.34	-62.21	32.66	141.52	55.04	61.46	22.67				
MGEOT075 LONEPINE OBSERVATION WELL	16.5	23.73	118.66	1.34	23.73	31.99	-75.26	23.73	118.66	59.93	65.83	27.73				
MGEOT110 STREIT, GEORGE * 4MI E - 1MI S FT BENTON MT.	15	99.19	183.28	0.81	99.19	56.92	79.55	19.64	183.28	44.71	52.19					
MGEOT243 WHITMAYER ASSOC * 4.5MI SE SUN PRAIRIE SCH	15.6	129.50	90.43	-0.44	90.43	25.98	17.38	73.06	90.43	40.85	48.71					
MGEOT109 CLARK, BRAD * 25 MI E FT. BENTON MT.	20	86.84	68.69	-0.24	68.69	55.57	37.05	31.63	68.69	30.21	39.06					
MGEOT114 LANDUSKY PLUNGE SPRINGS	24	31.75	182.01	1.78	31.75	39.46	-45.80	31.75	182.01	59.12	65.10	26.89				30
MGEOT072 LANDUSKY, I*8.5 MI S HAYS, MONTANA	20.3	35.17	180.75	1.71	35.17	35.90	-46.65	35.17	180.75	52.25	58.97					
MGEOT046 BLACK COULEE * E OF TEST AREA	28.8	107.18	90.94	-0.19	90.94	71.03	78.79		90.94	24.03	33.42					
MGEOT313 ALZHEIMER, PAUL * SW OF BRADY, MT	25	35.78	91.16	0.81	35.78	44.43	-29.79	35.78	91.16	33.34	41.90					
MGEOT312 REVERE, LEE	25	30.48	92.90	0.92	30.48	46.21	-35.70	30.48	92.90	33.34	41.90					
MGEOT049 LITTLE WARM SPRINGS*9 MI SE LODGE POLE	26.1	48.88	174.25	1.43	48.88	38.01	-19.43	48.88	174.25	55.25	61.66					
MGEOT324 LODGEPOLE WARM SPRINGS	30	48.82	171.71	1.41	48.82	35.10	-25.01	48.82	171.71	55.93	62.25					35
MGEOT048 BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	30.6	50.01	172.28	1.40	50.01	36.56	-20.28	50.01	172.28	55.93	62.25					
MGEOT051 BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	26	41.85	165.73	1.48	41.85	37.29	-32.47	41.85	165.73	51.77	58.54					
MGEOT052 KIRKALDIE, BRUCE*7 MI SW LODGEPOLE MT	24.5	46.53	168.86	1.43	46.53	35.59	-27.85	46.53	168.86	50.80	57.66					
MGEOT037 LARGE CAPACITY WELL*4 MI SW WOLF POINT, MT	51															
MGEOT024 CITY OF WOLF POINT * WELL IN WOLF POINT	18.3	174.23	123.03	-0.48	123.03	70.58	117.01		123.03	47.99	55.15					
MGEOT023 SHERMAN HOTEL OF WOLF POINT	17.2	64.71	37.56	-0.43	37.56	25.68	-62.97	37.56	37.56	47.99	55.15					
MGEOT038 USGS TEST WELL * 1 MILE SOUTH POPLAR, MT	13.9	61.39	107.46	0.60	61.39	47.54	16.02	45.37	107.46	38.94	46.98					
MGEOT025 FOSS ELMER * 5.8 MI SE BROCTON	16.1	122.02	104.85	-0.19	104.85	25.84	35.26	69.59	104.85	55.26	61.66	22.90				
MGEOT317 LANDTECH WATER DISPOSAL SERVICE	17.9	102.22	61.52	-0.53	61.52	24.69	-26.23	61.52	61.52	54.58	61.05	22.20				
MGEOT315 THORNESS, RICK * 4 MILES NW OF BAINVILLE	15	65.27	100.32	0.46	65.27	58.52	35.39	29.88	100.32	71.09	75.72	39.33	21.61			
MGEOT108 CLAWITER, MILT * 4MI N - 4MI E BIG SANDY MT.	16	105.28	97.71	-0.09	97.71	42.47	59.78	37.94	97.71	66.01	71.23	34.03	16.74			
MGEOT303 SIMS SPRING	15	15.54	135.47	1.67	15.54	43.27	-67.72	15.54	135.47	62.88	68.45	30.78				
MGEOT140 TEXACO INC * 1.7 MI NW CENTRAL SCHOOL.	35.5	156.01	92.86	-0.66	92.86	20.04	5.43	87.43	92.86	72.83	77.26	41.15				
MGEOT252 MATOVAICH, MARTIN*17 MI E MALTA NEAR SACO	42	68.06	158.77	1.01	68.06	32.52	0.16	67.90	158.77	57.66	63.80					
MGEOT111 SLEEPING BUF REC AREA * 4MI NNW ASHFIELD	41.3	71.17	155.20	0.94	71.17	36.32	12.16	59.02	155.20	57.66	63.80					45
MGEOT145 SHIRLE, WALTER * 3 MI S FRESNO DAM.	17.5	104.64	65.18	-0.51	65.18	35.53	1.67	63.51	65.18	29.81	38.69					
MGEOT106 PIMLEY, DON * 4 MI NW JOPLIN MT.	15	91.58	59.98	-0.43	59.98	39.79	1.44	58.54	59.98	30.21	39.06					
MGEOT105 CADY, ELWIN * 7.5 MI NW JOPLIN MT.	25	96.12	63.76	-0.43	63.76	42.66	12.08	51.68	63.76	47.99	55.15					
MGEOT309 FRANCIS, CLARA	29	31.89	126.42	1.28	31.89	37.75	-48.85	31.89	126.42	61.72	67.42	29.58				
MGEOT107 WELSH, ORVILLE * 13 MI N - 3MI E HINGHAM MT.	16	92.86	65.82	-0.36	65.82	28.38	-11.79	65.82	65.82	38.61	46.68					
MGEOT310 EDWARDS, MARVIN / MIKE DUSTERHOFF	25	70.51	46.04	-0.37	46.04	27.92	-44.01	46.04	46.04	25.45	34.71					
MGEOT039 BIG WEST OIL CO * 2 MI NE MTN VIEW SCHOOL	46															
MGEOT104 RYGH, KEN * 22 MI N - 5 MI W JOPLIN MT.	21	110.67	65.40	-0.57	65.40	53.07	29.37	36.02	65.40	34.82	43.24					
MGEOT142 BRADBURY, ALFRED * 11 MI E WILD HORSE MT	15.5	95.99	72.73	-0.30	72.73	22.41	-15.03	72.73	72.73	29.39	38.31					
MGEOT144 NAGEHUS, ORVILLE * 3 MI N SIMPSON MT.	15.5	85.64	73.17	-0.17	73.17	25.02	-8.42	73.17	73.17	35.89	44.21					

GEOTHERMAL RESOURCES OF MONTANA

Submitted to:

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Geo Heat Center

and

University of Utah Research Institute

Submitted by:

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GEOTHERMAL RESOURCES OF MONTANA

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ACKNOWLEDGMENTS

The author gratefully acknowledges the advise and guidance provided by Howard Ross of the University of Utah Research Institute, Paul Lienau of the Oregon Institute of Technology - GeoHeat Center. The cooperation of the owners of the springs and wells that were sampled as part of this assessment is also greatly appreciated.

DISCLAIMER

Notice

ABSTRACT

Montana's Geothermal Resources

The Montana Bureau of Mines and Geology has updated its inventory of low- and moderate temperature resources for the state and has assisted the Oregon Institute of Technology - GeoHeat Center and the University of Utah Research Institute in prioritizing and collocating important geothermal resource areas.

The database compiled for this assessment contains information on location, flow, water chemistry, and estimated reservoir temperatures for 267 geothermal wells and springs in Montana. For this assessment, the minimum temperature for low-temperature resource is defined as 10° C above the mean annual air temperature at the surface. The maximum temperature for a moderate-temperature resource is defined as greater than 50° C. Approximately 12% of the wells and springs in the database have temperatures above 50° C, 17% are between 30° and 50°C, 29% are between 20° and 30°C, and 42% are between 10° and 20° C. Low- and moderate-temperature wells and springs can be found in nearly all areas of Montana, but most are in the western third of the state. Information sources for the current database include the MBMG Ground Water Information Center, the USGS statewide database, the USGS GEOTHERM database, and new information collected as part of this program.

Five areas of Montana were identified for consideration in future investigations of geothermal development. The areas identified are those near Bozeman, Ennis, Butte, Boulder, and Camas Prairie. These areas were chosen based on the potential of the resource and its proximity to population centers.

1.0 INTRODUCTION

Previous Geothermal Assessments

Two state-wide geothermal assessments have been conducted in the past. Allen (1980) collocated geothermal resources and cities for eight western states including Montana. Allen's study focused on resource temperatures greater than 50°C and did not include low-temperature resources. Sonderegger and others (1981) produced a 1:1,000,000-scale map and associated table of geothermal resource areas in Montana based on a compilation of various published reports and theses. Although the compilation included temperatures below 50°C, these data were not stored in a digital format because electronic databases were not available then for retrieval or storage. These reports, however, provided a good basis for updating information which has now been stored in a digital format.

Overview of Program

The Montana Bureau of Mines and Geology (MBMG) entered into a cooperative agreement with the Oregon Institute of Technology GeoHeat Center (OIT-GHC) and the University of Utah Research Institute (UURI) to conduct several tasks related to Montana's geothermal resources. These tasks included:

- preparation of a comprehensive digital geothermal-resources database containing temperature, location (latitude/longitude, Township/Range/Section/tract, and county) and chemistry (pH, TDS, and selected chemistry). The minimum temperature for a low-temperature resource was defined to be 10°C above the mean annual air temperature at the surface.

- preparation of a 1:1,000,000-scale map of occurrences within Montana. The map was compiled in a digital format.

- collecting samples from areas lacking information; analyses of the samples were conducted by UURI Earth Science Laboratory.

- a final summary report describing all tasks and their results.

- assisting OIT-GHC and UURI to prioritize low- and moderate-temperature resource areas.

Funding for this program was provided by the Department of Energy through a task agreement with OIT GHC and UURI. The tasks performed under this agreement may be considered Phase I of the Low-Temperature Geothermal Resources and Technology Transfer Program. Phase II, if funded, will include a detailed study of priority sites.

2.0 DATA SOURCES

References Used and Selection Criteria

Ground Water Information Center

The criteria for selecting sites that were to be included in the database depended on the source of the data. For the initial search of the Montana Bureau of Mines Ground Water Information Center (GWIC) database, a minimum temperature of 13^{0} Celsius was used (10^{0} degrees above the lowest mean annual temperature officially reported anywhere in Montana) to ensure that all low-temperature sites were included. This query produced approximately 600 records. Each record included any information that was available on location , site name, well depth, flow, temperature, and chemistry. These records were then transferred to a PARADOX database where more restrictive queries could be made that would eliminate records while allowing for a review of the eliminated records. For example, after sorting and separating the data into five geographic areas for which the mean annual air temperature was better defined and running a query based on that temperature, approximately 250 sites were eliminated, leaving approximately 350 sites to be considered further. Each of the remaining 350 sites was assigned a 3-digit identification number with a prefix of MGEOT. The rejected records were reviewed for other geothermal indicators such as high chloride, silica, and/or arsenic concentrations and close proximity to known geothermal areas.

GEOTHERM

A digital version of the GEOTHERM database was obtained from the Department of Energy Geothermal Division. These data had been compiled in an earlier, region-wide inventory (Reed and others, 1983). Although no new records were added to the MGEOT database, the GEOTHERM records were compared to those in the MGEOT database for accuracy and completeness. Since there were few changes, it was not necessary to merge the databases; any necessary changes to the MGEOT database were made manually.

Published Data

The tables of geothermal wells and springs produced by Mariner and others (1976), Leonard and others (1978), and Sonderegger and others (1981), were also used to ensure the completeness and accuracy of the MGEOT database. Any additional sites or information from these reports were entered manually into the database. The same approach was taken with other published sources.

Twelve Master's theses were reviewed for additional information on geothermal resource areas. Many of the investigations focused on the geologic or geophysical aspects of a known geothermal area. Little chemistry data was gleaned from these reports; however, temperature and location of many sites were verified as a result of the review.

Error and Duplicate Records

The most common error encountered was high temperatures reported for wells and springs in areas where geothermal sources are known **not** to exist. The most probable cause for the high temperature is "warm-day" sampling or improper purging of shallow wells. These sites were eliminated based on the personal knowledge of the investigators or on data collected at that same site at another time. Another common error was in the units used for concentration data. Trace-metals such as boron, arsenic, and lithium were often in error as a result of converting between parts-per-billion (μg/L) and parts-per-million (mg/L). The original publication was used, if possible, to correct these. In other cases, a calculation of ionic balance was used to determine if a problem existed.

With some exceptions, duplicate records in the form of data for two or more samples from the same site were eliminated and the most recent, most complete data were used. The exceptions were the site that had been re-sampled as part of this inventory (Symes Hotel, MGEOT352) and sites where samples had been collected several years apart. The intent was to provide information on changes in temperature and chemistry over time. The other exception were those sites where

information was limited with respect to chemistry. In these cases, two data sets provided more useful information on the site. There is a total of 24 duplicate sites.

Reference/Bibliography

A reference is given for each record in the database. The reports published by Mariner and others (1976), Leonard and others (1978), and Sonderegger and others (1981) provided most of the information for previously identified geothermal areas. The GWIC database provided more recent data for previously identified sites. GWIC also provided information for areas near previously identified resource areas and for low-temperature sites in geothermal areas not previously identified.

The references/bibliography listed in Section 8.0 also includes the theses and other publications that pertain to geothermal resource areas in Montana. As noted in Section 2.0, some of these references provided confirmation of location and temperature. Rautio and Sonderegger (1980) also provided a bibliography of geothermal resources in Montana. This is reproduced in this report as a useful supplement to the bibliography.

3.0 DATA FORMAT

Organization of Tables

The data fields used in the database were recommended by program leaders at OIT-GHC and UURI, and agreed upon by state team members. The final version of the data was exported from the PARADOX database to a LOTUS-123 format. The spreadsheet enabled an evaluation of the distribution of sites, the calculation of reservoir temperature, and provided a means of graphical output.

State Geothermal Resource Map

The location (latitude/longitude), temperature, resource type (well or spring), and ID number of all sites in the database were imported from the spreadsheet to an ARC/INFO based Geographical Information System. The data were then plotted at 1:1,000,000 scale with county boundaries. Each data-point indicated the ID-number, the temperature range (by color), and resource type (well or spring, by symbol) as well as location. This initial plot was used to verify the accuracy of the location, to give an indication of the density of sites in a given area, and to identify any sites that were plotted in areas where geothermal resources are known **not** to exist. The final map uses the same format and presents each of the individual sites listed in the database. A listing of selected fields for all sites is presented in Appendix I. The large number of sites in the Camas-Lonepine area made it impractical to plot the ID number for each site; these are repeated in a separate table in Appendix I.

Procedures for using the data

The database listing in Appendix I is sorted by location (ascending latitude). This format is also used in the listing of maximum temperatures based on selected geothermometers in Appendix II. The information for each site is listed with reference to the ID number on the 1:1,000,000-scale map.

In the repetitive process of adding and deleting sites based on a multitude of criteria, it was found that maintaining the database in a PARADOX (or similar)

format was best. This format enables searches using the an ID-number or location from the map or general information, such as site name, and is contained in a single database-table. This single table can be separated into several tables as the need arises.

4.0 FLUID CHEMISTRY

Samples collected in this assessment

Eight water samples were collected from five areas in Montana; seven of these sample sites had not been sampled previously or had only limited information prior to this investigation. The eighth site was selected to provide a comparison of data collected approximately 10 years apart.

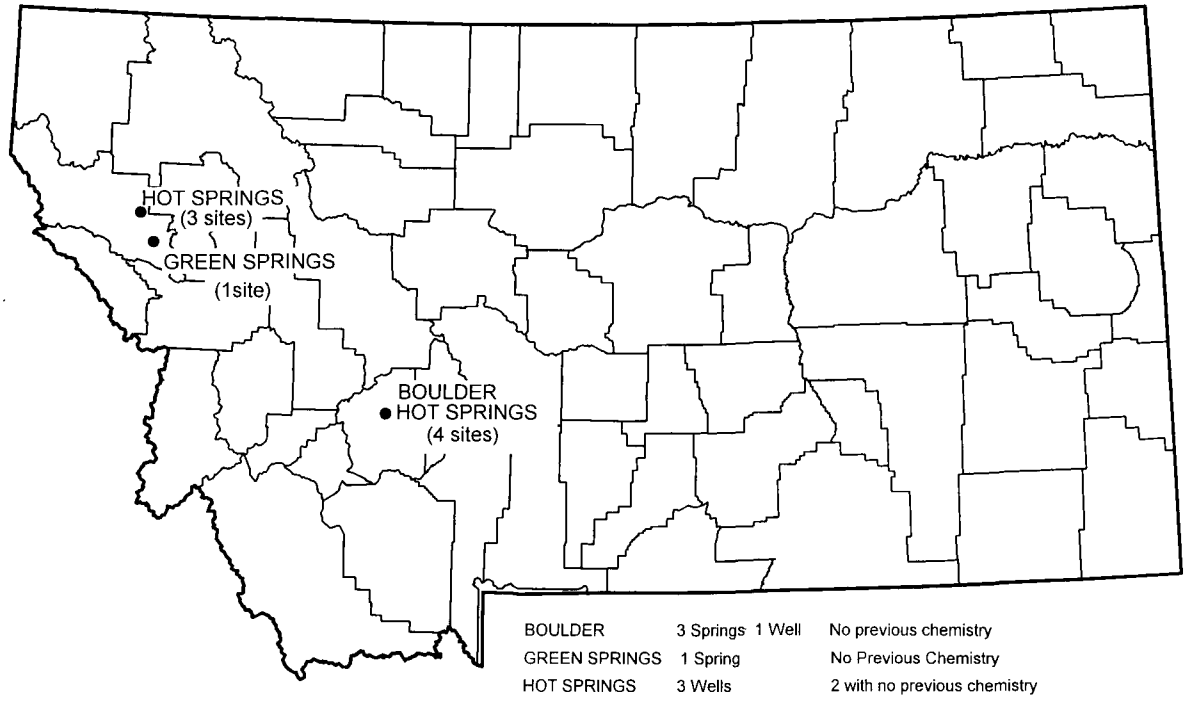

Figure 1 Eight samples were collected from three areas of Montana. Seven of the sites had little or no chemistry data.

Boulder Hot Springs, south of Boulder, MT

The Boulder Hot Springs resort is approximately 3 miles south of the town of Boulder within the Boulder Hot Springs KGRA. Previous owners of the resort would not grant access for sample collection during previous investigations. The

current owners, however, kindly allowed access, and each of the three springs near the resort were sampled (MGEOT349, MGEOT350, and MGEOT351). A fourth sample (MGEOT356) was collected from a well that had been intended as a drinking-water supply for the hotel, but produced "hot water" according to the owner.

Symes Hotel, Hot Springs, MT

The Symes Hotel uses a well for domestic water use. This well had been sampled in previous investigations, the sample date being 1980. The area has since undergone a moderate amount of development, and several additional wells have been completed in the area. Thus, this site (MGEOT352) was chosen to provide a comparison.

Koepling Well (MGEOT355) and Ostranger Well (MGEOT 354) , north of Hot Springs, MT

These wells are in the Little Bitteroot Valley 3 to 5 miles north of the town of Hot Springs. Although previously identified to be within a geothermal resource area, these wells had not been sampled in previous investigations.

Green Springs Area (MGEOT353), southwest of Camas Prairie, MT

Local residents identified 3 to 4 "hot" springs in the area south of the town of Camas Prairie. Nearby, Green Springs had been identified by Sonderegger and others (1981) as a geothermal area, but only limited data were available.

Sample collection/analytical methods

Water samples were collected from wells and springs in accordance with the Standard Operating Procedures provided by UURI (Kroneman, 1992). Each sample consisted of a 60-ml bottle filtered and preserved with 20% HNO_3, and 250-ml bottle filtered and preserved with 1% HCL, and a 500-ml bottle filtered with no

preservative. Upon collection of each sample, specific conductance, pH, water temperature and air temperature were obtained at the sample source. Spring samples were collected as close as possible to the source. Wells were sampled after pumping or bailing a minimum of three casing volumes and after field-parameters (pH, SC, Eh, and temperature) had stabilized to a range of less than 10%.

Samples were shipped within 48-hours of collection, via overnight delivery, to the UURI Analytical Laboratory in Salt Lake City, Utah. The samples were analyzed for major cations, major anions, and selected trace-metals.

Reservoir Temperatures

Several methods to estimate the reservoir temperature have been proposed; the most widely used are those using dissolved concentrations of silica (as SiO_2), Na-K-Ca, Na-K-Ca with a correction for Mg, and Na-K and are summarized by Fournier (1981). These methods represent empirical, equilibrium equations for which the water temperature at the reservoir is calculated. As noted by the authors of the methods, these calculations should be interpreted in consideration of the geologic and hydrogeologic setting.

Analytical Results

The analytical results for selected analytes are presented in Table 1. These sites are also included in the listing in Appendix I, in the listing of temperatures from geothermometers in Appendix II, and in the MGEOT database.

TABLE 1
ANALYTICAL RESULTS
1993 SAMPLING

ID	Site Name	Temp (°C)	Flow (L/m)	TDS (mg/L)	pH	Cl (mg/L)	SO_4 (mg/L)
MGEOT349	BOULDER (UPPER)	54.0	340*	419.5	8.89	21.0	76.0
MGEOT351	BOULDER (LOWER)	64.5	75.7*	401.4	8.80	22.0	73.0
MGEOT350	BOULDER (MIDDLE)	74.0	75**	421.1	8.89	22.0	80.0
MGEOT356	BOULDER (WELL)	34.5		373.1	8.46	16.0	54.0
MGEOT352	SYMES HOTEL	33.3		297.2	9.66	11.0	30.0
MGEOT355	WELL 138	26.5		275.0	8.23	10.0	5.1
MGEOT354	WELL 56	17.2		290.9	8.05	14.0	3.8
MGEOT353	GREEN SPRINGS	23.7	2000**	208.4	9.86	12.0	17.0

* Flow measured with bucket/stopwatch **Flow estimated

ID	Site Name	F* (mg/L)	Ca (mg/L)	Mg (mg/L)	Na (mg/L	K (mg/L)	Fe** (mg/L)
MGEOT349	BOULDER (UPPER)	11.8	2.7	0.4	122.0	3.8	ND
MGEOT351	BOULDER (LOWER)	11.0	3.2	ND	111.4	6.1	0.31
MGEOT350	BOULDER (MIDDLE)	11.1	2.0	0.3	118.2	ND	0.08
MGEOT356	BOULDER (WELL)	5.7	4.09	ND	108.2	3.7	0.09
MGEOT352	SYMES HOTEL	5.6	0.6	0.7	89.4	2.2	ND
MGEOT355	WELL 138	3.4	4.5	ND	95.6	2.9	0.06
MGEOT354	WELL 56	5.4	5.5	2.5	109.3	ND	0.39
MGEOT353	GREEN SPRINGS	2.1	0.8	1.2	57.1	2.1	0.27

* The drinking water standard (primary) for fluoride is 4mg/L.

** The drinking water standard (secondary) for iron is 0.3 mg/L; the aquatic life standard (acute) is 1mg/L.

TABLE 1 - Continued

ID	Site Name	SiO_2 (mg/L)	As (mg/L)	B (mg/L)	Li (mg/L)
MGEOT349	BOULDER (UPPER)	93.2	0.7*	0.6	0.23
MGEOT351	BOULDER (LOWER)	90.0	ND	0.5	0.22
MGEOT350	BOULDER (MIDDLE)	98.5	ND	0.5	0.23
MGEOT356	BOULDER (WELL)	86.55	ND	0.49	0.21
MGEOT352	SYMES HOTEL	73.08	ND	0.2	0.04
MGEOT355	WELL 138	36.64	ND	0.4	0.04
MGEOT354	WELL 56	12.96	ND	0.3	ND
MGEOT353	GREEN SPRINGS	55.8	ND	0.1	ND

* Because of the high As concentration, this spring was re-sampled and analyzed by MBMG. The second analysis indicated a concentration of 0.02ug/L As.
ND = Not Detected

Boulder Hot Springs

The Boulder Hot Springs area lies approximately 3 miles south of the town of Boulder near the Interstate 15 highway. The area lies within the Boulder Batholith about 4 miles from its eastern edge. Until this investigation, only limited chemistry data and field parameters were publicly available for this area (Robertson and others, 1976, published limited chemistry and a reservoir temperature, but the location of the sample was not made clear). Other hot-springs and warm-water wells are known to exist in the area around Boulder; however, access was not gained either because the owner denied access or could not be contacted.

The samples were collected from three springs that have been developed to supply the Boulder Hot Springs resort. At present, the primary use of the hot water is a naturally heated swimming pool. As renovation of the hotel continues, the water may also be used for space heating as was the case in the past. Samples were collected at the supply pipe at each spring-box. Water-flow, which was difficult to measure because of the structures, was measured at two of the

springs using a bucket and stopwatch; the flow of the middle springs could only be estimated. The combined flow of all three springs is on the order of 490 L/min.

The field-temperatures of the springs vary by 20°C; the upper spring had the lowest temperature (54°C) and the middle spring, which was not being used, had the highest temperature (74°C). The variance in temperature suggests that the water supplying the springs is undergoing mixing. Conversely, the chemistry of the waters from each of the three springs is similar (all are strongly a sodium-potassium type water) and the estimated reservoir temperature for each of the springs tend to agree regardless of the geothermometer used (Table 2). Thus, the variance in temperature may result from the way the spring was developed and fed to the spring boxes.

TABLE 2
Selected Geothermometer Temperatures*
Boulder Hot Springs

ID	Site Name	Na-K-Ca (corrected)	Na-K-Ca (uncorr.)	Qtz (no steam)	Qtz (steam)
MGEOT349	BOULDER (UPPER)	110°C	134°C	133°C	129°C
MGEOT351	BOULDER (LOWER)		158°C	131°C	128°C
MGEOT350	BOULDER (MIDDLE)	120°C	141°C	136°C	132°C
MGEOT356	BOULDER (WELL)		134°C	129°C	126°C

*Geothermometer temperatures for all sites are presented in Appendix II.

The well, with a depth of 37.5 meters and a static-water-level of 0.85 meters, is downhill from the resort and the springs. The chemistry of its water (Table 1) is similar to that of the springs; and the geothermometer temperatures (Table 2) are in good agreement with those calculated for the springs. The water temperature (34.5°C) was 20°C lower than the spring with the lowest temperature. A small pond near the well had a temperature of 21°C.

Hot Springs Area

Three water samples were collected from the Hot Springs area: two from wells north of Hot Springs and one from a well in Hot Springs. As noted previously, temperature and chemistry data were not available for three of these sites, and the fourth, the Symes Hotel, had a sample collected in 1972 .

The Koepling well and the Ostranger well are completed in the Lonepine aquifer approximately 1.5 miles apart and approximately 5 miles northeast of Hot Springs. The Symes Hotel is located in Hot Springs.

Water temperature and the concentration of several of the dissolved constituents varies between the three wells (Table 1). The geothermometer temperatures (Table 3) also indicate a range of temperatures wider than would be expected for a system with little or no mixing. Donovan (1985) suggested that the chemistry (and geothermometers) reflected the relative position of the well in a deep-circulating flow system.

TABLE 3
Selected Geothermometer Temperatures*
Hot Springs Area

ID	Site Name	Na-K-Ca (corrected)	Na-K-Ca (uncorr.)	Qtz (no steam)	Qtz (steam)
MGEOT352	SYMES HOTEL	35°C	131°C	120°C	118°C
MGEOT355	KOEPLING (WELL 138)			48°C	55°C
MGEOT354	OSTRANGER (WELL 56)		126°C	88°C	90°C

*Geothermometer temperatures for all sites are presented in Appendix II.

A time-comparison of geothermometer temperatures for the Symes Hotel well (Table 3) suggests a 3 to 5°C drop in temperature, perhaps the result of continued development of ground-water resources in the area. None of this

development, however, has been of the geothermal resources. This area could easily provide for applications of heat-transfer technology.

Green Springs

Green Springs is approximately 12 miles south of Hot Springs and approximately 2.5 miles southwest of Camas Prairie. Green Springs consists of 3 to 4 thermal springs feeding a wetlands/pond area. Elsewhere in the area, several small springs have been described by local citizens. A sample was collected from the largest of the springs at its source (Table 1). Although the site was documented by Sonderegger and others (1981), only a few chemical parameters were measured. The new data enabled a calculation of geothermometer temperatures (Table 4).

TABLE 4
Selected Geothermometer Temperatures*
Green Springs Area

ID	Site Name	Na-K-Ca (corrected)	Na-K-Ca (uncorr.)	Qtz (no steam)	Qtz (steam)
MGEOT353	GREEN SPRINGS		140°C	107°C	107°C

*Geothermometer temperatures for all sites are presented in Appendix II.

The differences between geothermometer temperatures suggests that mixing may be occurring and the difference in surface temperature and the geothermometer temperatures suggests either a high heat transfer or a slow circulation rate for this area.

Observations From Other Database Entries

Incorporating low-temperature sites in the inventory produced a new perspective of geothermal resources in the state. Areas such as Butte became more important with respect to potential development. The same may be true for the area near the city of Great Falls in Cascade County where wells 128- to 366-meters deep in the Madison Group produce water that ranges from 15 to 19°C; the water is used for irrigation and public water supply. Wells 274- to 396-meters deep in southern Treasure County and northern Big Horn County produce water whose temperatures range from 16.5°C to nearly 20°C.

The lower temperatures used in the selection criteria also had the effect of enlarging some of the areas identified by Sonderegger and others (1981). An example of this is in southern Broadwater County and northwestern Gallatin County where wells and springs had been identified in previous investigations. Updating the database provided additional information that may indicate a larger area for potential development.

5.0 DISCUSSION

Resource Potential

There are 291 records in the current database; these represent 267 individual sites (wells and springs). Approximately 71% of these sites exhibit water temperatures between 10 and 30° Celsius (Figure 2).

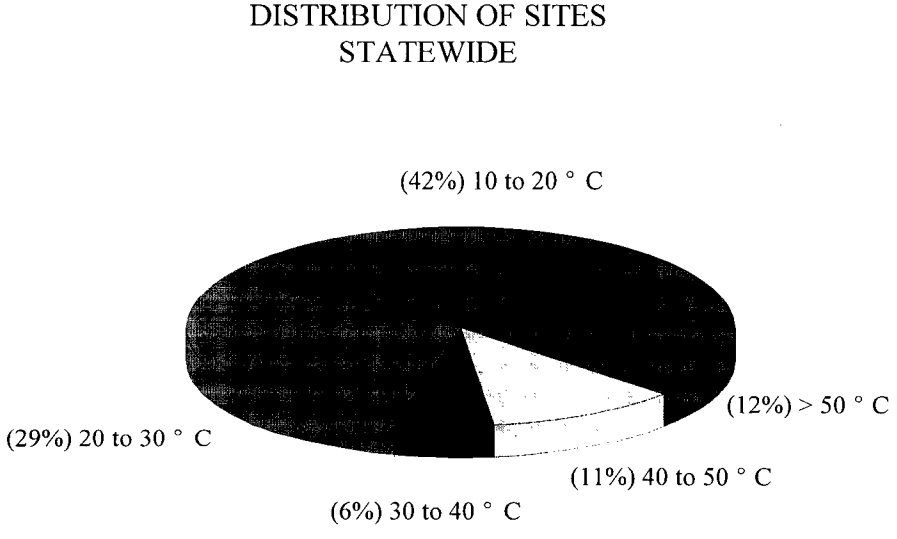

Figure 2 About 77% of the geothermal sites in Montana have water temperatures less than 40° Celsius; 12% of the sites have temperatures greater than 50° Celsius.

Collocation of Resources and Users

Montana's population centers are generally small (<50,000 people) and

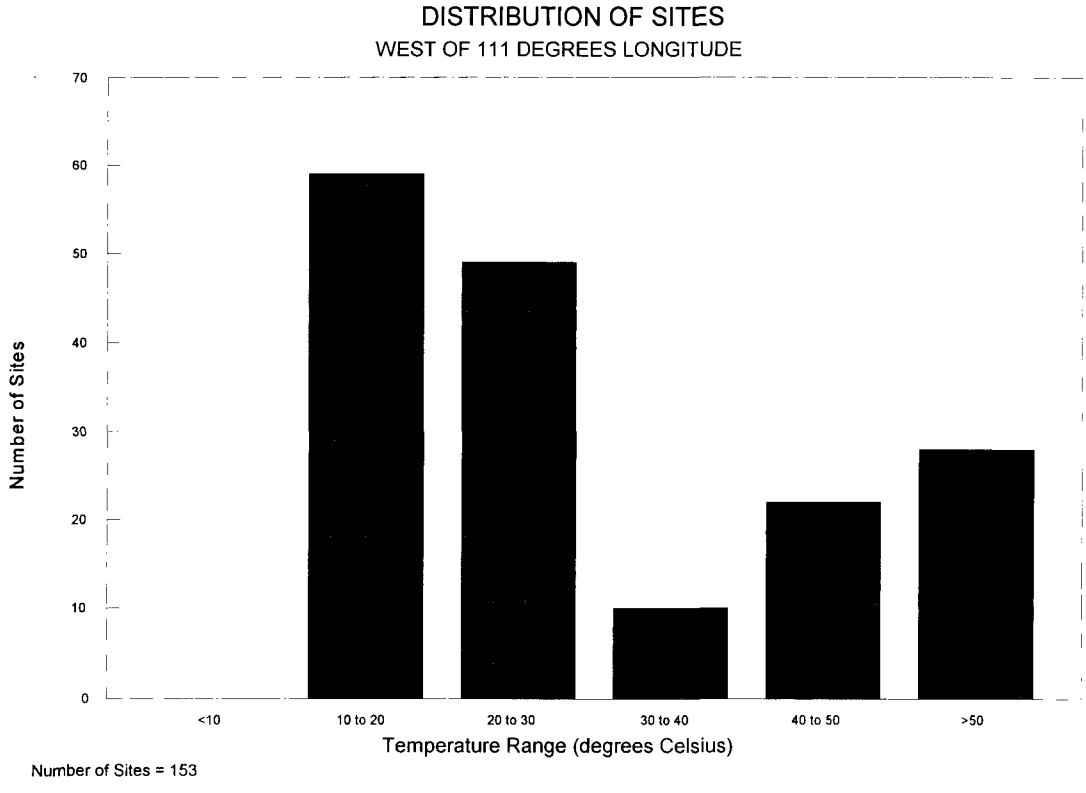

Figure 3 The western third of the state has 153 sites. About a third of those (approximately 100)have temperatures greater than 30°C.

widely distributed. The western third of the state has more of the larger population centers and a slightly higher overall population than the eastern two-thirds.

The distribution of geothermal resources mimics, but does not correlate, to that of the population; 152 of the 267 sites occur in the mountainous area of the western third (generally west of 111° longitude) whereas 115 sites are in the plains area of the eastern two-thirds of the state. Similarly, the number of warm and hot springs is much higher in the west.

A comparison of the distribution within the western (Figure 3) and eastern (Figure 4) parts of the state shows that the western third has a larger number of sites with temperatures greater than 30°C.

Collocation of population centers, albeit small, and geothermal resources are most likely to occur in the western third of the state. It should be noted, however, that deep wells into the Madison Formation in the eastern part of Montana have the potential to produce low- to moderate-temperature water as demonstrated in Treasure County and northern Big Horn County.

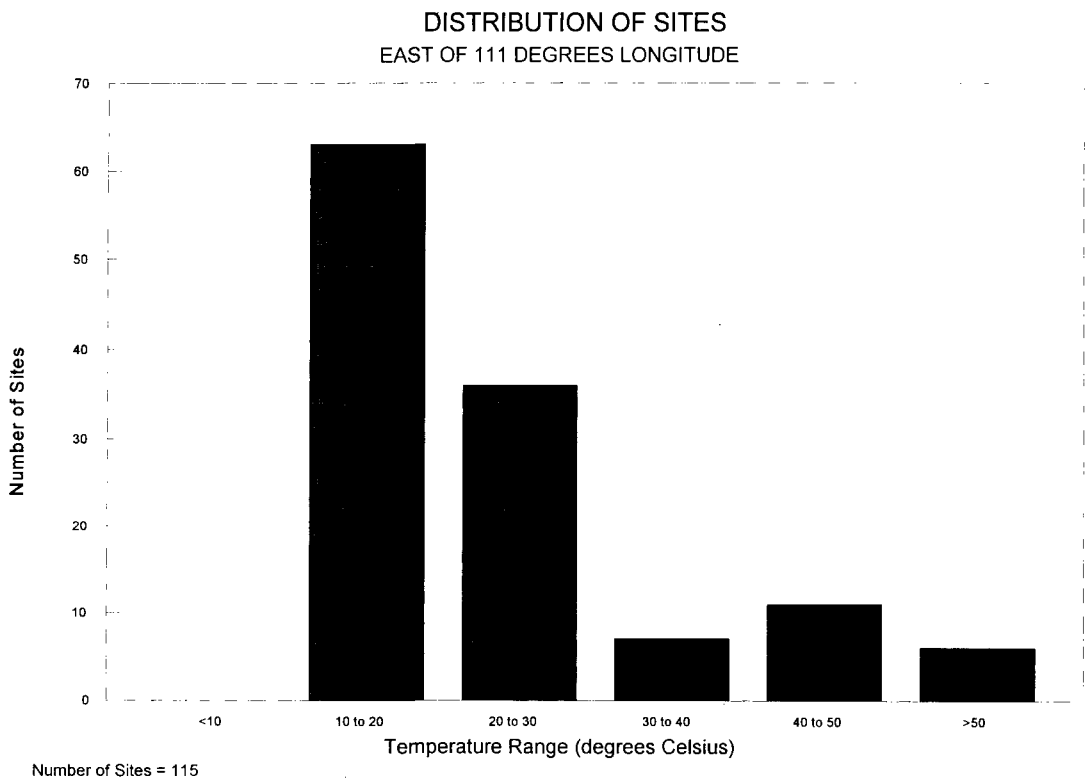

Figure 4 Most of the sites in the eastern third of the state. About 20 sites have temperatures greater than 30°C.

6.0 SUMMARY

Each of the tasks outlined in the agreement between the Montana Bureau of Mines and Geology and the Oregon Institute of Technology / University of Utah Research Institute have been completed. The database described here represents the most current information on geothermal resources in the state of Montana. The database also contains the information collected from eight sites that lacked information prior to this inventory. A 1:1,000,000 scale map, which accompanies this report, shows the location, temperature group, distribution, and type of geothermal resources in the state.

The distribution of geothermal resources and population in Montana suggests a good potential for development of these resources. Although Montana has only a few large population centers, smaller cities and towns near the resources could benefit from development. Although the low temperature of the resources (most are less than 50^{o}C) restricts the type of development, small-scale direct-heat or heat-pump applications, aquaculture, and other development may be economical in some areas.

Whereas the information presented in this report reflects the current knowledge and information on geothermal resources across the state, funding and time limitations would not permit an evaluation of each site. Individuals or groups with the intention of developing any of the sites or areas identified in this assessment should conduct a more thorough investigation and confirm the temperatures, chemistry, and flows.

7.0 RECOMMENDATIONS

Priority Areas for Phase II Studies

The dominant consideration in selecting areas in Montana for future studies is the proximity of the resource area to transportation and population centers. Although there are several resource areas with a relatively high potential for development, limited past and/or current use and low population in the area likely prohibit development. The areas that have the highest potential and are nearest population centers (Figure 5) and transportation routes are as follows:

Bozeman

The Gallatin valley near Bozeman has experienced a steady population growth over the last decade. Data for the Bozeman Hot Springs just west of the city of Bozeman indicates a surface temperature of approximately 55°C and an estimated reservoir temperature of 80°C. The springs are currently used to heat a swimming pool at a commercial campground. Although little resource development has occurred in the area over the last ten years, the Gallatin valley was identified by Sonderegger and others (1981) as an area expected to contain geothermal resources suitable for development. Geophysical exploration and deep drilling would better define the source and extent of this resource area.

Butte

The Butte Mining District was extensively mined over a period of nearly 100 years. At the cessation of underground mining in the early 1980's, dewatering of the bedrock was discontinued and water-levels were allowed to rise. Soon after the mines were shut down, the area was listed in the National Priorities List and is designated as a Superfund site. The rising water, which has a low pH and a high dissolved-metals content, is of much to concern to local, state, and federal agencies, and it has been recognized that water-levels will need to be controlled by pumping to prevent discharge into the Clark Fork River drainage.

With respect to geothermal development, the Butte area offers several avenues for low-to-moderate temperature resources. The underground workings were notoriously hot areas to work in while operating and recent data collected from the mines show water temperatures ranging from 13° to 33°C. Monitoring wells completed in the bedrock aquifer at depths less than 183 meters indicate temperatures of 10 to 18°C, and water quality is quite good (for example, see MGEOT341 and MGEOT342). Diamond drill holes with depths up to 610 meters and open mine shafts may provide access to the deeper, warmer waters. An evaluation of depth, temperature, and potential applications of heat-pump technology is needed.

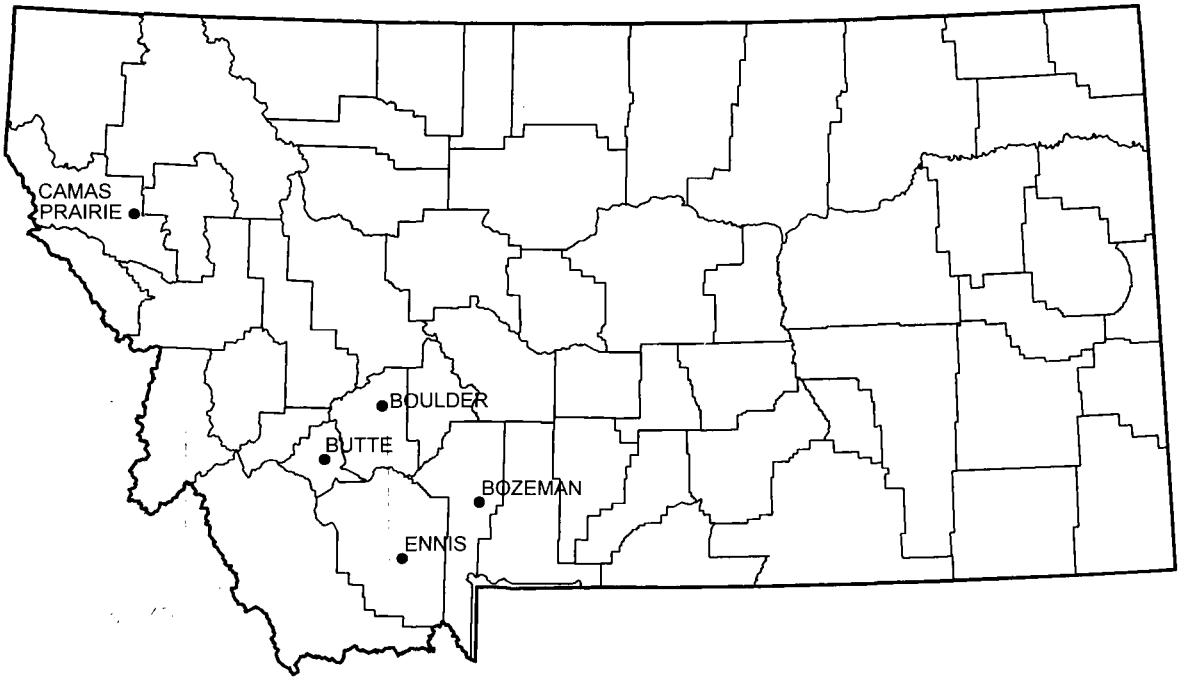

Figure 5 Five areas have been selected as potential areas for additional studies relating to application of direct-use technology.

Ennis

Several studies of the geothermal resources near Ennis have been conducted in the past; however, a deep drilling project is needed to fully understand the nature of this resource area. Recently, one of the areas in which wells were completed was offered for sale to the county government. Application of the information derived from previous studies to an investigation of potential direct-heat applications may also be warranted.

Boulder Hot Springs

The Boulder Hot Springs is within a few miles of Interstate-highway 15 and the town of Boulder is only 1/2 mile from it. Larger cities, Butte to the south and Helena to the north, are within 30 miles. The surface temperatures at the three springs sampled range from 54 to 74°C, and flow is approximately 340 L/min. at the larger spring. The site is currently undergoing renovation. The likelihood of other geothermal resources in the area is high. An inventory of springs and wells throughout the valley and a deep drilling project is needed to better define this potential resource area.

Camas Prairie

There are several previously un-recorded springs in this area; one site was sampled recently (MGEOT353). Although the area is not near any of the larger population centers, there are some recreational facilities in the area. This particular area of Montana has been especially popular for cottage-industry development. A more complete well and spring inventory, coupled with a water-chemistry sampling program is needed to better define the occurrence and potential development in this area.

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APPENDIX I
DATABASE LISTING
GEOTHERMAL RESOURCES OF MONTANA

AND

SEPARATE LIST OF 33 SITES
IDENTIFIED ON MAP AS THE CAMAS-LONEPINE AREA

MGEOT DATABASE

ID	Site name	Reference	Type	Flow (l/min)	Latitude	Longitude	Temp (deg c)	Status/use	SWL (M)	Sample Depth (M)	Date	Chloride mg/l	Sulfate mg/l	Fluoride mg/l
MGEOT209	TARGHEE SULPHUR SPRING*6MI W W YELLOWSTONE	Sonderegger et.al. 1981	SPRING		44.6775	111.2180	18.0	STOCK			23 AUG 1979	1.70	156.0	1.1
MGEOT177	UPPER WEST SPRING-STAUDENMEYER RANCH	MBMG-GWIC	SPRING		44.6988	111.8780	28.8	STOCK			02 OCT 1978	16.00	107.9	1.6
MGEOT123	UPPERMOST SPRING-STAUDENMEYER RANCH	Sonderegger et.al. 1981	SPRING		44.6988	111.8780	28.0	OTHER			03 OCT 1977			
MGEOT126	UPPER-EAST SPRING-STAUDENMEYER RANCH	MBMG-GWIC	SPRING		44.6988	111.8780	29.0	*OTHER*			04 OCT 1977			
MGEOT125	LOWER WEST SPRINGS-STAUDENMEYER RANCH	MBMG-GWIC	SPRING		44.6988	111.8780	31.0	OTHER			03 OCT 1977	9.35	116.0	1.8
MGEOT127	LOWER EAST SPRING-STAUDENMEYER RANCH	MBMG-GWIC	SPRING		44.6988	111.8780	28.0	OTHER			04 OCT 1977	9.80	114.0	1.8
MGEOT124	UPPER WEST SPRING-STAUDENMEYER RANCH	MBMG-GWIC	SPRING		44.6988	111.8780	29.0	OTHER			03 OCT 1977	9.80	114.0	1.8
MGEOT121	ANDERSONS PASTURE SPRING #1	MBMG-GWIC	SPRING		44.7025	111.8855	28.0	STOCK			03 OCT 1977			
MGEOT122	ANDERSONS PASTURE SPRING #2	MBMG-GWIC	SPRING		44.7030	111.8822	23.5	STOCK			03 OCT 1977	9.00	118.0	1.8
MGEOT210	USFS* BAKERS HOLE* 3MI N WEST YELLOWSTONE	Sonderegger et.al. 1981	WELL-FLOWING	15.0	44.7080	111.0991	16.0	PUBLIC SUPPLY	5.6	18.75	22 AUG 1979	17.00	8.8	3.7
MGEOT115	SLOAN COW CAMP SPRING	Sonderegger et.al. 1981	SPRING	1306.0	44.7688	111.6487	29.5				29 SEP 1977	8.00	4.0	3.1
MGEOT120	WEST FORK SWIMMING HOLE	Sonderegger et.al. 1981	SPRING	1690.0	44.7863	111.6550	25.5	OTHER			29 SEP 1977	2.75	11.8	0.4
MGEOT118	CURLEW CREEK WARM SPRING	MBMG-GWIC	SPRING		44.8730	111.5455	23.0	UNUSED			09 SEP 1977			
MGEOT119	WALL CANYON WARM SPRING	Sonderegger et.al. 1981	SPRING		44.9763	111.6508	24.0	UNUSED			13 SEP 1977	49.20	80.8	14.4
MGEOT229	WOLF CREEK HOT SPRING	Leonard et.al. 1978	SPRING	201.0	44.9838	111.6155	60.0	STOCK			29 SEP 1978	19.00	43.0	18.0
MGEOT129	LOWELL HILDRETH SPRING*15 MI SW DILLON	MBMG-GWIC	SPRING		45.0275	112.8452	19.6	DOMESTIC			24 MAR 1978	16.15	191.0	0.7
MGEOT018	BEAR CREEK SPRINGS	Sonderegger et.al. 1981	SPRING	38.0	45.0353	110.6653	24.0							
MGEOT132	VIGILANTE WARM SPRING	Sonderegger et.al. 1981	SPRING	8330.0	45.0369	111.9522	23.5	UNUSED			24 MAY 1978	1.90	174.0	0.9
MGEOT041	LA DUKE HOT SPRINGS	Mariner et.al. 1976	SPRING	500.0	45.0930	110.7737	65.0					45.00	1200.0	3.6
MGEOT012	BROWNS SPRINGS	Sonderegger et.al. 1981	SPRING	4160.0	45.1047	112.7508	23.7							
MGEOT010	PULLER HOT SPRINGS	Leonard et.al. 1978	SPRING	189.0	45.1717	112.1520	44.4					91.00	350.0	2.2
MGEOT019	TRUDAU SPRINGS	Sonderegger et.al. 1981	SPRING	660.0	45.2350	112.1347	22.7	UNUSED			25 MAY 1978	18.00	102.0	0.8
MGEOT040	CHICO HOT SPRINGS	Mariner et.al. 1976	SPRING	500.0	45.3370	110.6913	42.0					10.00	41.0	0.9
MGEOT032	GROUNDWATER*4.7 MI NE FT SMITH MT	MBMG-GWIC	WELL		45.3447	107.8627	20.0	OTHER		314.86	24 AUG 1960	7.90	125.0	1.4
MGEOT074	BROWN CATTLE CO* 3.1 MI N. BIRNEY MT	MBMG-GWIC	WELL	0.5	45.3663	106.5322	15.5	STOCK			11 NOV 1975	4.55	79.4	2.0
MGEOT276	JARDINE HOT SPRINGS 0.25 MI E OF JACKSON	MBMG-GWIC	SPRING		45.3675	113.4033	60.0	DOMESTIC			30 MAY 1961	8.00	45.5	1.8
MGEOT289	MBMG GEOTHERMAL TEST * THEXTON TX-12	MBMG-GWIC	WELL	28.6	45.3677	111.7247	87.0	RESEARCH		291.39	30 JUN 1982	116.00	224.0	10.0
MGEOT028	*JACKSON HOT SPRINGS*	Mariner et.al. 1976	SPRING	1000.0	45.3678	113.4030	58.0					8.00	45.0	2.0
MGEOT293	PRIVATE GEOTHERMAL TEST*ENNIS HOT SPRINGS*	MBMG-GWIC	WELL		45.3702	111.7252	87.0	INDUSTRIAL/COMM		371.86	06 JAN 1983	111.00	203.0	10.9
MGEOT277	LAPHAM DOMESTIC WELL 1 MI NW JACKSON, MT.	MBMG-GWIC	WELL		45.3825	113.4222	17.0	DOMESTIC		30.48	31 MAY 1981	7.80	40.4	1.4
MGEOT117	ENNIS HOT SPRINGS	MBMG-GWIC	SPRING		45.3852	111.7786	61.0	*UNUSED*			16 AUG 1977			
MGEOT058	BROWN CATTLE CO * 9.5MI SW BIRNEY DAY SCH.	MBMG-GWIC	WELL	0.2	45.3869	106.5330	16.5	STOCK	0.9	252.98	01 MAR 1974	9.00	71.0	2.3
MGEOT031	BEAVERHEAD ROCK SPRINGS	Sonderegger et.al. 1981	SPRING	380.0	45.3918	112.4512	27.0							
MGEOT133	APEX WARM SPRING	Sonderegger et.al. 1981	SPRING	2840.0	45.4205	112.6911	25.0	IRRIGATION			25 MAY 1978	11.55	135.0	0.6
MGEOT323	ELKHORN HOT SPRINGS	Mariner et.al. 1976	SPRING	400.0	45.4578	113.1087	48.5					2.00	27.0	2.6
MGEOT292	MARTIN, KIETH	MBMG-GWIC	SPRING	1589.8	45.4594	109.8758	20.5	DOMESTIC			22 SEP 1982	0.70	216.0	0.6
MGEOT326	NEW BILTMORE HOT SPRINGS	Mariner et.al. 1976	SPRING	280.0	45.4620	112.4750	53.0					46.00	1100.0	3.3
MGEOT306	NEWMAN, JOHN * JOLIET, MT	MBMG-GWIC	WELL		45.4663	108.9800	16.0	DOMESTIC	70.3	225.55	07 AUG 1984	15.20	2620.0	0.2
MGEOT280	ANDERSON SPRING	MBMG-GWIC	SPRING	189.9	45.5530	110.1422	25.0	RECREATIONAL			06 OCT 1981	0.10	129.0	0.5
MGEOT006	ANDERSON'S SPRING	Sonderegger et.al. 1981	SPRING	280.0	45.5530	110.1422	25.0					1.00	139.0	0.4
MGEOT043	NORRIS HOT SPRINGS	Leonard et.al. 1978	SPRING	424.0	45.5750	111.6833	50.0					22.00	130.0	8.1
MGEOT015	POTOSI HOT SPRINGS	Mariner et.al. 1976	SPRING	197.0	45.5892	111.8987	49.5					6.00	140.0	6.2
MGEOT187	GROSS, PETE * 4 MI S PONY MT	MBMG-GWIC	SPRING	64.4	45.6016	111.9002	37.5	OTHER			25 JUN 1979	6.20	166.0	6.1
MGEOT311	MCFERRAN, EUGENE * BILLINGS, MT	MBMG-GWIC	WELL		45.6033	108.4019	15.5	DOMESTIC	92.5	181.66	19 NOV 1984	39.80	71.7	5.8
MGEOT179	CARTER'S BRIDGE * 4 MI SE LIVINGSTON MT.	Sonderegger et.al. 1981	SPRING		45.6091	110.5686	28.0	UNUSED			22 DEC 1978			
MGEOT011	AVON WARM SPRING	Sonderegger et.al. 1981	SPRING	91.0	45.6103	112.5547	25.5							
MGEOT264	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	MBMG-GWIC	WELL	11.5	45.6602	111.1861	59.0	RESEARCH		164.59	16 DEC 1960	50.00	131.0	10.1
MGEOT266	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	MBMG-GWIC	WELL	1000.0	45.6602	111.1861	55.0	RESEARCH		140.21	17 DEC 1960	50.30	133.0	10.2
MGEOT265	BOZEMAN HOT SPRINGS * OLD WELL	MBMG-GWIC	WELL		45.6602	111.1861	54.0	RECREATIONAL	6.9	164.59	17 DEC 1960	50.00	132.0	10.1
MGEOT263	BOZEMAN HOT SPRINGS * ORIGINAL SPRING	MBMG-GWIC	SPRING		45.6605	111.1861	54.0	RECREATIONAL			17 DEC 1960	49.70	130.0	9.9
MGEOT335	BOZEMAN HOT SPRINGS	Leonard et.al. 1978	SPRING	284.0	45.6605	111.1862	54.6					48.00	120.0	12.0
MGEOT269	RANCA * MCLEOD	MBMG-GWIC	WELL		45.6647	110.1141	49.0	UNUSED			02 APR 1981	2.00	1331.0	2.8
MGEOT259	SCOTT FEED LOT	Sonderegger et.al. 1981	WELL	45.0	45.6819	108.1566	43.0	DOMESTIC			25 NOV 1960	60.30	119.0	7.1
MGEOT260	SCOTT FEED LOT	Sonderegger et.al. 1981	WELL	50.0	45.6838	108.1552	44.0	DOMESTIC			25 NOV 1960	72.00	83.4	9.0
MGEOT230	BLUE JOINT CREEK HOT SPRING	Sonderegger et.al. 1981	SPRING	849.0	45.6963	114.3633	29.4					3.00	5.0	9.5
MGEOT002	BRIDGER CANYON WARM SPRING	Sonderegger et.al. 1981	SPRING	379.0	45.7073	110.9755	20.2					1.00	80.0	0.5
MGEOT334	LOVE, MELVIN*THREE FORKS, MT	MBMG-GWIC	WELL		45.7269	111.4997	15.9	DOMESTIC		18.59	11 MAY 1989	20.50	18.4	1.4
MGEOT033	*GROUNDWATER*5.3 MI W HARDIN MT*	MBMG-GWIC	WELL		45.7305	107.7311	39.4	*OTHER*		1219.20	17 NOV 1960	4.00	1980.0	4.0
MGEOT332	SHIPTON, HAROLD * THREE FORKS MT	MBMG-GWIC	WELL		45.7350	111.4625	16.9	DOMESTIC		54.86	09 MAY 1989	32.00	24.9	1.4
MGEOT258	HERMAN, T.E. * ROCKY RANCH 7.4 M W HARDIN	MBMG-GWIC	WELL-FLOWING	2000.0	45.7369	107.7347	42.0	RECREATIONAL		1203.96	25 NOV 1960	4.30	2130.0	3.1
MGEOT344	GALLOGLY HOT SPRING	Sonderegger et.al. 1981	SPRING	454.0	45.7495	113.9395	48.9				05 AUG 1964	1.00	12.0	5.6
MGEOT245	LOST TRAIL * WARM AND HOT SPRINGS	MBMG-GWIC	SPRING		45.7497	113.9394	41.7	RECREATIONAL			07 OCT 1980			
MGEOT089	CAIN MIKE*6.6 MI S VOLBERG	MBMG-GWIC	WELL	2.2	45.7533	105.7283	18.0	DOMESTIC	54.9		01 JUL 1976	51.00	5.5	4.0
MGEOT018	HUNTERS HOT SPRINGS	Mariner et.al. 1976	SPRING	5000.0	45.7572	110.2572	60.0					18.00	11.0	5.6
MGEOT328	JORGENSON, JACK * THREE FORKS MT	MBMG-GWIC	WELL		45.7736	111.4686	16.0	IRRIGATION		16.76	20 MAY 1988			
MGEOT345	RENOVA HOT SPRINGS	Leonard et.al. 1978	SPRING	151.0	45.7917	112.1263	50.0					34.00	200.0	3.0
MGEOT339	WESTMORELAND * 9.1 M W SARPY SCHOOL	MBMG-GWIC	WELL		45.8027	107.0827	37.7	INDUSTRIAL	-0.5		24 AUG 1990	20.10	996.0	2.7
MGEOT095	LISCOM RANCH * 5.5 MI NW OF N STACY SCHOOL	MBMG-GWIC	WELL	0.1	45.8144	105.9705	15.5	STOCK	121.9	226.60	21 JUL 1975	13.15	61.3	1.0
MGEOT331	*TINDER, L. MARIE * THREE FORKS MT*	MBMG-GWIC	WELL		45.8219	111.4672	21.9	*DOMESTIC*		32.92	05 MAY 1989	18.60	40.4	2.2
MGEOT327	WILCOX, RALPH * THREE FORKS MT	MBMG-GWIC	WELL		45.8269	111.4638	16.5	DOMESTIC		22.25	19 MAY 1988			
MGEOT333	RICHARDSON, DEIRDRE * THREE FORKS	MBMG-GWIC	WELL		45.8300	111.4594	16.8	DOMESTIC		17.68	10 MAY 1989	25.00	60.5	2.4
MGEOT347	MEDICINE HOT SPRINGS	Mariner et.al. 1976	SPRING	400.0	45.8458	114.0347	45.0					7.00	33.0	14.0
MGEOT092	WESTERN ENERGY * 2 MI N COLSTRIP MT.	MBMG-GWIC	WELL	18.6	45.8863	106.6194	96.1	UNUSED	170.7	2645.61	09 JUL 1976	79.00	736.9	4.9
MGEOT020	PIPESTONE HOT SPRINGS	Mariner et.al. 1976	SPRING	300.0	45.8963	112.2428	57.0					20.00	94.0	5.3
MGEOT062	FRED WETSTEON SPRING DEVELOP	MBMG-GWIC	SPRING		45.9147	113.7608	19.0	OTHER			06 MAY 1976			
MGEOT330	HART, FRANK * THREE FORKS, MT	MBMG-GWIC	WELL		45.9186	111.4975	15.9	DOMESTIC	1.2	16.76	04 MAY 1989			
MGEOT063	*ANADARKO PROD*6 MI E FOSTER MT*	*MBMG-GWIC*	*WELL*		*45.9463*	*107.4388*	*28.7*	*UNUSED*		*781.51*	*17 JUN 1974*	*7860.00*	*30.0*	*0.7*
MGEOT053	UN-NAMED SPRING * 29 M NE OF FOSTER MT	MBMG-GWIC	SPRING		45.9580	107.0625	29.0	STOCK			03 SEP 1973			
MGEOT128	COWAN SPRING*9MI NW THREE FORKS MT	MBMG-GWIC	SPRING		45.9608	111.7227	23.0	STOCK			26 AUG 1977			

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Reference	Type	Flow (l/min)	Latitude	Longitude	Temp (deg c)	Status/use	SWL (M)	Sample Depth (M)	Date	Chloride mg/l	Sulfate mg/l	Fluoride mg/l
MGEOT178	WOLF CREEK HOT SPRING	MBMG-GWIC	SPRING		45.9638	111.6155	60.0	STOCK			29 SEP 1978			
MGEOT343	WILLIAMSBURG SPRING	MBMG-GWIC	SPRING	15.1	45.9916	112.5611	17.4				22 AUG 1991			
MGEOT030	OIL WELL (TENSLEEP FORMATION)	Sonderegger et.al. 1981	WELL	1100.0	46.0082	109.3977	69.0							
MGEOT341	MONTANA RESOURCES MONITORING WELL C	MBMG-GWIC	WELL		46.0088	112.4875	17.8	RESEARCH		244.14	29 MAY 1991	3.50	336.0	1.2
MGEOT342	MONTANA RESOURCES MONITORING WELL D2	MBMG-GWIC	WELL		46.0161	112.4902	16.0	RESEARCH	176.4	236.22	31 MAY 1991	5.80	652.1	1.0
MGEOT055	HOWARD SPRING * 25 M SE OF BIGHORN MT	MBMG-GWIC	SPRING		46.0233	107.1233	23.0	STOCK			25 JUN 1973	36.00	1516.0	0.2
MGEOT246	WENDT, FRED * .75 MI S GREGSON (FAIRMONT)	Sonderegger et.al. 1981	WELL	15.0	46.0322	112.8116	23.9	DOMESTIC	30.8	91.44	08 OCT 1980	4.90	17.4	1.1
MGEOT298	MBMG RESEARCH WELL * FAIRMONT HOT SPRINGS	MBMG-GWIC	WELL	30.1	46.0383	112.8094	20.0	RESEARCH	10.2	180.75	26 AUG 1983	18.70	214.0	21.0
MGEOT165	NELSON, HARVEY * 5 MI S BROADVIEW MT	MBMG-GWIC	WELL	6.9	46.0383	108.8822	16.0	DOMESTIC	45.7	182.88	26 SEP 1978	56.00	1562.0	1.6
MGEOT061	BRADBROOK * 10 M S BROADVIEW MT	MBMG-GWIC	WELL		46.0411	109.1502	32.9	STOCK	-0.0		11 OCT 1974	197.00	1736.0	3.8
MGEOT279	FAIRMONT HOT SPRINGS, ANACONDA	MBMG-GWIC	SPRING	946.3	46.0425	112.8111	61.5	INDUSTRIAL/COMM			29 SEP 1981			
MGEOT247	SPANGLER, HAZEL * 2 MI E-NE GREGSON MT	MBMG-GWIC	SPRING	151.4	46.0508	112.7691	15.5	STOCK			08 OCT 1980	21.00	48.5	0.6
MGEOT214	HUNSAKER SPRING	Sonderegger et.al. 1981	SPRING		46.0530	111.5011	24.5	UNUSED			26 JUN 1979	11.00	30.0	0.8
MGEOT150	MONT. HIGHWAY DEPT * .75 MI SE WACO MT.	MBMG-GWIC	WELL	9.9	46.0633	107.7102	15.5	DOMESTIC	45.7	91.14	23 SEP 1978	15.10	1660.0	1.4
MGEOT213	PLUNKET LAKE WARM SPRINGS	Sonderegger et.al. 1981	SPRING		46.0744	111.5844	17.0	IRRIGATION			17 JUL 1979			
MGEOT237	SPRINGS FROM JOINTS IN MISS CYN*SW PLUNKET	MBMG-GWIC	SPRING		46.0750	111.5833	17.0	IRRIGATION			10 NOV 1979	8.90	86.9	0.7
MGEOT151	MONTANA DEPT HIGHWAYS * 2.5 MI NE WACO MT	MBMG-GWIC	WELL	5.0	46.0891	107.6611	16.5	DOMESTIC	46.6		23 SEP 1978	23.90	615.0	3.0
MGEOT216	HUNSAKER, MAURICE	Sonderegger et.al. 1981	WELL	17.1	46.1022	111.5230	15.0	STOCK	21.3		12 JUN 1979	9.60	34.1	1.5
MGEOT135	ANACONDA RED TRAVETINE MOUND - GEYSER	Sonderegger et.al. 1981	SPRING	11.0	46.1047	112.7772	21.7	UNUSED			23 JUN 1978	7.00	1362.0	2.5
MGEOT325	SLEEPING CHILD HOT SPRINGS	Mariner et.al. 1976	SPRING	2000.0	46.1048	114.0042	43.0					9.00	81.0	14.0
MGEOT236	BRUCE, N * IRRIGATION WELL WITH BOOSTER	MBMG-GWIC	WELL	160.9	46.1186	111.5972	16.0	IRRIGATION	44.0	100.58	02 MAY 1980	21.70	133.0	0.5
MGEOT294	TOSTON WARM SPRING	MBMG-GWIC	SPRING		46.1258	111.3911	45.5	UNUSED			07 MAY 1983	6.60	50.0	0.7
MGEOT218	TOSTON WARM SPRING	Sonderegger et.al. 1981	SPRING		46.1258	111.3911	15.5	INDUSTRIAL/COMM			29 JUN 1979			
MGEOT217	BRUCE, NORMAN	Sonderegger et.al. 1981	WELL		46.1330	111.6033	16.0	IRRIGATION	35.9		29 JUN 1979	59.20	850.0	1.2
MGEOT215	KIMPTON SPRING	MBMG-GWIC	SPRING		46.1708	111.5855	16.0	UNUSED			16 JUN 1979	1.60	16.4	0.2
MGEOT134	WARNER WARM SPRING	Sonderegger et.al. 1981	SPRING		46.1725	111.5855	16.0	IRRIGATION			02 JUN 1978			
MGEOT172	STEELE, WILLIAM * 12.5 MI SE PINEVIEW MT.	MBMG-GWIC	WELL	0.5	46.1769	107.7380	16.0	STOCK	65.5	112.78	06 OCT 1978	124.70	1879.0	1.7
MGEOT284	MBMG TEST WELL*WARM SPRINGS STATE HOSPITAL	MBMG-GWIC	WELL		46.1780	112.7919	48.0	RESEARCH	4.0	92.66	17 FEB 1982	6.00	622.0	3.0
MGEOT009	WARM SPRINGS	Mariner et.al. 1976	SPRING	600.0	46.1787	112.7942	77.0					5.00	670.0	3.9
MGEOT233	WARM SPRINGS STATE HOSPITAL	MBMG-GWIC	WELL	2.3	46.1808	112.7930	67.0	RESEARCH	6.1		16 APR 1980	7.10	685.0	3.7
MGEOT231	WARM SPRINGS STATE HOSPITAL	MBMG-GWIC	WELL	2.2	46.1808	112.7930	54.0	RESEARCH	6.1		04 APR 1980	5.10	666.0	0.2
MGEOT349	BOULDER HOT SPRINGS - UPPER SPRING	MBMG/UURI	SPRING	340.0	46.1981	112.0947	54.0	RECREATION		38.10	02 NOV 1993	21.00	76.0	11.8
MGEOT351	BOULDER HOT SPRINGS - LOWER SPRING	MBMG/UURI	SPRING	75.7	46.1981	112.0947	64.5	RECREATION			02 NOV 1993	22.00	73.0	11.0
MGEOT350	BOULDER HOT SPRINGS - MIDDLE SPRING	MBMG/UURI	SPRING		46.1981	112.0947	74.0	RECREATION			02 NOV 1993	22.00	80.0	11.1
MGEOT232	WARM SPRINGS STATE HOSPITAL * SPRING	MBMG-GWIC	SPRING	68.9	46.2000	112.8833	79.0	RESEARCH			04 APR 1980			
MGEOT185	M-B NO. 12 * 5 MI NE HAMILTON MT	MBMG-GWIC	WELL	3.2	46.2836	114.0694	18.5	UNUSED	20.4	338.33	30 JUL 1979	10.30	19.8	0.4
MGEOT171	GRIERSON, J.B.*2.5MI NE RANCHERS CEMETARY.	MBMG-GWIC	WELL	0.5	46.2922	107.3958	21.0	STOCK		329.18	07 OCT 1978	997.90	9.4	2.1
MGEOT130	PRISON RANCH SPRING SITE NO. 4	MBMG-GWIC	SPRING		46.3333	112.8872	26.0	OTHER			27 MAR 1978			
MGEOT113	DEER LODGE PRISON RANCH WELL	Sonderegger et.al. 1981	WELL	57.0	46.3342	112.8663	26.0					3.00	33.0	7.5
MGEOT044	BEDFORD SPRINGS	Sonderegger et.al. 1981	SPRING	5680.0	46.3542	111.5667	23.6					9.00	103.0	0.7
MGEOT101	GRIERSON, J.B. * 23 MI NW HYSHAM MT	MBMG-GWIC	WELL	2.5	46.3852	107.6394	15.6	DOMESTIC	9.1	33.22	10 AUG 1978	92.00	1696.3	2.5
MGEOT275	MBMG RESEARCH WELL * WEED CREEK-1B	MBMG-GWIC	WELL		46.3952	107.7819	20.0	RESEARCH	64.3		10 MAR 1981	43.60	952.0	4.3
MGEOT274	MBMG RESEARCH WELL * WEED CREEK-1A	MBMG-GWIC	WELL		46.3952	107.7819	17.0	RESEARCH	65.9		11 MAR 1981	34.70	1017.0	3.8
MGEOT255	HANSER, BILL * 3 MI SW TWO DOT MT	Sonderegger et.al. 1981	WELL-FLOWING	200.0	46.4136	110.1394	18.0	STOCK		255.12	31 OCT 1980	6.60	20.6	1.4
MGEOT256	FOX INC * 1.5 MI W-SW TWO DOT	Sonderegger et.al. 1981	WELL-FLOWING	5.0	46.4208	110.1036	19.0	STOCK		216.41	31 OCT 1980	4.40	31.4	0.5
MGEOT257	HOMER, RAY * TWO DOT WATER SUPPLY	Sonderegger et.al. 1981	WELL-FLOWING	20.0	46.4261	110.0713	20.0	PUBLIC SUPPLY		274.32	31 OCT 1980	2.40	43.1	0.4
MGEOT298	HARLOWTON * SOUTH MUNICIPAL WELL	MBMG-GWIC	WELL	143.8	46.4344	109.8325	15.6	PUBLIC SUPPLY		280.72	25 MAY 1983	16.10	67.9	1.2
MGEOT013	HILLBROOK FLOWING WELL	Leonard et.al. 1978	WELL	57.0	46.4478	111.9872	30.0					25.00	170.0	6.7
MGEOT014	WALLS HOT SPRING	Leonard et.al. 1978	SPRING	110.0	46.4480	111.9805	55.6					11.00	66.0	6.9
MGEOT001	ALHAMBRA HOT SPRINGS NORTH	Mariner et.al. 1976	SPRING	380.0	46.4497	111.9805	56.5					10.00	69.0	6.4
MGEOT278	TOWNSEND,HERB*2.5 MI SW WHITE SULPHUR SPGS	MBMG-GWIC	WELL	180.1	46.5055	110.9347	48.5	IRRIGATION	4.6	76.20	21 JUL 1981	4.30	45.0	0.4
MGEOT290	RALPH JOHNSON,P.O.BOX 65,WHITE SULPHUR SPR	MBMG-GWIC	WELL		46.5444	110.9061	15.3	IRRIGATION	9.6	53.34		827.00	1332.0	7.7
MGEOT004	WHITE SULPHUR SPRINGS	Mariner et.al. 1976	SPRING	1500.0	46.5473	110.9038	46.0					180.00	310.0	7.4
MGEOT282	WHITE SULPHUR SPRINGS BANK WELL	MBMG-GWIC	WELL	5.1	46.5477	110.9063	43.3	OTHER	2.0	100.58	06 DEC 1981	147.00	211.0	6.3
MGEOT188	WATTS, JAMES * 16 MI NE KINSEY MT	MBMG-GWIC	WELL	0.4	46.5706	105.6980	15.0	DOMESTIC		259.08	08 AUG 1979	61.40	0.4	1.7
MGEOT184	M-B NO 8 WELL*2.5 MI SE CORVALLIS MT	MBMG-GWIC	WELL	1.8	46.5722	114.0363	18.3	OTHER	63.7	829.97	23 JUL 1979	5.79	34.3	0.6
MGEOT007	BROADWATER HOT SPRINGS WELL	Leonard et.al. 1978	WELL	227.0	46.5955	112.1117	65.5					34.00	180.0	11.0
MGEOT008	GLOEGE WELL	Leonard et.al. 1978	WELL	49.0	46.5958	112.1042	19.4					12.00	84.0	0.7
MGEOT003	GARRISON WARM SPRINGS	Sonderegger et.al. 1981	SPRING	204.0	46.6068	112.7747	25.0					3.00	335.0	1.3
MGEOT337	CHADWICK, GREG	MBMG-GWIC	WELL		46.6169	111.9883	15.0	DOMESTIC	9.0	23.16	17 JUL 1990	14.30		
MGEOT208	USGS OBS WELL * 4 MI SW EAST HELENA, MT.	MBMG-GWIC	WELL		46.6177	111.9961	25.0	RESEARCH	11.1	13.32	05 SEP 1979	59.00	44.5	0.2
MGEOT336	MUELLER BUZZ	MBMG-GWIC	WELL		46.6308	112.1025	15.0	STOCK	18.5	27.13	/ /19	16.00		
MGEOT242	FLORENCE TEST WELL A	Sonderegger et.al. 1981	WELL	1.1	46.6461	114.0625	15.0	RESEARCH	2.1		25 AUG 1980	4.50	20.1	3.1
MGEOT329	SIVERTE MYSSE * BOX 315 * INGOMAR MT 59039	MBMG-GWIC	WELL		46.6819	107.2030	37.0	STOCK	30.2	839.72	12 OCT 1988	40.10	298.0	11.5
MGEOT167	CHERRY CK SHEEP CO.*1.35MI SE HAGEN RANCH.	MBMG-GWIC	WELL	1.1	46.6819	107.2030	36.0	DOMESTIC	-0.3	842.47	13 OCT 1978	19.00	309.0	10.8
MGEOT261	MOORE, THOMAS * 6.5 MI SW ANGELA MT	Sonderegger et.al. 1981	WELL-FLOWING	120.1	46.6880	106.3225	62.0	RECREATIONAL		2529.84	20 NOV 1980	2080.00	1380.0	5.3
MGEOT322	BYRNE WARM SPRING * WEST OF BEARMOUTH	MBMG-GWIC	SPRING		46.7036	113.4536	20.0	UNUSED			30 JUL 1987			
MGEOT116	NIMROD SPRINGS	Sonderegger et.al. 1981	SPRING	12100.0	46.7057	113.4566	20.5					3.00	340.0	0.8
MGEOT026	BEARMOUTH SPRINGS	Sonderegger et.al. 1981	SPRING	4160.0	46.7168	113.3032	20.2					2.00	163.0	0.5
MGEOT338	GARRICK GALEN	MBMG-GWIC	WELL		46.7191	112.0536	15.0	DOMESTIC	36.5	53.64	19 JUL 1990	73.20		
MGEOT345	LOLO HOT SPRINGS	Mariner et.al. 1976	SPRING	100.0	46.7522	114.5328	44.0					6.00	18.0	6.4
MGEOT069	MARYSVILLE DEEP WELL DEPTH 5750	Sonderegger et.al. 1981	WELL		46.7544	112.3750	96.7	UNUSED	161.5	2069.59	29 AUG 1975	51.00	176.0	20.0
MGEOT170	CHERRY CREEK SHEEP CO*26 MI N VANANDA MT	MBMG-GWIC	WELL	23.0	46.7675	106.9194	44.0	STOCK	90.2	1433.17	14 OCT 1978	240.00	2469.0	3.4
MGEOT162	OLSEN, JONAS * 9 MI NW FLATWILLOW MT.	MBMG-GWIC	WELL	1.9	46.8958	108.5597	27.0	STOCK		353.57	28 SEP 1978	1.65	226.0	1.5
MGEOT201	OLSEN JONAS * 14 MI NE N-BAR RANCH	MBMG-GWIC	WELL	2.3	46.8983	108.6122	16.0	STOCK		166.12	15 AUG 1979	3.70	275.0	0.6
MGEOT164	REYNOLDS, KEITH * 6 MI NE FLATWILLOW MT.	MBMG-GWIC	WELL	0.6	46.9141	108.3602	24.5	DOMESTIC	-49.3	518.16	30 SEP 1978	12.30	477.0	1.4
MGEOT163	HILL, FLOYD * 7 MI N FLATWILLOW MT.	MBMG-GWIC	WELL	1.6	46.9330	108.3625	15.0	STOCK		458.72	28 SEP 1978	11.30	475.0	0.9
MGEOT180	M-B 4 (BUTLER CK) * 6 MI NW MISSOULA MT	MBMG-GWIC	WELL	1.1	46.9597	114.0644	16.0	RESEARCH	0.8	886.05	09 FEB 1979	9.50	13.9	0.7
MGEOT254	KING, JOE & SONS INC. * 5 MI SSW WINNET MT	MBMG-GWIC	WELL	0.2	46.9677	108.4500	16.0	STOCK	-95.1	644.35	29 OCT 1980	57.20	820.0	10.0

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters)

MGEOT DATABASE

ID	Site name	Reference	Type	Flow (l/min)	Latitude	Longitude	Temp (deg c)	Status/use	SWL (M)	Sample Depth (M)	Date	Chloride mg/l	Sulfate mg/l	Fluoride mg/l
MGEOT159	SHAW, BUD * 1.7 MI SW MOSBY MT.	MBMG-GWIC	WELL	21.0	46.9866	107.9158	29.0	DOMESTIC	-35.2	550.16	01 OCT 1978	16.35	337.0	3.2
MGEOT160	EAGER, REX * 2 MI SW WINNETT MT.	MBMG-GWIC	WELL	2.3	47.0008	108.3997	15.5	DOMESTIC	-42.2	518.16	30 SEP 1978	18.60	207.0	1.4
MGEOT161	BRATTON, WAYNE * 2 MI SE WINNETT MT.	MBMG-GWIC	WELL	0.8	47.0022	108.3244	24.2	DOMESTIC		643.74	01 OCT 1978	16.00	495.0	1.5
MGEOT305	BURLY VISTA TRACTS	MBMG-GWIC	WELL	6.8	47.0275	109.3691	46.0	DOMESTIC	10.7	120.40	27 NOV 1983	0.80	95.1	0.4
MGEOT157	TEIGEN, PETER * 9 MI E GRASSRANGE MT.	MBMG-GWIC	WELL	1.3	47.0347	108.6100	17.9	DOMESTIC		310.90	26 SEP 1978	26.50	552.0	0.8
MGEOT196	MATOVICH * 4.5 MI E GRASSRANGE MT	MBMG-GWIC	WELL	0.9	47.0491	108.7083	21.8	STOCK		312.72	15 AUG 1979	6.40	90.0	0.6
MGEOT181	HOLE NO 2 M-8 DRILLING PROJECT	MBMG-GWIC	WELL	1.1	47.0525	114.2616	15.0	UNUSED	47.2	786.57	03 MAY 1979		16.9	0.4
MGEOT240	MSU AG EXPERIMENT STATION * MOCCASIN MT	MBMG-GWIC	WELL	0.5	47.0561	109.9516	15.0	IRRIGATION	21.9	493.78	31 JUL 1980	2.10	53.0	0.3
MGEOT155	BRADY, EARL*4 MI NW WINNETT, MT	MBMG-GWIC	WELL	0.8	47.0575	108.3575	15.8	STOCK	-14.1		27 SEP 1978	9.00	203.0	2.2
MGEOT203	GERDRUM, RONALD * 3 MI NE GRASS RANGE, MT.	MBMG-GWIC	WELL	0.7	47.0638	108.7750	15.9	DOMESTIC		297.18	15 AUG 1979	9.60	120.0	1.4
MGEOT152	CENEX*15 MI NE WINNETT MT	MBMG-GWIC	WELL	2.6	47.0788	108.0405	16.0	INDUSTRIAL/COMM	91.4		21 SEP 1978	16.45	331.0	2.6
MGEOT158	BASSETT, EARL * 7.5 MI NW TEIGEN MT.	MBMG-GWIC	WELL	0.2	47.1233	108.6758	17.0	STOCK	-28.2	347.47	26 SEP 1978	1.70	117.0	0.5
MGEOT059	HEDMAN, J.* 40 MI NE LEWISTOWN MT.	MBMG-GWIC	WELL-FLOWING	30.5	47.1416	108.5933	21.0	DOMESTIC	-56.3	336.19	07 MAY 1974	3.60	123.0	0.7
MGEOT156	HARRIS FLOYD * 11 MI NW TEIGEN MT	MBMG-GWIC	WELL	1.7	47.1577	108.7322	19.2	STOCK	-14.1	572.72	25 SEP 1978	2.20	240.0	2.4
MGEOT194	FOX, DENNIS * 7 MI NW GRASSRANGE MT	MBMG-GWIC	WELL	0.4	47.1711	108.9486	20.8	STOCK	15.5	436.17	16 AUG 1979	1.20	186.0	0.5
MGEOT239	LAURENCE HESS * 1 MI N MOCCASIN MT	MBMG-GWIC	WELL	0.8	47.2058	109.9363	15.0	STOCK	26.8	527.61	29 JUL 1980	2.70	67.2	0.3
MGEOT204	DELANEY, DOUGLAS*7 MI NW (WILD HORSE UNIT)	MBMG-GWIC	WELL	1.2	47.2105	108.7277	23.0	STOCK		335.28	16 AUG 1979	30.20	141.0	0.9
MGEOT050	BROOKS WARM SPRING * 2.5 MI NW BROOKS MT.	MBMG-GWIC	SPRING		47.2191	109.4733	20.0	IRRIGATION			17 AUG 1973			
MGEOT195	DELANEY, DOUGLAS * 11 MI NW ROY MT	MBMG-GWIC	WELL		47.2333	108.7694	21.3	STOCK		426.72	16 AUG 1979	12.80	342.0	2.9
MGEOT154	MILLER RANCH * 14 MI SE VALENTINE MT.	MBMG-GWIC	WELL	0.3	47.2486	108.1394	19.5	STOCK		603.20	23 SEP 1978	1825.00		2.3
MGEOT045	CARDINAL PET CO * 10 M E HILGER MT	MBMG-GWIC	WELL		47.2816	109.1686	26.7	UNUSED		1392.94	10 APR 1972	18.80	60.0	6.1
MGEOT153	BUSENBARK, MERLIN*1 MI S VALENTINE MT*	MBMG-GWIC	WELL	7.0	47.2991	108.4208	27.0	STOCK	-45.8	637.64	20 SEP 1978	63.40	1.9	6.7
MGEOT005	QUINN'S HOT SPRINGS	Sonderegger et.al. 1981	SPRING	284.0	47.3300	114.7872	43.3					3.00	29.0	2.1
MGEOT268	QUINN'S HOT SPRINGS * JIM AND DONNA BROWN	Sonderegger et.al. 1981	WELL-FLOWING	75.0	47.3300	114.7872	45.1	INDUSTRIAL/COMM	11.4	44.20	16 JAN 1981	2.30	26.8	2.3
MGEOT197	YEAGER * 8 MI EAST MOULTON, MT.	MBMG-GWIC	WELL	0.6	47.3333	109.1836	15.0	STOCK	0.9	258.47	17 AUG 1979	6.20	450.0	0.5
MGEOT079	FINLEY, R.S.*1 MI NW ST. IGNATIUS	MBMG-GWIC	WELL		47.3350	114.1175	19.0	DOMESTIC	8.7	16.15	05 MAR 1976	3.50	15.6	-0.1
MGEOT205	SIROKY, FRANK * 9 MI EAST ROY, MT.	MBMG-GWIC	WELL	0.6	47.3402	108.7672	19.0	DOMESTIC	7.9	636.42	16 AUG 1979	2.60	260.0	0.4
MGEOT192	HORYNA, JAMES * 6 MI E ROY MT	MBMG-GWIC	WELL	5.5	47.3533	108.8513	18.4	DOMESTIC	36.6	611.12	19 AUG 1979	4.30	415.0	0.4
MGEOT131	CORPS OF ENGINEERS SOUTH WELL AFTER PERFS	MBMG-GWIC	WELL	24.9	47.3611	114.3119	15.0	UNUSED	0.1	56.39	03 MAY 1978	85.80	0.2	4.9
MGEOT090	BRYSON, HAROLD*1 MI W MOIESE MT	MBMG-GWIC	WELL		47.3730	114.2830	15.5	STOCK	33.7	91.44	01 JUL 1976	36.95	1.0	2.0
MGEOT070	YARGER, ROBERT * 13 MI W CIRCLE MT	MBMG-GWIC	WELL	0.3	47.3830	105.8597	25.0	STOCK	30.5		23 JUL 1975	3.30	670.7	-0.1
MGEOT267	SAND COULEE WTR USERS BENCH W ABV SAND COU	MBMG-GWIC	WELL		47.3972	110.1763	15.0	PUBLIC SUPPLY	45.7	64.01	19 JUN 1982	12.30	71.0	1.1
MGEOT193	TAYLOR, JAMES * 8 MI E CHRISTINA MT	MBMG-GWIC	WELL	3.0	47.4005	109.1400	21.0	STOCK		435.86	19 AUG 1979	5.40	642.0	0.5
MGEOT288	CHARLES ENTSMINGER*TOWN OF NUMBER SEVEN	MBMG-GWIC	WELL	1.0	47.4038	110.1547	16.0	DOMESTIC	36.9	56.39	22 JUN 1982	4.00	132.0	0.4
MGEOT295	CUSTER, EVERETT* EDEN RT, GREAT FALLS, MT	MBMG-GWIC	WELL		47.4061	111.2605	15.5	DOMESTIC	9.8		13 MAY 1983	30.10	215.0	1.1
MGEOT297	TOWN OF TRACY	MBMG-GWIC	WELL		47.4133	111.1533	16.0	PUBLIC SUPPLY	27.4	60.96	15 JUN 1983	6.90	145.0	0.6
MGEOT054	SLOGSVOLD, A. K. * 17 M SE RITCHEY MT	MBMG-GWIC	WELL	0.4	47.4211	105.1347	21.1	STOCK	39.6		15 OCT 1973	29.00	1154.0	0.1
MGEOT211	GOVER * 2.5 MI TRAVIS SCHOOL	MBMG-GWIC	WELL	1.2	47.4308	111.5052	17.5	DOMESTIC	6.7	54.86	12 SEP 1979	18.30	360.0	1.0
MGEOT200	VILLAGE INN * 2.5 MI NE TRAVIS SCHOOL	MBMG-GWIC	WELL	1.5	47.4355	111.5016	18.5	PUBLIC SUPPLY	15.9	140.21	23 AUG 1979	13.50	120.0	4.9
MGEOT299	STONE, GENE	MBMG-GWIC	WELL		47.4411	114.6500	25.0	DOMESTIC		101.19	13 SEP 1983	2.50	6.6	2.3
MGEOT062	WEBB RES * 17.5 MI SE GERALDINE MT.	MBMG-GWIC	WELL		47.4469	110.3044	20.0	UNUSED		793.70	26 NOV 1973	6.40	57.0	0.8
MGEOT353	HOLLAND, JIM - GREEN SPRINGS	MBMG/UURI	SPRING		47.4513	114.6478	23.7	UNUSED			02 NOV 1993	12.00	17.0	2.1
MGEOT248	GREEN SPRINGS * HOLLAND RANCH	Sonderegger et.al. 1981	SPRING		47.4513	114.6478	26.0					5.00	18.0	2.2
MGEOT191	TACKE, ROBERT * 2 MI SW GREAT FALLS MT	MBMG-GWIC	WELL	6.0	47.4605	111.3475	15.0	DOMESTIC	35.4	168.25	21 AUG 1979	125.00	575.0	2.3
MGEOT198	PAUL, MICHAEL(ROBINSON)*3.5M SW GREATFALLS	MBMG-GWIC	WELL	34.1	47.4619	111.3516	17.0	DOMESTIC	111.9	259.69	22 AUG 1979	145.00	582.0	2.6
MGEOT318	BUTTE CREEK SPRING * SQUARE BUTTE	MBMG-GWIC	SPRING	764.6	47.4650	110.2000	18.8	STOCK			07 JUN 1985			
MGEOT319	BUTTE CREEK SPRING - NORTH * SQUARE BUTTE	MBMG-GWIC	SPRING		47.4650	110.2000	17.0	RESEARCH			07 JUN 1985			
MGEOT169	CHAMBERLAIN, CURTIS * 2 MI W LLER SCHOOL.	MBMG-GWIC	WELL	1.0	47.4686	107.4780	16.0	DOMESTIC	146.3	158.50	06 OCT 1978	14.05	1337.0	2.1
MGEOT321	MELTON, LARUE * LOWER AQUIFER	MBMG-GWIC	WELL		47.4691	114.4033	16.0	UNUSED		202.69	15 AUG 1985	8.80	10.3	0.6
MGEOT314	USGS - MELTON, LEON	MBMG-GWIC	WELL	3.7	47.4763	114.4091	16.5	UNUSED	33.4	100.89	15 OCT 1984	10.60	5.8	3.4
MGEOT238	SCHMIDT, LLOYD * 3.5 MI SE SQUARE BUTTE	MBMG-GWIC	WELL		47.4897	110.1591	21.8		175.8	526.39	10 JUL 1980	40.20	65.9	1.3
MGEOT190	USGS OBS WELL * .5 MI S VALLEY SCHOOL	MBMG-GWIC	WELL	3.9	47.5144	104.7750	27.1	RESEARCH	13.3	67.06	12 AUG 1979	2.50	735.0	0.2
MGEOT199	EIDEL * .5 MI S SUNSET MEMORIAL CEMETARY	MBMG-GWIC	WELL	4.0	47.5230	111.4633	16.0	DOMESTIC	28.5	39.62	23 AUG 1979	49.10	1220.0	0.6
MGEOT078	WEBSTER, BONITA*BOX 443 RONAN MT	MBMG-GWIC	WELL		47.5441	114.1563	15.5	DOMESTIC	0.3	138.07	05 MAR 1976	1.70	0.5	0.1
MGEOT099	DEMARS,TOM J.* 10 MI W OF WINIFRED MT.	MBMG-GWIC	WELL		47.5650	109.5925	17.0	DOMESTIC		27.43	22 SEP 1976	13.00	511.3	0.8
MGEOT249	HOMESTEAD ACRES COUNTY WATER DISTRICT	MBMG-GWIC	WELL		47.5802	111.3077	15.0	PUBLIC SUPPLY	137.2	326.57	24 OCT 1980	14.70	201.0	0.9
MGEOT250	HOMESTEAD ACRES COUNTY WATER DISTRICT	MBMG-GWIC	WELL	20.0	47.5808	111.3075	15.0	PUBLIC SUPPLY	152.4	326.57	24 OCT 1980	15.90	210.0	1.0
MGEOT241	MCCOLLUM, JIM * 10 MI NW MATHISON RANCH	MBMG-GWIC	WELL	6.5	47.5822	108.7183	18.8	DOMESTIC	71.0	496.82	26 AUG 1980	16.90	71.0	1.9
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT	MBMG-GWIC	WELL		47.5827	114.5063	21.5	UNUSED		84.12	04 MAR 1976	6.00	8.1	0.6
MGEOT047	* RYFFEL BROS. * 3MI S & 3 MI E HIGHWOOD	MBMG-GWIC	SPRING	757.1	47.5883	110.6802	18.6	DOMESTIC			04 AUG 1972			
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.	MBMG-GWIC	WELL		47.5952	114.5302	22.5	UNUSED	-0.0	60.96	17 AUG 1976	17.45	8.6	3.5
MGEOT307	HOT SPRINGS CITY	MBMG-GWIC	WELL		47.6063	114.6736	21.0	PUBLIC SUPPLY		116.74	31 MAY 1984	3.10	10.7	0.2
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	MBMG-GWIC	WELL		47.6063	114.6744	18.5	PUBLIC SUPPLY	2.7	116.74	27 AUG 1975	2.20	12.1	1.6
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	Sonderegger et.al. 1981	WELL	9.1	47.6075	114.6713	29.8	DOMESTIC		128.02	03 DEC 1979	7.80	21.2	5.2
MGEOT291	SOUTH EAST OF CAMP AQUA	MBMG-GWIC	WELL	10.1	47.6147	114.6655	51.5	RESEARCH			19 AUG 1982	9.90	9.6	5.7
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS	MBMG-GWIC	SPRING		47.6147	114.6658	44.0	RECREATIONAL			15 SEP 1975			
MGEOT080	HOT SPRINGS MONTANA	MBMG-GWIC	SPRING		47.6155	114.6477	43.0	RECREATIONAL			19 APR 1976			
MGEOT017	CAMAS HOT SPRINGS	Mariner et.al. 1976	SPRING	200.0	47.6155	114.6663	45.0					9.00	38.0	5.6
MGEOT352	SYMES HOTEL WELL	MBMG/UURI	WELL		47.6163	114.6763	33.3	DOMESTIC			02 NOV 1993	11.00	30.0	5.6
MGEOT029	SYMES HOT SPRINGS WELL	Sonderegger et.al. 1981	WELL	76.0	47.6163	114.6763	38.0					9.00	40.0	5.8
MGEOT081	HOT SPRING GEOTHERM WELL - UNNAMED	MBMG-GWIC	WELL		47.6169	114.6555	15.0	UNUSED			23 APR 1976	3.60	61.2	2.3
MGEOT355	KOEPLING, DELBERT * WELL 138	MBMG/UURI	WELL		47.6170	114.6781	26.5	IRRIGATION			03 NOV 1993	10.00	5.1	3.4
MGEOT354	OSTRANGER, DAVE * WELL 56	MBMG/UURI	WELL		47.6171	114.6775	17.2	IRRIGATION			03 NOV 1993	14.00	3.8	5.4
MGEOT077	VERNER, ROSE*3.75 MI W PABLO MT	MBMG-GWIC	WELL		47.6180	114.2108	17.5	DOMESTIC	16.2	45.72	05 MAR 1976	7.50	17.8	0.4
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS	MBMG-GWIC	WELL		47.6297	114.6236	19.5	DOMESTIC		69.80	17 AUG 1976	25.25	0.3	0.8
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	MBMG-GWIC	WELL	40.0	47.6302	114.5550	19.0	IRRIGATION		87.17	04 DEC 1979	27.00	1.4	4.3
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	MBMG-GWIC	WELL		47.6311	114.5813	15.2				06 SEP 1978	2.40	14.0	5.4
MGEOT042	SUN RIVER SPRINGS	Sonderegger et.al. 1981	SPRING	2690.0	47.6325	112.8542	30.4							
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	MBMG-GWIC	WELL	303.1	47.6347	114.5619	42.7	RESEARCH	-0.1	305.41	15 JAN 1981	34.60	21.5	3.1

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Reference	Type	Flow (l/min)	Latitude	Longitude	Temp (deg c)	Status/use	SWL (M)	Sample Depth (M)	Date	Chloride mg/l	Sulfate mg/l	Fluoride mg/l
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	MBMG-GWIC	WELL	10.0	47.6361	114.5750	32.6	IRRIGATION		73.15	29 NOV 1979	16.00	1.5	7.6
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	MBMG-GWIC	WELL	30.0	47.6372	114.5611	28.8	IRRIGATION		79.25	05 DEC 1979	34.80	0.6	4.2
MGEOT286	JACKOLA AP. 100 FT E. OF CAMP AQUA BATH SPA	MBMG-GWIC	WELL	416.5	47.6411	114.5700	51.0	INDUSTRIAL/COMM	1.8	79.55	04 JUN 1982	34.00	0.6	5.0
MGEOT027	CAMP AQUA AREA TEST WELL	Sonderegger et.al. 1981	WELL-FLOWING	1300.0	47.6422	114.5713	50.0	RESEARCH				33.00	4.0	3.9
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	MBMG-GWIC	WELL	75.0	47.6422	114.5713	43.7	RESEARCH		98.76	18 DEC 1980	35.30	0.7	4.3
MGEOT202	OLSEN, EDWIN * 8.4 MI NE WINIFRED MT	MBMG-GWIC	WELL	0.1	47.6425	109.3113	22.0	STOCK		495.00	19 AUG 1979	2850.00	2.0	2.0
MGEOT251	SMELSER, JAMES A. * POWER MT	MBMG-GWIC	WELL		47.6427	111.5830	16.0	STOCK	137.2	369.72	24 OCT 1980	765.00	13.8	1.5
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	MBMG-GWIC	WELL	20.0	47.6433	114.5638	30.6	IRRIGATION		76.20	02 DEC 1979	35.50	0.6	4.5
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	MBMG-GWIC	WELL	94.8	47.6438	114.5741	38.9	IRRIGATION		82.30	29 NOV 1979	31.30	1.3	7.8
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	MBMG-GWIC	WELL	40.0	47.6452	114.5688	32.5	IRRIGATION		76.20	02 DEC 1979	30.90	0.6	5.0
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	MBMG-GWIC	WELL		47.6472	114.5761	34.4	DOMESTIC		71.63	07 SEP 1978	23.10	2.1	4.6
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT	MBMG-GWIC	WELL	0.4	47.6516	114.5838	24.0	STOCK			02 JUL 1976	28.25	1.2	6.1
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	MBMG-GWIC	WELL		47.6536	114.5813	25.8	IRRIGATION			06 SEP 1978	10.90	1.8	4.4
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	MBMG-GWIC	WELL	94.9	47.6619	114.5838	20.3	IRRIGATION		79.25	02 DEC 1979	19.00	2.1	4.8
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	MBMG-GWIC	WELL	35.1	47.6700	114.5880	22.8	IRRIGATION			06 SEP 1978	2.20	6.9	3.2
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	MBMG-GWIC	WELL		47.6736	114.6027	23.6	DOMESTIC	18.3	91.44	30 NOV 1979	7.80	5.8	3.4
MGEOT149	MATOVICH,JOHN * 23 MI SW SUN PRAIRIE MT	MBMG-GWIC	WELL	0.8	47.6830	108.0702	16.0	STOCK	71.1		15 SEP 1978	56.80	321.0	3.7
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	MBMG-GWIC	WELL		47.6880	114.6538	16.6	DOMESTIC	22.9	95.71	06 DEC 1979	2.10	12.0	1.2
MGEOT075	LONEPINE OBSERVATION WELL	MBMG-GWIC	WELL		47.7141	114.6477	16.5	DOMESTIC	33.2		04 MAR 1976	6.30	12.2	0.9
MGEOT110	STREIT, GEORGE * 4MI E-1MI S FT BENTON MT.	MBMG-GWIC	WELL	0.6	47.8030	110.5769	15.0	STOCK		616.31	16 JAN 1977	94.00	1164.0	3.0
MGEOT243	WHITMAYER ASSOC * 4.5MI SE SUN PRAIRIE SCH	MBMG-GWIC	WELL	1.0	47.8194	107.6294	15.6	STOCK	152.4	583.69	13 SEP 1980	920.00	102.0	2.7
MGEOT109	CLARK, BRAD * 25 MI E FT. BENTON MT.	MBMG-GWIC	WELL		47.8297	110.1708	20.0	DOMESTIC	15.2	146.61	15 JAN 1977	146.00	1174.0	1.2
MGEOT114	LANDUSKY PLUNGE SPRINGS	Sonderegger et.al. 1981	SPRING	11000.0	47.8432	108.5987	24.0	DOMESTIC			16 AUG 1973	10.00	620.0	1.6
MGEOT072	LANDUSKY, 1*6.5 MI S HAYS, MONTANA	Sonderegger et.al. 1981	SPRING	2378.0	47.8763	108.6572	20.3	IRRIGATION			23 SEP 1975	13.65	671.0	1.4
MGEOT046	BLACK COULEE * E OF TEST AREA	MBMG-GWIC	SPRING	56.8	47.9069	110.6586	28.8	UNUSED			03 AUG 1972	276.00	6230.0	0.4
MGEOT313	ALZHEIMER, PAUL * SW OF BRADY, MT	MBMG-GWIC	WELL		47.9097	111.9400	25.0	DOMESTIC		53.34	14 JAN 1985	25.20	646.0	0.6
MGEOT312	REVERE, LEE	MBMG-GWIC	WELL		47.9261	111.9533	25.0	DOMESTIC	0.3		14 JAN 1985	12.40	61.2	0.5
MGEOT049	LITTLE WARM SPRINGS*9 MI SE LODGE POLE	Sonderegger et.al. 1981	SPRING	4542.4	47.9691	108.3963	26.1	DOMESTIC			16 AUG 1973	59.00	1144.0	1.4
MGEOT324	LODGEPOLE WARM SPRINGS	Sonderegger et.al. 1981	SPRING	10200.0	47.9936	108.4443	30.0					57.00	1060.0	1.1
MGEOT048	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	MBMG-GWIC	SPRING		47.9955	108.4466	30.6	DOMESTIC			16 AUG 1973	57.00	1062.0	1.1
MGEOT051	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	MBMG-GWIC	SPRING		47.9958	108.4506	26.0	IRRIGATION			04 OCT 1973	36.00	650.0	0.9
MGEOT052	KIRKALDIE, BRUCE*7 MI SW LODGEPOLE MT	MBMG-GWIC	SPRING	10363.7	47.9963	108.4491	24.5	IRRIGATION			26 NOV 1973	50.00	693.0	0.7
MGEOT037	LARGE CAPACITY WELL*4 MI SW WOLF POINT, MT	MBMG-GWIC	WELL	100.1	48.0313	105.7422	51.0	OTHER		32.00	22 OCT 1963		522.0	
MGEOT024	CITY OF WOLF POINT * WELL IN WOLF POINT	MBMG-GWIC	WELL	6.6	48.0847	105.6433	18.3	DOMESTIC		335.28	10 OCT 1947	1850.00	1.9	1.0
MGEOT023	SHERMAN HOTEL OF WOLF POINT	MBMG-GWIC	WELL	9.4	48.0936	105.6363	17.2	DOMESTIC		300.23	10 OCT 1947	2050.00	5.6	1.0
MGEOT038	USGS TEST WELL * 1 MILE SOUTH POPLAR, MT	MBMG-GWIC	WELL		48.0950	105.2050	13.9	OTHER			07 SEP 1963	9.20	261.0	0.5
MGEOT025	FOSS ELMER * 5.8 MI SE BROCTON	MBMG-GWIC	WELL	0.9	48.1116	104.7975	16.1	STOCK		208.48	05 OCT 1947	116.00	5.8	4.8
MGEOT317	LANDTECH WATER DISPOSAL SERVICE	MBMG-GWIC	WELL	2.6	48.1463	104.1969	17.9	INDUSTRIAL/COMM			25 MAY 1985	242.00	-0.2	5.2
MGEOT315	THORNESS, RICK * 4 MILES NW OF BAINVILLE	MBMG-GWIC	WELL		48.2013	104.2452	15.0	DOMESTIC	10.7	14.94	01 MAY 1985	9.50	640.0	0.5
MGEOT108	CLAWITER, MILT * 4MI N-4MI E BIG SANDY MT.	MBMG-GWIC	WELL		48.2313	110.0268	16.0	DOMESTIC	6.1	72.24	14 JAN 1977	156.00	617.0	1.9
MGEOT303	SIMS SPRING	MBMG-GWIC	SPRING		48.3325	105.4552	15.0				10 SEP 1983	4.20	34.8	0.1
MGEOT140	TEXACO INC * 1.7 MI NW CENTRAL SCHOOL.	MBMG-GWIC	WELL	0.9	48.4819	109.2083	35.5	INDUSTRIAL/COMM	-8.1	1027.48	21 AUG 1978	307.00	5.8	8.5
MGEOT252	MATOVAICH, MARTIN*17 MI E MALTA NEAR SACO	MBMG-GWIC	WELL	9.1	48.4847	107.5275	42.0	RECREATIONAL		975.36	27 OCT 1980	183.00	2120.0	1.9
MGEOT111	SLEEPING BUF REC AREA * 4MI NNW ASHFIELD	Sonderegger et.al. 1981	WELL		48.4852	107.5327	41.3	RECREATIONAL		971.70	10 MAY 1977	195.50	2147.0	2.9
MGEOT145	SHIRLE, WALTER * 3 MI S FRESNO DAM.	MBMG-GWIC	WELL	0.4	48.5563	109.9288	17.5	DOMESTIC	52.7	65.53	02 SEP 1978	182.80	865.0	1.8
MGEOT106	PIMLEY, DON * 4 MI NW JOPLIN MT.	MBMG-GWIC	WELL		48.5994	110.8166	15.0	DOMESTIC	54.9	85.34	05 DEC 1978	184.00	2668.0	0.4
MGEOT105	CADY, ELWIN * 7.5 MI NW JOPLIN MT.	MBMG-GWIC	WELL		48.6747	110.7955	25.0	DOMESTIC	24.4	30.48	05 DEC 1978	18.00	1060.0	0.1
MGEOT309	FRANCIS, CLARA	MBMG-GWIC	WELL		48.6875	104.4552	29.0	IRRIGATION	7.6		29 SEP 1984	85.80	1400.0	0.9
MGEOT107	WELSH, ORVILLE * 13 MI N-3MI E HINGHAM MT.	MBMG-GWIC	WELL	3.2	48.7405	110.3447	16.0	DOMESTIC	41.8	62.48	12 JAN 1977	47.00	1657.0	0.4
MGEOT310	EDWARDS, MARVIN / MIKE DUSTERHOFF	MBMG-GWIC	WELL		48.7694	112.4555	25.0	DOMESTIC		24.38	16 NOV 1984	44.00	1010.0	0.3
MGEOT039	BIG WEST OIL CO * 2 MI NE MTN VIEW SCHOOL	MBMG-GWIC	WELL		48.8397	112.0869	46.0	UNUSED	36.1		24 SEP 1965	6.00	190.0	
MGEOT104	RYGH, KEN * 22 MI N - 5 MI W JOPLIN MT.	MBMG-GWIC	WELL		48.8783	110.8613	21.0	DOMESTIC		149.35	04 DEC 1976	14.50	0.1	0.9
MGEOT142	BRADBURY, ALFRED * 11 MI E WILD HORSE MT	MBMG-GWIC	WELL	2.8	48.9130	110.1058	15.5	STOCK	12.2		07 SEP 1978		823.0	2.3
MGEOT144	NAGEHUS, ORVILLE * 3 MI N SIMPSON MT.	MBMG-GWIC	WELL	0.8	48.9686	110.2102	15.5	STOCK	21.3	59.74	04 SEP 1978		312.0	2.6

NOTE. A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Std dev balance	Lab ph	Sc mmohs	Tds mg/l	Hco3 mg/l	Alkalinity	Sample type	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (sio2) mg/l	Arsenic ug/l
MGEOT209	TARGHEE SULPHUR SPRING*6MI W W YELLOWSTONE	-10.57	8.03	305.5	316.41	63.3		Dissolved	72.9	27.5	7.1	4.5	0.01	14.4	15.1
MGEOT177	UPPER WEST SPRING-STAUDENMEYER RANCH	0.51	6.29	607.0	395.15	249.0			67.3	25.0	26.9	6.9	0.02	20.8	
MGEOT123	UPPERMOST SPRING-STAUDENMEYER RANCH								67.5	24.5	25.8	6.8	0.01	20.1	
MGEOT126	UPPER-EAST SPRING-STAUDENMEYER RANCH								69.0	25.2	28.1	7.4	-0.01	22.7	
MGEOT125	LOWER WEST SPRINGS-STAUDENMEYER RANCH	0.32	7.44	625.5	400.95	251.0			68.0	24.0	29.0	7.7	-0.01	21.4	
MGEOT127	LOWER EAST SPRING-STAUDENMEYER RANCH	0.22	7.46	628.3	400.37	251.0		Dissolved	68.0	24.6	27.8	7.4	-0.01	23.3	
MGEOT124	UPPER WEST SPRING-STAUDENMEYER RANCH	0.55	7.52	617.2	395.24	249.0			67.0	24.0	27.9	7.2	0.02	20.8	
MGEOT121	ANDERSONS PASTURE SPRING #1								66.5	24.0	27.7	7.3	-0.01	21.4	
MGEOT122	ANDERSONS PASTURE SPRING #2	-0.08	7.47	627.0	400.75	247.0			71.0	24.0	26.9	7.3	0.01	21	
MGEOT210	USFS* BAKERS HOLE* 3MI N WEST YELLOWSTONE	0.20	7.76	310.8	256.64	152.0		Dissolved	11.2	6.0	48.0	7.0	0.01	79.9	21.8
MGEOT115	SLOAN COW CAMP SPRING		10.10		252		215		0.9	0.1	88.0	1.1	0.17	50.9	
MGEOT120	WEST FORK SWIMMING HOLE	-0.38	7.86	320.8	179.02	194.0			19.0	29.0	4.8	1.9	-0.01	13.7	
MGEOT118	CURLEW CREEK WARM SPRING								12.5	1.3	33.0	1.2	1.11	19.7	
MGEOT119	WALL CANYON WARM SPRING	-0.09	8.06	1097.0	703.41	493.0		Dissolved	6.6	1.7	260.0	6.0	0.08	41.7	
MGEOT229	WOLF CREEK HOT SPRING	0.83	8.81	492.9	331.67	157.0			8.0	1.4	104.0	1.8	-0.01	50.7	
MGEOT129	LOWELL HILDRETH SPRING*15 MI SW DILLON	0.17	7.44	722.0	480.7	217.0			88.0	27.5	28.3	4.5	-0.01	17.5	
MGEOT016	BEAR CREEK SPRINGS		9.50												
MGEOT132	VIGILANTE WARM SPRING	-0.49	7.74	617.7	403.41	182.0		Dissolved	84.5	27.0	6.7	3.1	-0.01	15.5	
MGEOT041	LA DUKE HOT SPRINGS		6.50		2230		299		320.0	58.0	230.0	23.0		49	
MGEOT012	BROWNS SPRINGS		7.40		480										
MGEOT010	PULLER HOT SPRINGS		7.70		1160		511		56.0	19.0	330.0	24.0		33	
MGEOT019	TRUDAU SPRINGS		8.40		540		425		78.0	30.0	70.0	11.1		19	
MGEOT040	CHICO HOT SPRINGS		7.40		342		172		35.0	8.8	35.0	6.8		34	
MGEOT032	GROUNDWATER*4.7 MI NE FT SMITH MT	-0.20	8.00	825.0	489.3	319.0		Dissolved	0.3	0.4	186.0	0.9	0.23	10	
MGEOT074	BROWN CATTLE CO* 3.1 MI N. BIRNEY MT	-0.70	8.53	1020.0	619.1	519.7			1.9	0.4	250.0	1.3	0.04	10.1	
MGEOT276	JARDINE HOT SPRINGS 0.25 MI E OF JACKSON	1.99	7.73	967.5	655.43	615.0		Dissolved	10.3	3.0	226.0	8.5	0.02	49.3	53.2
MGEOT289	MBMG GEOTHERMAL TEST * THEXTON TX-12	2.27	7.69	1338.0	1030.15	449.0		Dissolved	5.2	0.2	331.0	15.2	0.22	107	22.4
MGEOT028	JACKSON HOT SPRINGS		6.77		986		614		10.0	3.7	240.0	10.0		52	
MGEOT293	PRIVATE GEOTHERMAL TEST*ENNIS HOT SPRINGS*	0.84	7.84	1442.0	966.38	404.0		Dissolved	5.0	0.2	314.0	14.9	0.01	108	22.7
MGEOT277	LAPHAM DOMESTIC WELL 1 MI NW JACKSON, MT.	0.54	7.63	953.3	575.1	558.0		Dissolved	27.3	3.4	192.0	9.0	0.83	16.2	37.0
MGEOT117	ENNIS HOT SPRINGS														
MGEOT058	BROWN CATTLE CO * 9.5MI SW BIRNEY DAY SCH.	-0.64	8.28	992.0	600.36	531.0			2.2	0.1	243.0	1.4	0.05	9.7	
MGEOT031	BEAVERHEAD ROCK SPRINGS		7.20												
MGEOT133	APEX WARM SPRING	-0.33	7.78	519.5	340.92	140.0		Dissolved	62.0	16.2	23.4	3.2	-0.01	19.8	
MGEOT323	ELKHORN HOT SPRINGS		8.94		180		85		1.9	0.1	48.0	0.7		55	
MGEOT292	MARTIN, KIETH	-1.03	7.87	666.1	443.87	170.8		Dissolved	94.5	33.4	1.7	1.7	-0.00	10.7	
MGEOT326	NEW BILTMORE HOT SPRINGS		6.80		1970		232		290.0	73.0	160.0	24.0		46	
MGEOT308	NEWMAN, JOHN * JOLIET, MT	-0.99	7.72	6184.0	4639.66	466.0		Dissolved	20.1	12.9	1520.0	2.7	-0.00	7.8	
MGEOT280	ANDERSON SPRING	0.32	7.67	524.9	326.33	179.6		Dissolved	73.6	22.3	1.4	1.4	-0.00	11.5	
MGEOT006	ANDERSON'S SPRING		7.84	414.0	270		66		47.0	23.0	2.0	1.3		12.2	
MGEOT043	NORRIS HOT SPRINGS		7.80		651		383		19.0	3.2	190.0	11.0		78	
MGEOT015	POTOSI HOT SPRINGS		6.60		333		67		10.0	0.1	91.0	1.6		46	
MGEOT187	GROSS, PETE * 4 MI S PONY MT	1.29	8.36	474.4	368.76	67.3		Dissolved	13.2	0.1	94.6	1.7	0.01	47.7	
MGEOT311	MCFERRAN, EUGENE * BILLINGS, MT	0.65	7.36	1864.0	1140.2	1098.0		Dissolved	0.9	0.3	471.0	0.4	0.15	9.1	
MGEOT179	CARTER'S BRIDGE * 4 MI SE LIVINGSTON MT.								129.0	35.4	7.3	4.1	-0.01	19.4	1.1
MGEOT011	AVON WARM SPRING		6.90												
MGEOT264	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	6.43	9.41	715.1	434.4	52.5		Dissolved	2.3	0.1	115.0	2.4	0.01	71.2	5.0
MGEOT266	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	1.73	9.41	716.8	456.66	55.1		Dissolved	2.7	-0.0	136.0	2.5	-0.00	70.2	5.0
MGEOT265	BOZEMAN HOT SPRINGS * OLD WELL	0.11	9.43	713.9	462.34	53.7		Dissolved	1.3	-0.0	144.0	2.8	0.00	70.3	5.4
MGEOT263	BOZEMAN HOT SPRINGS * ORIGINAL SPRING	0.73	9.29	711.9	455.41	62.5		Dissolved	5.1	0.6	135.0	2.8	0.03	69.3	5.0
MGEOT335	BOZEMAN HOT SPRINGS		9.50		436		113		7.0	2.4	130.0	3.1		57	
MGEOT269	RANCA * MCLEOD	-0.41	7.58	2221.0	1983.42	116.3		Dissolved	454.0	79.1	13.4	11.5	0.70	30.6	
MGEOT259	SCOTT FEED LOT	0.96	8.93	2001.0	1269.15	1016.0		Dissolved	1.2	0.2	512.0	1.2	0.22	19.4	
MGEOT260	SCOTT FEED LOT	0.82	8.76	2521.0	1383.91	1169.0		Dissolved	1.2	0.2	559.0	1.1	0.06	20	
MGEOT230	BLUE JOINT CREEK HOT SPRING		8.22		179		67		2.6	0.1	38.0	0.3		54	
MGEOT002	BRIDGER CANYON WARM SPRING		7.70		275		209		54.8	22.7	4.0	1.4		8.2	
MGEOT334	LOVE, MELVIN*THREE FORKS, MT	2.08	7.92	396.5	317.3	284.7		Dissolved	62.1	13.8	23.4	4.5	0.00	32.1	26.0
MGEOT033	GROUNDWATER*5.3 MI W HARDIN MT	-1.55	7.60	3040.0	2935.17	180.0		Dissolved	665.0	136.0	14.0	24.0	1.50	18	
MGEOT332	SHIPTON, HAROLD * THREE FORKS MT	-0.43	8.07	593.9	369.54	284.9		Dissolved	59.0	26.4	27.0	5.2	-0.00	50.7	45.0
MGEOT256	HERMAN, T.E. * ROCKY RANCH 7.4 M W HARDIN	0.18	7.76	3294.0	3081.89	150.1		Dissolved	669.0	143.0	14.6	26.4	0.32	17.2	
MGEOT344	GALLOGLY HOT SPRING		9.12		190		89		3.0		43.0	0.7		43.7	
MGEOT245	LOST TRAIL * WARM AND HOT SPRINGS								3.0	-0.1	42.8	0.7	0.01	43.7	0.8
MGEOT069	CAIN MIKE*6.6 MI S VOLBERG	-0.39	8.30	1472.0	888.02	894.0			3.5	0.8	374.0	1.4	0.22	7.1	
MGEOT018	HUNTERS HOT SPRINGS		9.10		384		227		0.9	0.1	85.0	0.8		65	
MGEOT328	JORGENSON, JACK * THREE FORKS MT							Dissolved							61.0
MGEOT346	RENOVA HOT SPRINGS		7.50		655		310		51.0	13.0	150.0	13.0		37	
MGEOT339	WESTMORELAND * 9.1 M W SARPY SCHOOL	0.77	7.67	1837.8	1526.37	80.8		Dissolved	300.0	44.6	48.3	53.0	0.23	21	
MGEOT095	LISCOM RANCH * 5.5 MI NW OF N STACY SCHOOL	-0.71	8.61	1140.0	709.03	638.7			2.6	0.9	291.0	1.4	0.05	7.7	
MGEOT331	TINDER, L. MARIE * THREE FORKS MT	0.34	7.84	656.6	421.53	334.0		Dissolved	46.5	13.0	74.6	11.3	-0.00	49.5	116.0
MGEOT327	WILCOX, RALPH * THREE FORKS MT							Dissolved							130.0
MGEOT333	RICHARDSON, DEIRDRE * THREE FORKS	0.31	8.05	754.1	485.04	360.0		Dissolved	56.5	14.7	84.8	12.0	-0.00	50.2	78.0
MGEOT347	MEDICINE HOT SPRINGS		8.60		322		126		1.9	0.1	80.0	1.4		60	
MGEOT092	WESTERN ENERGY * 2 MI N COLSTRIP MT.	0.75	7.45	1900.0	1394.9	162.5		Dissolved	213.0	25.0	131.0	65.8	2.29	56.6	
MGEOT020	PIPESTONE HOT SPRINGS		8.70		396		108		2.6	0.1	98.0	1.9		66	
MGEOT062	FRED WETSTEON SPRING DEVELOP								4.5		95.8	2.3	-0.01	59.5	
MGEOT330	HART, FRANK * THREE FORKS, MT														
MGEOT063	ANADARKO PROD*6 MI E FOSTER MT	-2.31	8.75	22150.0	13237.2	0.0		Dissolved	87.0	29.0	5160.0	16.9	0.06	12.3	
MGEOT053	UN-NAMED SPRING * 29 M NE OF FOSTER MT								40.0	40.8	28.8	1.4	-0.01	1.6	
MGEOT128	COWAN SPRING*9MI NW THREE FORKS MT								14.5	6.8	41.6	3.6	0.12	3	

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters)

MGEOT DATABASE

ID	Site name	Std dev balance	Lab ph	Sc mmohs	Tds mg/l	Hco3 mg/l Alkalinity		Sample type	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (sio2) mg/l	Arsenic ug/l
MGEOT178	WOLF CREEK HOT SPRING							Dissolved				0.0	-0.01		8.0
MGEOT343	WILLIAMSBURG SPRING								19.9	5.3	8.1	2.3	0.09	9.7	1.9
MGEOT030	OIL WELL (TENSLEEP FORMATION)				2810										
MGEOT341	MONTANA RESOURCES MONITORING WELL C	-0.48	5.85	735.5	556.37	30.0		Dissolved	86.3	17.1	24.5	10.0	9.61	51.6	2.0
MGEOT342	MONTANA RESOURCES MONITORING WELL D2	0.58	6.36	1230.7	994.7	31.8		Dissolved	139.0	47.4	37.8	16.4	19.70	56.6	10.0
MGEOT055	HOWARD SPRING * 25 M SE OF BIGHORN MT	0.02	8.42	3237.0	2527.59	490.0			56.0	238.0	420.0	6.3	0.02	9.9	
MGEOT246	WENDT, FRED * .75 MI S GREGSON (FAIRMONT)	-0.95	8.50	243.1	173.34	106.8		Dissolved	20.7	1.0	29.1	2.8	0.22	43.1	3.3
MGEOT298	MBMG RESEARCH WELL * FAIRMONT HOT SPRINGS	-0.40	8.29	829.0	478.32	90.9		Dissolved	9.5	0.2	163.0	3.3	-0.00	3.8	
MGEOT165	NELSON, HARVEY * 5 MI S BROADVIEW MT	0.74	8.56	3921.0	2954.21	602.0		Dissolved	4.7	1.4	1004.0	1.7	0.02	9	
MGEOT061	BRADBROOK * 10 M S BROADVIEW MT	0.90	7.34	3726.0	3144.31	455.0		Dissolved	446.0	117.0	352.0	49.8	0.04	17.6	
MGEOT279	FAIRMONT HOT SPRINGS, ANACONDA								4.0	0.3	165.0	4.4	0.01	80.6	8.6
MGEOT247	SPANGLER, HAZEL * 2 MI E-NE GREGSON MT	0.79	7.71	433.0	294.23	156.2		Dissolved	33.2	9.9	36.9	7.3	0.02	56.8	
MGEOT214	HUNSAKER SPRING	-0.51	7.76	586.9	349.67	325.0		Dissolved	71.2	18.8	22.3	11.4	0.58	23.3	3.4
MGEOT150	MONT. HIGHWAY DEPT * .75 MI SE WACO MT.	0.55	8.07	3775.0	2806.74	379.0		Dissolved	14.2	5.0	914.0	2.4	0.02	7.1	
MGEOT213	PLUNKET LAKE WARM SPRINGS								36.5	23.5	22.4	2.4		15.5	1.7
MGEOT237	SPRINGS FROM JOINTS IN MISS CYN*SW PLUNKET	-0.82	8.48	497.3	299.55	183.0		Dissolved	46.0	23.0	22.7	2.7	-0.01	14.1	1.4
MGEOT151	MONTANA DEPT HIGHWAYS * 2.5 MI NE WACO MT	-0.55	8.50	2120.0	1416.54	504.0		Dissolved	16.8	11.1	477.0	1.7	0.01	7.5	
MGEOT216	HUNSAKER, MAURICE	-0.54	8.21	385.8	244.65	179.0		Dissolved	21.6	12.5	44.4	2.5	0.02	29.9	
MGEOT135	ANACONDA RED TRAVETINE MOUND-GEYSER	0.27	7.31	2624.0	2306.75	439.0		Dissolved	470.0	67.0	147.0	10.6	1.21	22.7	
MGEOT325	SLEEPING CHILD HOT SPRINGS		8.10		445		162		6.2	0.2	110.0	2.6		60	
MGEOT236	BRUCE, N * IRRIGATION WELL WITH BOOSTER	0.02	7.66	651.3	434.57	194.0		Dissolved	53.8	18.5	55.7	4.7	-0.01	48.4	6.0
MGEOT294	TOSTON WARM SPRING	-0.44	7.54	421.1	258.63	200.1		Dissolved	46.6	18.8	16.1	2.5	-0.00	18.4	4.1
MGEOT218	TOSTON WARM SPRING								48.7	20.2	13.6	3.6	-0.01	19.8	
MGEOT217	BRUCE, NORMAN	-0.06	7.05	1798.0	1374.26	30.7		Dissolved	279.0	3.0	129.0	5.5	0.03	31.9	1.3
MGEOT215	KIMPTON SPRING	-0.30	8.43	203.3	125.18	101.0		Dissolved	25.8	7.2	5.3	0.8	0.01	17.1	0.9
MGEOT134	WARNER WARM SPRING								25.6	6.8	5.4	0.9	-0.01	16	
MGEOT172	STEELE, WILLIAM * 12.5 MI SE PINEVIEW MT.	0.77	7.98	4583.0	3293.74	362.0		Dissolved	19.0	4.6	1074.0	3.8	0.02	7	
MGEOT284	MBMG TEST WELL*WARM SPRINGS STATE HOSPITAL	-3.59	7.54	1497.0	1176.78	263.5		Total Recovera	196.0	23.1	124.0	24.4	21.40	28.4	0.3
MGEOT009	WARM SPRINGS		6.46		1310		258		220.0	22.0	120.0	26.0		56	
MGEOT233	WARM SPRINGS STATE HOSPITAL	0.48	7.03	1662.0	1273.39	290.0		Dissolved	216.0	24.5	114.0	31.5	10.80	37.7	
MGEOT231	WARM SPRINGS STATE HOSPITAL	-1.04	7.34	1534.0	1256.29	301.6		Dissolved	218.0	24.5	126.0	32.9	0.36	33.6	14.9
MGEOT349	BOULDER HOT SPRINGS - UPPER SPRING	-0.62	8.89	434.0	419.46		161	Dissolved	2.7	0.4	122.0	3.8	-0.01	93.2	0.7
MGEOT351	*BOULDER HOT SPRINGS - LOWER SPRING*	*-0.30*	*8.80*	*430.0*	*401.44*		*158*	Dissolved	3.2	-0.0	111.4	6.1	0.31	90	-0.5
MGEOT350	BOULDER HOT SPRINGS - MIDDLE SPRING	-0.26	8.69	428.0	421.14		153	Dissolved	2.0	0.3	118.2	4.1	0.08	98.5	-0.5
MGEOT232	WARM SPRINGS STATE HOSPITAL * SPRING								225.6	23.1	121.4	23.8	0.06	55.8	23.0
MGEOT185	M-B NO. 12 * 5 MI NE HAMILTON MT	0.66	7.37	497.1	338.3	290.0		Dissolved	68.2	11.8	20.7	4.4	0.03	59.3	
MGEOT171	GRIERSON, J.B.*2.5MI NE RANCHERS CEMETARY.	-0.23	7.97	4171.0	2385.96	813.0		Dissolved	4.3	0.8	956.0	2.6	0.06	12.4	
MGEOT130	PRISON RANCH SPRING SITE NO. 4								3.9	0.1	45.8	0.5	-0.01	45.8	
MGEOT113	DEER LODGE PRISON RANCH WELL		8.96		172		66		3.9	0.1	46.0	0.5		45.8	
MGEOT044	BEDFORD SPRINGS		7.20		350		155		57.0	22.0					
MGEOT101	GRIERSON, J.B. * 23 MI NW HYSHAM MT	1.05	8.09	4506.0	3201.72	638.7		Dissolved	21.6	11.0	1050.0	4.1	0.05	6	
MGEOT275	MBMG RESEARCH WELL * WEED CREEK-1B	2.04	9.82	3202.0	2022.05	294.3		Dissolved	2.4	0.7	700.0	1.8	0.03	0.8	
MGEOT274	MBMG RESEARCH WELL * WEED CREEK-1A	2.64	8.93	3054.5	2002.53	463.0		Dissolved	2.0	1.3	674.0	1.9	0.05	7.5	
MGEOT255	HANSER, BILL * 3 MI SW TWO DOT MT	-0.42	9.22	1165.0	691.12	604.0		Dissolved	1.1	0.2	290.0	0.9	0.01	12.5	
MGEOT256	FOX INC * 1.5 MI W-SW TWO DOT	0.96	9.39	638.0	469.59	366.0		Dissolved	0.6	-0.1	197.0	0.4	0.01	14	
MGEOT257	HOMER, RAY * TWO DOT WATER SUPPLY	-0.12	9.35	755.0	443.51	312.0		Dissolved	1.1	0.1	178.0	0.5	0.05	13.2	
MGEOT296	HARLOWTON * SOUTH MUNICIPAL WELL	-0.95	8.94	909.9	556.33	383.0		Dissolved	2.0	0.1	223.0	0.2	0.01	10.2	
MGEOT013	HILLBROOK FLOWING WELL		6.90		1060		788		32.0	5.6	340.0	20.0		67	
MGEOT014	WALLS HOT SPRING				651		489		18.0	3.5	210.0	10.0		60	
MGEOT001	ALHAMBRA HOT SPRINGS NORTH		7.23		909		484		18.0	3.5	220.0	9.5		66	
MGEOT278	TOWNSEND,HERB*2.5 MI SW WHITE SULPHUR SPGS	0.72	7.89	409.7	237.25	192.5		Dissolved	48.0	15.1	10.9	2.0	0.01	15.9	1.6
MGEOT290	RALPH JOHNSON,P.O.BOX 65,WHITE SULPHUR SPR	1.58	8.63	7878.0	5700.36	2533.0		Dissolved	2.5	3.4	2130.0	19.0	0.01	44	11.8
MGEOT004	WHITE SULPHUR SPRINGS		6.80		1950		835		44.0	12.0	480.0	20.0		51	
MGEOT282	WHITE SULPHUR SPRINGS BANK WELL	-0.77	7.62	2189.0	1298.88	791.0		Dissolved	41.0	9.5	433.0	17.5	0.10	43.7	-1.0
MGEOT188	WATTS, JAMES * 16 MI NE KINSEY MT	-0.19	9.03	1303.0	805.43	709.0		Dissolved	1.0	0.2	340.0	0.6	0.03	10	
MGEOT184	M-B NO 8 WELL*2.5 MI SE CORVALLIS MT	0.29	7.31	269.8	222.97	113.0		Dissolved	20.8	5.3	25.1	4.9	0.51	70	
MGEOT007	BROADWATER HOT SPRINGS WELL				598		193		13.0	0.8	180.0	5.9		93	
MGEOT006	GLOEGE WELL		7.40		403		269		78.0	16.0	38.0	3.4		28	
MGEOT003	*GARRISON WARM SPRINGS*		7.30		558		59		77.0	35.0	24.0	5.2		18.2	
MGEOT337	CHADWICK, GREG							Dissolved				0.0			
MGEOT206	USGS OBS WELL * 4 MI SW EAST HELENA, MT.	-0.82	7.76	802.0	453.89	316.0		Dissolved	98.0	31.5	30.8	4.7	-0.01	15.8	
MGEOT336	MUELLER BUZZ							Dissolved							
MGEOT242	FLORENCE TEST WELL A	-1.38	8.80	354.9	207.65	164.5		Dissolved	1.0	0.2	81.3	2.9	2.70	4.9	
MGEOT329	SIVERTE MYSSE * BOX 315 * INGOMAR MT 59039	0.71	8.19	3105.0	2104.12	1795.0		Dissolved	3.0	0.5	843.0	1.8	0.02	21.8	
MGEOT167	CHERRY CK SHEEP CO.*1.35MI SE HAGEN RANCH.	-1.07	8.08	3106.0	2137.33	1828.0		Dissolved	3.5	0.8	871.0	2.4	0.03	20.4	
MGEOT261	MOORE, THOMAS * 6.5 MI SW ANGELA MT	-5.96	7.28	9968.0	5918.73	293.0		Dissolved	394.0	65.2	1684.0	115.0	0.08	50.8	
MGEOT322	BYRNE WARM SPRING * WEST OF BEARMOUTH								137.0	35.3	12.2	3.3	-0.00	20.7	8.3
MGEOT116	NIMROD SPRINGS		7.63		630		168		126.0	36.0	16.0	3.4		21	
MGEOT026	BEARMOUTH SPRINGS		7.69		420		220		89.0	26.0	8.0	1.8		16	
MGEOT338	GARRICK GALEN							Dissolved							
MGEOT345	LOLO HOT SPRINGS		9.30		224		86		1.8	0.1	52.0	1.2		72	
MGEOT069	*MARYSVILLE DEEP WELL DEPTH 5750*	3.01	6.62	1004.0	672.39	264.0		*Dissolved*	7.7	0.4	206.0	10.4	0.02	66.5	
MGEOT170	CHERRY CREEK SHEEP CO*26 MI N VANANDA MT	0.23	7.25	5062.0	4245.76	346.0			456.0	101.0	705.0	78.6	0.78	21.5	
MGEOT162	OLSEN, JONAS * 9 MI NW FLATWILLOW MT.	0.08	8.04	1005.0	656.12	360.0		Dissolved	26.2	11.5	190.0	4.9	0.01	13.1	
MGEOT201	OLSEN JONAS * 14 MI NE N-BAR RANCH	0.15	8.41	710.6	585.62	233.0		Dissolved	79.2	39.0	53.5	7.1	0.12	9.8	
MGEOT164	REYNOLDS, KEITH * 6 MI NE FLATWILLOW MT.	1.20	8.36	1670.0	1117.44	436.0		Dissolved	5.9	1.6	384.0	2.6	0.15	13.5	
MGEOT163	HILL, FLOYD * 7 MI N FLATWILLOW MT.	0.63	8.23	1606.0	1078.47	402.0		Dissolved	6.6	1.8	368.0	3.1	0.12	13	
MGEOT180	M-B 4 (BUTLER CK) * 6 MI NW MISSOULA MT	-2.54	7.66	919.5	707.83	651.0		Dissolved	10.4	5.4	237.0	9.0	8.90	91.9	
MGEOT254	KING, JOE & SONS INC. * 5 MI SSW WINNET MT	0.99	8.41	3276.0	2056.04	828.0		Dissolved	8.3	2.9	726.0	4.2	0.93	12.6	

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters)

MGEOT DATABASE

ID	Site name	Std dev balance	Lab ph	Sc mmohs	Tds mg/l	Hco3 mg/l	Alkalinity	Sample type	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (sio2) mg/l	Arsenic ug/l
MGEOT159	SHAW, BUD * 1.7 MI SW MOSBY MT.	-0.02	8.40	1512.0	995.54	509.0		Dissolved	3.9	0.9	363.0	2.1	0.35	13.8	
MGEOT160	EAGER, REX * 2 MI SW WINNETT MT.	-0.77	8.27	1134.0	727.86	429.0		Dissolved	6.0	2.0	267.0	2.7	0.02	11.9	
MGEOT161	BRATTON, WAYNE * 2 MI SE WINNETT MT.	0.37	8.30	1659.0	1128.06	411.0		Dissolved	6.9	2.0	387.0	2.7	0.39	14.2	
MGEOT305	BURLY VISTA TRACTS	0.46	7.51	602.1	355.09	280.6		Dissolved	73.4	29.9	5.7	4.4	0.42	6.7	
MGEOT157	TEIGEN, PETER * 9 MI E GRASSRANGE MT.	0.46	7.59	1571.0	1138.23	411.0		Dissolved	162.0	74.8	98.1	11.2	0.83	9.6	
MGEOT196	MATOVICH * 4.5 MI E GRASSRANGE MT	-0.64	7.96	592.3	365.71	267.0		Dissolved	51.2	20.9	50.1	4.7	-0.01	10.2	
MGEOT181	HOLE NO 2 M-8 DRILLING PROJECT	-0.62	7.86	875.6	435.76	450.0		Dissolved	5.7	1.1	171.0	2.0	0.35	16.6	
MGEOT240	MSU AG EXPERIMENT STATION * MOCCASIN MT	0.14	7.69	443.9	258.92	215.0		Dissolved	51.5	14.4	16.3	4.3	1.86	9.1	
MGEOT155	BRADY, EARL*4 MI NW WINNETT, MT	0.31	8.30	1125.0	715.94	444.0		Dissolved	8.9	3.1	252.0	3.4	0.82	14.6	
MGEOT203	GERDRUM, RONALD * 3 MI NE GRASS RANGE, MT.	-0.15	8.72	780.0	503.98	334.0		Dissolved	24.7	10.6	148.0	3.5	0.54	11.5	
MGEOT152	CENEX*15 MI NE WINNETT MT	0.58	8.63	1461.0	953.62	426.0		Dissolved	2.1	0.4	347.0	1.3	0.17	13.5	
MGEOT158	BASSETT, EARL * 7.5 MI NW TEIGEN MT.	-0.21	8.29	643.0	400.64	251.0		Dissolved	9.6	4.6	130.0	2.4	1.57	9.7	
MGEOT059	HEDMAN, J. * 40 MI NE LEWISTOWN MT.	-0.17	8.13	725.0	432.21	269.0			5.2	1.9	154.5	1.7	1.35	9.6	
MGEOT156	HARRIS FLOYD * 11 MI NW TEIGEN MT	-1.02	8.19	1167.0	747.06	429.0		Dissolved	18.0	7.3	251.0	2.7	0.21	11.9	
MGEOT194	FOX, DENNIS * 7 MI NW GRASSRANGE MT	-1.07	8.14	615.5	434.82	188.0		Dissolved	60.8	17.9	60.4	3.0	0.27	12.1	
MGEOT239	LAURENCE HESS * 1 MI N MOCCASIN MT	-0.55	7.78	576.5	330.32	276.0		Dissolved	54.7	20.6	33.8	5.2	1.47	8.3	
MGEOT204	DELANEY, DOUGLAS*7 MI NW (WILD HORSE UNIT)	0.30	8.29	862.0	532.05	309.0		Dissolved	10.9	5.6	178.0	2.6	0.26	10.3	
MGEOT050	BROOKS WARM SPRING * 2.5 MI NW BROOKS MT.								114.0	39.0	3.6	1.4	-0.01	10.7	
MGEOT195	DELANEY, DOUGLAS * 11 MI NW ROY MT	-0.93	8.41	1373.0	877.78	374.0		Dissolved	9.6	4.0	305.0	2.4	0.44	11	
MGEOT154	MILLER RANCH * 14 MI SE VALENTINE MT.	0.57	8.02	7535.0	4429.86	1630.0		Dissolved	5.9	2.1	1770.0	5.3	0.10	16.3	
MGEOT045	CARDINAL PET CO * 10 M E HILGER MT	0.77	8.52	1017.0	577.63	487.0			7.1	1.6	219.0	5.4	4.09	1.3	
MGEOT153	BUSENBARK, MERLIN*1 MI S VALENTINE MT*	-0.63	8.45	2587.0	1608.34	1639.0		Total Recovera	1.4	0.3	686.0	2.1	-100.00	16.5	
MGEOT005	QUINN'S HOT SPRINGS		8.90		224		71		3.6	0.2	39.0	1.5		76.6	
MGEOT268	QUINN'S HOT SPRINGS * JIM AND DONNA BROWN	0.71	8.70	206.1	185.68	51.2		Dissolved	2.7	-0.1	39.3	1.3	0.03	73.5	0.6
MGEOT197	YEAGER * 8 MI EAST MOULTON, MT.	1.05	8.29	1510.0	985.7	359.0		Dissolved	10.7	6.0	322.0	2.5	0.01	10.9	
MGEOT079	*FINLEY, R.S.*1 MI NW ST. IGNATIUS*	0.32	7.82	510.6	293.17	322.3		*Dissolved*	72.0	18.8	12.2	0.7	-0.01	11	
MGEOT205	*SIROKY, FRANK * 9 MI EAST ROY, MT.*	-0.05	9.12	1274.0	828.12	381.0		Dissolved	1.1	0.1	304.0	0.6	0.02	18	
MGEOT192	HORYNA, JAMES * 6 MI E ROY MT	1.08	9.16	1586.0	1036.58	398.0		Dissolved	1.9	0.4	366.0	1.2	0.13	16.6	
MGEOT131	CORPS OF ENGINEERS SOUTH WELL AFTER PERFS	0.30	8.17	1101.0	648.15	574.0		Dissolved	24.6	10.1	221.0	6.6	3.05	8.9	
MGEOT090	BRYSON, HAROLD*1 MI W MOIESE MT	-0.97	7.60	950.9	553.38	553.8			35.6	15.2	167.0	3.8	2.04	16.8	
MGEOT070	YARGER, ROBERT * 13 MI W CIRCLE MT	-1.06	8.38	1818.0	1280.09	410.4		Dissolved	32.2	142.4	190.0	10.6	-0.01	12.2	
MGEOT287	SAND COULEE WTR USERS BENCH W ABV SAND COU	0.31	7.69	789.2	453.57	444.0		Dissolved	51.7	69.9	17.2	2.9	0.01	7.5	
MGEOT193	TAYLOR, JAMES * 8 MI E CHRISTINA MT	-0.82	9.01	2032.0	1349.59	389.0		Dissolved	2.4	0.2	476.0	1.2	0.06	11.5	
MGEOT288	CHARLES ENTSMINGER*TOWN OF NUMBER SEVEN	0.41	7.94	596.3	393.46	246.9		Dissolved	79.6	28.7	11.4	2.5	-0.00	12.3	
MGEOT295	CUSTER, EVERETT* EDEN RT, GREAT FALLS, MT	0.49	7.48	808.0	557.4	255.0		Dissolved	100.0	36.1	30.7	4.4	0.00	14.1	0.2
MGEOT297	*TOWN OF TRACY*	0.23	7.57	623.8	407.36	236.2		*Dissolved*	82.2	29.1	12.4	2.3	0.02	11.8	0.9
MGEOT054	SLOGSVOLD, A. K. * 17 M SE RITCHEY MT	-0.57	7.64	2770.0	2402.46	1014.0			362.0	266.0	32.0	7.9	0.01	13.2	
MGEOT211	GOVER * 2.5 MI TRAVIS SCHOOL	-0.04	7.95	1557.0	1048.74	574.0		Dissolved	57.9	34.2	264.0	7.5	1.57	20.8	
MGEOT200	VILLAGE INN * 2.5 MI NE TRAVIS SCHOOL	0.91	8.16	1295.0	798.12	680.0		Dissolved	24.0	8.2	274.0	7.5	0.23	10.8	1.7
MGEOT299	STONE, GENE	0.81	9.78	238.2	161.7	3.2		Dissolved	0.8	-0.1	50.9	0.6	-0.00	56.4	
MGEOT062	WEBB RES * 17.5 MI SE GERALDINE MT.	-0.88	9.01	462.7	285.19	157.0			47.0	13.6	36.0	5.7	0.01	10.3	
MGEOT353	HOLLAND, JIM - GREEN SPRINGS	-0.11	9.86	195.0	208.38		73	Dissolved	0.8	1.2	57.1				
MGEOT248	GREEN SPRINGS * HOLLAND RANCH		9.20		280		125								
MGEOT191	TACKE, ROBERT * 2 MI SW GREAT FALLS MT	-0.55	7.57	1775.0	1260.1	348.0		Dissolved	182.0	75.4	132.0	13.5	3.37		1.1
MGEOT198	PAUL, MICHAEL(ROBINSON)*3.5M SW GREATFALLS	-0.39	7.67	1926.0	1375.49	365.0		Dissolved	224.0	71.1	124.0	13.4	2.22	20.6	0.3
MGEOT318	BUTTE CREEK SPRING * SQUARE BUTTE								36.6	7.9	23.9	3.6	0.03	18.1	0.6
MGEOT319	BUTTE CREEK SPRING - NORTH * SQUARE BUTTE								32.2	8.4	26.5	2.9	0.01	16.8	0.4
MGEOT169	CHAMBERLAIN, CURTIS * 2 MI W LLER SCHOOL.	-0.41	8.43	3633.0	2587.91	640.0			10.2	2.0	889.0	2.5	0.16	8.2	
MGEOT321	*MELTON, LARUE * LOWER AQUIFER*	-1.07	7.34	399.2	259.61	244.9		*Dissolved*	11.1	1.1	83.5	6.6	0.83	15.5	
MGEOT314	USGS - MELTON, LEON	0.06	8.16	367.4	215.58	191.8		Dissolved	12.2	5.2	61.4	1.2	-0.00	21.1	
MGEOT238	SCHMIDT, LLOYD * 3.5 MI SE SQUARE BUTTE	0.19	7.85	910.0	524.17	385.0		Dissolved	45.8	14.2	128.0	7.7	0.33	11	
MGEOT190	USGS OBS WELL * .5 MI S VALLEY SCHOOL	-13.71	8.12	1656.0	1284.72	232.0		Dissolved	210.0	151.0	43.4	7.1	1.32	19.8	
MGEOT199	EIDEL * .5 MI S SUNSET MEMORIAL CEMETARY	-1.24	7.90	3182.0	2362.2	651.0		Dissolved	112.0	114.0	523.0	11.9	0.14	10.6	2.0
MGEOT078	WEBSTER, BONITA*BOX 443 RONAN MT	-0.15	7.91	266.4	173.21	188.3		Dissolved	29.8	10.9	17.6	1.0	-0.01	18.8	
MGEOT099	DEMARS,TOM J.* 10 MI W OF WINIFRED MT.	0.89	7.51	1463.0	1045.4	390.4		Dissolved	163.5	57.5	94.5	4.1	0.03	7.9	-2.0
MGEOT249	HOMESTEAD ACRES COUNTY WATER DISTRICT	-0.03	7.78	813.0	505.57	250.0		Dissolved	86.0	36.1	26.4	4.4	0.33	10.6	
MGEOT250	HOMESTEAD ACRES COUNTY WATER DISTRICT	-0.89	8.35	777.0	501.93	223.0		Dissolved	83.2	39.0	27.7	4.8	0.21	10.2	
MGEOT241	*MCCOLLUM, JIM * 10 MI NW MATHISON RANCH*	-0.65	8.97		962.79	807.0		*Dissolved*	1.2	0.2	401.0	1.0	0.05	11	
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT	0.09	7.96	330.2	195.26	196.9		Dissolved	32.3	13.0	19.9	1.4	-0.01	16.2	
MGEOT047	* RYFFEL BROS. * 3MI S & 3 MI E HIGHWOOD								57.0	19.0	52.0	3.6		29	
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.	0.56	7.83	622.3	374.62	366.9		Dissolved	20.0	9.4	113.0	3.5	0.02	17.5	
MGEOT307	HOT SPRINGS CITY	0.76	7.99	253.6	172.15	149.3		Dissolved	17.2	4.0	32.0	3.1	0.07	26.1	
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	-0.46	6.74	245.6	156.07	127.8			15.2	3.8	33.0	3.0	0.17	22	
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	-0.63	9.46	383.5	286.58	84.6		Dissolved	0.9	-0.1	92.3	0.0	0.61	67	-1.0
MGEOT291	SOUTH EAST OF CAMP AQUA	-0.59	9.34	381.8	270.89	109.3		Dissolved	0.6	-0.1	85.8	1.7	-0.00	69.6	-1.0
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS								1.1	0.3	83.0	1.8	-0.01	58	
MGEOT060	HOT SPRINGS MONTANA								1.0	0.1	83.5	1.6	0.01	59	
MGEOT017	CAMAS HOT SPRINGS		9.40		399		169		0.9	0.1	85.0	1.7		70	
MGEOT352	SYMES HOTEL WELL	-0.01	9.66	280.0	297.16		131	Dissolved	0.6	0.7	89.4	2.2	-0.02	73.08	-0.5
MGEOT029	SYMES HOT SPRINGS WELL		9.80		367		158		1.2	0.2	91.0	1.7		68	
MGEOT081	HOT SPRING GEOTHERM WELL - UNNAMED	-0.67	7.08	341.3	220.43	101.0			16.4	5.2	43.2	5.6	0.07	32.8	
MGEOT355	KOEPLING, DELBERT * WELL 136	0.04	8.23	266.0	275.02		236	Dissolved	4.5	-0.2	95.6	2.9	0.06	36.64	-0.5
MGEOT354	OSTRANGER, DAVE * WELL 56	-0.07	8.05	312.0	290.91		278	Dissolved	5.5	2.5	109.3	-0.6	0.39	12.96	-0.5
MGEOT077	VERNER, ROSE*3.75 MI W PABLO MT	-0.54	8.06	726.8	436.13	472.3		Dissolved	33.7	36.1	68.5	3.1	0.01	14.8	
MGEOT096	IRRIGATION EQUIPMENT SALES*HOT SPRINGS	-0.78	7.51	471.8	283.29	264.5		Dissolved	37.0	11.9	46.0	3.9	5.80	21.9	
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	-0.67	8.06	592.9	375.46	324.0		Dissolved	5.5	1.0	139.0	2.1	0.28	35	19.5
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	-0.29	8.12	404.8	244.61	221.0		Dissolved	6.6	1.6	86.1	1.9	0.39	14.3	100.0
MGEOT042	SUN RIVER SPRINGS		7.20		890										
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	0.62	8.32	663.9	405.72	321.0		Dissolved	15.5	2.8	129.0	3.8	0.16	36.8	2.6

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Std dev balance	Lab ph	Sc mmohs	Tds mg/l	Hco3 mg/l	Alkalinity	Sample type	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (sio2) mg/l	Arsenic ug/l
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	-0.98	8.71	472.4	304.15	237.0		Dissolved	2.1	0.3	117.0	1.5	0.22	32.4	2.4
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	0.99	7.89	656.7	403.19	348.0		Dissolved	4.0	0.7	147.7	2.8	0.26	34.9	14.6
MGEOT286	JACKOLA AP. 100 FT E. OF CAMP AQUA BATH SPA	0.53	8.53	651.2	413.14	327.0		Dissolved	2.9	0.2	152.0	3.1	-0.00	43.2	0.2
MGEOT027	CAMP AQUA AREA TEST WELL		8.40		420		351		3.2	0.3	152.0	4.0		42.2	
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	2.03	8.21	655.6	390.02	343.0		Dissolved	12.6	2.4	127.0	3.3	0.11	35.3	0.8
MGEOT202	OLSEN, EDWIN * 8.4 MI NE WINIFRED MT	-2.46	8.09	9117.0	5325.18	608.0		Dissolved	10.0	3.3	2141.0	4.7	0.12	12.4	
MGEOT251	SMELSER, JAMES A. * POWER MT	0.37	7.83	3596.0	1981.91	607.0		Dissolved	25.6	9.5	750.0	10.6	0.06	7.6	
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	0.36	8.26	666.4	419.64	354.0		Dissolved	3.3	0.4	154.4	2.6	0.13	43.6	5.6
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	-0.38	8.38	593.7	394.41	314.0		Dissolved	4.8	1.0	144.0	2.8	0.65	41.4	0.7
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	0.52	8.40	635.6	384.72	328.0		Dissolved	4.4	0.4	142.0	2.1	0.12	36.6	3.3
MGEOT173	*KEMP, ANNA * HOT SPRINGS, MT **	-0.87	8.63	633.6	395.26	326.0		Dissolved	3.6	0.6	150.0	3.4	0.02	36.5	1.0
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT	0.49	8.18	617.2	381.08	331.8			5.7	0.6	139.0	3.7	0.11	32.9	
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	-0.21	9.16	470.6	338.76	280.0		Dissolved	4.6	0.7	127.0	2.7	0.03	29.3	6.7
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	-0.89	8.48	537.0	345.3	287.0		Dissolved	3.3	0.4	134.0	1.7	0.09	28.6	4.2
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	-0.54	9.45	442.3	273.01	186.0		Dissolved	5.8	0.7	101.0	2.3	0.20	21	23.0
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	-0.95	7.90	446.7	276.24	255.0		Dissolved	5.7	0.7	105.0	1.3	0.17	19.5	27.7
MGEOT149	MATOVICH,JOHN * 23 MI SW SUN PRAIRIE MT	0.90	8.50	2496.0	1637.93	845.0		Dissolved	2.4	0.6	606.0	1.6	0.07	10.5	
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	-0.69	7.89	289.7	174.8	164.0		Dissolved	28.4	7.8	23.6	2.2	0.30	15.9	7.0
MGEOT075	LONEPINE OBSERVATION WELL	-0.25	7.93	396.8	240.03	235.9		Dissolved	39.8	11.6	32.8	1.7	-0.01	18.2	
MGEOT110	STREIT, GEORGE * 4MI E- 1MI S FT BENTON MT.	0.25	7.38	2862.0	2252.84	620.0			207.0	180.0	253.0	34.4	0.09	11.8	
MGEOT243	WHITMAYER ASSOC * 4.5MI SE SUN PRAIRIE SCH	-3.15	8.90	4649.0	2646.37	889.0		Dissolved	11.6	3.2	1076.0	6.7	0.04	10.5	
MGEOT109	CLARK, BRAD * 25 MI E FT. BENTON MT.	-0.59	8.45	3737.0	2608.24	702.0			19.4	16.0	885.0	3.3	0.03	7.5	
MGEOT114	LANDUSKY PLUNGE SPRINGS		8.10		960		101		161.0	65.0	24.0	6.7		17.8	
MGEOT072	LANDUSKY, I*8.5 MI S HAYS, MONTANA	-0.07	7.88	1724.0	1366.89	170.5			250.9	86.8	35.2	9.1	0.01	14.7	
MGEOT046	BLACK COULEE * E OF TEST AREA	1.20	8.24	14300.0	13094	461.0		Total Recovera	329.0	508.0	3250.0	24.8		6.1	
MGEOT313	ALZHEIMER, PAUL * SW OF BRADY, MT	0.42	7.78	1678.0	1219.1	326.0		Dissolved	118.0	58.0	193.0	3.2	4.82	8.3	
MGEOT312	REVERE, LEE	0.69	7.85	744.8	439.94	402.0		Dissolved	42.9	22.8	89.4	1.7	2.36	8.3	
MGEOT049	LITTLE WARM SPRINGS*9 MI SE LODGEPOLE	0.53	8.06	2062.0	1754.58	101.0		Dissolved	289.0	110.0	72.0	13.3	0.10	16	
MGEOT324	LODGEPOLE WARM SPRINGS		8.10		1630		81		286.0	96.0	75.0	13.0		16.3	
MGEOT048	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	0.51	8.06	1980.0	1628.32	81.0		Dissolved	268.0	96.0	75.0	13.0	-0.01	16.3	
MGEOT051	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	-0.90	7.96	1430.0	1096.15	153.0			187.0	69.0	52.5	8.5	-0.01	14.5	
MGEOT052	KIRKALDIE, BRUCE*7 MI SW LODGEPOLE MT	0.86	7.14	1800.0	1433.67	148.0			242.0	83.0	67.0	11.1	-0.01	14.1	
MGEOT037	LARGE CAPACITY WELL*4 MI SW WOLF POINT, MT	9.22	7.80	1960.0	1234.47	627.0		Dissolved			402.0		1.60		
MGEOT024	CITY OF WOLF POINT * WELL IN WOLF POINT	-0.25	7.80	6510.0	3552.21	544.0		Dissolved	15.0	36.0	1330.0	19.0	0.13	13	
MGEOT023	SHERMAN HOTEL OF WOLF POINT	-0.19	8.30	7060.0	3862.29	482.0		Dissolved	24.0	5.2	1500.0	1.6	0.05	13	
MGEOT036	USGS TEST WELL * 1 MILE SOUTH POPLAR, MT	0.87	7.80	1350.0	871.89	541.0			54.0	31.0	214.0	4.7	0.67	9.9	
MGEOT025	FOSS ELMER * 5.8 MI SE BROCTON	-1.60	8.50	1950.0	1114.67	864.0		Dissolved	6.8	2.0	463.0	5.2	0.10	16	
MGEOT317	LANDTECH WATER DISPOSAL SERVICE	-0.25	8.38	2428.0	1429.18	1121.0		Dissolved	2.3	0.6	595.0	1.4	0.08	15.7	0.2
MGEOT315	THORNESS, RICK * 4 MILES NW OF BAINVILLE	-0.23	7.62	2028.0	1445.27	598.0		Dissolved	70.6	62.8	337.0	5.5	0.17	24.4	
MGEOT106	CLAWITER, MILT * 4MI N-4MI E BIG SANDY MT.	-1.33	8.36	3076.0	2011.28	912.0		Dissolved	25.4	13.0	710.0	7.1	0.06	21.4	2.9
MGEOT303	SIMS SPRING	0.04	7.65	465.6	280.28	263.0			49.5	23.3	17.1	1.7	-0.00	19.7	
MGEOT140	TEXACO INC * 1.7 MI NW CENTRAL SCHOOL	-0.76	8.29	3236.0	1918.59	1551.0		Dissolved	2.3	0.7	800.0	4.5	0.35	25.5	
MGEOT252	MATOVAICH, MARTIN*17 MI E MALTA NEAR SACO	0.53	8.35	4046.0	3333.97	112.5		Dissolved	521.0	156.0	254.0	25.1	0.46	17.1	
MGEOT111	SLEEPING BUF REC AREA * 4MI NNW ASHFIELD	0.79	7.38	3915.0	3419.37	151.0			490.0	174.0	293.0	25.4	0.03	17.1	
MGEOT145	SHIRLE, WALTER * 3 MI S FRESNO DAM.	-0.58	8.37	3736.0	2500.21	1005.0		Dissolved	6.2	2.5	922.0	2.5	0.02	7.4	
MGEOT106	*PIMLEY, DON * 4 MI NW JOPLIN MT.*	-0.10	8.02	6323.0	4762.08	566.0			26.0	11.2	1570.0	3.8	0.06	7.5	
MGEOT105	CADY, ELWIN * 7.5 MI NW JOPLIN MT.	0.59	7.59	5936.0	4245.74	3065.0			27.0	13.2	1600.0	4.4	0.05	13	
MGEOT309	FRANCIS, CLARA	-0.73	7.65	3288.0	2808	651.0		Dissolved	518.0	192.0	138.0	8.2	0.02	19.1	
MGEOT107	WELSH, ORVILLE * 13 MI N-3MI E HINGHAM MT.	0.85	8.09	4544.0	3249.73	842.0			17.4	4.8	1095.0	3.4	0.05	9.8	
MGEOT310	EDWARDS, MARVIN / MIKE DUSTERHOFF	0.87	8.24	3044.0	2077.47	596.0		Dissolved	7.1	1.8	713.0	1.1	0.03	6.4	
MGEOT039	BIG WEST OIL CO * 2 MI NE MTN VIEW SCHOOL	27.89			483.06	427.0		Dissolved	32.0	37.0			5.72		
MGEOT104	RYGH, KEN * 22 MI N - 5 MI W JOPLIN MT.	0.77	8.72	1484.0	913.88	941.0			0.8	0.9	385.0	1.0	0.03	8.7	
MGEOT142	BRADBURY, ALFRED * 11 MI E WILD HORSE MT	1.67	8.15	2706.0	1845.46	730.0		Dissolved	7.8	1.6	640.0	2.6	0.03	7.3	
MGEOT144	NAGEHUS, ORVILLE * 3 MI N SIMPSON MT.	0.07	8.38	1650.0	1055.12	652.0		Dissolved	5.5	1.3	394.0	1.8	0.01	9	

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MGEOT DATABASE

ID	Site name	Boron ug/l	Lithium ug/l	H_2S	Location	County
MGEOT209	TARGHEE SULPHUR SPRING*6MI W W YELLOWSTONE	60.0	30.0		13S 04E 27 AACA	GALLATIN
MGEOT177	UPPER WEST SPRING - STAUDENMEYER RANCH				13S 02W 17 CBD	BEAVERHEAD
MGEOT123	UPPERMOST SPRING - STAUDENMEYER RANCH				13S 02W 17 CBD	BEAVERHEAD
MGEOT126	UPPER - EAST SPRING - STAUDENMEYER RANCH				13S 02W 17 CBD	BEAVERHEAD
MGEOT125	LOWER WEST SPRINGS - STAUDENMEYER RANCH				13S 02W 17 CBD	BEAVERHEAD
MGEOT127	LOWER EAST SPRING - STAUDENMEYER RANCH				13S 02W 17 CBD	BEAVERHEAD
MGEOT124	UPPER WEST SPRING - STAUDENMEYER RANCH				13S 02W 17 CBD	BEAVERHEAD
MGEOT121	ANDERSONS PASTURE SPRING #1				13S 2W 18AC	BEAVERHEAD
MGEOT122	ANDERSONS PASTURE SPRING #2				13S 2W 18AC	BEAVERHEAD
MGEOT210	USFS* BAKERS HOLE* 3MI N WEST YELLOWSTONE	120.0	150.0		13S 05E 15 ABAB	GALLATIN
MGEOT115	SLOAN COW CAMP SPRING	0.2		0.9	12S 1E 19CDA	MADISON
MGEOT120	WEST FORK SWIMMING HOLE				12S 01E 18 CB	MADISON
MGEOT118	CURLEW CREEK WARM SPRING				11S 01E 13 DBC	MADISON
MGEOT119	WALL CANYON WARM SPRING				10S 01E 07 CAB	MADISON
MGEOT229	WOLF CREEK HOT SPRING				10S 01E 9 BBBB	MADISON
MGEOT129	LOWELL HILDRETH SPRING*15 MI SW DILLON				09S 10W 29 AAAC	BEAVERHEAD
MGEOT016	BEAR CREEK SPRINGS				9S 9E 19CAA	PARK
MGEOT132	VIGILANTE WARM SPRING				09S 03W 22 BDDD	MADISON
MGEOT041	LA DUKE HOT SPRINGS	0.5		1.0	8S 8E 32 CDBA	PARK
MGEOT012	BROWNS SPRINGS				8S 9W 30DCB	BEAVERHEAD
MGEOT010	PULLER HOT SPRINGS	0.7			8S 5W 1AACC	MADISON
MGEOT019	TRUDAU SPRINGS				7S 4W 7DCAD	MADISON
MGEOT040	CHICO HOT SPRINGS	0.1		0.6	6S 8E 1CDCD	PARK
MGEOT032	GROUNDWATER*4.7 MI NE FT SMITH MT	60.0			05S 31E 35 CCC2	BIG HORN
MGEOT074	BROWN CATTLE CO* 3.1 MI N. BIRNEY MT					ROSEBUD
MGEOT276	JARDINE HOT SPRINGS 0.25 MI E OF JACKSON	-20.0	290.0		05S 15W 25 CBAA	BEAVERHEAD
MGEOT289	MBMG GEOTHERMAL TEST * THEXTON TX - 12	680.0	230.0		05S 01W 28 DCA	MADISON
MGEOT028	JACKSON HOT SPRINGS	0.8		0.6	5S 15W 25CBBB	BEAVERHEAD
MGEOT293	PRIVATE GEOTHERMAL TEST*ENNIS HOT SPRINGS*	620.0	220.0		05S 01W 28 DBAA	MADISON
MGEOT277	LAPHAM DOMESTIC WELL 1 MI NW JACKSON, MT.		230.0		05S 15W 23 CABA	BEAVERHEAD
MGEOT117	ENNIS HOT SPRINGS				05S 01W 21 BB	MADISON
MGEOT058	BROWN CATTLE CO * 9.5MI SW BIRNEY DAY SCH.				05S 42E 22 DBBC	ROSEBUD
MGEOT031	BEAVERHEAD ROCK SPRINGS				5S 7W 22ABBD	MADISON
MGEOT133	APEX WARM SPRING				05S 09W 11 AADADD	BEAVERHEAD
MGEOT323	ELKHORN HOT SPRINGS			0.9	4S 12W 29ACAD	BEAVERHEAD
MGEOT292	MARTIN, KIETH	60.0	6.0			SWEET GRASS
MGEOT326	NEW BILTMORE HOT SPRINGS	0.9		1.1	4S 7W 28BDA	MADISON
MGEOT308	NEWMAN, JOHN * JOLIET, MT				04S 22E 23 CCDB	CARBON
MGEOT280	ANDERSON SPRING		-2.0		3S 13E 29ABA	SWEET GRASS
MGEOT006	ANDERSON'S SPRING				3S 13E 29ABAB	SWEET GRASS
MGEOT043	NORRIS HOT SPRINGS	0.1			3S 1W 14DAB	MADISON
MGEOT015	POTOSI HOT SPRINGS			0.5	3S 2W 6CACC	MADISON
MGEOT187	GROSS, PETE * 4 MI S PONY MT	30.0	56.0		03S 02W 06 CBDD	MADISON
MGEOT311	MCFERRAN, EUGENE * BILLINGS, MT				03S 27E 04 BCDD	YELLOWSTONE
MGEOT179	CARTER'S BRIDGE * 4 MI SE LIVINGSTON MT.	110.0	30.0			PARK
MGEOT011	AVON WARM SPRING				10N 8W 24BBC	POWELL
MGEOT264	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	260.0	38.0		02S 04E 14 DAD	GALLATIN
MGEOT266	BOZEMAN HOT SPRINGS * OWNER - CHARLES PAGE	250.0	38.0		02S 04E 14 DAD	GALLATIN
MGEOT265	BOZEMAN HOT SPRINGS * OLD WELL	260.0	38.0		02S 04E 14 DAD	GALLATIN
MGEOT263	BOZEMAN HOT SPRINGS * ORIGINAL SPRING	260.0	37.0		02S 04E 14 DAD	GALLATIN
MGEOT335	BOZEMAN HOT SPRINGS	0.2			2S 4E 14DDBAA	GALLATIN
MGEOT269	RANCA * MCLEOD		110.0			SWEET GRASS
MGEOT259	SCOTT FEED LOT	1850.0	65.0		2S 13E 15 BCB	YELLOWSTONE
MGEOT260	SCOTT FEED LOT	2290.0	74.0		2S 13E 15 BC	YELLOWSTONE
MGEOT230	BLUE JOINT CREEK HOT SPRING				2S 23W 1ABB	RAVALLI
MGEOT002	BRIDGER CANYON WARM SPRING				1S 6E 34BCDD	GALLATIN
MGEOT334	LOVE, MELVIN*THREE FORKS, MT	220.0	110.0		01S 02E 29 AAC	GALLATIN
MGEOT033	GROUNDWATER*5.3 MI W HARDIN MT	140.0			01S 32E 23 BD	BIG HORN
MGEOT332	SHIPTON, HAROLD * THREE FORKS MT	190.0	130.0		01S 02E 21 DBDB	GALLATIN
MGEOT258	HERMAN, T.E. * ROCKY RANCH 7.4 M W HARDIN	420.0	260.0		01S 32E 14 CCDD	BIG HORN
MGEOT344	GALLOGLY HOT SPRING	0.1			01S 19W 15BCCCA	RAVALLI
MGEOT245	LOST TRAIL * WARM AND HOT SPRINGS	50.0	90.0		01S 19W 15 BCC	RAVALLI
MGEOT089	CAIN MIKE*6.6 MI S VOLBERG					CUSTER
MGEOT018	HUNTERS HOT SPRINGS	0.7		5.3	1S 12E 9CCAD	PARK
MGEOT328	JORGENSON, JACK * THREE FORKS MT				01S 02E 03 DCC	GALLATIN
MGEOT346	RENOVA HOT SPRINGS	0.5			01N 4W 32DBC	JEFFERSON
MGEOT339	WESTMORELAND * 9.1 M W SARPY SCHOOL	261.0	309.0			TREASURE
MGEOT095	LISCOM RANCH * 5.5 MI NW OF N STACY SCHOOL				01N 46E 26 ABCB	CUSTER
MGEOT331	TINDER, L. MARIE * THREE FORKS MT	390.0	160.0		01N 02E 22 CABD	GALLATIN
MGEOT327	WILCOX, RALPH * THREE FORKS MT				01N 02E 22 CA	GALLATIN
MGEOT333	RICHARDSON, DEIRDRE * THREE FORKS	730.0	190.0		01N 02E 22 ABBB	GALLATIN
MGEOT347	MEDICINE HOT SPRINGS	0.1		0.6	01N 20W 12CCA	RAVALLI
MGEOT092	WESTERN ENERGY * 2 MI N COLSTRIP MT.		600.0		02N 41E 34 BADC	ROSEBUD
MGEOT020	PIPESTONE HOT SPRINGS	0.3		2.3	2N 8W 26BDDD	JEFFERSON
MGEOT062	FRED WETSTEON SPRING DEVELOP				02N 17W 19 ABB	RAVALLI
MGEOT330	HART, FRANK * THREE FORKS, MT				02N 02E 17 DDCC	GALLATIN
MGEOT063	ANADARKO PROD*6 MI E FOSTER MT				02N 34E 2 CACD	BIG HORN
MGEOT053	UN - NAMED SPRING * 29 M NE OF FOSTER MT					BIGHORN
MGEOT128	COWAN SPRING*9MI NW THREE FORKS MT		-10.0		02N 01W 04 AAAD	JEFFERSON

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MGEOT DATABASE

ID	Site name	Boron ug/l	Lithium ug/l	H_2S	Location	County
MGEOT178	WOLF CREEK HOT SPRING		70.0		10S 01E 9 BBBB	MADISON
MGEOT343	WILLIAMSBURG SPRING	350.0	12.0		03N 08W 23 CDBD	SILVER BOW
MGEOT030	OIL WELL (TENSLEEP FORMATION)					STILLWATER
MGEOT341	MONTANA RESOURCES MONITORING WELL C	-100.0	13.0		03N 07W 17 DAD	SILVER BOW
MGEOT342	MONTANA RESOURCES MONITORING WELL D2	-100.0	33.0		03N 07W 17 AAC	SILVER BOW
MGEOT055	HOWARD SPRING * 25 M SE OF BIGHORN MT					TREASURE
MGEOT246	WENDT, FRED * .75 MI S GREGSON (FAIRMONT)	70.0	39.0		03N 10W 11 BABD	SILVER BOW
MGEOT298	MBMG RESEARCH WELL * FAIRMONT HOT SPRINGS	240.0	600.0		03N 10W 02 CAD	SILVER BOW
MGEOT165	NELSON, HARVEY * 5 MI S BROADVIEW MT	930.0	110.0		03N 23E 4 CBBC	YELLOWSTONE
MGEOT061	BRADBROOK * 10 M S BROADVIEW MT	40.0	960.0			STILLWATER
MGEOT279	FAIRMONT HOT SPRINGS, ANACONDA	340.0	650.0		3N 10W 28DCA	SILVER BOW
MGEOT247	SPANGLER, HAZEL * 2 MI E-NE GREGSON MT	60.0	28.0		04N 09W 31 CDAC	SILVER BOW
MGEOT214	HUNSAKER SPRING	100.0	19.0		4N 2E 32DBDB	BROADWATER
MGEOT150	MONT. HIGHWAY DEPT * .75 MI SE WACO MT.		110.0		04N 32E 35 BABA	YELLOWSTONE
MGEOT213	PLUNKET LAKE WARM SPRINGS	110.0	32.0		4N 1E 27AA	BROADWATER
MGEOT237	SPRINGS FROM JOINTS IN MISS CYN*SW PLUNKET	120.0	20.0		04N 01E 27 ABDD	BROADWATER
MGEOT151	MONTANA DEPT HIGHWAYS * 2.5 MI NE WACO MT		60.0			YELLOWSTONE
MGEOT218	HUNSAKER, MAURICE	180.0	25.0		4N 2E 18ACAC	BROADWATER
MGEOT135	ANACONDA RED TRAVETINE MOUND - GEYSER				04N 11W 13 AADA	DEER LODGE
MGEOT325	SLEEPING CHILD HOT SPRINGS	0.3		1.0	4N 19W 7DCDD	RAVALLI
MGEOT236	BRUCE, N * IRRIGATION WELL WITH BOOSTER	180.0	20.0		04N 01E 10 BCBB	BROADWATER
MGEOT294	TOSTON WARM SPRING	70.0	39.0		04N 03E 06 DAD	BROADWATER
MGEOT218	TOSTON WARM SPRING	120.0	47.0		04N 03E 06 DAD	BROADWATER
MGEOT217	BRUCE, NORMAN	380.0	70.0		4N 1E 4ADDC	BROADWATER
MGEOT215	KIMPTON SPRING	-20.0	5.0			BROADWATER
MGEOT134	WARNER WARM SPRING				05N 01E 22 DBB	BROADWATER
MGEOT172	STEELE, WILLIAM * 12.5 MI SE PINEVIEW MT.		70.0		05N 32E 20 AAAC	YELLOWSTONE
MGEOT284	MBMG TEST WELL*WARM SPRINGS STATE HOSPITAL	110.0	370.0		05N 10W 24 ABAD	DEER LODGE
MGEOT009	WARM SPRINGS	0.1		0.7	5N 1E 22 DBBC	DEER LODGE
MGEOT233	WARM SPRINGS STATE HOSPITAL		430.0		5N 10W 24ABBD	DEER LODGE
MGEOT231	WARM SPRINGS STATE HOSPITAL	170.0	450.0		5N 10W 24A	DEER LODGE
MGEOT349	BOULDER HOT SPRINGS - UPPER SPRING	0.6	0.2		05N 04W 10CBA	JEFFERSON
MGEOT351	BOULDER HOT SPRINGS - LOWER SPRING	0.5	0.2		05N 04W 10CBA	JEFFERSON
MGEOT350	BOULDER HOT SPRINGS - MIDDLE SPRING	0.5	0.2		05N 04W 10CBA	JEFFERSON
MGEOT232	WARM SPRINGS STATE HOSPITAL * SPRING	110.0	400.0		05N 10W 24 ABBD	DEER LODGE
MGEOT185	M-8 NO. 12 * 5 MI NE HAMILTON MT		10.0		06N 20W 14 BBBB	RAVALLI
MGEOT171	GRIERSON, J.B.*2.5MI NE RANCHERS CEMETARY.		140.0		06N 35E 07 BAAC	TREASURE
MGEOT130	PRISON RANCH SPRING SITE NO. 4		70.0		07N 10W 29 BC	POWELL
MGEOT113	DEER LODGE PRISON RANCH WELL					POWEL
MGEOT044	BEDFORD SPRINGS				7N 1E 23BAAD	BROADWATER
MGEOT101	GRIERSON, J.B. * 23 MI NW HYSHAM MT	140.0	70.0		07N 33E 06 DBD	TREASURE
MGEOT275	MBMG RESEARCH WELL * WEED CREEK-1B		60.0			YELLOWSTONE
MGEOT274	MBMG RESEARCH WELL * WEED CREEK-1A		53.0			YELLOWSTONE
MGEOT255	HANSER, BILL * 3 MI SW TWO DOT MT	260.0	98.0		08N 13E 31 AACC	WHEATLAND
MGEOT256	FOX INC * 1.5 MI W-SW TWO DOT	160.0	55.0		08N 13E 28 CADD	WHEATLAND
MGEOT257	HOMER, RAY * TWO DOT WATER SUPPLY	100.0	52.0		08N 13E 27 ADAD	WHEATLAND
MGEOT296	HARLOWTON * SOUTH MUNICIPAL WELL	250.0	16.0		08N 15E 22 CDDA	WHEATLAND
MGEOT013	HILLBROOK FLOWING WELL	0.5				JEFFERSON
MGEOT014	WALLS HOT SPRING	0.2				JEFFERSON
MGEOT001	ALHAMBRA HOT SPRINGS NORTH	0.2			8N 3W 16ACAA	JEFFERSON
MGEOT278	TOWNSEND,HERB*2.5 MI SW WHITE SULPHUR SPGS	-20.0	-2.0		09N 06E 26 DCC	MEAGHER
MGEOT290	RALPH JOHNSON,P.O.BOX 65,WHITE SULPHUR SPR	25200.0	2020.0		09N 06E 13 ADAA	MEAGHER
MGEOT004	WHITE SULPHUR SPRINGS	9.1		0.7	9N 7E 16BB	MEAGHER
MGEOT282	WHITE SULPHUR SPRINGS BANK WELL	7900.0	1150.0		09N 06E 13 AAAA	MEAGHER
MGEOT168	WATTS, JAMES * 16 MI NE KINSEY MT	674.0	29.0		09N 48E 04 BBBA	CUSTER
MGEOT184	M-B NO 8 WELL*2.5 MI SE CORVALLIS MT		50.0		09N 19W 8 BAAC	RAVALLI
MGEOT007	BROADWATER HOT SPRINGS WELL	0.6			10N 4W 28ACA	LEWIS AND CLARK
MGEOT008	GLOEGE WELL	0.1			10N 4W 28AC	LEWIS AND CLARK
MGEOT003	GARRISON WARM SPRINGS				10N 9W 19ACB.	POWELL
MGEOT337	CHADWICK, GREG				10N 03W 16 CDDD	LEWIS AND CLARK
MGEOT208	USGS OBS WELL * 4 MI SW EAST HELENA, MT.		13.0		10N 03W 16 CCDC	LEWIS AND CLARK
MGEOT336	MUELLER BUZZ				10N 04W 10 CCC	LEWIS AND CLARK
MGEOT242	FLORENCE TEST WELL A		17.0		10N 20W 12BBBA	RAVALLI
MGEOT329	SIVERTE MYSSE * BOX 315 * INGOMAR MT 59039	1320.0	140.0		11N 36E 28 BAC	ROSEBUD
MGEOT167	CHERRY CK SHEEP CO.*1.35MI SE HAGEN RANCH.		180.0		11N 36E 28 BAC	ROSEBUD
MGEOT261	MOORE, THOMAS * 6.5 MI SW ANGELA MT	2620.0	1880.0		11N 43E 21 CDCA	ROSEBUD
MGEOT322	BYRNE WARM SPRING * WEST OF BEARMOUTH	140.0	30.0		11N 15W 14 CAC	GRANITE
MGEOT116	NIMROD SPRINGS				11N 15W 14CDAA	GRANITE
MGEOT026	BEARMOUTH SPRINGS				11N 14W 12CD	GRANITE
MGEOT338	GARRICK GALEN				11N 04W 12 CDD	LEWIS AND CLARK
MGEOT345	LOLO HOT SPRINGS	0.1		0.5	11N 23W 7ADCC	MISSOULA
MGEOT069	MARYSVILLE DEEP WELL DEPTH 5750	100.0	2000.0		12N 06W 32 ABDC	LEWIS AND CLARK
MGEOT170	CHERRY CREEK SHEEP CO*26 MI N VANANDA MT				12N 38E 27 AD	ROSEBUD
MGEOT162	OLSEN, JONAS * 9 MI NW FLATWILLOW MT.		200.0		13N 25E 09 CD	PETROLEUM
MGEOT201	OLSEN JONAS * 14 MI NE N-BAR RANCH	121.0	126.0		13N 24E 12 DDA	FERGUS
MGEOT164	REYNOLDS, KEITH * 6 MI NE FLATWILLOW MT.		310.0		13N 26E 01 DA	PETROLEUM
MGEOT163	HILL, FLOYD * 7 MI N FLATWILLOW MT.		330.0		14N 26E 35 AD	PETROLEUM
MGEOT160	M-B 4 (BUTLER CK) * 6 MI NW MISSOULA MT		30.0		14N 20W 24 ADBC	MISSOULA
MGEOT254	KING, JOE & SONS INC. * 5 MI SSW WINNET MT	1640.0	290.0		14N 26E 20 ABCC	PETROLEUM

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

MGEOT DATABASE

ID	Site name	Boron ug/l	Lithium ug/l	H_2S	Location	County
MGEOT159	SHAW, BUD * 1.7 MI SW MOSBY MT.		200.0		14N 30E 09 DACD	PETROLEUM
MGEOT160	EAGER, REX * 2 MI SW WINNETT MT.		170.0		14N 26E 02 CAD	PETROLEUM
MGEOT161	BRATTON, WAYNE * 2 MI SE WINNETT MT.		230.0		14N 27E 05 DBB	PETROLEUM
MGEOT305	BURLY VISTA TRACTS	40.0	29.0		15N 19E 30 CCDD	FERGUS
MGEOT157	TEIGEN, PETER * 9 MI E GRASSRANGE MT.		220.0		15N 25E 30 BBC	PETROLEUM
MGEOT196	MATOVICH * 4.5 MI E GRASSRANGE MT	86.0	91.0		15N 24E 20 BDB	FERGUS
MGEOT181	*HOLE NO 2 M-8 DRILLING PROJECT*		-10.0		15N 21W 17 DCCC	MISSOULA
MGEOT240	MSU AG EXPERIMENT STATION * MOCCASIN MT	60.0	33.0		15N 14E 16 DCDD	JUDITH BASIN
MGEOT155	BRADY, EARL*4 MI NW WINNETT, MT	170.0	200.0			PETROLEUM
MGEOT203	GERDRUM, RONALD * 3 MI NE GRASS RANGE, MT.	109.0	115.0		15N 23E 14 BCA	FERGUS
MGEOT152	CENEX*15 MI NE WINNETT MT	220.0	150.0			PETROLEUM
MGEOT156	BASSETT, EARL * 7.5 MI NW TEIGEN MT.		120.0		16N 24E 26 AAC	PETROLEUM
MGEOT059	HEDMAN, J. * 40 MI NE LEWISTOWN MT.				16N 25E 16 DDB	PETROLEUM
MGEOT156	HARRIS FLOYD * 11 MI NW TEIGEN MT	270.0	260.0		16N 24E 7 CC	PETROLEUM
MGEOT194	FOX, DENNIS * 7 MI NW GRASSRANGE MT	97.0	69.0		16N 22E 05 DDB	FERGUS
MGEOT239	LAURENCE HESS * 1 MI N MOCCASIN MT	-20.0	63.0		17N 14E 26 DAAD	JUDITH BASIN
MGEOT204	DELANEY, DOUGLAS*7 MI NW (WILD HORSE UNIT)	-20.0	123.0		17N 23E 25 ABB	FERGUS
MGEOT050	BROOKS WARM SPRING * 2.5 MI NW BROOKS MT.		20.0		17N 18E 19 DBDB	FERGUS
MGEOT195	DELANEY, DOUGLAS * 11 MI NW ROY MT	159.0	149.0		17N 23E 15 DBA	FERGUS
MGEOT154	MILLER RANCH * 14 MI SE VALENTINE MT.		200.0		17N 28E 09 DB	PETROLEUM
MGEOT045	CARDINAL PET CO * 10 M E HILGER MT				18N 20E 34 BCAC	FERGUS
MGEOT153	BUSENBARK, MERLIN*1 MI S VALENTINE MT*				18N 26E 29 AAA	PETROLEUM
MGEOT005	QUINN'S HOT SPRINGS				18N 25W 9CDADA	SANDERS
MGEOT268	*QUINN'S HOT SPRINGS * JIM AND DONNA BROWN*	250.0	-2.0		18N 25W 09 DCBB	SANDERS
MGEOT197	YEAGER * 8 MI EAST MOULTON, MT.	133.0	120.0		18N 20E 16 BBB	FERGUS
MGEOT079	FINLEY, R.S.*1 MI NW ST. IGNATIUS		-10.0		18N 20W 10 ADD	LAKE
MGEOT205	SIROKY, FRANK * 9 MI EAST ROY, MT.	70.0	28.0		18N 23E 10 ABA	FERGUS
MGEOT192	HORYNA, JAMES * 6 MI E ROY MT	140.0	54.0		18N 22E 01 AAC	FERGUS
MGEOT131	CORPS OF ENGINEERS SOUTH WELL AFTER PERFS		150.0		19N 21W 31 DAB	LAKE
MGEOT090	BRYSON, HAROLD*1 MI W MOIESE MT				19N 21W 28 CCA	LAKE
MGEOT070	YARGER, ROBERT * 13 MI W CIRCLE MT					MCCONE
MGEOT287	SAND COULEE WTR USERS BENCH W ABV SAND COU	50.0	42.0		19N 04E 14 DADA	CASCADE
MGEOT193	TAYLOR, JAMES * 8 MI E CHRISTINA MT	120.0	55.0		19N 20E 23 BCB	FERGUS
MGEOT288	*CHARLES ENTSMINGER*TOWN OF NUMBER SEVEN*	240.0	16.0		19N 04E 13 AADD	CASCADE
MGEOT295	CUSTER, EVERETT* EDEN RT, GREAT FALLS, MT	120.0	67.0			CASCADE
MGEOT297	TOWN OF TRACY	90.0	19.0		19N 05E 07 CBBD1	CASCADE
MGEOT054	SLOGSVOLD, A. K. * 17 M SE RITCHEY MT					DAWSON
MGEOT211	GOVER * 2.5 MI TRAVIS SCHOOL		70.0		19N 02E 5 ACBC	CASCADE
MGEOT200	VILLAGE INN * 2.5 MI NE TRAVIS SCHOOL		221.0		19N 02E 5 ABAA	CASCADE
MGEOT299	STONE, GENE	120.0	12.0		19N 24W 04 AADB	SANDERS
MGEOT062	WEBB RES * 17.5 MI SE GERALDINE MT.				20N 11E 35 BCDA	CHOUTEAU
MGEOT353	HOLLAND, JIM - GREEN SPRINGS				21N 24W 04ADB	SANDERS
MGEOT248	GREEN SPRINGS * HOLLAND RANCH					SANDERS
MGEOT191	TACKE, ROBERT * 2 MI SW GREAT FALLS MT		300.0		20N 03E 27 BCBB	CASCADE
MGEOT196	PAUL, MICHAEL(ROBINSON)*3.5M SW GREATFALLS		277.0		20N 03E 28 AACD	CASCADE
MGEOT318	BUTTE CREEK SPRING * SQUARE BUTTE	80.0	5.0		20N 12E 27 BBAC	CHOUTEAU
MGEOT319	BUTTE CREEK SPRING - NORTH * SQUARE BUTTE	80.0	4.0		20N 12E 27 BBAC	CHOUTEAU
MGEOT169	CHAMBERLAIN, CURTIS * 2 MI W LLER SCHOOL.				20N 33E 26 BA	GARFIELD
MGEOT321	MELTON, LARUE * LOWER AQUIFER	80.0	-2.0		20N 22W 28 ABCB	SANDERS
MGEOT314	USGS - MELTON, LEON	160.0	12.0		20N 22W 21 CBDA	SANDERS
MGEOT238	*SCHMIDT, LLOYD * 3.5 MI SE SQUARE BUTTE*	-20.0	100.0		20N 12E 13 BCDB	CHOUTEAU
MGEOT190	USGS OBS WELL * .5 MI S VALLEY SCHOOL	241.0	47.0		20N 54E 1 DCDD	DAWSON
MGEOT199	EIDEL * .5 MI S SUNSET MEMORIAL CEMETARY		251.0		20N 02E 3 BAAD	CASCADE
MGEOT078	WEBSTER, BONITA*BOX 443 RONAN MT		-10.0		21N 20W 33 AAA	LAKE
MGEOT099	DEMARS,TOM J.* 10 MI W OF WINIFRED MT.	220.0	110.0		21N 17E 30 BDBA	FERGUS
MGEOT249	HOMESTEAD ACRES COUNTY WATER DISTRICT	150.0	56.0		21N 03E 14 AABC	CASCADE
MGEOT250	HOMESTEAD ACRES COUNTY WATER DISTRICT	150.0	53.0		21N 03E 14 AABC	CASCADE
MGEOT241	MCCOLLUM, JIM * 10 MI NW MATHISON RANCH	630.0	35.0		21N 23E 13 CBBB	FERGUS
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT		-10.0		21N 23W 14 ACB	SANDERS
MGEOT047	* RYFFEL BROS. * 3MI S & 3 MI E HIGHWOOD		20.0		21N 06E 11 CB	CHOUTEAU
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.		20.0		21N 23W 10 BDD	SANDERS
MGEOT307	HOT SPRINGS CITY	70.0	13.0		21N 24W 04 DBDA	SANDERS
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH				21N 24W 04 DBDA	SANDERS
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	460.0	18.0		21N 24W 04 DABD	SANDERS
MGEOT291	SOUTH EAST OF CAMP AQUA	350.0	51.0		21N 24W 03 BBB	SANDERS
MGEOT071	*CORN HOLE* CAMAS HOT SPRINGS				21N 24W 03 BBB	SANDERS
MGEOT060	HOT SPRINGS MONTANA					SANDERS
MGEOT017	CAMAS HOT SPRINGS	0.3		7.4	21N 24W 3BBDB	SANDERS
MGEOT352	SYMES HOTEL WELL	0.2	0.0		21N 24W 04ADB	SANDERS
MGEOT029	SYMES HOT SPRINGS WELL				21N 24W 4ADCA	SANDERS
MGEOT061	HOT SPRING GEOTHERM WELL - UNNAMED					SANDERS
MGEOT355	KOEPLING, DELBERT * WELL 138	0.4	0.0		22N 24W 13DADD	SANDERS
MGEOT354	OSTRANGER, DAVE * WELL 56	0.3	-0.0		22N 23W 17BBC	SANDERS
MGEOT077	VERNER, ROSE*3.75 MI W PABLO MT		-10.0		22N 20W 31 CDD	LAKE
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS		30.0		22N 24W 36 BBB	SANDERS
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	844.0	61.0		22N 23W 33 BABB	LAKE
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	690.0	20.0			LAKE
MGEOT042	SUN RIVER SPRINGS				22N 10W 26CAB	LEWIS AND CLARK
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	500.0	73.0		22N 23W 29 DADD	SANDERS

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MGEOT DATABASE

ID	Site name	Boron ug/l	Lithium ug/l	H_2S	Location	County
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	914.0	56.0		22N 23W 29 CAC A	LAKE
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	966.0	80.0		22N 23W 28 CBBB	LAKE
MGEOT286	JACKOLA AP.100 FT E. OF CAMP AQUA BATH SPA	540.0	78.0		22N 23W 29 ACAB	LAKE
MGEOT027	CAMP AQUA AREA TEST WELL	0.6			22N 23W 29 AC	LAKE
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	550.0	59.0		22N 23W 29 BADD	LAKE
MGEOT202	OLSEN, EDWIN * 8.4 MI NE WINIFRED MT	121.0	126.0		22N 19E 32 ABBC	FERGUS
MGEOT251	SMELSER, JAMES A. * POWER MT	1000.0	450.0		22N 01E 22 DDAC	CASCADE
MGEOT225	KEMP * 0.5 MI E CAMPAQUA MT	934.0	80.0		22N 23W 29 AADB	LAKE
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	910.0	81.0		22N 23W 29 BAAC	LAKE
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	885.0	74.0		22N 23W 20 DCDB	LAKE
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	870.0	100.0		22N 23W 20 CDBC	LAKE
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT					SANDERS
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	710.0	80.0			SANDERS
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	849.0	65.0		22N 23W 18 DDAD	SANDERS
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	540.0	40.0			SANDERS
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	511.0	24.0		22N 23W 18 BBBB	SANDERS
MGEOT149	MATOVICH,JOHN * 23 MI SW SUN PRAIRIE MT		110.0			PETROLEUM
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	91.0	-8.0		22N 24W 10 ABAB	SANDERS
MGEOT075	LONEPINE OBSERVATION WELL		-10.0			SANDERS
MGEOT110	STREIT, GEORGE * 4MI E- 1MI S FT BENTON MT.				24N 09E 26 DDAA	CHOUTEAU
MGEOT243	WHITMAYER ASSOC * 4.5MI SE SUN PRAIRIE SCH		170.0		24N 32E 29 AAAC	VALLEY
MGEOT109	CLARK, BRAD * 25 MI E FT. BENTON MT.				24N 12E 22 AAAD	CHOUTEAU
MGEOT114	LANDUSKY PLUNGE SPRINGS				24N 24E 12CDDA	BLAINE
MGEOT072	LANDUSKY, I*8.5 MI S HAYS, MONTANA				25N 24E 32 DBAD	PHILLIPS
MGEOT046	BLACK COULEE * E OF TEST AREA		2100.0			CHOUTEAU
MGEOT313	ALZHEIMER, PAUL * SW OF BRADY, MT				25N 03W 24 BBCB	TETON
MGEOT312	REVERE, LEE				25N 03W 14 BAAB	TETON
MGEOT049	LITTLE WARM SPRINGS*9 MI SE LODGE POLE		140.0			BLAINE
MGEOT324	LODGEPOLE WARM SPRINGS				26N 25E 24CABD	BLAINE
MGEOT048	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT		140.0		26N 25E 24 BCD	BLAINE
MGEOT051	BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT				26N 25E 24 BCD	BLAINE
MGEOT052	KIRKALDIE, BRUCE*7 MI SW LODGEPOLE MT				26N 25E 24 BDBC	BLAINE
MGEOT037	LARGE CAPACITY WELL*4 MI SW WOLF POINT, MT				26N 46E 02 DCD	ROOSEVELT
MGEOT024	CITY OF WOLF POINT * WELL IN WOLF POINT	5160.0			27N 47E 22 BBBB	ROOSEVELT
MGEOT023	SHERMAN HOTEL OF WOLF POINT	5070.0			27N 47E 15 BDCA	ROOSEVELT
MGEOT038	USGS TEST WELL * 1 MILE SOUTH POPLAR, MT					ROOSEVELT
MGEOT025	FOSS ELMER * 5.8 MI SE BROCTON	970.0			27N 54E 07 BACA	RICHLAND
MGEOT317	LANDTECH WATER DISPOSAL SERVICE	2520.0	96.0			RICHLAND
MGEOT315	THORNESS, RICK * 4 MILES NW OF BAINVILLE	220.0	65.0			ROOSEVELT
MGEOT108	CLAWITER, MILT * 4MI N-4MI E BIG SANDY MT.	1100.0	70.0		29N 13E 34 ABCB	CHOUTEAU
MGEOT303	SIMS SPRING					ROOSEVELT
MGEOT140	TEXACO INC * 1.7 MI NW CENTRAL SCHOOL.	2690.0	300.0		32N 19E 36 CDCA	BLAINE
MGEOT252	MATOVAICH, MARTIN*17 MI E MALTA NEAR SACO	950.0	260.0		32N 32E 35 DCBC	PHILLIPS
MGEOT111	SLEEPING BUF REC AREA * 4MI NNW ASHFIELD				32N 32E 35 CDB	PHILLIPS
MGEOT145	SHIRLE, WALTER * 3 MI S FRESNO DAM.		160.0		32N 14E 04 CCBC	HILL
MGEOT106	PIMLEY, DON * 4 MI NW JOPLIN MT.				33N 07E 21 DADC	LIBERTY
MGEOT105	CADY, ELWIN * 7.5 MI NW JOPLIN MT.				34N 07E 27 DAAB	LIBERTY
MGEOT309	FRANCIS, CLARA	1170.0	130.0			SHERIDAN
MGEOT107	WELSH, ORVILLE * 13 MI N-3MI E HINGHAM MT.				35N 11E 31 DCCC	HILL
MGEOT310	EDWARDS, MARVIN / MIKE DUSTERHOFF	490.0	76.0		35N 07W 24 DCDD	GLACIER
MGEOT039	BIG WEST OIL CO * 2 MI NE MTN VIEW SCHOOL					TOOLE
MGEOT104	RYGH, KEN * 22 MI N - 5 MI W JOPLIN MT.				36N 06E 13 ADDD	LIBERTY
MGEOT142	BRADBURY, ALFRED * 11 MI E WILD HORSE MT		160.0			HILL
MGEOT144	NAGEHUS, ORVILLE * 3 MI N SIMPSON MT.		80.0		37N 12E 18 BBDD	HILL

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

CAMAS – LONEPINE AREA (33 Sites)

ID	Site name	Reference	Type	Flow (l/min)	Latitude	Longitude	Temp (deg c)	Status/use	SWL (M)	Date	Chloride mg/l	Sulfate mg/l	Fluoride mg/l
MGEOT017	CAMAS HOT SPRINGS	Mariner et.al. 1976	SPRING	200.0	47.6155	114.6663	45				9.0	38.0	5.6
MGEOT029	SYMES HOT SPRINGS WELL	Sonderegger et.al. 1981	WELL	76.0	47.6163	114.6763	38				9.0	40.0	5.8
MGEOT058	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	MBMG-GWIC	WELL		47.6063	114.6744	18.5	PUBLIC SUPPLY	2.74	27 AUG 1975	2.2	12.1	1.6
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS	MBMG-GWIC	SPRING		47.6147	114.6658	44	RECREATIONAL		15 SEP 1975			
MGEOT075	LONEPINE OBSERVATION WELL	MBMG-GWIC	WELL		47.7141	114.6477	16.5	DOMESTIC	33.22	04 MAR 1976	6.3	12.2	0.9
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT	MBMG-GWIC	WELL		47.5827	114.5063	21.5	UNUSED		04 MAR 1976	6.0	8.1	0.6
MGEOT080	HOT SPRINGS MONTANA	MBMG-GWIC	SPRING		47.6155	114.6477	43	RECREATIONAL		19 APR 1976			
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT	MBMG-GWIC	WELL	0.4	47.6516	114.5836	24	STOCK		02 JUL 1976	28.3	1.2	6.1
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS	MBMG-GWIC	WELL		47.6297	114.6236	19.5	DOMESTIC		17 AUG 1976	25.3	0.3	0.8
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	MBMG-GWIC	WELL		47.6472	114.5761	34.4	DOMESTIC		07 SEP 1978	23.1	2.1	4.6
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	MBMG-GWIC	WELL		47.6536	114.5813	25.8	IRRIGATION		06 SEP 1978	10.9	1.8	4.4
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	MBMG-GWIC	WELL		47.6311	114.5813	15.2			08 SEP 1978	2.4	14.0	5.4
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	MBMG-GWIC	WELL	94.9	47.6619	114.5836	20.3	IRRIGATION		02 DEC 1979	19.0	2.1	4.6
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	MBMG-GWIC	WELL	40.0	47.6302	114.555	19	IRRIGATION		04 DEC 1979	27.0	1.4	4.3
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	MBMG-GWIC	WELL	30.0	47.6372	114.5811	28.8	IRRIGATION		05 DEC 1979	34.8	0.6	4.2
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	MBMG-GWIC	WELL		47.666	114.6538	16.6	DOMESTIC	22.86	06 DEC 1979	2.1	12.0	1.2
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	MBMG-GWIC	WELL		47.6736	114.6027	23.6	DOMESTIC	18.29	30 NOV 1979	7.8	5.8	3.4
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	MBMG-GWIC	WELL	40.0	47.6452	114.5686	32.5	IRRIGATION		02 DEC 1979	30.9	0.6	5.0
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	MBMG-GWIC	WELL	20.0	47.6433	114.5636	30.6	IRRIGATION		02 DEC 1979	35.5	0.6	4.5
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	MBMG-GWIC	WELL	10.0	47.6361	114.575	32.6	IRRIGATION		29 NOV 1979	16.0	1.5	7.6
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	MBMG-GWIC	WELL	94.6	47.6436	114.5741	38.9	IRRIGATION		29 NOV 1979	31.3	1.3	7.8
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	MBMG-GWIC	WELL	75.0	47.6422	114.5713	43.7	RESEARCH		18 DEC 1980	35.3	0.7	4.3
MGEOT286	JACKOLA AP.100 FT E. OF CAMP AQUA BATH SPA	MBMG-GWIC	WELL	416.5	47.6411	114.57	51	INDUSTRIAL/COMM	1.83	04 JUN 1982	34.0	0.6	5.0
MGEOT027	CAMP AQUA AREA TEST WELL	Sonderegger et.al. 1981	WELL-FLOWING	1300.0	47.6422	114.5713	50	RESEARCH			33.0	4.0	3.9
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.	MBMG-GWIC	WELL		47.5952	114.5302	22.5	UNUSED	-0.01	17 AUG 1976	17.5	8.8	3.5
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	MBMG-GWIC	WELL	35.1	47.67	114.588	22.8	IRRIGATION		08 SEP 1978	2.2	6.9	3.2
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	Sonderegger et.al. 1981	WELL	9.1	47.6075	114.6713	29.8	DOMESTIC		03 DEC 1979	7.8	21.2	5.2
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	MBMG-GWIC	WELL	303.1	47.6347	114.5819	42.7	RESEARCH	-0.06	15 JAN 1981	34.8	21.5	3.1
MGEOT291	SOUTH EAST OF CAMP AQUA	MBMG-GWIC	WELL	10.1	47.6147	114.6655	51.5	RESEARCH		19 AUG 1982	9.9	9.6	5.7
MGEOT307	HOT SPRINGS CITY	MBMG-GWIC	WELL		47.6063	114.6736	21	PUBLIC SUPPLY		31 MAY 1984	3.1	10.7	0.2
MGEOT352	SYMES HOTEL WELL	MBMG/UURI	WELL		47.6163	114.6763	33.3	DOMESTIC		02 NOV 1993	11.0	30.0	5.6
MGEOT355	KOEPLING, DELBERT * WELL 136	MBMG/UURI	WELL		47.6170	114.6781	26.5	IRRIGATION		03 NOV 1993	10.0	5.1	3.4
MGEOT354	OSTRANGER, DAVE * WELL 56	MBMG/UURI	WELL		47.6171	114.6775	17.2	IRRIGATION		03 NOV 1993	14.0	3.8	5.4

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

CAMAS – LONEPINE AREA (33 Sites)

ID	Site name	Std dev balance	Lab ph	SC mmohs	TDS mg/l	Hco3 mg/l	Alkalinity	Sample type	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Iron mg/l	Silica (SiO2) mg/l	Arsenic ug/l
MGEOT017	CAMAS HOT SPRINGS		9.40		399.00		189		0.9	0.1	85.0	1.7		70.0	
MGEOT029	SYMES HOT SPRINGS WELL		9.80		367.00		158		1.2	0.2	91.0	1.7		68.0	
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	-0.46	6.74	245.60	156.07	127.8			15.2	3.6	33.0	3.0	0.17	22.0	
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS								1.1	0.3	83.0	1.8	-0.01	58.0	
MGEOT075	LONEPINE OBSERVATION WELL	-0.25	7.93	396.80	240.03	235.9		Dissolved	39.8	11.6	32.8	1.7	-0.01	18.2	
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT	0.09	7.96	330.20	195.26	196.9		Dissolved	32.3	13.0	19.9	1.4	-0.01	16.2	
MGEOT080	HOT SPRINGS MONTANA								1.0	0.1	83.5	1.8	0.01	59.0	
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT	0.49	8.18	617.20	381.08	331.8			5.7	0.6	139.0	3.7	0.11	32.9	
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS	-0.78	7.51	471.80	283.29	264.5		Dissolved	37.0	11.9	46.0	3.9	5.80	21.9	
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	-0.87	8.63	633.60	395.26	326.0		Dissolved	3.6	0.6	150.0	3.4	0.02	36.5	1.0
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	-0.21	9.16	470.60	338.76	280.0		Dissolved	4.6	0.7	127.0	2.7	0.03	29.3	6.7
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	-0.29	8.12	404.80	244.61	221.0		Dissolved	6.6	1.5	88.1	1.9	0.39	14.3	100.0
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	-0.89	8.48	537.00	345.30	287.0		Dissolved	3.3	0.4	134.0	1.7	0.09	28.6	4.2
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	-0.67	8.06	592.90	375.46	324.0		Dissolved	5.5	1.0	139.0	2.1	0.28	35.0	19.5
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	0.99	7.89	656.70	403.19	346.0		Dissolved	4.0	0.7	147.7	2.8	0.26	34.9	14.6
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	-0.69	7.89	289.70	174.80	164.0		Dissolved	28.4	7.8	23.6	2.2	0.30	15.9	7.0
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	-0.95	7.90	446.70	276.24	255.0		Dissolved	5.7	0.7	105.0	1.3	0.17	19.5	27.7
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	0.52	8.40	635.60	384.72	328.0		Dissolved	4.4	0.4	142.0	2.1	0.12	36.6	3.3
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	0.38	8.28	668.40	419.64	354.0		Dissolved	3.3	0.4	154.4	2.6	0.13	43.6	5.6
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	-0.98	8.71	472.40	304.15	237.0		Dissolved	2.1	0.3	117.0	1.5	0.22	32.4	2.4
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	-0.38	8.38	593.70	394.41	314.0		Dissolved	4.8	1.0	144.0	2.8	0.65	41.4	0.7
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	2.03	8.21	655.60	390.02	343.0		Dissolved	12.6	2.4	127.0	3.3	0.11	35.3	0.8
MGEOT286	JACKOLA AP. 100 FT E. OF CAMP AQUA BATH SPA	0.53	8.53	651.20	413.14	327.0		Dissolved	2.9	0.2	152.0	3.1	-0.00	43.2	0.2
MGEOT027	CAMP AQUA AREA TEST WELL		8.40		420.00		351		3.2	0.3	152.0	4.0		42.2	
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.	0.56	7.83	622.30	374.62	366.9		Dissolved	20.0	9.4	113.0	3.5	0.02	17.5	
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	-0.54	9.45	442.30	273.01	188.0		Dissolved	5.8	0.7	101.0	2.3	0.20	21.0	23.0
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	-0.63	9.46	383.50	286.58	84.6		Dissolved	0.9	-0.1	92.3	0.0	0.61	67.0	-1.0
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	0.62	8.32	663.90	405.72	321.0		Dissolved	15.5	2.8	129.0	3.8	0.16	36.8	2.8
MGEOT291	SOUTH EAST OF CAMP AQUA	-0.59	9.34	361.80	270.89	109.3		Dissolved	0.6	-0.1	85.8	1.7	-0.00	69.6	-1.0
MGEOT307	HOT SPRINGS CITY	0.76	7.99	253.60	172.15	149.3		Dissolved	17.2	4.0	32.0	3.1	0.07	28.1	
MGEOT352	SYMES HOTEL WELL	-0.01	9.66	280.00	297.16		131	Dissolved	0.6	0.7	89.4	2.2	-0.02	73.1	-0.5
MGEOT355	KOEPLING, DELBERT * WELL 138	0.04	8.23	266.00	275.02		236	Dissolved	4.5	-0.2	95.6	2.9	0.06	36.6	-0.5
MGEOT354	OSTRANGER, DAVE * WELL 56	-0.07	8.05	312.00	290.91		278	Dissolved	5.5	2.5	109.3	-0.6	0.39	13.0	-0.5

NOTE: A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

CAMAS – LONEPINE AREA (33 Sites)

ID	Site name	Boron ug/l	Lithium ug/l	H_2S	Location	County
MGEOT017	CAMAS HOT SPRINGS	300.0		7.4	21N 24W 3BBDB	SANDERS
MGEOT029	SYMES HOT SPRINGS WELL				21N 24W 4ADCA	SANDERS
MGEOT068	TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH				21N 24W 04 DBDA	SANDERS
MGEOT071	CORN HOLE* CAMAS HOT SPRINGS				21N 24W 03 BBB	SANDERS
MGEOT075	LONEPINE OBSERVATION WELL		-10.0			SANDERS
MGEOT076	CARR, FRANK*BOX 456 HOT SPRINGS MT		-10.0		21N 23W 14 ACB	SANDERS
MGEOT080	HOT SPRINGS MONTANA					SANDERS
MGEOT091	KEMP, ANNA* 5 MI N HOT SPRINGS, MT					SANDERS
MGEOT098	IRRIGATION EQUIPMENT SALES*HOT SPRINGS		30.0		22N 24W 36 BBB	SANDERS
MGEOT173	KEMP, ANNA * HOT SPRINGS, MT *	870.0	100.0		22N 23W 20 CDBC	LAKE
MGEOT174	HUGHES, RAY * HOT SPRINGS, MT	710.0	80.0			SANDERS
MGEOT176	KOPP, ARVID * HOT SPRINGS, MT	690.0	20.0			LAKE
MGEOT219	BAXTER, C * 1.5 MI N CAMPAQUA MT	649.0	65.0		22N 23W 18 DDAD	SANDERS
MGEOT220	JACOBSEN, R * HOT SPRINGS MT	844.0	61.0		22N 23W 33 BABB	LAKE
MGEOT221	KEMP * .5 MI SE CAMPAQUA MT	968.0	60.0		22N 23W 28 CBBB	LAKE
MGEOT222	GAIL PATTON RANCH * 1 MI SW LONEPINE MT	91.0	-8.0		22N 24W 10 ABAB	SANDERS
MGEOT223	LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	511.0	24.0		22N 23W 18 BBBB	SANDERS
MGEOT224	KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	685.0	74.0		22N 23W 20 DCDB	LAKE
MGEOT225	KEMP * 0.3 MI E CAMPAQUA MT	934.0	80.0		22N 23W 29 AADB	LAKE
MGEOT226	KOPP, ARVID * .25 MI S CAMPAQUA MT	914.0	58.0		22N 23W 29 CACA	LAKE
MGEOT227	KEMP * .25 MI N CAMPAQUA MT	910.0	61.0		22N 23W 29 BAAC	LAKE
MGEOT262	MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	550.0	59.0		22N 23W 29 BADD	LAKE
MGEOT266	JACKOLA AP. 100 FT E. OF CAMP AQUA BATH SPA	540.0	78.0		22N 23W 29 ACAB	LAKE
MGEOT027	CAMP AQUA AREA TEST WELL	640.0			22N 23W 29 AC	LAKE
MGEOT097	CHRISTIANSON, BOB*HOT SPRINGS MT.		20.0		21N 23W 10 BDD	SANDERS
MGEOT175	BAXTER, CHARLES * HOT SPRINGS, MT	540.0	40.0			SANDERS
MGEOT228	LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	460.0	18.0		21N 24W 04 DABD	SANDERS
MGEOT267	MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	500.0	73.0		22N 23W 29 DADD	SANDERS
MGEOT291	SOUTH EAST OF CAMP AQUA	350.0	51.0		21N 24W 03 BBB	SANDERS
MGEOT307	HOT SPRINGS CITY	70.0	13.0		21N 24W 04 DBDA	SANDERS
MGEOT352	SYMES HOTEL WELL	0.2	0.0		21N 24W 04ADB	SANDERS
MGEOT355	KOEPLING, DELBERT * WELL 138	0.4	0.0		22N 24W 13DADD	SANDERS
MGEOT354	OSTRANGER, DAVE * WELL 56	0.3	-0.0		22N 23W 17BBC	SANDERS

NOTE. A negative value for concentration indicates the detection limit for that analyte. A negative value for SWL (static water level) indicates head above ground surface (meters).

APPENDIX II

GEOTHERMOMETER TEMPERATURES FOR SELECTED SITES

TEMPERATURES BASED ON SELECTED GEOTHERMOMETERS

Site name	Surface Temp	Na–K–Ca (B=4/3)	Na–K–Ca (B=1/3)	Mg CORRECTION Log(sqrtCa/Na)	Temperature Corrected	R Coefficient	Delta T (Mg Corr.)	Na–K–Ca Corrected	Na–K–Ca Uncorrected	Quartz (no steam)	Quartz (steam loss)	Chalcedony	a–Cristobalite	B–Cristobalite	Amorphous Silica	Published Estimates
MGEOT209 TARGHEE SULPHUR SPRING*6MI W W YELLOWSTONE	18	25.14	213.95	2.14	25.14	37.62	−61.25	25.14	213.95	51.53	58.32	19.07				18
MGEOT127 LOWER EAST SPRING–STAUDENMEYER RANCH	28	50.56	190.06	1.53	50.56	36.10	−20.25	50.56	190.06	69.28	74.13	37.45				
MGEOT125 LOWER WEST SPRINGS–STAUDENMEYER RANCH	31	52.05	190.72	1.51	52.05	35.49	−18.99	52.05	190.72	66.01	71.23	34.03				
MGEOT124 UPPER WEST SPRING–STAUDENMEYER RANCH	29	50.11	188.52	1.53	50.11	35.89	−21.38	50.11	188.52	64.92	70.27	32.91				
MGEOT177 UPPER WEST SPRING–STAUDENMEYER RANCH	28.8	48.53	187.46	1.54	48.53	36.79	−22.28	48.53	187.46	64.92	70.27	32.91				
MGEOT123 UPPERMOST SPRING–STAUDENMEYER RANCH	28	47.70	188.17	1.56	47.70	36.27	−24.62	47.70	188.17	63.63	69.12	31.56				45
MGEOT126 UPPER–EAST SPRING–STAUDENMEYER RANCH	29	50.39	189.52	1.53	50.39	36.34	−20.08	50.39	189.52	68.27	73.23	36.39				
MGEOT121 ANDERSONS PASTURE SPRING #1	28	50.56	189.64	1.53	50.56	36.04	−20.37	50.56	189.64	66.01	71.23	34.03				45
MGEOT122 ANDERSONS PASTURE SPRING #2	23.5	49.09	190.13	1.56	49.09	34.62	−25.49	49.09	190.13	65.29	70.59	33.28				45
MGEOT210 USFS* BAKERS HOLE* 3MI N WEST YELLOWSTONE	16	91.96	183.40	0.90	91.96	40.09	48.22	43.74	183.40	125.03	122.44	97.08	74.38	26.38	6.13	45
MGEOT115 SLOAN COW CAMP SPRING	29.5	93.08	100.79	0.09	93.08	10.12	−19.50	93.08	100.79	102.64	103.28	72.78	52.24			85
MGEOT120 WEST FORK SWIMMING HOLE	25.5	22.90	191.44	2.02	22.90	70.54	−12.10	22.90	191.44	49.80	56.77	17.29				30
MGEOT118 CURLEW CREEK WARM SPRING	23	33.96	112.31	1.09	33.96	14.05	−86.94	33.96	112.31	62.88	68.45	30.78				
MGEOT119 WALL CANYON WARM SPRING	24	120.82	126.06	0.05	126.06	22.46	50.23	75.83	126.06	93.53	95.39	63.02	43.32			
MGEOT229 WOLF CREEK HOT SPRING	60	63.55	101.42	0.49	63.55	20.56	−32.25	63.55	101.42	102.46	103.12	72.58	52.05			
MGEOT129 LOWELL HILDRETH SPRING*15 MI SW DILLON	19.6	33.21	160.79	1.58	33.21	33.43	−55.00	33.21	160.79	58.50	64.55	26.24	9.58			
MGEOT016 BEAR CREEK SPRINGS	24															
MGEOT132 VIGILANTE WARM SPRING	23.5	14.06	192.50	2.20	14.06	34.09	−89.48	14.06	192.50	54.13	60.65	21.74				30
MGEOT041 LA DUKE HOT SPRINGS	65	74.46	161.74	0.95	74.46	22.38	−12.71	74.46	161.74	100.87	101.74	70.87				73
MGEOT012 BROWNS SPRINGS	23.7															30
MGEOT010 PULLER HOT SPRINGS	44.4	122.49	166.37	0.42	166.37	31.45	116.37	50.00	166.37	83.38	86.53	52.25				90
MGEOT019 TRUDAU SPRINGS	22.7	68.70	177.23	1.16	68.70	37.15	10.00	58.69	177.23	61.53	67.25	29.38				45
MGEOT040 CHICO HOT SPRINGS	42	63.04	182.95	1.29	63.04	27.38	−18.12	63.04	182.95	84.64	87.64	53.59				58
MGEOT032 GROUNDWATER*4.7 MI NE FT SMITH MT	20	122.94	82.65	−0.47	82.65	46.42	45.21	37.44	82.65	39.26	47.27					
MGEOT074 BROWN CATTLE CO* 3.1 MI N. BIRNEY MT	15.5	93.67	78.14	−0.20	78.14	20.45	−12.29	78.14	78.14	39.58	47.56					
MGEOT276 JARDINE HOT SPRINGS 0.25 MI E OF JACKSON	60	121.03	142.13	0.21	142.13	25.23	75.24	66.89	142.13	101.15	101.99	71.18				
MGEOT289 MBMG GEOTHERMAL TEST * THEXTON TX–12	87	175.27	163.18	−0.10	163.18	2.48	−0.45	163.18	163.18	141.01	135.92	114.73	90.40			
MGEOT028 JACKSON HOT SPRINGS	58	129.49	148.01	0.18	148.01	28.74	91.06		148.01	103.65	104.14	73.86				125
MGEOT293 PRIVATE GEOTHERMAL TEST*ENNIS HOT SPRINGS*	87	174.67	164.28	−0.09	164.28	2.54	0.01	164.27	164.28	141.54	136.37	115.32	90.94			
MGEOT277 LAPHAM DOMESTIC WELL 1 MI NW JACKSON, MT.	17	96.20	142.30	0.49	96.20	14.94	−4.51	96.20	142.30	55.70	62.06	23.36				
MGEOT117 ENNIS HOT SPRINGS	81															129
MGEOT058 BROWN CATTLE CO * 9.5MI SW BIRNEY DAY SCH.	16.5	92.50	80.39	−0.15	80.39	5.35	−30.60	80.39	80.39	38.28	46.38					
MGEOT031 BEAVERHEAD ROCK SPRINGS	27															
MGEOT133 APEX WARM SPRING	25	29.04	153.19	1.59	29.04	29.57	−70.34	29.04	153.19	63.07	68.62	30.98				76
MGEOT323 ELKHORN HOT SPRINGS	48.5	56.42	94.55	0.52	56.42	6.80	−53.08	56.42	94.55	106.31	106.44	76.72	55.84			
MGEOT292 MARTIN, KIETH	20.5	−8.62	210.02	2.82	−8.62	36.61	−130.80		210.02	41.47	49.27					
MGEOT326 NEW BILTMORE HOT SPRINGS	53	74.05	177.28	1.09	74.05	28.48	0.54	73.51	177.28	97.96	99.23	67.75				
MGEOT308 NEWMAN, JOHN * JOLIET, MT	16	85.34	52.06	−0.47	52.06	49.75	4.98	47.08	52.06	31.42	40.15					
MGEOT006 ANDERSON'S SPRING	25	−3.89	194.51	2.60	−3.89	44.31	−102.80		194.51	45.84	53.20					30
MGEOT280 ANDERSON SPRING	25	−10.31	208.61	2.85	−10.31	33.10	−142.90		208.61	43.85	51.42					
MGEOT043 NORRIS HOT SPRINGS	50	112.68	154.87	0.42	154.87	17.64	61.48	93.39	154.87	123.77	121.36	95.70	73.12			107
MGEOT015 POTOSI HOT SPRINGS	49.5	54.51	99.00	0.60	54.51	1.50	−14.81	54.51	99.00	97.96	99.23	67.75				60
MGEOT187 GROSS, PETE * 4 MI S PONY MT	37.5	51.38	98.58	0.64	51.38	1.16	−5.13	51.38	98.58	99.63	100.67	69.54	49.28			
MGEOT311 MCFERRAN, EUGENE * BILLINGS, MT	15.5	77.73	35.87	−0.64	35.87	30.92	−55.34	35.87	35.87	36.24	44.53					
MGEOT179 CARTER'S BRIDGE * 4 MI SE LIVINGSTON MT.	28	14.63	201.35	2.25	14.63	30.81	−95.22		201.35	62.30	67.94	30.18				
MGEOT011 AVON WARM SPRING	25.5															
MGEOT264 BOZEMAN HOT SPRINGS * OWNER – CHARLES PAGE	59	101.91	117.96	0.18	117.96	2.28	−10.03	117.96	117.96	119.06	117.35	90.55	68.44			
MGEOT265 BOZEMAN HOT SPRINGS * OLD WELL	54	125.96	122.00	−0.04	122.00	0.00			122.00	118.41	116.80	89.84	67.79			
MGEOT266 BOZEMAN HOT SPRINGS * OWNER – CHARLES PAGE	55	101.72	114.11	0.14	114.11	0.00			114.11	118.34	116.74	89.76	67.72			
MGEOT263 BOZEMAN HOT SPRINGS * ORIGINAL SPRING	54	90.29	114.55	0.28	90.29	13.15	−15.52	90.29	114.55	117.68	116.18	89.05	67.07			
MGEOT335 BOZEMAN HOT SPRINGS	54.6	86.10	117.51	0.37	86.10	31.54	24.04	62.06	117.51	108.02	107.91	78.57	57.52			80
MGEOT269 RANCA * MCLEOD	49	23.53	227.45	2.26	23.53	22.10	−94.90		227.45	80.23	83.77	48.92				50
MGEOT259 SCOTT FEED LOT	43	110.94	63.14	−0.61	63.14	15.38	−43.36	63.14	63.14	62.30	67.94					46
MGEOT260 SCOTT FEED LOT	44	108.71	58.85	−0.65	58.85	15.75	−48.51	58.85	58.85	63.44	68.95					46
MGEOT230 BLUE JOINT CREEK HOT SPRING	29.4	26.85	69.82	0.69	26.85	5.65	−74.20		69.82	105.44	105.68	75.78	54.98			45
MGEOT002 BRIDGER CANYON WARM SPRING	20.2	0.03	171.81	2.33	0.03	40.27	−104.10		171.81	32.96	41.56					25
MGEOT334 LOVE, MELVIN*THREE FORKS, MT	15.9	37.46	170.17	1.59	37.46	26.11	−62.30	37.46	170.17	82.22	85.52	51.02	32.33			
MGEOT033 GROUNDWATER*5.3 MI W HARDIN MT	39.4	35.50	273.88	2.33	35.50	24.88	−68.16		273.88	59.53	65.47					
MGEOT332 SHIPTON, HAROLD * THREE FORKS MT	16.9	43.32	173.18	1.51	43.32	41.38	−22.49	43.32	173.18	102.46	103.12	72.58	52.05			
MGEOT258 HERMAN, T.E. * ROCKY RANCH 7.4 M W HARDIN	42	38.17	279.16	2.31	38.17	25.68	−61.92		279.16	57.87	63.99					
MGEOT344 GALLOGLY HOT SPRING	48.9	46.93	94.45	0.67	46.93	0.00			94.45	95.63	97.21	65.26				56
MGEOT245 LOST TRAIL * WARM AND HOT SPRINGS	41.7	46.89	94.56	0.67	46.89	0.00			94.56	95.63	97.21	65.26	45.37			
MGEOT089 CAIN MIKE*6.6 MI S VOLBERG	18	86.75	68.76	−0.24	68.76	23.83	−17.46	68.76	68.76	28.55	37.54					
MGEOT018 HUNTERS HOT SPRINGS	60	72.46	80.46	0.11	72.46	12.01	−37.45	72.46	80.46	114.46	113.43	85.55	63.88			78
MGEOT328 JORGENSON, JACK * THREE FORKS MT	16															
MGEOT346 RENOVA HOT SPRINGS	50	91.54	162.75	0.74	91.54	27.10	21.49	70.06	162.75	88.27	90.81	57.43	38.20			90
MGEOT339 WESTMORELAND * 9.1 M W SARPY SCHOOL	37.7	86.26	281.79	1.61	86.26	18.35	−7.06	86.26	281.79	65.29	70.59					
MGEOT095 LISCOM RANCH * 5.5 MI NW OF N STACY SCHOOL	15.5	90.70	75.57	−0.20	75.57	30.91	7.91	67.67	75.57	31.02	39.79					
MGEOT331 TINDER, L. MARIE * THREE FORKS MT	21.9	80.95	180.54	1.02	80.95	29.08	11.61	69.34	180.54	101.34	102.15	71.38	50.96			
MGEOT327 WILCOX, RALPH * THREE FORKS MT	16.5															
MGEOT333 RICHARDSON, DEIRDRE * THREE FORKS	16.8	80.06	177.43	1.01	80.06	27.90	7.77	72.29	177.43	102.00	102.72	72.08	51.60			
MGEOT347 MEDICINE HOT SPRINGS	45	83.15	107.55	0.30	83.15	5.93	−30.04	83.15	107.55	110.51	110.05	81.26	59.98			82
MGEOT092 WESTERN ENERGY * 2 MI N COLSTRIP MT.	96.1	114.82	251.67	1.11	251.67	14.32	109.95	141.72	251.67	107.69	107.62					100
MGEOT020 PIPESTONE HOT SPRINGS	57	88.72	112.11	0.28	88.72	4.41	−24.40	88.72	112.11	115.22	114.08	86.37	64.64			88
MGEOT082 FRED WETSTEON SPRING DEVELOP	19	82.54	116.66	0.41	82.54	0.00			116.66	110.10	109.70	80.82	59.58			
MGEOT330 HART, FRANK * THREE FORKS, MT	15.9															
MGEOT063 ANADARKO PROD*6 MI E FOSTER MT	26.7	134.01	75.21	−0.68	75.21	33.33	12.31	62.90	75.21	46.11	53.45					
MGEOT053 SPRING * 29 M NE OF FOSTER MT	29	18.24	114.33	1.40	18.24	62.30	−29.92	18.24	114.33							

TEMPERATURES BASED ON SELECTED GEOTHERMOMETERS

Site name	Surface Temp	Na-K-Ca (B=4/3)	Na-K-Ca (B=1/3)	Mg CORRECTION Log(sqrtCa/Na)	Temperature Corrected	R Coefficient	Delta T (Mg Corr.)	Na-K-Ca Corrected	Na-K-Ca Uncorrected	Quartz (no steam)	Quartz (steam loss)	Chalcedony	a-Cristobalite	B-Cristobalite	Amorphous Silica	Published Estimates
MGEOT128 COWAN SPRING*9MI NW THREE FORKS MT	23	63.30	152.04	1.02	63.30	40.69	8.10	55.21	152.04							
MGEOT178 WOLF CREEK HOT SPRING	60															
MGEOT343 WILLIAMSBURG SPRING	17.4	30.83	182.20	1.80	30.83	29.31	-67.60	30.83	182.20	38.28	46.38					
MGEOT030 OIL WELL (TENSLEEP FORMATION)	69															
MGEOT341 MONTANA RESOURCES MONITORING WELL C	17.8	53.38	210.53	1.64	53.38	23.57	-41.16	53.38	210.53	103.29	103.83	73.47	52.86			
MGEOT342 MONTANA RESOURCES MONITORING WELL D2	16	62.65	218.39	1.55	62.65	34.65	-3.88	62.65	218.39	107.69	107.62	78.21	57.19			
MGEOT055 HOWARD SPRING * 25 M SE OF BIGHORN MT	23	76.61	101.34	0.31	76.61	86.89	66.11	10.51	101.34	38.94	46.98					
MGEOT246 WENDT, FRED * .75 MI S GREGSON (FAIRMONT)	23.9	46.09	148.63	1.25	46.09	6.93	-63.27	46.09	148.63	95.01	96.67	64.60	44.76			
MGEOT298 MBMG RESEARCH WELL * FAIRMONT HOT SPRINGS	20	83.88	111.99	0.34	83.88	2.86	-22.61	83.88	111.99		21.23					
MGEOT165 NELSON, HARVEY * 5 MI S BROADVIEW MT	16	98.25	53.63	-0.61	53.63	29.30	-28.79	53.63	53.63	35.89	44.21					
MGEOT061 BRADBROOK * 10 M S BROADVIEW MT	32.9	98.03	184.48	0.84	98.03	29.04	34.40	63.63	184.48	58.71	64.74					
MGEOT279 FAIRMONT HOT SPRINGS, ANACONDA	61.5	115.66	129.30	0.14	129.30	7.33	1.09	128.21	129.30	125.49	122.83	97.58	74.84			
MGEOT247 SPANGLER, HAZEL * 2 MI E-NE GREGSON MT	15.5	66.77	185.41	1.25	66.77	30.65	-5.60	66.77	185.41	107.85	107.76	78.39	57.36			
MGEOT214 HUNSAKER SPRING	24.5	59.89	224.82	1.64	59.89	28.69	-20.17	59.89	224.82	69.28	74.13	37.45				40
MGEOT150 MONT. HIGHWAY DEPT * .75 MI SE WACO MT.	15.5	83.47	60.04	-0.32	60.04	34.83	-7.58	60.04	60.04	28.55	37.54					
MGEOT213 PLUNKET LAKE WARM SPRINGS	17	29.41	144.77	1.50	29.41	49.38	-32.09	29.41	144.77	54.13	60.65	21.74				20
MGEOT237 SPRINGS FROM JOINTS IN MISS CYN*SW PLUNKET	17	28.82	148.12	1.54	28.82	43.44	-43.52	28.82	148.12	50.80	57.66	18.31				
MGEOT151 MONTANA DEPT HIGHWAYS * 2.5 MI NE WACO MT	16.5	62.23	61.83	-0.01	61.83	50.88	21.34	40.50	61.83	30.21	39.06					
MGEOT216 HUNSAKER, MAURICE	15	46.07	130.57	1.08	46.07	47.39	-7.99	46.07	130.57	79.27	82.93	47.91	29.48			45
MGEOT135 ANACONDA RED TRAVETINE MOUND-GEYSER	21.7	40.53	136.37	1.23	40.53	18.86	-70.75	40.53	136.37	68.27	73.23	36.39				75
MGEOT325 SLEEPING CHILD HOT SPRINGS	43	81.05	115.74	0.41	81.05	4.19	-28.46	81.05	115.74	110.51	110.05	81.26	59.98			125
MGEOT236 BRUCE, N * IRRIGATION WELL WITH BOOSTER	18	48.74	145.18	1.18	48.74	35.18	-25.00	48.74	145.18	100.30	101.25	70.26	49.94			
MGEOT218 TOSTON WARM SPRING	15.5	31.42	179.66	1.77	31.42	39.72	-45.88	31.42	179.66	63.07	68.62	30.98				20
MGEOT294 TOSTON WARM SPRING	45.5	24.75	155.61	1.69	24.75	39.30	-58.65		155.61	60.34	66.19					20
MGEOT217 BRUCE, NORMAN	18	31.66	116.11	1.17	31.66	1.73	-25.96	31.66	116.11	81.96	85.29	50.75	32.08			
MGEOT215 KIMPTON SPRING	18	0.75	141.55	2.04	0.75	31.18	-122.99		141.55	57.66	63.80	25.37				
MGEOT134 WARNER WARM SPRING	18	3.33	146.44	2.03	3.33	30.08	-119.85		146.44	55.26	61.66	22.90				
MGEOT172 STEELE, WILLIAM * 12.5 MI SE PINEVIEW MT.	16	94.50	69.17	-0.33	69.17	26.58	-10.71	69.17	69.17	28.12	37.15					
MGEOT284 MBMG TEST WELL*WARM SPRINGS STATE HOSPITAL	48	80.29	191.17	1.11	80.29	15.45	-21.47	80.29	191.17	77.16	81.08	45.70				
MGEOT009 WARM SPRINGS	77	79.49	194.96	1.15	79.49	13.46	-26.80	79.49	194.96	107.17	107.18	77.65				79
MGEOT233 WARM SPRINGS STATE HOSPITAL	67	85.73	208.59	1.17	85.73	14.82	-16.53	85.73	208.59	89.09	91.52	58.29				79
MGEOT231 WARM SPRINGS STATE HOSPITAL	54	88.33	206.44	1.12	88.33	14.68	-13.93	88.33	206.44	84.14	87.20	53.05				79
MGEOT350 BOULDER HOT SPRINGS - LOWER SPRING	64.5	130.10	157.93	0.26	157.93	0.00			157.93	131.37	127.80	104.05	80.71			
MGEOT349 BOULDER HOT SPRINGS - MIDDLE SPRING	74	126.81	141.13	0.14	141.13	10.65	21.54	119.59	141.13	136.34	131.99	109.54	85.70			
MGEOT348 BOULDER HOT SPRINGS - UPPER SPRING	54	115.54	134.06	0.19	134.06	12.64	24.04	110.02	134.06	133.32	129.45	106.20	82.67			
MGEOT232 WARM SPRINGS STATE HOSPITAL * SPRING	79	76.20	189.23	1.15	76.20	13.81	-29.92		189.23	107.00	107.03					79
MGEOT185 M-B NO. 12 * 5 MI NE HAMILTON MT	18.5	34.29	172.45	1.66	34.29	21.64	-76.40	34.29	172.45	109.94	109.56	80.64	59.41			
MGEOT171 GRIERSON, J.B.*2.5MI NE RANCHERS CEMETARY.	21	116.09	67.49	-0.60	67.49	18.98	-30.12	67.49	67.49	46.38	53.70					
MGEOT130 PRISON RANCH SPRING SITE NO. 4	26	34.21	80.00	0.69	34.21	3.82	-58.24	34.21	80.00	97.76	99.06	67.54	47.45			40
MGEOT113 DEER LODGE PRISON RANCH WELL	26	34.25	79.90	0.69	34.25	3.82	-58.21	34.25	79.90	97.76	99.06	67.54	47.45			
MGEOT044 BEDFORD SPRINGS	23.6					38.89										30
MGEOT101 GRIERSON, J.B. * 23 MI NW HYSHAM MT	15.6	93.90	71.33	-0.29	71.33	43.35	24.47	46.86	71.33	23.55	32.97					
MGEOT274 MBMG RESEARCH WELL * WEED CREEK-1A	17	119.32	68.93	-0.62	68.93	41.89	18.57	50.36	68.93	30.21	39.06					
MGEOT275 MBMG RESEARCH WELL * WEED CREEK-1B	20	112.81	65.58	-0.59	65.58	25.78	-17.76	65.58	65.58							
MGEOT255 HANSER, BILL * 3 MI SW TWO DOT MT	18	95.31	66.32	-0.38	66.32	17.44	-35.02	66.32	66.32	46.66	53.94					
MGEOT256 FOX INC * 1.5 MI W-SW TWO DOT	19	77.08	53.12	-0.35	53.12	0.00			53.12	50.55	57.44					22
MGEOT257 HOMER, RAY * TWO DOT WATER SUPPLY	20	70.27	58.54	-0.17	58.54	10.84	-54.82	58.54	58.54	48.52	55.62					
MGEOT296 HARLOWTON * SOUTH MUNICIPAL WELL	15.6	35.61	27.84	-0.14	27.84	7.27	-84.39	27.84	27.84	39.90	47.85					
MGEOT013 HILLBROOK FLOWING WELL	30	130.95	160.89	0.28	160.89	17.94	67.79	93.10	160.89	115.98	114.73	87.19	65.38			
MGEOT014 WALLS HOT SPRING	55.6	111.67	147.60	0.37	147.60	19.97	63.64	83.96	147.60	110.51	110.05	81.26	59.98			
MGEOT001 ALHAMBRA HOT SPRINGS NORTH	56.5	110.28	143.79	0.35	143.79	20.15	60.68	83.11	143.79	115.22	114.08	86.37	64.64			96
MGEOT278 TOWNSEND,HERB*2.5 MI SW WHITE SULPHUR SPGS	48.5	16.27	157.17	1.86	16.27	33.68	-86.02		157.17	55.04	61.46					
MGEOT290 RALPH JOHNSON,P.O.BOX 65,WHITE SULPHUR SPR	15.3	259.05	122.38	-1.07	122.38	31.42	59.60	52.77	122.38	95.94	97.48	65.59	45.67			
MGEOT004 WHITE SULPHUR SPRINGS	46	126.79	147.27	0.20	147.27	26.73	84.76	62.50	147.27	102.74	103.36	72.88	52.33			125
MGEOT282 WHITE SULPHUR SPRINGS BANK WELL	43.3	121.76	144.81	0.23	144.81	23.87	73.83	70.98	144.81	95.63	97.21	65.26	45.37			
MGEOT188 WATTS, JAMES * 16 MI NE KINSEY MT	15	85.25	51.90	-0.47	51.90	20.14	-50.45	51.90	51.90	39.26	47.27					
MGEOT184 M-B NO 8 WELL*2.5 MI SE CORVALLIS MT	18.3	60.33	181.90	1.32	60.33	27.27	-22.50	60.33	181.90	118.19	116.62	89.60	67.58			
MGEOT007 BROADWATER HOT SPRINGS WELL	65.5	98.03	130.98	0.36	98.03	7.61	-19.47	98.03	130.98	133.18	129.33	106.05	82.53			
MGEOT008 GLOEGE WELL	19.4	30.72	139.24	1.43	30.72	24.86	-76.67	30.72	139.24	76.58	80.57	45.09	26.89			
MGEOT003 GARRISON WARM SPRINGS	25	37.70	174.98	1.62	37.70	42.01	-30.80	37.70	174.98	59.93	65.83	27.73				
MGEOT208 USGS OBS WELL * 4 MI SW EAST HELENA, MT.	25	33.21	159.26	1.57	33.21	34.09	-53.67	33.21	159.26	54.81	61.26					
MGEOT242 FLORENCE TEST WELL A	15	126.79	141.90	0.15	141.90	11.71	26.55	115.35	141.90	17.75	27.65					70
MGEOT167 CHERRY CK SHEEP CO.*1.35MI SE HAGEN RANCH	36	117.14	67.99	-0.61	67.99	21.81	-23.10	67.99	67.99	64.19	69.61					
MGEOT329 SIVERTE MYSSE * BOX 315 * INGOMAR MT 59039	37	109.43	60.78	-0.63	60.78	17.37	-42.84	60.78	60.78	66.71	71.85					
MGEOT261 MOORE, THOMAS * 6.5 MI SW ANGELA MT	62	158.97	174.41	0.13	174.41	19.18	84.02	90.39	174.41	102.55	103.20					
MGEOT322 BYRNE WARM SPRING * WEST OF BEARMOUTH	20	12.77	169.78	2.04	12.77	29.56	-101.51		169.78	64.74	70.10	32.72				
MGEOT116 NIMROD SPRINGS	20.5	16.61	162.80	1.91	16.61	31.73	-89.43	16.61	162.80	65.29	70.59	33.28				30
MGEOT026 BEARMOUTH SPRINGS	20.2	3.20	157.08	2.13	3.20	33.93	-111.79		157.08	55.26	61.66	22.90				35
MGEOT345 LOLO HOT SPRINGS	44	74.60	113.07	0.47	74.60	6.39	-36.98	74.60	113.07	119.63	117.84	91.17	69.00			83
MGEOT069 MARYSVILLE DEEP WELL DEPTH 5750	96.7	136.70	156.51	0.19	156.51	4.82	8.00	148.51	156.51	117.09	115.68					122
MGEOT170 CHERRY CREEK SHEEP CO*26 MI N VANANDA MT	44	124.20	183.90	0.54	183.90	25.13	113.90	69.99	183.90	66.18	71.38					
MGEOT162 OLSEN, JONAS * 9 MI NW FLATWILLOW MT.	27	74.75	116.42	0.51	74.75	38.18	20.78	53.97	116.42	48.26	55.38					
MGEOT201 OLSEN JONAS * 14 MI NE N-BAR RANCH	16	52.65	163.23	1.28	52.65	43.70	-3.43	52.65	163.23	38.61	46.68					
MGEOT164 REYNOLDS, KEITH * 6 MI NE FLATWILLOW MT.	24.5	96.56	85.39	-0.14	85.39	26.73	12.43	72.96	85.39	49.29	56.31					
MGEOT163 HILL, FLOYD * 7 MI N FLATWILLOW MT.	15	99.00	91.62	-0.09	91.62	26.13	19.29	72.32	91.62	47.99	55.15	15.44				
MGEOT180 M-B 4 (BUTLER CK) * 6 MI NW MISSOULA MT	16	123.77	143.22	0.19	143.22	37.23	105.41	37.82	143.22	132.53	128.78	105.33	81.88	33.52		
MGEOT254 KING, JOE & SONS INC. * 5 MI SSW WINNET MT	16	114.09	85.32	-0.34	85.32	31.39	22.64	62.68	85.32	46.93	54.19					
MGEOT159 SHAW, BUD * 1.7 MI SW MOSBY MT.	29	98.14	81.79	-0.20	81.79	22.97	-1.32	81.79	81.79	50.05	56.99					

TEMPERATURES BASED ON SELECTED GEOTHERMOMETERS

Site name	Surface Temp	Na–K–Ca (B=4/3)	Na–K–Ca (B=1/3)	Mg CORRECTION Log(sqrtCa/Na)	Temperature Corrected	R Coefficient	Delta T (Mg Corr.)	Na–K–Ca Corrected	Na–K–Ca Uncorrected	Quartz (no steam)	Quartz (steam loss)	Chalcedony	a–Cristobalite	B–Cristobalite	Amorphous Silica	Published Estimates
MGEOT160 EAGER, REX * 2 MI SW WINNETT MT.	15.5	93.19	95.04	0.02	93.19	30.87	32.17	61.02	95.04	45.00	52.45					
MGEOT161 BRATTON, WAYNE * 2 MI SE WINNETT MT.	24.2	94.27	85.61	-0.11	85.61	28.48	16.70	68.90	85.61	51.04	57.88					
MGEOT305 BURLY VISTA TRACTS	46	22.81	221.76	2.24	22.81	39.46	-61.88		221.76	26.81	35.95					
MGEOT157 TEIGEN, PETER * 9 MI E GRASSRANGE MT.	17.9	57.79	159.85	1.17	57.79	42.37	2.44	55.35	159.85	37.94	46.08					
MGEOT196 MATOVICH * 4.5 MI E GRASSRANGE MT	21.8	48.68	148.85	1.21	48.68	39.13	-17.71	48.68	148.85	39.90	47.85					
MGEOT181 HOLE NO 2 M-8 DRILLING PROJECT	15	79.09	95.24	0.20	79.09	21.24	-9.11	79.09	95.24	56.58	62.84	24.27				
MGEOT240 MSU AG EXPERIMENT STATION * MOCCASIN MT	15	36.41	182.25	1.70	36.41	30.66	-54.91	36.41	182.25	36.24	44.53					
MGEOT155 BRADY, EARL*4 MI NW WINNETT, MT	15.8	91.37	102.46	0.13	91.37	32.45	33.08	58.30	102.46	52.02	58.76	19.56				
MGEOT203 GERDRUM, RONALD * 3 MI NE GRASS RANGE, MT.	15.9	64.48	110.59	0.59	64.48	39.75	8.28	56.20	110.59	43.85	51.42					
MGEOT152 CENEX*15 MI NE WINNETT MT	16	95.18	70.64	-0.32	70.64	19.25	-25.17	70.64	70.64	49.29	56.31	16.76				
MGEOT158 BASSETT, EARL * 7.5 MI NW TEIGEN MT.	17	70.90	105.48	0.44	70.90	41.19	20.33	50.57	105.48	38.28	46.38					
MGEOT059 HEDMAN, J. * 40 MI NE LEWISTOWN MT.	21	85.37	95.29	0.12	85.37	43.49	44.67	40.69	95.29	37.94	46.08					
MGEOT156 HARRIS FLOYD * 11 MI NW TEIGEN MT	19.2	68.35	90.04	0.29	68.35	38.31	11.58	56.77	90.04	45.00	52.45					
MGEOT194 FOX, DENNIS * 7 MI NW GRASSRANGE MT	20.8	35.54	122.35	1.17	35.54	32.13	-53.47	35.54	122.35	45.56	52.95					
MGEOT239 LAURENCE HESS * 1 MI N MOCCASIN MT	15	46.67	166.08	1.40	46.67	37.19	-24.59	46.67	166.08	33.34	41.90					
MGEOT204 DELANEY, DOUGLAS*7 MI NW (WILD HORSE UNIT)	23	74.05	99.87	0.33	74.05	43.02	27.90	46.15	99.87	40.22	48.14					
MGEOT050 BROOKS WARM SPRING * 2.5 MI NW BROOKS MT.	20	-9.89	169.12	2.53	-9.89	35.92	-135.23		169.12	41.47	49.27					
MGEOT195 DELANEY, DOUGLAS * 11 MI NW ROY MT	21.3	80.00	85.13	0.07	80.00	37.85	27.75	52.25	85.13	42.38	50.09					
MGEOT154 MILLER RANCH * 14 MI SE VALENTINE MT.	19.5	146.52	75.27	-0.80	75.27	28.67	2.70	72.58	75.27	55.93	62.25	23.59				
MGEOT045 CARDINAL PET CO * 10 M E HILGER MT	26.7	112.37	125.93	0.15	125.93	21.10	45.93	80.01	125.93							
MGEOT153 BUSENBARK, MERLIN*1 MI S VALENTINE MT*	27	133.83	73.49	-0.70	73.49	16.65	-27.23	73.49	73.49	56.36	62.65					
MGEOT268 QUINN'S HOT SPRINGS * JIM AND DONNA BROWN	45.1	65.79	121.07	0.68	65.79	0.00			121.07	120.69	118.74	92.33	70.05			99
MGEOT005 QUINN'S HOT SPRINGS	43.3	64.25	125.22	0.75	64.25	7.02	-46.66	64.25	125.22	122.82	120.56	94.66				99
MGEOT197 YEAGER * 8 MI EAST MOULTON, MT.	15	79.55	84.68	0.07	79.55	45.23	39.16	40.40	84.68	42.08	49.82					
MGEOT079 FINLEY, R.S.*1 MI NW ST. IGNATIUS	19	-9.53	105.88	1.90	-9.53	29.99	-148.28		105.88	42.38	50.09					
MGEOT205 SIROKY, FRANK * 9 MI EAST ROY, MT.	19	81.85	53.55	-0.40	53.55	10.49	-60.86	53.55	53.55	59.53	65.47	27.31				
MGEOT192 HORYNA, JAMES * 6 MI E ROY MT	18.4	95.34	67.59	-0.36	67.59	20.78	-25.99	67.59	67.59	56.58	62.84	24.27				
MGEOT131 CORPS OF ENGINEERS SOUTH WELL AFTER PERFS	15	89.35	125.42	0.41	89.35	37.31	39.81	49.54	125.42	35.53	43.89					
MGEOT090 BRYSON, HAROLD*1 MI W MOISE MT	15.5	60.88	108.31	0.61	60.88	40.03	3.25	57.63	108.31	57.01	63.23	24.71				
MGEOT070 YARGER, ROBERT * 13 MI W CIRCLE MT	25	98.01	148.92	0.54	98.01	86.19	90.69		148.92	45.84	53.20					
MGEOT287 SAND COULEE WTR USERS BENCH W ABV SAND COU	15	27.13	159.87	1.68	27.13	68.43	-8.62	27.13	159.87	30.21	39.06					
MGEOT193 TAYLOR, JAMES * 8 MI E CHRISTINA MT	21	92.92	61.16	-0.43	61.16	9.86	-52.08	61.16	61.16	43.85	51.42					
MGEOT288 CHARLES ENTSMINGER*TOWN OF NUMBER SEVEN	16	14.10	162.56	1.95	14.10	36.91	-83.47	14.10	162.56	46.11	53.45					
MGEOT295 CUSTER, EVERETT* EDEN RT, GREAT FALLS, MT	15.5	31.23	155.98	1.57	31.23	36.80	-51.86	31.23	155.98	50.80	57.66	18.31				
MGEOT297 TOWN OF TRACY	16	12.44	155.43	1.92	12.44	36.53	-87.52	12.44	155.43	44.71	52.19					
MGEOT054 SLOGSVOLD, A. K. * 17 M SE RITCHEY MT	21.1	25.05	173.33	1.83	25.05	56.30	-28.20	25.05	173.33	48.52	55.62					
MGEOT211 GOVER * 2.5 MI TRAVIS SCHOOL	17.5	76.53	119.91	0.52	76.53	47.74	38.45	38.08	119.91	64.92	70.27	32.91				
MGEOT200 VILLAGE INN * 2.5 MI NE TRAVIS SCHOOL	18.5	96.99	124.94	0.31	96.99	32.69	41.02	55.97	124.94	41.77	49.54					
MGEOT299 STONE, GENE	25	69.58	92.80	0.30	69.58	0.00			92.80	107.51	107.47	78.02	57.02			
MGEOT062 WEBB RES * 17.5 MI SE GERALDINE MT.	20	52.54	169.93	1.34	52.54	31.00	-27.05	52.54	169.93	40.22	48.14					
MGEOT353 HOLLAND, JIM - GREEN SPRINGS	23.7	116.03	139.80	0.24	139.80	51.73	123.24	16.56	139.80	107.00	107.03	77.47	56.52			
MGEOT248 GREEN SPRINGS * HOLLAND RANCH	26															
MGEOT191 TACKE, ROBERT * 2 MI SW GREAT FALLS MT	15	63.90	158.35	1.07	63.90	39.69	7.30	56.61	158.35							
MGEOT198 PAUL, MICHAEL(ROBINSON)*3.5M SW GREATFALLS	17	58.99	158.33	1.14	58.99	33.68	-11.45	58.99	158.33	64.56	69.94	32.53				
MGEOT318 BUTTE CREEK SPRING * SQUARE BUTTE	18.8	40.96	162.57	1.46	40.96	25.31	-57.88	40.96	162.57	59.73	65.65	27.52				
MGEOT319 BUTTE CREEK SPRING - NORTH * SQUARE BUTTE	17	38.47	149.75	1.39	38.47	29.14	-54.40	38.47	149.75	57.01	63.23	24.71				
MGEOT169 CHAMBERLAIN, CURTIS * 2 MI W LLER SCHOOL	16	92.13	63.42	-0.38	63.42	22.31	-28.59	63.42	63.42	32.96	41.56					
MGEOT321 MELTON, LARUE * LOWER AQUIFER	16	96.64	161.09	0.66	96.64	11.13	-13.96	96.64	161.09	54.13	60.65	21.74				
MGEOT314 USGS - MELTON, LEON	18.5	39.61	96.88	0.82	39.61	40.09	-31.05	39.61	96.88	65.47	70.75	33.47				
MGEOT238 SCHMIDT, LLOYD * 3.5 MI SE SQUARE BUTTE	21.8	74.66	143.59	0.78	74.66	32.01	8.85	65.81	143.59	42.38	50.09					
MGEOT190 USGS OBS WELL * .5 MI S VALLEY SCHOOL	27.1	33.68	162.09	1.58	33.68	53.82	-18.07	33.68	162.09	63.07	68.62	30.98				
MGEOT199 EIDEL * .5 MI S SUNSET MEMORIAL CEMETARY	16	84.77	115.71	0.37	84.77	61.42	64.71	20.06	115.71	41.16	48.99					
MGEOT078 WEBSTER, BONITA*BOX 443 RONAN MT	15.5	11.58	115.96	1.55	11.58	37.22	-87.73		115.96	51.13	66.90	28.97				
MGEOT099 DEMARS,TOM J.* 10 MI W OF WINIFRED MT.	17	30.65	116.22	1.19	30.65	36.41	-53.66	30.65	116.22	31.81	40.51					
MGEOT249 HOMESTEAD ACRES COUNTY WATER DISTRICT	15	32.47	162.17	1.61	32.47	41.59	-40.57	32.47	162.17	41.16	48.99					
MGEOT250 HOMESTEAD ACRES COUNTY WATER DISTRICT	15	35.58	165.22	1.58	35.58	42.88	-32.85	35.58	165.22	39.90	47.85					
MGEOT241 MCCOLLUM, JIM * 10 MI NW MATHISON RANCH	18.8	100.95	62.56	-0.50	62.56	16.15	-42.71	62.56	62.56	42.38	50.09					
MGEOT076 CARR, FRANK*BOX 456 HOT SPRINGS MT	21.5	18.67	125.83	1.52	18.67	39.37	-69.72		125.83	55.70	62.06	23.36				
MGEOT047 * RYFFEL BROS. * 3MI S & 3 MI E HIGHWOOD	18.6	40.02	134.81	1.22	40.02	34.74	-40.50	40.02	134.81	78.01	81.83	46.59	28.27			
MGEOT097 CHRISTIANSON, BOB*HOT SPRINGS MT.	22.5	66.02	119.13	0.66	66.02	41.56	13.68	52.34	119.13	58.50	64.55	26.24				
MGEOT068 TOWN OF HOT SPRINGS* MAIN WELL BY CHURCH	18.5	54.84	150.35	1.13	54.84	26.18	-33.36	54.84	150.35	67.06	72.16	35.13				
MGEOT307 HOT SPRINGS CITY	21	53.15	151.90	1.17	53.15	25.98	-36.45	53.15	151.90	76.73	80.70	45.24	27.03			
MGEOT228 LEISTNER, LAURA * CENTRAL AVE,HOT SPRINGS	29.8									115.98	114.73	87.19	65.38			
MGEOT291 SOUTH EAST OF CAMP AQUA	51.5	119.51	120.98	0.02	120.98	0.00				117.90	116.37	89.29	67.29			
MGEOT071 CORN HOLE* CAMAS HOT SPRINGS	44	105.48	120.10	0.16	120.10	19.65	35.28	84.82	120.10	108.86	108.63	79.48	58.35			
MGEOT017 CAMAS HOT SPRINGS	45	108.70	118.49	0.11	118.49	8.52	-2.55	118.49	118.49	118.19	116.62	89.60	67.58			100
MGEOT080 HOT SPRINGS MONTANA	43	107.98	120.58	0.14	120.58	7.90	-2.83	120.58	120.58	109.69	109.34	80.38	59.17			
MGEOT351 SYMES HOTEL IN HOT SPRINGS	33.3	132.15	130.82	-0.01	130.82	39.49	95.70	35.12	130.82	120.39	118.49	92.00	69.76			
MGEOT029 SYMES HOT SPRINGS WELL	38	102.31	114.75	0.14	114.75	13.73	10.78	103.97	114.75	116.72	115.36	88.01	66.12			
MGEOT081 HOT SPRING GEOTHERM WELL - UNNAMED	15	74.80	171.81	1.03	74.80	30.79	6.55	68.25	171.81	83.13	86.31	51.98	33.21			
MGEOT144 KOEPLING, DELBERT * WELL 138	15.5	90.38	126.34	0.41	90.38	0.00			126.34	87.85	90.44					
MGEOT144 OSTRANGER, DAVE * WELL 56	15.5			0.39		42.78	-98.53			47.89	55.05					
MGEOT077 VERNER, ROSE*3.75 MI W PABLO MT	17.5	50.10	117.31	0.88	50.10	62.78	18.18	31.93	117.31	52.49	59.18	20.05				
MGEOT098 IRRIGATION EQUIPMENT SALES*HOT SPRINGS	19.5	48.72	145.33	1.18	48.72	33.47	-28.35	48.72	145.33	66.89	72.01	34.95				
MGEOT220 JACOBSEN, R * HOT SPRINGS MT	19	79.21	102.28	0.29	79.21	20.05	-11.84	79.21	102.28	85.88	88.72	54.89	35.88			
MGEOT176 KOPP, ARVID * HOT SPRINGS, MT	15.2	67.39	108.85	0.52	67.39	25.84	-14.97	67.39	108.85	51.29	58.10	18.82				
MGEOT042 SUN RIVER SPRINGS	30.4															
MGEOT267 MBMG GEOTHERMAL TEST WELL #1*CAMPAQUA AREA	42.7	75.25	120.61	0.54	75.25	20.93	-15.03	75.25	120.61	88.04	90.60	57.18				

TEMPERATURES BASED ON SELECTED GEOTHERMOMETERS

Site name	Surface Temp	Na-K-Ca (B=4/3)	Na-K-Ca (B=1/3)	Mg CORRECTION Log(sqrtCa/Na)	Temperature Corrected	R Coefficient	Delta T (Mg Corr.)	Na-K-Ca Corrected	Na-K-Ca Uncorrected	Quartz (no steam)	Quartz (steam loss)	Chalcedony	a-Cristobalite	B-Cristobalite	Amorphous Silica	Published Estimates
MGEOT226 KOPP, ARVID * .25 MI S CAMPAQUA MT	32.6	87.52	100.02	0.15	87.52	14.71	-14.78	87.52	100.02	82.61	85.86	51.43	32.71			
MGEOT221 KEMP * .5 MI SE CAMPAQUA MT	28.8	97.10	113.78	0.19	97.10	17.52	3.62	93.48	113.78	85.76	88.61	54.76	35.76			
MGEOT286 JACKOLA AP 100 FT E. OF CAMP AQUA BATH SPA	51	109.26	119.23	0.11	119.23	6.84	-6.36	119.23	119.23	95.11	96.76	64.71				
MGEOT027 CAMP AQUA AREA TEST WELL	50	116.70	129.16	0.13	129.16	8.61	5.22	123.93	129.16	94.06	95.85	63.59				100
MGEOT262 MBMG GEO. TEST WELL #1 * CAMPAQUA AREA	43.7	74.99	116.72	0.51	74.99	21.69	-13.60	74.99	116.72	86.25	89.04	55.28				
MGEOT202 OLSEN, EDWIN * 8.4 MI NE WINIFRED MT	22	128.37	64.87	-0.77	64.87	30.48	-8.80	64.87	64.87	46.38	53.70	13.79				
MGEOT251 SMELSER, JAMES A. * POWER MT	16	121.58	111.36	-0.11	111.36	33.55	61.05	50.31	111.36	31.42	40.15					
MGEOT225 KEMP * 0.3 MI E CAMPAQUA MT	30.6	99.61	110.97	0.13	99.61	12.46	-7.70	99.61	110.97	95.53	97.12	65.15	45.27			
MGEOT227 KEMP * .25 MI N CAMPAQUA MT	38.9	92.46	113.25	0.24	92.46	20.92	7.26	85.20	113.25	93.21	95.11	62.68	43.01			
MGEOT224 KEMP IRR WELL (RUNAWAY) * .5 MI N CAMPAQUA	32.5	84.39	103.13	0.23	84.39	10.75	-26.72	84.39	103.13	87.80	90.40	56.93	37.75			
MGEOT173 KEMP, ANNA * HOT SPRINGS, MT *	34.4	107.11	121.90	0.16	121.90	15.62	23.95	97.95	121.90	87.68	90.29	56.80	37.63			
MGEOT091 KEMP, ANNA* 5 MI N HOT SPRINGS, MT	24	97.92	124.33	0.29	97.92	11.52	-11.76	97.92	124.33	83.25	86.42	52.11	33.33			
MGEOT174 HUGHES, RAY * HOT SPRINGS, MT	25.8	90.72	115.41	0.29	90.72	16.17	-7.38	90.72	115.41	78.44	82.20	47.04	28.68			
MGEOT219 BAXTER, C * 1.5 MI N CAMPAQUA MT	20.3	83.08	98.53	0.19	83.08	13.65	-22.28	83.08	98.53	77.45	81.33	46.00	27.73			
MGEOT175 BAXTER, CHARLES * HOT SPRINGS, MT	22.8	77.55	113.58	0.44	77.55	14.19	-27.52	77.55	113.58	65.29	70.59	33.28				
MGEOT223 LUCKY HOWSER RANCH * 3 MI SE LONEPINE MT	23.6	60.70	91.51	0.42	60.70	15.35	-46.68	60.70	91.51	62.49	68.11	30.38				
MGEOT149 MATOVICH,JOHN * 23 MI SW SUN PRAIRIE MT	16	106.44	64.86	-0.53	64.86	23.50	-23.85	64.86	64.86	40.85	48.71					
MGEOT222 GAIL PATTON RANCH * 1 MI SW LONEPINE MT	16.6	32.66	141.52	1.41	32.66	30.34	-62.21	32.66	141.52	55.04	61.46	22.67				
MGEOT075 LONEPINE OBSERVATION WELL	16.5	23.73	118.66	1.34	23.73	31.99	-75.26	23.73	118.66	59.93	65.83	27.73				
MGEOT110 STREIT, GEORGE * 4MI E- 1MI S FT BENTON MT.	15	99.19	183.28	0.81	99.19	56.92	79.55	19.64	183.28	44.71	52.19					
MGEOT243 WHITMAYER ASSOC * 4.5MI SE SUN PRAIRIE SCH	15.6	129.50	90.43	-0.44	90.43	25.98	17.38	73.06	90.43	40.85	48.71					
MGEOT109 CLARK, BRAD * 25 MI E FT. BENTON MT.	20	86.84	68.69	-0.24	68.69	55.57	37.05	31.63	68.69	30.21	39.05					
MGEOT114 LANDUSKY PLUNGE SPRINGS	24	31.75	182.01	1.78	31.75	39.46	-45.80	31.75	182.01	59.12	65.10	26.89				30
MGEOT072 LANDUSKY, I*8.5 MI S HAYS, MONTANA	20.3	35.17	180.75	1.71	35.17	35.90	-46.65	35.17	180.75	52.25	58.97					
MGEOT046 BLACK COULEE * E OF TEST AREA	28.8	107.18	90.94	-0.19	90.94	71.03	78.79		90.94	24.03	33.42					
MGEOT313 ALZHEIMER, PAUL * SW OF BRADY, MT	25	35.78	91.16	0.81	35.78	44.43	-29.79	35.78	91.16	33.34	41.90					
MGEOT312 REVERE, LEE	25	30.48	92.90	0.92	30.48	46.21	-35.70	30.48	92.90	33.34	41.90					
MGEOT049 LITTLE WARM SPRINGS*9 MI SE LODGEPOLE	26.1	48.88	174.25	1.43	48.88	38.01	-19.43	48.88	174.25	55.26	61.66					
MGEOT324 LODGEPOLE WARM SPRINGS	30	48.82	171.71	1.41	48.82	35.10	-25.01	48.82	171.71	55.93	62.25					35
MGEOT048 BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	30.6	50.01	172.28	1.40	50.01	36.56	-20.28	50.01	172.28	55.93	62.25					
MGEOT051 BIG WARM SPRINGS*6.4 MI NE ZORTMAN MT	26	41.85	165.73	1.48	41.85	37.29	-32.47	41.85	165.73	51.77	58.54					
MGEOT052 KIRKALDIE, BRUCE*7 MI SW LODGEPOLE MT	24.5	46.53	168.86	1.43	46.53	35.59	-27.85	46.53	168.86	50.80	57.66					
MGEOT037 LARGE CAPACITY WELL*4 MI SW WOLF POINT, MT	51															
MGEOT024 CITY OF WOLF POINT * WELL IN WOLF POINT	18.3	174.23	123.03	-0.48	123.03	70.58	117.01		123.03	47.99	55.15					
MGEOT023 SHERMAN HOTEL OF WOLF POINT	17.2	64.71	37.56	-0.43	37.56	25.68	-62.97	37.56	37.56	47.99	55.15					
MGEOT038 USGS TEST WELL * 1 MILE SOUTH POPLAR, MT	13.9	61.39	107.46	0.60	61.39	47.54	16.02	45.37	107.46	38.94	46.98					
MGEOT025 FOSS ELMER * 5.8 MI SE BROCTON	16.1	122.02	104.85	-0.19	104.85	25.84	35.26	69.59	104.85	55.26	61.66	22.90				
MGEOT317 LANDTECH WATER DISPOSAL SERVICE	17.9	102.22	61.52	-0.53	61.52	24.69	-26.23	61.52	61.52	54.58	61.05	22.20				
MGEOT315 THORNESS, RICK * 4 MILES NW OF BAINVILLE	15	65.27	100.32	0.46	65.27	58.52	35.39	29.88	100.32	71.09	75.72	39.33	21.61			
MGEOT108 CLAWITER, MILT * 4MI N-4MI E BIG SANDY MT.	16	105.28	97.71	-0.09	97.71	42.47	59.78	37.94	97.71	66.01	71.23	34.03	16.74			
MGEOT303 SIMS SPRING	15	15.54	135.47	1.67	15.54	43.27	-67.72	15.54	135.47	62.88	68.45	30.78				
MGEOT140 TEXACO INC * 1.7 MI NW CENTRAL SCHOOL	35.5	156.01	92.86	-0.66	92.86	20.04	5.43	87.43	92.86	72.83	77.26	41.15				
MGEOT252 MATOVAICH, MARTIN*17 MI E MALTA NEAR SACO	42	68.06	158.77	1.01	68.06	32.52	0.16	67.90	158.77	57.66	63.80					
MGEOT111 SLEEPING BUF REC AREA * 4MI NNW ASHFIELD	41.3	71.17	155.20	0.94	71.17	36.32	12.16	59.02	155.20	57.66	63.80					45
MGEOT145 SHIRLE, WALTER * 3 MI S FRESNO DAM.	17.5	104.64	65.18	-0.51	65.18	35.53	1.67	63.51	65.18	29.81	38.69					
MGEOT106 PIMLEY, DON * 4 MI NW JOPLIN MT.	15	91.58	59.98	-0.43	59.98	39.79	1.44	58.54	59.98	30.21	39.06					
MGEOT105 CADY, ELWIN * 7.5 MI NW JOPLIN MT.	25	96.12	63.76	-0.43	63.76	42.66	12.08	51.68	63.76	47.99	55.15					
MGEOT309 FRANCIS, CLARA	29	31.89	126.42	1.28	31.89	37.75	-48.85	31.89	126.42	51.72	57.42	29.58				
MGEOT107 WELSH, ORVILLE * 13 MI N-3MI E HINGHAM MT.	16	92.86	65.82	-0.36	65.82	28.38	-11.79	65.82	65.82	38.61	46.68					
MGEOT310 EDWARDS, MARVIN / MIKE DUSTERHOFF	25	70.51	46.04	-0.37	46.04	27.92	-44.01	46.04	46.04	25.45	34.71					
MGEOT039 BIG WEST OIL CO * 2 MI NE MTN VIEW SCHOOL	46															
MGEOT104 RYGH, KEN * 22 MI N - 5 MI W JOPLIN MT.	21	110.67	65.40	-0.57	65.40	53.07	29.37	36.02	65.40	34.82	43.24					
MGEOT142 BRADBURY, ALFRED * 11 MI E WILD HORSE MT	15.5	95.99	72.73	-0.30	72.73	22.41	-15.03	72.73	72.73	29.39	38.31					
MGEOT144 NAGEHUS, ORVILLE * 3 MI N SIMPSON MT.	15.5	85.64	73.17	-0.17	73.17	25.02	-8.42	73.17	73.17	35.89	44.21					