Hydrogeology of the Upper Beaverhead Basin near Dillon, Montana

William Uthman and James Beck

Montana Department of Natural Resources and Conservation

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Front cover

The Blacktail Deer Creek Valley
by
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The photograph shows the Blacktail Deer Creek valley, with the Blacktail Range in the background and the East Bench Irrigation District Canal in the foreground. The view is south.

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ACKNOWLEDGMENTS

The success of the Beaverhead Groundwater Project resulted from the cooperation and support of private entities and government agencies, which supplied funding, and numerous, interested citizens of Beaverhead County, who provided access to their property. We take this opportunity to express our thanks. Private entities and government agencies participating with the Montana Department of Natural Resources and Conservation (DNRC) include the East Bench Irrigation District (EBID) of Dillon, the Montana Power Company (MPC), the U.S. Bureau of Reclamation (USBR), and the U.S. Geological Survey (USGS).

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ABSTRACT

The Beaverhead Groundwater Project was conducted from 1991 through 1996 to determine the impacts of groundwater development on groundwater levels and surface water availability. The project encompasses the upper Beaverhead basin between Dillon and Barretts, including the major tributary valleys of Blacktail Deer and Rattlesnake creeks. The project objectives were addressed by the drilling of observation wells and characterizing the geology of the aquifers, documenting the occurrence and movement of groundwater, determining hydraulic properties by analyzing drawdown impacts through aquifer testing, measuring streamflow, evaluating surface water-groundwater interactions, determining water quality, and modeling groundwater flow.

Three aquifers occur in the project area. These include (1) the bedrock aquifer, surrounding the upper Beaverhead basin, which recharges the valley-fill aquifers; (2) the fine-grained, lower Tertiary aquifer, which produces low yields of water; and (3) the coarse-grained Quaternary/upper Tertiary aquifer. The Quaternary/upper Tertiary aquifer is the most important aquifer of the upper Beaverhead basin because it is capable of supporting large groundwater withdrawals.

A large volume of groundwater is stored in the Quaternary/upper Tertiary aquifer and is available for use. Groundwater is recharged from the bedrock of the nearby mountains. Based on groundwater-level data, groundwater flows northwest in the Blacktail Deer Creek valley, southeast in the Rattlesnake Creek valley, and northeast along the Beaverhead River floodplain between Barretts and Dillon. Groundwater levels have not steadily declined as a result of the current level of groundwater development, but fluctuated annually in response to recharge. Groundwater levels declined during times of below-average precipitation, and rose during times of above-average precipitation. Groundwater levels were lowest in late spring and highest in mid to late summer. In the irrigation well fields, localized drawdown occurred during the summer as a result of pumpage, but groundwater levels rapidly recovered after irrigation ended.

Aquifer test analyses indicate that the hydraulic properties of the Quaternary/upper Tertiary aquifer are favorable for producing and sustaining large groundwater withdrawals without causing adverse, widespread drawdown impacts. Streams were not affected by drawdown from irrigation wells because the drawdown remained localized in the well fields, and streams were already losing naturally in the irrigated agricultural areas.

Streamflow in the Beaverhead River was greater at Barretts than at Dillon during the summer. During the non-irrigation season, streamflow was greater at Dillon. The Beaverhead River lost water to the aquifer between Barretts and the Interstate 15 exit at Highway 278. From this point north to Dillon, the Beaverhead River floodplain is a groundwater discharge area where streamflow increased from baseflow accretions. Rattlesnake Creek and the upper reaches of Blacktail Deer Creek were losing streams. Large irrigation diversions also decreased their streamflow. The EBID Canal and Canyon Ditch did not lose significant amounts of water across the lower Blacktail Deer Creek valley.

Water quality was generally very good for consumptive and irrigation uses. Chemical constituents fell below maximum limits of the U.S. Environmental Protection Agency National Primary and Secondary Drinking Water Regulations. Age-dating techniques showed that groundwater ages were less than 10 years to more than 20 years.

Surface water-groundwater interactions were assessed using groundwater flow models. An initial model, developed from the extensive data collected, was calibrated so that calculated heads reasonably simulated observed heads. Four predictive groundwater models, derived from the initial model, were used to evaluate the impacts on surface water availability from various degrees of groundwater development and drought conditions. Two of the predictive models evaluated impacts on baseflow to the Beaverhead River from groundwater development ranging from no development to double the current level. These two predictive models show that baseflow varied slightly, when compared with the initial model, and that irrigation wells have not substantially impacted the baseflow accretions. The third predictive model evaluated impacts on baseflow from a severe three-year drought. The results indicate that below-average precipitation had less effect on baseflow accretions than irrigation return flow. The fourth predictive model assessed the impact on baseflow of flood irrigation return flow and demonstrated that baseflow accretions were larger due to the increased return-flow recharge caused by more water applied during flood irrigation. All models demonstrated that irrigation return flow was a significant component of baseflow.

In conclusion, groundwater development for irrigation use has not adversely affected groundwater levels nor has it significantly impacted surface water availability.

INTRODUCTION

Problem

Groundwater development for irrigation use has significantly increased in agricultural areas near Dillon over the last several decades. The area has also experienced some years of drought and chronic water shortages, which have created water rights disputes concerning the potential impacts of these groundwater developments on surface-water users and streamflow in the Beaverhead River. The Beaverhead River also provides flow for hydropower facilities, which might be affected during periods of low streamflow.

Because of these concerns, the 1991 Montana Legislature established a partial closure in the Beaverhead River basin to new groundwater appropriation for irrigation use until June 30, 1996. This closure would allow time to conduct a groundwater investigation to assess the effects that groundwater withdrawals might have on groundwater levels and streamflow in the Beaverhead River before issuing any new groundwater irrigation permits. The Beaverhead Groundwater Project was initiated to address these concerns.

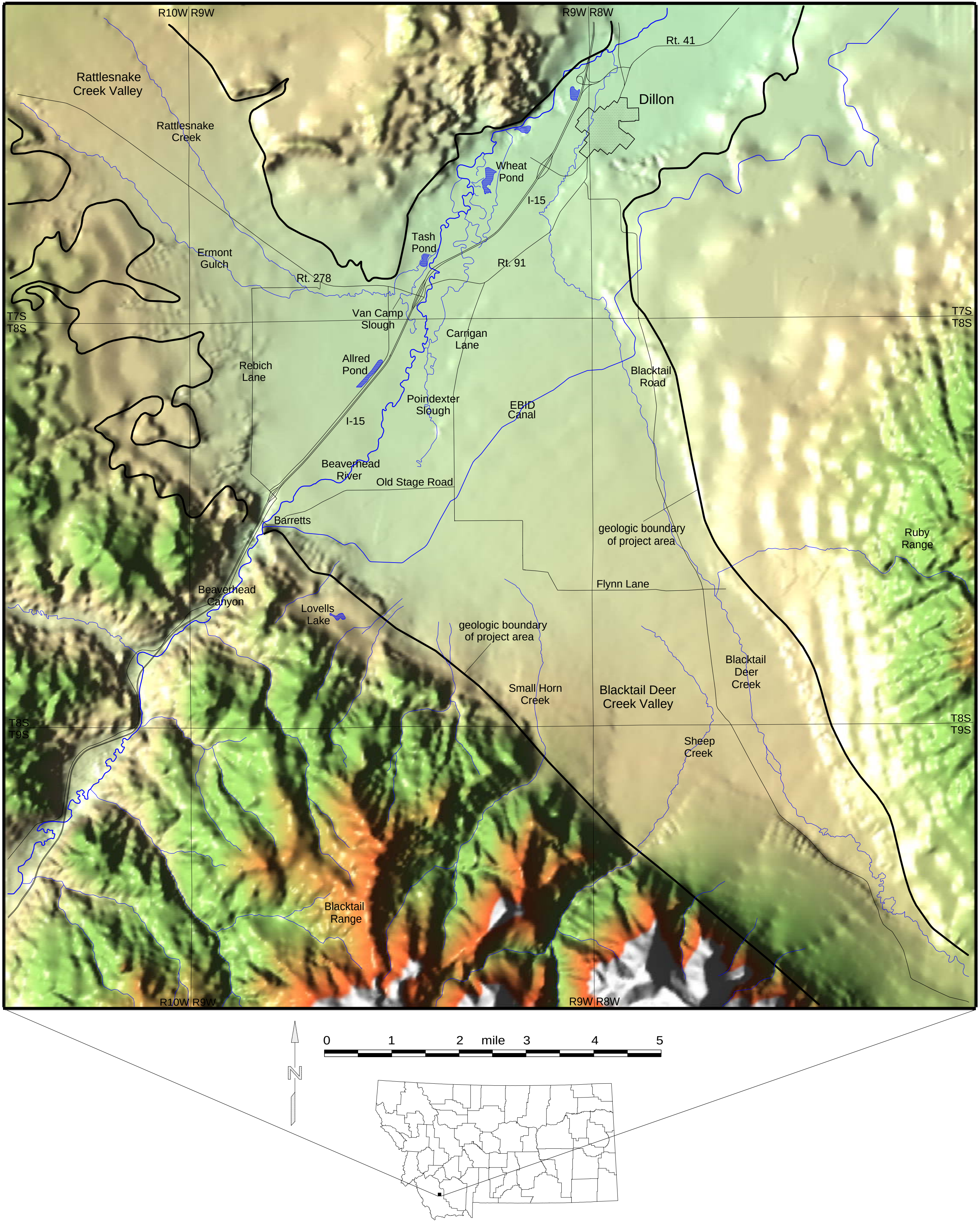
Background

Project Location. The project encompasses the upper Beaverhead basin between Dillon and Barretts, including the major tributary valleys of Blacktail Deer and Rattlesnake creeks (Figure 1).

Physiography. The 710-square mile Beaverhead intermontane basin (Kendy and Tresch 1996) is one of the largest basins of southwest Montana. The main axis of this irregularly-shaped basin extends southwest from the confluence of the Beaverhead and Big Hole rivers near Twin Bridges up the Beaverhead River valley to Barretts, where the river emerges from the narrow Beaverhead Canyon. The Beaverhead basin is bounded by the Blacktail Range on the south, the Pioneer Mountains on the west, the Ruby Range on the east, and the Tobacco Root Mountains on the northeast. At the lower end, one arm of the basin extends southeast up the Ruby River between the Tobacco Root Mountains and the Ruby Range, and another arm extends north toward Melrose along the Big Hole River between the Pioneer and Highland mountains. At the upper end of the basin, which is the focus of this project, a third arm extends northwest along Rattlesnake Creek, and a fourth extends southeast along Blacktail Deer Creek. The Beaverhead River floodplain is flanked by dissected alluvial fans along the basin margins.

The drainage area of the upper Beaverhead basin at Dillon, which includes upstream basins, is 2,895 square miles (Shields et al. 1996). Within the project area, the mean elevation averages about 5,200 feet. Elevations range from about 5,100 feet at Dillon to about 5,700 feet in the Blacktail Deer Creek valley near the USGS gaging station in Section 14, Township 9 South (T9S), Range 8 West (R8W), and 6,150 feet near Argenta in Section 29, T6S, R10W, where Rattlesnake Creek emerges from the Pioneer Mountains onto its alluvial plain.

Figure 1. Project Location in the Upper Beaverhead Basin, Beaverhead County, Montana



The Beaverhead River originates at the confluence of the Red Rock River and Horse Prairie Creek, located about 23 miles southwest of Dillon. The Beaverhead River flows through the narrow, steep-walled Beaverhead Canyon for about 15 miles before entering the upper Beaverhead basin at Barretts. Near Dillon, the Beaverhead River is joined by Blacktail Deer and Rattlesnake creeks, its major tributaries in the upper Beaverhead basin. About 35 miles downstream from Dillon, the Beaverhead River joins the Big Hole and Ruby rivers to form the Jefferson River, one of the three forks of the upper Missouri River.

The Blacktail Deer Creek valley originates in the Snowcrest Range and extends northwest for approximately 40 miles. The stream meanders across a narrow floodplain along the northeast side of the Blacktail Range to Sheep Creek in T9S, R8W, where it emerges onto a coalescing alluvial fan/alluvial plain complex sloping gently northwest toward the Beaverhead River. Its total drainage area is 312 square miles (Shields et al. 1996).

The Rattlesnake Creek valley extends southeast for approximately 22 miles from where its headwaters originate in the southern Pioneer Mountains. The stream discharges to the Beaverhead River about 11 miles southeast of Argenta. The total drainage area is about 24 square miles (Shields et al. 1996).

The climate of the upper Beaverhead basin is semi-arid and typical of the mountain valleys of southwest Montana. Winter temperatures may drop below 0EF, and summer temperatures may rise to 90+EF. However, based on annual records of the National Oceanic and Atmospheric Administration (NOAA), average temperatures generally range from 24EF in winter to 66EF in summer. The mean annual temperature is about 44EF (NOAA 1996). The mean annual precipitation at Western Montana College of The University of Montana in Dillon is 11.47 inches, based on 50 years of NOAA records from 1948 to 1997.

Clark Canyon Dam and Irrigation. The economy of Beaverhead County is based almost exclusively upon agriculture, with alfalfa as one of the important crops. Water for agricultural irrigation has traditionally been provided by the Beaverhead River and its tributaries since the late 1800s. Major irrigation diversions control the summertime flow of the Beaverhead River, sometimes significantly diminishing the flow.

In the 1960s, Clark Canyon Dam was constructed at the confluence of the Red Rock River and Horse Prairie Creek. With a total holding capacity of 255,600 acre-feet (ac-ft) (Shields et al. 1996), Clark Canyon Reservoir must satisfy irrigation water rights for the valley lands between Barretts and Twin Bridges, which had historically been irrigated with decreed rights from surface flows. Clark Canyon Reservoir provides additional irrigation water for a secondary water service contract of 21,800 acres, administered by the East Bench Irrigation District of Dillon. The water provided by the East Bench Irrigation District is conveyed downvalley by the East Bench Irrigation District Canal, the largest diversion on the Beaverhead River. There are several other diversions between Barretts and Dillon. Flood irrigation has been the principal type of irrigation system; however, the use of sprinkler irrigation has become more widespread in recent decades.

Groundwater Appropriations. As agriculture developed, groundwater use for irrigation expanded. In the 1930s, the first irrigation wells were drilled in the area. It was not until the 1950s, however, that the Blacktail Deer Creek valley experienced major development with the filing of numerous water use claims. The Blacktail Deer Creek valley also experienced substantial groundwater development during the 1960s. Prior to 1973, water rights claims totaling 32,344 acre-feet, or about 71% of the volume appropriated through 1990, had been filed. Groundwater development continued through the 1970s and into 1981 in the Blacktail Deer Creek valley. Only a few permits, amounting to about 3% of the total appropriated volume, have been issued in the Blacktail Deer Creek valley since 1981. Generally, permitted volumes are based on a maximum anticipated use, and actual use during many years would be less than permitted volumes.

Groundwater development in the Rattlesnake Creek valley had been slow prior to 1973, with five filed water use claims. Most permitting activity in this area occurred during the 1980s, with appropriations of 3,884 ac-ft, or about 76% of the appropriated volume of groundwater through 1990. Tables 1 and 2 summarize groundwater development in the Blacktail Deer and Rattlesnake creek valleys.

Table 1. Groundwater Development in the Blacktail Deer Creek Valley through 1990

Decade	Incremental Development (ac-ft)	Cumulative Development (ac-ft)
1930s	360	360
1940s	0	360
1950s	21,004	21,364
1960s	10,980	32,344
1970s	6,858	39,202
1980s	3,360	45,562

Table 2. Groundwater Development in the Rattlesnake Creek Valley through 1990

Decade	Incremental Development (ac-ft)	Cumulative Development (ac-ft)
1930s	183	183
1940s	0	183
1950s	0	183
1960s	452	635
1970s	575	1,210
1980s	3,884	5,094

The Beaverhead Groundwater Project

With continuing development of additional land irrigated by groundwater and the drought years of 1988 to 1990, the local irrigators, who suffered irrigation water shortages, became concerned over the continued sustainability of the area's groundwater production and the effects of groundwater withdrawal on streamflow in the Beaverhead River. Irrigators contended that the cumulative impact of groundwater development and drought were diminishing baseflow accretions to the Beaverhead River, which would result in lower streamflow and chronic water shortages, creating irrigation diversion restrictions.

Irrigation return flow to the Beaverhead River provides 40% to 50% of the irrigation water needed to supply the valley lands (Chamberlin 1996). If return flow were diminished by groundwater development, decreased baseflow to the Beaverhead River, and resultant decreases in streamflow, would require additional releases of water from Clark Canyon Reservoir to satisfy downstream uses. If the additional releases of water were insufficient to irrigate the valley lands, the East Bench Irrigation District could be denied water. Downstream hydropower production could also be impacted by decreased streamflow in the Beaverhead River.

Consequently, the DNRC, which has responsibilities of water resource management, faced serious allegations about the proper management of groundwater resources from agricultural and hydropower interests. The level of detailed hydrogeological information in the 1980s prevented the DNRC from credibly evaluating the question. Groundwater studies in the upper Beaverhead basin had been either too site-specific or too general, such as those conducted by McMurtrey (1965, 1966), Botz (1967), and McMurtrey and Reed (1967, 1968). Technically sound water management strategies could be based only on an understanding of the basin's groundwater resources, obtained through detailed, extensive studies.

The Beaverhead Groundwater Project began in 1990 as a joint cooperative effort of several government agencies and private entities. The DNRC served as principal investigator, with field and technical support from the East Bench Irrigation District of Dillon, the U.S. Geological Survey, and the University of Montana Geology Department. Funding for the project was provided by the Montana Legislature ($100,000), the U.S. Bureau of Reclamation ($250,000), the Montana Power Company ($50,000), and DNRC in-kind services. This mix of funding represented a cooperative effort among state, federal, local, and private entities. Furthermore, the implementation of House Bill 745 on April 4, 1991 to establish a partial basin closure in the Beaverhead basin to groundwater use for irrigation, mandated that a study be conducted to determine the impacts of groundwater appropriation. Field investigations began in July 1991 and ended in September 1996. Project analyses were completed in December 1997.

The objectives of the Beaverhead Groundwater Project were to evaluate the effects of groundwater development on surface water availability and groundwater levels, including drawdown impacts from irrigation wells. The study had widespread public support and cooperation, which allowed access to private property for project activities. The study was structured to provide a detailed, technical, hydrogeological framework on which groundwater management strategies could be based to ensure that groundwater development would not cause over-production from the aquifers or adversely affect water rights which might depend on baseflow to the Beaverhead River. The project objectives were addressed by the drilling of monitoring wells and characterizing the geology of the aquifers, documenting the occurrence and movement of groundwater, determining hydraulic properties by analyzing drawdown impacts through aquifer testing, measuring streamflow, evaluating surface water-groundwater interactions, determining water quality, and modeling groundwater flow.

PRECIPITATION

Methods

The annual reports of the National Oceanic and Atmospheric Administration provided total monthly precipitation data for the recording station at Western Montana College of The University of Montana in Dillon.

Results and Interpretations

Monthly precipitation totals recorded from 1991 through 1996 are shown in Table 3 and Figure 2. The mean annual precipitation for the six-year period was 12.09 inches. The precipitation in 1992, 1994, and 1996 was below average. The precipitation in 1993 and 1995 was above average. The precipitation for 1991 was near average.

Table 3. Total Monthly Precipitation (inches) at Western Montana College, Dillon

Month	1991	1992	1993	1994	1995	1996
Jan	0.06	0.12	0.31	0.12	1.03	0.19
Feb	0.00	0.14	0.58	0.39	0.10	0.66
Mar	0.75	0.36	1.38	0.54	0.90	1.10
Apr	1.56	1.18	1.56	1.06	3.09	0.79
May	2.97	1.46	2.75	0.98	4.32	2.87
Jun	2.12	2.99	2.07	1.16	3.96	0.54
Jul	0.40	0.93	4.01	1.22	1.68	0.00
Aug	0.64	0.17	2.21	0.93	1.01	0.17
Sep	1.38	0.25	0.09	0.09	2.05	0.37
Oct	0.89	0.14	1.47	1.86	0.56	0.32
Nov	0.70	0.54	0.04	0.33	0.10	0.44
Dec	0.00	0.24	0.08	0.35	0.36	0.38
Total	11.47	8.52	16.55	9.03	19.16	7.83

A precipitation record, presented in Figure 3, for the 50-year period from 1948 to 1997 compares longer-term precipitation patterns with those observed during the project. The mean annual precipitation for the 50-year period is 11.47 inches. This 50-year period includes 27 years of above-average precipitation and 23 years of below-average precipitation. Periods of consecutive dry years ranged in length from two to six years, with an average length of three years. The longest drought period during the 50-year record was six consecutive years from 1949 through 1954. The last multi-year drought period observed in the project area occurred between 1988 and 1990. Precipitation patterns observed during the 1990s, when the project was being conducted, differed from patterns observed earlier in the 50-year period. During the 1990s, three of the highest precipitation years of the 50-year record occurred. Precipitation in the 1990s alternated annually between above- and below-average amounts.

Figure 2. Monthly Precipitation from 1991 through 1996

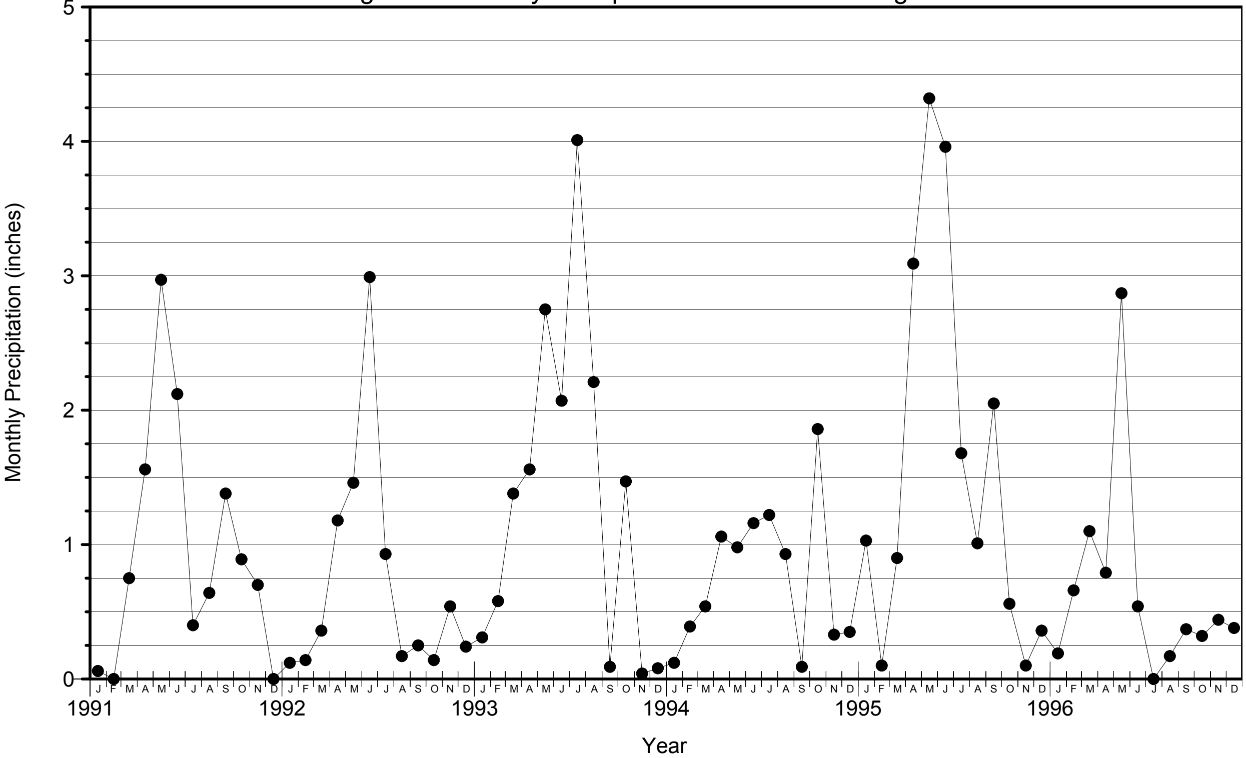
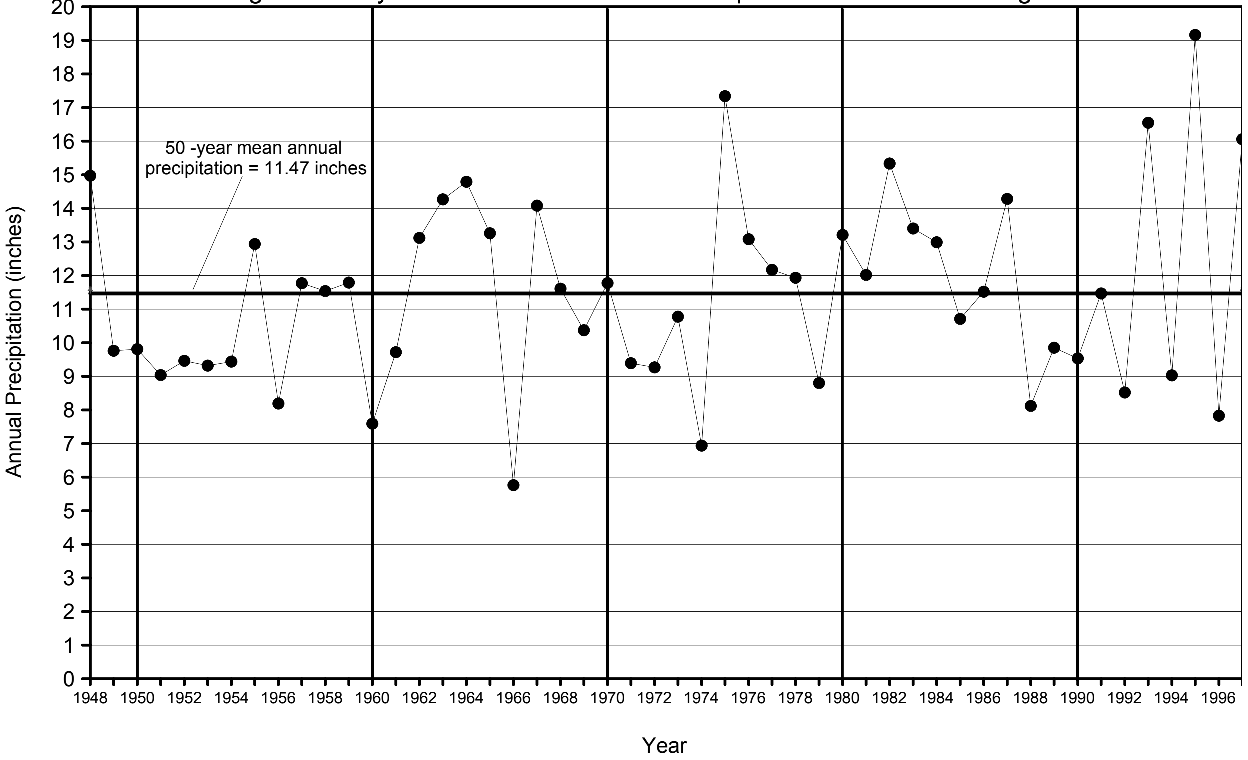


Figure 3. Fifty-Year Record of Annual Precipitation from 1948 through 1997



Summary

The 50-year precipitation record averaged 11.47 inches per year. During this 50-year period, there were more years of above-average than below-average precipitation. Multi-year drought periods averaged three years in length. The last multi-year drought period occurred between 1988 and 1990. The mean annual precipitation from 1991 through 1996 was 12.09 inches. Precipitation during this period alternated between above- and below-average amounts. Three of the highest precipitation years of the 50-year record occurred in the 1990s.

GEOLOGY

Methods

The general geology of southwest Montana was examined by reviewing the previous work, including geologic and geophysical maps of the Dillon 1° x 2° quadrangle. The subsurface geology of the project area was characterized by drilling 47 new observation wells and describing the borehole cuttings, preparing well lithology and geologic cross-section diagrams, examining available well lithology logs, and conducting seismic refraction profiling.

Observation well drilling sites were chosen based on various intended uses. Well sites were selected to measure groundwater levels, to serve as aquifer test observation wells, to observe the influence of surface water on groundwater levels, and to explore the subsurface geology. Wells drilled on private land required long-term property access easements with individual property owners. The USBR drilled the first seven observation wells, the 91-series wells, during autumn 1991. The DNRC contracted three drilling contractors to complete the remaining 40 observation wells. Drilling of the 92-series wells began in autumn 1992 and was completed in spring 1993. The three 93-series wells were drilled in autumn 1993, and the two 94-series wells were drilled in summer 1994. Original well lithology reports have been archived for reference in the Ground-Water Information Center (GWIC) database at the Montana Bureau of Mines and Geology, Montana Tech of The University of Montana, Butte, Montana.

Well drilling was conducted with air-rotary drilling rigs. Borehole cuttings were collected and examined at 5-foot depth intervals. The 91-series observation wells were constructed of 2-inch PVC casing and a 10-foot PVC slotted screen at the bottom of each well. The 92- through 94-series observation wells consisted of 6-inch steel well casing, and most were perforated along a 5- to 10-foot interval near the bottom. All wells were developed until the discharge was free of sand and turbidity. Well development usually required approximately 15 minutes, but a few wells required up to three hours. Following completion, a permanent measuring point was marked at the top of the well casing, static groundwater level and distance from the measuring point to the ground surface were measured, and the well casing was fitted with a lockable cap and padlock.

The USGS conducted 10 seismic refraction profiles to estimate the thickness of valley-fill sediments overlying bedrock. This geophysical method requires a surficial source of energy, such as an explosive charge, which propagates into the geologic materials. Based on the assumption that layered geologic materials have progressively greater seismic velocities with increasing depth, seismic energy propagating downward encounters refracting geologic surfaces. The energy refracting along these surfaces produces seismic waves that return to the surface, where they are detected by geophones and recorded by data loggers for analyses.

Results and Interpretations

Geologic Time Scale. A geologic time scale (Palmer 1983) is presented in Table 4 for reference to approximate geologic ages indicated for lithologic units and tectonic events.

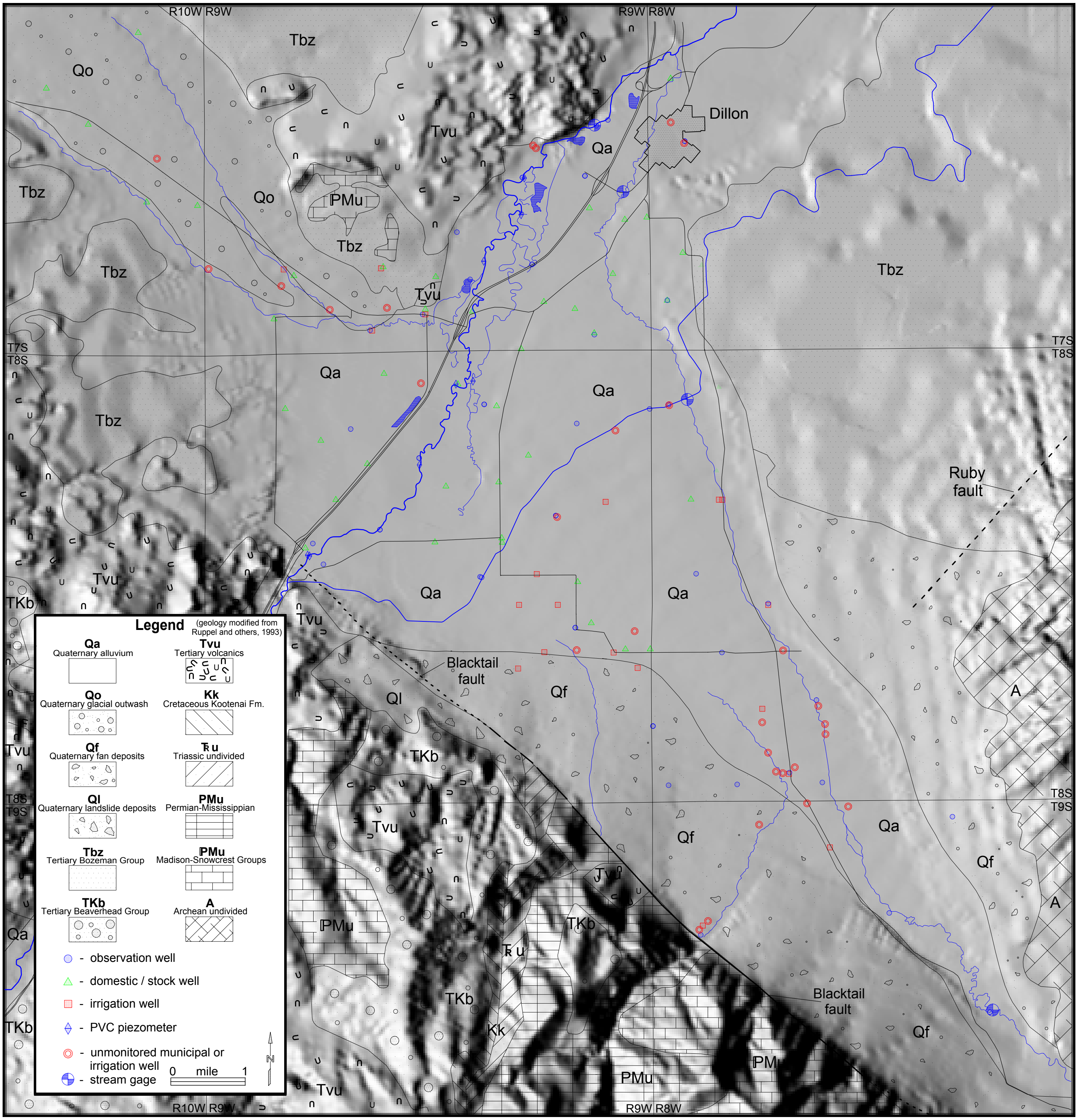
Table 4. Geologic Time Scale
(modified from Palmer 1983)

Era	Period	Epoch	Approximate Age (million years)	Duration (million years)
Cenozoic	Quaternary	Holocene	0 - 0.01	0.01
		Pleistocene	0.01 - 2	2
	Tertiary	Pliocene	2 - 5	3
		Miocene	5 - 24	19
		Oligocene	24 - 37	13
		Eocene	37 - 58	21
		Paleocene	58 - 66	8
Mesozoic	Cretaceous		66 - 144	78
	Jurassic		144 - 208	64
	Triassic		208 - 245	37
Paleozoic	Permian		245 - 286	41
	Pennsylvanian		286 - 320	34
	Mississippian		320 - 360	40
	Devonian		360 - 408	48
	Silurian		408 - 438	30
	Ordovician		438 - 505	67
	Cambrian		505 - 570	65
Precambrian			570 - 4,600	4,030

Previous Geologic Investigations. Numerous investigators have elaborated on the stratigraphy, structural framework, and tectonic evolution of southwest Montana, including the Beaverhead basin. Selected studies include those of Pardee (1950), Alden (1953), Hamilton (1963, 1978), Richmond (1965), Hamilton and Myers (1966), Stewart (1978), Reynolds (1979), Chadwick (1980, 1981), Ruppel (1982, 1993), Ruppel and Lopez (1984), Tysdal (1988), and Hanna et al. (1993). Ruppel et al. (1993) have compiled a geologic map of the Dillon 1° x 2° quadrangle, which covers a large region of southwest Montana. A portion of this geologic map covering the project area is presented in Figure 4. Descriptions of lithologic units in Figure 4 are presented in Appendix A1.

The earliest Cenozoic basin studies of southwest Montana were reconnaissance investigations. Hayden (1872) described Tertiary strata as lacustrine in origin and Peale (1896) named the Tertiary strata the “Bozeman lake beds.” Other early studies, listed in Fields et al. (1985), were descriptive and did not deal with regional structural or tectonic evolution or Cenozoic sedimentary deposits in southwest Montana. Robinson (1963) initiated a formal stratigraphic nomenclature for Tertiary rocks in the Three Forks basin of southwest Montana by assigning to the Bozeman Group the “Tertiary fluvial, eolian, and

Figure 4. Generalized Geology of the Upper Beaverhead Basin



lacustrine rocks which accumulated in the basins of western Montana after the Laramide orogeny." Further work by Robinson (1967), Kuenzi (1966), Kuenzi and Fields (1971), Hoffman (1971), and Petkewich (1972) has led to subdivision of the Bozeman Group into the Sixmile Creek and Renova formations. Because of problems in identifying Bozeman Group lithostratigraphy, Hanneman and Wideman (1991) have used sequence stratigraphy to facilitate the correlation of Cenozoic sediments. Later Cenozoic intermontane basin geology studies have integrated structural, tectonic, sedimentological, and paleontological data from the basins of southwest Montana.

Intermontane Basin Development. Ruppel (1993) identifies the Beaverhead basin as one of many Tertiary intermontane basins of southwest Montana that share tectonic origins and sedimentological similarities. The beginning of basin formation is not known, but it is accepted that the basins generally began to form in the middle Oligocene (Ruppel 1993). Basins had developed to their current configurations by the early Miocene (Fields et al. 1985) as down-dropped fault blocks that formed through basin-and-range crustal extension. As basin subsidence continued throughout Tertiary times, sediments accumulated to thicknesses of several thousand feet. The basins contain four distinct lithologies of Cenozoic continental clastic sediments, separated by erosional and angular unconformities (Robinson 1960, Kuenzi and Fields 1971).

The upper Beaverhead basin is bounded by the northwest-trending Blacktail fault along its southern margin. The Blacktail fault dips steeply to the southwest. Several other large fault zones either bound, cross, or extend through portions of the upper basin. These include the Badger Pass, the Ruby, the Beaverhead Rock, the Virginia City, and the McCartney fault zones (Ruppel et al. 1993).

The thickness of the Beaverhead basin is not precisely known; however, gravity and seismic data and lithologic descriptions from two deep drillholes provide approximations of the thickness of the basin sediments and the depth to crystalline basement rock. The lower end of the basin is the deepest, where gravity data (Hanna et al. 1993) indicate a maximum thickness of sediments of almost 5,000 feet. Southeast of Twin Bridges, a borehole drilled to over 3,500 feet, penetrates metamorphic rocks at a depth of about 2,100 feet (Ruppel 1993). Between Dillon and Twin Bridges, where the McCartney and Virginia City fault zones extend into the basin, the depth to basement rock ranges from about 3,300 feet to 5,000 feet (Hanna et al. 1993). North of Dillon, near the center of the valley between the Beaverhead Rock and Ruby fault zones, the thickness of the basin is about 1,700 feet. This depth is based on data from an 8,200-foot well, which penetrates the contact of Tertiary rocks and basement rocks at a depth of about 1,700 feet (Ruppel 1993). Near the basin margin along the Ruby fault zone east of Dillon, gravity data (Hanna et al. 1993) indicate that depth to basement rock is about 3,000 feet. The depth of the basin at its upper end, along the Blacktail fault, ranges from about 1,500 feet to 3,300 feet (Hanna et al. 1993). Magnetic data, discussed by Hanna et al. (1993), also indicate that the Beaverhead basin is floored mostly by Archean crystalline metamorphic rocks (approximately 2,500 to 3,800 million years before present).

Tertiary sediments of the Beaverhead basin belong to the Bozeman Group Renova and Sixmile Creek formations. Geologic age dates are based on fossil vertebrates (Kuenzi and Fields 1971). The lower Tertiary unit, the Renova Formation, is dominated by fine-grained, volcanic-rich mudstones, siltstones, and sandstones with interbeds of limestone and lenses of cemented gravels. The Renova Formation contains mostly fluvial, lacustrine, and paludal sediments that were deposited regionally in the middle Tertiary in a broad area of subdued topography (Kuenzi and Fields 1971, Fields et al. 1985). The voluminous sediment accumulations and sedimentary structures suggest arid conditions (Thompson et al. 1981, 1982). Deposition ended by the early Miocene and was followed by a regional uplift and subsequent erosion that removed a large quantity of Renova material.

Deposition of the upper Tertiary unit, the Sixmile Creek Formation, began in the middle Miocene and ended in the late Miocene (Fields et al. 1985). The Sixmile Creek sediments are characterized as darker and coarser than Renova sediments and include alluvial fan, channel fill, mudflow, and debris-flow deposits. A combination of a desert-like climate, that diminished protective vegetative cover, seasonal torrential precipitation, that transported enormous quantities of debris downslope to overload regional stream systems, and renewed regional uplift caused accumulation of coarse sediments on coalescing alluvial fans (Thompson et al. 1981, 1982). The Sixmile Creek sediments lie uncomformably on the tilted Renova materials. Following deposition of the Sixmile Creek Formation, an undetermined quantity of sediment was eroded during the Pliocene.

Numerous investigations of Tertiary-age rocks, such as those of Kuenzi and Fields (1971), Hoffman (1971), and Petkewich (1972), have dated and correlated Tertiary stratigraphy in the lower Beaverhead basin. Monroe (1976) has extended the Tertiary lithostratigraphy to the upper Ruby basin. Although there have been geologic investigations of Tertiary rocks in the lower Beaverhead basin, there have been none in the upper part of the basin because the fossil evidence used for age dating is generally unavailable. Lithostratigraphic age dating of sediments is discouraged because the Renova and Sixmile Creek formations may contain nearly identical lithology (Hanneman and Wideman 1991). Tertiary valley-fill sediments, as described by Fields et al. (1985) and Ruppel et al. (1993), are found on the foothills near Dillon. Based on lithologic observations and interpretations, Tertiary sediments are believed to underlie Quaternary sediments throughout the project area. The Tertiary rocks of the upper Beaverhead basin are best described from well logs.

Quaternary valley-fill sediments of the Beaverhead basin were deposited upon the Tertiary strata to a depth of several hundred feet near the center of the basin. They are characterized as mixtures of poorly sorted colluvial and alluvial fan deposits along the basin margins and fluvial deposits along the streams. Glacial deposits also occur in the upper Beaverhead basin. The Pioneer Mountains were glaciated during the Pleistocene. Alden (1953) states that the Rattlesnake Creek valley was glaciated to within one mile of Argenta. Northwest of Argenta, there are terminal and lateral moraines. The Rattlesnake Creek valley, a sloping planar surface from Argenta to its confluence with the Beaverhead River, is strewn with large cobbles and gravels. Ruppel et al. (1993) indicate that glaciofluvial outwash extends down the Rattlesnake Creek valley to Section 33, T7S, R9W.

Aquifers. The preceding overview of the geology of the Beaverhead basin provides a framework for understanding the interrelationships between geology and groundwater systems. The various rock types serve as the area's aquifers and may be grouped into three categories. These include the Archean to Cretaceous bedrock aquifer, the lower Tertiary aquifer, and the Quaternary/upper Tertiary aquifer.

The bedrock aquifer is comprised of the various pre-Cenozoic rocks along the basin margins. Aquifer properties are a result of secondary porosity created by the development of fractures, joints, and solution cavities. Although the bedrock aquifer may produce only small yields to individual wells, it provides significant groundwater recharge to the valley-fill aquifer. Bedrock recharge originates as snowmelt and rainfall over the mountains. This recharge is important in sustaining the groundwater in storage in the valley-fill aquifer.

The lower Tertiary aquifer is comprised of several thousand feet of sandy clays and siltstone that overlie basement bedrock. The thick lower Tertiary aquifer contains a large volume of groundwater in storage. However, it typically has poor hydraulic properties and does not easily transmit or release groundwater. It is relatively impermeable, and yields of water are low because groundwater is tightly bound to fine-grained materials and not easily released from storage. Wells completed in the lower Tertiary aquifer often do not produce usable amounts of water; however, when water is produced, the yields are usually sufficient only for domestic wells.

The Quaternary/upper Tertiary aquifer includes Quaternary fluvial and glacial sediments and Tertiary alluvial fan sediments that may be locally cemented. The contact between the Quaternary and upper Tertiary parts of the aquifer cannot be determined precisely from borehole cuttings because of similar lithologies. This aquifer overlies the thick, lower Tertiary aquifer. When thick sequences of fine-grained sediments were penetrated in a borehole, the contact between the coarse- and fine-grained sediments was interpreted as the contact between the Quaternary/upper Tertiary and the lower Tertiary aquifers.

The Quaternary/upper Tertiary aquifer is generally unconfined, and sequences of silt and clay, which may locally separate and confine coarse-grained deposits, are usually spatially discontinuous and hydraulically interconnected with more permeable materials. Thicknesses and textures may rapidly change spatially so that one layer may be very productive and production from another layer may be limited. The aquifer, which ranges in total thickness from tens of feet to several hundred feet, is the most important, productive, and utilized in the basin. Its hydraulic properties are favorable to groundwater production and development.

Aquifer Descriptions and Geologic Interpretations. Lithologic logs of irrigation, municipal, and observation wells were reviewed to characterize the aquifers. Locations of wells and seismic refraction profiles are presented in Figure 5. A well inventory is tabulated in Appendix A2. Lithology diagrams for most of the wells are presented in Appendix A3. A geologic cross-section location map is presented in Figure 6. Geologic cross-sections are presented with some of the following aquifer locality descriptions.

Figure 5. Locations of Observation, Irrigation, and Municipal Wells, and Seismic Refraction Profiles

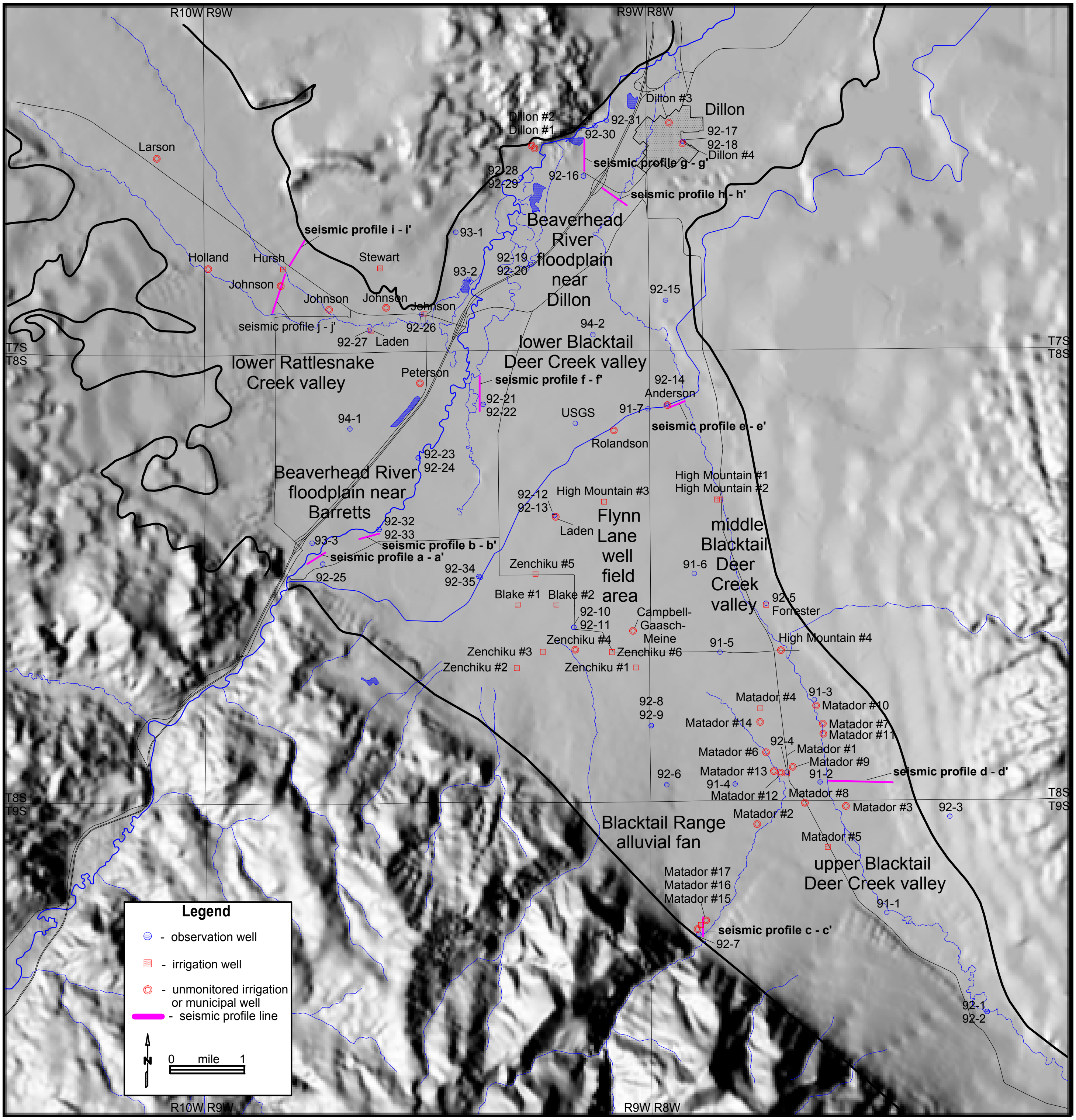
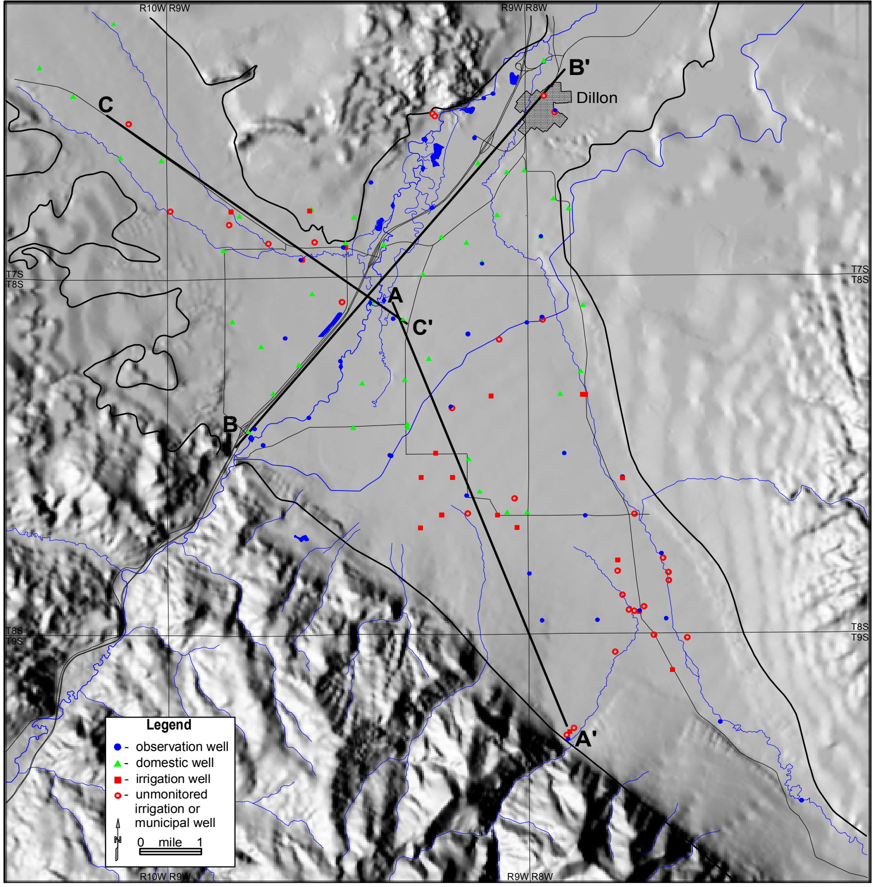


Figure 6. Geologic Cross-Section Locations



Upper Blacktail Deer Creek Valley. Seven observation wells, 91-1, 91-2, 91-3, 92-1, 92-2, 92-3, and 92-4, were drilled in the upper Blacktail Deer Creek valley. Existing wells include several irrigation wells owned by the Matador Cattle Company and a few shallow, stock wells. Lithologic logs for wells in this area are presented in Appendix A3.

Wells 91-1, 91-2, and 91-3, ranging in depth from 55 to 95 feet, were drilled near Blacktail Deer Creek to observe surface water-groundwater interactions. Sediments encountered during drilling were interlayered sand and gravel. Wells 92-1 and 92-2 were drilled near the upper Blacktail Deer Creek gaging station in Section 14, T9S, R8W. Well 92-1 penetrated sandy gravel at a depth of 22 feet and was drilled to 148 feet. The material between 22 and 148 feet was sandy silt and clay with thin clayey gravel seams. The borehole was backfilled with natural material to 119 feet, and a 2-inch PVC casing with a 20-foot slotted screen was installed. Well 92-2 was drilled, adjacent to well 92-1, through the sandy gravel to a depth of 25 feet and perforated between 15 and 19 feet. Well 92-3 was drilled in Section 2, T9S, R8W in the foothills east of Blacktail Deer Creek. Borehole cuttings were silt and fine sand, with a white bentonitic clay between depths of 30 to 40 feet. No water was found at a depth of 200 feet when drilling was delayed in autumn 1992. In spring 1993 when drilling resumed, the groundwater level was near the top of the well casing. However, deepening the well to 260 feet failed to produce water in usable quantities. Well 92-4 was drilled to 158 feet near Matador Ranch irrigation well #1 as an aquifer test observation well. Cuttings were interlayered sand, gravel, and silt.

Fourteen large-diameter, high-discharge wells are located along and near Blacktail Deer Creek on the Matador Cattle Company ranch in Sections 4 and 5, T9S, R8W, and Sections 28, 29, 32, and 33, T8S, R8W. Eight of these wells were drilled in the early 1950s and six were drilled in the early 1960s. Their lithologic logs indicate that their primary use was irrigation; however, today only three or four are pumped regularly for irrigation use. Discharges listed on the logs range from 800 to 2,200 gallons per minute (gpm). The wells range in depth from 132 to 185 feet. Lithology descriptions were consistent. Sediments included stratified, dirty-to-clean gravel and cobbles. Most of the well logs indicate that the irrigation wells were finished in clay, generally at depths between 150 and 175 feet. Although there are no deeper wells in the upper Blacktail Deer Creek valley, the well logs suggest that the stratified, coarse gravel comprising the aquifer are underlain by clay, perhaps of lower Tertiary age, at depths of 150 to 175 feet.

Blacktail Range Alluvial Fan. Five observation wells, 91-4, 92-6, 92-7, 92-8, and 92-9, were drilled in the Blacktail Range alluvial fan. Existing wells in this area include three large-diameter irrigation wells which were drilled along Sheep Creek in Section 5, T9S, R8W in the 1960s and are now owned by the Matador Cattle Company. Discharges range from 1,000 to 1,700 gallons per minute, and well depths range from 320 to 420 feet. Well logs describe stratified coarse gravel, cobbles, and boulders with cemented layers. Lithologic logs for wells in this area are presented in Appendix A3.

Well 92-7 was drilled near Matador Ranch irrigation well #15 as an observation well for an aquifer test. The observation well was drilled to 300 feet and cased with 4-inch PVC and slotted screen to 225 feet, below which the borehole was backfilled with cuttings. Lithologies to a depth of 225 feet consisted of coarse gravel and cobbles with mixed sand and silt. Well 91-4 was drilled on the lower end of the alluvial fan to a depth of 149 feet. Lithologies consisted of silty sand and gravel. Well 92-6 was drilled on the mid-fan to a depth of 217 feet. Lithologies consisted of an unconsolidated mixture of silt, sand, coarse gravel, and cobbles to a depth of 108 feet. Below 108 feet, cementation of the sand, gravel, and cobbles are common. Wells 92-8 and 92-9 were drilled to 400 feet and 230 feet, respectively, on the alluvial fan above the large irrigation-well field near Flynn Lane. Lithologies in both boreholes consisted of stratified, poorly sorted mixtures of silt, sand, and gravel. In the deeper well, 92-8, a cemented 45-foot interval occurred between 235 and 280 feet. More significantly, a distinct lithologic change occurred at a depth of 290 feet, where interlayered coarse materials changed to predominantly fine-grained clay and silt. This lithologic change was interpreted as the contact between the Quaternary/upper Tertiary aquifer and the lower, fine-grained Tertiary aquifer.

Flynn Lane Well Field Area of the Middle Blacktail Deer Creek Valley. This gently sloping, alluvial surface is comprised of Quaternary stream deposits from the ancestral Blacktail Deer Creek. This area of the Blacktail Deer Creek valley contains approximately 12 large-diameter, high-discharge irrigation wells that are pumped regularly during the summer. There are also many domestic wells that, in addition to some of the irrigation wells, served as observation wells. Four observation wells, 92-10, 92-11, 92-12, and 92-13, were drilled in this area. Lithologic logs for wells in this area are presented in Appendix A3.

Wells 92-10 and 92-11 were drilled on the Blake property in Section 23, T8S, R9W in approximately the center of the Flynn Lane well field. The deeper well, 92-10, was fitted with a continuous water-level recorder, that operated from spring 1994 to spring 1997. Groundwater-level changes resulting from the frequent use of many irrigation wells were recorded, as well as other seasonal changes in groundwater levels. Lithologies for both observation wells and the two Blake irrigation wells were similar. Unconsolidated sand and gravel with silt and clay were found to depths of about 200 feet. From depths of 200 to about 275 feet, the gravel and sand were cemented. Between the depths of 275 and 300 feet, sediments were predominantly sandy-to-gravelly clay. About one mile east along Flynn Lane, the Campbell-Gaasch-Meine irrigation well was drilled to 300 feet. Its lithologic log describes unconsolidated sand and gravel to a depth of 240 feet and cemented sediments from 240 to 300 feet.

Five of the six irrigation wells, drilled in the 1970s by the Selkirk Hereford Ranch and currently owned by the Zenchiku Land and Livestock Company, are located on the lower end of the Quaternary alluvial fan in Sections 25 and 26, T8S, R9W. The sixth well is located along Flynn Lane in Section 14, T8S, R9W. The Zenchiku #1 well is 715 feet deep and produces about 825 gpm; lithologies were reported as interlayered clayey gravel and clay seams, with some intermittent cemented layers. The Zenchiku #2 well is 485 feet deep and produces about 1,000 gpm; lithologies were interlayered, clay-rich mixes of sand and gravel. The Zenchiku #3 well is 415 feet deep and produces about 2,500 gpm; lithologies consisted of layers of clay-rich mixes of sand and gravel and, below a depth of 205 feet, cemented gravel interlayered with sand and gravel. The Zenchiku #4 well is 435 feet deep and produces about 1,800 gpm; lithologies consisted of layers of clay-rich mixes of sand and gravel with cemented gravel interlayered with clay-rich sand and gravel below a depth of 260 feet. Zenchuku #5, located along Flynn Lane in Section 14, T8S, R9W, is 405 feet deep and pumps about 1,900 gpm. Lithologies consisted of unconsolidated sand and gravel to a depth of 200 feet and intercalated layers of cemented conglomerate and clayey sand and gravel to a depth of 405 feet. The well log for Zenchiku #6 is unavailable. Another large-diameter well was drilled to 605 feet in Section 24, T8S, R9W, but was abandoned because it did not produce sufficient discharge for irrigation use. Its lithologies, consistent with those already described, consisted of 170 feet of unconsolidated, mixed sand and gravel and 435 feet of intercalated layers of cemented conglomerate and clay.

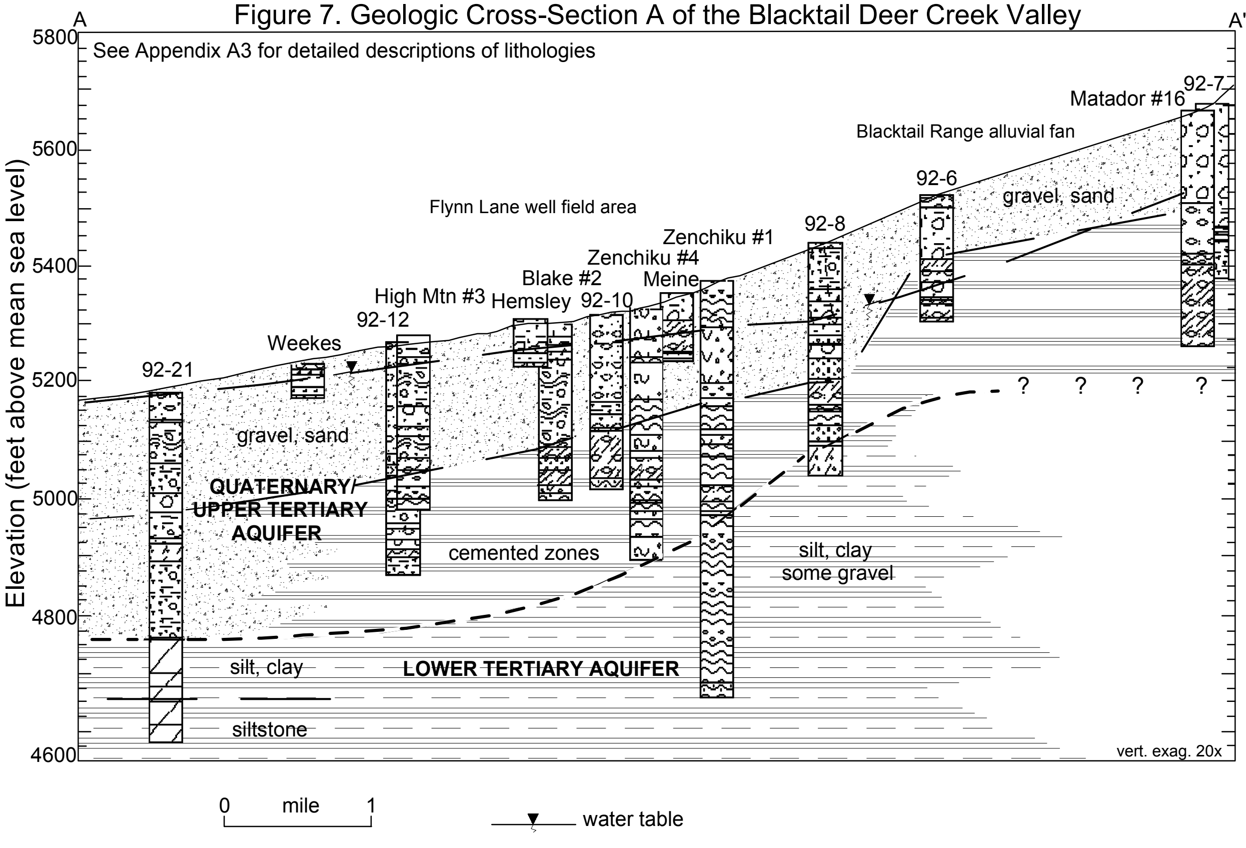
Observation wells 92-12 and 92-13 were drilled on the Laden property in the Flynn Lane well field north of the Blake and Zenchiku irrigation wells. Well 92-12 was intended as a deep, exploratory borehole to be drilled to about 600 feet but, due to difficult drilling, was completed to a depth of 400 feet. Well 92-13, drilled to 174 feet, served as an observation well for an aquifer test conducted at the 200-foot deep Laden irrigation well. Lithologies for both boreholes were mixtures of sand and fine to coarse gravel with variable amounts of silt. In well 92-12, cemented gravelly zones were encountered at depths between 254 and 269 feet, and between 355 to 370 feet. Stratified mixtures of silty sand and gravel occurred between the cemented zones to depths of 400 feet.

The last well included in the Flynn Lane well field area is the 960-gpm, 300-foot deep High Mountain Ranches irrigation well #3 located in Section 13, T8S, R9W. The reported lithologies consisted of layers of cemented gravel between depths of 156 and 231 feet and a continuous sequence of clay from 280 to 300 feet.

In the Flynn Lane well field area, poorly sorted mixtures of sand, gravel, and silt, representing Quaternary alluvial fan deposits, interfinger with fluvial deposits of the ancestral Blacktail Deer Creek. Layers of cemented conglomerate occur at depths of 200 or more feet. Thick sequences of clay-rich sediments, perhaps of lower Tertiary age, may occur at depths of several hundred feet.

A geologic cross-section of a portion of the Blacktail Deer Creek valley, the Flynn Lane well field area, and the Blacktail Range alluvial fan is presented in Figure 7. The location of the cross-section is presented in Figure 6.

Figure 7. Geologic Cross-Section A of the Blacktail Deer Creek Valley



Middle Blacktail Deer Creek Valley. Five observation wells, 91-5, 91-6, 91-7, 92-5, and 92-14 were drilled in the middle Blacktail Deer Creek valley. Existing wells include three of the High Mountain Ranches irrigation wells, the Forrester and Anderson irrigation wells, and some domestic wells. Lithologic logs for this area are presented in Appendix A3.

Wells 91-5 and 91-6 were drilled in Township 8 South, Range 8 West where no other wells existed. Well depths are 105 feet and 121 feet, respectively. The lithologies in well

91-5 were silty sand or silty gravel, and lithologies in well 91-6 were a mixture of sand, gravel, and silt. Well 92-5 was drilled to 177 feet as an observation well for an aquifer test at the 184-foot Forrester irrigation well. Lithologies were mixes of silty sand and gravel.

Three of the High Mountain Ranches irrigation wells are located in this area. Two are located along Blacktail Road in Section 7, T8S, R8W. High Mountain irrigation well #1 was finished to 186 feet, and High Mountain irrigation well #2 was drilled to 300 feet. High Mountain irrigation well #4, located in Section 20, T8S, R8W, was drilled to a depth of 140 feet. Lithologies of these wells and other domestic wells consisted of mixes of sand and gravel. Cemented gravel occurred in the High Mountain irrigation well #2.

Well 91-7 was drilled to a depth of 62 feet adjacent to the East Bench Irrigation District Canal in Section 1, T8S, R9W to observe canal water-groundwater interactions. About ¼ mile east, well 92-14 was drilled to a depth of 320 feet near the Anderson irrigation well as an observation well for an aquifer test. Lithologies for both observation wells consisted of heterogeneous mixtures of sand and gravel to depths of about 60 feet. In well 92-14, there was a distinctive lithologic change at 75 feet to mostly fine to medium sand with small amounts of silt and traces of gravel. Because Tertiary sediments occur in the foothills east of this well (Ruppel et al. 1993), the fine-grained sediments in this well were interpreted to be of Tertiary age. Coarse alluvial sediments overlie the Tertiary materials.

<u>Lower Blacktail Deer Creek Valley</u>. All wells in this area are shallow domestic wells. Lithologic logs for wells in this area are presented in Appendix A3.

Four observation wells, 92-15, 94-2, 92-34, and 92-35, were drilled in the lower Blacktail Deer Creek valley. Well 92-15 was drilled to a depth of 540 feet. Cemented sediments occurred between the depths of 12 and 37 feet. Sand, gravel, and silt were encountered between 37 and 101 feet. Between 101 and 450 feet, borehole cuttings were predominantly fine-grained mixtures of fine to medium sand and tan-brown silt. These sediments were interpreted to be of Tertiary age.

Well 94-2 is a deep exploratory well drilled to 400 feet on the Petersen property in Section 36, T7S, R9W. The purpose of the well was to describe characteristics of the aquifer materials and to verify the presence of Tertiary-age fine-grained sediments. Lithologies below a depth of 78 feet were brown clay with traces of fine sand, silt/clay with heaving fine-medium sand, hardened and clumped clay, and grayish silt and clay with minor sand. Fine-grained sediments, such as these, are commonly described as Tertiary age. Thin strata of coarse-grained, alluvial materials overlie the fine-grained sediments in this well.

Wells 92-34 and 92-35 are shallow wells drilled adjacent to the East Bench Irrigation District Canal to determine whether canal leakage losses were occurring. Lithologies consisted of gravel and cobbles with sand and silt. Lithologies of other shallow domestic wells within the lower Blacktail Deer Creek valley were generally described as stratified sand, gravel, and silt.

Beaverhead River Floodplain near Barretts. Eight observation wells, 92-21, 92-22, 92-23, 92-24, 92-25, 92-32, 92-33, and 93-3, were drilled in this area. In addition to these newly drilled wells, several shallow domestic wells and a deep industrial well already existed. Lithologic logs for wells in this area are presented in Appendix A3.

Observation well 93-3 was drilled to a depth of 420 feet on the Barretts Minerals, Inc. (B.M.I.) property in Section 17, T8S, R9W. This well was to serve as an observation well for an aquifer test to be conducted in a new industrial production well. However, no groundwater was found in the borehole, and the well was abandoned. Because the borehole was dry and the drilling project was a joint endeavor with B.M.I., no further plans were developed for additional exploratory drilling to site a production well. Well 93-3 penetrated gravel with mixed sand, silt, and clay to a depth of 41 feet which was interpreted to be Quaternary river alluvium. Between 41 and 420 feet the lithologies were brown sandy clay with traces of gravel. The clay sediments were interpreted as lower Tertiary strata that were not eroded by the ancestral Beaverhead River. In addition to well 93-3, there is an existing 455-foot well located nearby on the B.M.I. property. Its lithologies were similar to those of well 93-3, except that buried paleochannel gravel at depths between 390 and 415 feet produces groundwater.

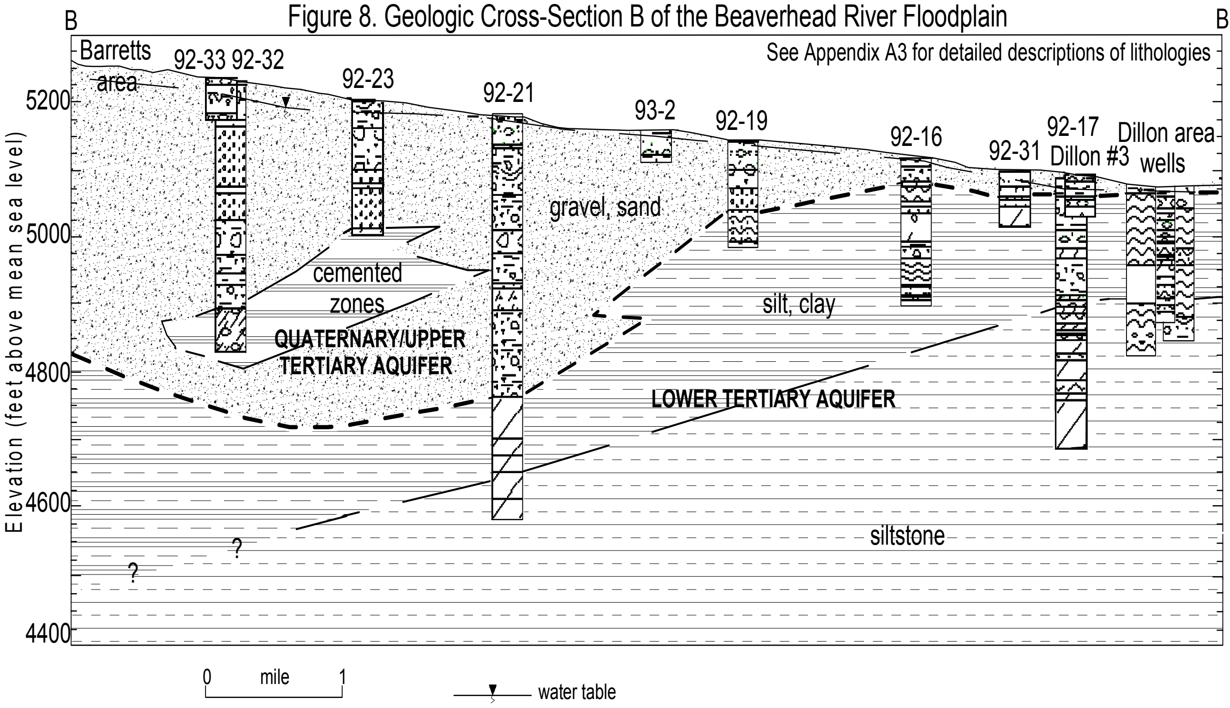
Observation well 92-25 was drilled to a depth of 51 feet southeast of well 93-3 across the Beaverhead River. Lithologies consisted of clean, river-deposited gravel and sand. It is unknown whether fine-grained materials occur at shallow depths below this well. Approximately 1½ miles downriver, observation wells 92-32 and 92-33 were drilled to depths of 395 feet and 53 feet, respectively, along the Beaverhead River in Section 16, T8S, R9W. Lithologies to depths of about 50 feet consisted of coarse fluvial gravel and cobbles mixed with sand and silt. In the deeper well 92-32 lithologies at depths below 50 feet were layers of sand interbedded with thin gravel and cobble layers. Cemented sandy gravel and cobbles occur between 330 and 395 feet.

Observation wells 92-23 and 92-24 were drilled to depths of 200 feet and 51 feet, respectively, along the Beaverhead River in Section 9, T8S, R9W approximately 2½ miles downstream of the Barretts diversion dam. Lithologies in both wells consisted of coarse gravel and cobbles mixed with sand and silt to depths of about 50 feet. In the deeper well 92-23 lithologies at depths below 50 feet consisted of interlayers of coarse gravel and sand, with some cementation near the bottom of the well.

Observation wells 92-21 and 92-22 were drilled to depths of 600 feet and 51 feet, respectively, near Poindexter Slough in Section 3, T8S, R9W. Lithologies in well 92-21 to 205 feet were mixtures of coarse gravel, cobbles, sand, and silt. Between 205 and 420 feet the sediments became more sandy with abundant silt. There was a distinct lithologic change at a depth of 420 feet, where borehole cuttings were soft, poorly consolidated, brown-orange and greenish siltstone. The sediments above a depth of 420 feet were interpreted as the Quaternary/upper Tertiary aquifer, and those below 420 feet were interpreted as the lower Tertiary aquifer. No usable groundwater yields occurred in the deeper strata.

A geologic cross-section of the Beaverhead River floodplain from the Barretts area to Dillon is presented in Figure 8. The cross-section location is presented in Figure 6.

Figure 8. Geologic Cross-Section B of the Beaverhead River Floodplain



Lower Rattlesnake Creek Valley. Most wells in this area are shallow domestic wells, but several large-diameter, high-discharge irrigation wells operate during the summer. The deepest of these irrigation wells is approximately 200 feet. Three observation wells, 94-1, 92-26, and 92-27, were drilled in the lower Rattlesnake Creek valley. Lithologic logs for wells in this area are presented in Appendix A3.

Because there were no wells deeper than 200 feet in the lower Rattlesnake Creek valley, well 94-1 was intended to be a 400- to 500-foot deep exploratory well in approximately the center of the valley in Section 8, T8S, R9W. However, because the gravel was coarse and drilling was difficult, the well was completed at a depth of 275 feet. Lithologies in well 94-1 were fine to coarse gravel and cobbles with small amounts of sand and silt. No fine-grained sediments were encountered during well drilling, and the materials were interpreted to be of Quaternary age.

Cutbanks eroded into the low foothills along the northwest margin of the lower Rattlesnake Creek valley in Sections 5 and 8, T8S, R9W mark a former position of the ancestral Beaverhead River. It is likely that Sections 3, 4, 8 (east half), and 9 contain coarse river gravel and sand several hundred feet thick, that overlie fine-grained Tertiary materials. Well logs for Sections 5, 6, and 8 along the northwest margin of the lower Rattlesnake Creek valley describe sequences of sediments. In these wells, 40 to 50 feet of river alluvium overlies sediments, such as clay, red clay, sandy shale, tan or brown clay, tan sandy shale, and shale and clay, which may be part of the lower Tertiary aquifer.

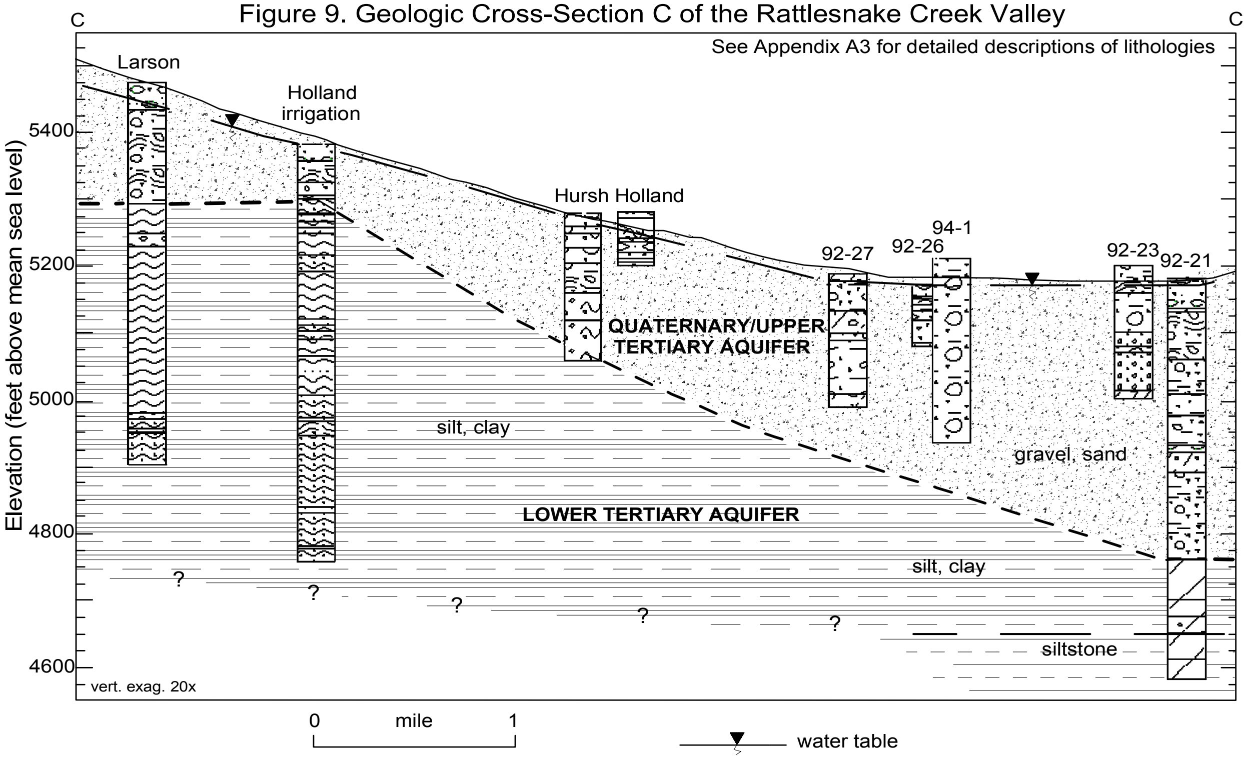
Wells 92-26 and 92-27 were drilled primarily as observation wells for aquifer tests at two irrigation wells. Lithologies in well 92-26, drilled in Section 33, T7S, R9W consisted of stratified alluvial deposits overlying volcanic bedrock at a depth of 88 feet. An irrigation well, located in the NE¼ of Section 33, also penetrated bedrock at a depth of 112 feet. The valley alluvium is about 100 feet thick in the N½ of Section 33 and thins on the low foothills to the north. In the low foothills in Section 28, T7S, R9W, several deep wells, ranging in depth from 140 to 265 feet, penetrate limestone at shallow depths.

The Beaverhead River alluvium grades into the Quaternary glacial outwash in Section 33, T7S, R9W along Rattlesnake Creek, as illustrated in Figure 4. Well 92-27 was drilled to a depth of 200 feet on the margin of the glacial outwash in Section 33. Lithologies in well 92-27 were silty or clayey gravel and sand interbedded with silt and clay layers.

Lithologies of two 200-foot irrigation wells, one in the SW¼ of Section 29 and another in the NW¼ of Section 32, T7S, R9W, consisted of interfingered glacial outwash and stream sediments described as stratified mixtures of cobbles with silt and clay and clay-rich sand with gravel. Two other deep wells are located farther west in the upper Rattlesnake Creek valley. The Larson well was drilled to 571 feet in Section 24, T7S, R10W, and the Holland Ranch Co. irrigation well was drilled to 624 feet in Section 25, T7S, R10W. Beneath 150 to 175 feet of glacial outwash and stream deposits are thick sequences of brown and white clay with small amounts of sand and gravel, which may be part of the lower Tertiary aquifer.

A geologic cross-section of the Rattlesnake Creek valley is presented in Figure 9. The location of the cross-section is presented in Figure 6.

Figure 9. Geologic Cross-Section C of the Rattlesnake Creek Valley



Beaverhead River Floodplain near Dillon. Eleven observation wells, 92-16, 92-17, 92-18, 92-19, 92-20, 92-28, 92-29, 92-30, 92-31, 93-1, and 93-2, were drilled in this area. In addition, numerous shallow domestic and four municipal wells already existed. Lithologic logs for wells in this area are presented in Appendix A3.

Wells 92-19, 92-20, 93-1, and 93-2 were drilled 2 to 2½ miles south of Dillon. Well 93-1, drilled to a depth of 81 feet on the west margin of the valley, was completed in weathered limestone. Wells 93-2 and 92-20, drilled to depths of 41 feet and 18 feet, respectively, were completed in Quaternary gravel and sand. Well 92-19 penetrated the Quaternary/upper Tertiary aquifer at a depth of 101 feet, and was completed in the lower Tertiary aquifer at 160 feet, where lithologies were predominantly sandy silt and clay. The Quaternary/upper Tertiary-lower Tertiary contact, at an elevation of 5,040 feet, was also observed in wells 94-2 and 92-15 to the southeast, where the contacts are slightly higher at an elevation of about 5,115 feet. The contact may also be extrapolated southwest to an elevation of about 4,760 feet in well 92-21. This suggests that lower Tertiary strata are either tilted or more eroded toward the southwest. The implication is that lower Tertiary strata are found at shallower depths toward the northeast and that the Quaternary/upper Tertiary aquifer thins toward Dillon, as illustrated in Figure 8.

The thinning of the Quaternary/upper Tertiary aquifer toward the northeast is also noted in observation wells drilled along the Beaverhead River floodplain near Dillon. Lithologies observed in well 92-16, drilled to 220 feet in Section 24, T7S, R9W at exit 62 of Interstate 15, consisted of alluvial materials to a depth of 34 feet and an elevation of 5,081 feet, where the contact between the Quaternary/upper Tertiary and lower Tertiary aquifers was noted. Below the contact, there were sequences of yellow-brown clay that contained small quantities of sand and thin paleochannel deposits of silty gravel or sand. Wells 92-17 and 92-18, drilled to 400 feet and 79 feet, respectively, in Section 19, T7S, R8W in Dillon, penetrated alluvial deposits. These deposits were interpreted to be buried paleochannel sand and gravel interlayered with sandy silt and clay. The contact between the Quaternary/upper Tertiary and lower Tertiary aquifers was again observed in well 92-17, at a depth of 28 feet and an elevation of 5,061 feet. Sediments below 28 feet were tan-yellow silt/clay with small quantities of sand and gravel and traces of white clay. Below a depth of 240 feet, poorly consolidated siltstone and hard, orange-brown claystone were observed in drill cuttings.

Several other deep wells in Sections 18 and 19, T7S, R8W near Dillon range in depths from 150 to 260 feet. Well logs show that lithology consisted of red-orange, grey, and yellow clay, clay with gravel, and yellow shale with sand lenses, lying beneath gravel and sand. These lithologic descriptions suggest that the lower Tertiary aquifer is widespread in the subsurface of the Dillon area.

Four additional observation wells were constructed along the Beaverhead River on the Beaverhead River floodplain near Dillon. Wells 92-28 and 92-29 were drilled to depths of 85 feet and 20 feet, respectively, in Section 23, T7S, R9W. Both wells penetrated coarse gravel and cobbles to depths of 20 feet. Well 92-28 penetrated weathered volcanic bedrock at a depth of 52 feet. Well 92-30, drilled to 32 feet in Section 24, T7S, R9W at the Dillon gaging station, penetrated fractured volcanic bedrock at a depth of 24 feet. Well 92-31, drilled to 80 feet in Section 13, T7S, R9W, penetrated clay and silt with gravel inclusions at a depth of 34 feet.

Seismic Refraction Profiles. The USGS conducted seismic refraction surveys to estimate the thickness of the valley-fill deposits in various parts of the project area. The locations of the seismic refraction profiles are presented in Figure 5. Geologic interfaces are based on seismic velocity differences between unconsolidated and cemented sediments interpreted as differentiating Quaternary and Tertiary strata. Although Quaternary and upper-Tertiary Sixmile Creek Formation sediments may be indistinguishable in borehole cuttings, they may be differentiated based on seismic velocities. The USGS seismic models assume that unconsolidated alluvium of Quaternary age generally has lower seismic velocities than more cemented Tertiary age sediments. Therefore, the USGS interpreted low seismic velocity sediments as Quaternary age and higher velocity cemented sediments as the Tertiary Sixmile Creek Formation.

Profile a-a′ is located in Section 17, T8S, R9W. Seismic refraction profiling indicates cemented Tertiary deposits at depths ranging from 91 feet on the east to 37 feet on the west. Basement rock was too deep to profile.

Profile b-b′ is located northeast of profile a-a′ in Section 16, T8S, R9W. The USGS interprets the Quaternary-upper Tertiary contact at depths of 75 to 108 feet.

Profile c-c′ is located in Section 7, T9S, R8W, near the canyon mouth of Sheep Creek. Seismic refraction data indicate that the Quaternary-upper Tertiary contact lies at depths of 60 feet near the canyon mouth and 135 feet at the end of the profile. The profile also indicates the presence of a fault, as shown by Ruppel et al. (1993).

Profile d-d′ is located in Section 33, T8S, R8W east of Blacktail Road in the upper Blacktail Deer Creek valley. The seismic data show differences in seismic velocity, which were interpreted to be the Quaternary-upper Tertiary contact at depths of 24 feet on the west and 45 feet on the east.

Profile e-e′ is located in Section 6, T8S, R8W along the EBID Canal. The USGS data indicate a refractor with a seismic velocity of about 14,000 feet per second (fps) at a depth of about 500 feet. The refractor probably represents Archean bedrock under the valley fill.

Profile f-f′ is located in Section 3, T8S, R9W along the floodplain of the Beaverhead River near Poindexter Slough. The seismic refraction profile indicates the Quaternary-upper Tertiary interface at depths of 21 feet on the south and 35 feet on the north.

Profile g-g′ is located in Section 24, T7S, R9W along the Beaverhead River floodplain. Seismic data indicate shallow deposits, probably of lower Tertiary age, overlying igneous bedrock. Depths to bedrock increase from 117 to 475 feet southeast toward I-15.

Profile h-h′ is a continuation of profile g-g′, located to the southeast across Interstate 15 in Sections 24 and 25, T7S, R9W. Seismic profiling indicates an interface, perhaps of lower Tertiary age, at depths of about 6 to 13 feet, with no trace of underlying bedrock.

Profile I-I′ is located in Section 29, T7S, R9W approximately 2 miles above the confluence of Rattlesnake Creek with the Beaverhead River. The data are consistent with interpretations of up to 100 feet of Quaternary sediments overlying upper Tertiary strata. The refraction data suggest bedrock at a depth of about 168 feet north of Rattlesnake Creek, and at a depth of 460 feet at the south end of the profile near Highway 278.

Profile j-j′ is a continuation of profile I-I′. It is located in Sections 30 and 31, T7S, R9W. Profiling indicates Quaternary deposits, but no bedrock appears on the profile.

Summary

The upper Beaverhead basin is comprised of the Beaverhead River floodplain and two tributaries, Blacktail Deer and Rattlesnake creeks. The Blacktail Range and Blacktail fault bound the basin on the south, the Ruby Range and Ruby fault on the east, and the Pioneer Mountains on the west.

The mountains surrounding the Beaverhead basin are comprised of folded, tilted, and faulted bedrock, ranging in age from Archean to Tertiary. The Beaverhead basin is floored with Archean metamorphic rocks, which are overlain by thick sequences of Tertiary sediments, and Quaternary fluvial and glacial sediments. Geophysical gravity data indicate a depth to basement rock of about 3,000 feet northeast of Dillon and depths from 1,500 to 3,300 feet in the lower Blacktail Deer Creek valley (Hanna et al. 1993).

Seismic refraction profiling data suggest bedrock at depths of several hundred feet on the northeast side of the Blacktail Deer Creek valley and bedrock underlying sediments along the north margin of the lower Rattlesnake Creek valley. Igneous rock was interpreted to underlie sediments along the Beaverhead River southwest of Dillon. The USGS interpreted unconsolidated sediments with lower seismic velocity to be of Quaternary age and cemented sediments with higher seismic velocity to be the upper Tertiary Sixmile Creek Formation. The seismic refraction profiles indicate that the depth of the interface between the Quaternary and upper Tertiary sediments is generally less than 100 feet, although it may be deeper than 100 feet in certain areas.

There are three principal aquifers in the upper basin. These are the bedrock aquifer, the lower Tertiary aquifer, and the Quaternary/upper Tertiary aquifer. The bedrock aquifer forms the mountains around the basin and extends beneath the valley fill. This aquifer produces small yields of water to wells, but its total recharge contribution to the valley aquifer may be significant. The lower Tertiary aquifer overlies the bedrock aquifer and is buried beneath younger, coarser sediments. It is comprised of predominantly fine-grained lithologies and may be up to 3,000 feet thick in parts of the upper basin. The lower Tertiary aquifer typically has low well yields because its predominantly fine-grained materials do not easily transmit or release water from storage. The Quaternary/upper Tertiary aquifer consists of interconnected fluvial and glacial cobbles, gravel, sand, and silt, and is locally cemented. It is the most important, productive, and utilized aquifer in the upper basin because its coarse materials are favorable for groundwater production. The Quaternary/upper Tertiary aquifer is several hundred feet thick in the Barretts area and the lower Rattlesnake Creek valley, but thins to about 25 feet near Dillon. In the Blacktail Deer Creek valley the aquifer consists of stratified cobbles, gravel, sand, and silt, with localized cemented conglomerate. Most of the groundwater development in the project area has occurred in the Flynn Lane well field area where the aquifer is thickest.

GROUNDWATER OCCURRENCE AND MOVEMENT

Methods

Domestic, stock, and irrigation wells; 47 new observation wells; and several riverside piezometers (Figure 10) served as groundwater-level monitoring wells to document the occurrence and movement of groundwater between July 1991 and September 1996.

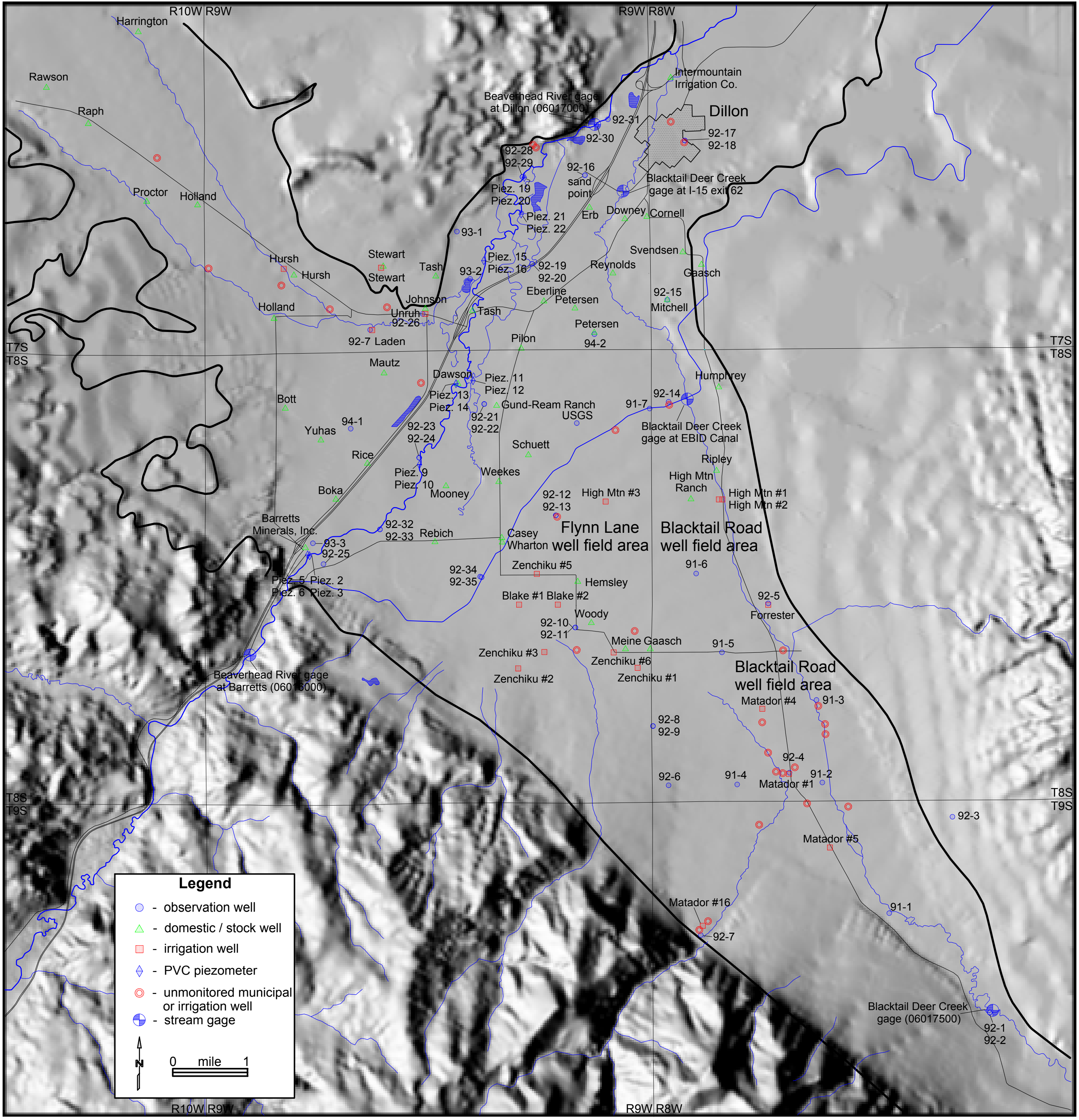
Domestic, stock, and some irrigation wells were selected for groundwater-level monitoring based on location, proximity to surface water or to high-discharge wells, accessibility, availability of well logs, and completion interval. By 1996, the monitoring well network consisted of 125 wells, which included 47 dedicated observation wells, 45 domestic and stock wells, 17 irrigation wells, and 16 piezometers. The piezometers were installed in nests of two or three along the Beaverhead River and Poindexter Slough to collect data on surface water-groundwater interactions. Of the 22 piezometers installed, six were abandoned because of vandalism, destruction by livestock, plugging with silt, or site inaccessibility resulting from flood waters on the Beaverhead River in 1995.

Forty-seven new observation wells were drilled for various purposes. At eight locations wells were drilled to monitor proposed aquifer testing. Observation well drilling was not required at the City of Dillon #3 municipal well site because a PVC observation well already existed. Five sites along the Beaverhead River and Poindexter Slough were selected to observe the influence of surface water on groundwater levels. The remaining wells were drilled at locations where additional information was needed to understand the geology, and to monitor groundwater levels in areas where there were no other wells. Groundwater was not produced in wells 92-3 and 93-3, but useful subsurface geologic information was collected during the drilling of these wells.

Measuring points were located on the top of the well casings and indicated with permanent marks. Elevations of the measuring points were surveyed to the nearest 0.01 foot from U.S. Geological Survey benchmarks with the National Geodetic Vertical Datum of 1929 defining mean sea level. Measuring point distances above or below land surface, and depths from the measuring points to the bottoms of the wells were also measured, where possible, to the nearest 0.01 foot.

Groundwater levels were measured approximately twice per month during the irrigation seasons and once per month during the non-irrigation seasons. All groundwater-level measurements collected during the Beaverhead Groundwater Project have been archived in the Ground-Water Information Center database at the Montana Bureau of Mines and Geology, Montana Tech of The University of Montana, Butte, Montana. After the conclusion of field work for the Beaverhead Groundwater Project, groundwater-level monitoring continued through a joint effort between the DNRC and the MBMG Groundwater Assessment Program. Approximately six measurements per observation well per year are being collected and these measurements are also being archived in the GWIC database.

Figure 10. Groundwater and Surface-Water Monitoring Sites



Groundwater levels were measured with 300- and 500-foot steel measuring tapes and electric water level indicators or well probe tapes. Groundwater levels were measured at least twice at each well to verify the accuracy of the measurement and to determine that the measurement represented the static groundwater level and not a declining or recovering water level from pumping. In instances when static water level was not obtainable, the measurements were rejected and the groundwater level was re-measured later. Groundwater levels were recorded as depth-to-groundwater from the measuring points and entered into a database.

To date, nearly 7,000 groundwater-level observations have been collected and evaluated to determine directions of groundwater flow, and the impacts of seasonal precipitation, irrigation return-flow recharge, stream stages, and irrigation well withdrawals. Hydrographs showing seasonal groundwater-level changes, and maps showing groundwater-level fluctuations, depths to groundwater, and potentiometric surfaces were prepared.

Hydrographs were prepared for each well for the period of record by plotting the observed depth to groundwater versus the date of measurement. Four of the observation wells also had Stevens Type-F continuous recorders installed during the summer months between spring 1994 and autumn 1995. Water levels from these instruments were converted to daily averages for hydrograph plotting. A fifth observation well, 92-10, also had a Stevens Type-F recorder, that operated continuously until March 1997.

Seasonal groundwater-level change maps were constructed by selecting dates in the spring and summer of each year when groundwater levels were lowest and highest, respectively. Differences in groundwater levels in each well were determined between the two selected dates and contoured to produce a chronological sequence of maps illustrating seasonal changes of groundwater levels.

A maximum observed groundwater-level fluctuation map was prepared by determining the difference between the maximum and minimum observed static groundwater levels for each well during the period of record and contouring the differences.

A depth-to-groundwater map was prepared by averaging all depths to groundwater, adjusted to land surface, for each well for the period of record and contouring the depths.

Composite potentiometric surface maps were prepared for selected dates in late spring and mid to late summer of each year when groundwater levels were lowest and highest, respectively. The maps represent composite potentiometric surfaces because groundwater levels were observed in many wells screened or perforated at various intervals within the aquifer.

Results and Interpretations

Groundwater Flow Direction. Examination of groundwater levels measured between 1991 and 1996 indicates that the regional groundwater flow system consists of three components. The general direction of horizontal groundwater flow (Figure 11) is northwest in the Blacktail Deer Creek valley, southeast in the Rattlesnake Creek valley, and northeast from Barretts toward Dillon along the Beaverhead River floodplain. Groundwater flow lines converge on gaining reaches of the Beaverhead River, Blacktail Deer Creek, and Poindexter Slough, and diverge from losing reaches of those streams.

Groundwater Levels and Hydrographs. Hydrographs from all monitored wells illustrate that groundwater levels generally declined during the autumn, winter, and spring months until late April or early May, when the lowest annual groundwater levels were observed. Following this time, groundwater levels rose. The magnitude of the groundwater-level rise from its early spring low to the summertime high was a function of the amount of the winter snowpack; spring and summer precipitation, which recharged the aquifer through surface flow entering the valleys; overland surface flow infiltrating to the aquifer on the foothills; irrigation water recharging the aquifer as return flow during the summer irrigation season; and groundwater flow from the bedrock of the mountains. Groundwater generally rose to its highest annual level by mid to late summer.

A complete record of groundwater-level measurements is presented in Appendix B1 as individual records containing well identification and location information, dates of measurement, static groundwater level for each measurement date, measuring point elevation, and the hydrograph of groundwater levels. Hydrographs for general areas of the project (Figure 12) are presented in Figures 13 through 20. The hydrographs illustrate patterns of groundwater-level changes that occurred in those general areas during certain times of the period of record.

Upper Blacktail Deer Creek Valley. Hydrographs (Figure 13) illustrate the influences on groundwater levels of surface water leaking from or diverted from Blacktail Deer Creek. Hydrographs document 10- to 50-foot rises in groundwater levels when surface water was diverted for either flood control or irrigation use.

Blacktail Range Alluvial Fan. Hydrographs (Figure 14) illustrate small changes in groundwater levels in observation wells located on the Sheep Creek and Small Horn Creek alluvial fans (Figure 1) south of Flynn Lane in the Blacktail Deer Creek valley. These hydrographs show annual groundwater-level fluctuations of 5 to 12 feet except during late spring 1995, when groundwater levels rose between 12 and 30 feet in these mountain-front wells. These observation wells are located downslope of the Blacktail Range where fractured bedrock, bedrock springs, and infiltration of runoff on the alluvial fans contributed significant quantities of water to the aquifer. Bedrock springs, such as those in Sheep Creek canyon in T9S, R8W, and in the Lovells Lake area in T8S, R9W, attest to the potential for groundwater recharge from bedrock of the mountains. Other sources of water to the aquifer include overland surface flow on the alluvial fans along the mountains and surface water infiltrating to the aquifer from Blacktail Deer, Sheep, and Small Horn creeks.

Figure 11. General Groundwater Flow Direction

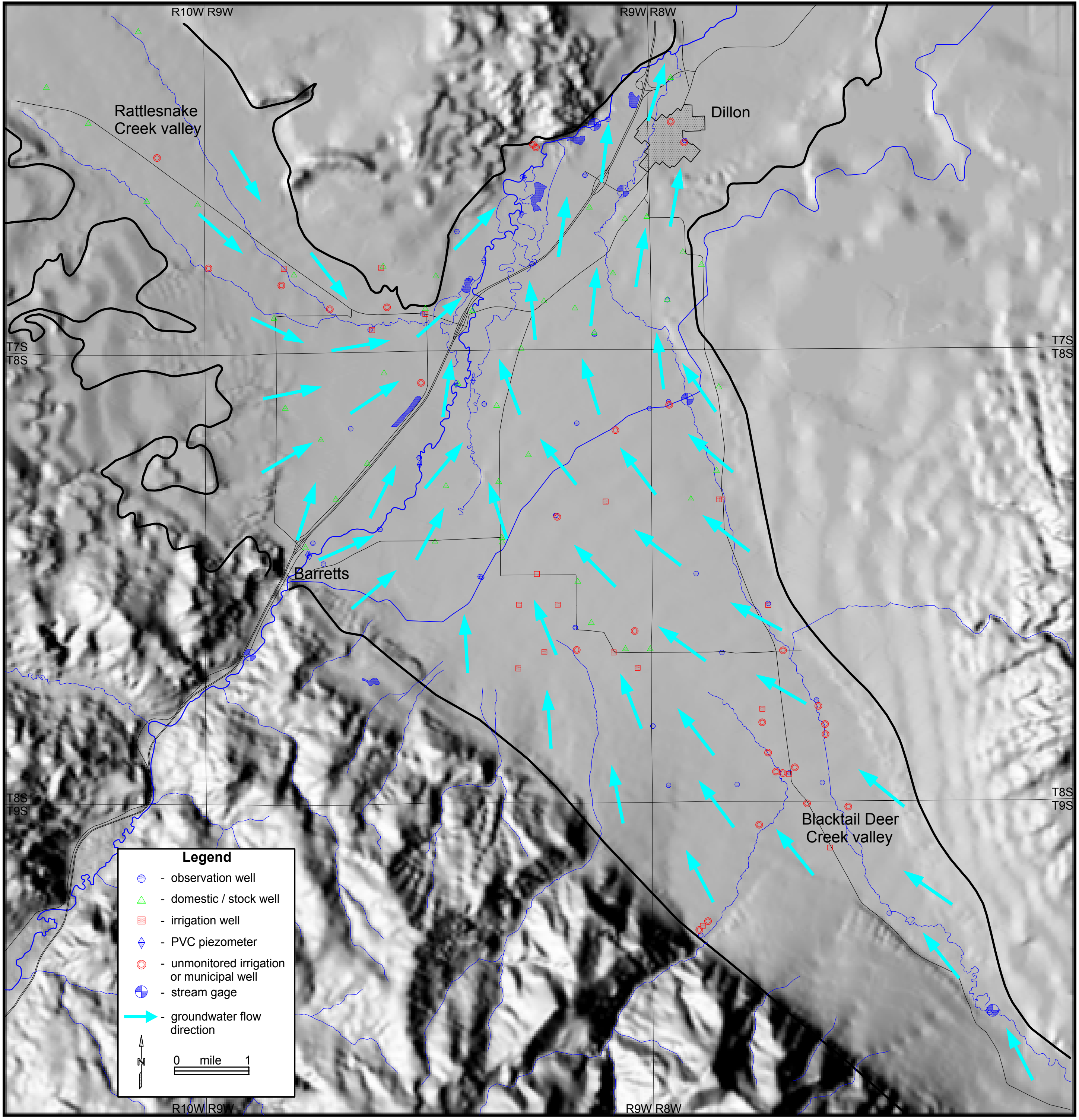


Figure 12. Groundwater Hydrograph Localities

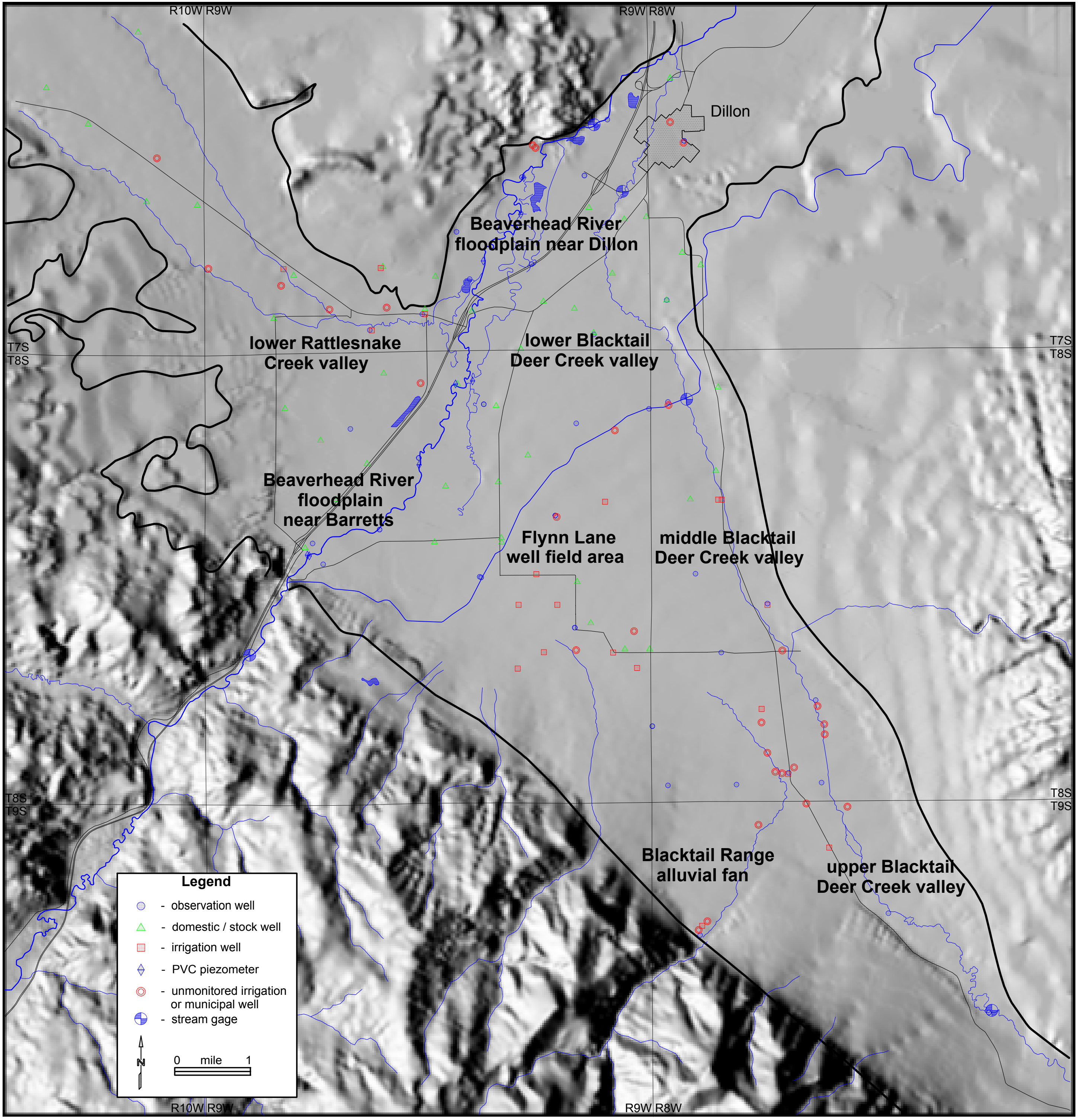


Figure 13. Groundwater Hydrographs in the Upper Blacktail Deer Creek Valley

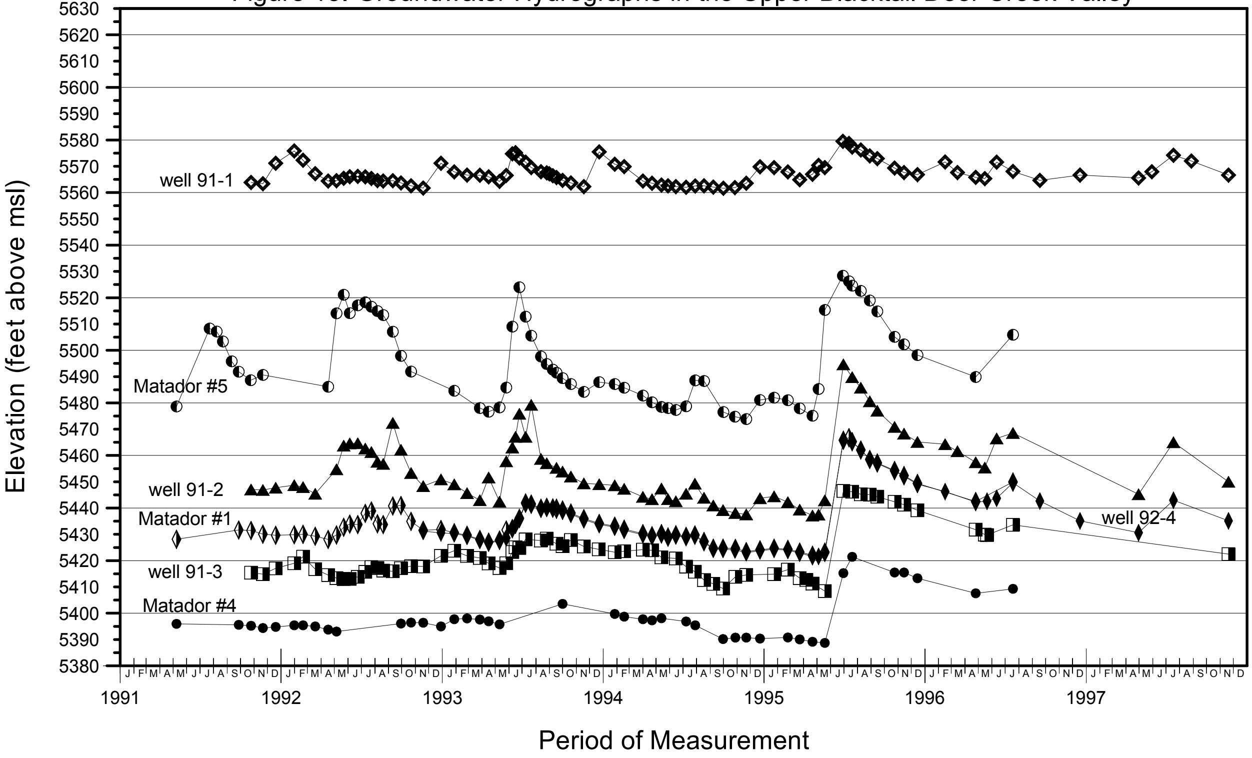
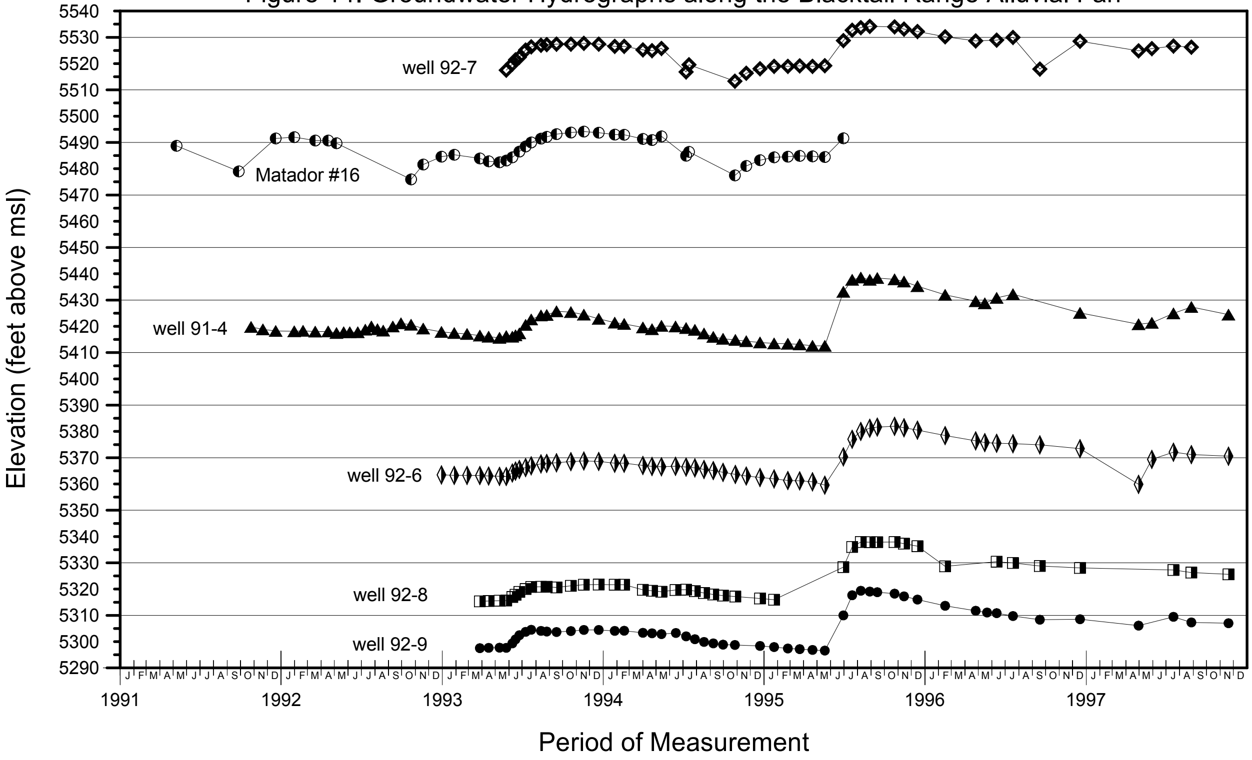


Figure 14. Groundwater Hydrographs along the Blacktail Range Alluvial Fan



Wells near Blacktail Deer Creek receive more recharge from the stream, while wells close to the Blacktail Range receive more recharge from the mountain front. Mountain-front recharge originates in the large mountainous catchment area as spring snowmelt and summer rainfall. This recharge infiltrates fractures, joints, faults, and solution cavities of the mountain bedrock and flows into the valley-fill aquifer abutting the mountain front.

Flynn Lane Well Field Area. Hydrographs (Figure 15) indicate that groundwater levels were affected by pumpage from the large-discharge irrigation wells. Groundwater-level declines of approximately 5 to 15 feet occurred during the dry summers of 1992, 1994, and 1996, when many of the irrigation wells were frequently pumped. Smaller groundwater-level declines of several feet were observed during the wet summers of 1993 and 1995, when fewer irrigation wells were pumped. Even though small declines were observed during times of pumping, groundwater levels generally rose during these summers. For example, groundwater levels rose 7 to 10 feet during the summer of 1993, and 12 to 18 feet during the summer of 1995. Observation wells 92-12 and 92-13, located north of the center of the Flynn Lane well field, were affected less by the drawdown from the well field. Groundwater levels rose about 5 to 7 feet in these wells during the wet summers of 1993 and 1995.

Middle Blacktail Deer Creek Valley. Hydrographs (Figure 16) document the same general patterns of surface water influences as those hydrographs for wells along upper Blacktail Deer Creek. Average annual change in groundwater levels was about 10 feet. However, in 1993, water-level changes of 10 to 25 feet were observed, and in 1995, water-level changes of 25 to 35 feet were documented. These wells were located far enough from the Flynn Lane well field so that drawdown impacts were not observed.

Lower Blacktail Deer Creek Valley. Hydrographs (Figure 17) for the lower part of the Blacktail Deer Creek valley between Blacktail Road near Dillon and Carrigan Lane (Figure 1) show seasonal oscillations of groundwater levels of 10 to 20 feet as groundwater rose in the early summer, peaked during mid to late summer, and declined until late spring of the following year. These summertime water-level rises resulted from irrigation return flow recharging the aquifer. Following summertime irrigation, groundwater levels declined until the following spring.

Beaverhead River Floodplain near Barretts. Hydrographs (Figure 18) indicate the same general patterns of groundwater-level fluctuations as observed in the lower Blacktail Deer Creek valley. The 10- to 15-foot changes were caused by irrigation return flow, but streamflow losses from the Beaverhead River along its losing reach between the Barretts diversion and Highway 278 also contributed to the fluctuations. Well 92-21 had small seasonal groundwater-level changes because it was completed in the lower Tertiary aquifer. Well 92-22 had smaller annual changes in water levels than other wells completed in the Quaternary/upper Tertiary aquifer in this area because groundwater levels in this well were influenced by the well’s proximity to the groundwater discharge area along the Beaverhead River.

Figure 15. Groundwater Hydrographs in the Flynn Lane Well Field Area

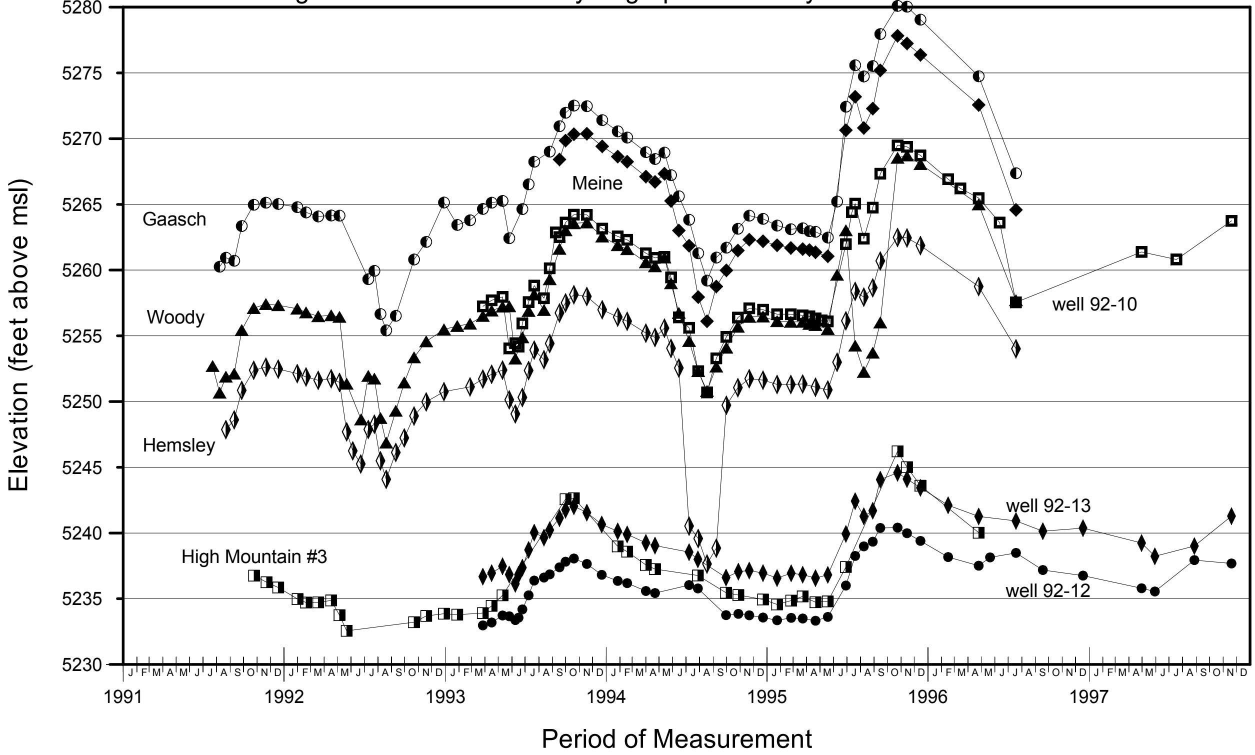


Figure 16. Groundwater Hydrographs in the Middle Blacktail Deer Creek Valley

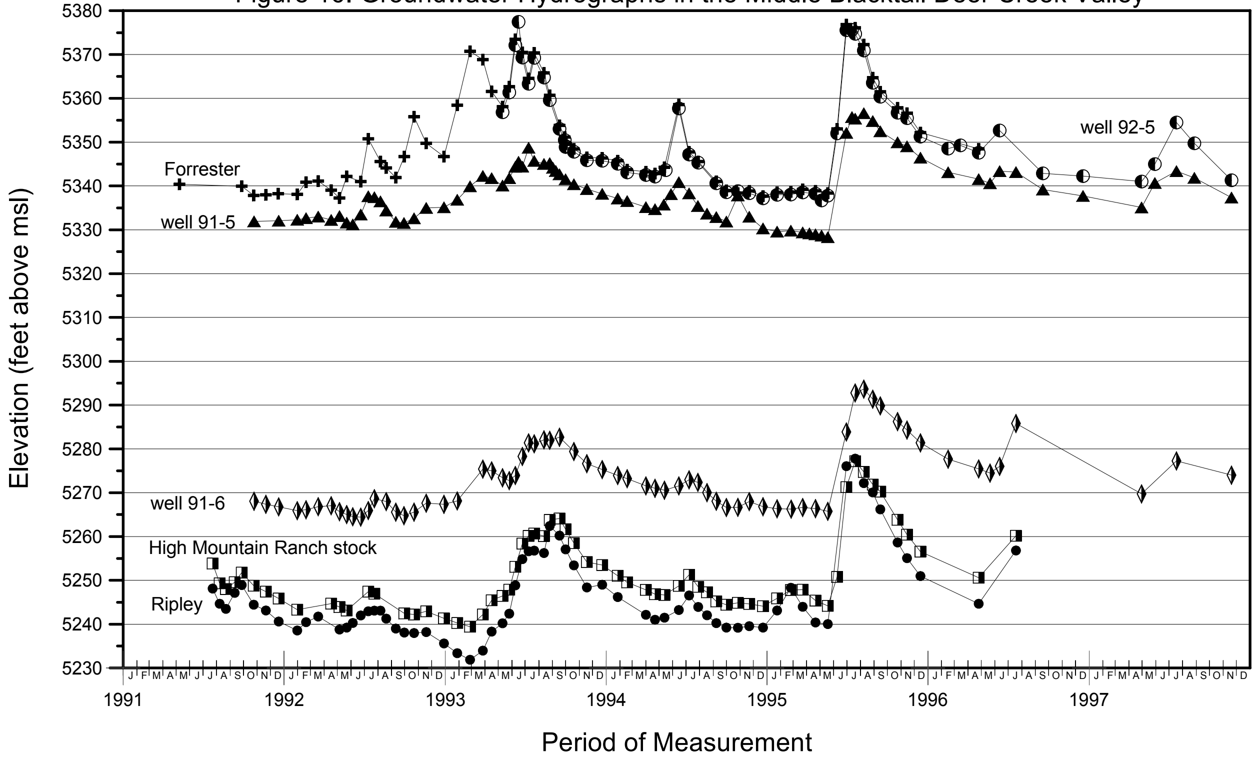


Figure 17. Groundwater Hydrographs in the Lower Blacktail Deer Creek Valley

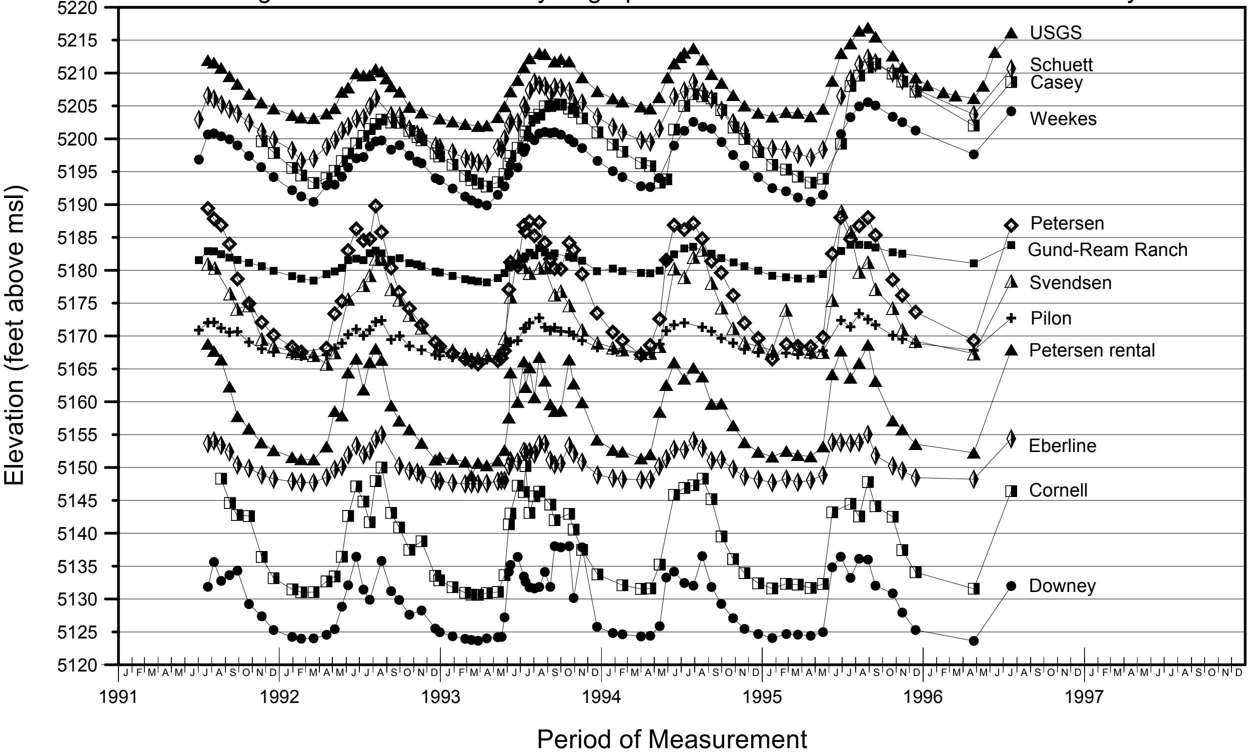
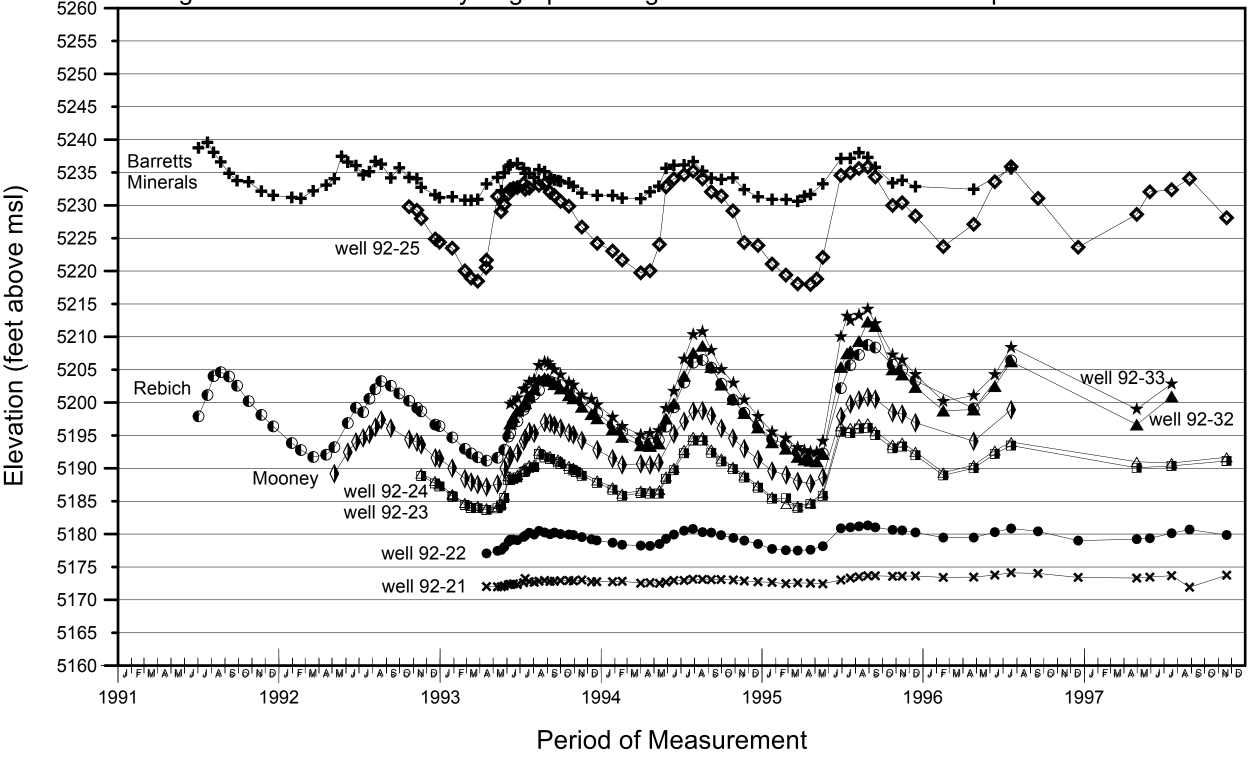


Figure 18. Groundwater Hydrographs along the Beaverhead River Floodplain near Barretts



Lower Rattlesnake Creek Valley. Hydrographs (Figure 19) show that seasonal groundwater-level changes were similar to those of the lower Blacktail Deer Creek valley and the Barretts area. Cyclic groundwater-level changes of 7 to 20 feet resulted from irrigation return flow in the lower Rattlesnake Creek valley.

Beaverhead River Floodplain near Dillon. Hydrographs (Figure 20) for the Beaverhead River floodplain between Highway 278 and Dillon illustrate different patterns of groundwater-level change than those observed in the lower Rattlesnake and Blacktail Deer Creek valleys. Groundwater levels were near land surface and relatively constant throughout the year. Seasonal fluctuations amounted to a few feet. Groundwater levels in wells near the Beaverhead River were influenced by stages of the river and proximity to the groundwater discharge area.

Continuous Recorder Hydrographs. Continuous hydrographs were recorded for five of the observation wells (92-2, 92-10, 92-33, 92-34, and 92-35) for portions of the period of record. Records for wells 92-2, 92-33, 92-34, and 92-35 (Figures 21 through 23) are presented as daily averages for periods from spring to mid autumn of 1994 and 1995. The continuous hydrograph for well 92-10 (Figure 24) is presented as 4-hour readings between April 1994 and March 1997. The hydrograph for well 92-10 illustrates the drawdown impacts from irrigation well withdrawals in the Flynn Lane well field and groundwater-level recovery following summer irrigation.

Seasonal Groundwater-Level Changes. Seasonal groundwater-level change maps, presented chronologically in Figures 25 through 34, illustrate water-level rise or decline between two observation dates. Observation dates in late spring and mid-to-late summer of each year were selected to compare the annual change of groundwater levels from their lowest to highest levels (Figures 26, 28, 30, 32, and 34). These change maps illustrate that groundwater levels rose seasonally each summer along the Beaverhead River near Barretts and in the Rattlesnake Creek valley. Groundwater-level rises of 5 to 15 feet were observed near Barretts and in the lower Rattlesnake and Blacktail Deer Creek valleys. Along the Beaverhead River near Dillon, rises ranging from less than 1 foot to 5 feet were observed. Most groundwater levels declined from late summer through late spring of the following year (Figures 25, 27, 29, 31, and 33). The magnitudes of the observed declines were similar to rises observed the previous summer.

Different patterns of groundwater-level change were observed during wet and dry years in the area of the Flynn Lane well field. During the wet summers of 1993 and 1995, groundwater levels rose sharply throughout the project area, with changes ranging from about 2 to 24 feet in 1993 and 7 to 43 feet in 1995 occurring along Blacktail Deer Creek. In the Flynn Lane well field, however, small rises of 2 to 4 feet in 1993 and 5 to 13 feet in 1995 were observed. Groundwater-level rises in the Flynn Lane well field were smaller than rises observed elsewhere because the irrigation wells continued to withdraw groundwater from aquifer storage. In spite of these withdrawals, groundwater flow provided enough recharge for seasonal groundwater-level rises to occur. From autumn to spring, groundwater levels declined in the project area, except in the Flynn Lane well field area, where groundwater levels recovered following pumping. Groundwater-level

Figure 19. Groundwater Hydrographs in the Lower Rattlesnake Creek Valley

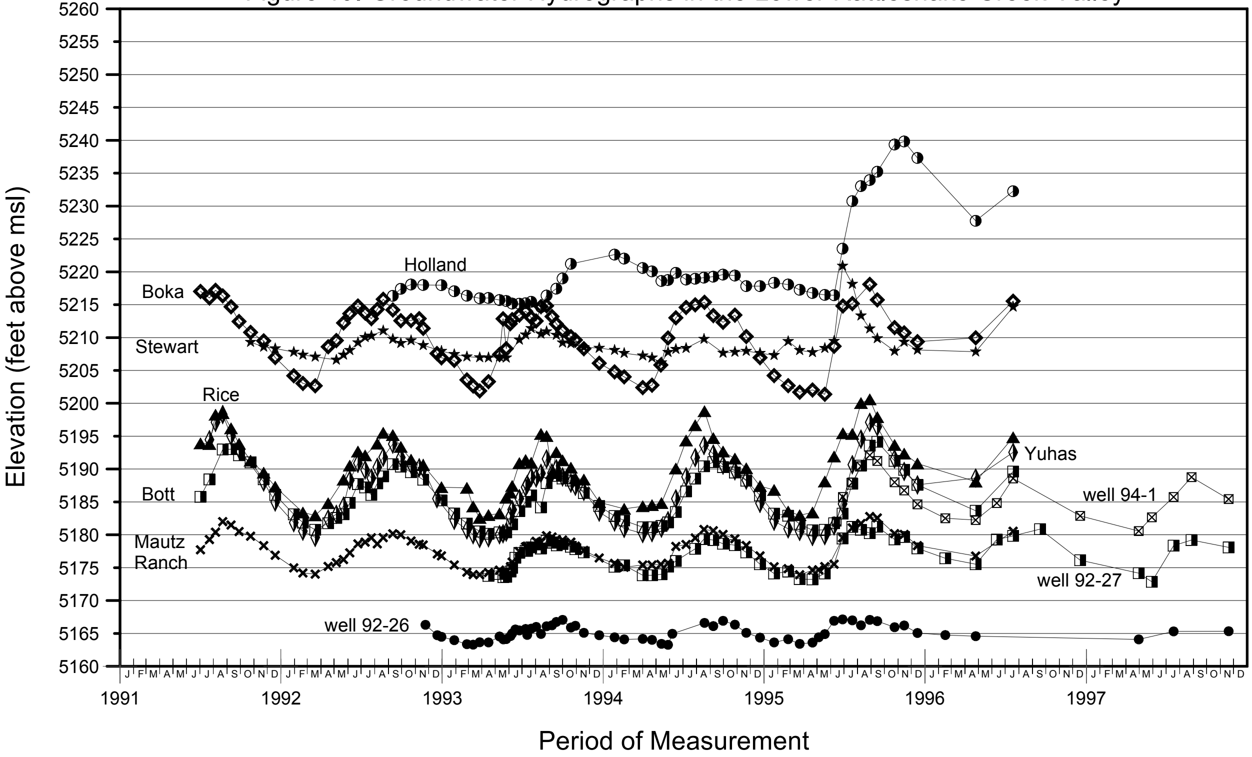


Figure 20. Groundwater Hydrographs along the Beaverhead River Floodplain near Dillon

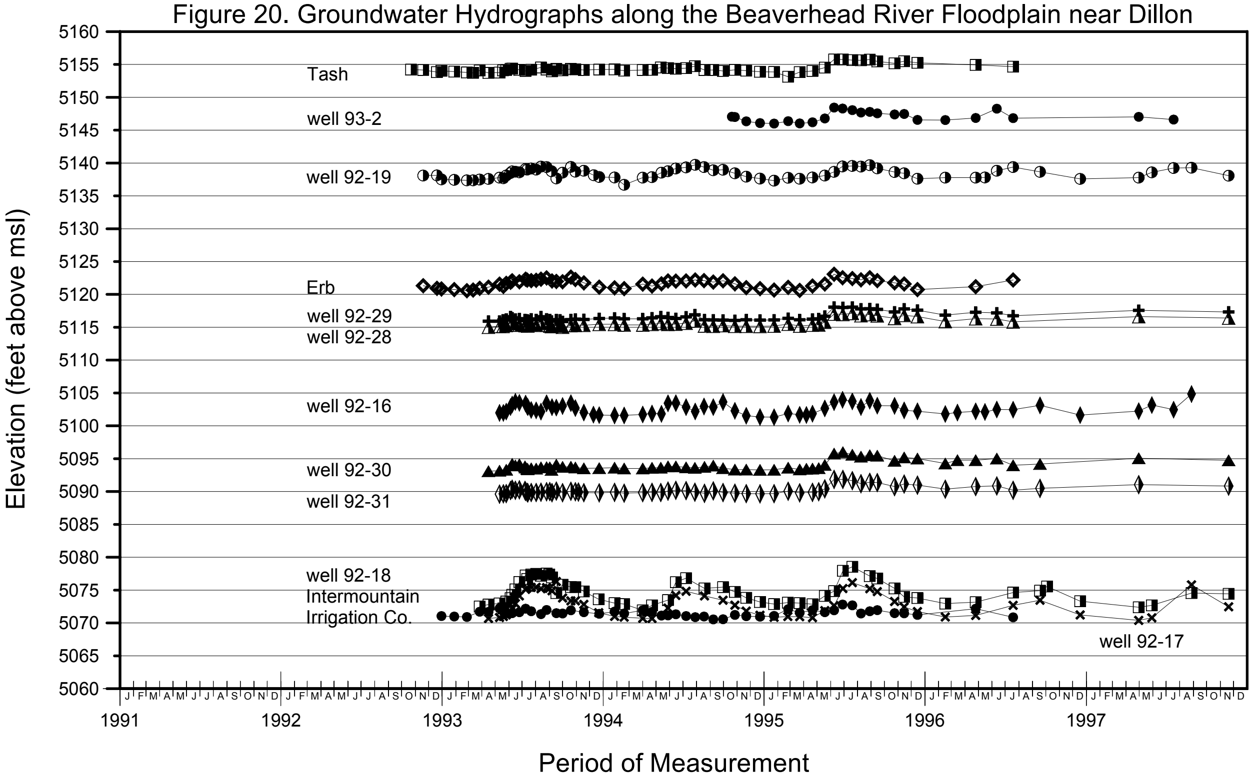


Figure 21. Continuous Recorder Groundwater Hydrograph for Well 92-2

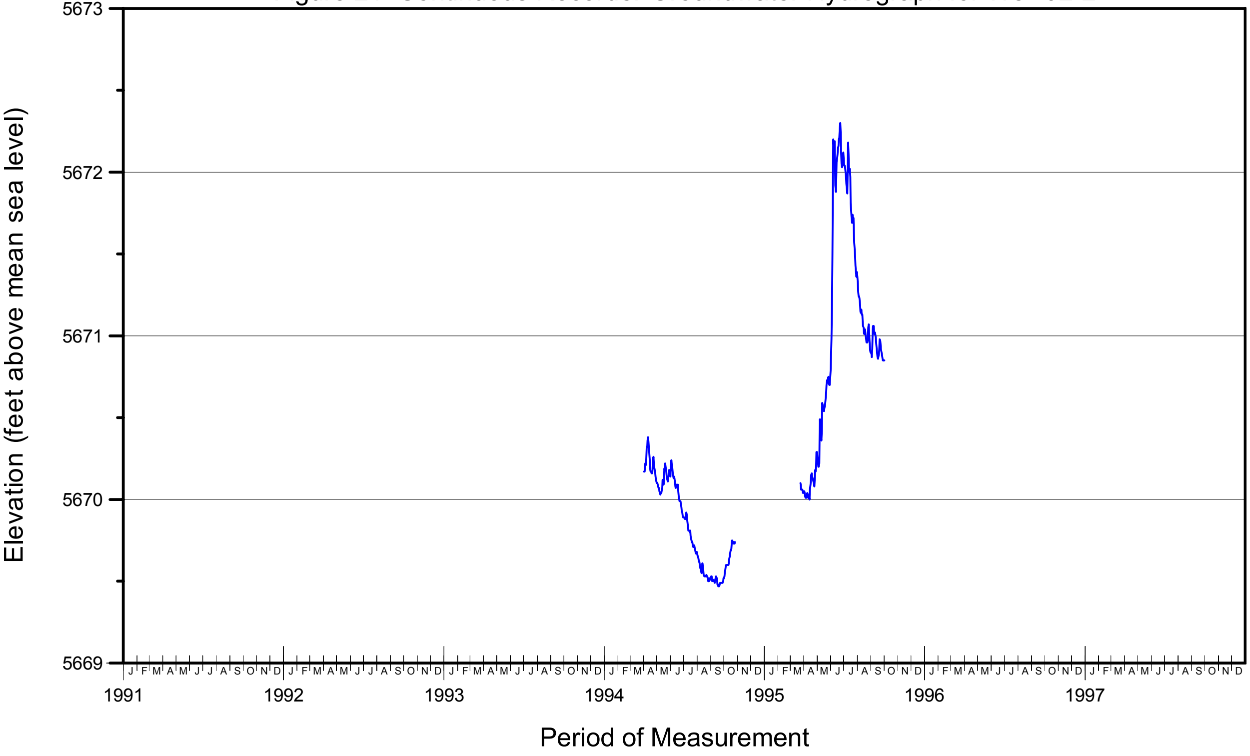


Figure 22. Continuous Recorder Groundwater Hydrograph for Well 92-33

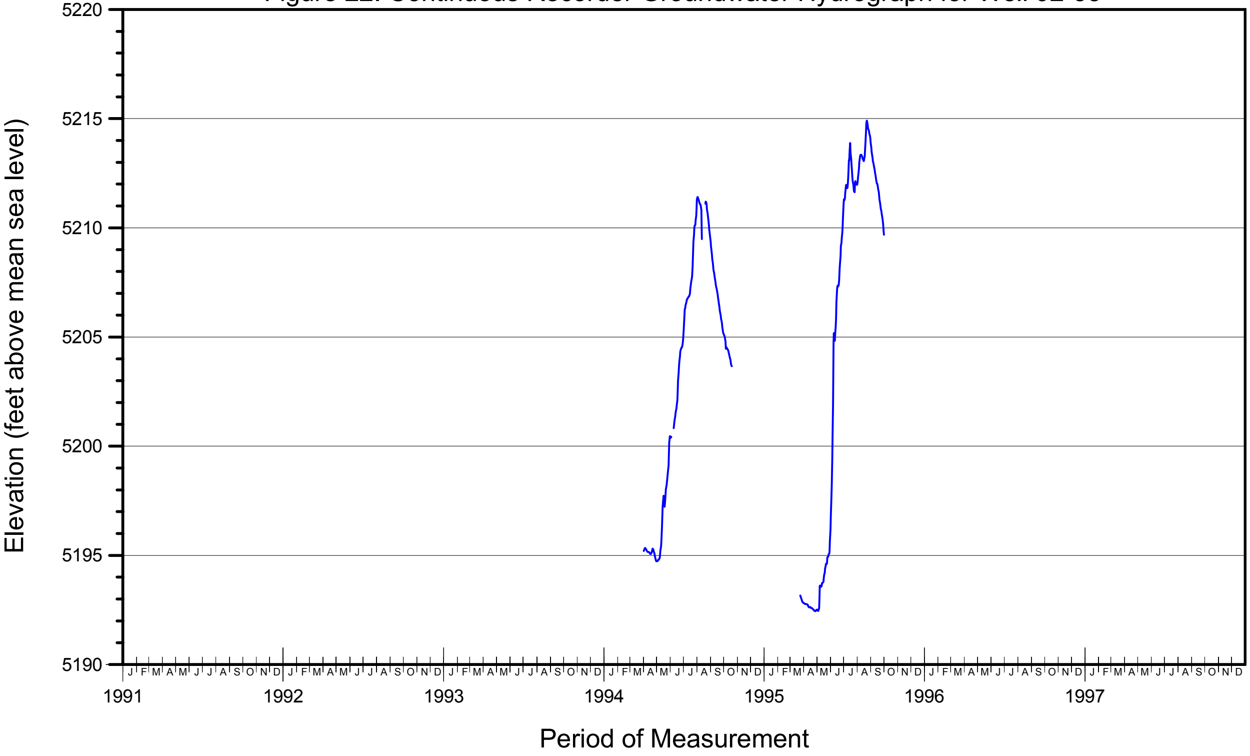


Figure 23. Continuous Recorder Groundwater Hydrographs for Wells 92-34 and 92-35

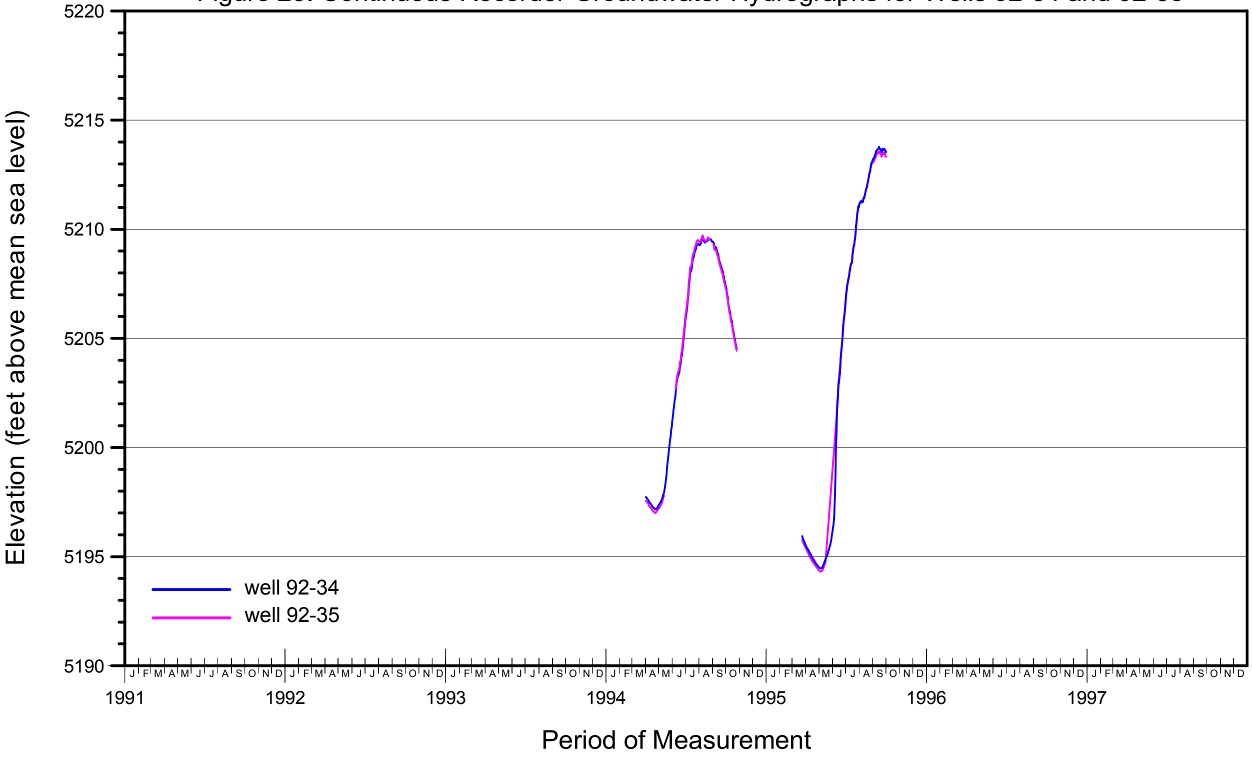
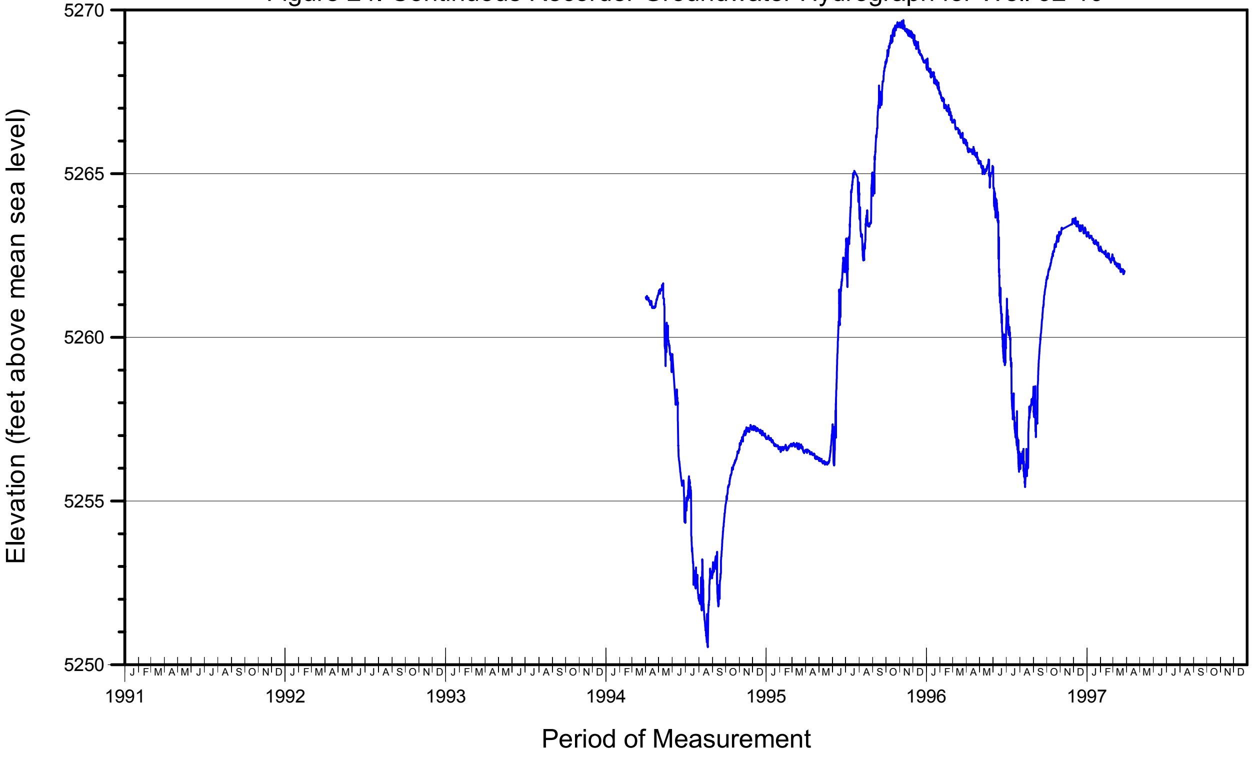


Figure 24. Continuous Recorder Groundwater Hydrograph for Well 92-10



recovery from irrigation well drawdown was mostly complete by late autumn of each year. A groundwater-level change map (Figure 33) illustrates the late summer-to-spring rise of groundwater in the well field after the wet summer of 1995. The size of the impacted area in the Flynn Lane well field showing groundwater-level recovery following wet summers was smaller than that following dry summers.

During the dry summers of 1992, 1994, and 1996, groundwater levels rose throughout the project area with patterns similar to those observed during wet years, except in the Flynn Lane well field area where declines were noted (Figures 26, 30, and 34). In this area, observed groundwater levels declined up to 5 feet in 1992, up to 15 feet in 1994, and up to 8 feet in 1996 as a result of irrigation well withdrawals. Larger declines occurred during these dry years because more groundwater was pumped, and because groundwater flow from upgradient did not provide as much recharge as during wet years. Regardless of the lack of precipitation, groundwater levels in the Flynn Lane well field area quickly recovered to seasonal levels after irrigation withdrawals ended, as illustrated in the hydrograph for well 92-10 (Figure 24). From late summer to spring following the dry summers of 1992 and 1994 (Figures 27 and 31), groundwater levels declined throughout the project area, except in the Flynn Lane well field area, where groundwater levels recovered from pumping. The size of the impacted area showing groundwater-level recovery following dry summers was larger than that following wet summers (Figures 29 and 33).

The upper Blacktail Deer Creek area experienced groundwater-level changes of 5 to 15 feet during times of average or below-average precipitation and flood irrigation operations. However, during years of high precipitation and high stream stage in upper Blacktail Deer Creek, surface flow was diverted onto the agricultural lands along upper Blacktail Deer Creek in T9S, R8W for flood control purposes. Much of this diverted surface flow infiltrated the aquifer, causing large rises (10 to 40 feet) in groundwater levels (Figure 32). During the following spring, groundwater levels declined to seasonal levels (Figure 33).

Maximum Observed Groundwater-Level Fluctuations. A map of maximum observed groundwater-level fluctuations (Figure 35) was prepared for the period of record. This map illustrates the potential for groundwater-level variability in response to stage in the Beaverhead River and tributary streams, stream diversions, annual precipitation, irrigation well withdrawals, period of irrigation water application, quantity of groundwater flow into and from the aquifer, and changes in aquifer storage. Maximum groundwater-level changes of about 60 feet were observed along upper Blacktail Deer Creek; most of this change was attributed to artificial recharge from stream diversions rather than irrigation well withdrawals. Maximum groundwater-level changes of 10 to 25 feet observed in the lower Blacktail Deer and Rattlesnake creek valleys and on the Beaverhead River floodplain near Barretts were attributed to irrigation return flow. The groundwater-level changes near Dillon amounted to a few feet.

Depth to Groundwater. The average depth to groundwater from the land surface for the period of record (Figure 36) ranged from a few feet along the Beaverhead River near Dillon to over 150 feet near the Blacktail Range.

Figure 25. Groundwater-Level Changes between July 22, 1991 and April 16, 1992

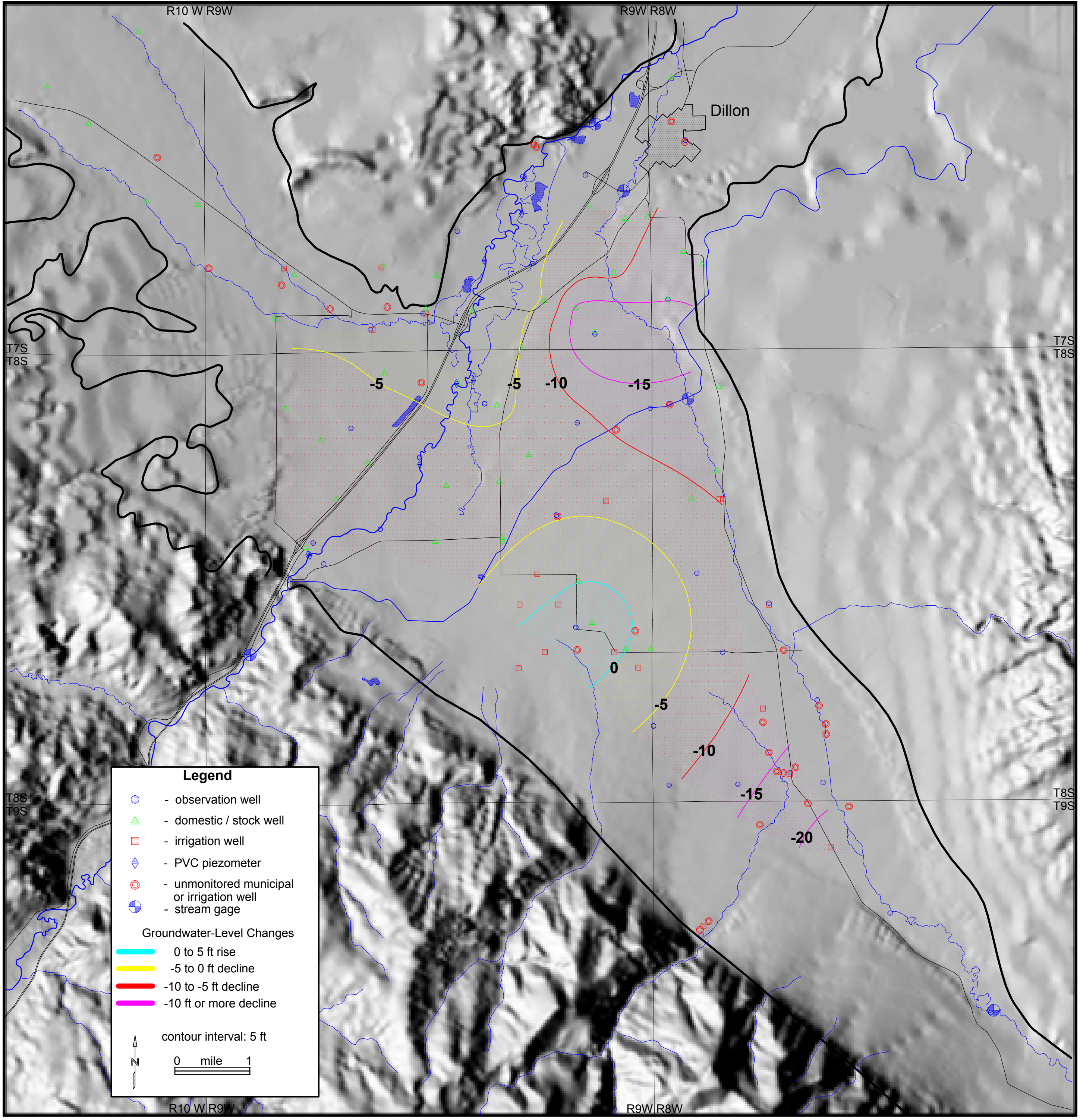


Figure 26. Groundwater-Level Changes between April 16, 1992 and July 23, 1992

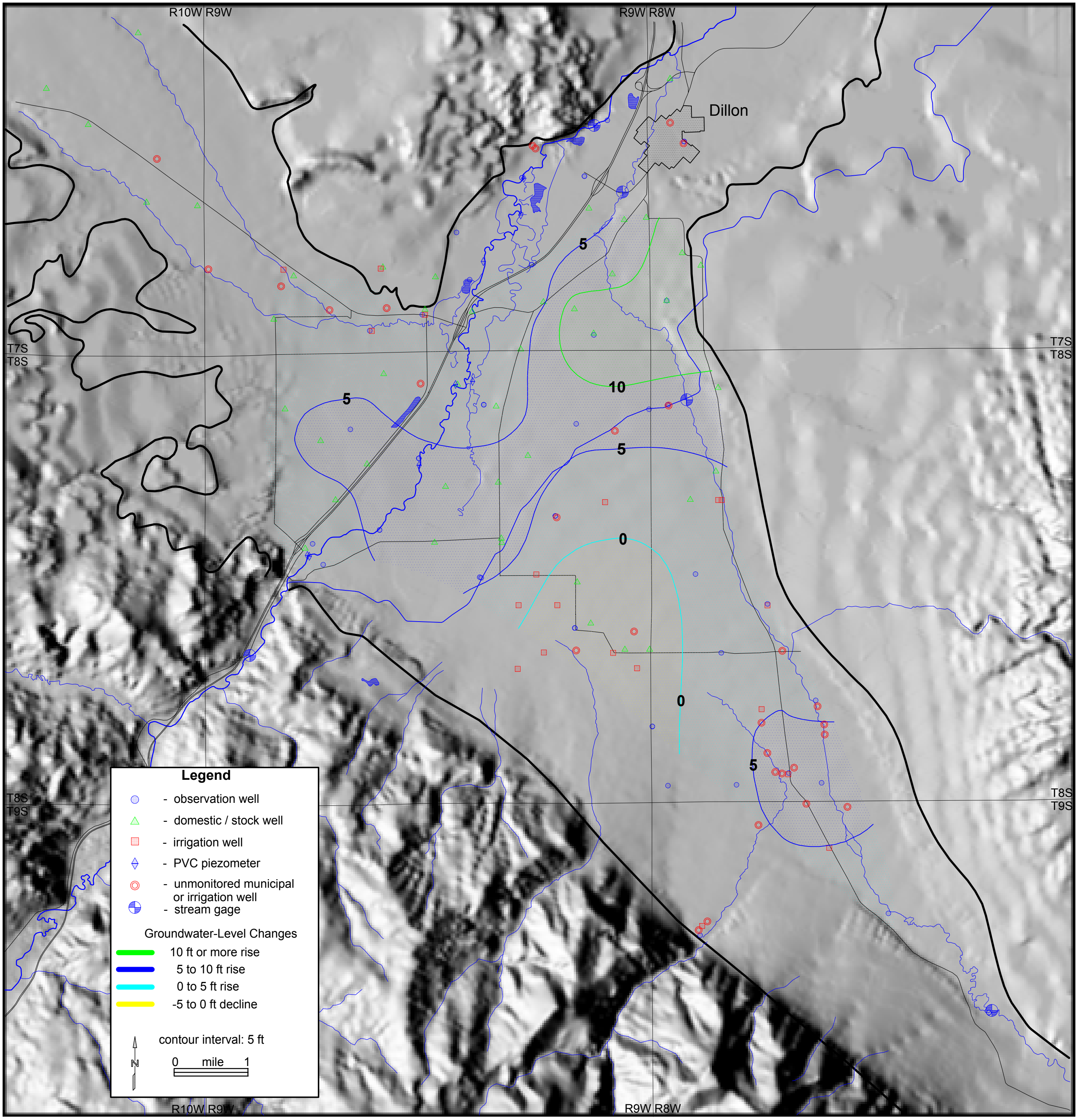


Figure 27. Groundwater-Level Changes between July 23, 1992 and April 15, 1993

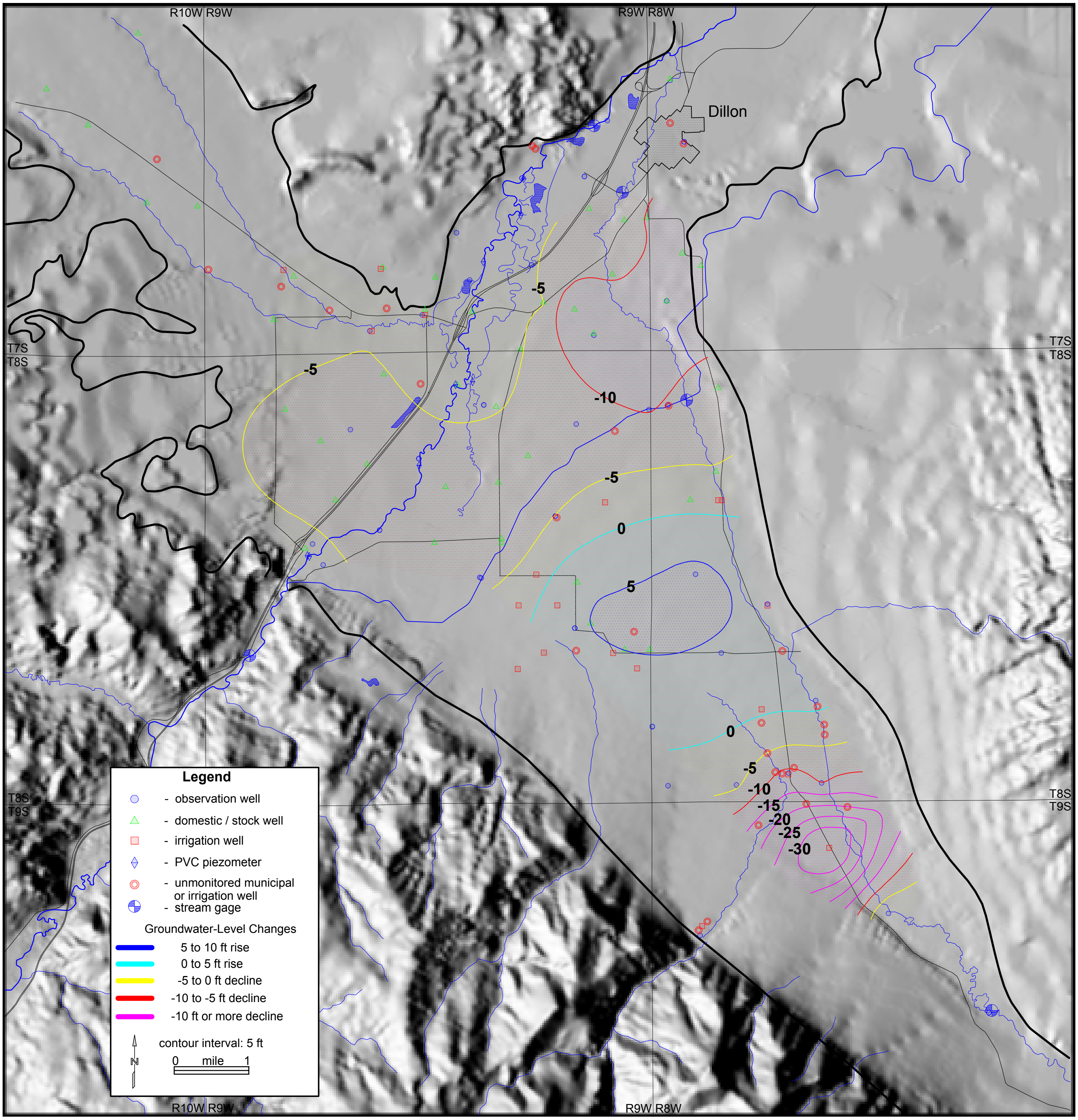


Figure 28. Groundwater-Level Changes between April 15, 1993 and August 25, 1993

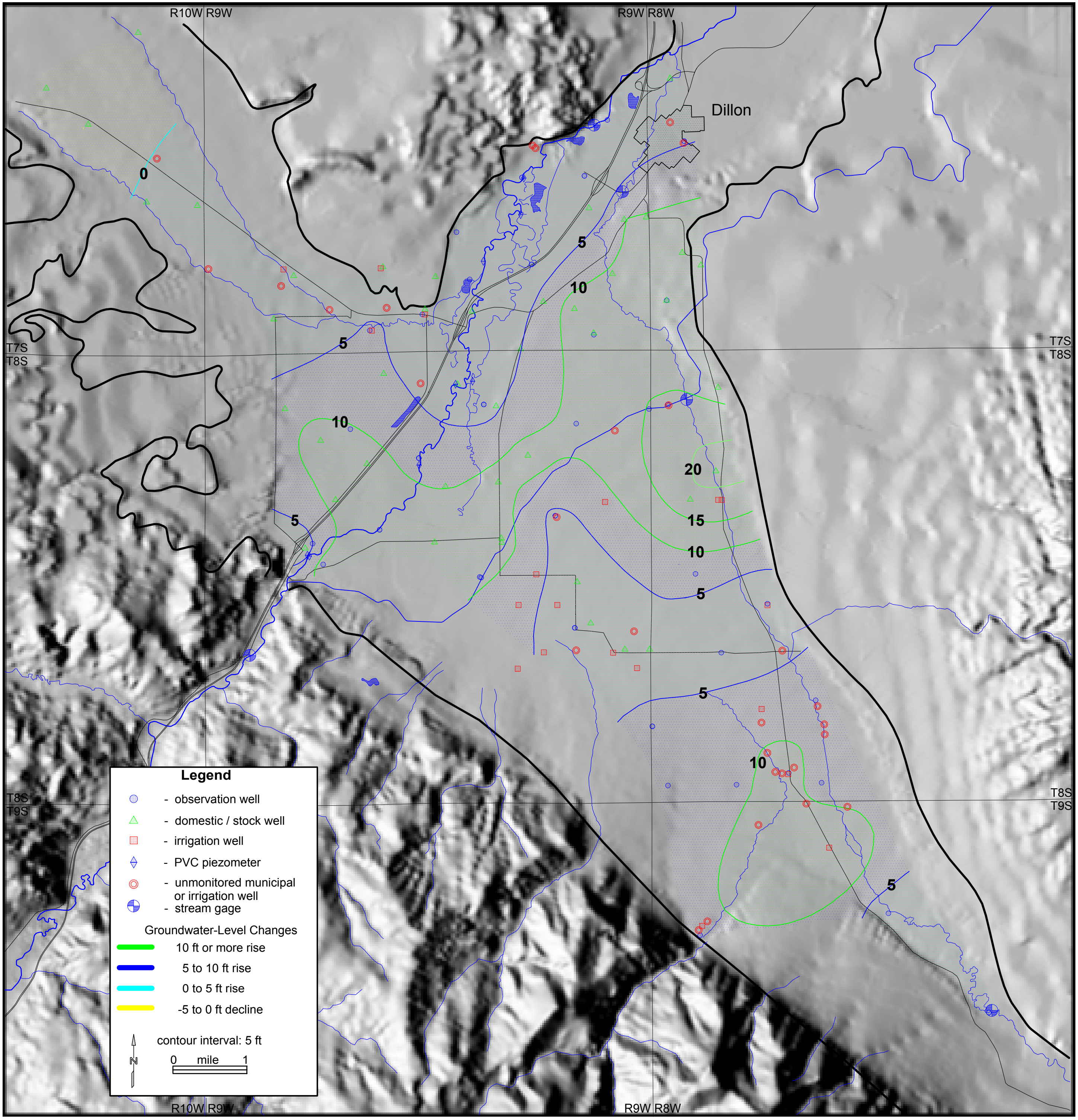


Figure 29. Groundwater-Level Changes between August 25, 1993 and April 21, 1994

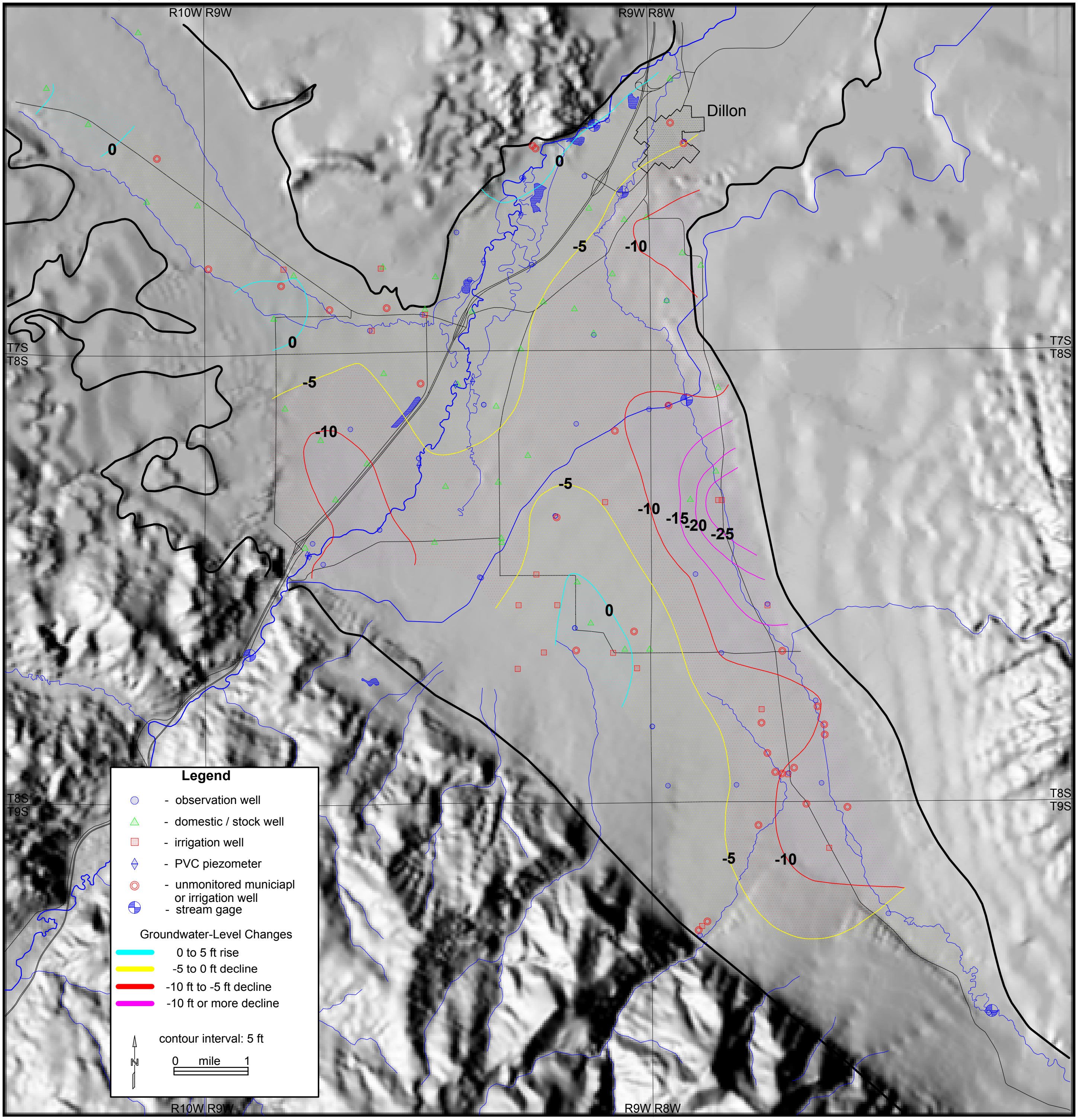


Figure 30. Groundwater-Level Changes between April 21, 1994 and July 28, 1994

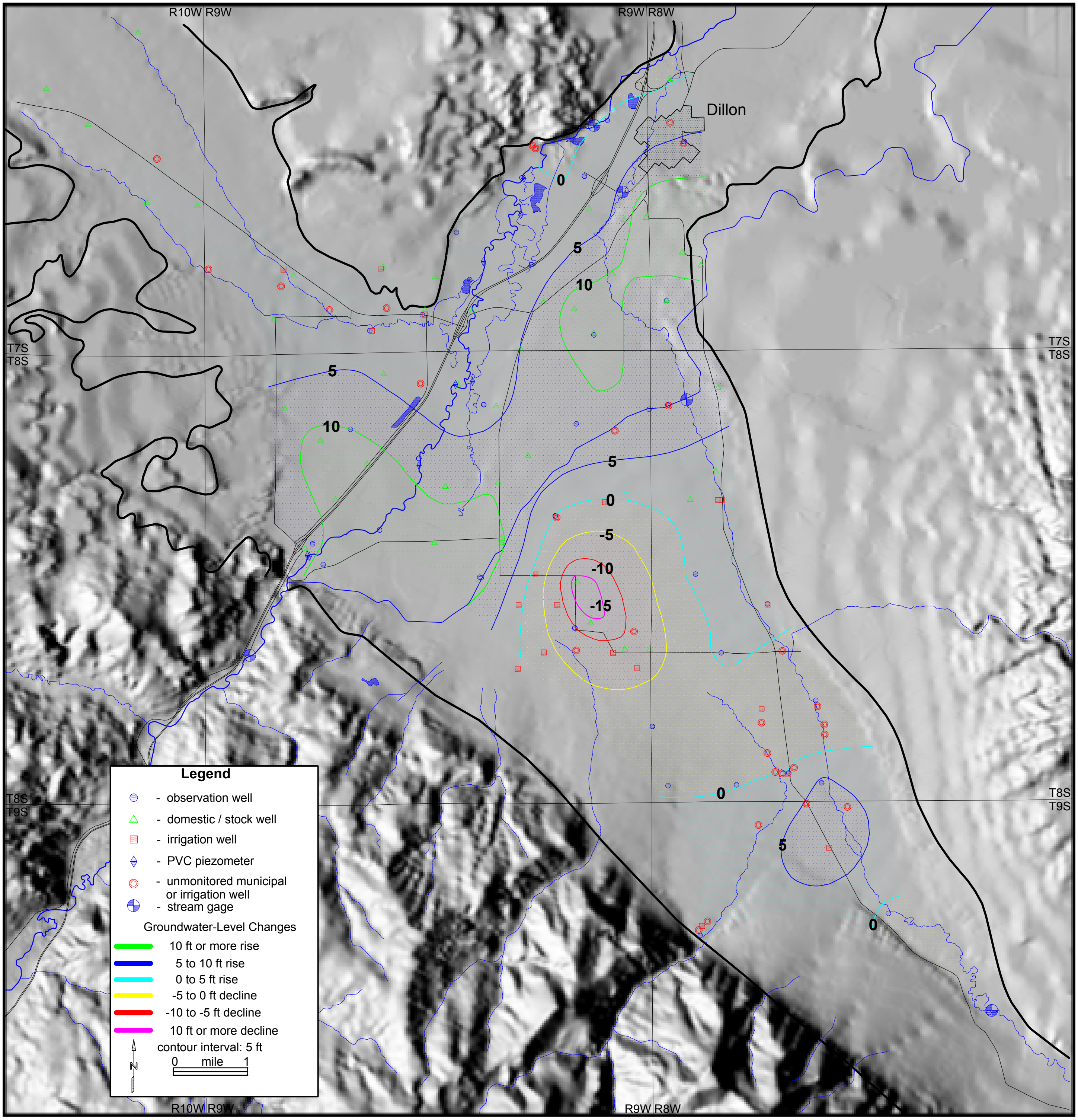


Figure 31. Groundwater-Level Changes between July 28, 1994 and April 20, 1995

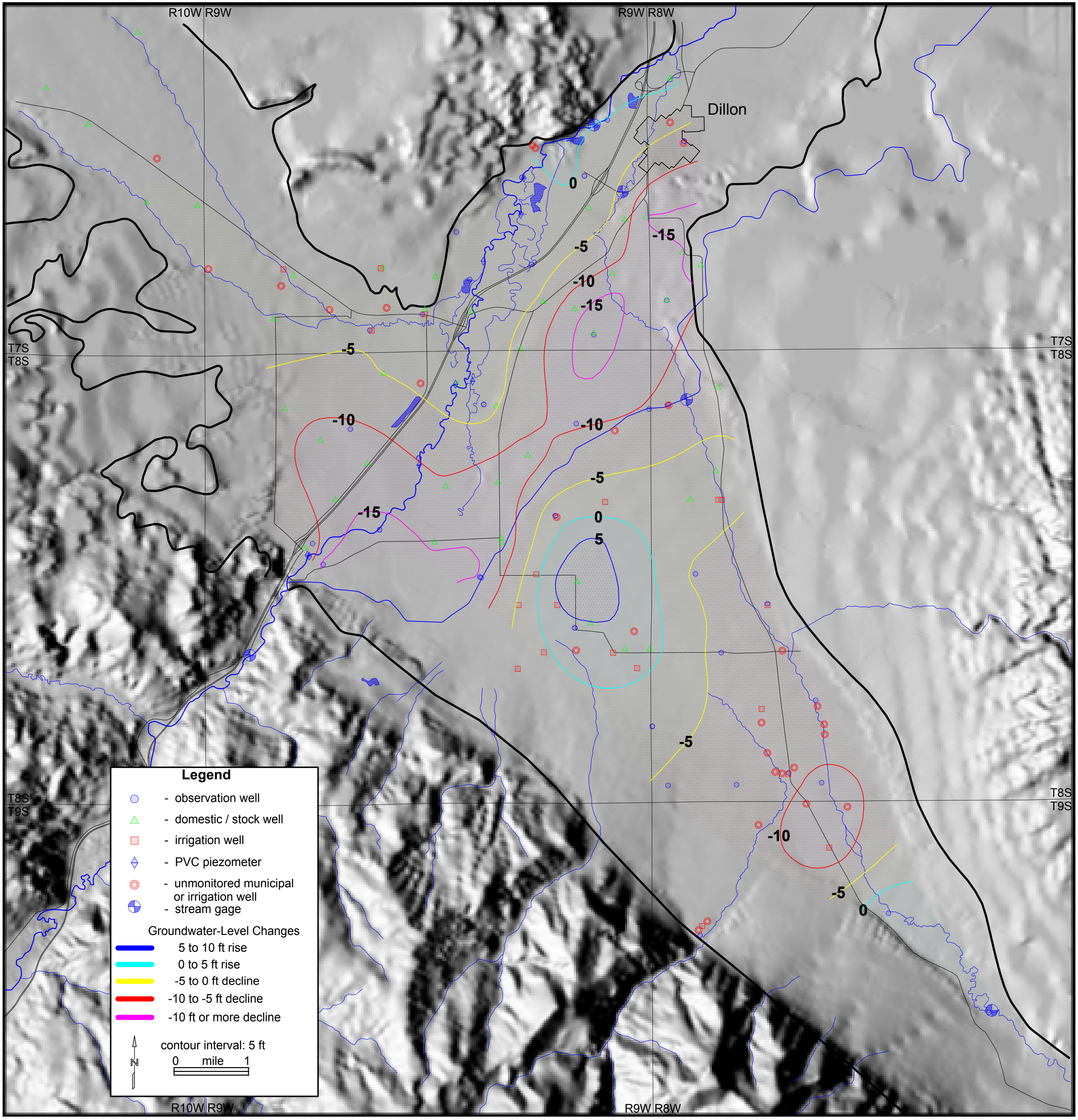


Figure 32. Groundwater-Level Changes between April 20, 1995 and August 28, 1995

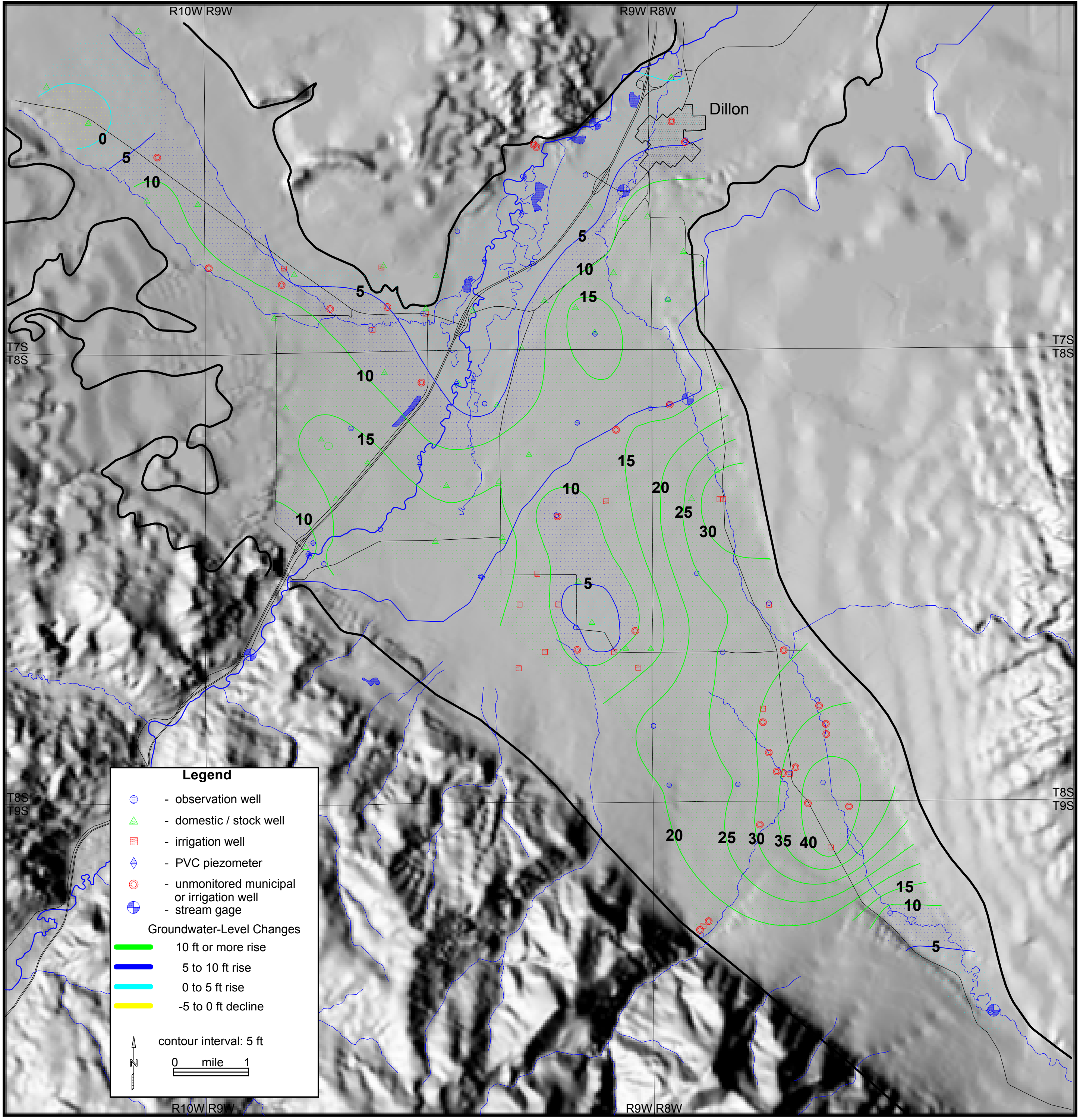


Figure 33. Groundwater-Level Changes between August 28, 1995 and April 24, 1996

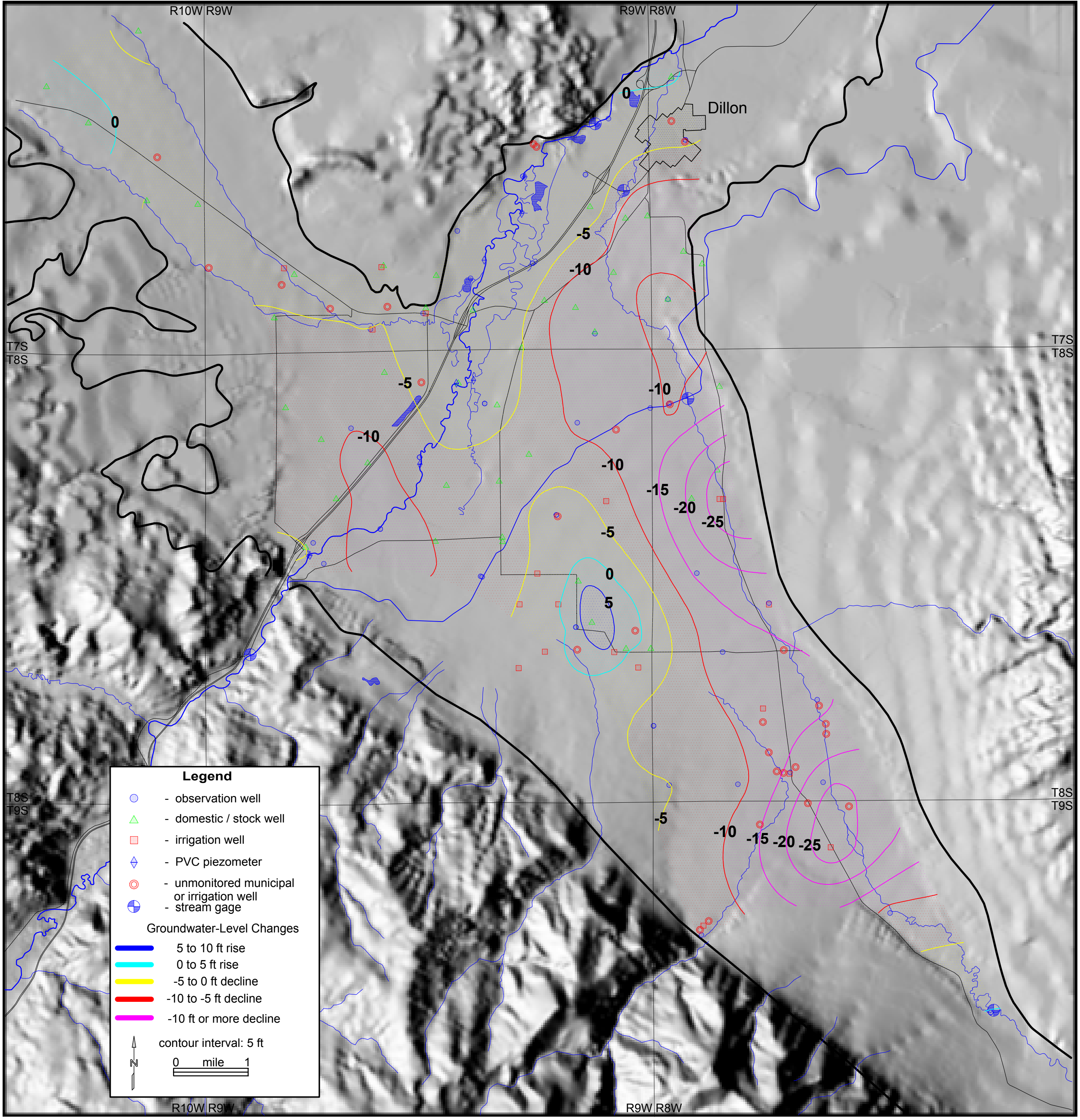


Figure 34. Groundwater-Level Changes between April 24, 1996 and July 18, 1996

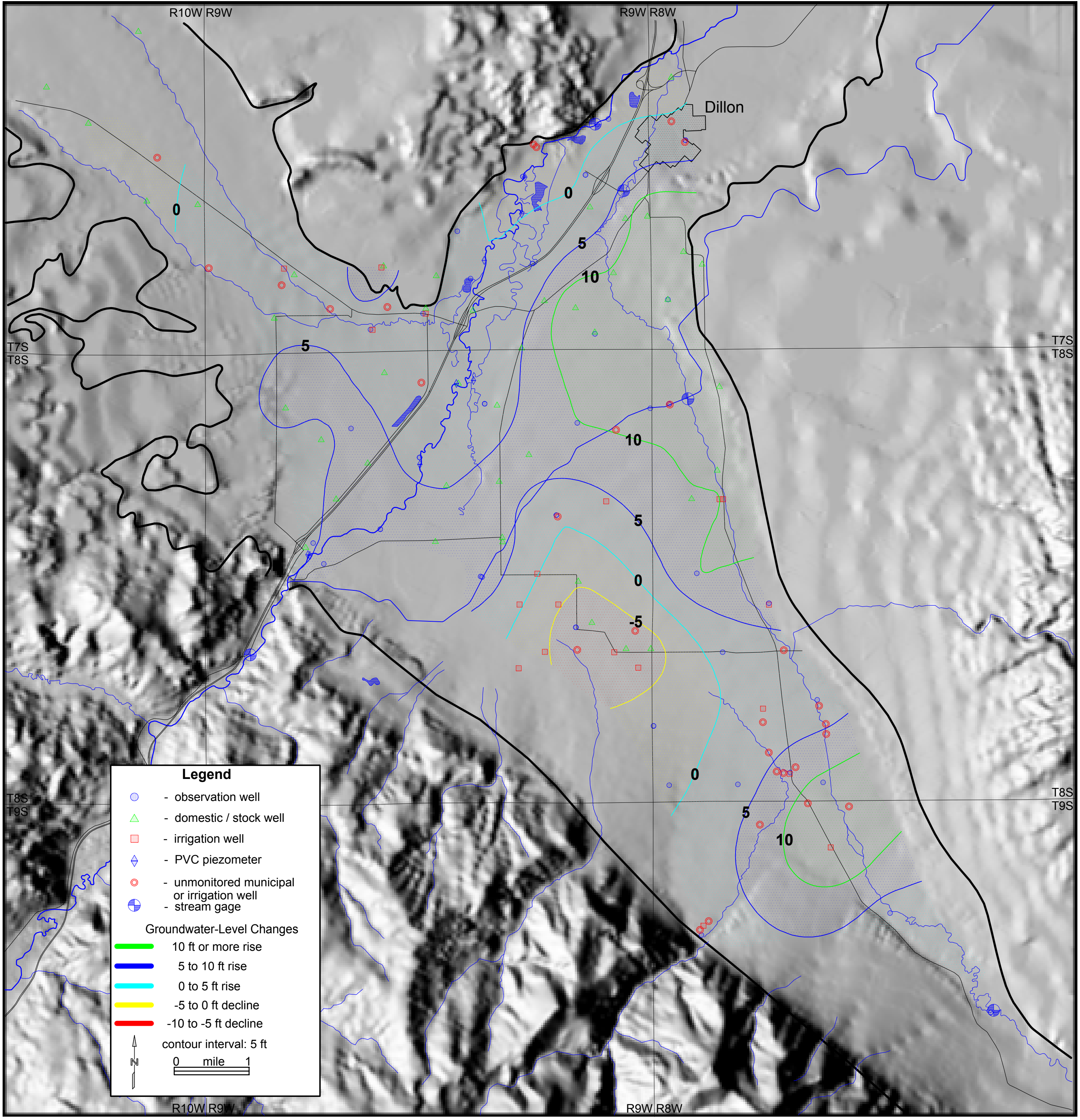


Figure 35. Range of Maximum Observed Groundwater-Level Changes between July, 1991 and July, 1996

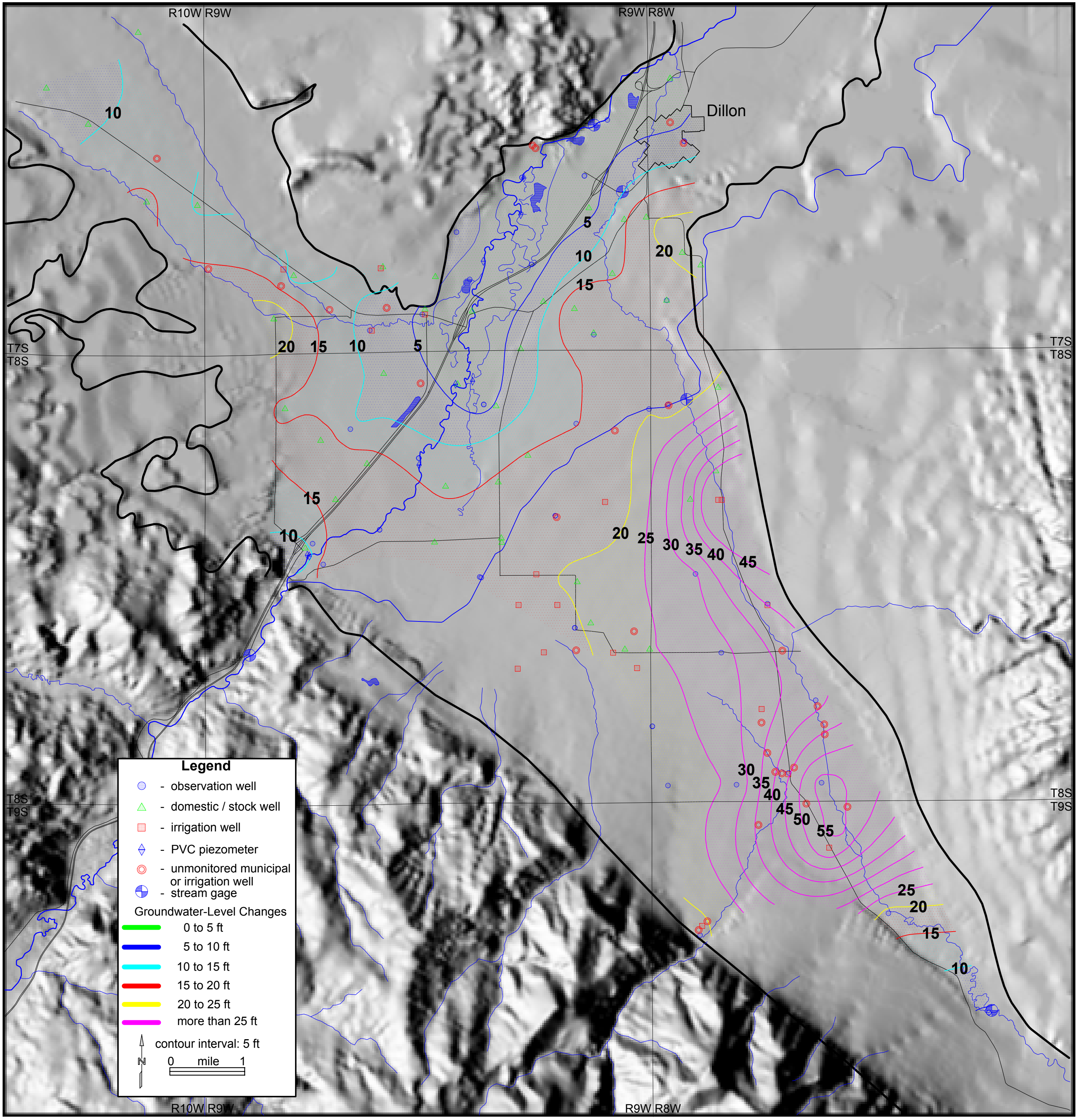
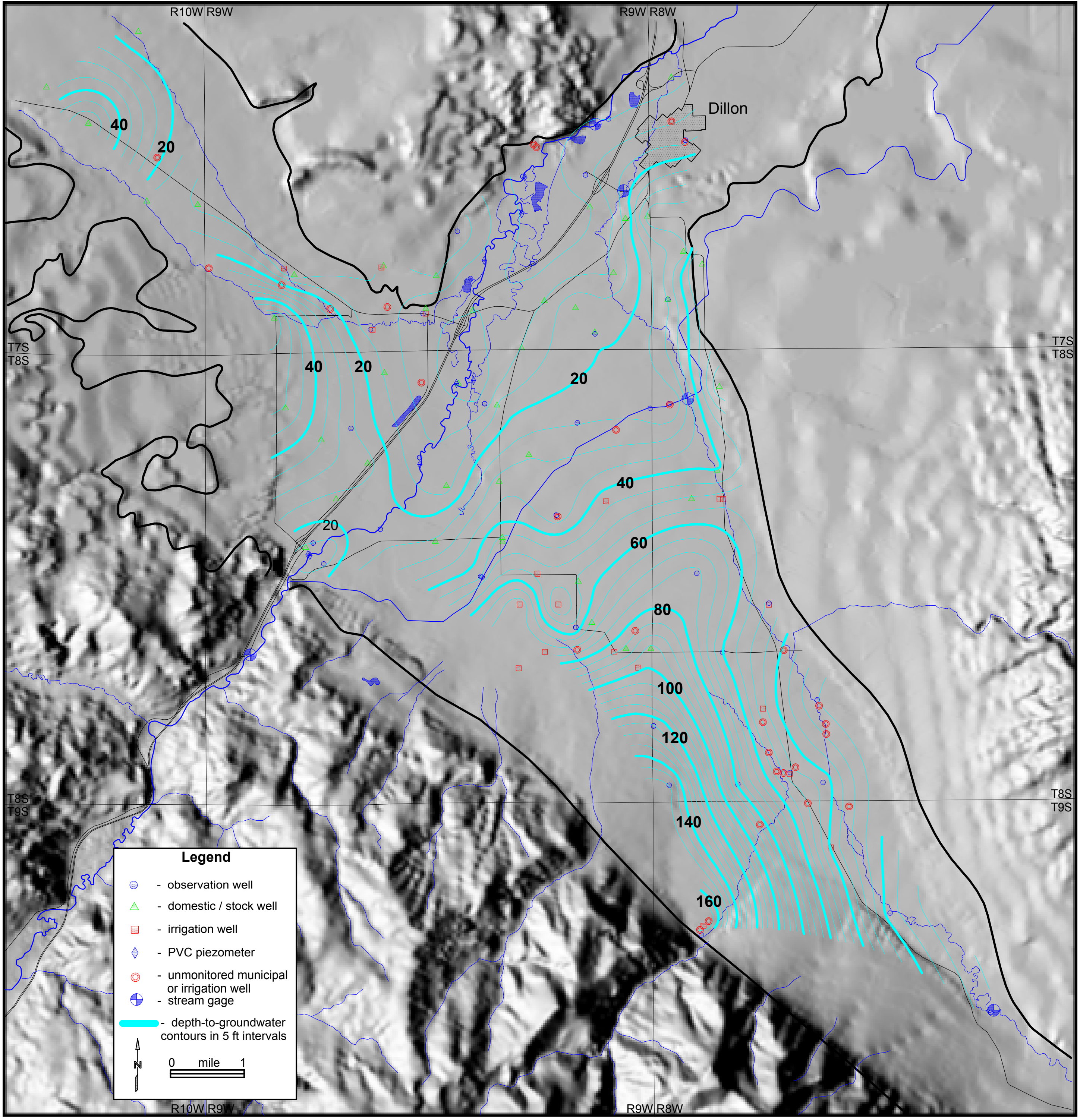


Figure 36. Average Depth to Groundwater from Land Surface between July, 1991 and July, 1996



Potentiometric Surfaces. Composite potentiometric surfaces (Figures 37 through 42) were constructed from groundwater-level measurements for both April and late July or late August of 1991 through 1996, when levels were generally at their lowest and highest points, respectively. Comparisons of potentiometric surfaces illustrate that, regardless of varying amounts of precipitation, irrigation well withdrawals, and stream stages, the configurations of the potentiometric surface contours remained relatively unchanged. The largest annual shifts of the potentiometric surface contours occurred between the 5,200- and 5,250-foot elevations in the lower Blacktail Deer Creek valley and on the Beaverhead River floodplain near Barretts. These shifts occurred as the potentiometric surface adjusted to increased precipitation and irrigation return flow in the late spring and early summer, and decreased precipitation and irrigation return flow, and diminished aquifer storage, in the late summer and autumn. As groundwater levels rose between spring and mid to late summer, the contours shifted downvalley toward the Beaverhead River. As groundwater-level declines began in late summer and continued to the following spring, potentiometric contours shifted up the Blacktail Deer Creek valley and Beaverhead River floodplain toward Barretts to approximately where they were the previous summer.

Potentiometric surface contour shifts elsewhere were small, with virtually no contour shifts in the Rattlesnake and upper Blacktail Deer Creek valleys. Comparisons of potentiometric surfaces indicate that the patterns of contour shifts are repetitive from year to year. Localized drawdown during the summer irrigation periods in the Flynn Lane well field is not discernible on the potentiometric surface maps and may be viewed simply as temporary, localized depressions of the groundwater surfaces during irrigation periods.

Potentiometric surface contours are more widely spaced between the 5,200- and 5,300-foot contours from the Beaverhead River floodplain to Flynn Lane than between the 5,300- and 5,600-foot contours from Flynn Lane to the upper Blacktail Deer Creek gage. The wide contour spacing indicates a more gradual change in groundwater surface elevations and reflects the greater hydraulic conductivity and aquifer thickness in the Flynn Lane well field area and middle Blacktail Deer Creek valley, compared with the upper portion of the valley. The hydraulic gradient from the Flynn Lane area of the Blacktail Deer Creek valley to the Beaverhead River ranged from 0.006 to 0.007, whereas the hydraulic gradient of the potentiometric surface in the upper portion of the valley was approximately 0.010. The hydraulic gradients in the Rattlesnake Creek valley and along the Beaverhead River between Barretts and Dillon were relatively constant at 0.012 and 0.004, respectively.

Summary

Hydrographs, groundwater-level change maps, and potentiometric surface maps indicate that groundwater availability has been relatively constant. Groundwater levels have not steadily declined in spite of large seasonal groundwater irrigation withdrawals and some low precipitation years. Groundwater levels have fluctuated annually in response to variations in recharge from precipitation, irrigation return flow, stream leakage, and groundwater infiltration from the fractured bedrock aquifer. Groundwater levels rise dramatically during times of above-average precipitation, and decline during drought. Groundwater levels have typically been lowest during late spring and highest in mid to late

Figure 37. 1991 Composite Potentiometric Surface

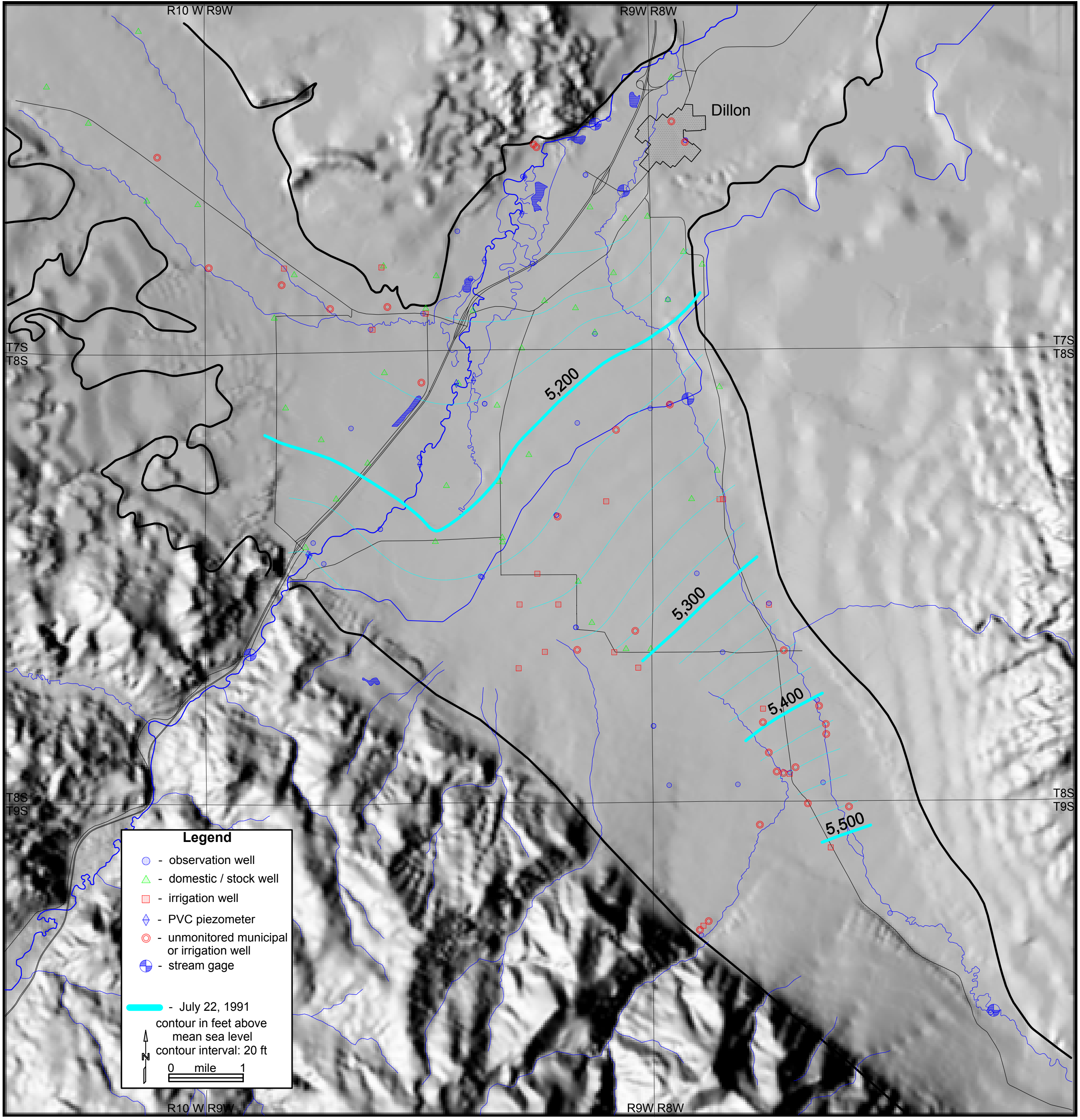


Figure 38. 1992 Composite Potentiometric Surfaces

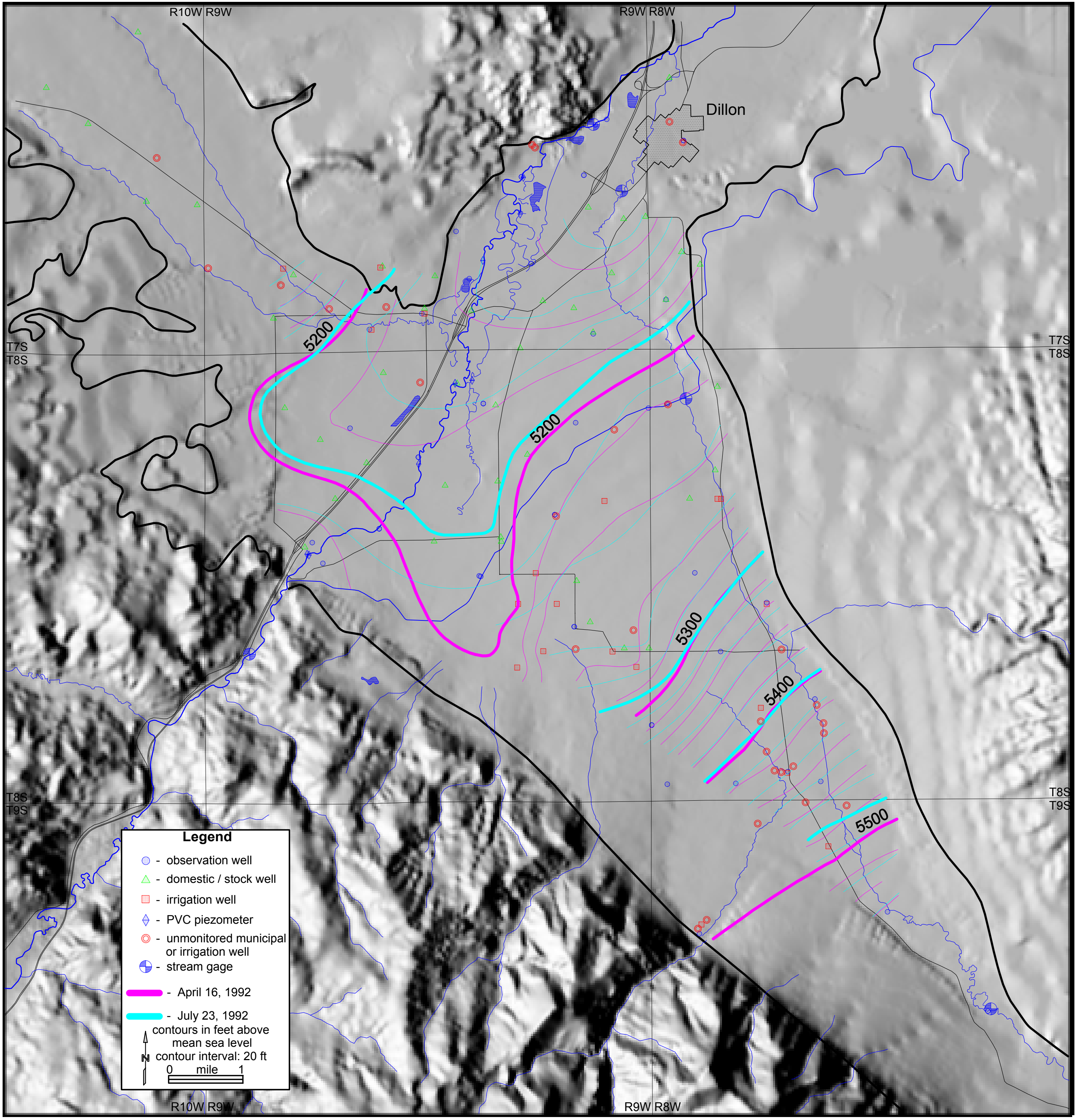


Figure 39. 1993 Composite Potentiometric Surfaces

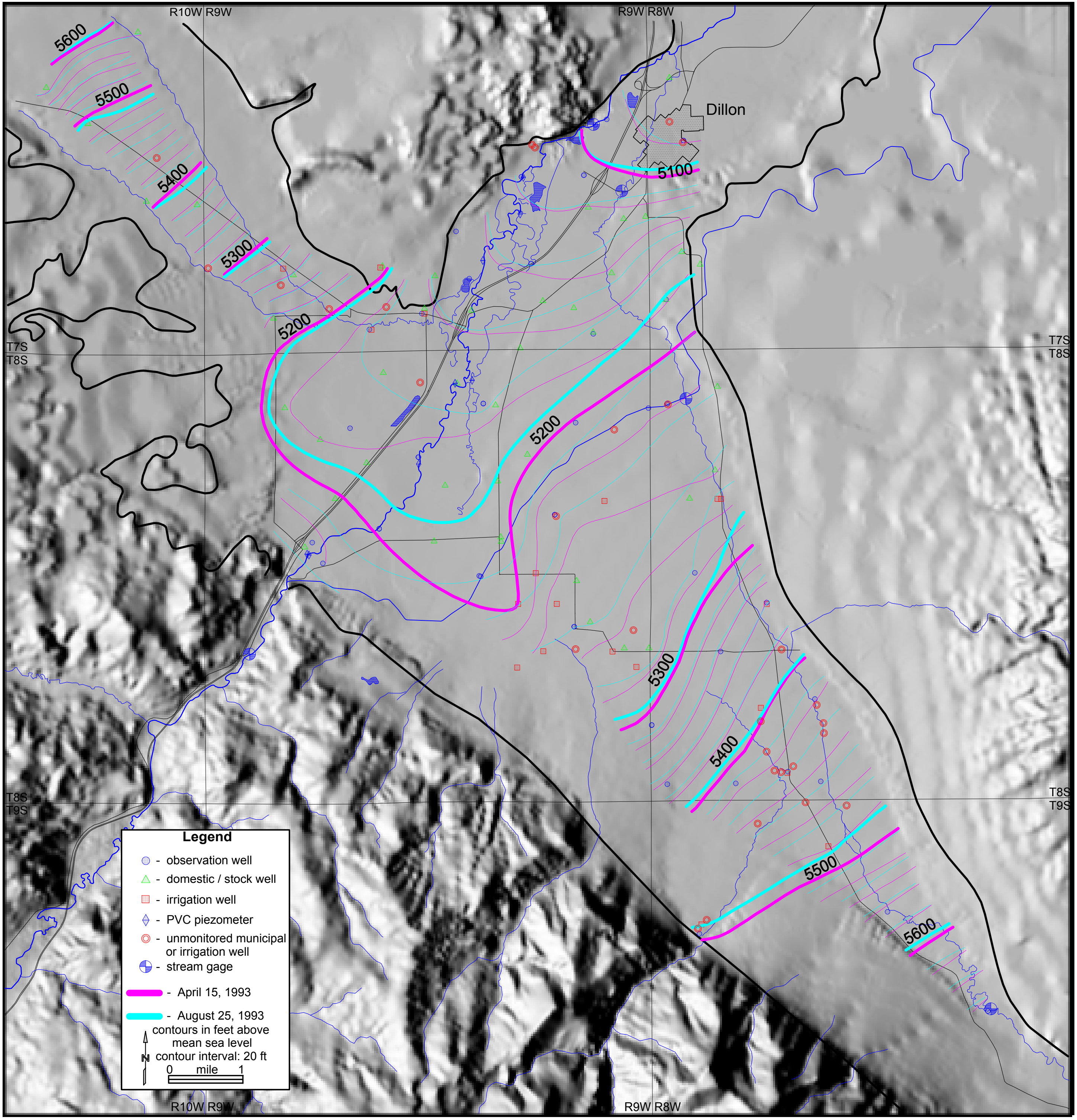


Figure 40. 1994 Composite Potentiometric Surfaces

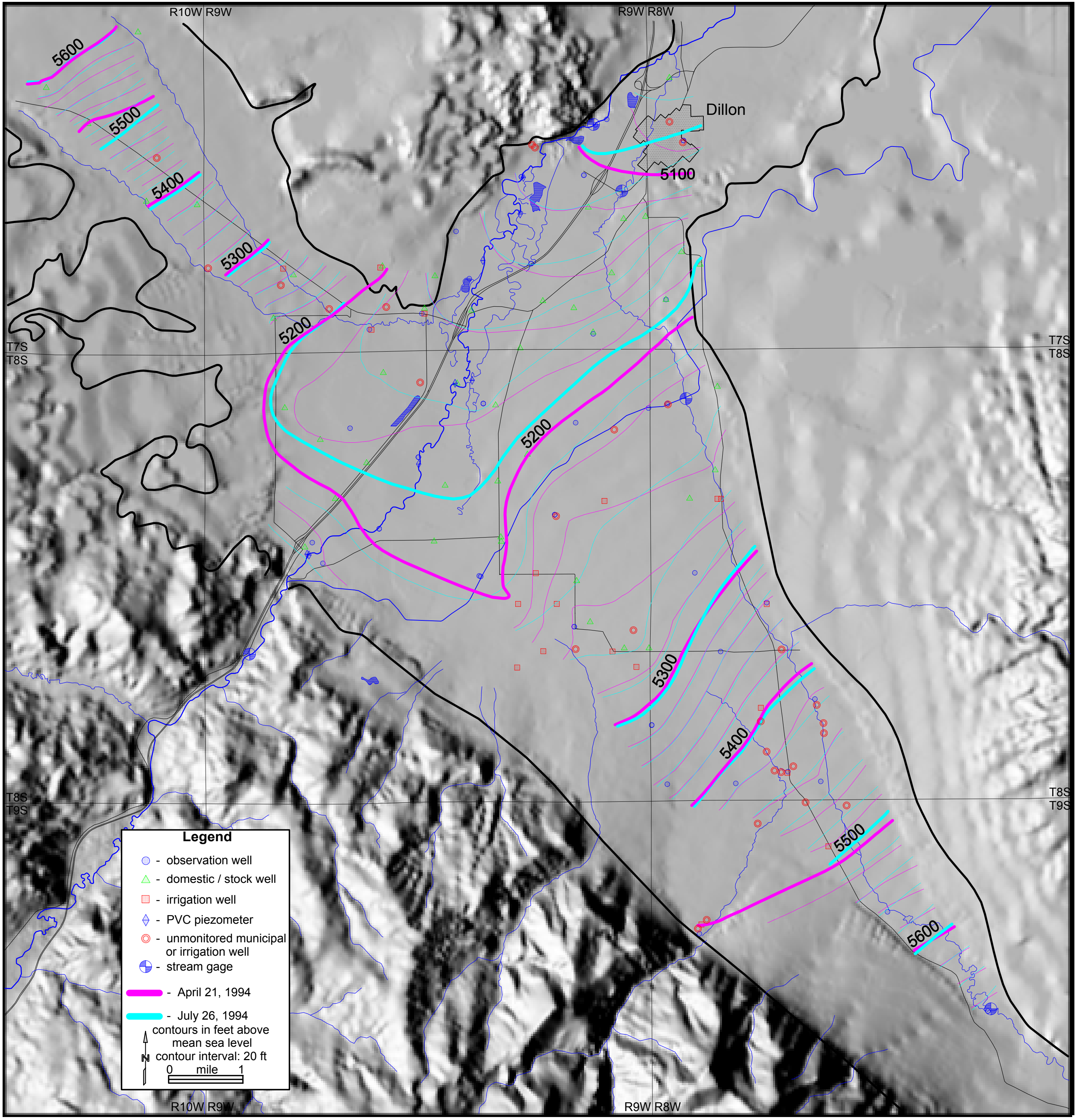


Figure 41. 1995 Composite Potentiometric Surfaces

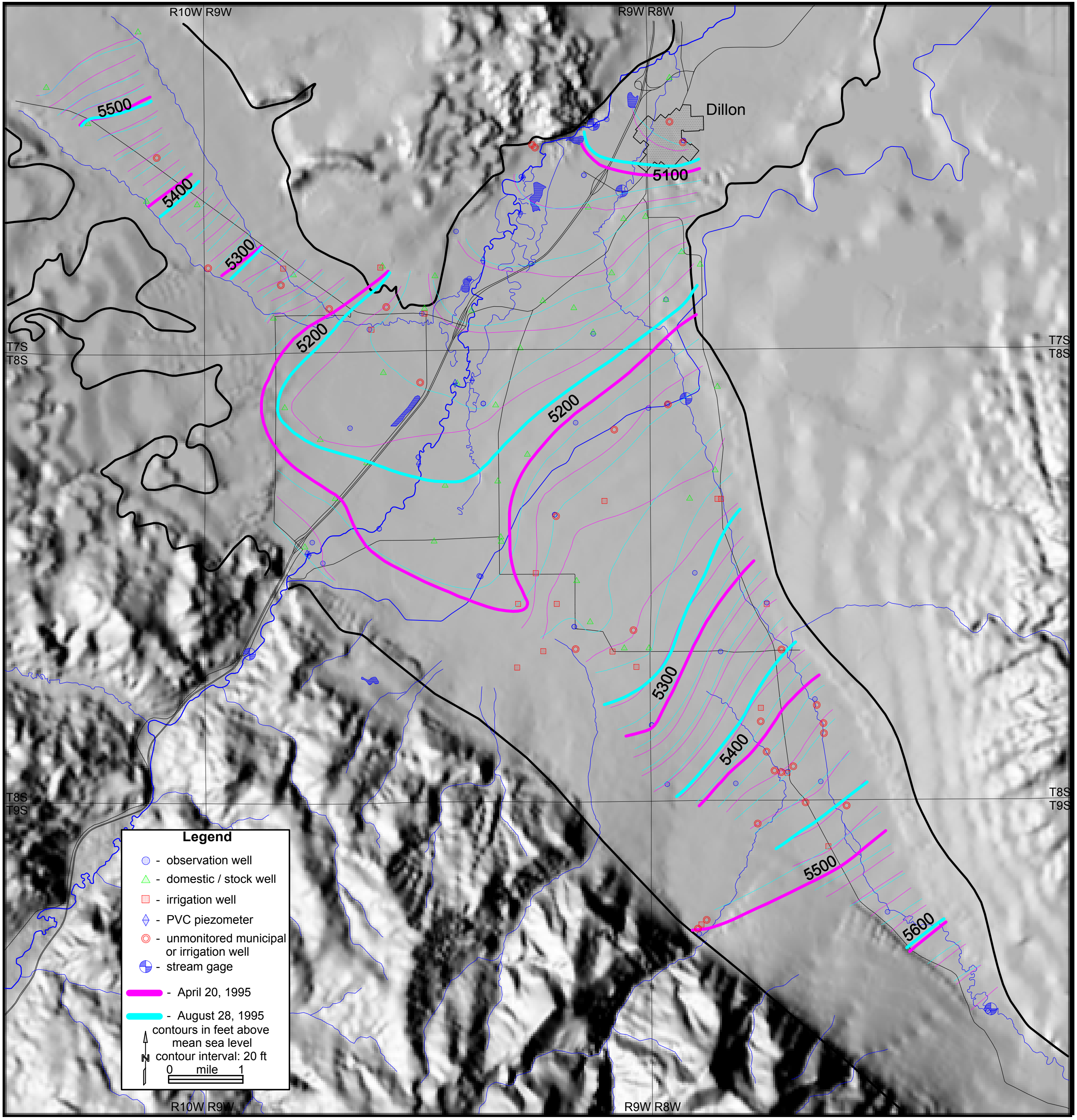
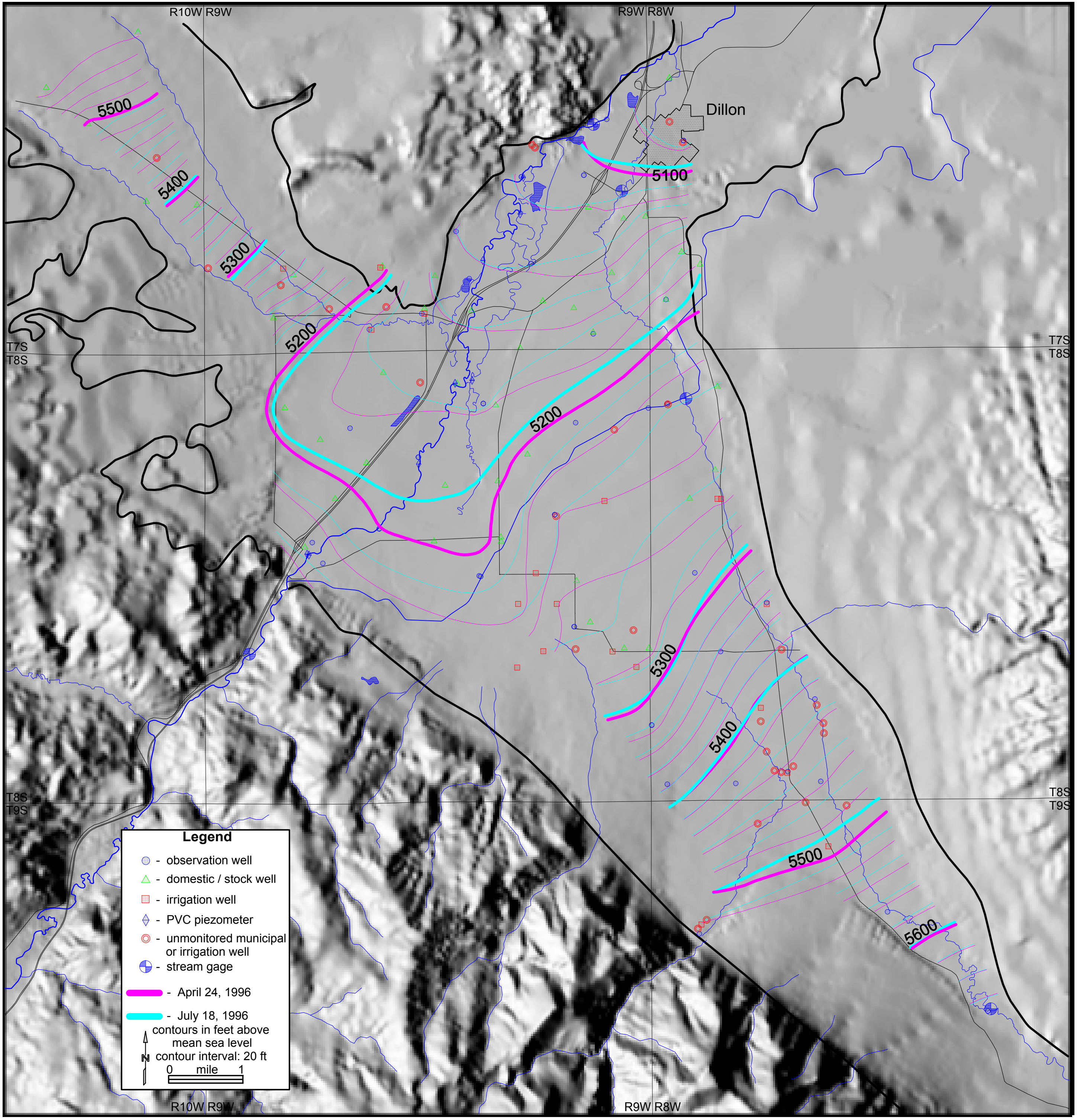


Figure 42. 1996 Composite Potentiometric Surfaces



summer. In the irrigation well fields, groundwater levels declined locally during the summer as a result of pumping withdrawals, but rapidly recovered after summer irrigation ended. No groundwater-level declines resulting from irrigation withdrawals were observed in other areas near the irrigation well fields.

The Quaternary/upper Tertiary aquifer serves as a storage reservoir for a large quantity of groundwater. Aquifer storage is maintained by recharge from fractured bedrock of the mountains. The aquifer storage also provides a buffering influence to potentially adverse groundwater-level declines and reductions of baseflow accretions when irrigation wells are pumping.

AQUIFER TESTING AND DRAWDOWN IMPACTS

Methods

An aquifer test consists of pumping a well at a constant discharge rate sufficient to stress the aquifer, while measuring declines in groundwater levels in a nearby observation well. Data collected from aquifer testing are analyzed to provide estimates of hydraulic conductivity, transmissivity and storage coefficient - all important aquifer properties. These properties describe the capability of an aquifer to transmit and store groundwater, and to sustain and recover from groundwater withdrawals.

Aquifer tests of at least 24-hour duration were conducted in seven irrigation wells and two municipal wells during 1993 and 1994. Five of these aquifer tests were conducted in irrigation wells in the Blacktail Deer Creek valley, two in irrigation wells in the Rattlesnake Creek valley, and two in the City of Dillon municipal wells. Standard solution methods, incorporated into aquifer test analysis computer software, were used to analyze the data. The aquifer test analyses are presented graphically.

The measurements collected prior to and during each aquifer test included:

1. Distance from the pumping well to the observation well(s).
2. Total depths of the pumping and observation well(s).
3. Depths to top and bottom of screened or perforated interval(s) from the top of the aquifer or the water table for partial-penetration analyses.
4. Pre-pumping static groundwater levels in the pumping and observation wells.
5. Time that pumping started.
6. Drawdown measurements in the observation well at specified time intervals during the aquifer test.
7. Elapsed time from start of the aquifer test for each drawdown measurement.
8. Measurement of discharge rate approximately twice per hour so that it could be adjusted, if necessary, to maintain a constant discharge.
9. Time of change of discharge rate.
10. Time-series measurements of natural and man-caused hydrologic changes that might influence results, such as precipitation in the area during the aquifer test and groundwater discharge from other wells before and during the test.

The irrigation and municipal wells used for aquifer testing had vertical line-shaft pumps and were either screened or perforated over a significant length of the well casing. Well depths and their screened or perforated intervals were determined from either direct measurement or examination of well logs. Pre-pumping static groundwater levels were measured several times prior to each aquifer test. All aquifer testing began during the morning hours so that less frequent measurements would be required during the nighttime hours near the end of the tests.

Five of the aquifer tests were constant-rate discharge tests. Pumping rates were variable for four of the aquifer tests, with changes in well discharge rates ranging from 3% to 16%. These aquifer tests were analyzed as variable-rate discharge tests.

Well discharges during three aquifer tests were measured with a 9-inch Parshall flume, which was installed in ditches into which the pumped groundwater was discharged. Stage in the 9-inch Parshall flume was converted to gallons per minute from Table 15 of the *Water Measurement Manual* (USBR 1984). Well discharges for two other aquifer tests were directly measured with in-line flow meters installed on the discharge lines near the well pumps. Well discharges for another two aquifer tests were calculated by making sprinkler-head pressure measurements, converting to discharge per sprinkler head, summing the discharge of all sprinkler heads, and calibrating with in-line pressure gage readings. Well discharges for the final two aquifer tests were measured by monitoring in-line pressure gage readings and calibrating with known discharge rates as determined from accumulation flow meters.

Pumped groundwater was disposed of in several ways to prevent significant infiltration to the aquifer during the aquifer tests. For the two City of Dillon municipal wells, groundwater was discharged into municipal distribution lines for consumption during the day and, for one aquifer test, into a ditch during the nighttime hours when demand for water was low. For three of the Blacktail Deer Creek irrigation wells, pumped groundwater was disposed of by discharging it into nearby ditches, which were lined near the irrigation wells to prevent infiltration of water into the aquifer. These ditches conveyed the water away from the test sites. Of the remaining four irrigation-well aquifer tests, water was disposed of by discharging it to center pivots or wheel lines for distribution to irrigated fields, assuming that infiltration to the aquifer was minimal during the tests.

Drawdowns at nearby observation wells were measured with an electric well probe. Drawdown measurements were collected every 30 seconds up to 10 minutes, approximately every minute up to 20 minutes, every 4 to 8 minutes up to 100 minutes, every 15 to 20 minutes up to about 5 hours, every 30 to 60 minutes up to 14 hours, and every 1½ to 2 hours up to 24 hours. Drawdown measurements and elapsed time since the start of the test were recorded on standard aquifer test data forms, and time-drawdown curves were plotted as time permitted.

Precipitation, which could have affected results, did not occur during any of the aquifer tests. Arrangements were made so that no other nearby large discharge wells would begin or stop pumping during the aquifer tests. Measurements of antecedent trends of groundwater-level changes were not attempted because of the uncertainty and difficulty of establishing actual starting times for tests. Irrigation or municipal well aquifer tests were scheduled, based on the needs or requirements of the well owners. For the irrigation wells, starting times were often proposed and cancelled several times before actually beginning a test because the starting times were scheduled to coincide with the need for crop irrigation. For the municipal wells, the City of Dillon had to pump almost continuously to supply municipal water and could shut off a well for only one day, to allow pumping water levels to recover to static conditions, at which time a test could be started.

Standard aquifer test solution methods were used to evaluate the test data. These methods are based on non-equilibrium equations of groundwater flow toward a pumping well, in which groundwater levels within the cone of depression are not stabilized. The groundwater flow equations are based on the following assumptions.

1. The groundwater flow to the well is in an unsteady state.
2. The aquifer has infinite areal extent.
3. The aquifer is uniform, and hydraulic conductivity is isotropic.
4. The aquifer has uniform thickness over the area influenced by the discharge.
5. The aquifer does not receive recharge from any source, except in the case of leakage from an aquitard.
6. The aquifer is pumped at a constant discharge.
7. The pumping and observation wells penetrate the full thickness of the aquifer.
8. The pumped well receives water from the entire thickness of the aquifer.
9. The pumping and observation well diameters are small, and well storage is negligible.
10. The pumping well is 100% efficient.
11. The water removed from the well is derived from aquifer storage.
12. The water removed from aquifer storage is discharged instantaneously when head is lowered.

The Neuman (1974) solution for an unconfined aquifer was selected to analyze six of the aquifer tests because the aquifer at those six test sites was interpreted as being unconfined, based on review of well lithology reports. Additional assumptions applicable to the Neuman solution include:

1. Prior to pumping, the water table is horizontal over the area influenced by the test.
2. The pumped well receives water from the entire saturated thickness of the aquifer.
3. The influence of the unsaturated zone upon drawdown is negligible.

The Hantush-Jacob (1955) and Hantush (1960) solutions for semi-confined aquifers were used to analyze three of the aquifer tests. These methods were selected because the aquifer at those three test sites was interpreted as being semi-confined, based on review of well lithology reports. Additional assumptions applicable to the semi-confined aquifer test solutions include:

1. The aquitard has infinite areal extent.
2. The aquitard is homogeneous and isotropic, and has uniform thickness.
3. The potentiometric surface is horizontal over the area influenced by the test.
4. The groundwater flow in the aquitard is vertical.
5. The water supplied by leakage from the aquitard is discharged simultaneously with decline of head.
6. The water table level in the overlying, unpumped aquifer remains constant during the aquifer test.
7. For the Hantush-Jacob (1955) method, there is no storage in the aquitard, and for the Hantush (1960) method, there is storage in the aquitard.

Results and Interpretations

Aquifer Test Analyses. Aquifer test locations and aquifer test analyses are presented in Figure 43, and Figures 44 through 52, respectively. Aquifer test time-drawdown data are presented in Appendix C1.

Figure 43. Aquifer Test Locations

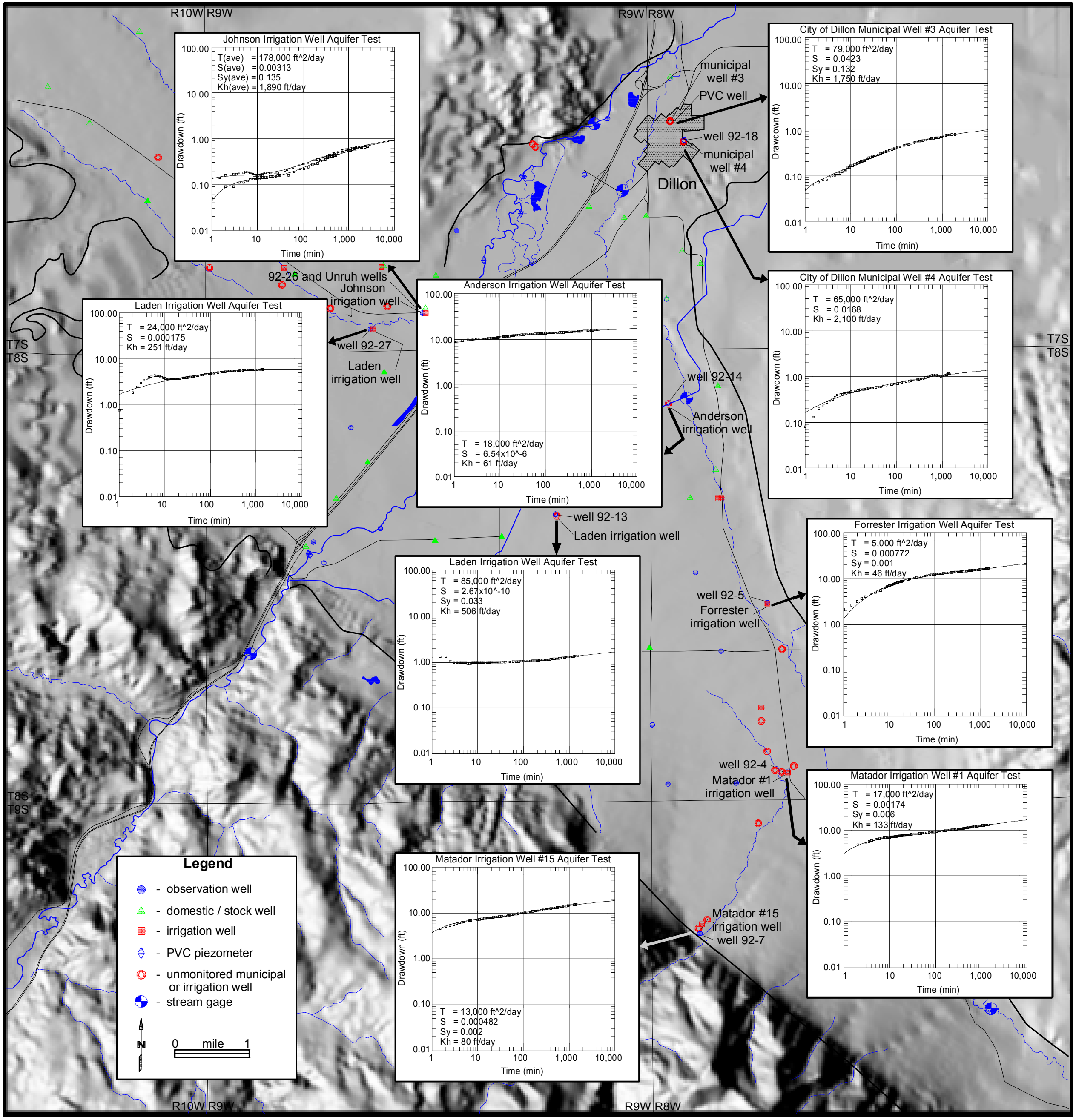
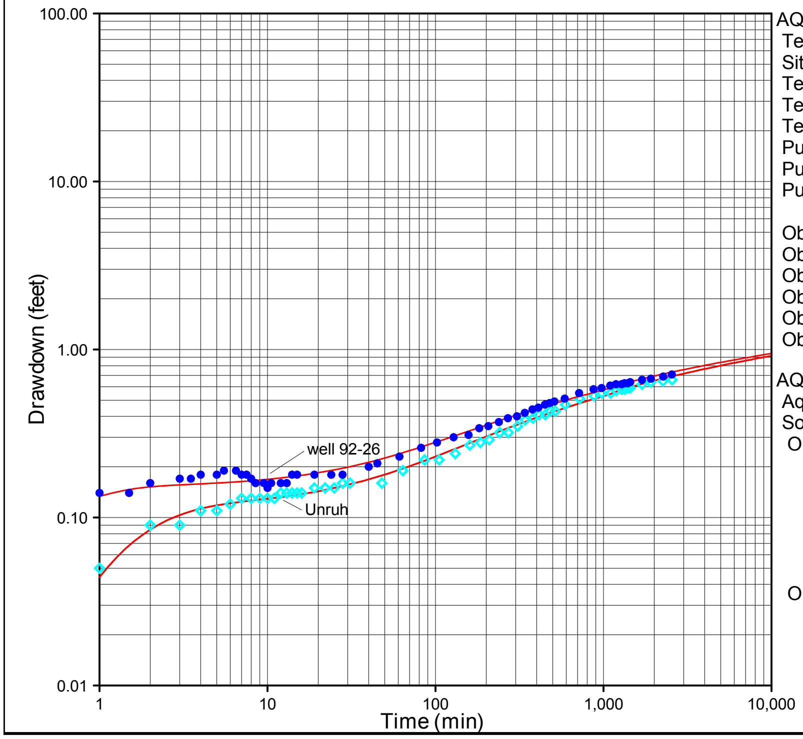


Figure 44. Johnson Irrigation Well Aquifer Test

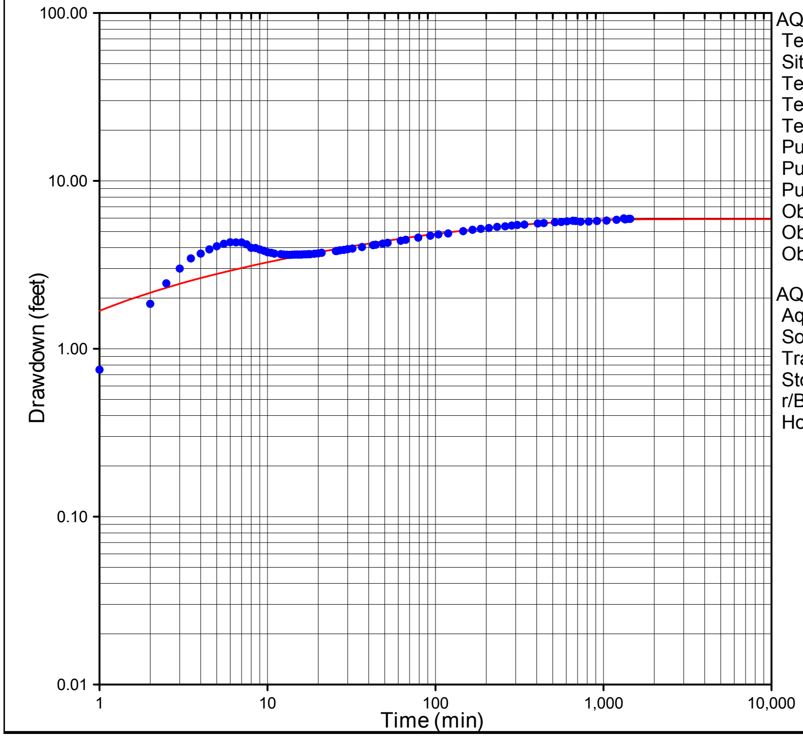


AQUIFER TEST DESCRIPTION:
Test Site: Big Sky Pallets property
Site Location: 07S 09W 33 DAAA
Test Date: 6/6 - 6/8, 1994
Test Well: Johnson irrigation well
Test Well Perforations: 20 - 102 ft
Pumping Rate: 1,800 - 1,860 gpm
Pumping Duration: 2,557 min
Pumping Rate Measuring Device: pressure gauge and accumulation meter
Observation Well #1: well #92-26
Observation Well #1 Perforations: 81 - 86 ft
Observation Well #1 Distance: 190.75 ft
Observation Well #2: Unruh domestic well
Observation Well #2 Perforations: none, open-ended
Observation Well #2 Distance: 348.5 ft

AQUIFER TEST ANALYSIS:
Aquifer Model: unconfined, 94 ft saturated thickness
Solution Method: Neuman, partially-penetrating wells
Observation Well #1:
- Transmissivity: 182,450 ft^2/day
- Storativity: 2.856e-03
- Specific Yield: 1.862e-01
- Beta: 4.640e-01
- Horizontal Hydraulic Conductivity: 1,941 ft/day
- Ratio of Vertical to Horiz. Hyd. Cond.: 1.127e-01

Observation Well #2:
- Transmissivity: 172,940 ft^2/day
- Storativity: 3.409e-03
- Specific Yield: 8.415e-02
- Beta: 7.239e-01
- Horizontal Hydraulic Conductivity: 1,840 ft/day
- Ratio of Vertical to Horiz. Hyd. Cond.: 5.267e-02

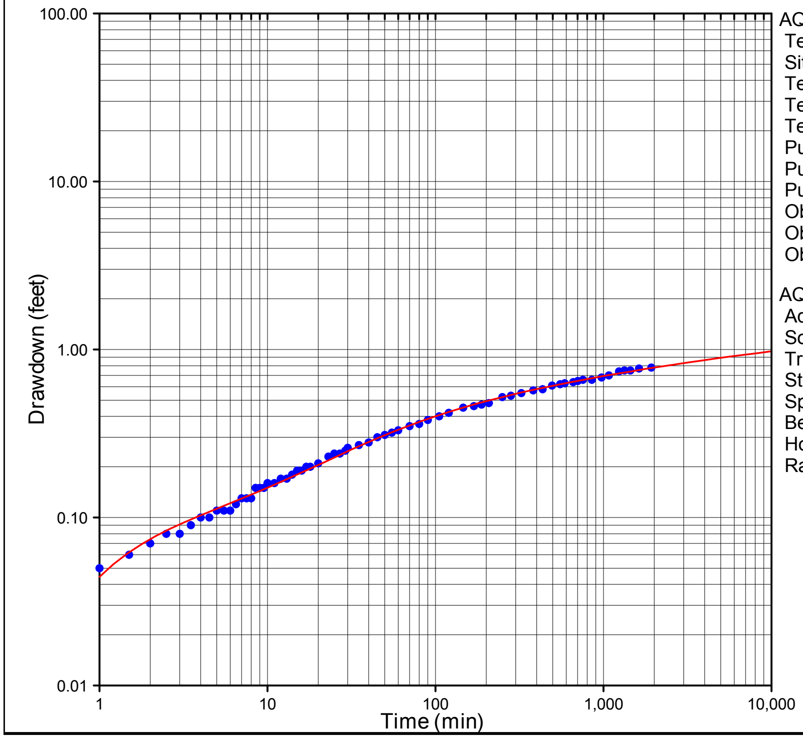
Figure 45. Laden Rattlesnake Creek Irrigation Well Aquifer Test



AQUIFER TEST DESCRIPTION:
Test Site: Laden property in Rattlesnake Creek valley
Site Location: 07S 09W 33 CBDD
Test Date: 9/8 - 9/9, 1993
Test Well: Laden irrigation well
Test Well Perforations: 20 - 200 ft
Pumping Rate: 1,130 gpm
Pumping Duration: 1,440 min
Pumping Rate Measuring Device: pressure gauge
Observation Well: well #92-27
Observation Well Perforations: 65 - 175 ft
Observation Well Distance: 146.5 ft

AQUIFER TEST ANALYSIS:
Aquifer Model: leaky confined, 97 ft thick aquifer
Solution Method: Hantush-Jacob, no aquitard storage
Transmissivity: 24,341 ft^2/day
Storativity: 1.752e-04
r/B: 1.745e-02
Horizontal Hydraulic Conductivity: 251 ft/day

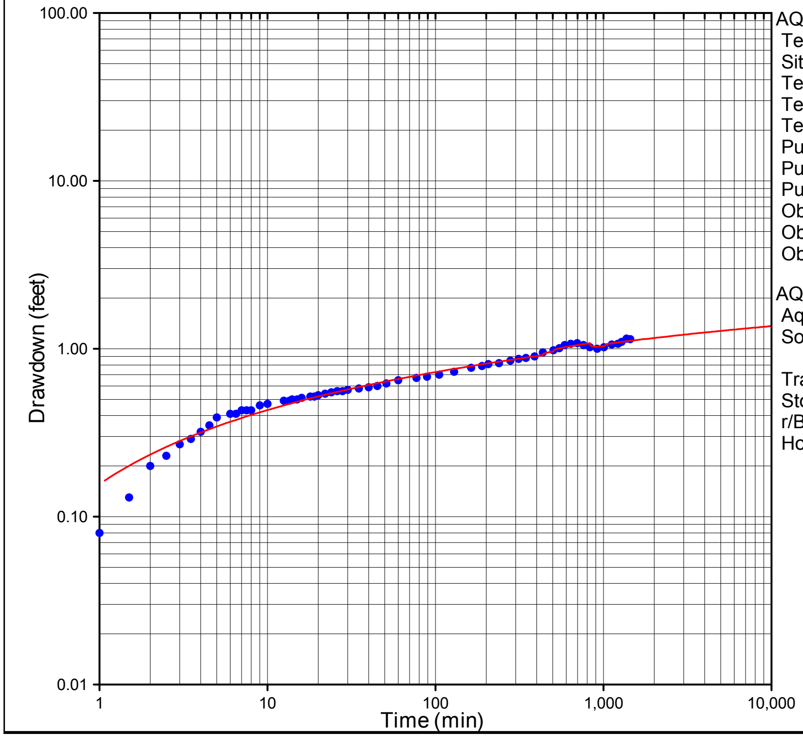
Figure 46: City of Dillon Municipal Well #3 Aquifer Test



AQUIFER TEST DESCRIPTION:
Test Site: City of Dillon at municipal building
Site Location: 07S 08W 18 CDCC
Test Date: 8/9 - 8/10, 1994
Test Well: City of Dillon municipal well #3
Test Well Perforations: 20 - 46 ft
Pumping Rate: 615 - 635 gpm
Pumping Duration: 1,926 min
Pumping Rate Measuring Device: flow meter
Observation Well: 2-inch PVC well
Observation Well Perforations: 10 - 30 ft
Observation Well Distance: 55.75 ft

AQUIFER TEST ANALYSIS:
Aquifer Model: unconfined, 45 ft saturated thickness
Solution Method: Neuman, partially-penetrating wells
Transmissivity: 78,743 ft^2/day
Storativity: 4.225e-02
Specific Yield: 1.317e-01
Beta: 9.693e-02
Horizontal Hydraulic Conductivity: 1,750 ft/day
Ratio of Vertical to Horiz. Hyd. Cond.: 6.314e-02

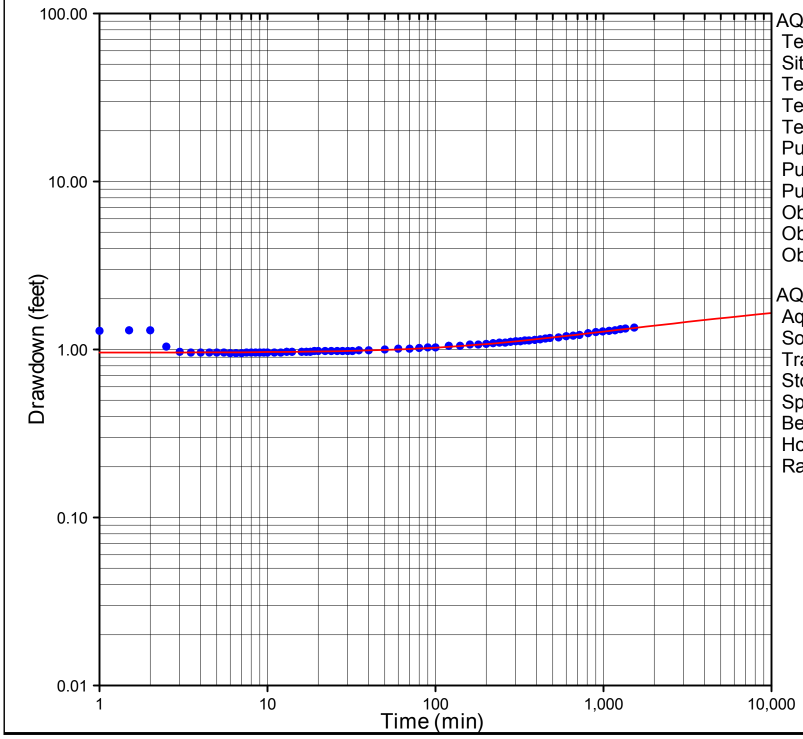
Figure 47: City of Dillon Municipal Well #4 Aquifer Test



AQUIFER TEST DESCRIPTION:
Test Site: City of Dillon at Vigilante Park
Site Location: 07S 08W 19 BADD
Test Date: 8/2 - 8/3, 1994
Test Well: City of Dillon municipal well #4
Test Well Perforations: 20 - 33 ft, 64 - 72 ft
Pumping Rate: 550 - 600 gpm
Pumping Duration: 1,440 min
Pumping Rate Measuring Device: flow meter
Observation Well: well #92-18
Observation Well Perforations: 74 - 79 ft
Observation Well Distance: 46.5 ft

AQUIFER TEST ANALYSIS:
Aquifer Model: leaky confined, 31 ft thick aquifer
Solution Method: Hantush-Jacob, no aquitard storage
and partially-penetrating wells
Transmissivity: 65,325 ft^2/day
Storativity: 1.681e-02
r/B: 3.068e-03
Horizontal Hydraulic Conductivity: 2,107 ft/day

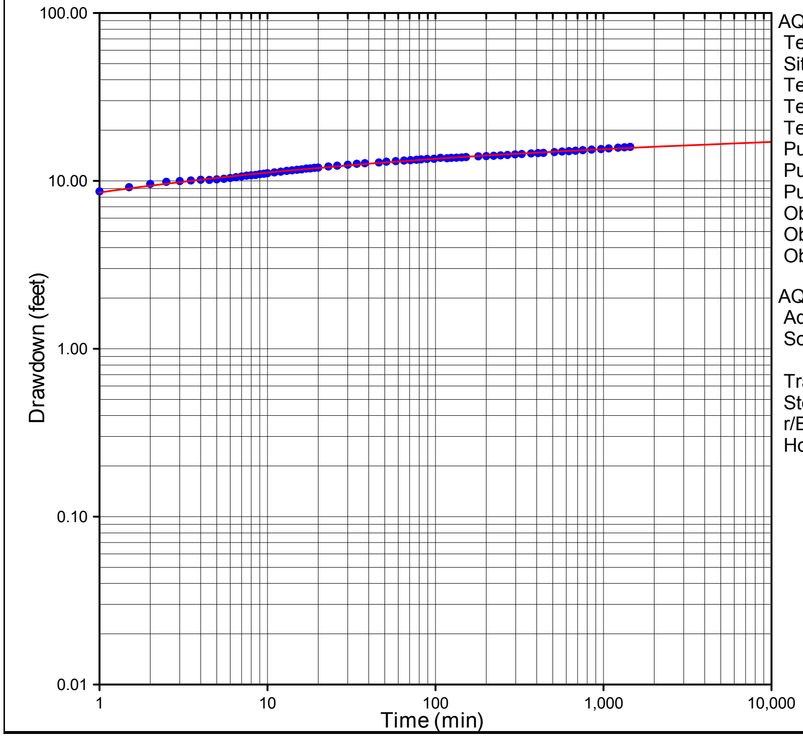
Figure 48. Laden Blacktail Deer Creek Irrigation Well Aquifer Test



AQUIFER TEST DESCRIPTION:
Test Site: Laden property in Blacktail Deer Creek valley
Site Location: 08S 09W 14 ABDD
Test Date: 7/13 - 7/14, 1994
Test Well: Laden irrigation well
Test Well Screen Interval: 100 - 170 ft
Pumping Rate: 925 gpm
Pumping Duration: 1,524 min
Pumping Rate Measuring Device: pressure gauge
Observation Well: well #92-13
Observation Well Perforations: 100 - 170 ft
Observation Well Distance: 98.75 ft

AQUIFER TEST ANALYSIS:
Aquifer Model: unconfined, 169 ft saturated thickness
Solution Method: Neuman, partially-penetrating wells
Transmissivity: 85,452 ft^2/day
Storativity: 2.668e-10
Specific Yield: 3.304e-02
Beta: 1.301e-02
Horizontal Hydraulic Conductivity: 506 ft/day
Ratio of Vertical to Horiz. Hyd. Cond.: 3.809e-02

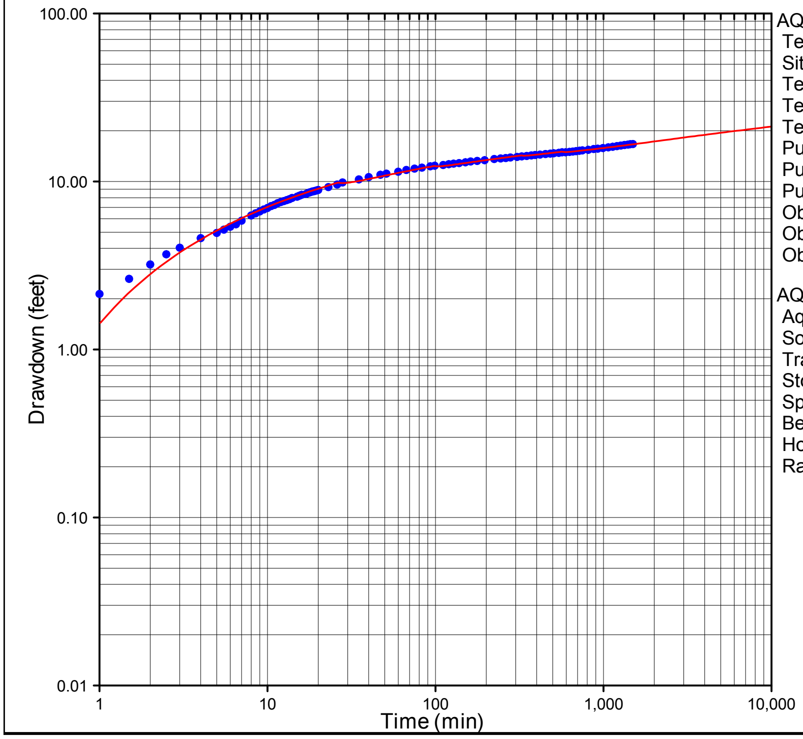
Figure 49. Anderson Irrigation Well Aquifer Test



AQUIFER TEST DESCRIPTION:
Test Site: J.B. Anderson property
Site Location: 08S 08W 06 CBDD
Test Date: 9/15 - 9/16, 1994
Test Well: Anderson irrigation well
Test Well Perforations: 50 - 315 ft
Pumping Rate: 1,465 gpm
Pumping Duration: 1,440 min
Pumping Rate Measuring Device: 9" Parshall flume
Observation Well: well #92-14
Observation Well Perforations: 52 - 258 ft
Observation Well Distance: 67.5 ft

AQUIFER TEST ANALYSIS:
Aquifer Model: leaky confined, 295 ft aquifer thickness
Solution Method: Hantush with aquitard storage
and partially-penetrating wells
Transmissivity: 17,984 ft^2/day
Storativity: 6.539e-06
r/B: 1.000e-03
Horizontal Hydraulic Conductivity: 61 ft/day

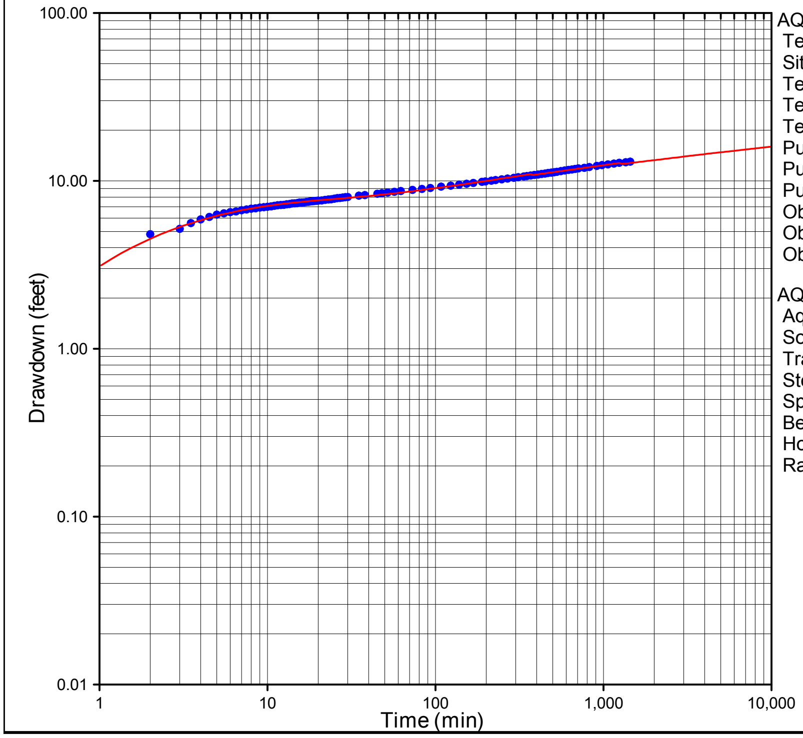
Figure 50. Forrester Irrigation Well Aquifer Test



AQUIFER TEST DESCRIPTION:
Test Site: Roy Forrester property
Site Location: 08S 08W 20 ACCA
Test Date: 9/28 - 9/29, 1993
Test Well: Forrester irrigation well
Test Well Perforations: 40 - 184 ft
Pumping Rate: 835 - 996 gpm
Pumping Duration: 1,495 min
Pumping Rate: Measuring Device: 9" Parshall flume
Observation Well: well #92-5
Observation Well Perforations: 86 - 169 ft
Observation Well Distance: 103 ft

AQUIFER TEST ANALYSIS:
Aquifer Model: unconfined, 110 ft saturated thickness
Solution Method: Neuman, partially-penetrating wells
Transmissivity: 5,006 ft^2/day
Storativity: 7.720e-04
Specific Yield: 1.073e-03
Beta: 2.665e-03
Horizontal Hydraulic Conductivity: 46 ft/day
Ratio of Vertical to Horiz. Hyd. Cond.: 3.040 e-03

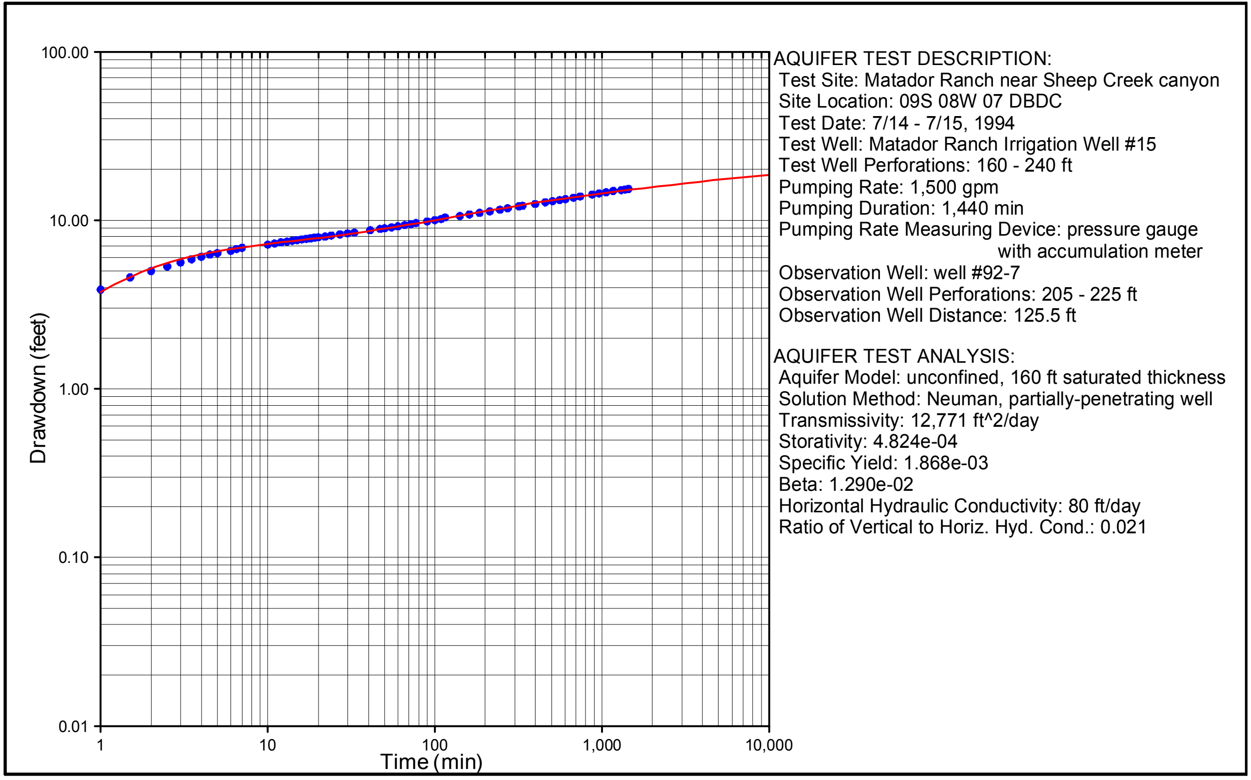
Figure 51. Matador Ranch Irrigation Well #1 Aquifer Test



AQUIFER TEST DESCRIPTION:
Test Site: Matador Ranch near Blacktail Road
Site Location: 08S 08W 32 DABD
Test Date: 9/30 - 10/1, 1993
Test Well: Matador Ranch Irrigation Well #1
Test Well Perforations: 100 - 160 ft
Pumping Rate: 1,867 - 1,961 gpm
Pumping Duration: 1,440 min
Pumping Rate Measuring Device: 9" Parshall flume
Observation Well: well #92-4
Observation Well Perforations: 130 - 150 ft
Observation Well Distance: 100.5 ft

AQUIFER TEST ANALYSIS:
Aquifer Model: unconfined, 125 ft saturated thickness
Solution Method: Neuman, partially-penetrating wells
Transmissivity: 16,658 ft^2/day
Storativity: 1.744e-03
Specific Yield: 5.546e-03
Beta: 4.565e-02
Horizontal Hydraulic Conductivity: 133 ft/day
Ratio of Vertical to Horiz. Hyd. Cond.: 7.063e-02

Figure 52. Matador Ranch Irrigation Well #15 Aquifer Test



AQUIFER TEST DESCRIPTION:
Test Site: Matador Ranch near Sheep Creek canyon
Site Location: 09S 08W 07 DBDC
Test Date: 7/14 - 7/15, 1994
Test Well: Matador Ranch Irrigation Well #15
Test Well Perforations: 160 - 240 ft
Pumping Rate: 1,500 gpm
Pumping Duration: 1,440 min
Pumping Rate Measuring Device: pressure gauge with accumulation meter
Observation Well: well #92-7
Observation Well Perforations: 205 - 225 ft
Observation Well Distance: 125.5 ft

AQUIFER TEST ANALYSIS:
Aquifer Model: unconfined, 160 ft saturated thickness
Solution Method: Neuman, partially-penetrating well
Transmissivity: 12,771 ft^2/day
Storativity: 4.824e-04
Specific Yield: 1.868e-03
Beta: 1.290e-02
Horizontal Hydraulic Conductivity: 80 ft/day
Ratio of Vertical to Horiz. Hyd. Cond.: 0.021

Aquifer Properties. Aquifer hydraulic properties are summarized in Table 5, in which K is the horizontal hydraulic conductivity and T is transmissivity.

Table 5. Summary of Aquifer Hydraulic Properties Determined from Aquifer Tests

Test Well	K (ft/d)	T (ft^2/d)	Storativity	Specific Yield
Johnson at well 92-26	1,940	182,000	2.86×10^{-3}	0.186
Johnson at Unruh well	1,840	173,000	3.41×10^{-3}	0.084
Laden Rattlesnake Crk.well	251	24,000	1.75×10^{-4}	not applicable
Dillon municipal well #3	1,750	79,000	4.23×10^{-2}	0.132
Dillon municipal well #4	2,100	65,000	1.68×10^{-2}	not applicable
Laden Blacktail Crk. well	506	85,000	2.67×10^{-10}	0.033
Anderson irrigation well	61	18,000	6.54×10^{-6}	not applicable
Forrester irrigation well	46	5,000	7.72×10^{-4}	0.001
Matador irrigation well #1	133	17,000	1.74×10^{-3}	0.006
Matador irrigation well #15	80	13,000	4.82×10^{-4}	0.002

Hydraulic conductivity (K) is defined as the rate at which a porous material transmits water. According to Morris and Johnson (1967), hydraulic conductivity (K) for clean gravel ranges from as low as 100 feet per day (ft/day) to as high as 8,800 ft/day; however, typical values fall between 500 ft/day for clean, coarse gravel and 1,470 ft/day for clean, fine gravel. They also indicate that hydraulic conductivity for clean sand may range from less than 1 ft/day to as high as 1,870 ft/day; however, typical values may lie between 8 ft/day for clean, fine sand and about 150 ft/day for clean, coarse sand. The average hydraulic conductivity of silt is typically less than 1 ft/day (Morris and Johnson 1967). Most alluvial materials, however, consist of poorly-sorted mixtures of variously sized gravel and sand and some amount of silt. The sand and silt fill the interstices of the gravel, decreasing the water-producing properties of poorly-sorted materials.

According to the *Groundwater Manual* (USBR 1977), values of hydraulic conductivity ranging from 1 ft/day to approximately 10^4 ft/day are considered moderate to very high for municipal and irrigation purposes. All values of hydraulic conductivity determined from aquifer tests fell within this range.

Transmissivity (T) is the product of the average hydraulic conductivity and the saturated thickness of the aquifer. Transmissivity is defined as the rate of groundwater flow through an aquifer cross-section of unit width over the entire saturated thickness of the aquifer under a unit hydraulic gradient. Transmissivity is used to classify or categorize an aquifer's water-producing capability. According to the *Groundwater Manual* (USBR 1977), values of transmissivity ranging from approximately 10^4 feet squared per day (ft^2/day) to 10^6 ft^2/day are considered good to very good for municipal and irrigation purposes. All transmissivity values reported from aquifer tests, except the 5,000 ft^2/day value, fell within the good to very good range. The 5,000 ft^2/day value is considered fair; however, this well has served irrigation uses for many years. In areas where the aquifer is thick, as in the middle Blacktail Deer Creek valley, the actual transmissivity values are greater than values derived from aquifer test analyses. Where the aquifer is thick, the pumping wells only partially penetrate the aquifer, thereby stressing only a portion of the full aquifer thickness.

Storativity (S) is defined as the volume of water that is absorbed by or released from aquifer storage per unit surface area of aquifer per unit change in hydraulic head. Storativity, a dimensionless value, typically ranges from 0.005 to 0.00005. Most values of storativity from the aquifer tests fell within this range. The only anomalous storativity value, $2.67\text{x}10^{-10}$, was calculated for the Laden Blacktail Deer Creek aquifer test. Although of minor importance because the aquifer is unconfined, this anomalous value can be attributed to several complicating factors. Moench (1994) states that, although an unconfined aquifer test analysis can account for storativity, evaluation of storativity should not be attempted because the very early time data are subject to large errors. In the case of the Laden aquifer test, the collection of credible very early time data was not possible.

Specific yield (Sy) is the storage term for an unconfined aquifer. It is defined as the volume of water that an unconfined aquifer releases from storage per unit surface area of aquifer per unit decline of the water table. In an unconfined aquifer, the level of the water table may rise or fall with changes in the amount of water draining from or accumulating in pore spaces of the aquifer materials. Specific yield, also a dimensionless value, usually ranges from 0.01 to about 0.32 and is considerably larger than the storativity of a confined or semi-confined aquifer. The excellent storage properties of an unconfined aquifer makes it more favorable and efficient than a confined aquifer for groundwater productivity. The same yield of groundwater can generally be realized from an unconfined aquifer as from a confined aquifer with less drawdown. In addition, drawdown impacts remain more localized in an unconfined aquifer.

According to Morris and Johnson (1967), average specific yields for clean, fine-to-coarse gravel range from 0.28 to 0.21, respectively. They also indicate that average specific yields for clean, fine-to-coarse sand range from 0.33 to 0.30, respectively. Morris and Johnson (1967) state that the average specific yield for silt is 0.20. Specific yields were determined from the six unconfined aquifer tests. Specific yield estimates for the Johnson irrigation well and Dillon municipal well #3 aquifer tests were credible, representative values. A specific yield of 0.033 for the Laden Blacktail Deer Creek valley aquifer test was questionable. Aquifer test analysis software reported specific yield values of 0.001 for the Forrester irrigation well aquifer test, 0.006 for the Matador Ranch irrigation well #1 aquifer test, and 0.002 for the Matador Ranch irrigation well #15 aquifer test. These three values were below the realistic range of values expected for specific yield, as explained by Morris and Johnson (1967).

Moench (1994) reports that specific yields are sometimes reported as unrealistically low for unconsolidated granular aquifers when compared with controlled laboratory experiments conducted on samples of aquifer materials. Moench (1994) suggests that low values for specific yields may be the result that water in the zone above the declining water table is not released instantaneously from storage, and of poor representation in the solution algorithm, that mathematically simulates the drainage of materials above the declining water table. As a remedy, it is suggested that multiple observation wells should be used during aquifer testing and that composite time/distance-squared plots be used for analysis by type curves.

Drawdown Analyses. During aquifer testing, groundwater-level drawdowns were observed in observation wells at distances ranging from 46 to 348 feet from the pumping irrigation and municipal wells. Total observed drawdowns ranged from less than 1 foot to a maximum of about 17 feet. After 24 or more hours, drawdown observations indicated that, for all nine aquifer tests, the rate of drawdown had slowed to a few hundredths of a foot per hour. They also suggested that, for longer pumping periods, the near-maximum drawdowns would be established within approximately one day after pumping commenced, and significant further declines of groundwater levels would not be expected. Under the current level of pumping, drawdown remained localized in the area of the pumping wells and the impacts did not continue to propagate for large distances. The farther the distance from a pumped well, the smaller the drawdown effect was.

Distance-drawdown graphs are useful in extrapolating the impacts of groundwater withdrawals for times and distances from the pumped well beyond those observed during testing. To graphically illustrate the decreasing effect of drawdown with increasing distance from a pumping well, distance-drawdown graphs, derived from the time-drawdown data of the aquifer tests, are presented in Figures 53 through 55. For the distance-drawdown projections, it was assumed that each well would discharge continuously for 30 days, a reasonable length of time for irrigation or municipal use, prior to shutting off. The 30-day projected drawdown was plotted and a distance-drawdown projection was constructed through the point representing the observation well distance from the pumping well. The distance-drawdown graphs illustrate that, after 30 days of continuous pumping,

Figure 53. Distance-Drawdown 30-Day Projections for Rattlesnake Creek Aquifer Tests

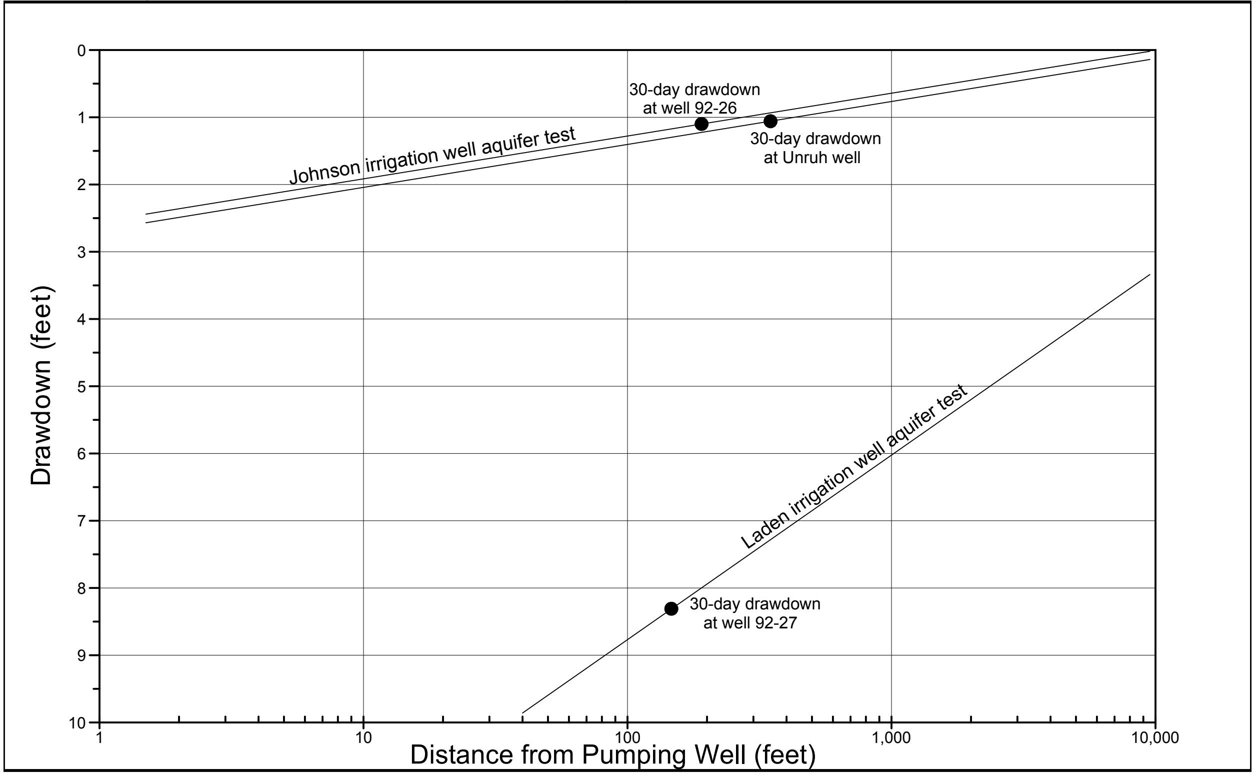


Figure 54. Distance-Drawdown 30-Day Projections for City of Dillon Aquifer Tests

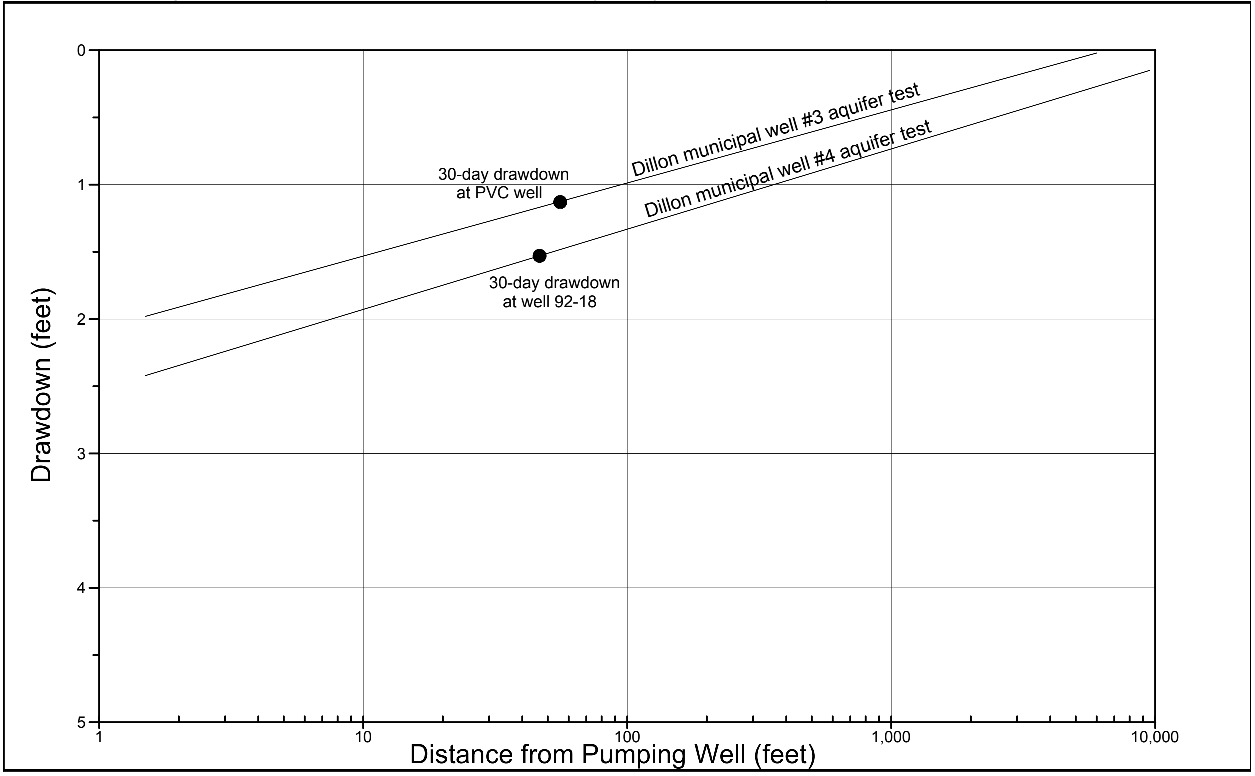
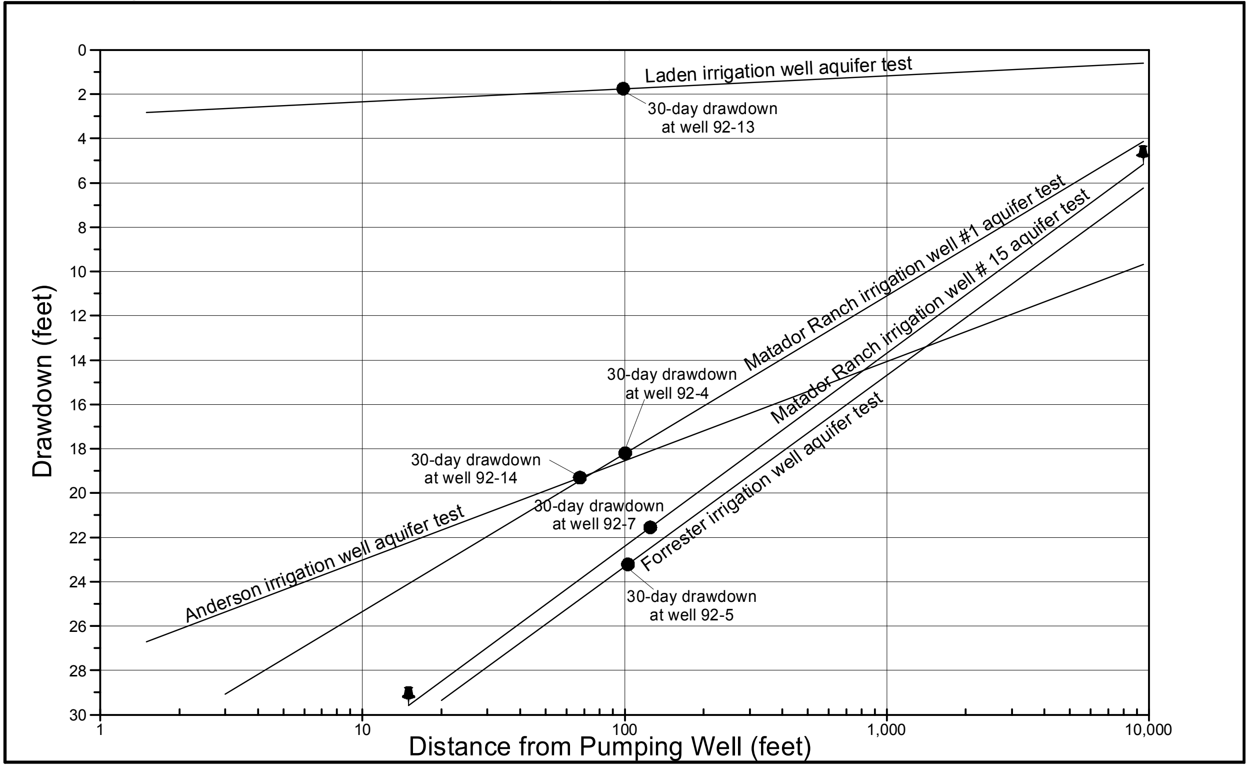


Figure 55. Distance-Drawdown 30-Day Projections for Blacktail Deer Creek Aquifer Tests



drawdown decreased with increasing distance from the pumping well. For example, at a distance of 10,000 feet (approximately 2 miles) from the pumping wells, projected drawdowns ranged from 0 feet to less than 10 feet. These projections support the observations collected during the 24-hour aquifer tests that near-maximum drawdowns were established within approximately one day after pumping commenced and that significant drawdowns were not propagated indefinitely for large distances beyond the pumping wells.

The distance-drawdown graphs may be considered "worst-case" projections because they represent drawdown only when the assumptions under which they were generated are true. When one or more of the assumptions of the analysis do not apply to a field situation, the actual drawdown will vary, perhaps significantly, from the projected drawdown. The following assumptions, applied in the construction of the distance-drawdown graphs, do not exactly replicate field situations, with the result that actual drawdown is measurably less than drawdown predicted by the distance-drawdown graphs.

1. The analysis assumes that the spreading cone of depression never reaches equilibrium and continues to spread indefinitely. In reality, it will cease spreading when enough groundwater flow has been intercepted to sustain well discharge.

2. The analysis assumes that no recharge reaches the cone of depression. Actually, precipitation, seepage losses from streams, and irrigation return flow will infiltrate to recharge the cone of depression, attenuating drawdown impacts.

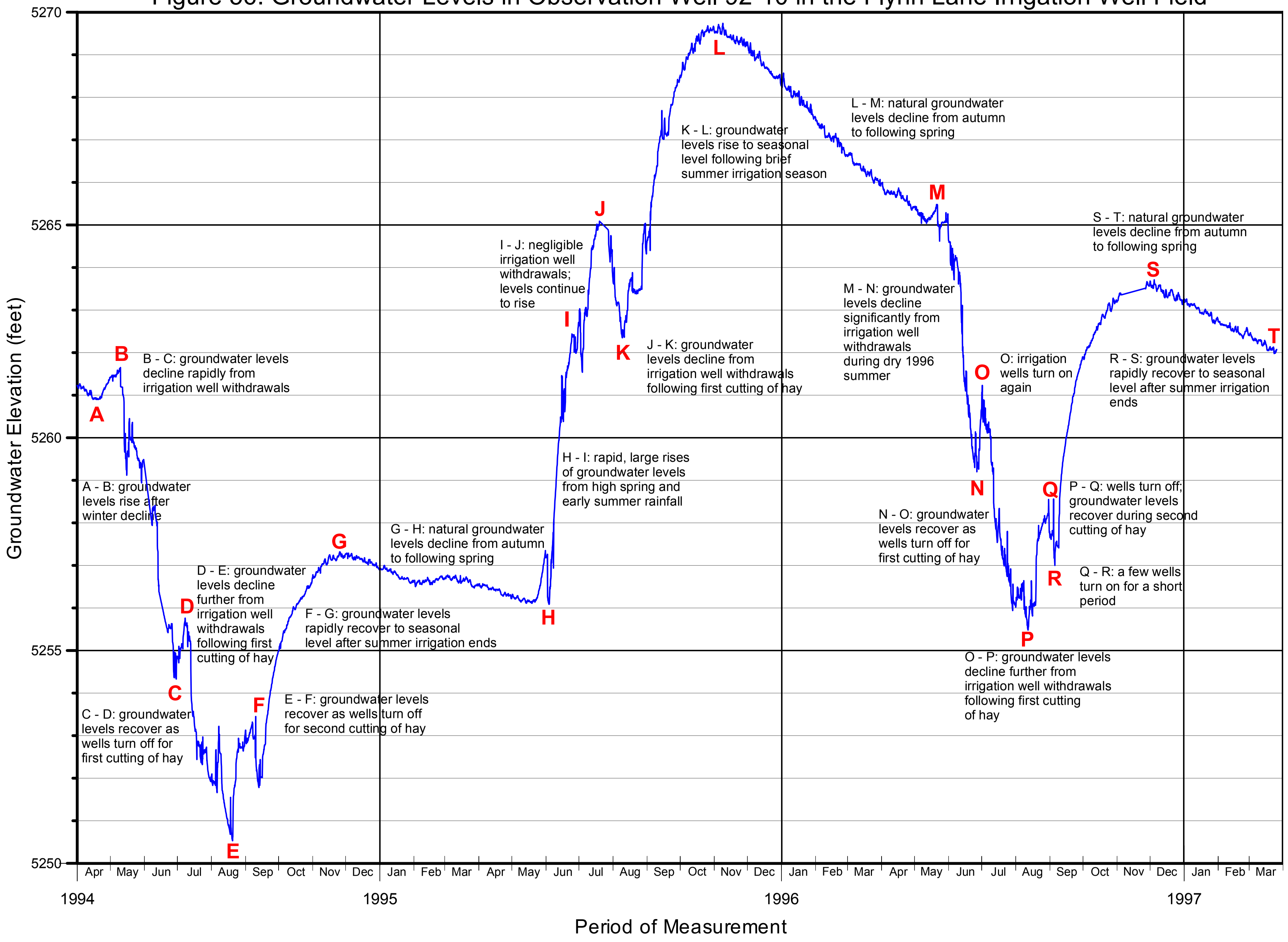
3. The analysis assumes that, for a semi-confined aquifer, the aquitard is infinite in extent. In reality, the aquitard is discontinuous. The aquifer's storage coefficient is very small under confined or semi-confined conditions. Where the aquitard is discontinuous, there is a transition from semi-confined to unconfined conditions with a large increase in the storage coefficient. When a storage coefficient becomes large, the aquifer contributes significantly larger quantities of groundwater to the cone of depression per unit decline in head, attenuating the drawdown impacts.

The area most impacted by drawdown was the Flynn Lane irrigation well field area (Figure 12). In this area, several cones of depression from pumping irrigation wells coalesced to form an extended area of drawdown during the summer irrigation season. There were no direct drawdown effects from the numerous pumping wells of the Flynn Lane well field observed in wells in the middle or lower Blacktail Deer Creek valley, and along the Beaverhead River floodplain near Barretts (Figures 16 through 18). These observations imply that the extended cone of depression of the Flynn Lane well field remained localized during the summer and did not extend across the Blacktail Deer Creek valley or to the Beaverhead River, where streambed infiltration losses might be induced. The irrigation wells pumped more groundwater from aquifer storage than what was recharged from groundwater flow. This caused temporary decreases in aquifer storage and declines of groundwater levels in and adjacent to the well field during irrigation, and a temporarily decreased hydraulic gradient toward the Beaverhead River. Drawdown impacts from other, more remotely located single irrigation or municipal wells were not observed.

The effects of drawdown were temporary. When groundwater withdrawal ended, depleted aquifer storage was recharged by a continuous flow of groundwater from upgradient. In the case of a highly transmissive aquifer, as in the Flynn Lane well field, aquifer storage losses were quickly replenished, which was expressed as rising groundwater levels. This, in turn, increased the hydraulic gradient toward the Beaverhead River. An example is documented in observation well 92-10, located near the middle of the Flynn Lane well field, in which continuous groundwater levels were recorded from April 1994 to March 1997. The annotated hydrograph for this well (Figure 56) illustrates the effects of below- and above-average precipitation years and the drawdown impacts on groundwater levels from pumping irrigation wells. Drawdown up to 12 feet, a result of many concurrently-pumping irrigation wells, was recorded during peak pumping periods. However, after irrigation well withdrawals ended, groundwater levels rapidly recovered to seasonal levels.

In other parts of the project area with similar aquifer materials and large irrigation withdrawals, a similar groundwater response would be expected. Although the Blacktail Road well field has about the same number of pumping wells as the Flynn Lane well field, the same magnitude of drawdown was not observed because many of the Blacktail Road wells were not pumped as frequently as the Flynn Lane wells. A drawdown of several feet was established throughout the Flynn Lane well field area only by the concurrent pumping of many irrigation wells. A few, isolated irrigation or municipal wells would have small impacts on groundwater levels and water availabilty.

Figure 56. Groundwater Levels in Observation Well 92-10 in the Flynn Lane Irrigation Well Field



Where a pumping well is sited near surface water, such as a stream or a pond, there is a greater potential for induced surface water losses to the pumping well. However, when the streambed is perched above the groundwater surface, induced streamflow losses do not occur because the stream and groundwater are not in direct hydraulic contact. Several irrigation wells are sited near Blacktail Deer Creek in T8S, R8W. Apparent drawdown impacts from wells may be interpreted along Blacktail Deer Creek, as illustrated in Figure 30, where groundwater-level decline contours extend to this stream. The groundwater-level decline was the result of composite drawdown from irrigation wells of the Blacktail Road well field. However, induced streamflow losses from Blacktail Deer Creek did not occur because the stream was perched above the groundwater level, rather than in direct hydraulic interconnection with it. Rattlesnake Creek was also perched above the groundwater level, and induced streamflow losses to pumping wells did not occur.

Summary

Aquifer test analyses indicated high hydraulic conductivity and transmissivity values for most of the wells tested in those areas, such as the Flynn Lane and Blacktail Road well fields, containing large-discharge irrigation wells. Measured hydraulic conductivity ranged from 46 to 2,100 ft/day. Transmissivity, a product of hydraulic conductivity and aquifer thickness, ranged from approximately 5,000 to 182,000 ft^2/day. Transmissivity was high in the Flynn Lane well field area and the lower Blacktail Deer Creek valley, where the thickness of aquifer materials was greatest. Hydraulic conductivity and aquifer thickness of the upper Blacktail Deer Creek valley and the middle Blacktail Deer Creek valley along the stream were lower, but still sufficient to provide for sustained groundwater withdrawal. On the northeast side of the lower Blacktail Deer Creek valley, alluvial materials were finer-grained. In this area both hydraulic conductivity and transmissivity decreased. In the lower Rattlesnake Creek valley, the combination of high hydraulic conductivity and aquifer thickness accounted for higher aquifer transmissivity. Near Dillon, the hydraulic conductivity and transmissivity were high although the aquifer materials were thin.

The implication of the aquifer test analyses is that the Quaternary/upper Tertiary aquifer is sufficiently coarse and thick to support a large sustained volume of groundwater withdrawal without propagating widespread or adverse drawdown impacts, affecting surface water, or causing long-term declines of groundwater levels. In spite of the large amount of groundwater withdrawal in the Blacktail Deer and Rattlesnake creek valleys, the favorable aquifer hydraulic properties permitted rapid recovery of groundwater levels. Groundwater levels quickly recovered to seasonal levels in autumn after irrigation ended. Groundwater levels have not steadily declined, but have fluctuated seasonally in response to variable sources of recharge and groundwater withdrawals.

STREAMFLOW AND SURFACE WATER-GROUNDWATER INTERACTIONS

Methods

Streamflow data were collected each irrigation season at five streamflow gaging stations (Figure 10). Beaverhead River streamflow was recorded at the Barretts gaging station in SE¼ Section 19, T8S, R9W (USGS Gage No. 06016000) and the Dillon gaging station in SW¼ Section 13, T7S, R9W (USGS Gage No. 06017000). Blacktail Deer Creek streamflow was recorded at three gaging stations: at the upper Blacktail Deer Creek gage in SE¼ Section 14, T9S, R8W (USGS Gage No. 06017500), near the East Bench Irrigation District Canal siphon in the SW¼ Section 6, T8S, R8W, and near Interstate 15 exit 62 in the SE¼ Section 24, T7S, R9W. Rattlesnake Creek streamflow was measured at an 8-foot-throat Parshall flume near Argenta, northwest of the project area, in the NE¼ Section 25, T6S, R11W. Except for the Rattlesnake Creek site, the gaged streamflow sites were measured periodically with a flow meter to establish stage/flow rating curves.

Both Beaverhead River gages, the upper Blacktail Deer Creek gage, and the EBID Canal gage are traditional stilling wells connected to the streams by two horizontal steel pipes. Water levels were recorded by mechanical recorders that were checked for proper calibration one to four times per month. The lower Blacktail Deer Creek gage at I-15 exit 62 consisted of a 4-inch diameter PVC pipe laid at the angle of the stream bank and buried for protection. At its lower end, the PVC pipe was perforated with 3/16-inch-diameter holes. A Stevens SDT-II pressure transducer was placed in the 4-inch pipe by mounting it on a ½-inch-diameter PVC pipe and placing the smaller pipe within the outer protective pipe. A Stevens model 420 data logger was used to calibrate the water pressure to an equivalent staff gage reading. The data logger electronically recorded the stage every 15 minutes, and data were summarized as mean daily discharge.

At the Rattlesnake Creek site, an 8-foot-throat Parshall flume was fitted with a stilling well. A Stevens SDT-II pressure transducer and Stevens model 420 data logger were installed in the stilling well. The 15-minute stage data gathered by the logger were converted to mean daily discharge. Following installation of the stilling well in 1993, measurements were collected for a portion of the field season. Due to vandalism in 1994, and flood waters in 1995, which overtopped the flume and washed away the instrumentation, streamflow data were lost. This site was never rehabilitated after the 1995 flood.

The East Bench Irrigation District, which maintains gaging stations on its canal and the Canyon Ditch near the Barretts diversion dam, provided mean daily flows for both ditches.

Synoptic seepage measurements were conducted along the Beaverhead River and the EBID Canal to determine losses or gains in streamflow. Measurements were completed on the same day by the same operator using either a Price AA vertical axis meter or a Marsh-McBirney sonic flow meter. Two sets of synoptic seepage measurements were collected along the Beaverhead River between the Barretts diversion and Dillon. Four sets of synoptic seepage measurements were collected on the EBID Canal to determine whether the canal lost water and to quantify the losses, if they occurred.

Staff gages were installed along the Beaverhead River near riverside piezometers and wells to evaluate surface water-groundwater interactions. Elevations of these structures were surveyed to 0.01-foot accuracy. Long-term relationships between groundwater level and stage in the Beaverhead River were determined by comparisons of groundwater elevations from wells and piezometers located near the river with river stage elevations observed at staff gages. Relationships between groundwater levels and stage in Blacktail Deer Creek were also examined by comparing groundwater elevations observed in wells near the stream with observed stage elevations.

Direct measurement of streambed seepage in the Beaverhead River was attempted at several sites with seepage rings placed in the riverbed. The rate of seepage loss or gain per unit area of riverbed may be quantified by measuring the volume of water moving into or from the area of the riverbed enclosed by the seepage ring over a specified period of time. However, the seepage data obtained by this procedure were extremely variable and inconclusive. Further attempts with this procedure were not pursued.

Results and Interpretations

Streamflow. Beaverhead River streamflow data recorded between 1991 and 1996 at the Barretts and Dillon gaging stations were converted to mean daily flows and plotted as seasonal hydrographs (Figures 57 and 58). Mean daily streamflow for these gages and stage/flow rating curves are presented in Appendices D1 and D2, respectively. For the period of record, mean daily streamflow at the Barretts gage ranged from 97 to 1,640 cfs, and mean daily streamflow at the Dillon gage ranged from 32 to 1,385 cfs. In non-irrigation periods, Beaverhead River streamflow at the Dillon gage was greater than at the Barretts gage. However, during summer irrigation periods, greater streamflow was recorded at the Barretts gage because, downstream of this gage, numerous canals and ditches diverted a large volume of streamflow for irrigation use.

The Barretts gaging station is operated by the U.S. Geological Survey. Streamflow records are compiled for the months of March through October and published annually as U.S. Geological Survey Water-Data Reports. Mean monthly streamflow at the Barretts gaging station, reported as cubic feet per second, is presented in Table 6.

Table 6. Mean Monthly Streamflow at the Barretts Gaging Station

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1991	120	126	224	793	785	536	178	116
1992	165	187	609	605	479	574	204	113
1993	142	140	392	610	463	496	277	218
1994	203	223	610	774	812	431	255	121
1995	152	178	462	1271	1485	1322	864	592
1996	680	701	852	942	972	636	317	212

Figure 57. Beaverhead River Streamflow at the Barretts Gaging Station

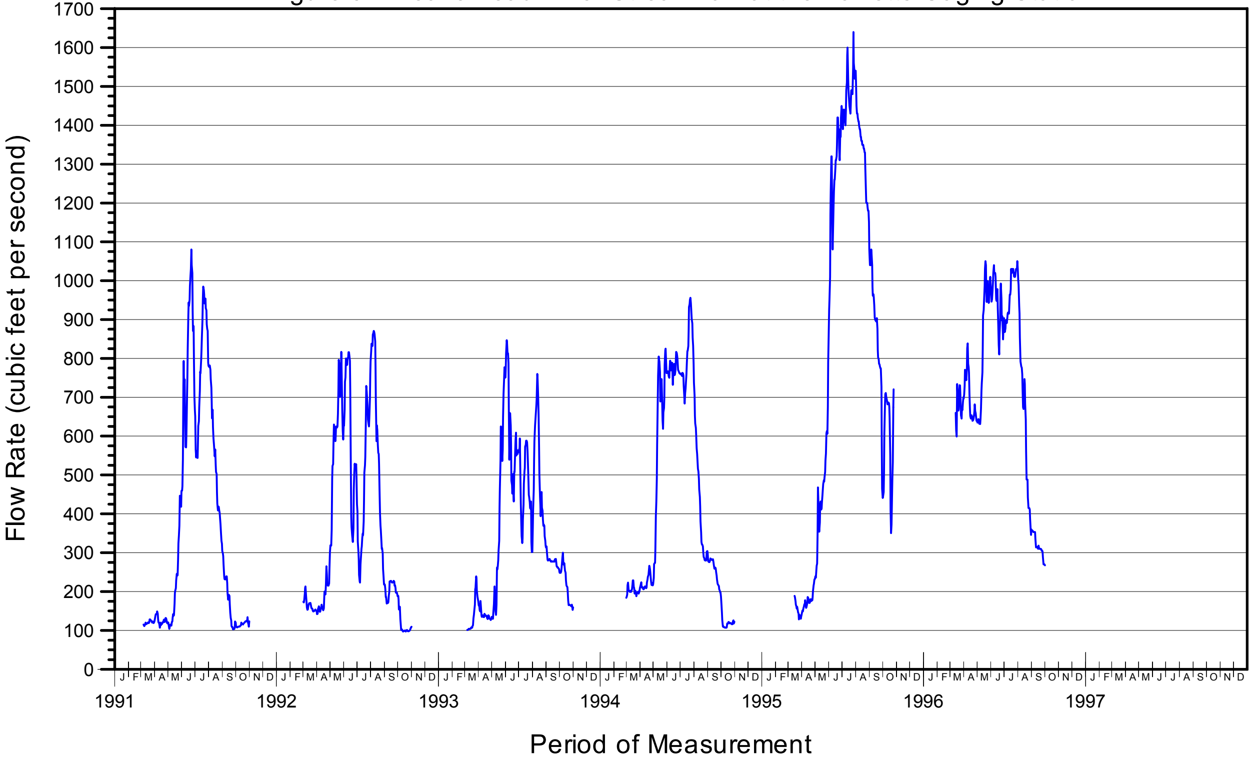
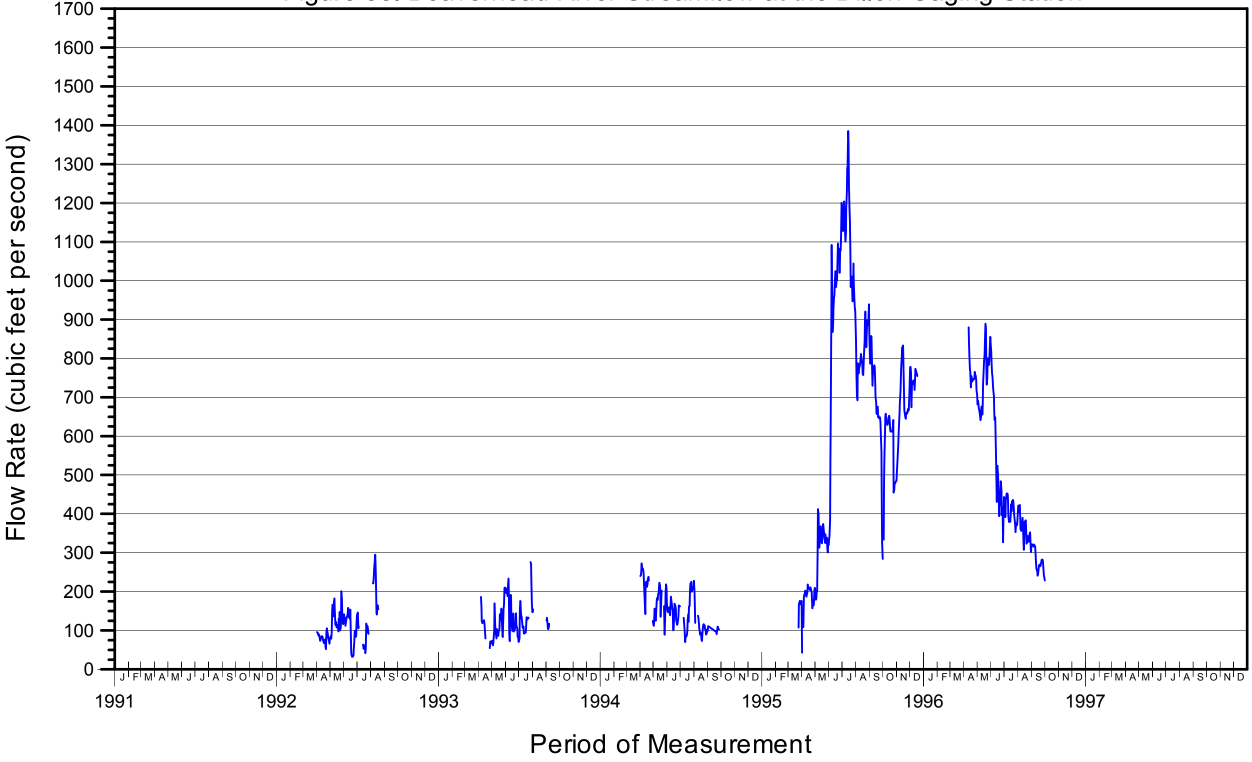


Figure 58. Beaverhead River Streamflow at the Dillon Gaging Station



The Dillon gaging station is currently operated and maintained by the East Bench Irrigation District. Streamflow records are compiled for the months of April through September or October of each year, but are not published. Mean monthly streamflow at the Dillon gaging station, reported as cubic feet per second, is presented in Table 7.

Table 7. Mean Monthly Streamflow at the Dillon Gaging Station

	Apr	May	Jun	Jul	Aug	Sep	Oct
1992	81	128	103	89	162	82	
1993	107	116	139	139	125	137	154
1994	222	169	148	147	108	95	
1995	186	317	930	1108	818	678	576
1996	761	747	542	406	359	278	

The East Bench Irrigation District Canal and the Canyon Ditch divert water for irrigation use from the Beaverhead River at the Barretts diversion dam located one mile downstream of the Barretts gaging station. These and other diversions from the Beaverhead River accounted for a portion of the difference in streamflow between the Barretts and Dillon gaging stations. The EBID Canal and Canyon Ditch diversions are plotted as seasonal hydrographs (Figure 59). Mean daily diversion records are tabulated in Appendix D1. Mean daily diversion to the EBID Canal from the Beaverhead River ranged from 25 to 496 cfs, and mean daily diversion to the Canyon Ditch from the Beaverhead River ranged from 0 to 285 cfs. Mean monthly diversions for the EBID Canal and the Canyon Ditch, reported as cubic feet per second, are presented in Tables 8 and 9, respectively.

Table 8. Mean Monthly EBID Canal Diversions from the Beaverhead River

	May	Jun	Jul	Aug	Sep	Oct
1991	117	343	388	283	74	
1992	276	299	261	242	96	
1993	210	314	252	289	148	117
1994	238	372	449	257	153	
1995	140	300	364	342	162	124
1996	142	372	464	288	167	135

Table 9. Mean Monthly Canyon Ditch Diversions from the Beaverhead River

	May	Jun	Jul	Aug	Sep	Oct
1991	29	63	185	70	19	
1992	64	70	55	67		
1993	41	47	48	46	25	26
1994	57	90	87	61		
1995		32	39	82	31	19
1996	42	72	98	89	50	16

Blacktail Deer Creek streamflow data for its three gaging stations are summarized as mean daily flow, plotted as seasonal hydrographs in Figures 60 through 62, and tabulated in Appendix D1. Mean daily streamflow in the lower Blacktail Deer Creek gage at I-15 exit 62 ranged from 19 to 307 cfs. Mean daily streamflow in middle Blacktail Deer Creek at the

Figure 59. EBID Canal and Canyon Ditch Diversions from the Beaverhead River

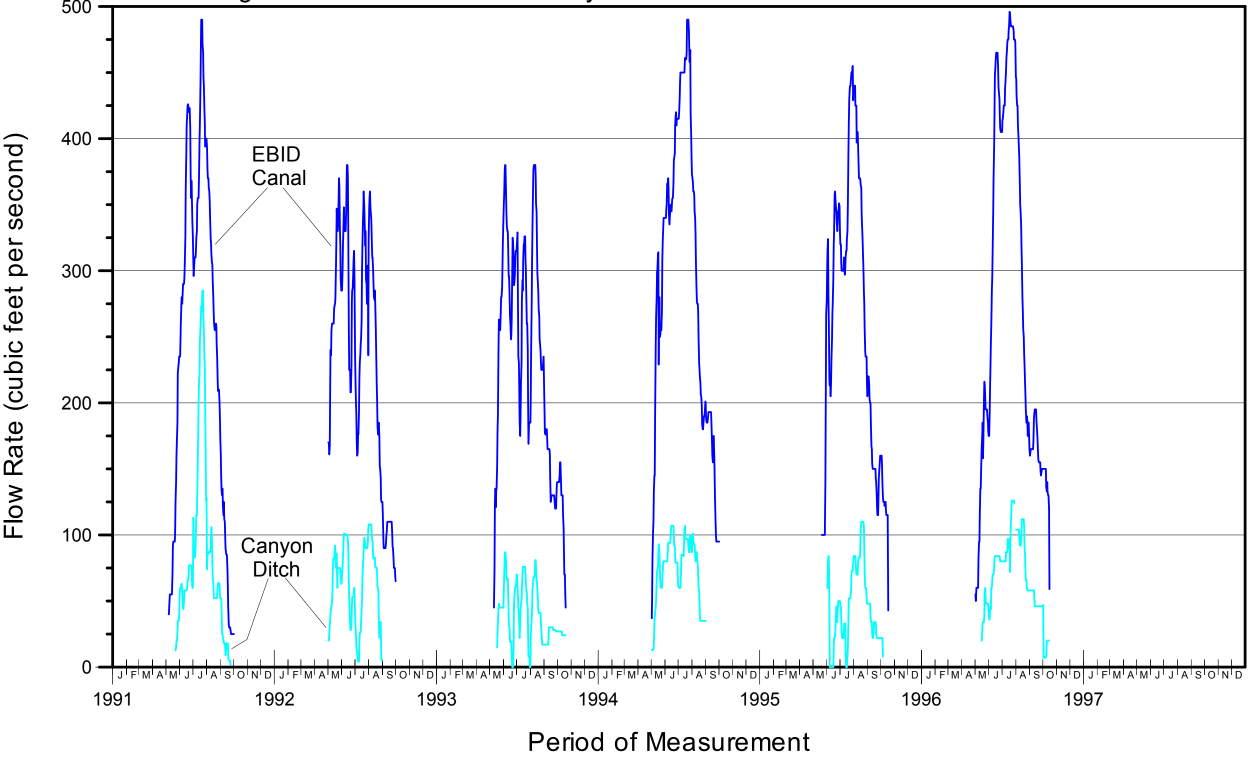


Figure 60. Lower Blacktail Deer Creek Streamflow at the I-15 Gaging Station

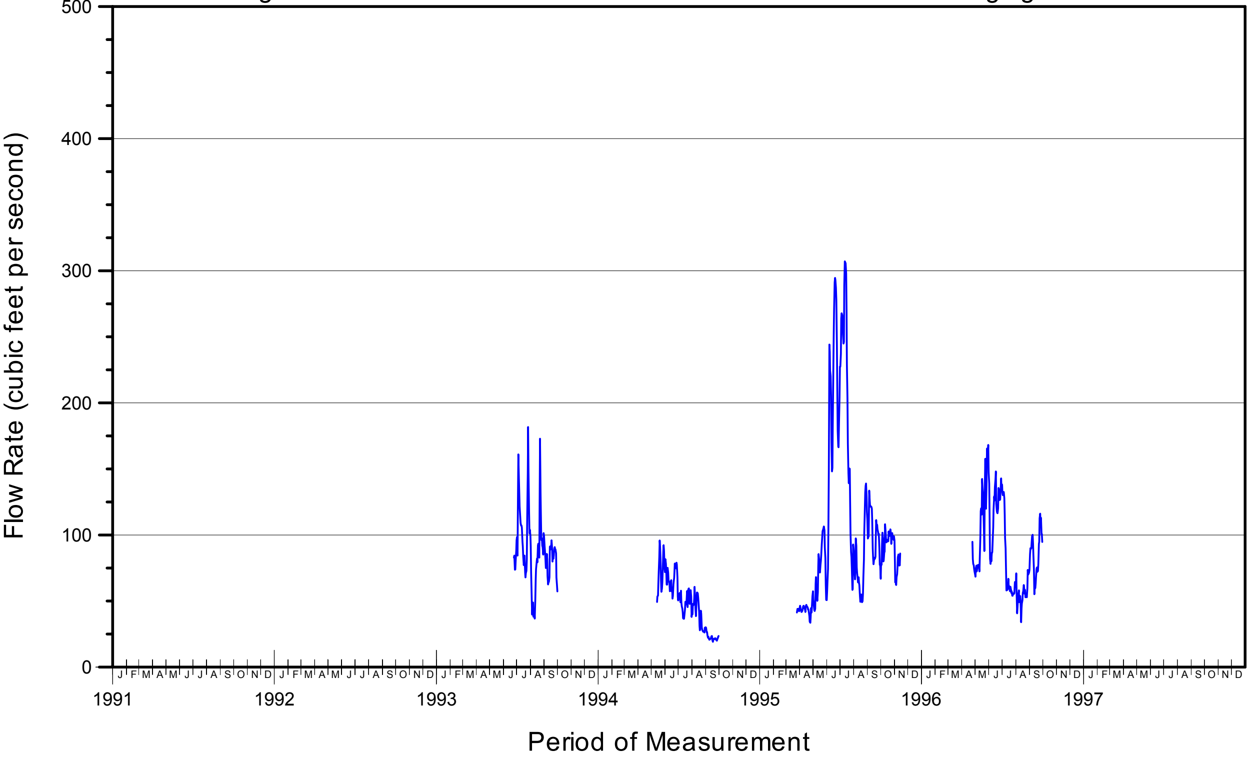


Figure 61. Middle Blacktail Deer Creek Streamflow at EBID Canal Gaging Station

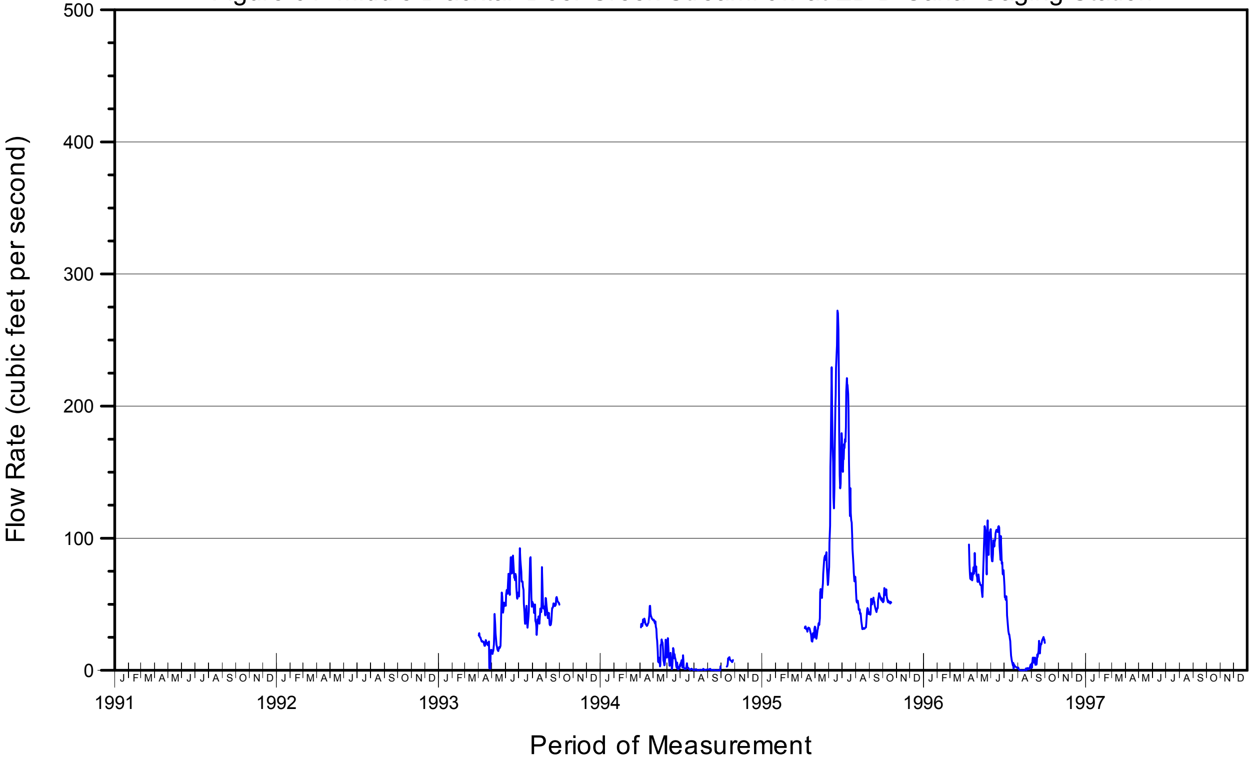
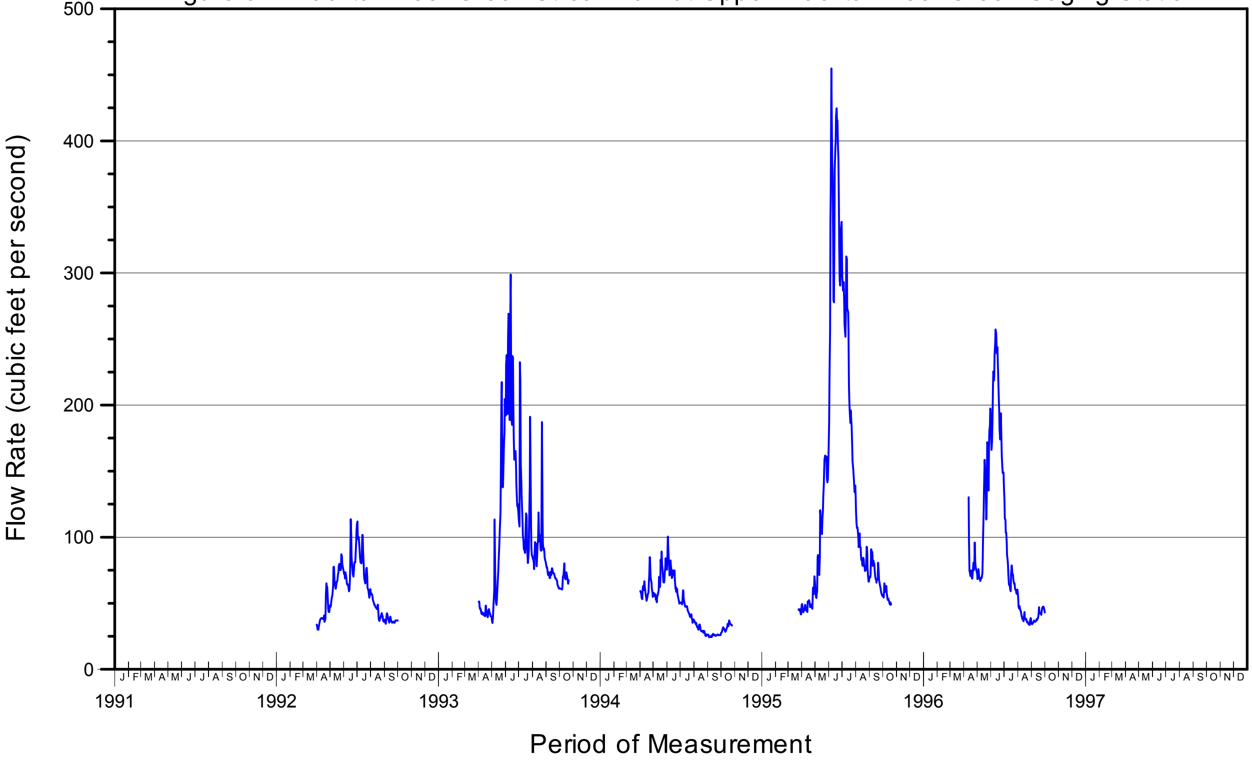


Figure 62. Blacktail Deer Creek Streamflow at Upper Blacktail Deer Creek Gaging Station



EBID Canal gage ranged from 0 to 272 cfs. Mean daily streamflow in upper Blacktail Deer Creek ranged from 24 to 455 cfs. Mean monthly streamflows at the Blacktail Deer Creek gaging stations, reported as cubic feet per second, are presented in Tables 10 through 12.

Table 10. Mean Monthly Streamflow at the Lower Blacktail Deer Creek Gaging Station

	Apr	May	Jun	Jul	Aug	Sep
1992		(gage not constructed until 1993)				
1993			83	106	80	81
1994		72	67	48	40	22
1995	44	73	200	194	81	100
1996	78	113	118	75	56	87

Table 11.Mean Monthly Streamflow at the Middle Blacktail Deer Creek Gaging Station

	Apr	May	Jun	Jul	Aug	Sep
1992		(gage not constructed until 1993)				
1993	19	30	68	58	45	46
1994	38	18	8	2	0.4	0.3
1995	29	58	180	141	41	51
1996	76	84	93	21	1	14

Table 12. Mean Monthly Streamflow at the Upper Blacktail Deer Creek Gaging Station

	Apr	May	Jun	Jul	Aug	Sep
1992	42	69	77	78	45	37
1993	43	106	194	117	95	70
1994	61	67	69	45	30	26
1995	50	114	346	221	87	71
1996	80	118	199	75	40	40

Blacktail Deer Creek is perched above groundwater levels from Section 10, T9S, R8W near well 91-1 to the EBID Canal gage. Along those reaches where Blacktail Deer Creek is perched, streamflow infiltration losses to the aquifer occurred naturally. Depths to groundwater along perched sections of Blacktail Deer Creek generally ranged from approximately 10 to 55 feet, as observed in wells 91-1, 91-2, 91-3, the High Mountain #4 irrigation well, the Ripley domestic well, and well 92-14. The amount of streamflow infiltration losses to the aquifer was not quantified; however, these losses would probably be small compared with irrigation diversions along this reach. If drawdown from irrigation wells had spread to Blacktail Deer Creek, additional streamflow losses induced by the drawdown would not occur along the perched reaches of the stream because groundwater levels were below the stream, rather than in direct hydraulic connection with it.

Blacktail Deer Creek streamflow was significantly diminished by irrigation diversions between the upper gage and the middle gage at the EBID Canal, and at times, the channel was dry upstream of the EBID Canal gage. Even when the channel was dry, water was flowing downstream of the EBID Canal gage where Blacktail Deer Creek becomes a gaining stream. Streamflow increased from baseflow accretions between the EBID Canal gage and the lower gage at I-15 exit 62. In addition, Blacktail Deer Creek was used as a conveyance by the Canyon Ditch and Dillon Canal. It would be difficult to quantify streamflow gains from baseflow accretions between these gages because ditch water was added to the Blacktail Deer Creek channel. Although streamflow measurements were not collected along Blacktail Deer Creek north of Dillon, it probably gained streamflow to its confluence with the Beaverhead River.

Sheep Creek is the major tributary of Blacktail Deer Creek within the project area. The baseflow of Sheep Creek originated as seepage from limestone springs upstream of the canyon mouth. The channel upstream of the springs was often dry, but snowmelt and summer precipitation in the Blacktail Range added to streamflow in the upper channel. A large amount of streamflow infiltrated to the aquifer after leaving Sheep Creek canyon.

Rattlesnake Creek streamflow records were incomplete because the gaging site was in operation for only a short time prior to vandalism and its destruction by flood waters. Streamflow was often visually estimated where it flowed through the culvert under Highway 278 in the NE¼ Section 30, T7S, R9W. Streamflow in Rattlesnake Creek ranged from less than 1 cfs during drier periods of the year to several cfs in late spring.

Surface Water-Groundwater Interactions. Groundwater-level elevations in wells and piezometers along the Beaverhead River are compared to river stage elevations observed at staff gages (Figures 63 through 72) and tabulated in Appendix D3. These comparisons indicate that the Beaverhead River lost water to the aquifer between the Barretts diversion in Section 17, T8S, R9W and the Interstate 15 exit at Highway 278 in Section 34, T7S, R9W. The Beaverhead River gained water from this point north to the Dillon gage.

Figure 63. Groundwater - Beaverhead River Stage Relationship at Bolick Ranch

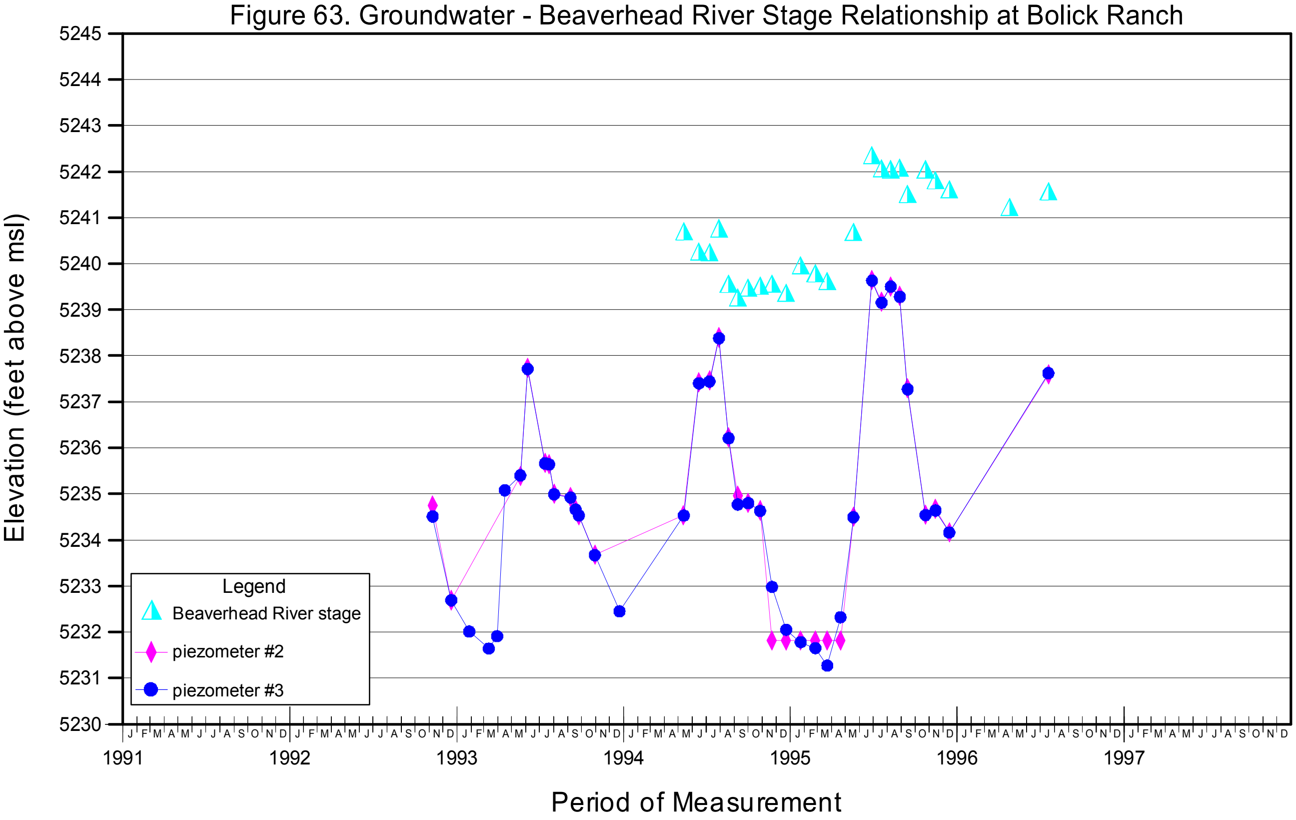


Figure 64. Groundwater - Beaverhead River Stage Relationship at Barretts Minerals, Inc.

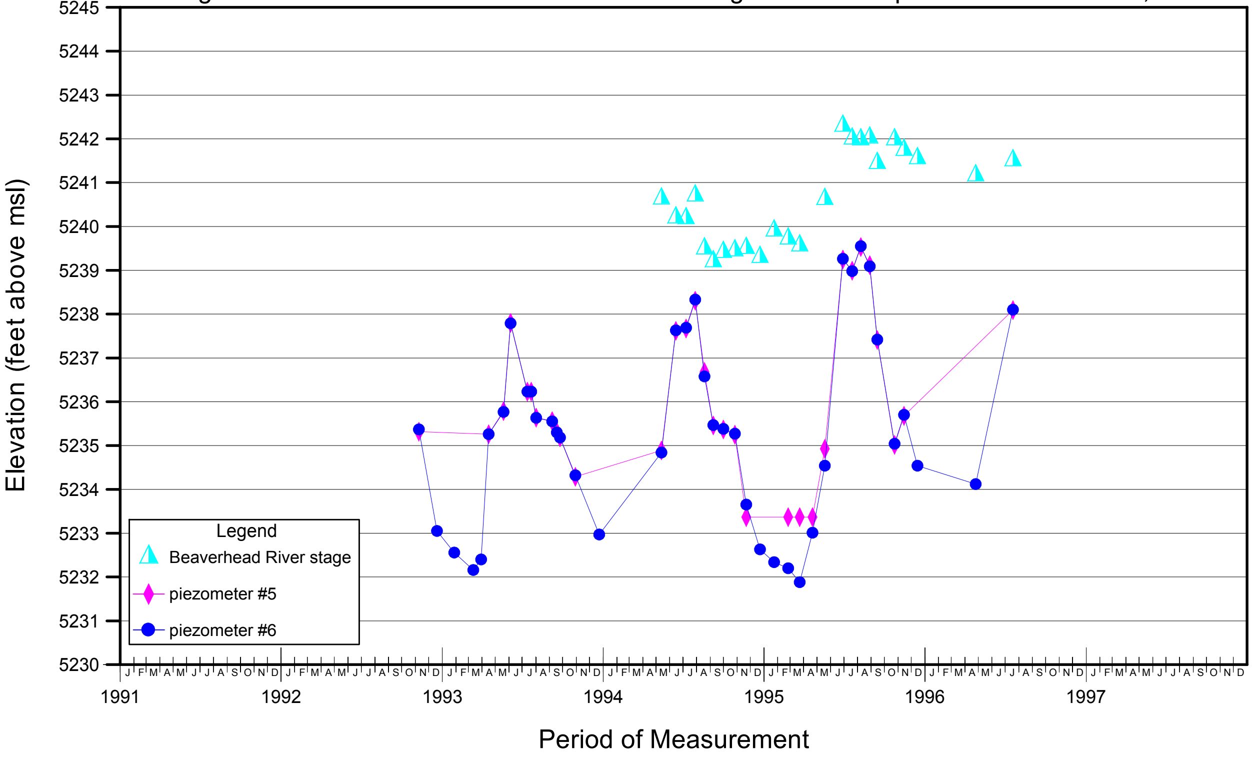


Figure 65. Groundwater - Beaverhead River Stage Relationship at Wells 92-32 and 92-33

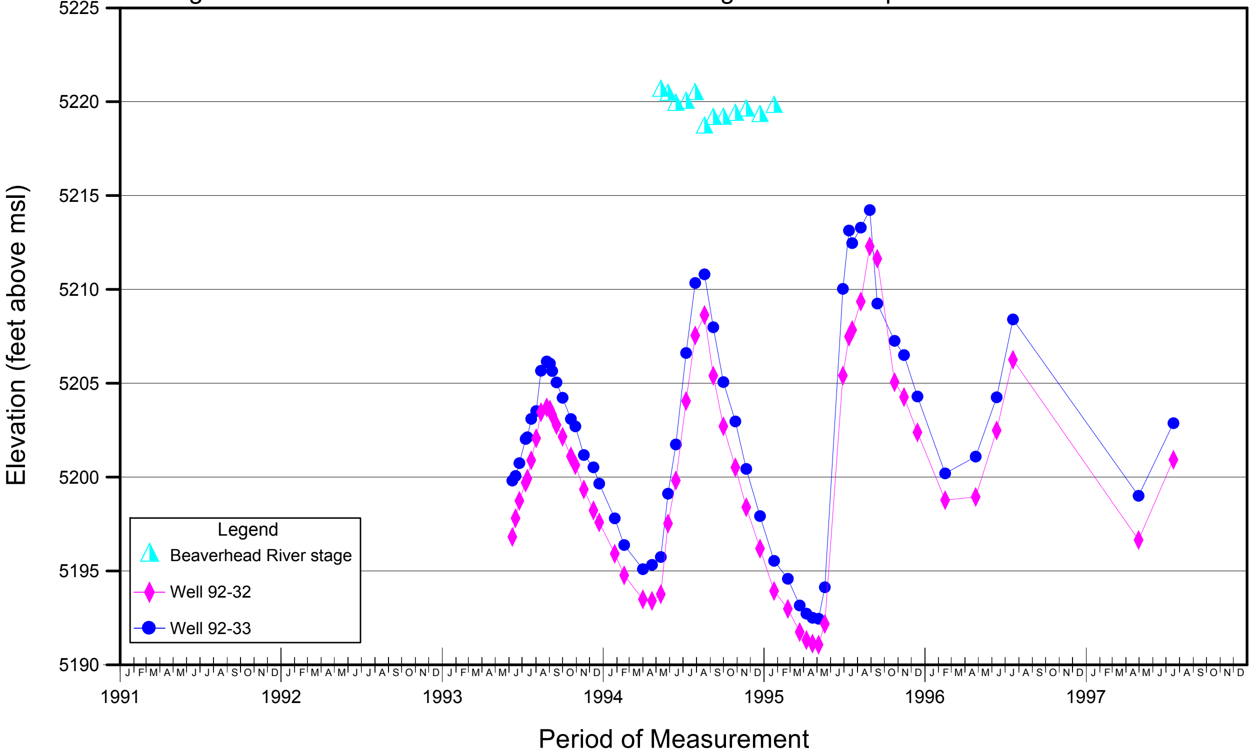


Figure 66. Groundwater - Beaverhead River Stage Relationship on Steffanic Property

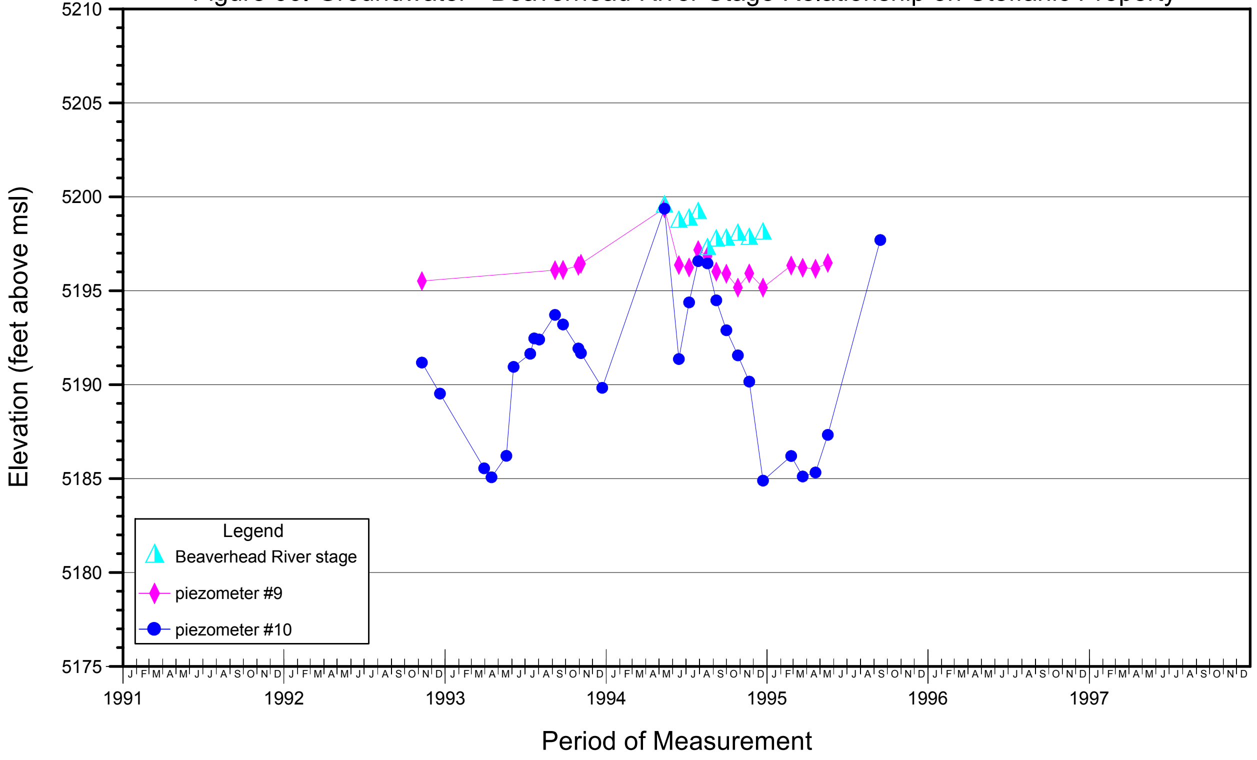


Figure 67. Groundwater - Beaverhead River Stage Relationship on Dawson Property

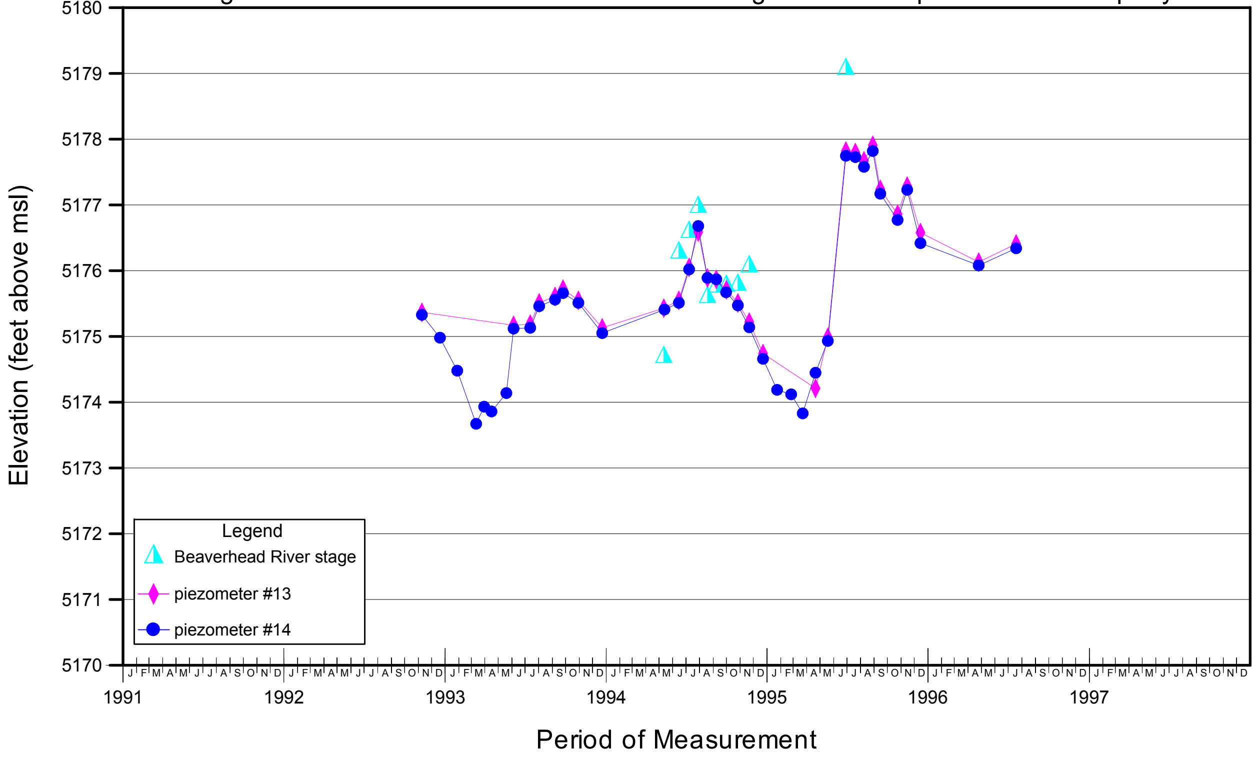


Figure 68. Groundwater - Poindexter Slough Stage Relationship on Gund-Ream Ranch

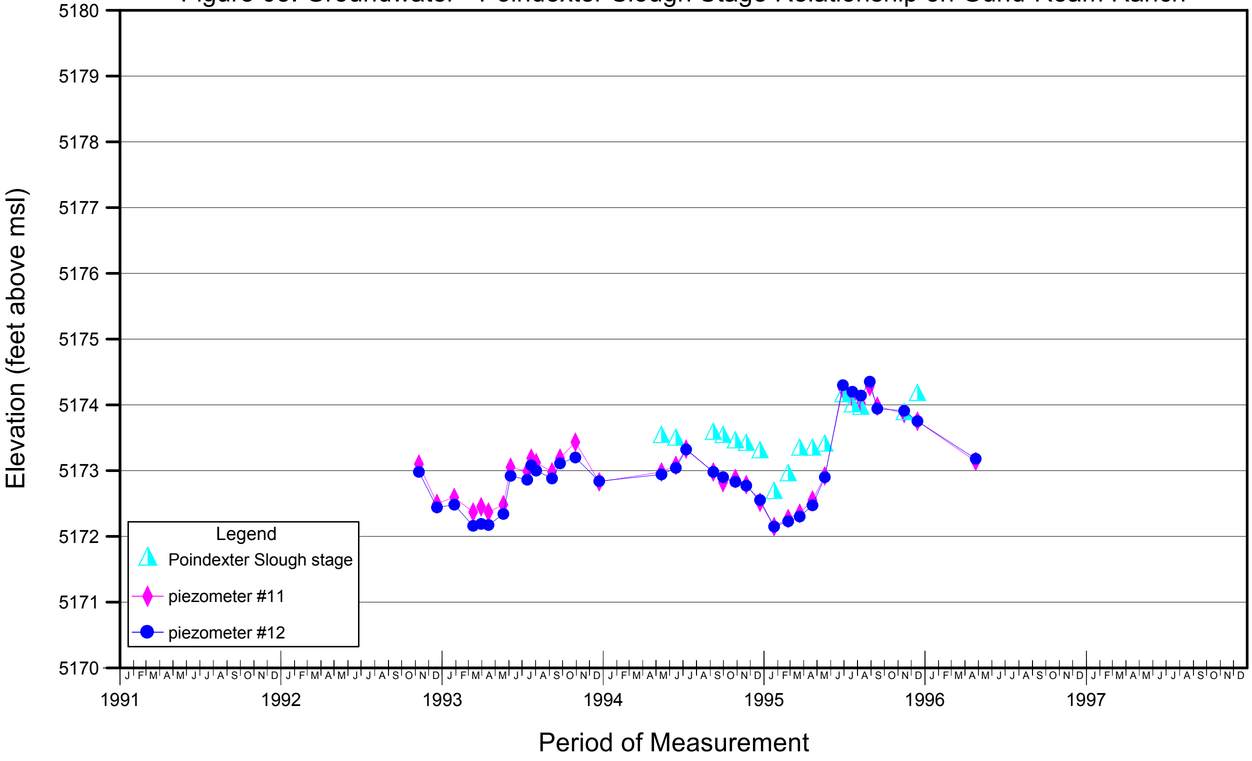


Figure 69. Groundwater - Beaverhead River Stage Relationship on Tash Ranch near Highway 41

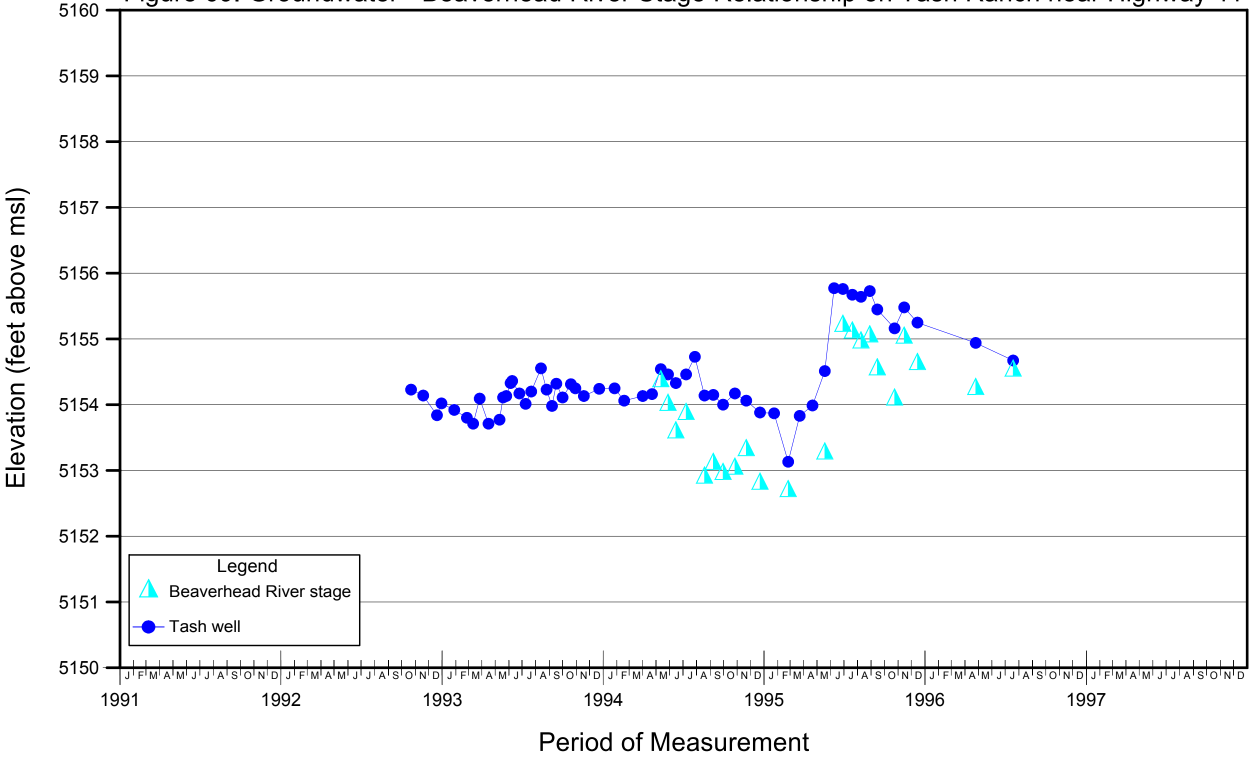


Figure 70. Groundwater - Beaverhead River Stage Relationship near Tash Ranch Pond

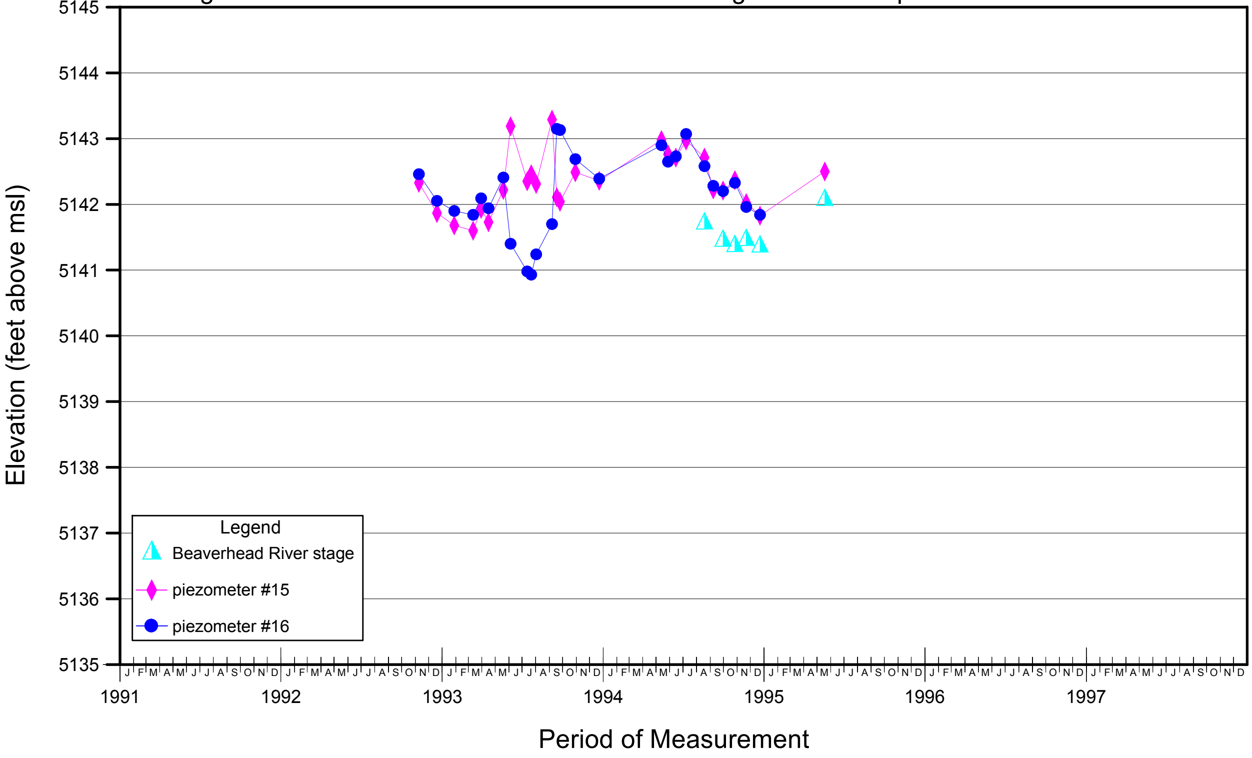


Figure 71. Groundwater - Beaverhead River Stage Relationship on Wheat Property

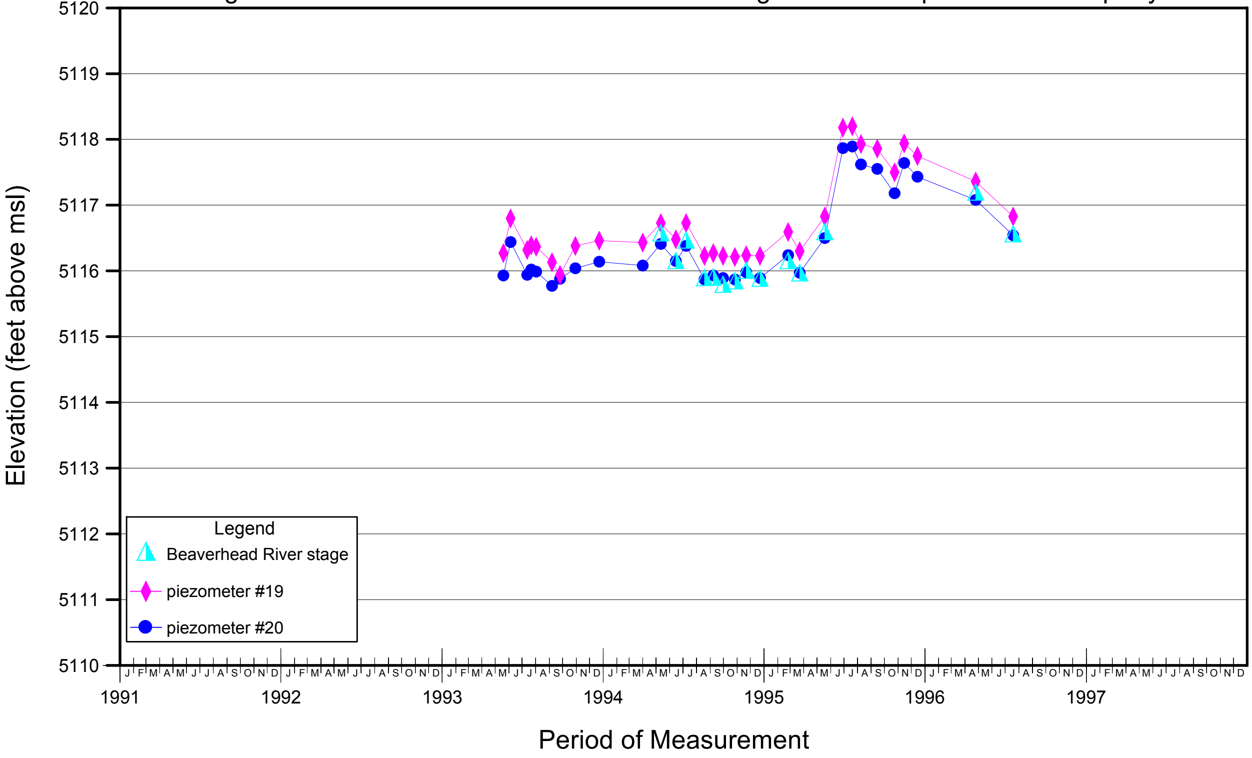
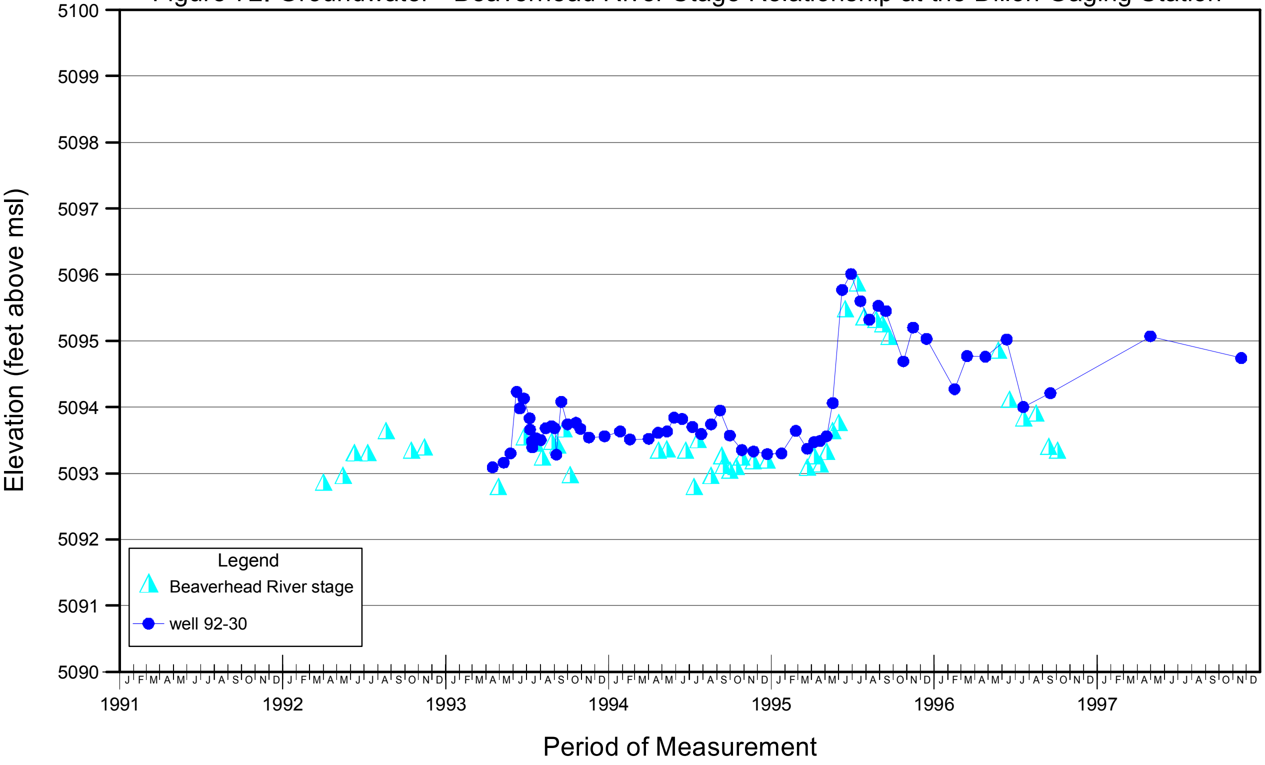


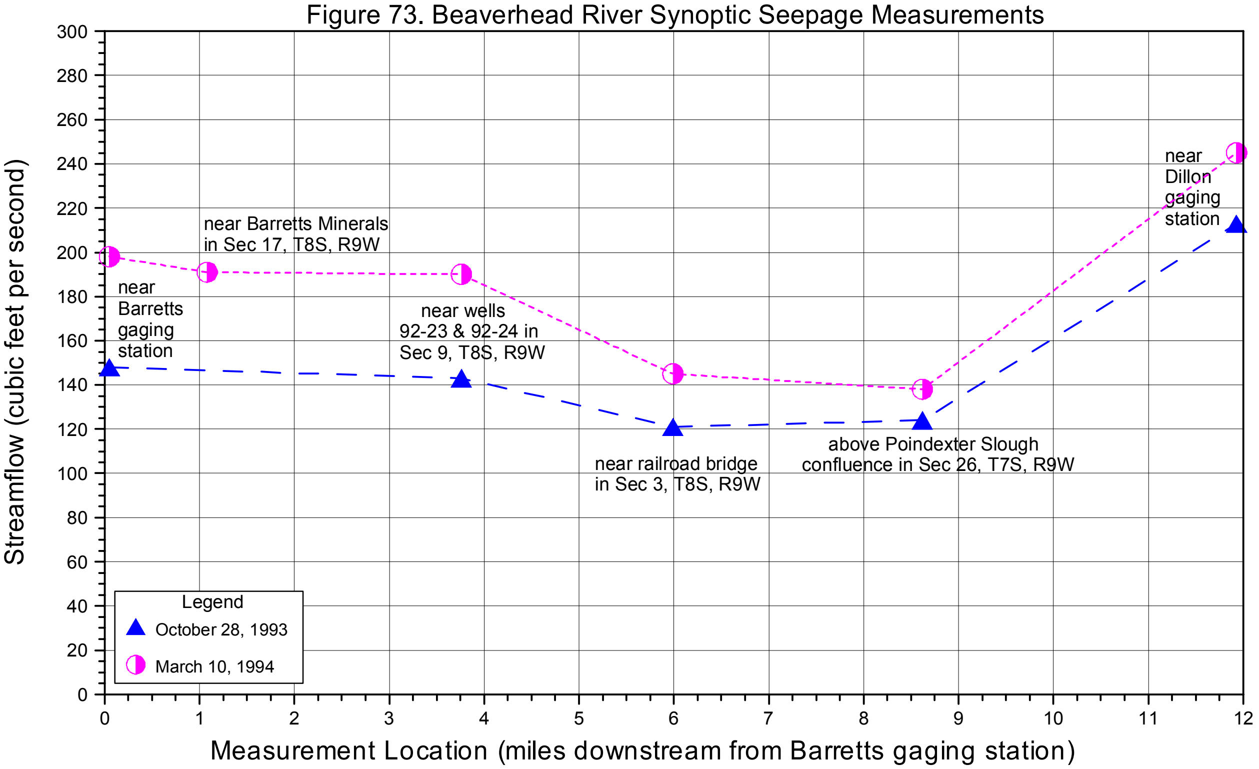
Figure 72. Groundwater - Beaverhead River Stage Relationship at the Dillon Gaging Station



Two complete sets of synoptic seepage measurements, presented in Figure 73 and tabulated in Appendix D4, were collected along the Beaverhead River between the Barretts and the Dillon gaging stations to quantify the river's gains and losses. The seepage runs were conducted in October 1993 and March 1994 when there were no irrigation diversions. The seepage runs confirmed the pattern of gains and losses indicated by observations of river stage at staff gages and groundwater elevations in piezometers. The October 1993 seepage runs indicated that the Beaverhead River lost 24 cfs between Barretts and its confluence with Poindexter Slough, gained 40 cfs from baseflow between the confluence of Poindexter Slough and the Dillon gage, and gained 49 cfs from Poindexter Slough, for a net gain of 65 cfs. The March 1994 seepage runs indicated that the Beaverhead River lost 60 cfs between Barretts and its confluence with Poindexter Slough, gained 41 cfs from baseflow between the confluence of Poindexter Slough and the Dillon gage, and gained 66 cfs from Poindexter Slough, for a net gain of 47 cfs. Baseflow during summer irrigation seasons could not be practically quantified because of the logistics of measuring the numerous irrigation diversions.

The Beaverhead River floodplain between Highway 278 and Dillon is a groundwater discharge area, in which the vertical component of the groundwater gradient is generally upward. Groundwater flowing from the Blacktail Deer and Rattlesnake creek valleys converges here, and accumulates as ponds and sloughs. In addition, groundwater levels rise higher because the aquifer thins northeastward. The hydraulic gradient slopes toward the Beaverhead River and other surface water bodies. In the groundwater discharge area, streamflow of the Beaverhead River, the lower reach of Blacktail Deer Creek, and sections of Poindexter Slough increased from baseflow accretions.

Figure 73. Beaverhead River Synoptic Seepage Measurements



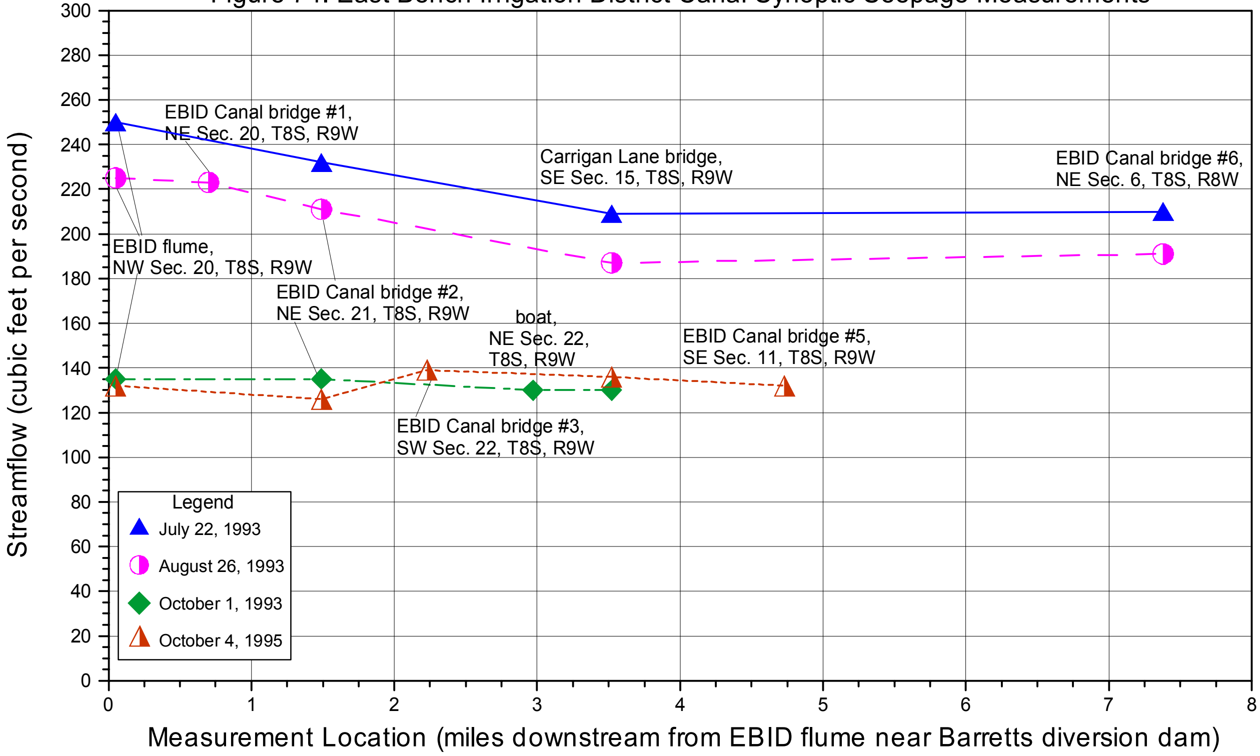
The EBID Canal annually diverts a large amount of water from the Beaverhead River for irrigation. Significant leakage losses from the canal probably did not occur because the canal bottom was lined with a low-permeability asphalt liner. Synoptic seepage measurements in the canal, presented in Figure 74 and tabulated in Appendix D4, were collected three times in 1993 and once in 1995 between the Barretts diversion and Blacktail Road where the canal leaves the project area. No leakage losses from the canal were observed between Carrigan Lane and Blacktail Road (Figure 1). Between the Barretts diversion and Carrigan Lane differences in flow, ranging from about 4% to 17%, were noted. Some may be attributable to typical streamflow measurement error.

In order to further evaluate the potential for canal leakage losses in this reach, observation wells 92-34 and 92-35 were drilled along the EBID Canal near the Carrigan Lane bridge. Well 92-34 was sited on the west downslope bank of the canal, and well 92-35 was sited farther downslope in the estimated direction of groundwater flow. Continuous groundwater-level records from these wells indicate that there were no groundwater-level rises immediately after the canal began to flow in the spring. A larger groundwater-level rise did not occur first in well 92-34 nearest the canal, compared with the more distant well 92-35, which would have suggested groundwater leaking from the canal and moving downgradient. Continuous groundwater-level records also showed that rises in these two observation wells began about two to three weeks after flow began in the EBID Canal. These groundwater-level rises occurred simultaneously with rises also observed in other wells farther from the canal. The gradient of the groundwater surface observed between wells 92-34 and 92-35 was identical to the gradient between these wells and other wells upslope of the canal, which indicated an area-wide groundwater-level rise from spring snowmelt, rainfall, and irrigation return flow, rather than from canal leakage losses.

An additional observation regarding leakage from the EBID Canal was noted during an aquifer test conducted in the Anderson irrigation well within 100 feet of the canal in SW¼, Section 6, T8S, R8W. No recharge boundary was observed during collection of aquifer test data, as would be expected if the canal supplied water to the pumping well.

Based on canal construction details and hydrogeologic measurements, it was concluded that the EBID Canal did not significantly leak water to the aquifer in the project area.

Figure 74. East Bench Irrigation District Canal Synoptic Seepage Measurements



Summary

Greater streamflow was noted in the Beaverhead River at the Barretts gaging station than at the Dillon gaging station during summers because of the large irrigation diversions from the river. During non-irrigation seasons, greater streamflow was recorded at the Dillon gaging station. The Beaverhead River lost water to the aquifer between the Barretts diversion and the Interstate 15 exit at Highway 278 in Section 34,T7S, R9W, and gained streamflow from baseflow accretions from this point north to Dillon. This observation was documented by comparisons of river stages with groundwater elevations in wells and piezometers located along the river. Streamflow gains and losses were quantified by two sets of synoptic seepage measurements along the Beaverhead River between the Barretts and the Dillon gaging stations. Observed net gains to the Beaverhead River during the non-irrigation season ranged from 47 to 65 cfs. Baseflow accretions could not be practically or accurately determined during the summer irrigation season because of the logistics of measuring the numerous irrigation diversions.

The floodplain of the Beaverhead River between the I-15 exit at Highway 278 and Dillon is a groundwater discharge area. Groundwater flowing from the Blacktail Deer and Rattlesnake creek valleys converges here. In addition, groundwater levels wefsre higher because the aquifer thins northeastward. The hydraulic gradient slopes toward the Beaverhead River, and streamflow of the Beaverhead River, lower Blacktail Deer Creek, and Poindexter Slough increased from baseflow accretions.

Streamflow in upper Blacktail Deer Creek also increased from baseflow accretions. However, the stream is naturally losing for several miles downstream to the EBID Canal area. In addition to natural seepage losses, large irrigation diversions decreased streamflow. Blacktail Deer Creek gained flow from baseflow accretions along its lower reach to its confluence with the Beaverhead River.

Streamflow in Sheep Creek originated as seepage from limestone springs near its canyon mouth. The channel farther upstream was usually dry, but snowmelt and summer precipitation in the Blacktail Range increased the flow. A large amount of water infiltrated to the aquifer after leaving Sheep Creek canyon.

The EBID Canal and Canyon Ditch did not lose significant amounts of water across the lower Blacktail Deer Creek valley. Minimal seepage losses from the EBID Canal probably occurred in the upper 1 or 2 miles.

Streamflow in Rattlesnake Creek was visually estimated because the stream gaging station was destroyed. Streamflow ranged from less than 1 cfs during drier periods of the year to several cfs in late spring.

WATER QUALITY

Methods

Chemical properties of water were characterized by analyzing samples for standard major, minor, and trace inorganic chemical constituents. Organic constituents were not determined. Water quality samples were collected from 69 wells and seven surface water sites in 1993 and 1994, according to procedures specified by Knapton (1985). Wells were purged until several casing volumes were evacuated. Water samples were field tested for pH, specific conductance, and temperature. Water samples, collected by the USGS, were analyzed at the Montana Bureau of Mines and Geology water quality lab. Other water samples were analyzed at The University of Montana Geology Department analytical lab. Duplicates and blanks were also submitted for analyses for quality control purposes.

Results of these water quality analyses, plus eight others collected by the USGS in the project area in 1991, were compiled and presented both in tabular format and as Stiff diagrams. Stiff diagrams, which graphically illustrate the chemical variations of the major ions, were prepared for geochemical comparative purposes. A water quality map was prepared for total dissolved solids.

All water quality analyses have been archived for reference in the Ground-Water Information Center database at the Montana Bureau of Mines and Geology, Montana Tech of The University of Montana, Butte, Montana.

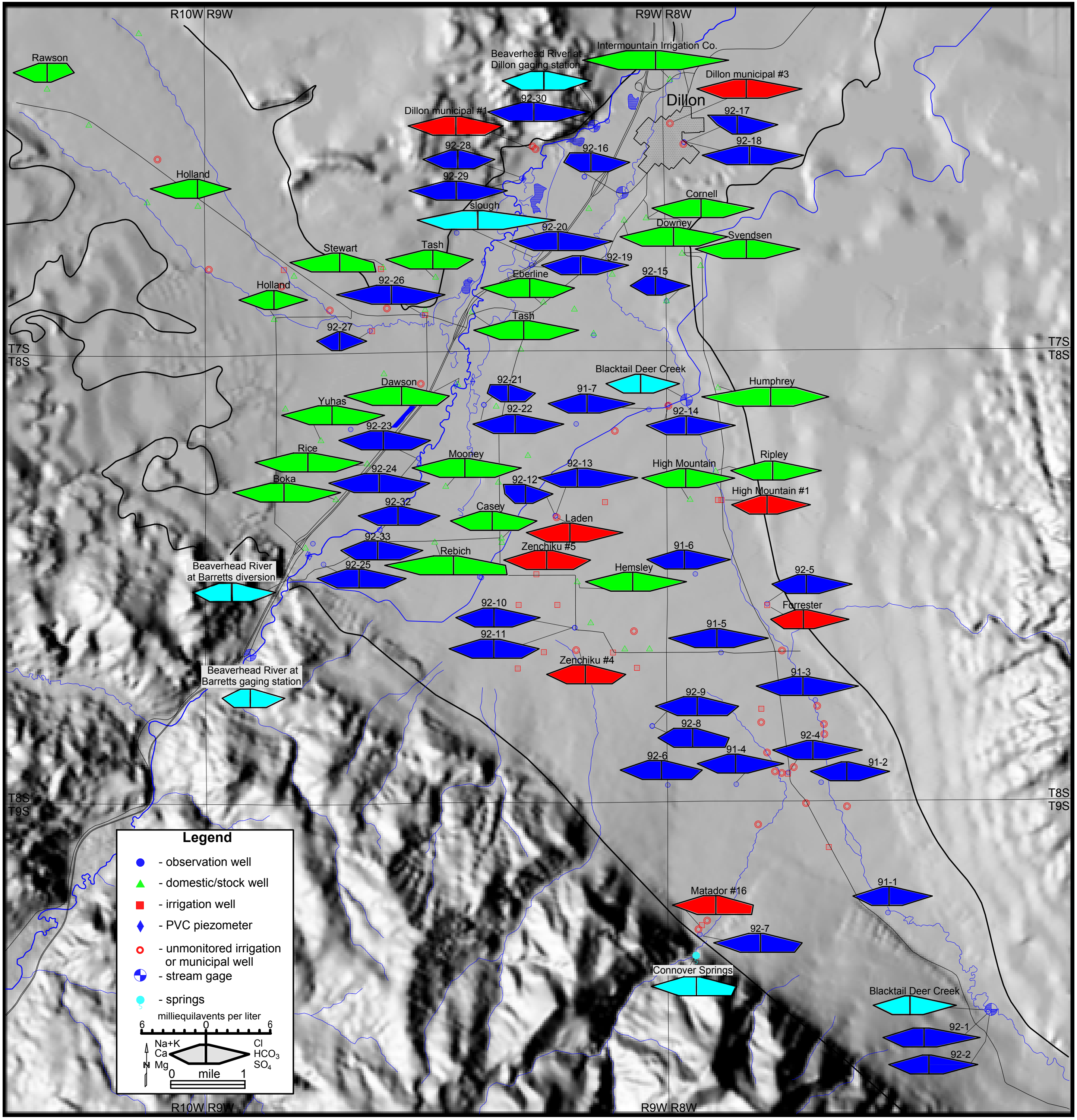
The USGS collected water samples for chlorofluorocarbon (CFC) age-dating analyses from 48 sites. CFC concentrations in groundwater are used to assign primary estimates of age dates, from the time they enter the groundwater. CFC sampling was conducted according to methods specified by Busenberg and Plummer (1991), and the samples were analyzed at the USGS Chlorofluorocarbon Laboratory. CFC organic compounds, used as refrigerants and aerosol propellants, have been accumulating in the atmosphere for several decades. CFCs enter groundwater when they are dissolved by precipitation.

The USGS collected water samples for tritium/helium isotope age-dating analyses at 18 sites. Tritium (^3H) entered the atmosphere as a result of thermonuclear testing in the 1950s and 1960s. Following test-ban treaties in 1963, tritium input to the atmosphere has decreased. From concentrations of ^3H and its decay product, tritiogenic helium-3 ($^3He_{trit}$), reliable ages of water samples can be calculated, based on a radioactive decay equation. Samples for ^3H-^3He dating were analyzed at the Lamont-Dohert Earth Observatory Noble Gas Facility. The USGS used the ^3H-^3He dates to resolve discrepancies in chlorofluorocarbon age dating.

Results and Interpretations

Water Quality. The major ionic constituents (sodium, potassium, calcium, magnesium, chloride, bicarbonate, and sulfate) are presented as a Stiff diagram map in Figure 75. Water temperature ranged from 6EC to 22EC in groundwater and 1EC to 20.5EC in surface

Figure 75. Water Quality Stiff Diagrams



water. Field pH ranged from 7.07 to 8.76, with the highest values occurring in surface water samples. A water quality inventory, detailed Stiff diagrams, and water quality analysis reports are presented in Appendices E1 through E3, respectively.

Water quality analyses indicated that the concentrations of inorganic constituents for most samples fell below the U.S. Environmental Protection Agency (EPA) National Primary and Secondary Drinking Water Standards, which specify limits on the concentration of certain dissolved minerals in drinking water. Manganese and iron concentrations exceeded limits in two wells. Specific conductance ranged from about 300 to 900 micromhos per centimeter (µmhos/cm). Hardness ranged from 115 to 512 milligrams per liter (mg/l), where 200 mg/l is the recommended limit. Total dissolved solids ranged from 170 to 624 mg/l, where 500 mg/l is the recommended limit. The distribution of total dissolved solids is illustrated in Figure 76. The ranges of concentration for major inorganic ionic constituents are summarized in Table 13.

Table 13. Summary of Major Inorganic Constituents of Water Samples

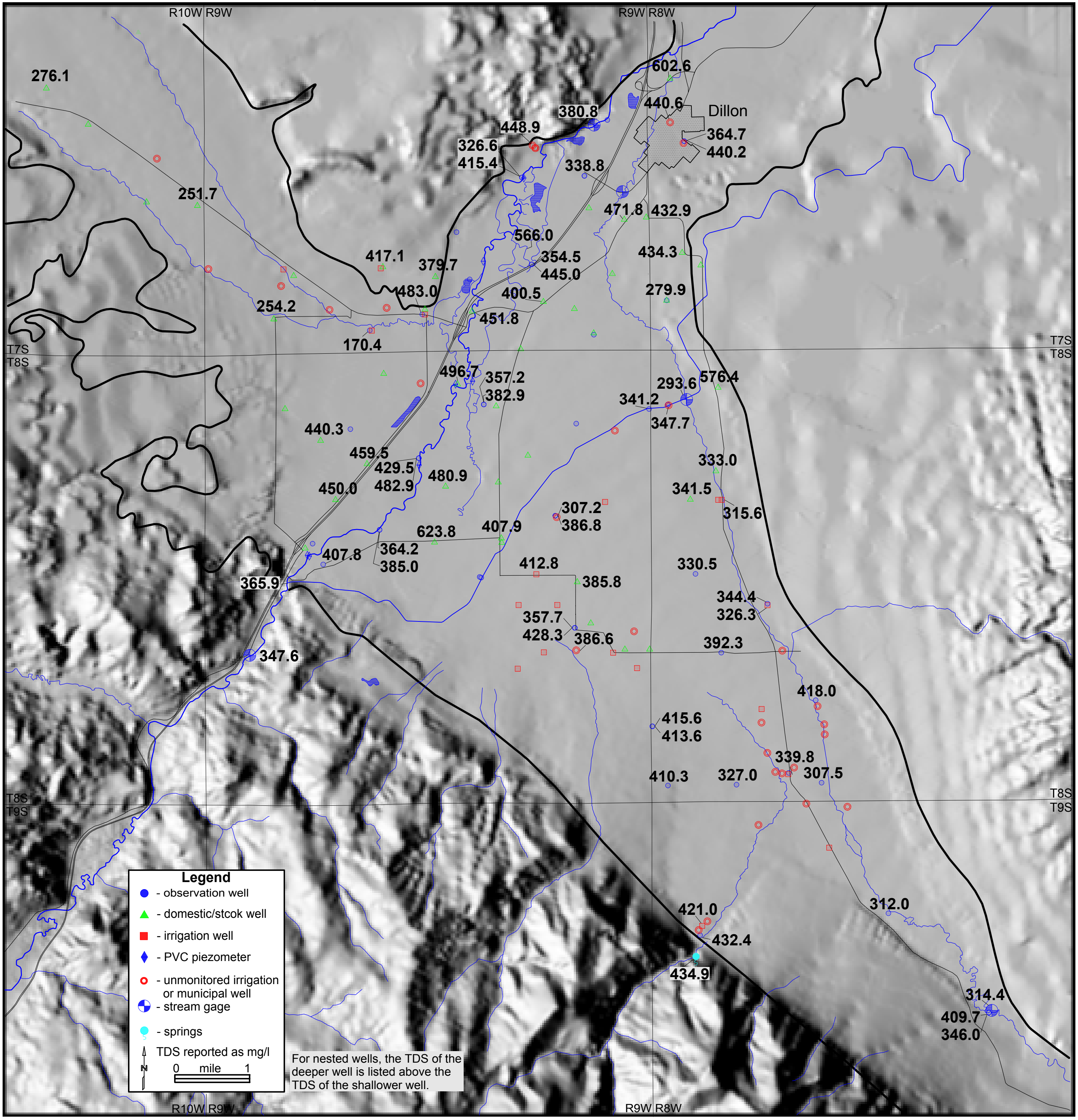
Constituent	Range of Concentration (mg/l)	EPA Standards (mg/l)
Sodium (Na)	4.1 - 58.4	2,000.0
Potassium (K)	1.3 - 13.2	no limit
Calcium (Ca)	32.4 - 136.0	no limit
Magnesium (Mg)	5.5 - 42.0	2,000.0
Iron (Fe)	<0.003 - 0.66	0.3
Chloride (Cl)	4.52 - 82.2	250.0
Bicarbonate (HCO_3)	153.6 - 440.0	no limit
Sulfate (SO_4)	8.80 - 239.2	250.0
Silica (SiO_2)	9.23 - 80.7	no limit
Nitrate (NO_3)	<0.05 - 8.95	10.0

Three geochemical patterns were recognized. First, water from the Blacktail Deer Creek valley was categorized as a calcium-bicarbonate water type. Water from the Beaverhead River floodplain was categorized as a calcium-sodium-bicarbonate water type. The concentrations of many samples from the floodplain were greater than those from the Blacktail Deer Creek valley, because the lowland floodplain served as a collection system for mineral concentrations. Water from shallow wells of the floodplain was generally young, because it was affected by surface water interactions and local recharge sources.

Second, groundwater of the Blacktail Range alluvial fans and the Flynn Lane area was a calcium-bicarbonate-sulfate water type. The strong sulfate concentration suggested the Madison limestone of the Blacktail Range as the source for groundwater recharge. A similar concentration pattern was observed in the lower Rattlesnake Creek valley, where some wells obtained their water from the Madison limestone.

Last, several deep wells drilled into the Tertiary sediments, along flowpaths from the Blacktail Range, were also classed as a calcium-bicarbonate-sulfate water type, but these wells had distinctly higher concentrations of sodium and potassium, reflecting longer travel time and contact with salts.

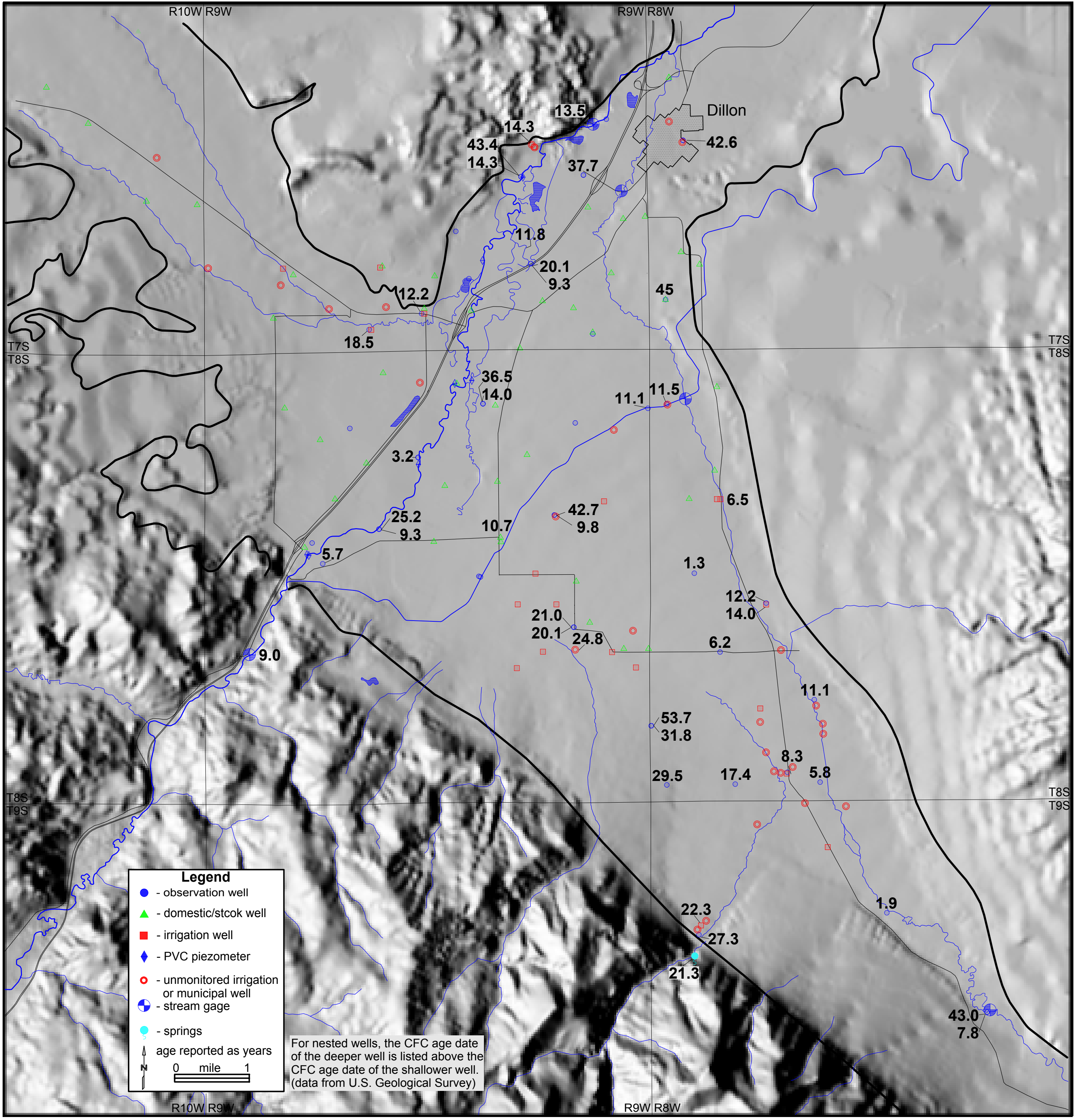
Figure 76. Distribution of Total Dissolved Solids



For nested wells, the TDS of the deeper well is listed above the TDS of the shallower well.

Chlorofluorocarbon Age-Dating Analyses. The USGS collected water samples for chlorofluorocarbon and tritium/helium isotope age dating analyses. The distribution of the CFC age dates is illustrated in Figure 77.

Figure 77. Distribution of Chlorofluorocarbon Age Dates



For nested wells, the CFC age date of the deeper well is listed above the CFC age date of the shallower well. (data from U.S. Geological Survey)

Results of the age-dating analyses indicated that most water along Blacktail Deer Creek was less than 15 years old. The age of groundwater from the Blacktail Range alluvial fan and the Flynn Lane area of the Blacktail Deer Creek valley was generally about 20 or more years. Wells in this area were recharged by water moving from the Madison limestone of the Blacktail Range. Deeper wells, and wells farther downslope from the source of recharge, showed increasing age as the travel time increased. However, the age of water in shallow wells from the Beaverhead River floodplain became younger, suggesting a connection with river water or a local recharge source, such as irrigation return flow. The age of water in the deeper wells of nested pairs was older, indicating a deeper flow system with less connection to river recharge.

Summary

Water quality is very good for consumptive and irrigation uses. Concentrations of most inorganic constituents fell below recommended levels of the U.S. Environmental Protection Agency National Primary and Secondary Drinking Water Standards. In many cases, however, total dissolved solids and hardness were above the recommended limits. Chemical properties of water from the Blacktail Deer Creek valley and the Beaverhead River floodplain indicated calcium-bicarbonate and calcium-sodium-bicarbonate water types, respectively. There was, however, a large sulfate component in water from the Blacktail Range alluvial fan and the Flynn Lane area of the Blacktail Deer Creek valley. Water from these areas was classified as a calcium-bicarbonate-sulfate water type. Deeper water had a higher concentration of sodium and potassium, indicating a longer time in contact with aquifer materials.

Chlorofluorocarbon and tritium/helium isotope age dating showed that water along Blacktail Deer Creek was less than 15 years old, and water from the Blacktail Range alluvial fan and Flynn Lane area of the Blacktail Deer Creek valley was 20 or more years old. The age of water in shallow wells of the Beaverhead River floodplain ranged from less than 10 years to about 40 years in the deeper wells. The older water from the deeper wells suggested less influence from younger surface water.

GROUNDWATER MODELING

Methods

Introduction. Groundwater flow modeling simulates and quantifies natural groundwater flow and its interactions with surface water by incorporating data measured in the field, such as land elevation, aquifer geometry, hydraulic properties of the aquifer, groundwater levels, streamflow, precipitation, return-flow recharge, and irrigation well discharge. Groundwater flow modeling assesses impacts, that are either impossible to measure or not easily measured in the field, such as the effects of current or future groundwater development on groundwater availability and interactions with surface water.

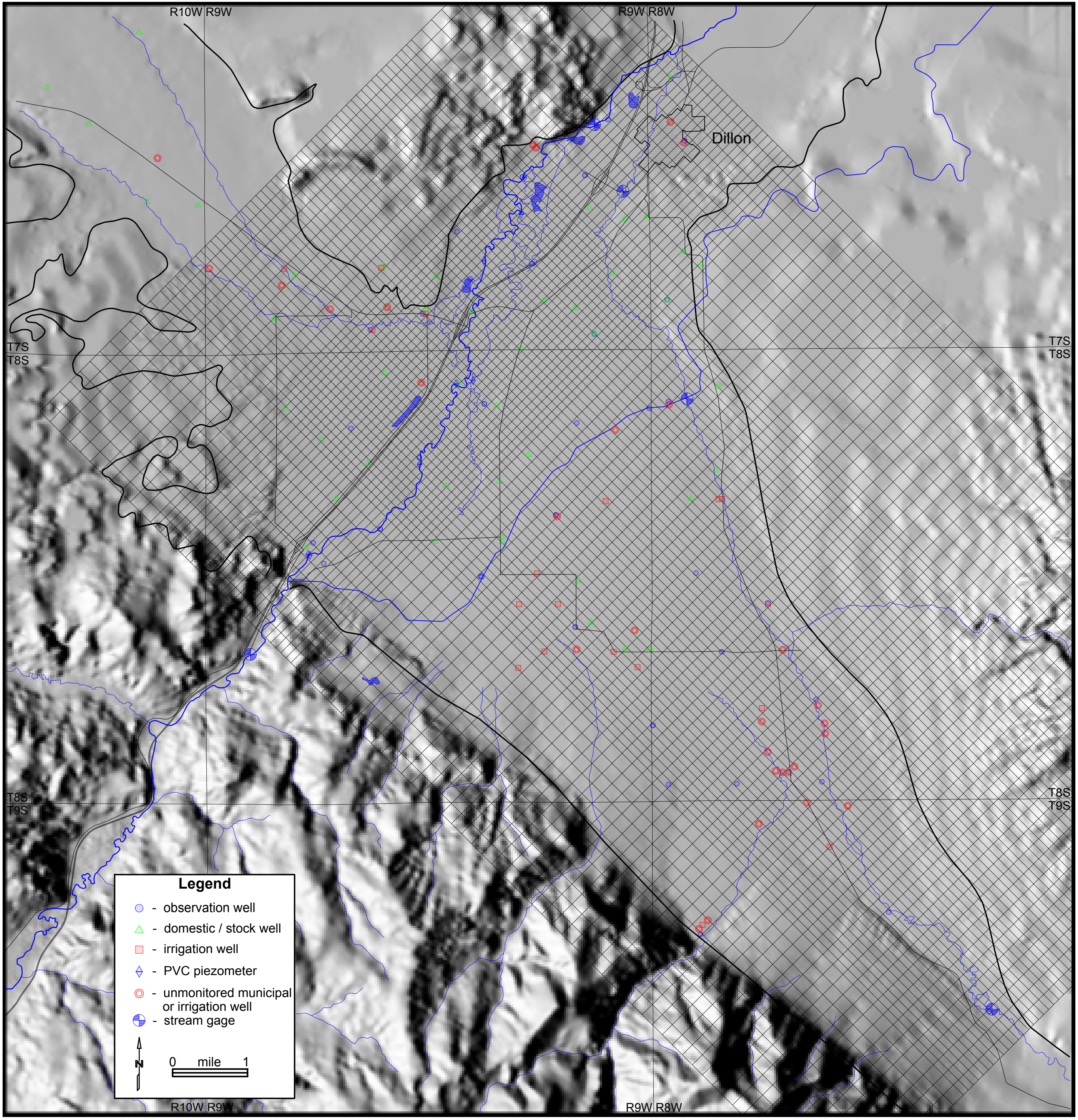
Visual MODFLOW, recognized as reliable three-dimensional groundwater flow modeling software, was used to develop and calibrate the groundwater flow model. The upper Rattlesnake Creek valley northwest of Section 30, T7S, R9W was excluded from the model because detailed hydrogeologic data were lacking. An initial model was developed from the field information collected for the period from April 1, 1993 to September 30, 1996, which included the wet years of 1993 and 1995 and the dry years of 1994 and 1996. April 1, 1993 was selected as the starting date for the model because impacts of the previous irrigation season on groundwater levels had abated and sufficient groundwater-level calibration data were available. September 30, 1996 was selected to terminate the model because the collection of field data ended at that time. Four predictive groundwater flow models were derived from the initial model to evaluate the impacts on baseflow from hypothetical pumping and irrigation scenarios and a three-year period of drought.

Project Boundary, Base Maps, and Surface Topography. Project boundaries were assigned to the lithologic contacts of the Dillon 1Ex 2E geologic map (Ruppel et al. 1993) generally separating the valley deposits from Tertiary-age materials and pre-Cenozoic bedrock along the valley margins. Geographic and hydrologic features, such as roads, streams, large-discharge wells, and geologic boundaries, were digitized as a base map to provide site references during model construction. Topographic map coverage within the project area was digitized at 20-foot contour intervals. A topographic map of a portion of the upper Beaverhead basin is presented in Appendix F1.

Model Layer and Grid Construction. Groundwater flow model construction required that aquifer materials be assigned to layers. This model consisted of two layers. Layer 1 simulated the Quaternary-upper Tertiary aquifer comprised of fluvial and alluvial fan gravel and sand. Layer 2 simulated the underlying, fine-grained, lower Tertiary aquifer.

The two layers were then subdivided into a three-dimensional gridwork of blocks by superimposing the base map of the project area onto a rectangular grid (Figure 78). The base map was then rotated 45E for proper alignment with the rectangular grid. The rectangular grid divided the two model layers into a series of grid cells of 75 columns and 95 rows. Cell sizes ranged from a maximum of 1,000 feet x 1,000 feet around the model's margins to a minimum of 500 feet x 500 feet along the Beaverhead River floodplain and in the lower Blacktail Deer and Rattlesnake creek valleys.

Figure 78. Groundwater Model Grid



Model cells within the project boundary were designated as active cells, in which parameters such as topographic elevation, layer thickness, hydraulic conductivity, and aquifer storage coefficient were assigned. Observed groundwater levels were used to calibrate the model. The effects of external stresses were simulated in the flow model by designating either an active cells or group of active cells as various types of boundaries. Cells beyond the project boundary were designated as inactive or no-flow cells.

Topographic Elevations, Layer Thicknesses, and Aquifer Types. Digitized topographic elevations were imported and an average surface elevation for each grid cell of layer 1 was interpolated, using an inverse distance squared algorithm. The modeled topographic surface closely approximated the actual topographic surface.

Layer thicknesses were assigned, based on lithology reports and estimates from a conceptual model of the geology. Layer 1, which simulated the Quaternary/upper Tertiary aquifer, ranged in thickness from 25 feet at upper Blacktail Deer Creek to about 170 feet at Flynn Lane. This aquifer is thickest in the Flynn Lane well field area. Based on lithologic interpretations, the aquifer was assigned thicknesses of 400 to 700 feet in this area. Toward the east and northeast side of the Blacktail Deer Creek valley, the aquifer thins to about 150 feet. Near Barretts, a 500-foot aquifer thickness was assigned, which thinned to about 250 feet near Highway 278 and to 25 feet in the Dillon area. In the lower Rattlesnake Creek valley, the aquifer was assigned a thickness of 425 feet near its center, and about 175 feet near the valley margins. The elevations of the base of layer 1 corresponded to the elevations of the top of layer 2. The base of layer 2 was globally assigned an elevation of 4,200 feet. It was assumed that there was low potential for surface water-groundwater interactions or impacts from pumping wells near the base of layer 2. The thickness of layer 2 was not required to be as thick as its actual geologic thickness. Layer 1 was modeled as an unconfined aquifer, and layer 2 was modeled as a confined aquifer.

Hydraulic Conductivity. Hydraulic conductivities were assigned to the model's cells based on results of aquifer testing and comparisons of borehole sediments with those described by Morris and Johnson (1967). Hydraulic conductivity distribution maps for layers 1 and 2 are presented in Figures 79 and 80, respectively.

The thickness and textural characteristics of the Quaternary/upper Tertiary aquifer vary considerably. Individual cells of layer 1, representing large areas, included wide variations in hydraulic conductivity; however, only one value per cell was permitted in the model. Hydraulic conductivity values assigned to cells were carefully chosen to reasonably represent the variations of actual hydraulic conductivity. Vertical hydraulic conductivities assigned were 10 times less than horizontal hydraulic conductivities.

Blacktail Deer Creek deposited poorly sorted, interlayered gravel and sand as it slowly migrated back and forth across its valley. On the northeast side of the valley, borehole cuttings and lithologic reports indicate that the sediments are mixtures of gravel and sand with a large quantity of silt and clay. Hydraulic conductivity values assigned to cells in this area ranged from 10 to 50 feet/day. Farther southwest, toward the center of the valley, the

Figure 79. Hydraulic Conductivity Distribution of Model Layer 1

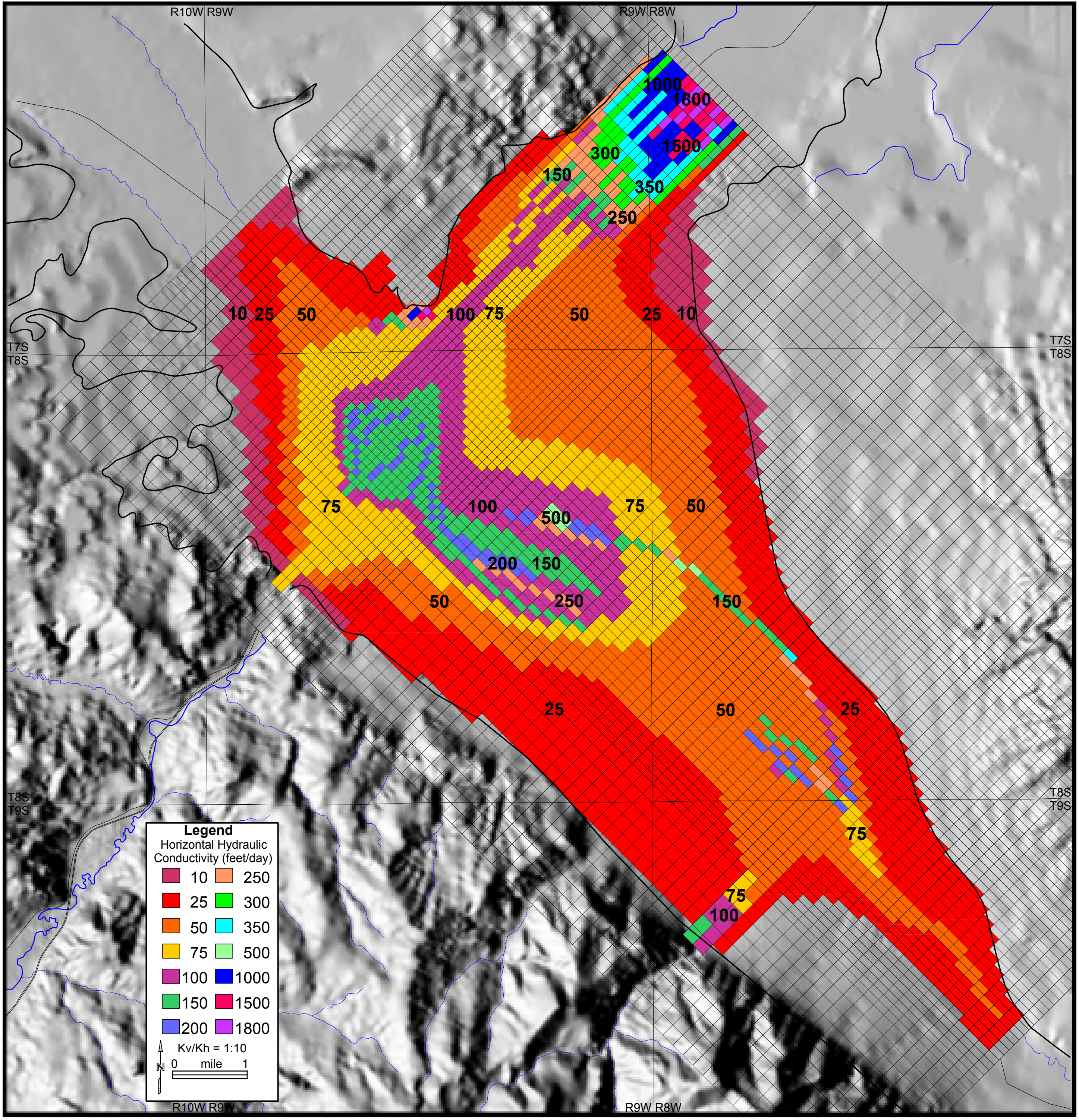
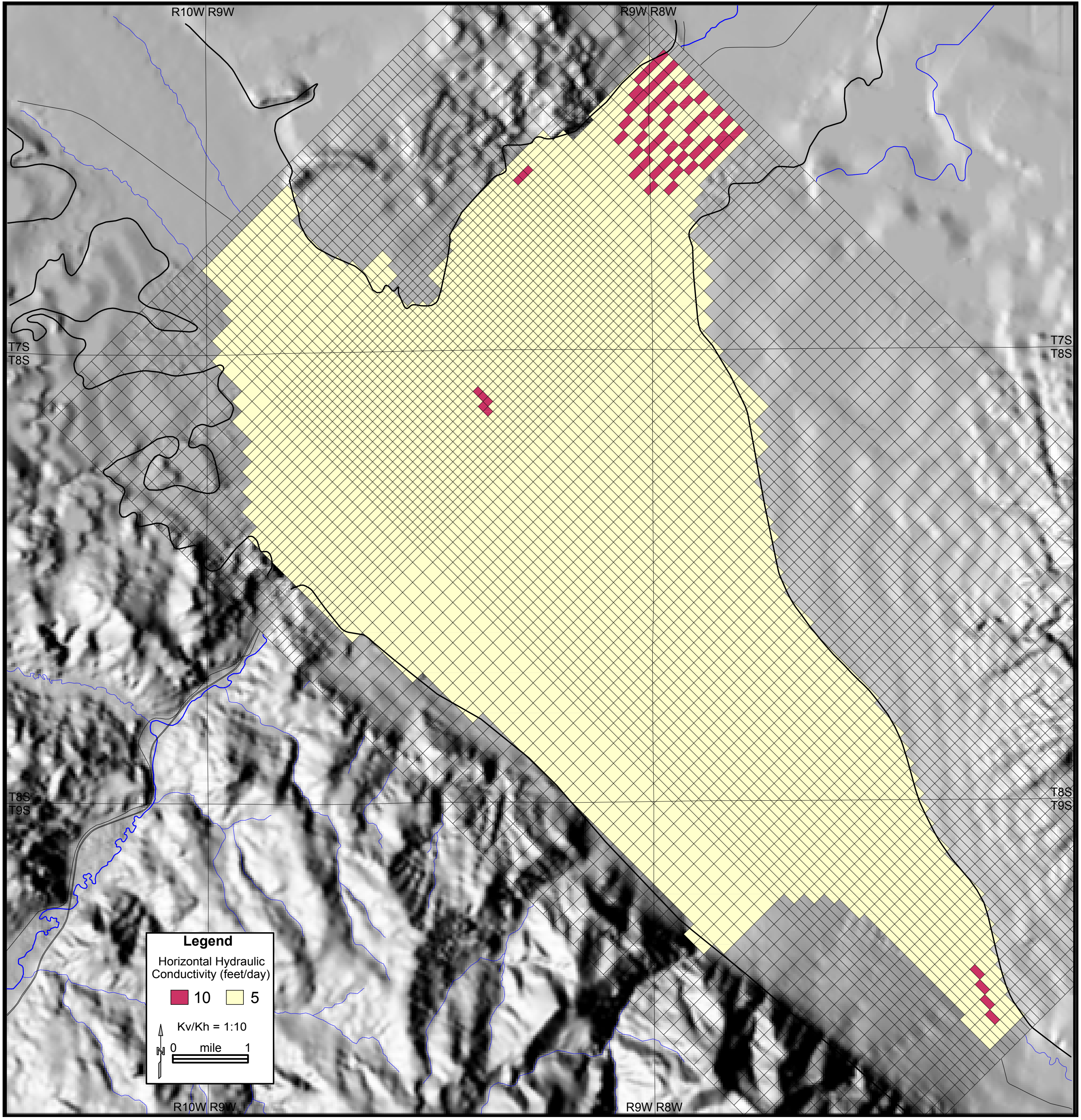


Figure 80. Hydraulic Conductivity Distribution of Model Layer 2



sediments are less silty and contain more gravel. Higher hydraulic conductivities, ranging from 75 to 500 feet/day, were assigned in this area. Discontinuous, coarse, buried paleochannel deposits are believed to exist in the center of the Blacktail Deer Creek valley. These were simulated by bands of cells with higher hydraulic conductivity. Fluvial deposits interfinger with alluvial fan sediments, creating lateral and vertical variation in hydraulic conductivity. Blacktail Range alluvial fan deposits consist of debris flow and localized channel deposits, in which textural variability is large and sorting is poor. Some sediments are cemented as discontinuous layers. The cementation and decrease of hydraulic conductivity with depth were considered in the assignment of hydraulic conductivity values to model cells.

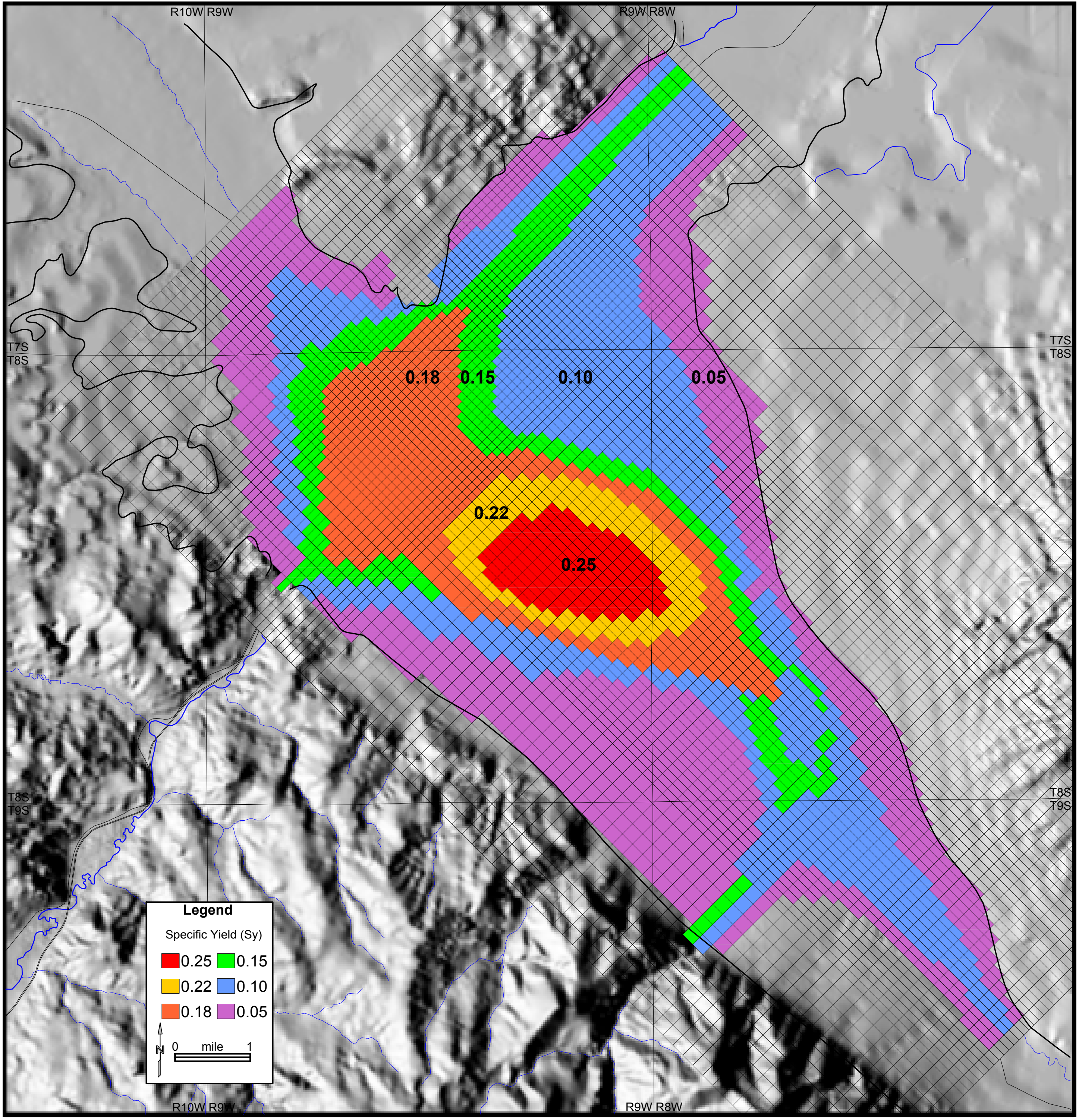
Channel deposits of the Beaverhead River floodplain between Barretts and Dillon also have large variations in sorting and texture. Some layers consist of coarse gravel and sand, while others consist of fine-grained materials. Assigned hydraulic conductivities ranged from 75 to 200 feet/day. High hydraulic conductivities, ranging from 250 to 1,800 feet/day, were assigned to buried paleochannel deposits in the Dillon vicinity. Beaverhead River sediments interfinger with fluvial deposits of lower Rattlesnake Creek and glacial outwash deposits farther west in Sections 32 and 33, T7S, R9W. Assigned hydraulic conductivities ranged from 10 to 1,000 feet/day.

Layer 2 simulates the various lithologies described as fine-grained silt, clay, siltstone, and fine sandstone. These materials comprise the lower Tertiary aquifer underlying the coarse Quaternary/upper Tertiary aquifer. A hydraulic conductivity of 0.5 feet/day was assigned to layer 2 because these materials are fine-grained and do not readily transmit water, and because they may be more cemented and lithified than materials of layer 1. A hydraulic conductivity of 10 feet/day was assigned to buried, discontinuous paleochannel deposits, believed to also occur in layer 2.

Aquifer Storage. Credible, representative aquifer storage coefficients are difficult to obtain from aquifer tests and may be subject to error. The storage parameter relevant to an unconfined aquifer is specific yield. Credible specific yields were obtained from only three of the six unconfined aquifer tests. Furthermore, estimates of hydraulic properties were provided only for the areas influenced by the aquifer tests. Beyond the zones of influence, aquifer storage values were either estimated or approximated, based on lithology. Measured specific yields, and specific yields described by Morris and Johnson (1967) for unconsolidated gravel and sand, were assigned to the unconfined aquifer of layer 1. Assigned specific yields ranged from 0.05 to 0.25. A specific yield distribution map is presented in Figure 81.

Storativity, a confined aquifer storage parameter, typically ranges from 0.005 to 0.00005. Most storativity values obtained from aquifer testing fell within this range. Storativity was approximated in the model as the product of specific storage and aquifer thickness. Specific storage, defined as the volume of water that a unit volume of aquifer releases from storage per unit decline in head, was assigned as 0.000001 to all cells of layer 2.

Figure 81. Specific Yield Distribution of Model Layer 1



Time Discretization. The period from April 1, 1993 to September 30, 1996 was divided into 57 time blocks of variable lengths, or stress periods, as presented in Table 14. The stress periods ranged in length from eight to 31 days. The use of stress periods permitted periodic changes of external stresses during the model simulation. Stress periods combined schedules of changes of river stages, pumping withdrawals, evapotranspiration, and recharge from precipitation, irrigation return flow, and general heads. River stages, precipitation, Dillon municipal wells 1 and 2, and general heads operated continuously during the model simulation. Other stresses operated intermittently, as shown in Table 14.

Table 14. Stress Periods of Groundwater Model

Stress Period	Date Range	Elapsed Days	Days/Period	Intermittent Stresses
1	Apr 01 - Apr 30, 1993	0 - 30	30	
2	May 01 - May 20, 1993	30 - 50	20	
3	May 21 - May 31, 1993	50 - 61	11	ON: irrigation wells, sprinkler irrigation, evt
4	Jun 01 - Jun 10, 1993	61 - 71	10	ON: Dillon municipal wells 3 & 4; evt; irrigation wells; sprinkler, mixed and flood irrigation
5	Jun 11 - Jun 30, 1993	71 - 91	20	ON: Dillon municipal wells 3 & 4, evt
6	Jul 01 - Jul 18, 1993	91 - 109	18	ON: Dillon municipal wells 3 & 4; evt; irrigation wells; sprinkler, mixed and flood irrigation
7	Jul 19 - Jul 31, 1993	109 - 122	13	ON: Dillon municipal wells 3 & 4, evt
8	Aug 01 - Aug 15, 1993	122 - 137	15	ON: Dillon municipal wells 3 & 4, evt
9	Aug 16 - Aug 31, 1993	137 - 153	16	ON: Dillon municipal wells 3 & 4; evt; irrigation wells; sprinkler, mixed and flood irrigation
10	Sep 01 - Sep 30, 1993	153 - 183	30	
11	Oct 01 - Oct 31, 1993	183 - 214	31	
12	Nov 01 - Nov 30, 1993	214 - 244	30	
13	Dec 01 - Dec 31, 1993	244 - 275	31	
14	Jan 01 - Jan 31, 1994	275 - 306	31	
15	Feb 01 - Feb 28,1994	306 - 334	28	
16	Mar 01 - Mar 31, 1994	334 - 365	31	
17	Apr 01 - Apr 30, 1994	365 - 395	30	
18	May 01 - May 15, 1994	395 - 410	15	
19	May 16 - May 31, 1994	410 - 426	16	ON: irrigation wells, sprinkler irrigation, evt
20	Jun 01 - Jun 15, 1994	426 - 441	15	ON: Dillon municipal wells 3 & 4; evt; irrigation wells; sprinkler, mixed and flood irrigation
21	Jun 16 - Jun 30, 1994	441 - 456	15	ON: Dillon municipal wells 3 & 4, evt
22	Jul 01 - Jul 20, 1994	456 - 476	20	ON: Dillon municipal wells 3 & 4; evt; irrigation wells; sprinkler, mixed and flood irrigation
23	Jul 21 - Jul 31, 1994	476 - 487	11	ON: Dillon municipal wells 3 & 4, evt
24	Aug 01 - Aug 15, 1994	487 - 502	15	ON: Dillon municipal wells 3 & 4, evt
25	Aug 16 - Aug 31, 1994	502 - 518	16	ON: Dillon municipal wells 3 & 4; evt; irrigation wells; sprinkler, mixed and flood irrigation
26	Sep 01 - Sep 30, 1994	518 - 548	30	
27	Oct 01 - Oct 31, 1994	548 - 579	31	
28	Nov 01 - Nov 30, 1994	579 - 609	30	
29	Dec 01 - Dec 31, 1994	609 - 640	31	
30	Jan 01 - Jan 31, 1995	640 - 671	31	
31	Feb 01 - Feb 28, 1995	671 - 699	28	
32	Mar 01 - Mar 31, 1995	699 - 730	31	
33	Apr 01 - Apr 30, 1995	730 - 760	30	
34	May 01 - May 31, 1995	760 - 791	31	
35	Jun 01 - Jun 08, 1995	791 - 799	8	ON: irrigation wells, sprinkler irrigation, evt
36	Jun 09 - Jun 30, 1995	799 - 821	22	ON: evt
37	Jul 01 - Jul 15, 1995	821 - 836	15	ON: Dillon municipal wells 3 & 4; evt; irrigation wells; sprinkler, mixed and flood irrigation
38	Jul 16 - Jul 31, 1995	836 - 852	16	ON: Dillon municipal wells 3 & 4, evt
39	Aug 01 - Aug 20, 1995	852 - 872	20	ON: Dillon municipal wells 3 & 4, evt
40	Aug 21 - Aug 31, 1995	872 - 883	11	ON: Dillon municipal wells 3 & 4; evt; irrigation wells; sprinkler, mixed and flood irrigation

Table 14 (continued)

Stress Period	Date Range	Elapsed Days	Days/Period	Intermittent Stresses
41	Sep 01 - Sep 30, 1995	883 - 913	30	
42	Oct 01 - Oct 31, 1995	913 - 944	31	
43	Nov 01 - Nov 30, 1995	944 - 974	30	
44	Dec 01 - Dec 31, 1995	974 - 1005	31	
45	Jan 01 - Jan 31, 1996	1005 - 1036	31	
46	Feb 01 - Feb 29,1996	1036 - 1065	29	
47	Mar 01 - Mar 31, 1996	1065 - 1096	31	
48	Apr 01 - Apr 30, 1996	1096 - 1126	30	
49	May 01 - May 15, 1996	1126 - 1141	15	
50	May 16 - May 31, 1996	1141 - 1157	16	ON: irrigation wells, sprinkler irrigation, evt
51	Jun 01 - Jun 15, 1996	1157 - 1172	15	ON: Dillon municipal wells 3 & 4; evt; irrigation wells; sprinkler, mixed and flood irrigation
52	Jun 16 - Jun 30, 1996	1172 - 1187	15	ON: Dillon municipal wells 3 & 4, evt
53	Jul 01 - Jul 20, 1996	1187 - 1207	20	ON: Dillon municipal wells 3 & 4; evt; irrigation wells; sprinkler, mixed and flood irrigation
54	Jul 21 - Jul 31, 1996	1207 - 1218	11	ON: Dillon municipal wells 3 & 4; evt; mixed and flood irrigation
55	Aug 01 - Aug 15, 1996	1218 - 1233	15	ON: Dillon municipal wells 3 & 4, evt
56	Aug 16 - Aug 31, 1996	1233 - 1249	16	ON: Dillon municipal wells 3 & 4; evt; irrigation wells; sprinkler, mixed and flood irrigation
57	Sep 01 - Sep 30, 1996	1249 - 1279	30	
		Total Days:	1,279	

Observed Groundwater Levels. Observed groundwater levels for 44 of the monitoring wells and 18 of the domestic and stock wells were selected as calibration targets. Observed April groundwater-level measurements were extrapolated to April 30 dates, which corresponded to the end of stress periods and represented the lowest seasonal groundwater levels observed during 1993 through 1996. Observed July 1994 and 1996 and August 1993 and 1995 groundwater-level measurements were extrapolated to July 31 and August 31, respectively, which also corresponded to the end of stress periods and represented the highest seasonal groundwater levels observed during 1993 through 1996.

Recharge and Discharge Boundaries. Sources of water recharging the aquifer included groundwater flow from bedrock of the mountains and alluvial fan sediments, streambed leakage losses, precipitation, and irrigation return flow. Aquifer discharge included groundwater flux from the basin near Dillon, baseflow to streams, evapotranspiration, and pumpage from irrigation and municipal wells. Water recharging or discharging from the model was simulated by designating either an individual cell or group of cells as a general-head, river, recharge, or evapotranspiration boundary, or a pumping cell.

General-Head Boundary. Groundwater recharges the aquifer as infiltration from fractured bedrock, especially the Madison Group limestone of the Blacktail Range, the alluvial fans along the valley margins, and alluvial sediments where streams enter the basin. The recharge from these sources collectively contributes significant quantities of water to the aquifer. Groundwater discharges from the basin north of Dillon.

General-head boundary cells simulate geologic sources of groundwater recharging to and discharging from the modeled aquifer. Groundwater recharge to the aquifer from fractured bedrock and alluvial fans was simulated as general-head boundaries around the basin margin for most of layer 1. General-head boundary cells for layer 1 are presented in

Figure 82. General-head cells for layer 2 were assigned along the margin of the Blacktail Range, where low cell conductances resulted in minimal seepage of recharge to the aquifer. Groundwater discharge was simulated as general-head cells extending across the basin north of Dillon. The hydraulic heads specified in these cells varied through modeled stress periods, based on seasonal groundwater levels observed at or extrapolated to general-head cells. The quantity of recharge or discharge per cell was controlled by the difference between hydraulic head stipulated for the general-head cell and modeled head in the adjacent cell, and by the cell's conductance, which is comprised of assigned hydraulic conductivity and dimensions of the cell.

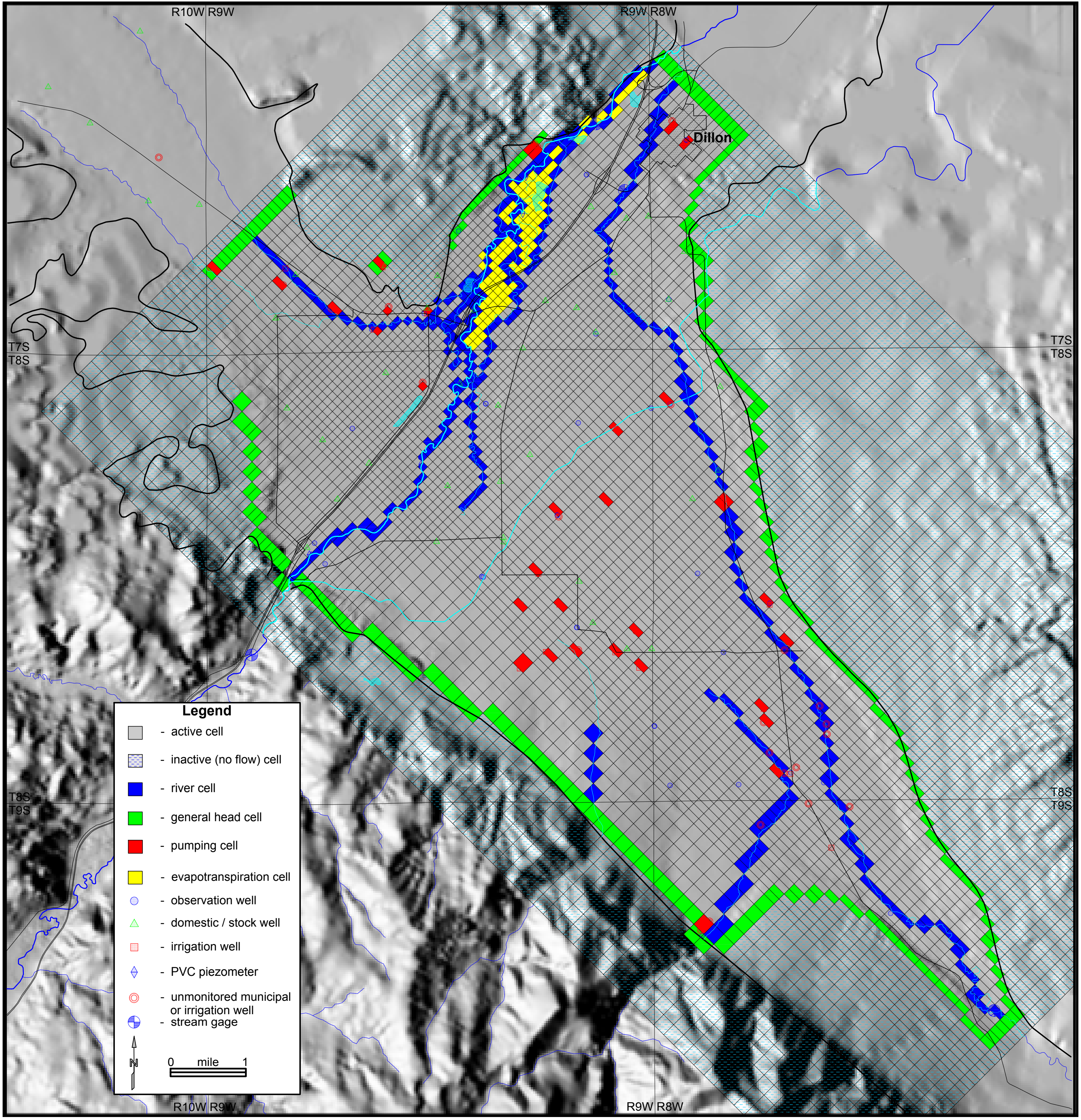
River Boundary. River boundary cells simulate rivers and streams in the modeled aquifer-stream system (Figure 82). Mean monthly stages of the Beaverhead River, Blacktail Deer, Rattlesnake, Sheep, and Small Horn creeks, and Poindexter and Van Camp sloughs were assigned to river cells. Groundwater-surface water interactions are determined by the conductance of each river cell. Average stream width and length per cell and streambed hydraulic conductivity were considered in the assignment of the cell's conductance value. Attempts were made to measure vertical streambed hydraulic conductivity, but the results were inconclusive. Vertical streambed hydraulic conductivities of 0.5 to 2 feet/day were assumed for modeling. Streamflow of the Beaverhead River and Blacktail Deer Creek were measured, and stages were determined from gaging station stage/flow rating tables. These are listed in Appendices D1 and D2, respectively.

Streamflow and stage in Rattlesnake Creek were estimated because the gaging station was destroyed and the data were lost. Because summer streamflow in Rattlesnake Creek was small, errors in stage estimation were assumed to be negligible for modeling purposes. Streamflow in Sheep and Small Horn creeks, and Poindexter, Van Camp, and other sloughs was estimated because gaging stations were not established.

Mean monthly streamflow diversions from the Beaverhead River to the EBID Canal and the Canyon Ditch were quantified. For modeling, Beaverhead River streamflow at the Barretts gaging station was reduced by the mean monthly diversion. Some diversion water returned to the aquifer as irrigation return flow and was accounted for in the model. The remainder was conveyed from the project area in the canals. Measurements of streamflow in the EBID Canal showed no significant losses. It was assumed that any leakage from the Canyon Ditch was negligible, compared with total groundwater flux from the Blacktail Deer Creek valley. In the model, streambed infiltration losses to the aquifer occurred when modeled groundwater levels were lower than stream stage. Streamflow gains occurred when modeled groundwater levels were higher than stream stage. The exchange of water per cell is controlled by the cell's conductance and head difference between stream stage and groundwater level. Changes made to conductance during model calibration resulted in only small changes in surface water-groundwater exchange.

Precipitation Recharge Boundary. The amount of precipitation that infiltrated to the modeled aquifer as areal recharge was assumed to be 10% of the actual measured monthly precipitation, as observed at Western Montana College in Dillon (Table 3). It was also assumed that the observed monthly precipitation was uniform over all active cells.

Figure 82. Groundwater Model Cell Types



Irrigation Return-Flow Recharge Boundary. Irrigation return flow provided a significant component of recharge to the aquifer during the summer. Three types of irrigation (Figure 83) were designated in the model. Flood irrigation water was supplied from ditch and canal diversions from the Beaverhead River, and Blacktail Deer, Sheep, and Rattlesnake creeks. Groundwater withdrawals from irrigation wells comprised another important source of irrigation water, which was distributed by center-pivot, wheel-line, and hand-line sprinkler irrigation systems. The third type of irrigation, designated as mixed irrigation, was a combination of flood and sprinkler irrigation. Total acreage for each irrigation type included 3,727 acres of flood irrigation, 13,347 acres of sprinkler irrigation, and 7,280 acres of mixed irrigation. A total of 24,354 acres of irrigation was simulated in the model.

Each irrigation zone was assigned an average infiltration rate, which permitted only a fraction of the total irrigation water applied to each zone to infiltrate to the aquifer as irrigation return flow. It is difficult to simulate variable application periods and rates, and the large variation in ditch leakage, soil type, infiltration rate, and evapotranspiration. In the model, these factors were assumed constant for each irrigation zone. Infiltration rates for the three irrigation zones were 10% for sprinkler irrigation, 25% for mixed irrigation, and 50% for flood irrigation. Irrigation schedules are presented in Table 14. Irrigation infiltration rates, total water applied, and total days of irrigation are presented in Table 15.

Table 15. Irrigation Zones of Groundwater Model

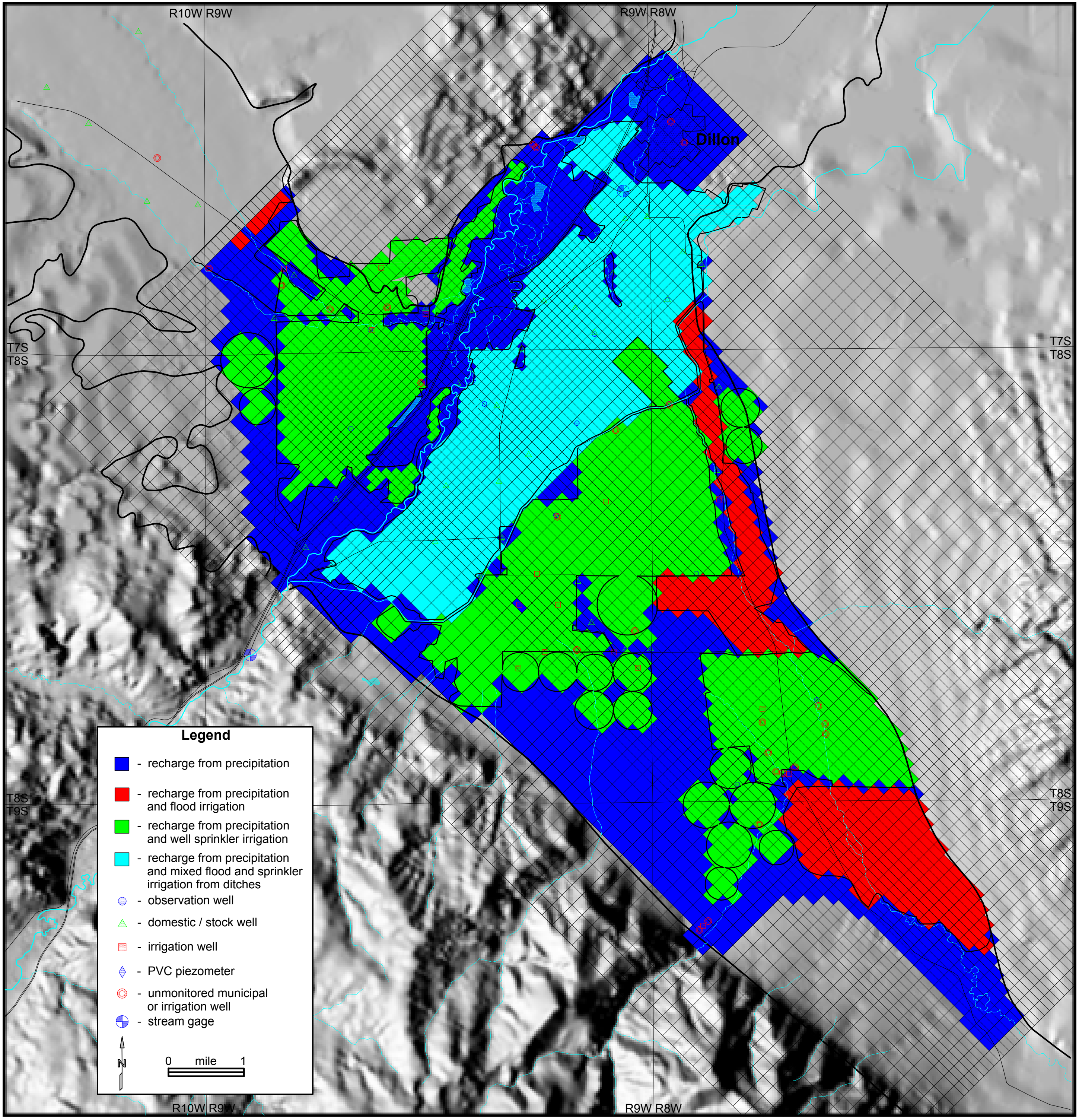
Recharge Zone	Infiltration (%)	Total Water Applied (inch)				Total Days Annual Irrigation			
		1993	1994	1995	1996	1993	1994	1995	1996
Sprinkler irrigation	10	18	24	4	10	55	67	34	67
Mixed irrigation	25	36	48	17	25	44	51	26	62
Flood irrigation	50	60	84	50	84	44	51	26	62

The modeling software allowed only one recharge boundary per cell. Precipitation recharge, the first recharge boundary assigned, was overwritten in cells in which irrigation return-flow recharge boundaries were assigned. To remedy this problem, precipitation recharge was added to the irrigation return-flow recharge.

Evapotranspiration Boundary. Surface water losses from evapotranspiration were not considered in the model. Groundwater evapotranspiration losses from phreatophyte vegetation along the Beaverhead River floodplain were simulated by assigning cells to an evapotranspiration boundary (Figure 82). Evapotranspiration losses decreased linearly to an extinction depth of seven feet, below which losses did not occur. Evapotranspiration losses from the modeled aquifer occurred only during the summer, as listed in Table 14.

Irrigation and Municipal Wells. Pumping wells withdraw groundwater from aquifer storage. Domestic and stock wells were not simulated because their discharges were small and pumping intervals were short. Large-discharge irrigation wells and the City of Dillon municipal wells were simulated in the model by pumping cells (Figure 82). Although as many as 50 large-discharge wells may exist in the project area, not all of these wells were in operation during the modeled period of time. Only those wells observed to be in operation from 1993 through 1996 were simulated in the model.

Figure 83. Groundwater Model Irrigation Zones



Irrigation wells were pumped on variable schedules, as required by the water needs of alfalfa, an important crop in the area. It was impractical to simulate actual pumping periods for each well during an irrigation season. Therefore, a pumping schedule common to all irrigation wells was developed. The pumping schedule, presented in Table 14, was based on the amount of summer precipitation, estimated periods of irrigation withdrawals, and estimated periods for two cuttings of hay, during which irrigation wells were turned off.

The City of Dillon municipal wells #1 and #2 pump almost continuously and were modeled as operating continuously during the model simulation. The City of Dillon municipal wells #3 and #4 were pumped mostly during the summer for supplemental needs. Periods of operation of municipal wells #3 and #4 were approximated, based on summer precipitation. Pumping well discharge rates used in the model were either measured pumping rates or obtained from water rights records. Discharge rates are presented in Table 16.

Table 16. Pumping Wells and Discharge Rates of Groundwater Model

Well	Discharge (gpm)	Well	Discharge (gpm)
Anderson	1,250	Laden @ Blacktail Crk	1,100
Blake #1	1,800	Laden @ Rattlesnake Crk	1,120
Blake #2	1,800	Matador #4	1,950
Campbell-Gaasch-Meine	2,250	Matador #13	1,860
Dillon #1	500	Matador #14	1,800
Dillon #2	500	Matador #15	1,675
Dillon #3	1,000	Matador #16	980
Dillon #4	700	Matador #17	1,675
Forrester	950	Peterson	500
High Mountain #1	2,300	Rolandson	1,335
High Mountain #2	2,000	Stewart	375
High Mountain #3	1,000	Zenchiku #1	825
High Mountain #4	1,000	Zenchiku #2	1,000
Holland	500	Zenchiku #3	2,500
Johnson #1-7S 9W 33 AD	1,600	Zenchiku #4	1,800
Johnson #2-7S 9W 33 AC	1,200	Zenchiku #5	1,500
Johnson #3-7S 9W 32 AC	600	Zenchiku #6	2,000
Johnson #4-7S 9W 32 BB	500		

Results and Interpretations

Introduction. The Strongly Implicit Procedure (SIP) solver option, with an acceleration factor set to 1, was selected for iteratively solving the system of simultaneous linear groundwater flow equations. At each active grid cell, an equation defining groundwater flow between each of the six adjacent grid cells was solved iteratively by comparing the maximum head change between one iteration and the next with a specified closure criterion. The model converged when maximum head change for any grid cell was less than the selected closure criterion of 0.01 foot. The model was calibrated so that the statistical errors were minimized, and the modeled water budget and groundwater levels reasonably matched the observed data.

Steady State Modeling. A steady state model was developed to test and calibrate initial boundary parameters and produce an initial head array for transient simulations. The steady state initial head array consisted of observed heads extrapolated to April 1, 1993.

Transient Modeling. The calibrated transient groundwater flow model, CURRENT WELLS, represents the current level of groundwater development in the project area. CURRENT WELLS was developed from measurements of precipitation, groundwater levels, aquifer properties, stream discharge, and knowledge of operating irrigation wells, pumping schedules and rates, irrigated acreage, irrigation schedules, application rates, and type of irrigation. The model was calibrated through systematic adjustment of aquifer parameters, external stresses, and boundary conditions. The objectives of the calibration process were to match simulated groundwater levels and baseflow with the calibration targets of observed groundwater levels and measured baseflow, and to minimize errors in statistical comparisons. The calibration process required hundreds of model runs.

Statistical Evaluation. Calibration statistical errors evaluate the average error between modeled and observed heads. Comparisons of modeled heads with observed heads showed that the mean absolute errors (MAE) ranged from 7.79 to 9.91 feet, and that the root mean squared errors (RMS) ranged from 9.94 to 13.00 feet. The mean absolute error is the sum of the absolute values of differences between calculated (cal_i) and observed (obs_i) heads for all wells, divided by the total number of observation wells. The mean absolute error is expressed as $MAE = 1/n\ '\ _{i=1,n} |cal_i - obs_i|$. The use of mean absolute error statistical evaluation eliminates the cancellation of large positive and negative heads. The root mean squared error is the square root of the sum of differences squared between calculated (cal_i) and observed (obs_i) heads for all wells, divided by the total number of observation wells. The root mean squared error is expressed as $RMS = \{1/n\ '\ _{i=1,n}(cal_i - obs_i)^2\}^{½}$. Mean absolute and root mean squared errors are summarized in Table 17 for the eight calibration dates representing the highest and lowest groundwater levels observed for each of the years 1993 through 1996.

Table 17. Calibration Statistical Errors of the CURRENT WELLS Model

Calibration Date	Mean Absolute Error (ft)	Root Mean Squared Error (ft)
April 30, 1993	9.54	12.12
August 31, 1993	8.16	10.44
April 30, 1994	9.91	12.69
July 31, 1994	7.79	10.34
April 30, 1995	9.84	13.00
August 31, 1995	8.81	11.93
April 30, 1996	8.78	11.44
July 31, 1996	7.80	9.94

Comparisons of modeled heads with observed heads (Figures 84 through 91) provided an indication of how accurately the model simulated observed groundwater levels. Exact fits of calculated and observed heads lie on the graphs' 45E lines. Overcalculated heads lie above the 45E lines, and undercalculated heads lie below the 45E lines.

Figure 84. Calculated vs. Observed Heads for Apr. 30, 1993

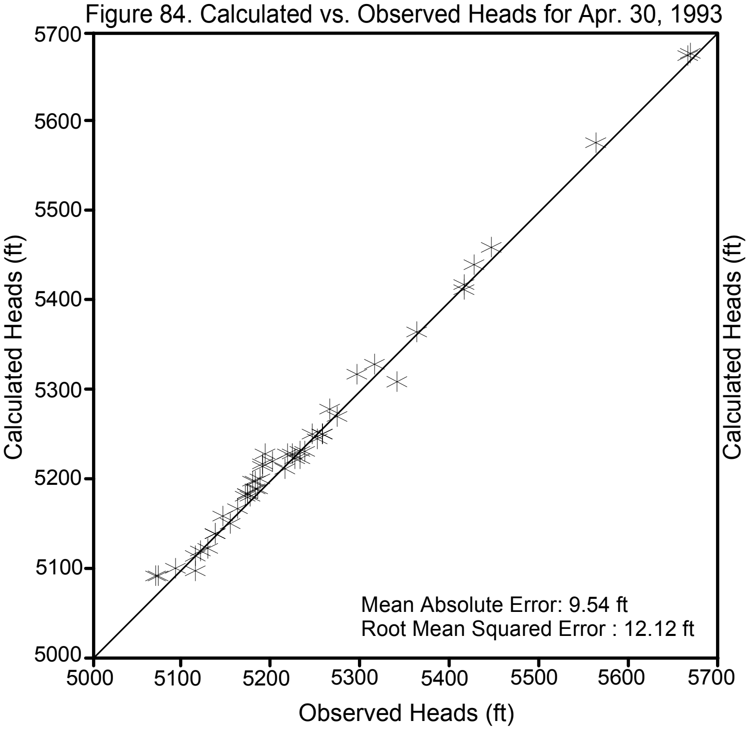


Figure 85. Calculated vs. Observed Heads for Aug. 31, 1993

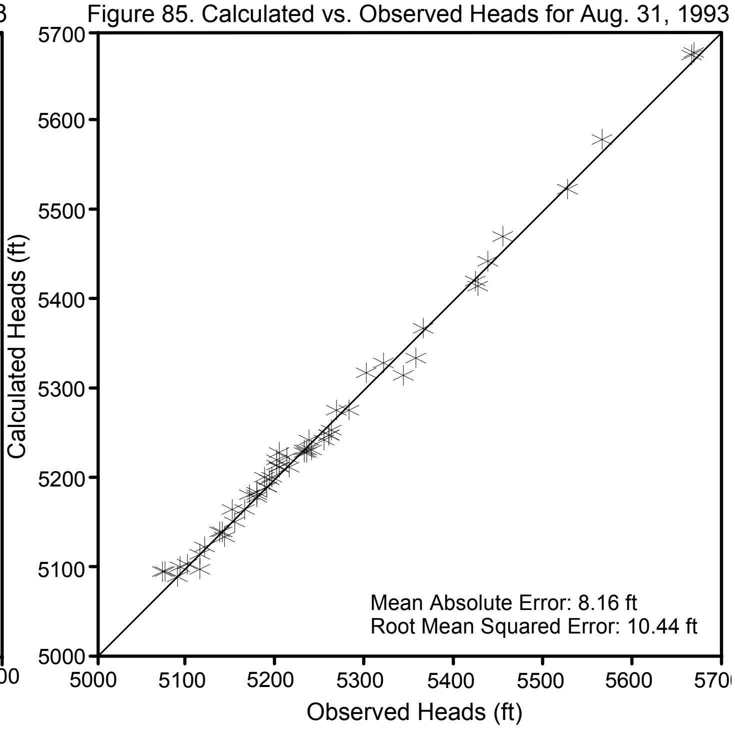


Figure 86. Calculated vs. Observed Heads for Apr. 30, 1994

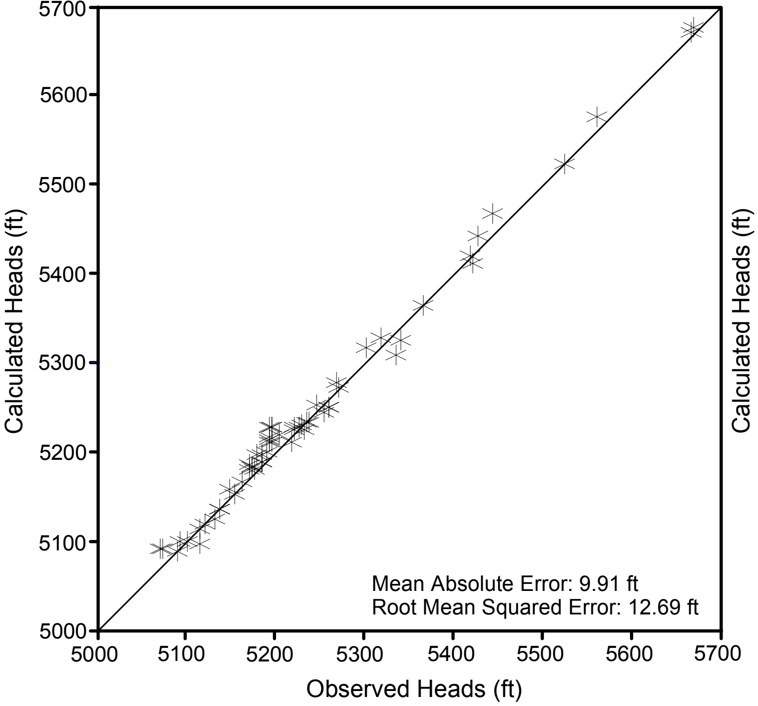


Figure 87. Calculated vs. Observed Heads for Jul. 31, 1994

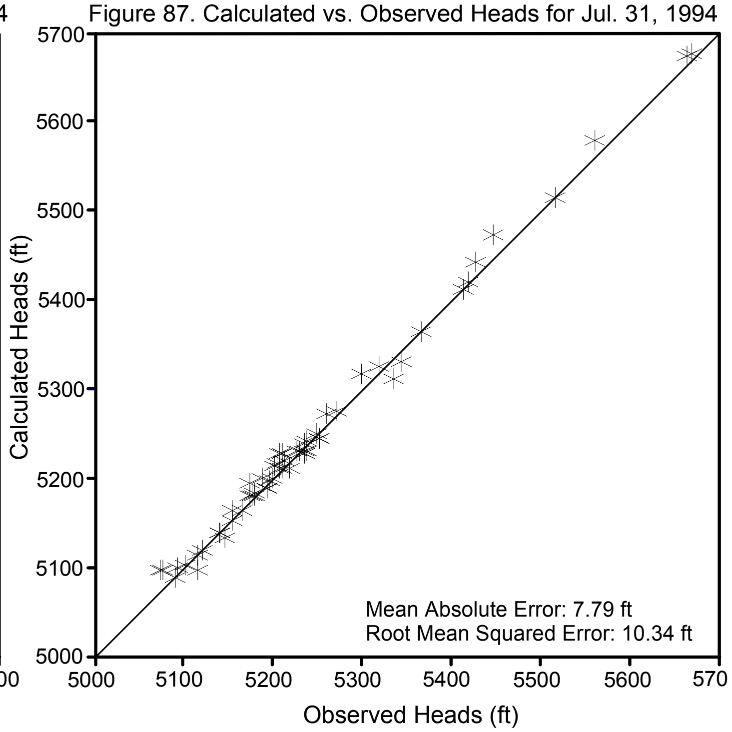


Figure 88. Calculated vs. Observed Heads for Apr. 30, 1995

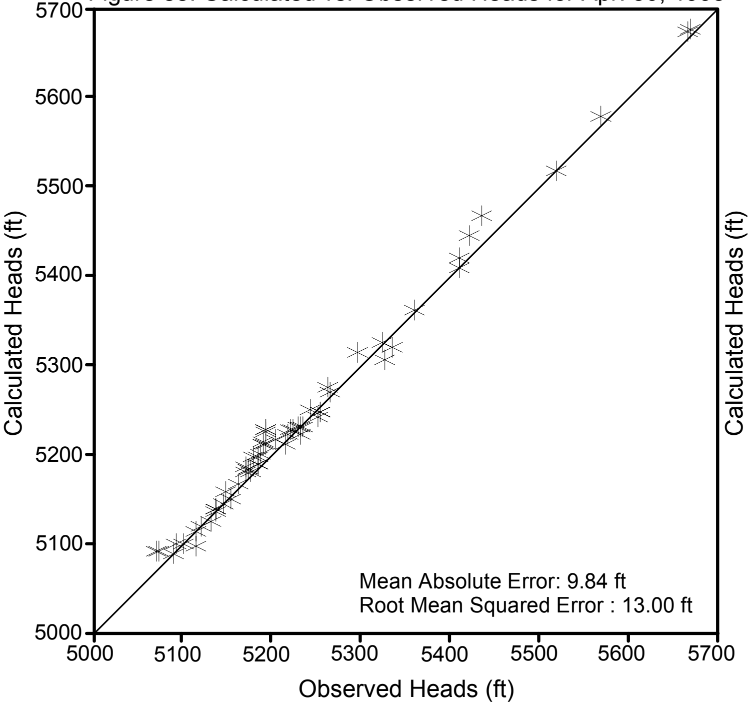


Figure 89. Calculated vs. Observed Heads for Aug. 31, 1995

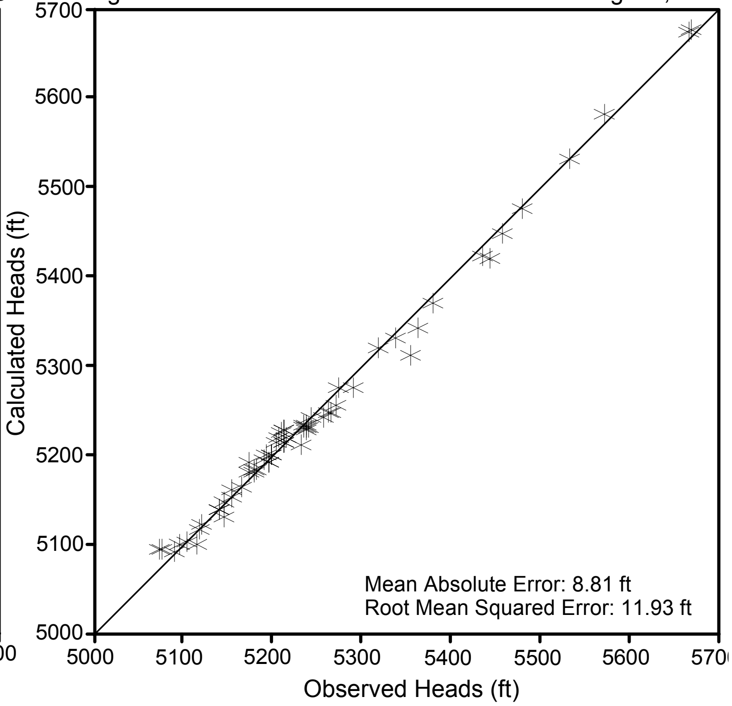


Figure 90. Calculated vs. Observed Heads for Apr. 30, 1996

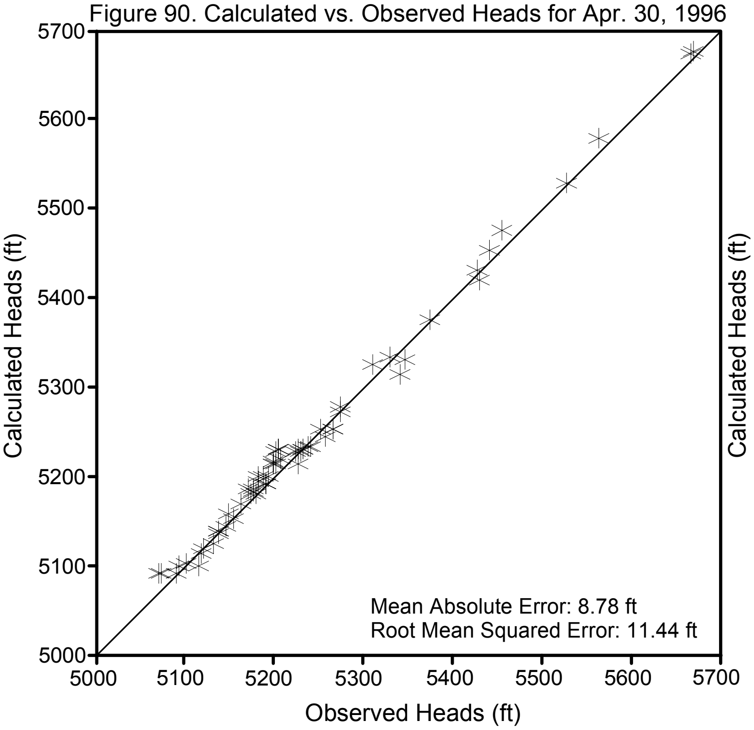
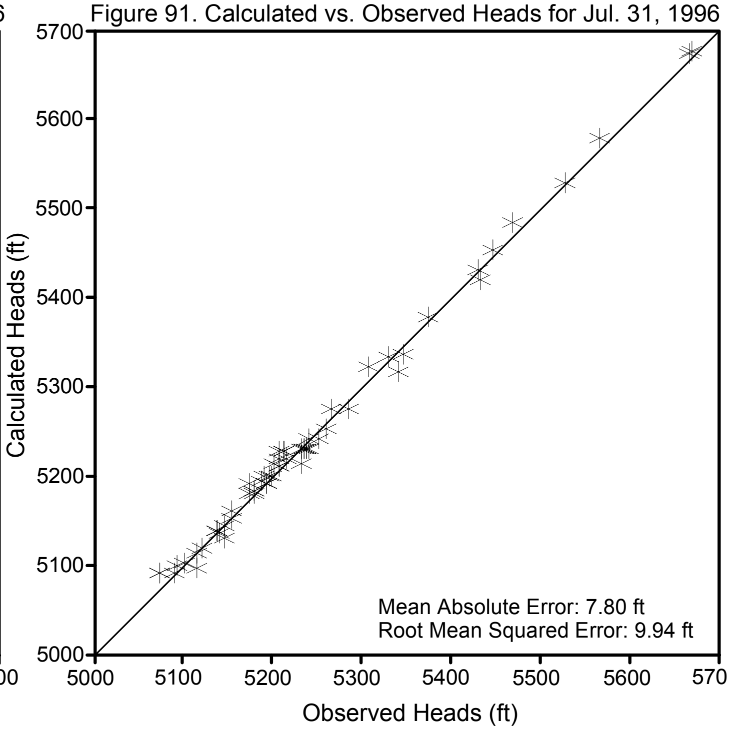


Figure 91. Calculated vs. Observed Heads for Jul. 31, 1996



These errors are acceptable, considering the model size, the grid cell dimensions, and the difference in elevation (5,075 to 5,675 feet) over which groundwater levels were observed. The percent discrepancy, or difference between cumulative modeled volumes of water entering and leaving the model, was 0.00%. This discrepancy indicates a good balance within the model and that all water was accounted for in the mathematical calculations.

Sensitivity Analysis. A sensitivity analysis quantifies the uncertainty of parameter estimates of the calibrated model by systematically adjusting the calibrated parameters, one at a time, and observing the effects of the adjustment on the average measure of error of the calibrated model. These effects denote the sensitivity of the solution to each parameter.

Several parameters were selected for sensitivity analyses for the eight calibration dates in Table 17. Horizontal and vertical hydraulic conductivities (Figures 79 and 80), specific yield (Figure 81), and irrigation return-flow recharge (Table 15) were systematically varied. The RMS errors were compared with those of the calibrated model. Results of the sensitivity analyses are presented in Figures 92 through 95. The sensitivity analysis for horizontal hydraulic conductivity (Figure 92) showed that RMS errors increased significantly when the values were decreased by 50% or more from calibrated values. However, increases of horizontal hydraulic conductivity above current values caused only small improvements in RMS errors. The sensitivity analysis for vertical hydraulic conductivity (Figure 93) showed that RMS errors also increased when the ratios of horizontal to vertical hydraulic conductivity were increased from the default ratio of 10:1 in the calibrated model. However, no significant improvements in RMS errors were noted when the ratio was decreased to as low as 2:1. The sensitivity analyses for specific yield (Figure 94) and irrigation return-flow recharge (Figure 95) did not indicate significant changes of RMS errors when parameters were modified from their calibrated values.

Surface Water-Groundwater Budget Evaluations. Results of surface water-groundwater budget evaluations for the 1993 through 1996 irrigation seasons are presented in Table 18 and calculations are tabulated in Appendix F2. The water budget approximation is based on the equation, Model $\text{Difference}_{(\text{IN - OUT})} = \text{Riv}_{\text{in}} + \text{Irrig}_{\text{in}} + \text{Flux}_{\text{in}} + \text{Ppt}_{\text{in}} - \text{Riv}_{\text{out}} - \text{Evt}_{\text{out}} - \text{Flux}_{\text{out}} - \text{Gw}_{\Delta S}$. The terms of the equation are defined below.

Riv_{in} - recharge from river/stream leakage
Irrig_{in} - recharge from irrigation return flow
Flux_{in} - recharge from general head flux
Ppt_{in} - recharge from precipitation
Riv_{out} - baseflow to river and streams
Evt_{out} - aquifer evapotranspiration losses
Flux_{out} - discharge from general head flux
$\text{Gw}_{\Delta S}$ - aquifer storage accumulation

Table 18. Surface Water-Groundwater Budget Evaluations

	Water IN (cfs)							Water OUT (cfs)								
	Bvhd River @ Barr.Div.	up. Blktl. Dr. Crk.	Rat. Crk	Mixed Zn. Irrig.	Ppt	GH Flux	**Total IN**	Bvhd River @ Dillon	lo. Blktl Creek	EVT	$\text{Gw}_{\Delta S}$	GH Flux	**Total OUT**	**Mod. Diff. (IN-OUT)**	Model Diff (in)	Alfalfa Use (in)
1993	169.7	119.1	5.0	11.7	22.3	99.2	**426.9**	134.8	87.6	2.1	77.9	20.8	**323.1**	**103.9**	12.4	10.9
1994	200.9	42.5	3.5	15.6	9.0	66.8	**338.3**	124.3	44.4	2.1	23.8	32.7	**227.3**	**111.0**	13.2	15.9
1995	897.5	181.4	6.0	5.5	20.8	127.3	**1238.5**	883.4	143.7	3.1	105.6	18.7	**1154.5**	**84.1**	10.0	10.6
1996	316.7	88.6	6.0	8.1	2.4	77.3	**499.1**	396.4	84.1	2.5	37.3	21.0	**541.3**	**-42.3**	-5.0	18.2

Figure 92. Sensitivity Analysis for Horizontal Hydraulic Conductivity

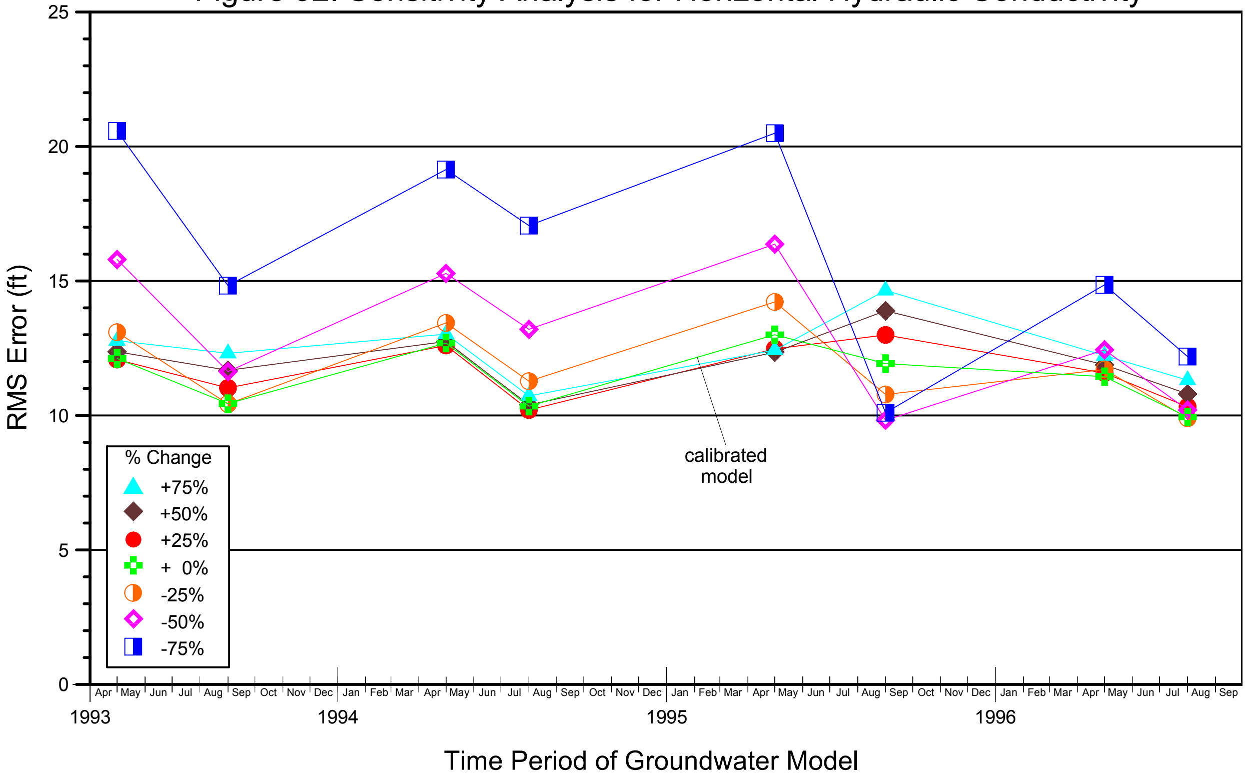


Figure 93. Sensitivity Analysis for Vertical Hydraulic Conductivity

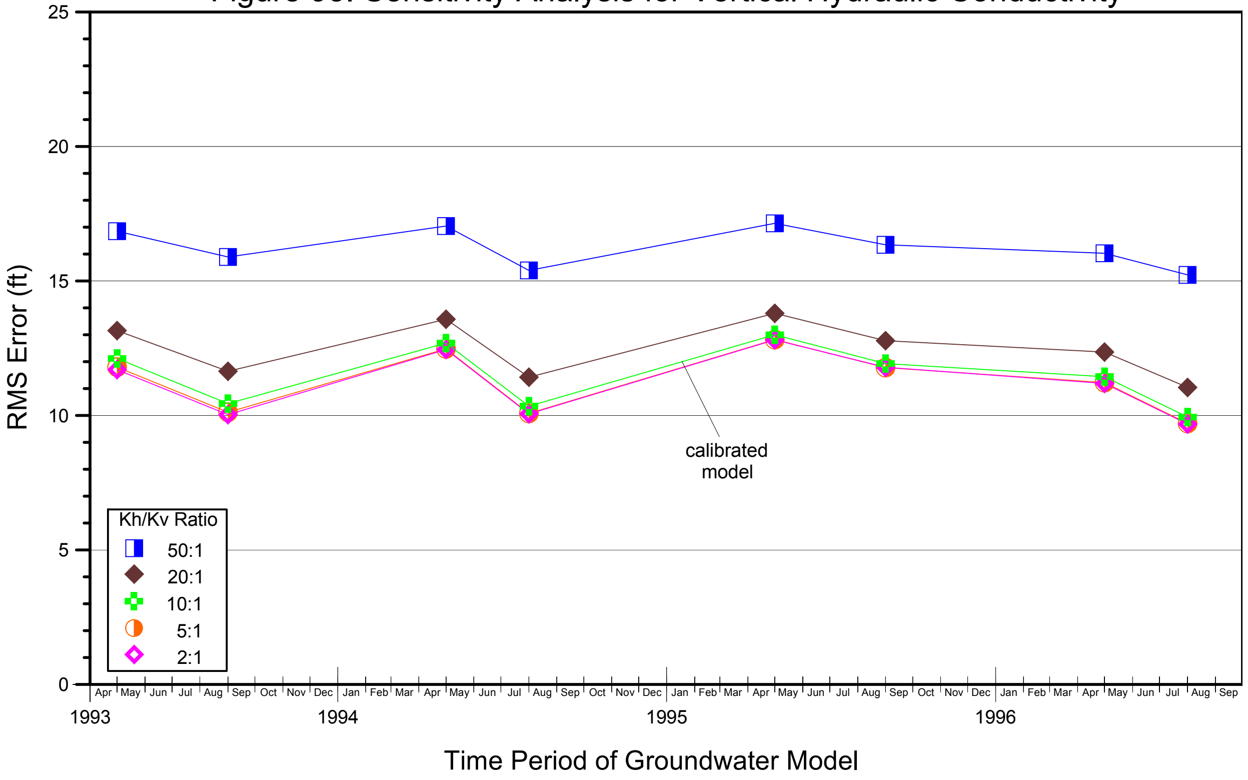


Figure 94. Sensitivity Analysis for Specific Yield

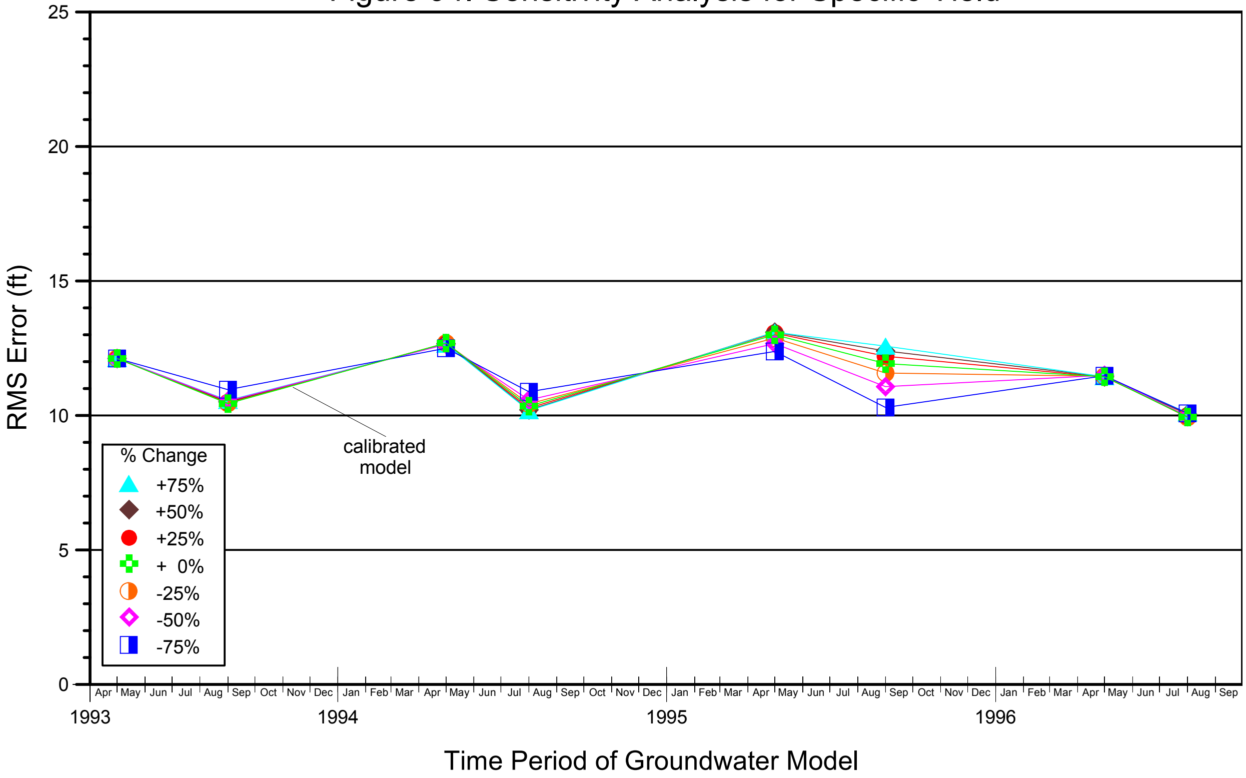
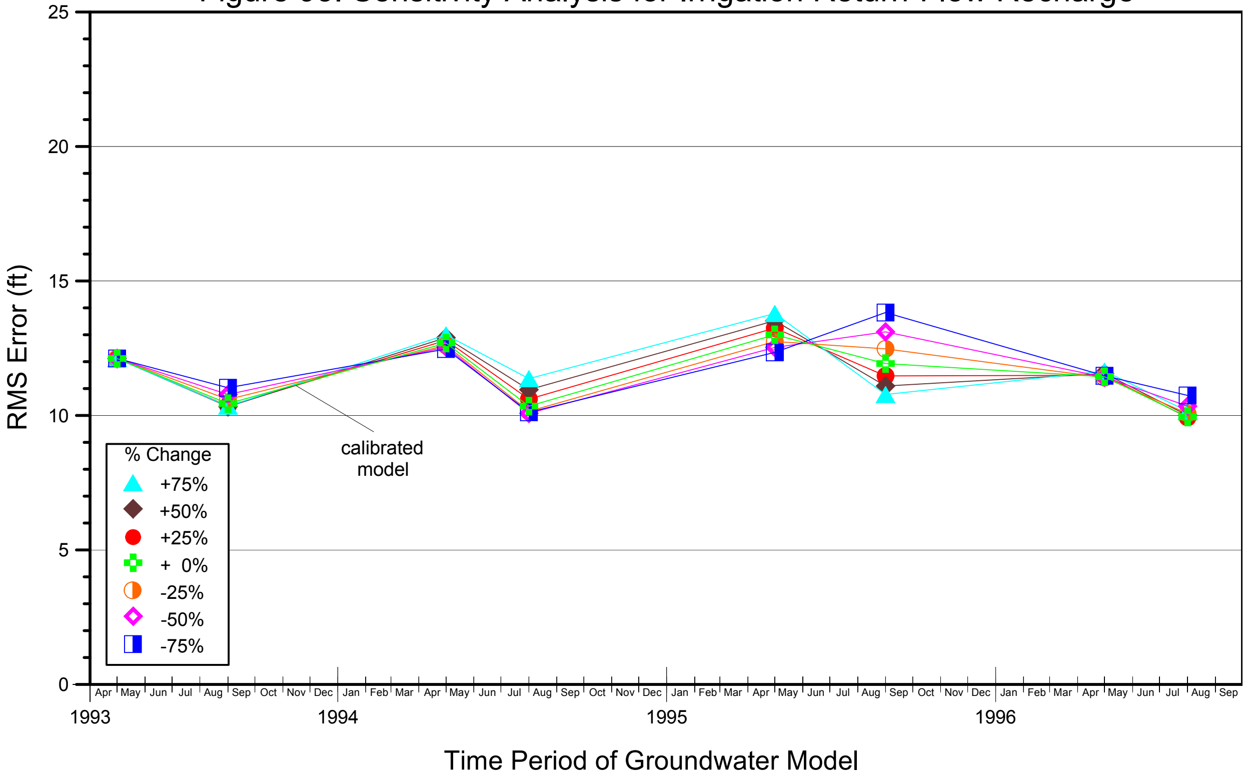


Figure 95. Sensitivity Analysis for Irrigation Return-Flow Recharge



The irrigation season surface water-groundwater budgets for 1993 to 1996 tested whether the model budget could reasonably account for water required for crop consumption. The amount of water, assumed to have been consumed by crops, is the model difference between water recharging to and discharging from the aquifer. This difference was compared with the estimated alfalfa consumptive use. The estimated consumptive use of alfalfa for June through September in Beaverhead County (U.S. Soil Conservation Service 1986) is 19.3 inches of water, minus the available precipitation. The water budgets for 1993 to 1995 could reasonably account for water required for crop consumption, but there was a discrepancy in the 1996 budget. The discrepancy may be attributable to a combination of insufficient data, imprecise field control, errors in water budget procedures, and modeled recharge.

Blacktail Range Recharge Area Zone Budget Evaluation. The Blacktail Range is a major source of groundwater recharge to the aquifer of the Blacktail Deer Creek valley. To estimate this recharge, an area of 46 square miles of the Blacktail Range was designated as the catchment area for snowfall and rainfall, some of which directly infiltrated to the mountain bedrock and the Blacktail Deer Creek valley aquifer. A mean annual total precipitation of 19 inches, totaling 2,030,326,000 ft^3 per year, was assumed for the catchment area. An average infiltration rate of 20%, although variable by lithology, was assumed for precipitation infiltrating the bedrock. The mean annual infiltration recharging the aquifer from the catchment area of the Blacktail Range estimated by this method was 406,065,000 ft^3 per year (12.88 cfs) or about 1,113,000 ft^3 per day.

To compare the estimated groundwater recharge from the Blacktail Range with the recharge calculated by the model, a zone budget boundary, representing the margin of the Blacktail Range, was assigned to the general-head boundary. Zone budget analysis indicated that the model received bedrock recharge ranging from about 8 to 28 cfs for each stress period, depending on seasonal precipitation. In the model, almost all recharge occurred in layer 1, whereas layer 2 received only 1 to 2 cfs per stress period. Modeled recharge along the general-head boundary was 363,800,000 ft^3 (11.54 cfs) in 1994 and 521,018,000 ft^3 (16.52 cfs) in 1995. A comparison of the estimated mean annual groundwater recharge (406,065,000 ft^3 per year) with the modeled recharge illustrates that the model reasonably approximated the estimated recharge from the Blacktail Range.

Modeled well withdrawals amounted to 650,000,000 ft^3 (20.61 cfs) in 1994 and 370,000,000 ft^3 (11.73 cfs) in 1995. A comparison of modeled well withdrawals with modeled groundwater recharge from the Blacktail Range indicates that groundwater recharge from the Blacktail Range supplied 56% of total well withdrawals during 1994 and amounted to 141% of total well withdrawals during 1995.

A comparison of the modeled general-head recharge along the Blacktail Range with total modeled general-head recharge from 1993 to 1996 indicates that the Blacktail Range contributed approximately 35% of the total general-head boundary recharge. This appears reasonable because the Blacktail Range is bounded by the Madison Group limestone, which is cavernous and very permeable. Numerous springs are noted along the mountain front, and many more are suspected to occur beneath the land surface.

Groundwater Budget Evaluation. Results of groundwater flow modeling are presented as a groundwater budget graph to summarize all inflows to and outflows from the model, and to illustrate interactions among the flow components of the model. Flow components add water to or remove water from the modeled aquifer. Flow components that serve as recharge to the model are indicated by positive values on the groundwater budget graph. Recharge includes precipitation, irrigation return flow, river leakage, and general-head boundaries. Flow components that function as sinks, or depletions of water from the aquifer, are indicated by negative values on the groundwater budget graph. Depletions include evapotranspiration losses, irrigation and municipal well withdrawals, baseflow, and general-head boundary discharge. Flow into or out of aquifer storage is considered part of the overall groundwater budget. Aquifer storage change can function as either a recharge or a depletion of water. Aquifer storage change is a positive value when it releases groundwater from storage to make it available for well discharge, evapotranspiration, and baseflow. Aquifer storage change is a negative value when groundwater is added to or accumulates in storage as water is removed from the flow components. The total change in aquifer storage equals the difference between aquifer inflow and outflow. Groundwater levels decline when water is released from aquifer storage and rise when water accumulates in aquifer storage. In cases when aquifer storage and flow components, such as river and general-head boundaries, function concurrently in the model as both sources and sinks of water, their net gains or losses are plotted on the groundwater budget graph.

An examination of a groundwater budget graph shows that flow component and storage-change flow rates are plotted as cubic feet per second for each stress period. The graph illustrates the interactions among recharge from general-head boundaries, stream leakage, irrigation return-flow, and precipitation; and discharge from wells, evapotranspiration, baseflow accretions to streams, and aquifer storage changes. Irrigation return-flow and general-head boundary recharge constitute the largest contributions of water to the model. The largest changes in flow components occur during the summer, when the largest increments of recharge occur. However, general-head recharge occurs throughout the year, while irrigation return flow occurs only from late spring to early autumn. Later in the autumn, and in the winter and spring, when irrigation return flow does not occur and general-head recharge diminishes, aquifer storage releases water to supplement general-head recharge to maintain baseflow to streams.

The largest aquifer discharges included periodic groundwater withdrawals from irrigation wells and the City of Dillon municipal wells #3 and #4 during the summer, and a continuous discharge from City of Dillon municipal wells #1 and #2. Baseflow accretions to streams were greater during the summer than other seasons because there was a large amount of recharge from irrigation return flow and general-head boundaries. As a result, groundwater levels were higher and the hydraulic gradient toward the Beaverhead River and its sloughs increased. Aquifer storage changes were also large in the summer because they were required to balance the large increments of recharge and withdrawal from the aquifer. During the autumn, winter, and spring, baseflow decreased as groundwater levels declined.

A groundwater budget for the CURRENT WELLS model is presented in Figure 96 and tabulated in Appendix F3. Irrigation well withdrawals amounted to 95 cfs for stress periods when they were in operation. Municipal well withdrawals ranged from 2.23 to 6.03 cfs, and baseflow ranged from 11.2 to 71.7 cfs for various stress periods. Larger baseflow was noted during the summer because there was greater recharge to the model across the general-head boundaries, and from irrigation return flow and precipitation. Baseflow accretions diminished during summer 1995 because river stage was high and irrigation return flow decreased.

Predictive Groundwater Modeling. Four predictive, hypothetical groundwater models, derived from the CURRENT WELLS model, evaluated the effects on groundwater levels and baseflow from various levels of groundwater development, prolonged drought conditions, and conversion from the current sprinkler irrigation to flood irrigation.

The first predictive flow model, NO WELLS, evaluated the impacts on baseflow from elimination of irrigation well withdrawals. A groundwater budget is presented in Figure 97 and tabulated in Appendix F3. Modifications to the NO WELLS model included deactivation of all irrigation wells and removal of the return-flow component attributed to irrigation well sprinkler application. The Dillon municipal wells remained active. A total area of 15,359 acres or 24.0 square miles was irrigated by flood and sprinkler irrigation from streams. The groundwater budget indicated that modeled baseflow ranged from 4.8 to 79.3 cfs. This baseflow was approximately 5 to 8 cfs larger than the baseflow of the CURRENT WELLS model as a result of eliminating 95 cfs of irrigation well withdrawals.

The second predictive model, MORE WELLS, evaluated the impacts on baseflow from additional groundwater development. A groundwater budget is presented as Figure 98 and tabulated in Appendix F3. Modifications to the MORE WELLS model included doubling the current irrigation well discharge from 95 to 190 cfs and distributing this additional discharge among 20 new, 2,132-gpm irrigation wells that pumped concurrently with the irrigation wells active in the CURRENT WELLS model. A proportional increment of the return-flow component attributed to irrigation well sprinkler application was added to this model. Ten of the new wells were sited in or near the Flynn Lane well field, five in the Blacktail Road well field, and five in the lower Rattlesnake Creek valley. Irrigated acreage was the same as in the CURRENT WELLS model. The groundwater budget indicated that baseflow ranged from 4.5 to 64.2 cfs. This amounted to decreases of baseflow averaging about 7 cfs when compared with the CURRENT WELLS model. The MORE WELLS and NO WELLS models demonstrated that various levels of groundwater development did not substantially affect baseflow accretions to streams.

The third predictive model, DRY YEARS, assessed the impacts on baseflow from three consecutive dry years. A groundwater budget is presented in Figure 99 and tabulated in Appendix F3. A three-year drought period was selected because it represented the average length of a prolonged dry period, as illustrated in Figure 3. Modifications to the DRY YEARS model, intended to simulate very dry conditions, were made only for 1995 and 1996, because 1994 was already simulated as a dry year. For 1995 and 1996, river stages were lowered as much as 2 feet, general-head boundary recharge was decreased

Figure 96. Groundwater Budget for CURRENT WELLS Model

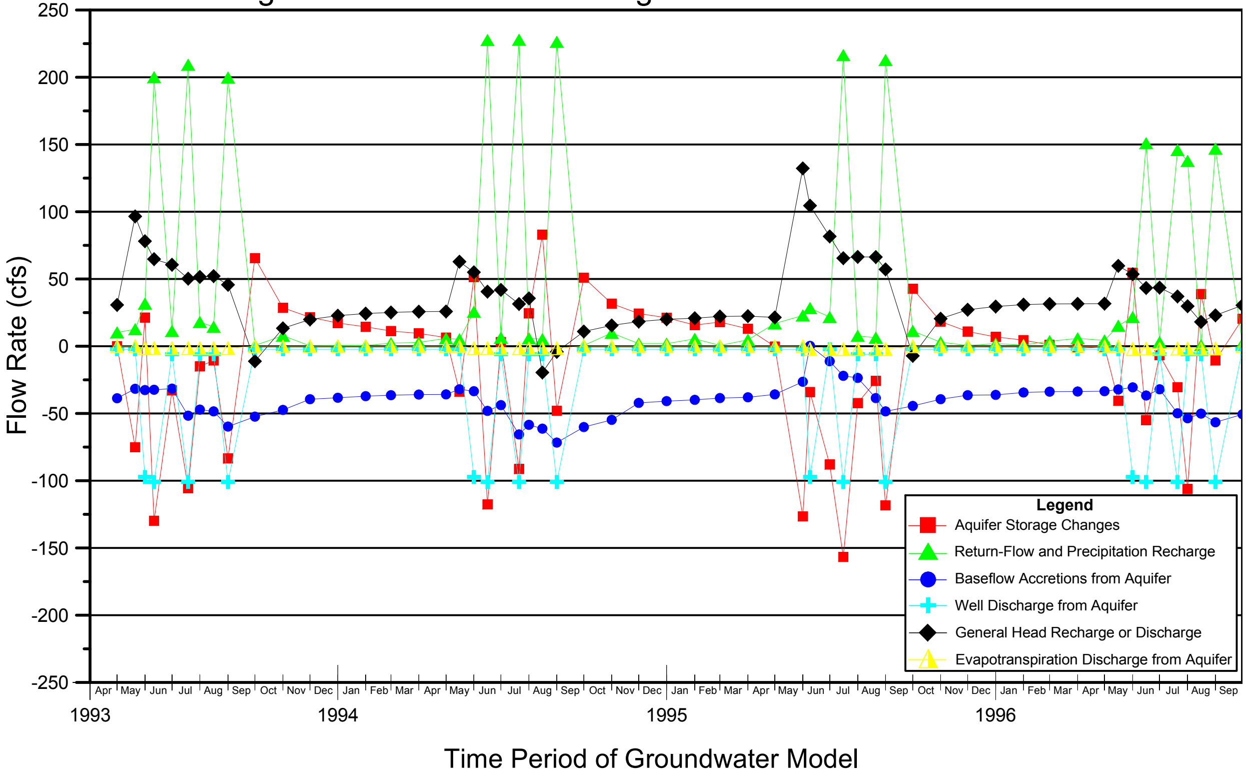


Figure 97. Groundwater Budget for NO WELLS Model

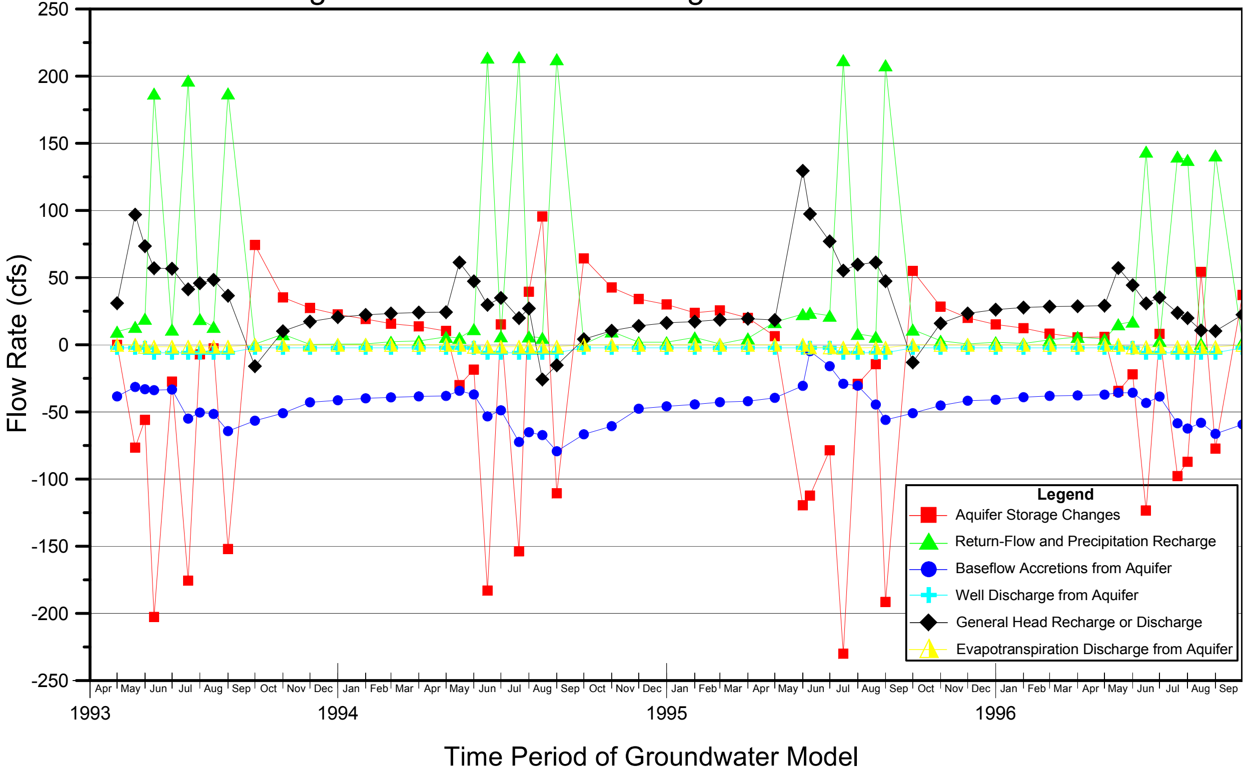


Figure 98. Groundwater Budget for MORE WELLS Model

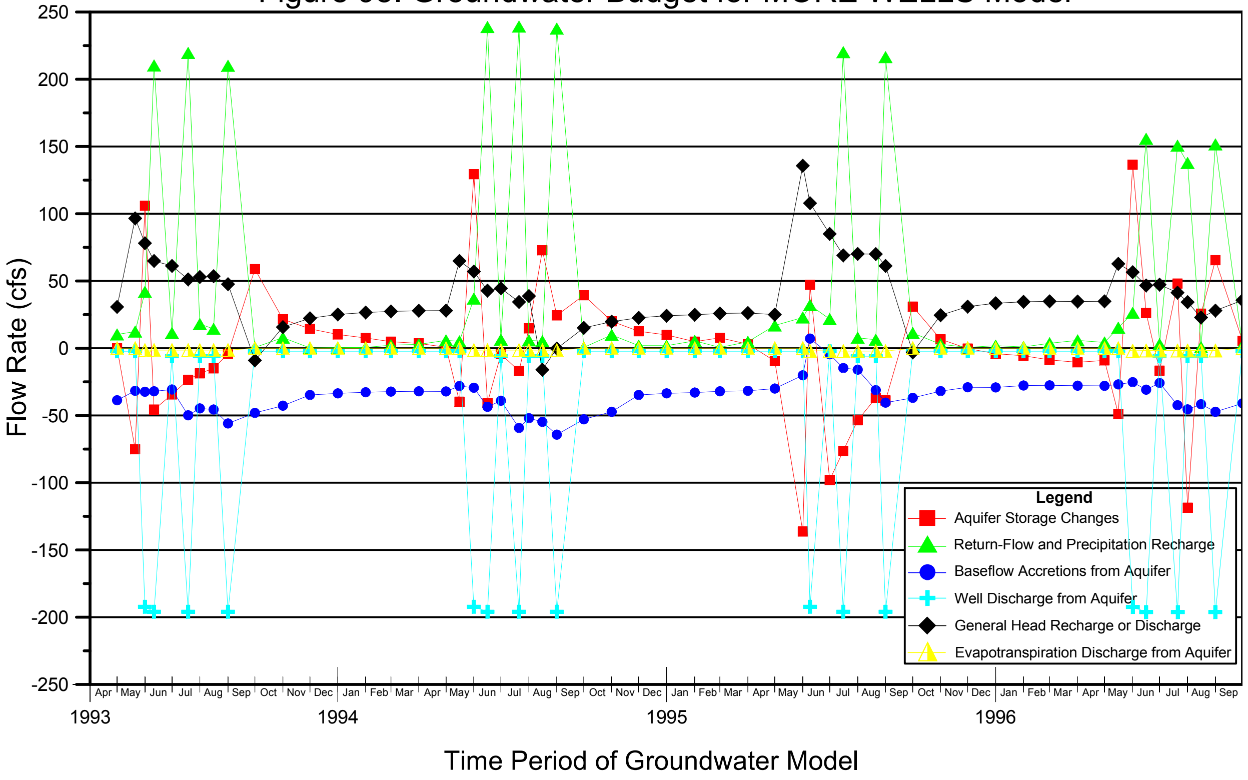
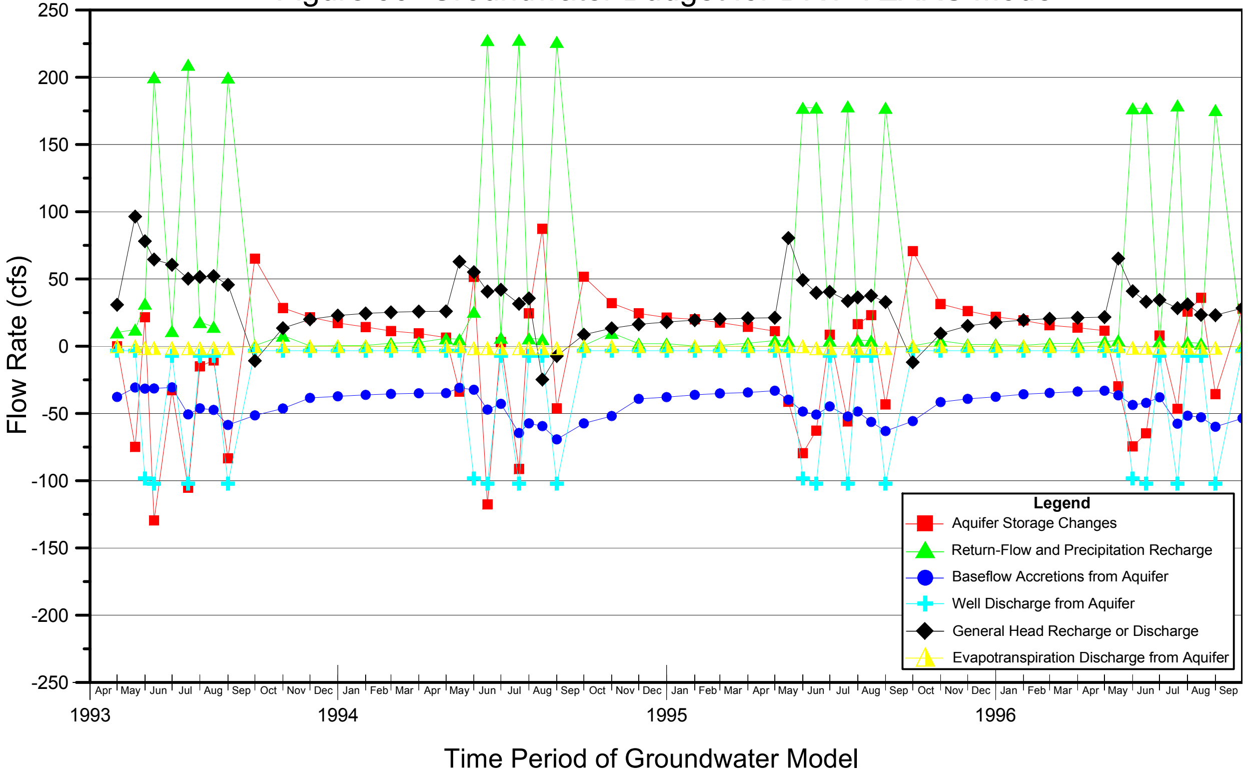


Figure 99. Groundwater Budget for DRY YEARS Model



along the valley margins, and annual precipitation was decreased from 19.16 inches to 5.18 inches in 1995, and from 7.83 inches to 4.13 inches in 1996. Irrigation well pumping schedules were lengthened and the amount of applied irrigation water was increased. Irrigated acreage was the same as in the CURRENT WELLS model. The groundwater budget indicated that modeled baseflow ranged from 30.6 to 69.3 cfs. Baseflow was similar to that of the CURRENT WELLS model, except for summer and autumn 1995. The larger baseflow of the DRY YEARS model during this period was attributed to decreased river stage and increased irrigation return flow. The similarity of baseflow between these models demonstrated that below-average precipitation had less impact on baseflow accretions to the Beaverhead River than irrigation return flow.

The fourth predictive model, FLOOD IRRIGATION, assessed the impacts on baseflow of conversion from sprinkler to flood irrigation. A groundwater budget is presented in Figure 100 and tabulated in Appendix F3. Modifications to the FLOOD IRRIGATION model included deactivation of all irrigation wells, assignment of all irrigation types to flood irrigation, and a major reduction in the irrigated acreage to include only those areas that could reasonably be irrigated by stream diversions. A total area of 11,038 acres or 17.3 square miles was irrigated by flood irrigation in this model. The groundwater budget indicated that modeled baseflow ranged from 15.5 to 155.1 cfs. This baseflow was large, when compared with that of the CURRENT WELLS model, and was due to more water being applied to flood-irrigated lands, with resultant increases in the return flow.

Comparisons of Baseflow among Models. Baseflow of the five models are summarized in Figure 101 and tabulated in Appendix F3. Compared with the CURRENT WELLS model, baseflow of the MORE WELLS model was less. The hydraulic gradient toward the Beaverhead River was decreased as a result of additional groundwater development. Baseflow of the NO WELLS model was greater, in which there were no groundwater irrigation withdrawals. The increase in baseflow of the NO WELLS model, when compared with that of the CURRENT WELLS model, was attributed to the elimination of 95 cfs of withdrawals by irrigation wells. As a result, the increased hydraulic gradient provided more baseflow to the Beaverhead River. However, the FLOOD IRRIGATION model, which also lacked irrigation well withdrawals, produced larger increases in baseflow as a result of more irrigation water being applied and a larger irrigation return-flow component. Baseflow of the DRY YEARS model, which simulated the impacts from prolonged drought, was similar to that of the CURRENT WELLS model, except during the summer and autumn of 1995, when the DRY YEARS model produced larger baseflow. The DRY YEARS model demonstrated that precipitation had less impact on baseflow than irrigation return flow.

Comparisons of Modeled Potentiometric Surfaces. Potentiometric surfaces for the five models and the observed potentiometric surfaces for the four summer calibration dates are presented in Figures 102 through 105. These comparisons illustrate that the observed and modeled potentiometric surfaces were similar. The modeled potentiometric surfaces for April 1993 through 1996 were similar to the observed April potentiometric surfaces illustrated in Figures 39 through 42.

Figure 100. Groundwater Budget for FLOOD IRRIGATION Model

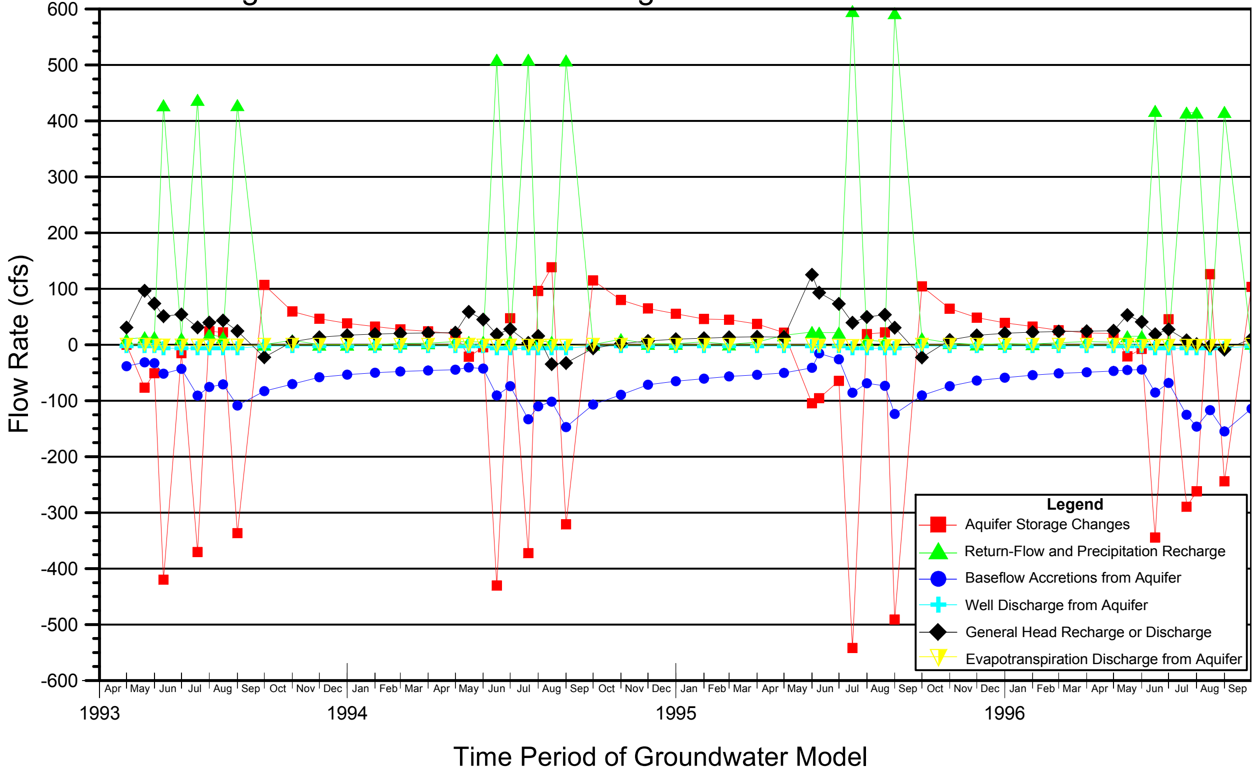


Figure 101. Comparison of Baseflow among Models

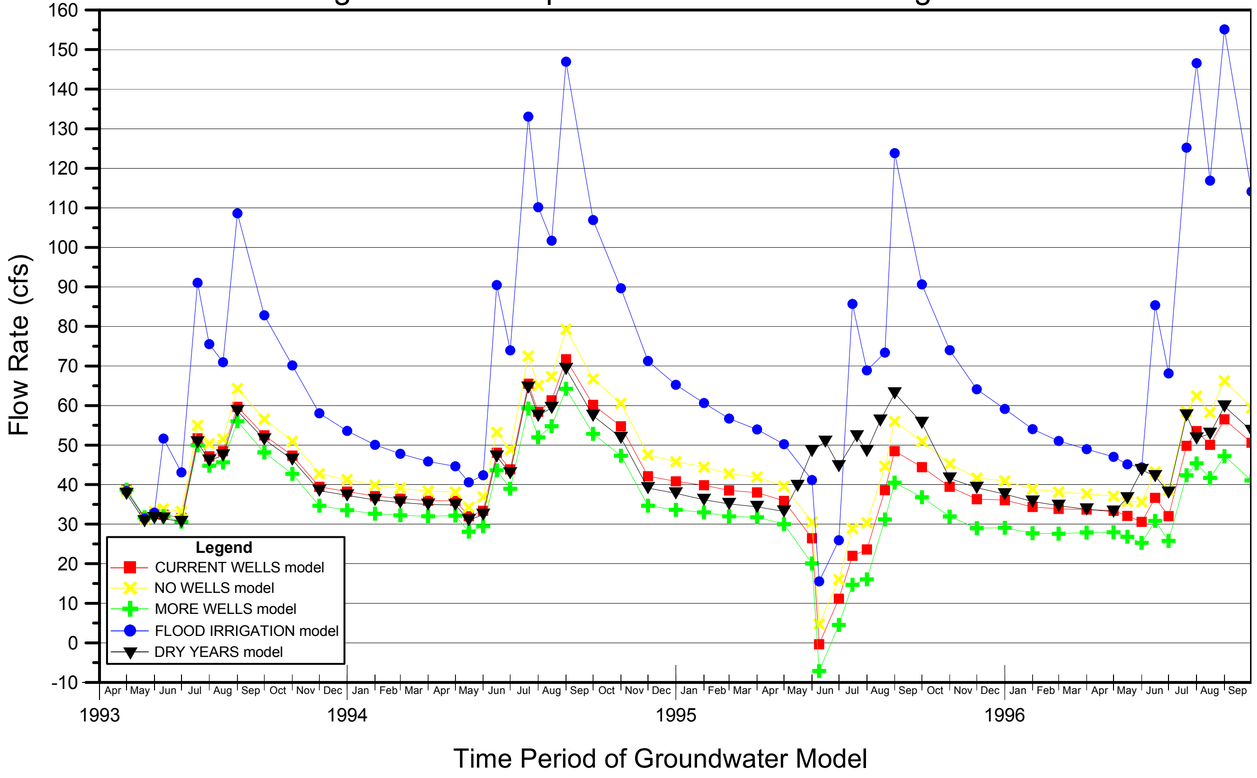


Figure 102. Modeled Potentiometric Surfaces for August 31, 1993

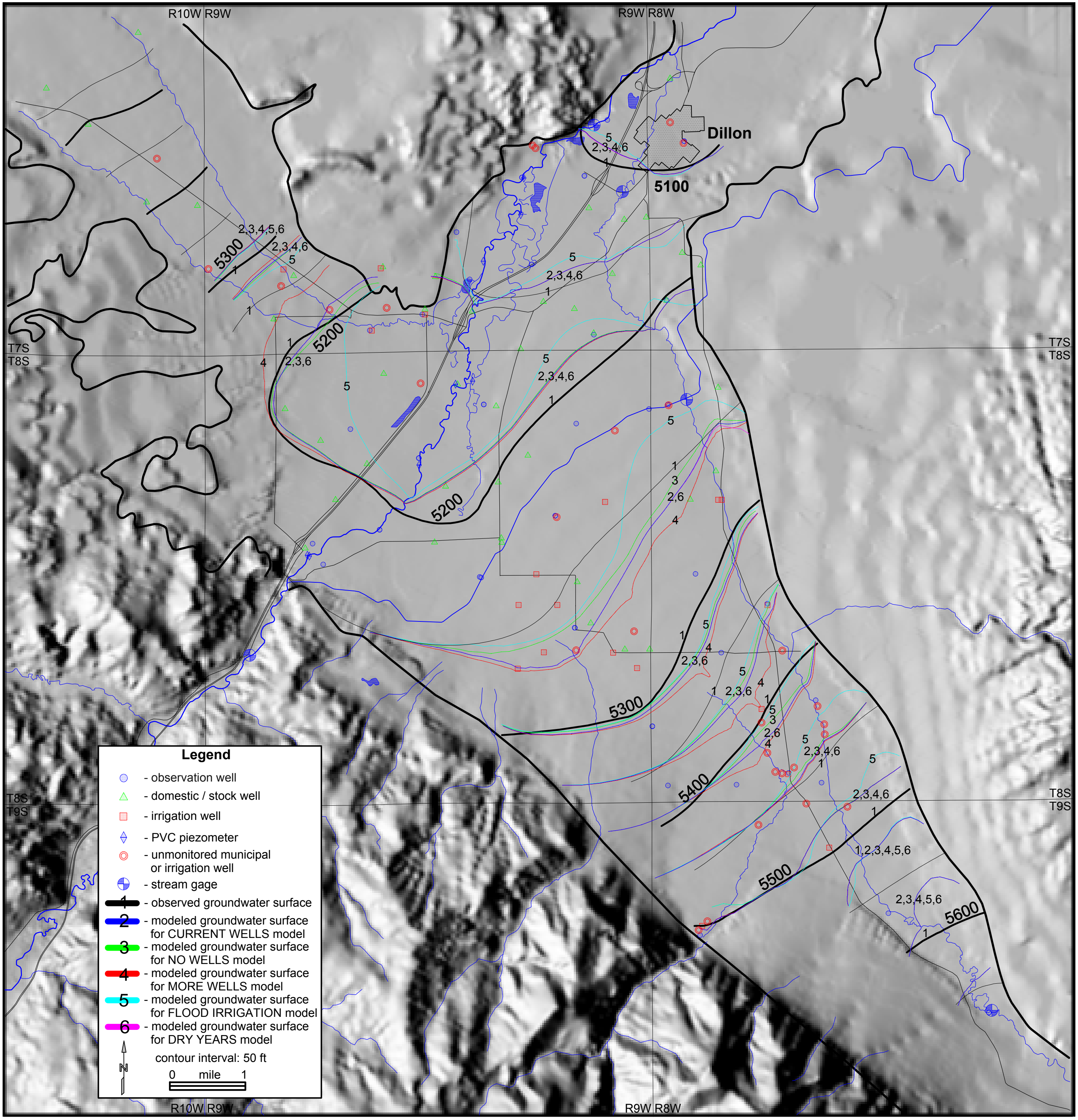


Figure 103. Modeled Potentiometric Surfaces for July 31, 1994

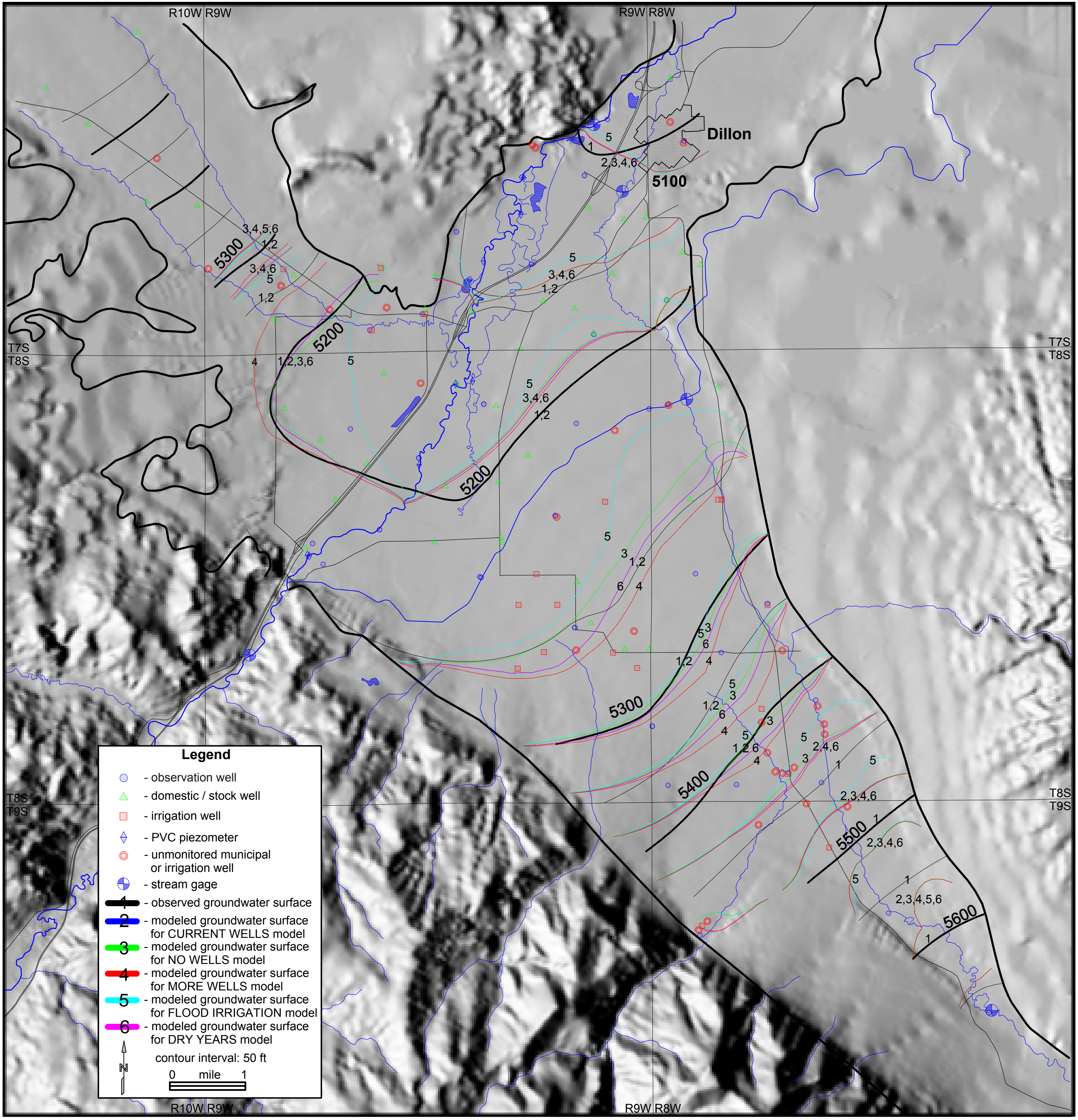


Figure 104. Modeled Potentiometric Surfaces for August 31, 1995

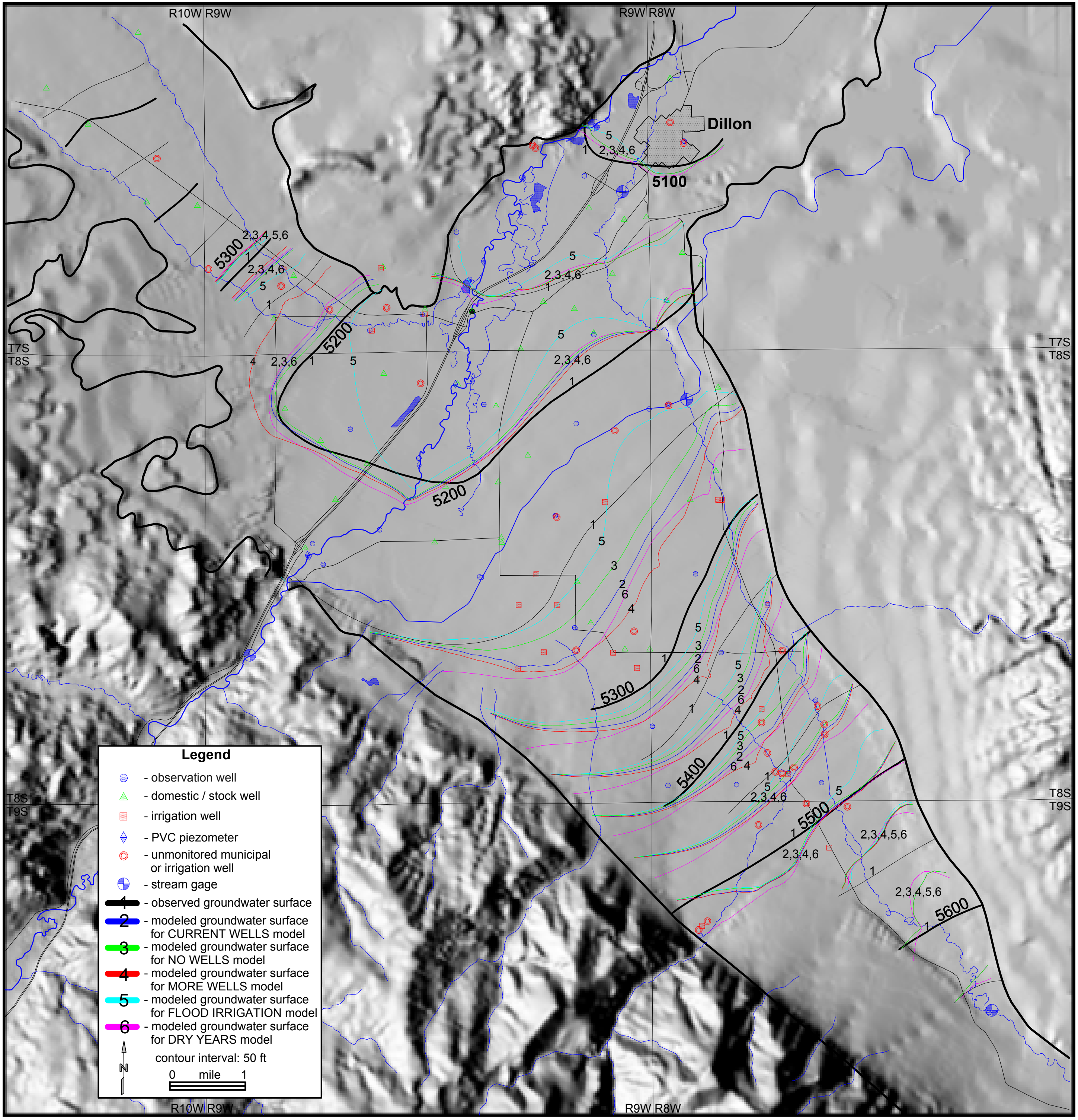
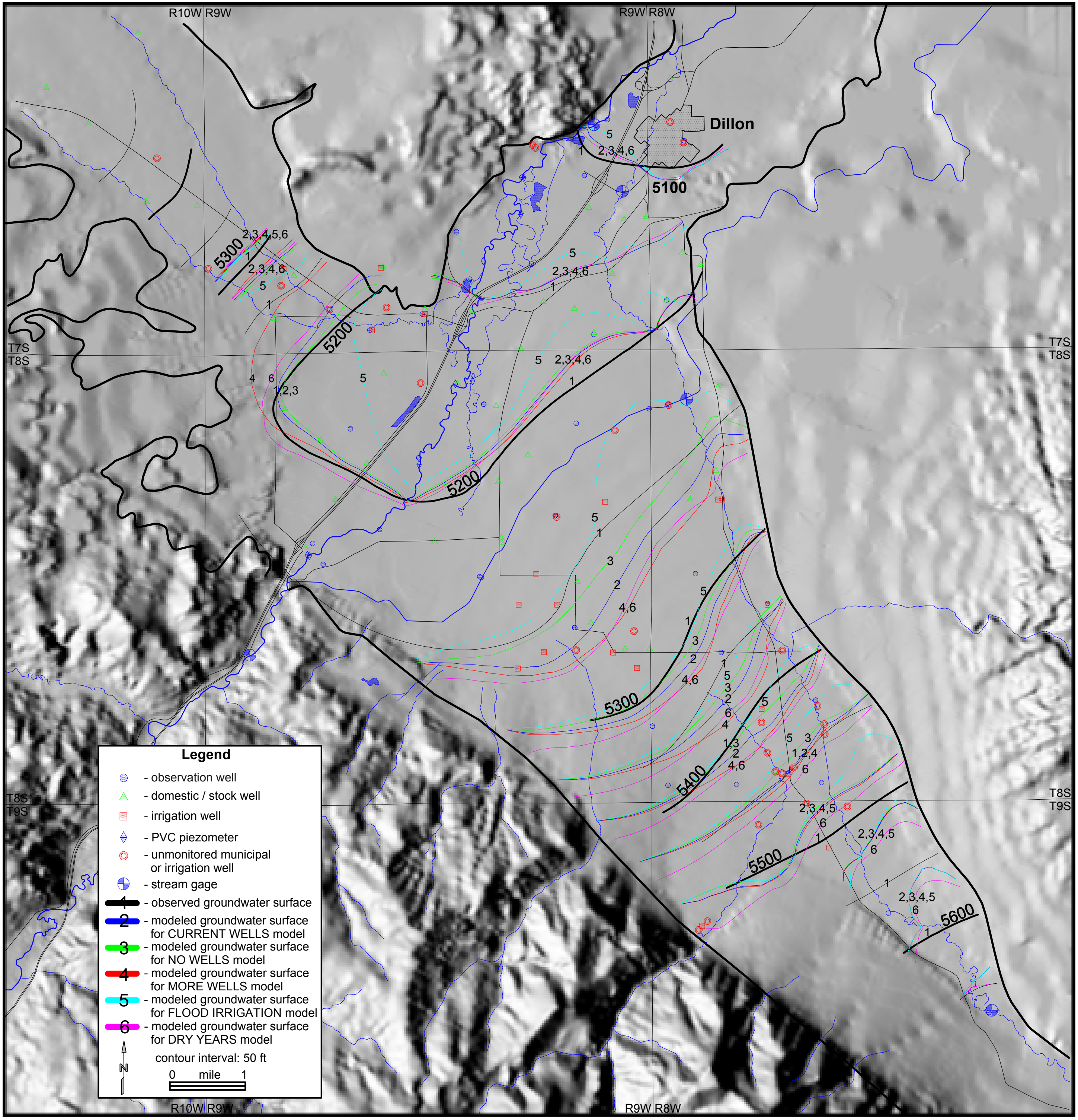


Figure 105. Modeled Potentiometric Surfaces for July 31, 1996



Summary

Comparisons of calculated versus observed heads indicate that the CURRENT WELLS model reasonably simulated the observed data. The mean absolute errors ranged from 7.79 to 9.91 feet, and the root mean squared errors ranged from 9.94 to 13.00 feet. These errors suggest that the model is reasonably accurate, considering its size and grid cell dimensions. The difference of 0.00% between the cumulative volumes of water entering and leaving the model indicates that all water was accounted for in the model's mathematical calculations.

Composite potentiometric surfaces for the five models were compared with the observed potentiometric surfaces for each of the four summer calibration dates. Comparisons illustrate that the observed and modeled potentiometric surfaces were reasonably similar.

A sensitivity evaluation quantifies the uncertainty of parameter estimates of the calibrated model. The parameters selected for sensitivity analyses were horizontal and vertical hydraulic conductivity, specific yield, and total irrigation return-flow recharge. The sensitivity analysis for horizontal hydraulic conductivity showed that it was sensitive to decreases of 50% or more from the calibrated values, but not to increases. The sensitivity analysis for vertical hydraulic conductivity showed that it was sensitive to increases in ratios of horizontal to vertical hydraulic conductivity greater than the default ratio of 10:1, but insensitive to decreases as low as 2:1. The sensitivity analyses for specific yield and irrigation return-flow recharge did not indicate significant changes of RMS errors when these parameters were modified from their calibrated values. The calibrated parameters represent a reasonable simulation of the naturally occurring hydrogeological processes.

Irrigation season surface water-groundwater budget evaluations for 1993 to 1996 tested whether the model's water budgets reasonably accounted for water required for crop consumption. The estimated annual consumptive use of alfalfa is 19.3 inches of water, minus the available precipitation. The water budgets for 1993 through 1995 reasonably accounted for water required for crop consumption, but for 1996, there was a discrepancy in the comparison.

The Blacktail Range is a major source of groundwater recharge to the aquifer of the Blacktail Deer Creek valley. A comparison of the estimated mean annual infiltration of 406,065,000 ft^3 per year recharging the valley aquifer from the Blacktail Range with recharge calculated by the model, 363,800,000 ft^3 in 1994 and 521,018,000 ft^3 in 1995, illustrated that the model reasonably approximated the natural recharge along the Blacktail Range. A comparison of the modeled general-head recharge along the Blacktail Range with total modeled general-head recharge indicated that the Blacktail Range contributed approximately 35% of the general-head boundary recharge. A comparison of annual well withdrawals with annual groundwater recharge from the Blacktail Range suggests that the Blacktail Range supplied 56% of annual well withdrawals during 1994, and 141% during 1995.

Impacts to groundwater levels and surface-water availability were assessed using groundwater flow models. The initial model, CURRENT WELLS, was developed from the extensive data collected. It demonstrated that baseflow ranged from 11.2 to 71.7 cfs under the scenario observed during the project of alternating above- and below-average precipitation years and groundwater withdrawals from two irrigation well fields. Four predictive models, derived from the initial model, were used to assess impacts on surface water availability from various degrees of groundwater development and drought conditions by compaing the results with those of the initial model.

The NO WELLS model evaluated a hypothetical scenario in which there were no irrigation well withdrawals. It demonstrated that an elimination of irrigation well withdrawals totaling 95 cfs produced baseflow accretions ranging from 4.8 to 79.3 cfs, a 5- to 8- cfs increase when compared with the initial model. The MORE WELLS model tested another hypothetical scenario, representing increased groundwater development, by doubling the irrigation well withdrawals to 190 cfs. In spite of doubling the aquifer withdrawals, this model produced baseflow accretions ranging from 4.5 to 64.2 cfs, a 6- to 7- cfs reduction in baseflow when compared with the initial model. These two predictive models illustrated that irrigation wells have not substantially affected baseflow accretions to the Beaverhead River, Poindexter Slough, or lower Blacktail Deer Creek.

The DRY YEARS model compared impacts on baseflow from a severe three-year period of drought, following the wet year of 1993, with those of the initial model. The comparison showed similar results, except that the largest differences in baseflow occurred during the summer and autumn of 1995. The DRY YEARS model demonstrated that below-average precipitation had less impact on baseflow than irrigation return flow.

The FLOOD IRRIGATION model compared the impact of flood irrigation only on baseflow. Results were compared with those of the NO WELLS model, in which more acreage was irrigated by sprinkler irrigation from ditches and canals. There were no irrigation well withdrawals in either model. Baseflow in the FLOOD IRRIGATION model was significantly larger than that of the NO WELLS model because larger amounts of water were applied to flood-irrigated lands, with resultant increases in the return-flow component.

CONCLUSIONS

The Beaverhead Groundwater Project was conducted to determine the effects of groundwater development on groundwater levels and surface water availability, including the drawdown impacts from irrigation wells.

Three aquifers occur in the project area. The bedrock aquifer forms the margins of the basin. This aquifer produces only small yields of water to wells, but its total recharge potential to the valley-fill aquifers is significant. The lower Tertiary aquifer consists of deeper-lying, fine-grained materials up to about 3,000 feet thick. Yields of water to wells from the lower Tertiary aquifer are typically sufficient only for domestic and stock use. The Quaternary/upper Tertiary aquifer consists of coarse materials which overlie the lower Tertiary aquifer. The thickness of the Quaternary/upper Tertiary aquifer ranges from hundreds of feet in the southern part of the project area to tens of feet near Dillon. It is the most productive and utilized aquifer because it is capable of supporting large groundwater withdrawals for irrigation and municipal use. The Quaternary/upper Tertiary aquifer serves as a voluminous reservoir for a large quantity of groundwater in storage. The groundwater is readily available for use.

Groundwater levels were frequently measured in wells completed in both the lower Tertiary and Quaternary/upper Tertiary aquifers. Based on groundwater-level data, the directions of horizontal groundwater flow were determined to be northwest in the Blacktail Deer Creek valley, southeast in the Rattlesnake Creek valley, and northeast along the Beaverhead River floodplain between Barretts and Dillon.

Groundwater levels in the project area have not steadily declined as a result of the current level of groundwater development, but fluctuated in response to variations in recharge from precipitation, irrigation return flow, streamflow leakage, and groundwater recharge from the bedrock aquifer. Groundwater levels declined during times of below-average precipitation, and rose dramatically, as demonstrated, during times of above-average precipitation. Groundwater levels have typically been lowest during the late spring and highest in mid to late summer, following summer precipitation and irrigation return-flow recharge from the agricultural lands. However, in the irrigation well fields, groundwater levels declined locally during the summer as a result of irrigation pumpage. After summer irrigation ended, groundwater levels rapidly recovered to seasonal levels as aquifer storage was replenished. No groundwater-level declines were noted in areas adjacent to the well fields as a result of pumpage in the irrigation well fields.

Aquifer test analyses indicate that hydraulic properties of the Quaternary/upper Tertiary aquifer are favorable for producing and sustaining large groundwater withdrawals without causing adverse, widespread drawdown impacts to nearby wells, affecting surface water flow, and causing long-term declines of groundwater levels. The Flynn Lane well field area was most impacted during summer irrigation by drawdown from large groundwater withdrawals. Numerous large-discharge irrigation wells in this area created a cone of depression extending throughout the well field. Drawdown effects were not noted in wells beyond the well field, which implies that the cone of depression remained localized. Following summer irrigation, groundwater levels quickly recovered to seasonal levels as depleted aquifer storage was replenished by a continuous flow of groundwater from upgradient. A drawdown of the magnitude observed in the Flynn Lane well field was created only by the pumping of numerous irrigation wells. The same magnitude of drawdown was not observed elsewhere in the project area because isolated irrigation and municipal wells have small impacts on groundwater levels and surface water availability.

Streams were generally not affected by drawdown from irrigation well withdrawals because (1) drawdown did not extend to the Beaverhead River or other streams, and (2) streams were already losing naturally in the irrigated agricultural areas where drawdown spreading to a stream might induce additional streamflow losses, if the stream were gaining.

Streamflow in the Beaverhead River was measured at the Barretts and Dillon gaging stations. During the summer, streamflow was greater at the Barretts gaging station than at the Dillon gaging station because there were numerous irrigation diversions from the Beaverhead River. During the non-irrigation season, streamflow was greater at the Dillon gaging station. Based on streamflow measurements and river stage/groundwater-level relationships, the Beaverhead River was a losing stream between the Barretts diversion and the Interstate 15 exit at Highway 278. From this point north to Dillon, the Beaverhead River floodplain is a groundwater discharge area, where groundwater levels are near land surface and the hydraulic gradient slopes toward surface water. In the groundwater discharge area the Beaverhead River, Blacktail Deer Creek, and Poindexter Slough gained streamflow from baseflow accretions.

Blacktail Deer Creek, upstream of the EBID Canal, and Rattlesnake Creek were losing streams. Large irrigation diversions from Blacktail Deer Creek also decreased streamflow. Downstream of the EBID Canal, Blacktail Deer Creek was a gaining stream to its confluence with the Beaverhead River. The EBID Canal and Canyon Ditch did not lose significant amounts of water across the lower Blacktail Deer Creek valley. Minimal seepage losses from the EBID Canal probably occurred in its upper 1 or 2 miles.

Water quality is very good for consumptive and irrigation uses. Chemical properties of water along Blacktail Deer Creek and the Beaverhead River indicated calcium-bicarbonate and calcium-sodium-bicarbonate water types, respectively. Groundwater from the Blacktail Range alluvial fan, the Flynn Lane area of the Blacktail Deer Creek valley, and the lower Rattlesnake Creek valley had high sulfate concentrations. Deeper groundwater had higher concentrations of sodium and potassium, indicating a longer contact time with aquifer materials. Water chemistry data supported interpretations that the Blacktail Range served as a source for groundwater recharge to the basin-fill aquifers.

Surface water-groundwater interactions were assessed using groundwater flow models. An initial groundwater model was developed from the extensive data collected for the period of April 1993 through September 1996. This model simulated the scenario observed during the project of alternating below- and above-average precipitation years and groundwater withdrawals from two irrigation well fields. Four predictive groundwater flow models, derived from the initial model, were used to assess the impacts on baseflow to the Beaverhead River from various degrees of groundwater development and prolonged drought conditions. Results were compared with the initial model. Two of the predictive models evaluated impacts on baseflow from groundwater development ranging from no development to double the current level. These models produced increases and decreases in baseflow accretions, respectively, when compared with the baseflow of the initial model. These models indicated that irrigation wells have not substantially impacted baseflow accretions to the Beaverhead River, Poindexter Slough, or lower Blacktail Deer Creek. The third predictive model evaluated impacts on baseflow from a severe three-year period of drought. A comparison of results with those of the initial model showed similarities, and demonstrated that diminished precipitation had less effect on baseflow accretions than irrigation return flow. The fourth predictive model evaluated the impact on baseflow of flood-irrigation only. Results were compared with another predictive model which had more acreage irrigated by sprinkler irrigation from ditches and canals. There were no irrigation well withdrawals in either model. The comparison showed that baseflow accretions of the flood irrigation model were significantly larger than those of the other predictive model, because there was more return-flow recharge as a result of flood irrigation. All models demonstrated that irrigation return flow was a significant component of baseflow.

Groundwater modeling showed that baseflow accretions were generally slightly affected by various levels of groundwater development and three consecutive years of drought. Other observations that collectively support or contribute to this interpretation include:

1. The Beaverhead River and other streams were located far from most of the large-discharge wells, beyond the zones of drawdown influence.
2. Streams were losing naturally in irrigated agricultural areas where additional streamflow losses might be induced by drawdown if the stream were gaining and drawdown were to extend to the stream.
3. Groundwater released from aquifer storage during the summer was a major component of baseflow accretions along gaining reaches of streams, and provided a buffering influence to potentially adverse groundwater-level declines and reductions of baseflow when wells were pumping or drought occurred.
4. Irrigation return flow recharging the aquifer during the summer was a major component of baseflow accretions along gaining reaches of streams.

The project results indicate that groundwater development for irrigation use has not adversely affected groundwater levels; has not caused widespread, adverse, and long-term drawdown impacts; and has not significantly impacted surface water availability.

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Appendix A

Geology

Appendix A1. Lithologic Descriptions for the Dillon 1° x 2° Quadrangle Geologic Map

(from Ruppel et al. 1993)

Symbol	Lithology Unit	Lithology Description
Qa	Alluvium (Holocene)	Silt, sand, and gravel in channels and floodplains of major rivers and streams and in related alluvial fans. May be partly of Pleistocene age. Maximum thickness unknown.
Qo	Glacial outwash (Pleistocene)	Poorly sorted bouldery gravel and sand deposited by glacial meltwater.
Qf	Alluvial fan deposits (Holocene-Pleistocene)	Poorly sorted silty sand and gravel deposited in broad alluvial fans along valley margins. Includes gravel veneer on pediments.
Ql	Landslide deposits (Holocene-Pleistocene)	Angular fragments of bedrock mixed with soil or heterogeneous boulders and finer-grained material derived from glacial deposits on steep valley walls; characterized by irregular, hummocky topography; boggy in places. Many landslides are marked by torn sod, tilted trees, and steep unvegetated slopes that indicate continuing movement.
Tbz	Bozeman Group and valley-fill deposits, undiv. (Pliocene to Eocene)	Light gray to yellowish-brown, moderately indurated to well-indurated tuffaceous sandstone and siltstone containing subordinate interbeds of limestone and marl and lenses of pebble and cobble conglomerate composed of locally derived rock fragments. Commonly veneered with residual gravel or a thin layer of eolian silt. Variable thickness from less than 300 meters to as much as 4,600 meters in Big Hole basin.
Tkb	Beaverhead Group (Tertiary?-Up.Cretaceous)	Moderately indurated massive boulder, cobble, and pebble conglomerate having a quartz-sand matrix and cemented with calcite, and some interbedded sandstone and fresh-water limestone; in most places these rocks consist of rounded to subangular fragments of Proterozoic quartzite and Paleozoic carbonate rocks; as much as 350 meters thick.

Tvu	Volcanic rocks (Tertiary)	Basaltic andesite, andesite, dacite, and rhyodacite. Light brownish-gray to brownish-gray (tinted purple in places), fine-grained, locally porphyritic volcanic and associated intrusive rocks. Phenocrysts include sodic plagioclase, sanidine, quartz, and biotite. Individual flows as much as 50 meters in thickness.
Kk	Kootenai Formation (Lower Cretaceous)	Mudstone, siltstone, limestone, and sandstone. Upper part of formation is principally limestone with subordinate interbedded mudstone, siltstone, and sandstone; limestone beds also occur in middle part of formation. Limestone is medium light gray to medium dark gray, finely to coarsely crystalline, thin-to-medium bedded, and fossiliferous; abundant fragments of gastropods in some beds. Mudstone and siltstone, principally in middle and lower parts of formation, are light olive gray, grayish-green, and medium light gray to pale red, grayish-red, and medium dark gray, partly thinly laminated, partly fissile, calcareous, and contain carbonaceous material and fragments of fossil wood. Sandstone occurs in subordinate interbeds throughout formation but is predominant in lower part; typically it is light olive gray and medium light gray to medium dark gray, fine-to coarse-grained, thin-to thick-bedded, and calcareous; rounded to subangular quartz grains and grains of dark chert are abundant; basal sandstone commonly is conglomeratic and contains abundant pebbles and cobbles of chert. Thickness 200-400 meters.
Tru	Triassic (undivided)	Thaynes Formation (Lower Triassic) - Light gray limestone, sandstone, and siltstone. Maximum thickness about 120 meters in south-central and southeast parts of map area; absent elsewhere in Dillon region. Woodside Formation (Lower Triassic) - Reddish-brown, reddish-purple, and medium gray calcareous mudstone, siltstone, and limestone. Maximum thickness about 30 meters in south-central part of map area and in Snowcrest Range; absent elsewhere in Dillon region.

		Dinwoody Formation (Lower Triassic) - Grayish-green, yellowish-gray, and grayish-brown, calcareous, thinly laminated siltstone; fine-grained sandstone; shale; gray, pale-red and brownish-gray weathering,thin-bedded limestone. Maximum thickness, in south-central area, is about 250 meters, but commonly 100-160 meters.
Pmu	Permian to Mississippian	Phosphoria Formation (Permian) - Divisible into upper and lower units. Upper unit is yellowish-brown to brownish-gray and dark gray, partly glauconitic chert, cherty fine-grained sandstone, and quartzitic sandstone. 40-45 meters thick. Quadrant Formation (Pennsylvanian and Upper Mississippian) - light gray to pale yellowish-brown, fine- to medium-grained, quartzitic sandstone and vitreous quartzite; contains well-sorted, subrounded to well-rounded quartz grains; commonly cross-stratified, locally hematitic. Locally includes thin interbeds of light gray to medium gray, micritic, silty or sandy dolomite or limestone; in some places lower 15-55 meters of formation is mainly dolomite or limestone containing thin interbeds of dolomitic or calcareous, fine-grained sandstone. Thickness is about 210 meters in Blacktail Mountains.
úPu	Snowcrest Range-Madison Group	Snowcrest Range Group (Lower Penn-Up. Miss.) - includes the Conover Ranch Formation, Lombard Limestone, and Kibbey Sandstone. Conover Ranch Formation - Pale reddish-brown to pale reddish-purple, thin-bedded, calcareous mudstone and minor interbeds of limestone, calcareous sandstone and siltstone, limestone-pebble conglomerate, and phosphatic claystone. About 13-33 meters thick. Lombard Limestone - Light olive-gray, thin- to thick-bedded fossiliferous limestone and thin interbeds of silty limestone, siltstone, and shale, about 85-125 meters thick. Kibbey Sandstone - Pale red to pale yellow, thin- to medium-bedded siltstone, sandstone, and claystone, and interbedded limestone solution breccia and evaporite solution breccia in middle part of formation. About 5-45 meters thick.

		Madison Group (Upper Miss.-Lower Miss.) - includes the Mission Canyon Limestone and Lodgepole Limestone. Mission Canyon Limestone - Olive-gray to yellowish-gray and dark yellowish-brown, light-gray-weathering, medium- and thick-bedded to massive, generally fine- to medium-grained limestone. Locally cherty. Includes a few beds of dolomitic limestone in places. Upper part of formation includes pale red to grayish-orange limestone solution breccia. Thickness of up to 240 meters in Blacktail Mountains. Lodgepole Limestone - Medium to dark gray, fine- to medium-grained, thin- to thick-bedded limestone overlying medium to dark gray and brownish-gray, thin-bedded, laminated, argillaceous limestone containing thin interbeds and bedding partings of dark gray, shaly limestone and calcareous shale. Thickness is 180-230 meters in Blacktail Mountains.
A	Archean (undivided)	Includes quartzofeldspathic gneiss, amphibolite, interlayered schist and gneiss, and marble.

Appendix A2. Inventory of Monitored Wells

Site Name	MBMG Site Id#	USGS 7½' Quad Map	Location	Elevation @ Measuring Point (ft)	Measuring Point from Ground (ft)	Well Depth @ Measuring Point (ft)	Well Dia. (in)
Beaverhead River valley							
92-16	M:133382	Dillon West, Mont	07S 09W 24 CBDB	5117.49	2.16	204.67	6
92-17	M:133384	Dillon West, Mont	07S 08W 19 BADD	5089.00	1.61	327.16	6
92-18	M:133386	Dillon West, Mont	07S 08W 19 BADD	5089.13	1.37	80.66	6
92-19	M:133387	Dillon West, Mont	07S 09W 26 CDAD	5143.55	2.24	149.53	6
92-20	M:133390	Dillon West, Mont	07S 09W 26 CDAD	5144.11	2.39	20.28	6
92-21	M:133392	Dillon West, Mont	08S 09W 03 DACC	5184.61	2.25	487.30	6
92-22	M:133394	Dillon West, Mont	08S 09W 03 DACC	5184.57	2.22	50.81	6
92-23	M:133395	Dillon West, Mont	08S 09W 09 ADDB	5202.63	2.05	201.36	6
92-24	M:133396	Dillon West, Mont	08S 09W 09 ADDB	5202.33	1.80	52.47	6
92-25	M:133397	Dillon West, Mont	08S 09W 17 DCBA	5247.17	2.16	52.98	6
92-28	M:133400	Dillon West, Mont	07S 09W 23 CACD	5121.86	2.35	87.12	6
92-29	M:133402	Dillon West, Mont	07S 09W 23 CACD	5121.69	2.34	22.09	6
92-30	M:133403	Dillon West, Mont	07S 09W 24 BABA	5101.06	1.22	32.37	6
92-31	M:140584	Dillon West, Mont	07S 09W 13 CDDD	5097.07	2.27	34.26	6
92-32	M:133406	Dillon West, Mont	08S 09W 16 BDAC	5227.26	2.65	368.85	6
92-33	M:133409	Dillon West, Mont	08S 09W 16 BDAC	5227.66	2.81	55.56	6
93-1	M:144014	Dillon West, Mont	07S 09W 27 BDDB	5160.84	1.51	81.00	6
93-2	M:144016	Dillon West, Mont	07S 09W 34 ABBA	5154.30	1.52	41.43	6
93-3	M:144017	Dillon West, Mont	08S 09W 17 CAAB	5248	~2.0	420	6
B.M.I.	M:109925	Dillon West, Mont	08S 09W 17 CAAC	5250.49	1.73	45	8
Dawson	M:109840	Dillon West, Mont	08S 09W 03 BDDD	5180.97	1.08	40	6
Erb	M:145387	Dillon West, Mont	07S 09W 25 BBAD	5127.84	1.77	29.72	6
Intermtn Irrig.	M:145389	Dillon West, Mont	07S 08W 18 BDCB	5075.51	1.13		6
Mooney	M:126665	Dillon West, Mont	08S 09W 10 CDBB	5207.84	1.59	38	6
Piez #2		Dillon West, Mont	08S 09W 17 CADD	5242.66	1.07	10.84	½
Piez #3		Dillon West, Mont	08S 09W 17 CADD	5242.56	1.09	15.31	½
Piez #5		Dillon West, Mont	08S 09W 17 CADB	5243.71	0.89	10.34	½
Piez #6		Dillon West, Mont	08S 09W 17 CADB	5243.77	1.10	15.32	½
Piez #9		Dillon West, Mont	08S 09W 09 DAAB	5200.55	2.04	5.38	½
Piez #10		Dillon West, Mont	08S 09W 09 DAAB	5200.52	1.97	15.63	½
Piez #11		Dillon West, Mont	08S 09W 03 ACDB	5176.70	1.09	6.35	½
Piez #12		Dillon West, Mont	08S 09W 03 ACDB	5176.70	1.09	23.68	½
Piez #13		Dillon West, Mont	08S 09W 03 BDDC	5180.67	1.14	6.46	½
Piez #14		Dillon West, Mont	08S 09W 03 BDDC	5180.69	1.08	15.81	½
Piez #15		Dillon West, Mont	07S 09W 27 DDBC	5146.97	1.05	7.43	½
Piez #16		Dillon West, Mont	07S 09W 27 DDBC	5147.35	1.33	15.89	½
Piez #19		Dillon West, Mont	07S 09W 23 CACD	5120.83	1.84	12.42	1
Piez #20		Dillon West, Mont	07S 09W 23 CACD	5120.66	1.97	6.96	½
Piez #21		Dillon West, Mont	07S 09W 26 BACC	5130.86	1.82	7.17	½
Piez #22		Dillon West, Mont	07S 09W 26 BACC	5130.86	1.78	14.02	½
Rebich	M:125143	Dillon West, Mont	08S 09W 15 CBAB	5224.91	0.18	41	6
Sandpoint	M:145392	Dillon West, Mont	07S 09W 24 CBCA	5117.37	2.03	13.11	1
Tash	M:109703	Dillon West, Mont	07S 09W 34 ACDC	5160.88	1.39	47	6
Tash stock	M:109668	Dillon West, Mont	07S 09W 34 BBAB	5173.48	1.71	36.95	6

Site Name	MBMG Site Id#	USGS 7½' Quad Map	Location	Elevation @ Measuring Point (ft)	Measuring Point from Ground (ft)	Well Depth @ Measuring Point (ft)	Well Dia. (in)
Blacktail Deer Creek valley							
91-1	M:126669	Ashbough Canyon, Mont	09S 08W 10 BCDC	5586.11	1.70	57.02	2
91-2	M:126666	Ashbough Canyon, Mont	08S 08W 33 CDBB	5501.24	1.75	96.25	2
91-3	M:126662	Ashbough Canyon, Mont	08S 08W 28 CBDA	5448.66	1.70	66.79	2
91-4	M:126664	Ashbough Canyon Mont	08S 08W 32 CCAB	5500.66	1.45	150.26	2
91-5	M:126663	Ashbough Canyon, Mont	08S 08W 30 AAAA	5399.58	1.66	106.91	2
91-6	M:126661	Dillon East, Mont	08S 08W 18 DCCD	5352.83	1.74	122.48	2
91-7	M:133329	Dillon West, Mont	08S 09W 01 DDAA	5250.64	1.98	62.29	2
92-1	M:131129	Ashbough Canyon, Mont	09S 08W 14 CDAD	5676.66	1.65	120.90	6
92-2	M:131130	Ashbough Canyon, Mont	09S 08W 14 CDAD	5677.08	2.15	27.13	6
92-3	M:140579	Ashbough Canyon, Mont	09S 08W 02 BBCC	5730	2.30	260	6
92-4	M:131122	Ashbough Canyon, Mont	08S 08W 32 DABD	5484.03	1.94	160.42	6
92-5	M:133332	Dillon East, Mont	08S 08W 20 ACCA	5400.45	1.42	177.89	6
92-6	M:133371	Gallagher Mountain, Mont	08S 08W 31 CCAA	5522.87	2.17	207.30	6
92-7	M:133372	Gallagher Mountain, Mont	09S 08W 07 DBDC	5679.63	1.55	226.36	6
92-8	M:133373	Gallagher Mountain, Mont	08S 08W 30 CCCC	5441.56	1.41	341.41	6
92-9	M:133374	Gallagher Mountain, Mont	08S 08W 30 CCCC	5442.14	2.38	229.10	6
92-10	M:133375	Gallagher Mountain, Mont	08S 09W 23 DADD	5317.89	1.89	281.46	6
92-11	M:133376	Gallagher Mountain, Mont	08S 09W 23 DADD	5317.88	1.87	100.04	6
92-12	M:133377	Dillon West, Mont	08S 09W 14 ABDD	5270.54	1.62	401.78	6
92-13	M:133378	Dillon West, Mont	08S 09W 14 ABDD	5270.41	1.53	175.30	6
92-14	M:140582	Dillon West, Mont	08S 08W 06 CBDD	5248.30	1.61	320.02	6
92-15	M:133380	Dillon West, Mont	07S 08W 31 BCAD	5218.45	1.68	510.68	6
92-34	M:140585	Dillon West, Mont	08S 09W 22 ABAA	5253.90	1.50	66.25	6
92-35	M:140586	Dillon West, Mont	08S 09W 22 ABAA	5247.92	1.64	61.78	6
94-2	M:149512	Dillon West, Mont	07S 09W 36 CCAA	5195.05	1.86	358.31	6
Blake #1	M:109936	Dillon West, Mont	08S 09W 23 BCDA	5278.94	0.65	300	16
Blake #2	M:109935	Dillon West, Mont	08S 09W 23 ADCB	5299.81	0.85	300	16
Casey	M:109904	Dillon West, Mont	08S 09W 14 CBBB	5247.78	1.66	80	6
Cornell	M:109658	Dillon West, Mont	07S 09W 25 AADD	5181.45	2.59	69	6
Downey	M:109659	Dillon West, Mont	07S 09W 25 ACAB	5144.59	1.30	40	6
Eberline	M:145386	Dillon West, Mont	07S 09W 35 ACBD	5161.72	1.32	40	6
Forrester	M:109803	Dillon East, Mont	08S 08W 20 ACCA	5400.11	0	183.73	20
Gaasch, D.	M:145391	Dillon West, Mont	07S 08W 30 DCDA	5248.79	0.77	150	6
Gund-Ream	M:145388	Dillon West, Mont	08S 09W 03 DADD	5199.16	1.64		6
Hemsley	M:109940	Dillon West, Mont	08S 09W 24 BBBC	5309.67	1.28	82	6
High Mtn Ranch	M:109945	Gallagher Mountain, Mont	08S 09W 24 DDDD	5365.22	1.19	119	6
High Mtn stock	M:109794	Dillon West, Mont	08S 08W 07 DCCC	5304.81	2.38	80	6
High Mtn #1	M:109796	Dillon East, Mont	08S 08W 07 DDDD	5315.09	1.19	186	20
High Mtn #2	M:109800	Dillon East, Mont	08S 08W 07 DDDC	5312.35	1.12	300	20
High Mtn #3	M:109896	Dillon West,Mont	08S 09W 13 BAAB	5281.03	0.70	300	20
Humphrey	M:109789	Dillon East, Mont	08S 08W 06 ADDD	5294.64	1.56	94	6
Matador #1	M:109819	Ashbough Canyon, Mont	08S 08W 32 DACA	5483.34	0.25	165	24
Matador #4	M:109812	Ashbough Canyon, Mont	08S 08W 29 CDAA	5445.49	0.89	172	20
Matador #5	M:110033	Ashbough Canyon, Mont	09S 08W 04 CAAC	5535.29	0.46	150	20
Matador #16	M:110037	Gallagher Mountain, Mont	09S 08W 07 DBDB	5667.53	1.27	405	20
Meine	M:131128	Gallagher Mountain, Mont	08S 09W 24 DCDC	5353.44	1.50	117	6
Mitchell stock	M:145390	Dillon West, Mont	07S 08W 31 BCAD	5219.97	2.23	93	6

Site Name	MBMG Site Id#	USGS 7½' Quad Map	Location	Elevation @ Measuring Point (ft)	Measuring Point from Ground (ft)	Well Depth @ Measuring Point (ft)	Well Dia. (in)
Blacktail Deer Creek valley (cont.)							
Petersen	M:109717	Dillon West, Mont	07S 09W 36 CDBB	5194.02	0.97	41	6
Petersen	M:109715	Dillon West, Mont	07S 09W 36 BCCC	5179.26	0	42	6
Pilon	M:109713	Dillon West, Mont	07S 09W 35 CDCC	5181.01	1.37	30	6
Reynolds	M:109662	Dillon West, Mont	07S 09W 25 DCCC	5154.77	-1.93	26	6
Ripley	M:109795	Dillon East, Mont	08S 08W 07 DAAC	5287.46	1.74	75	8
Schuett	M:109891	Dillon West, Mont	08S 09W 11 BDDB	5227.21	-5.57	54	6
Svendsen	M:121424	Dillon West, Mont	07S 08W 30 CADC	5208.24	2.47	130	6
USGS	M:135736	Dillon West, Mont	08S 09W 01 CCCC	5237.14	2.09	47	6
Weekes	M:109890	Dillon West, Mont	08S 09W 10 DDAA	5232.49	2.0	58	6
Wharton	M:123861	Dillon West, Mont	08S 09W 14 CBBC	5251.16	2.14	80	6
Woody	M:120986	Gallagher Mountain, Mont	08S 09W 24 CBAC	5324.30	0.86	100	6
Zenchiku #1	M:109951	Gallagher Mountain, Mont	08S 09W 25 AACD	5375	0.65	715	16
Zenchiku #2	M:109953	Gallagher Mountain, Mont	08S 09W 26 BBDD	5325	0	485	20
Zenchiku #3	M:109952	Gallagher Mountain, Mont	08S 09W 26 ABBA	5318	0.40	415	16
Zenchiku #5	M:149188	Dillon West, Mont	08S 09W 14 CDDD	5275	0.30	405	20
Zenchiku #6	M:151492	Gallagher Mountain, Mont	08S 09W 25 BAAA	5358.41	0.55	400	20
Rattlesnake Creek valley							
92-26	M:133398	Dillon West, Mont	07S 09W 33 DAAA	5174.76	2.15	94.52	6
92-27	M:133399	Dillon West, Mont	07S 09W 33 CBDD	5190.24	1.47	182.97	6
94-1	M:149511	Dillon West, Mont	08S 09W 08 AAAA	5214.06	1.92	276.81	6
Boka	M:109869	Dillon West, Mont	08S 09W 08 DDCB	5235.16	1.26	60	6
Bott	M:145393	Dillon West, Mont	08S 09W 05 CBCD	5239.39	3.26	74.91	6
Harrington	M:145395	Burns Mountain, Mont	07S 10W 12 CBDC	5600	0.53		6
Holland	M:145396	Burns Mountain, Mont	07S 10W 25 AAAB	5393.21	1.46		6
Holland stock	M:109683	Dillon West, Mont	07S 09W 31 DAAA	5282.08	1.31	80	6
Hursh	M:145394	Dillon West, Mont	07S 09W 29 CCDD	5266.24	1.90		6
Hursh irrig.	M:109686	Dillon West, Mont	07S 09W 29 CCCA	5279.54		220	20
Johnson irrig.	M:109691	Dillon West, Mont	07S 09W 33 DAAA	5172.65	0.73	80	20
Laden irrig.	M:109699	Dillon West, Mont	07S 09W 33 CACC	5190.49	0.38	200	20
Mautz Ranch	M:109846	Dillon West, Mont	08S 09W 04 BDAB	5192.71	0.54	25.24	6
Proctor	M:145397	Burns Mountain, Mont	07S 10W 24 CCDD	5424	0.52		6
Rawson	M:123858	Burns Mountain, Mont	07S 10W 15 ADDC	5622	1.00	155	6
Rice	M:109872	Dillon West, Mont	08S 09W 09 BCDD	5213.44	-4.47	52	6
Stewart	M:109675	Dillon West, Mont	07S 09W 28 CDAC	5225.68	1.39	38	6
Stewart irrig.	M:109678	Dillon West, Mont	07S 09W 28 CDDB	5220.54	2.08	140	20
Unruh	M:145398	Dillon West, Mont	07S 09W 33 ADDD	5172.09	1.53	103.63	6
Yuhas	M:109858	Dillon West, Mont	08S 09W 08 ABCA	5224.56	2.36	54	6

Site Name	MBMG Site Id #	Perforated or Screened Interval(s) (ft)	Well Open Bottom	Yield (gpm)	Date Well Completed	Primary Use of Water
			Beaverhead River valley			
92-16	M:133382	190-197	Y	60	04/20/93	Mon.
92-17	M:133384	315½-325½	N	20	04/08/93	Mon.
92-18	M:133386	74-77½	Y	35	03/15/93	Mon.
92-19	M:133387	96-100	N	20	11/17/92	Mon.
92-20	M:133390		Y	35	11/18/92	Mon.
92-21	M:133392	475-485	N	15	04/02/93	Mon.
92-22	M:133394	43-48	Y	30	03/11/93	Mon.
92-23	M:133395	191-196	Y	200	11/12/92	Mon.
92-24	M:133396	43-48	Y	80	11/13/92	Mon.
92-25	M:133397	43½-47½	Y	50	10/06/92	Mon.
92-28	M:133400	76-80	Y	4	04/14/93	Mon.
92-29	M:133402	17½-19	Y	5	04/14/93	Mon.
92-30	M:133403	22-24	Y	5	04/05/93	Mon.
92-31	M:140584	20-31	N	3	04/15/93	Mon.
92-32	M:133406		Y	25	06/01/93	Mon.
92-33	M:133409	46-51	Y	40	06/01/93	Mon.
93-1	M:144014	61-81	N	23	10/14/94	Mon.
93-2	M:144016		Y	23	10/14/94	Mon.
93-3	M:144017		Y	0	11/09/94	Mon.
B.M.I.	M:109925		Y	120	08/ /59	Irrig.
Dawson	M:109840		Y	20	10/10/71	Dom.
Erb	M:145387		Y			Stock
Intermtn Irrig.	M:145389		Y			Irrig.
Mooney	M:126665		Y	18	/92	Stock
Piezometer #2			Y	1		Mon.
Piezometer #3			Y	1		Mon.
Piezometer #5			Y	1		Mon.
Piezometer #6			Y	1		Mon.
Piezometer #9			Y	1		Mon.
Piezometer #10			Y	1		Mon.
Piezometer #11			Y	1		Mon.
Piezometer #12			Y	1		Mon.
Piezometer #13			Y	1		Mon.
Piezometer #14			Y	1		Mon.
Piezometer #15			Y	1		Mon.
Piezometer #16			Y	1		Mon.
Piezometer #19			Y	1		Mon.
Piezometer #20			Y	1		Mon.
Piezometer #21			Y	1		Mon.
Piezometer #22			Y	1		Mon.
Rebich	M:125143		Y	30	03/30/78	Dom.
Sandpoint	M:145392		Y	2	06/ /93	Mon.
Tash	M:109703		Y	10	10/25/78	Dom.
Tash stock	M:109668		Y	20		Stock

Site Name	MBMG Site Id #	Perforated or Screened Interval(s) (ft)	Well Open Bottom	Yield (gpm)	Date Well Completed	Primary Use of Water
Blacktail Deer Creek valley						
91-1	M:126669	45½-55½	N	5	08/30/91	Mon.
91-2	M:126666	84-94	N	5	09/03/91	Mon.
91-3	M:126662	55½-65½	N	5	09/01/91	Mon.
91-4	M:126664	142-152	N	5	09/13/91	Mon.
91-5	M:126663	95½-105½	N	5	09/16/91	Mon.
91-6	M:126661	110½-120½	N	5	09/18/91	Mon.
91-7	M:133329	50½-60½	N	5	09/26/91	Mon.
92-1	M:131129	109¼-119¼	N	3	10/16/92	Mon.
92-2	M:131130	15½-19½	Y	40	10/09/92	Mon.
92-3	M:140579		Y	0	03/10/93	Mon.
92-4	M:131122	130-135,145-150	Y	75	11/09/92	Mon.
92-5	M:133332	86-91,124-127, 147-152,164-169	Y	60	04/22/93	Mon.
92-6	M:133371	207-217	Y	7	03/09/93	Mon.
92-7	M:133372	205-225	N	30	05/18/93	Mon.
92-8	M:133373	323-330	N	30	03/05/93	Mon.
92-9	M:133374	219-226	N	20	03/09/93	Mon.
92-10	M:133375	269½-279½	Y	200	03/24/93	Mon.
92-11	M:133376	93-98	Y	30	03/12/93	Mon.
92-12	M:133377	390-396	Y	200	03/17/93	Mon.
92-13	M:133378	100-105,135-140, 165-170	Y	200	03/19/93	Mon.
92-14	M:140582	52-57,70-76, 140-150, 239-245, 253-258	Y	75	11/10/93	Mon.
92-15	M:133380		Y	15	11/04/93	Mon.
92-34	M:140585	61½-63	Y	15	11/10/93	Mon.
92-35	M:140586	57-58½	Y	20	11/10/93	Mon.
94-2	M:149512	275-280, 285-300	Y	20	06/08/95	Mon.
Blake #1	M:109936	80-300	Y	1,800	02/26/80	Irrig.
Blake #2	M:109935	55-300	Y	1,800	03/20/80	Irrig.
Casey	M:109904		Y	20	04/27/88	Dom.
Cornell	M:109658		Y	30	05/01/78	Dom.
Downey	M:109659		Y	20	05/05/82	Dom.
Eberline	M:145386		Y			Dom.
Forrester	M:109803	46-186	Y	1,300	05/ /51	Irrig.
Gaasch, D.	M:145391		Y	25		Dom.
Gund-Ream	M:145388		Y	10		Dom.
Hemsley	M:109940		Y	40	04/28/89	Dom.
High Mtn Ranch	M:109945		Y	20	08/24/87	Dom.
High Mtn stock	M:109794		Y	20	03/16/89	Stock
High Mtn #1	M:109796	59-169	Y	2,300	09/ /51	Irrig.
High Mtn #2	M:109800	53-302	Y	2,100	08/30/77	Irrig.
High Mtn #3	M:109896	40-280	Y	960	03/04/84	Irrig.
Humphrey	M:109789		Y	14	08/06/82	Dom.
Matador #1	M:109819	100-160	Y	2,000	11/01/51	Irrig.
Matador #4	M:109812	35-165	Y	2,000	05/14/52	Irrig.

Site Name	MBMG Site Id #	Perforated or Screened Interval(s) (ft)	Well Open Bottom	Yield (gpm)	Date Well Completed	Primary Use of Water
Blacktail Deer Creek valley (cont.)						
Matador #5	M:110033	65-140	Y	800	12/16/52	Irrig.
Matador #16	M:110037	140-240,240-360	Y	980	03/09/64	Irrig.
Meine	M:131128		Y	20	05/04/78	Dom.
Mitchell stock	M:145390		Y	30	10/29/90	Stock
Petersen	M:109717		Y	30	06/26/80	Dom.
Petersen	M:109715		Y	20	10/11/74	Dom.
Pilon	M:109713		Y	15	08/17/78	Dom.
Reynolds	M:109662		Y	15		Dom.
Ripley	M:109795		Y	20	10/15/81	Dom.
Schuett	M:109891		Y	20	10/18/88	Dom.
Svendsen	M:121424		Y	20	10/29/90	Dom.
USGS	M:135736		Y	0		Mon.
Weekes	M:109890		Y	35	05/17/84	Dom.
Wharton	M:123861		Y	30	08/03/91	Dom.
Woody	M:120986		Y	20	07/18/90	Dom.
Zenchiku #1	M:109951	150-185,200-280, 302-690	Y	2,250	06/18/75	Irrig.
Zenchiku #2	M:109953	170-450	Y	1,000	11/10/74	Irrig.
Zenchiku #3	M:109952	75-415	Y	2,250	10/31/78	Irrig.
Zenchiku #5	M:149188	104-404	Y	1,500		Irrig.
Zenchiku #6	M:151492	95-370	Y	2,000	05/20/74	Irrig.
Rattlesnake Creek valley						
92-26	M:133398	81-86	Y	90	11/19/92	Mon.
92-27	M:133399	65-70,160-165, 168-175	Y	40	04/13/93	Mon.
94-1	M:149511		Y	150	06/14/95	Mon.
Boka	M:109869		Y	20	04/30/82	Dom.
Bott	M:145393		Y			Stock
Harrington	M:145395		Y			Dom.
Holland	M:145396		Y			Dom.
Holland stock	M:109683		Y	30	11/11/83	Stock
Hursh	M:145394		Y			Dom.
Hursh irrig.	M:109686	10-185	Y	600	12/ /79	Irrig.
Johnson irrig.	M:109691	20-80	Y	1,800	/78	Irrig.
Laden irrig.	M:109699	20-200	Y	1,120	07/10/82	Irrig.
Mautz Ranch	M:109846		Y	30		Stock
Proctor	M:145397		Y			Stock
Rawson	M:123858		Y	25	07/22/91	Dom.
Rice	M:109872		Y	30	11/07/64	Dom.
Stewart	M:109675		Y	18	08/06/73	Dom.
Stewart irrig.	M:109678	18-112	Y	350	08/28/85	Irrig.
Unruh	M:145398		Y	15		Dom.
Yuhas	M:109858		Y	20	04/13/81	Stock

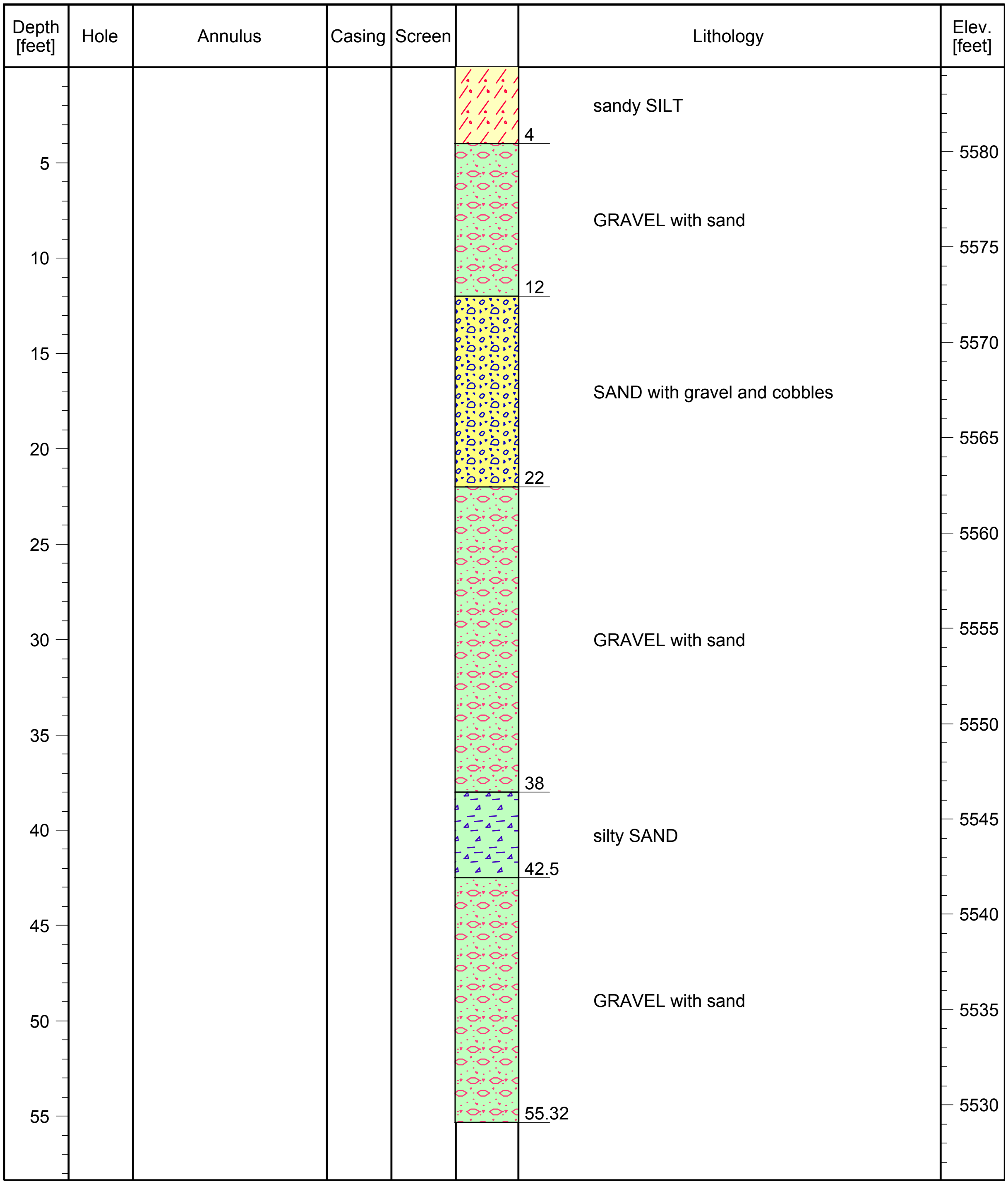
Appendix A3. Well Lithology Diagrams
Upper Blacktail Deer Creek Valley

Well Lithology

Well Identification 91-1	**MBMG Site #** M:126669	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 91-1

Location 09S 08W 10 BCDC	**Ground Surface Elev. (ft)** 5584.41	**Measuring Point Elev. (ft)** 5586.11	**Well Depth below m.p. (ft)** 57.02	**Vertical Scale** 100

Date Completed 8/30/1991	**Drilling Method** air rotary	**Well Dia. (in)** 2.0	**Perforated or Screened Interval (ft)** 45.5 - 55.5	**Yield (gpm)** 5	**Use** monitoring



Well Lithology

Well Identification 91-2

MBMG Site # M:126666

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 91-2

Location 08S 08W 33 CDBB

Ground Surface Elev. (ft) 5499.49

Measuring Point Elev. (ft) 5501.24

Well Depth below m.p. (ft) 96.25

Vertical Scale 175

Date Completed 9/3/1991

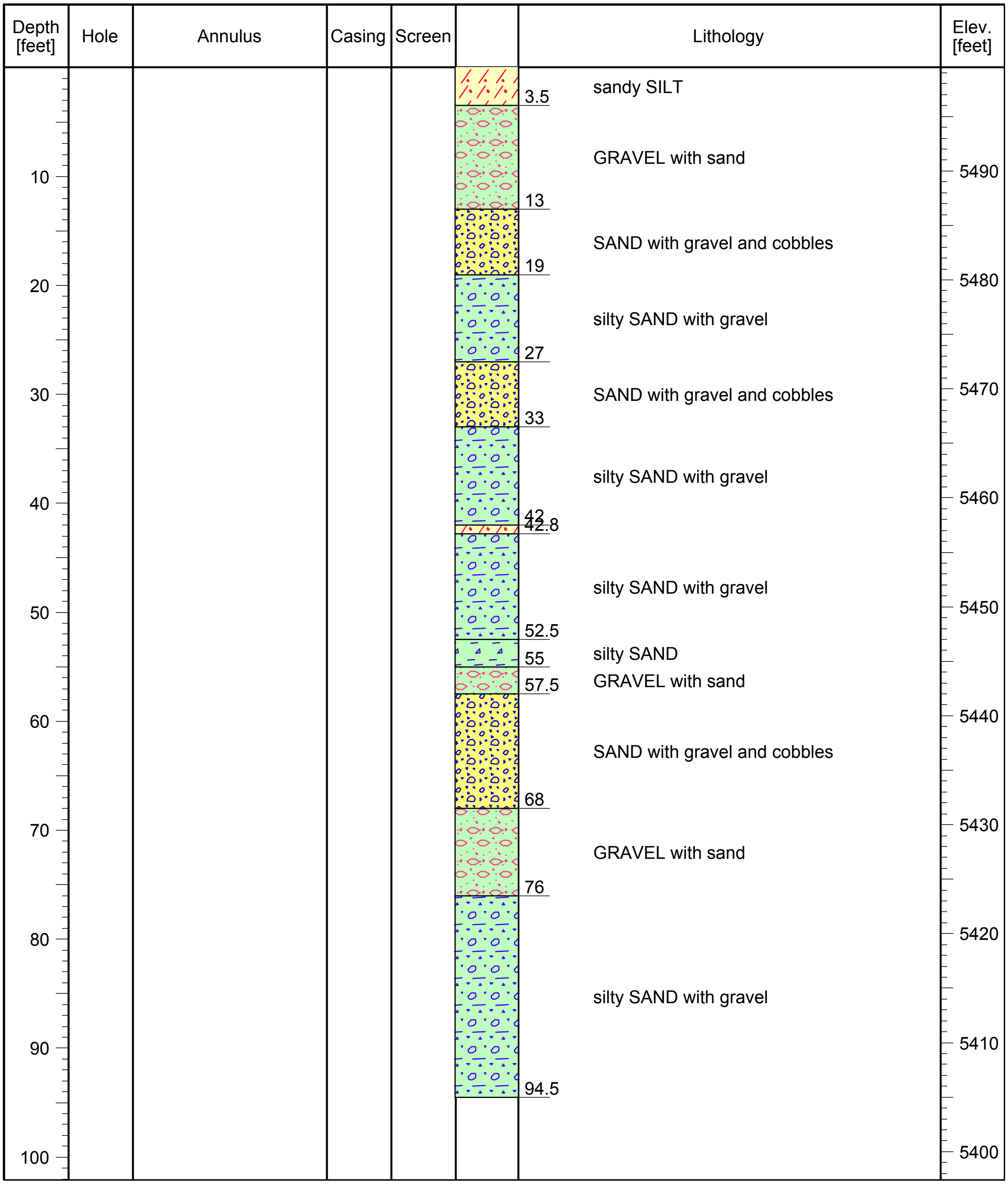
Drilling Method air rotary

Well Dia. (in) 2.0

Perforated or Screened Interval (ft) 84 - 94

Yield (gpm) 5

Use monitoring



Well Lithology

Well Identification 91-3

MBMG Site # M:126662

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 91-3

Location 08S 08W 28 CBDA

Ground Surface Elev. (ft) 5446.96

Measuring Point Elev. (ft) 5448.66

Well Depth below m.p. (ft) 66.79

Vertical Scale 125

Date Completed 9/1/1991

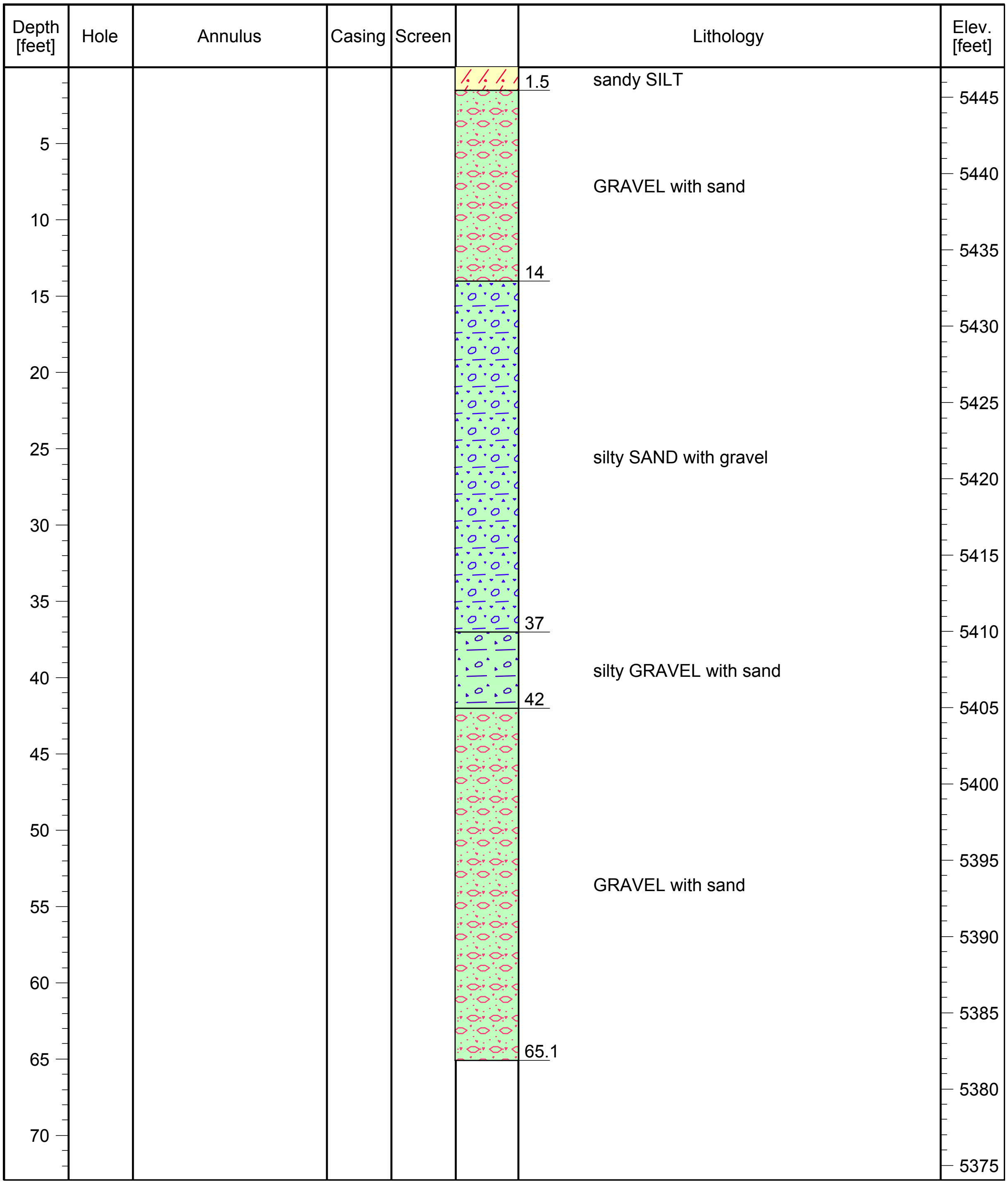
Drilling Method air rotary

Well Dia. (in) 2.0

Perforated or Screened Interval (ft) 55.5 - 65.5

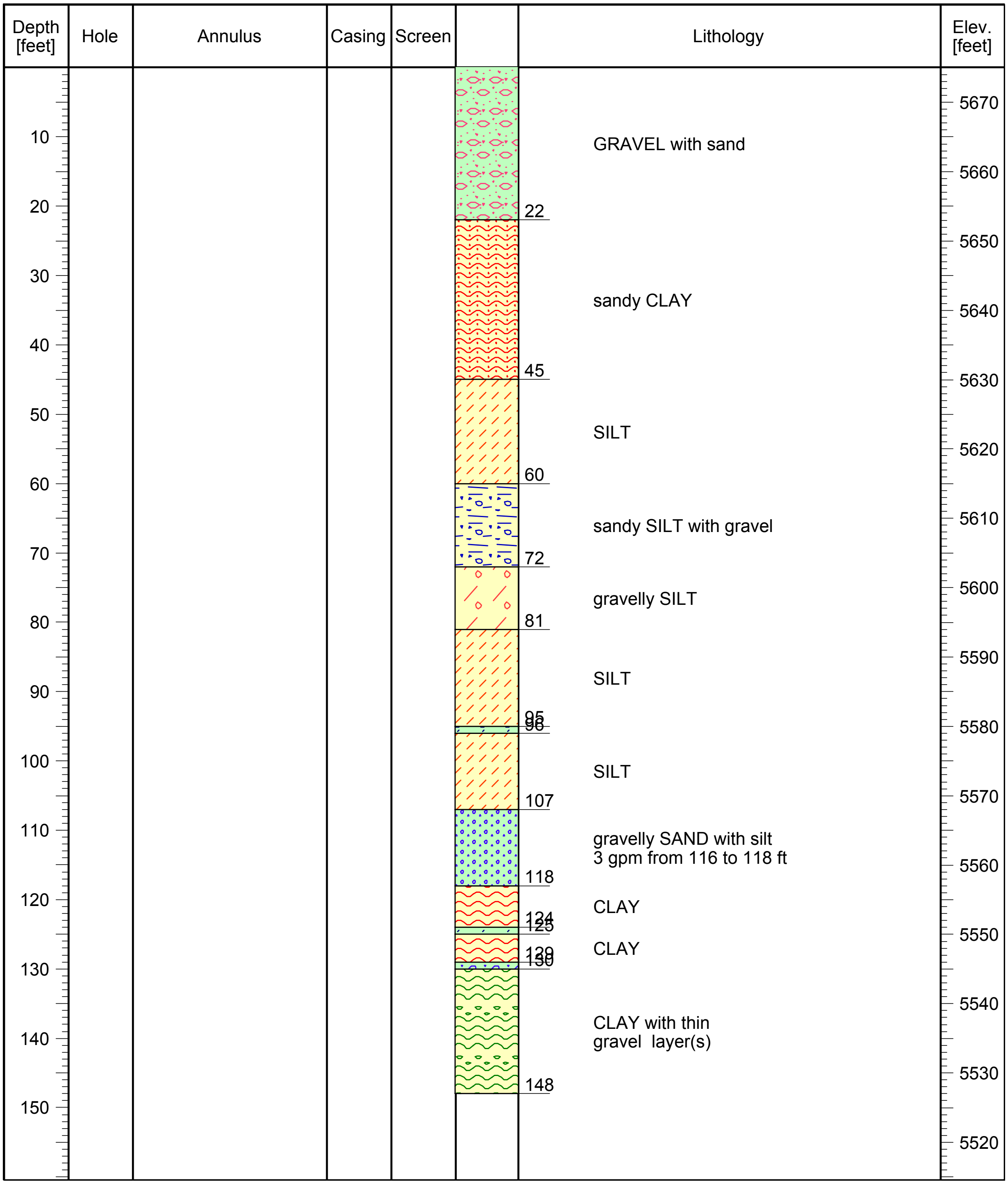
Yield (gpm) 5

Use monitoring



Well Lithology

Well Identification 92-1	**MBMG Site #** M:131129	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-1	
Location 09S 08W 14 CDAD	**Ground Surface Elev. (ft)** 5675.01	**Measuring Point Elev. (ft)** 5676.66	**Well Depth below m.p. (ft)** 120.90
Vertical Scale 275			
Date Completed 10/16/1992	**Drilling Method** air rotary	**Well Dia. (in)** 2.0	**Perforated or Screened Interval (ft)** 109.5 - 119.5
Yield (gpm) 3	**Use** monitoring		



Well Lithology

Well Identification 92-2

MBMG Site # M:131130

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-2

Location 09S 08W 14 CDAD

Ground Surface Elev. (ft) 5674.93

Measuring Point Elev. (ft) 5677.08

Well Depth below m.p. (ft) 27.13

Vertical Scale 50

Date Completed 10/9/1992

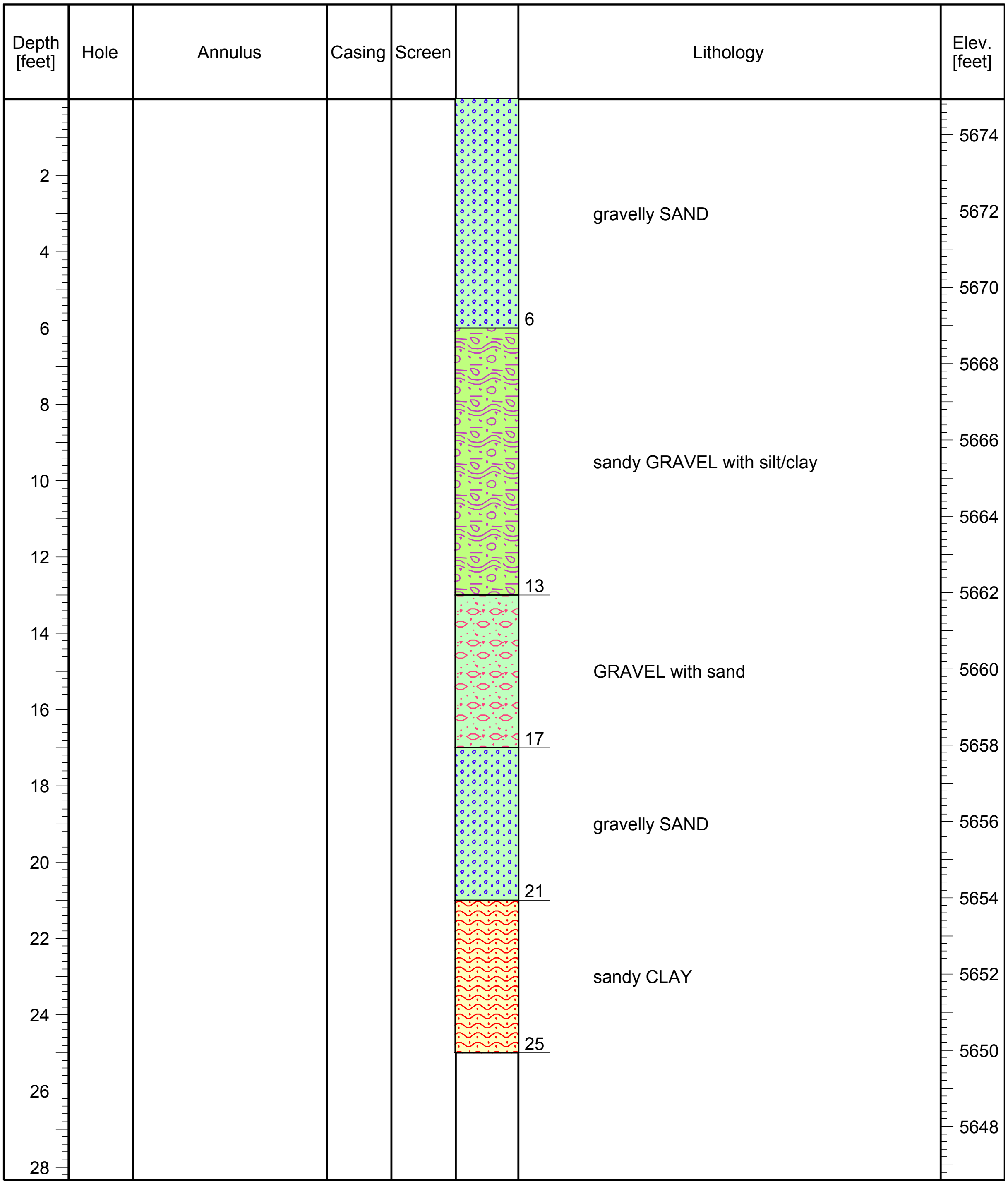
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 15.5 - 19.5

Yield (gpm) 40

Use monitoring



Well Lithology

Well Identification 92-3

MBMG Site # M:140579

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-3

Location 09S 08W 02 BBCC

Ground Surface Elev. (ft) 5727.70

Measuring Point Elev. (ft) 5730.00

Well Depth below m.p. (ft) 260.00

Vertical Scale 450

Date Completed 3/10/1993

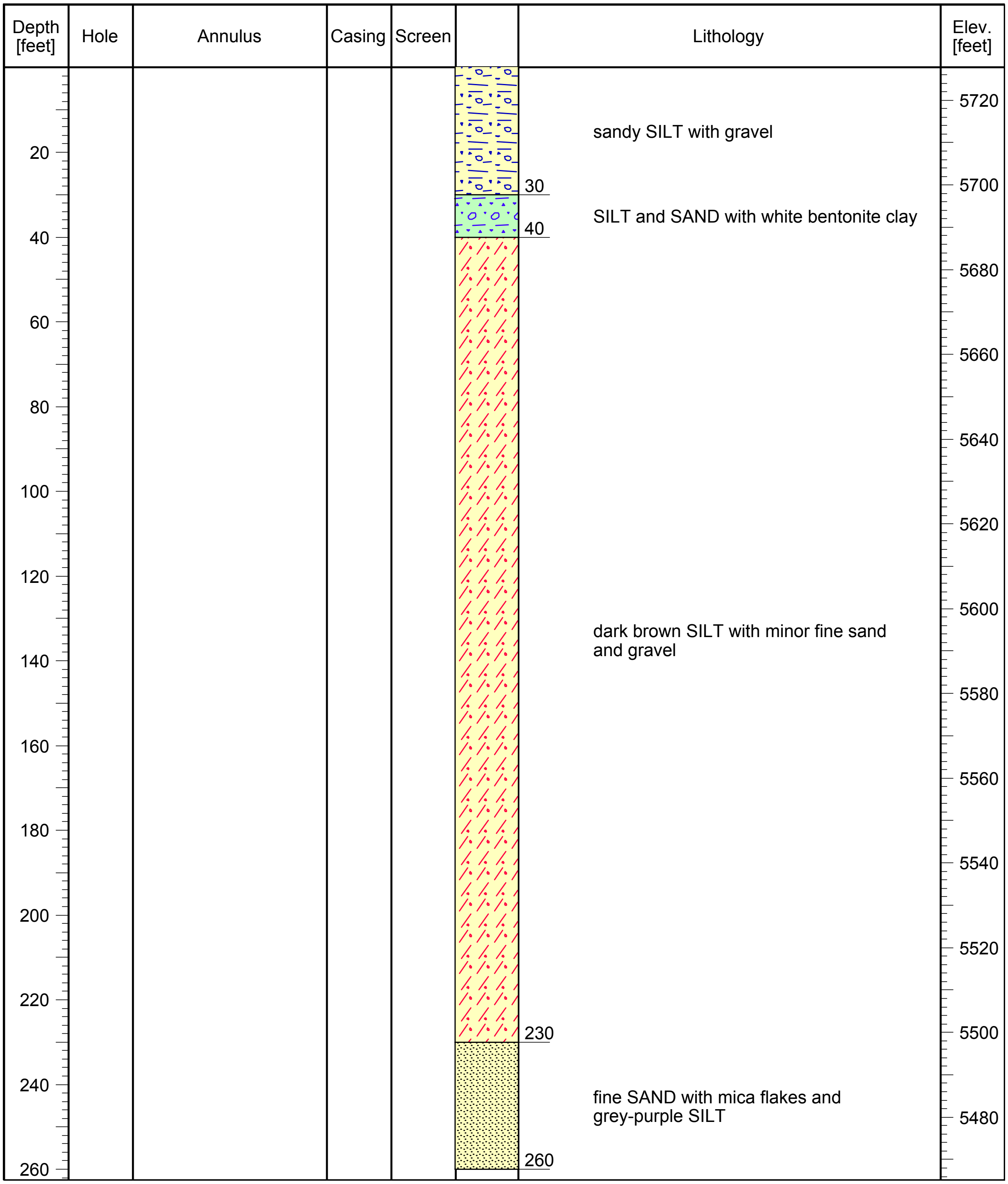
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) none

Yield (gpm) 0

Use monitoring



Well Lithology

Well Identification
92-4

MBMG Site #
M:131122

Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-4

Location
08S 08W 32 DABD

Ground Surface Elev. (ft)
5482.09

Measuring Point Elev. (ft)
5484.03

Well Depth below m.p. (ft)
160.42

Vertical Scale
275

Date Completed
11/9/1992

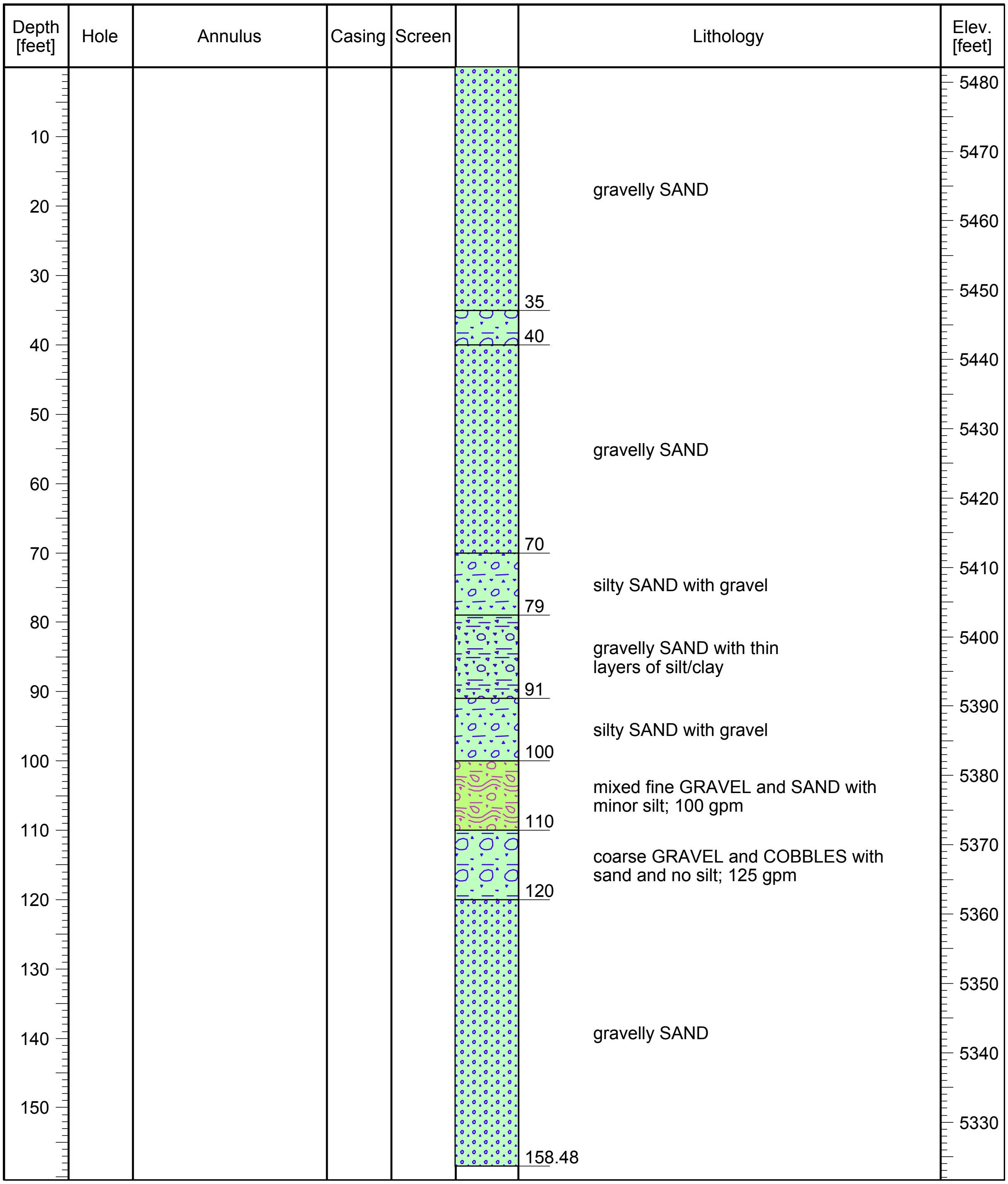
Drilling Method
air rotary

Well Dia. (in)
6.0

Perforated or Screened Interval (ft)
130-135, 145-150

Yield (gpm)
75

Use
monitoring



Well Lithology

Well Identification MATADOR1

MBMG Site # M:109819

Well Name or Well Owner Matador Ranch irrigation well #1

Location 08S 08W 32 DACA

Ground Surface Elev. (ft) 5483.09

Measuring Point Elev. (ft) 5483.34

Well Depth below m.p. (ft) 165.00

Vertical Scale 300

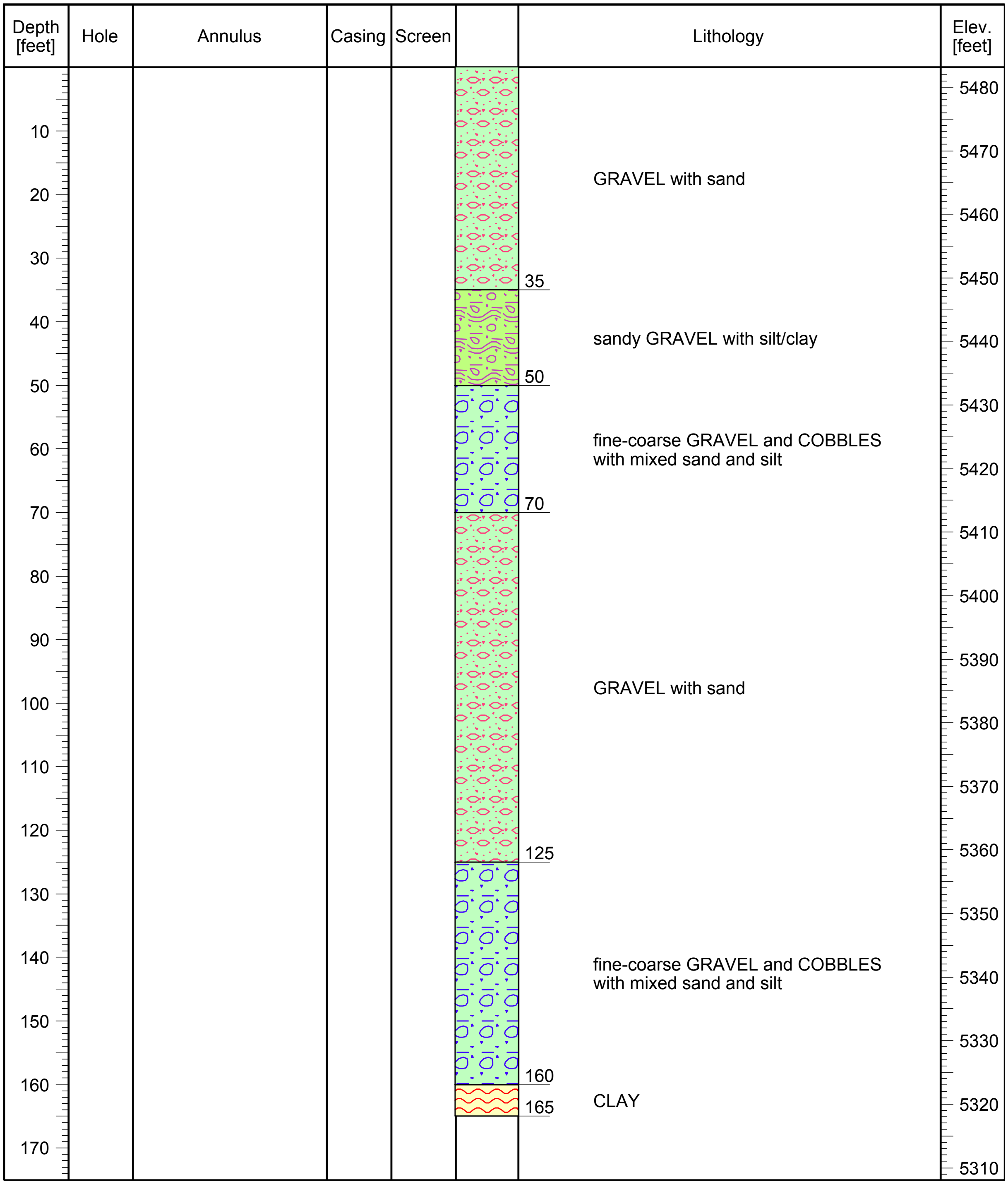
Date Completed 11/1/1951

Well Dia. (in) 24.

Perforated or Screened Interval (ft) 100 - 160

Yield (gpm) 2000

Use irrigation



Well Lithology

Well Identification MATADOR2

MBMG Site # M:110034

Well Name or Well Owner Matador Ranch irrigation well #2

Location 09S 08W 05 ACB

Ground Surface Elev. (ft) 5523.00

Well Depth below m.p. (ft) 168.00

Vertical Scale 300

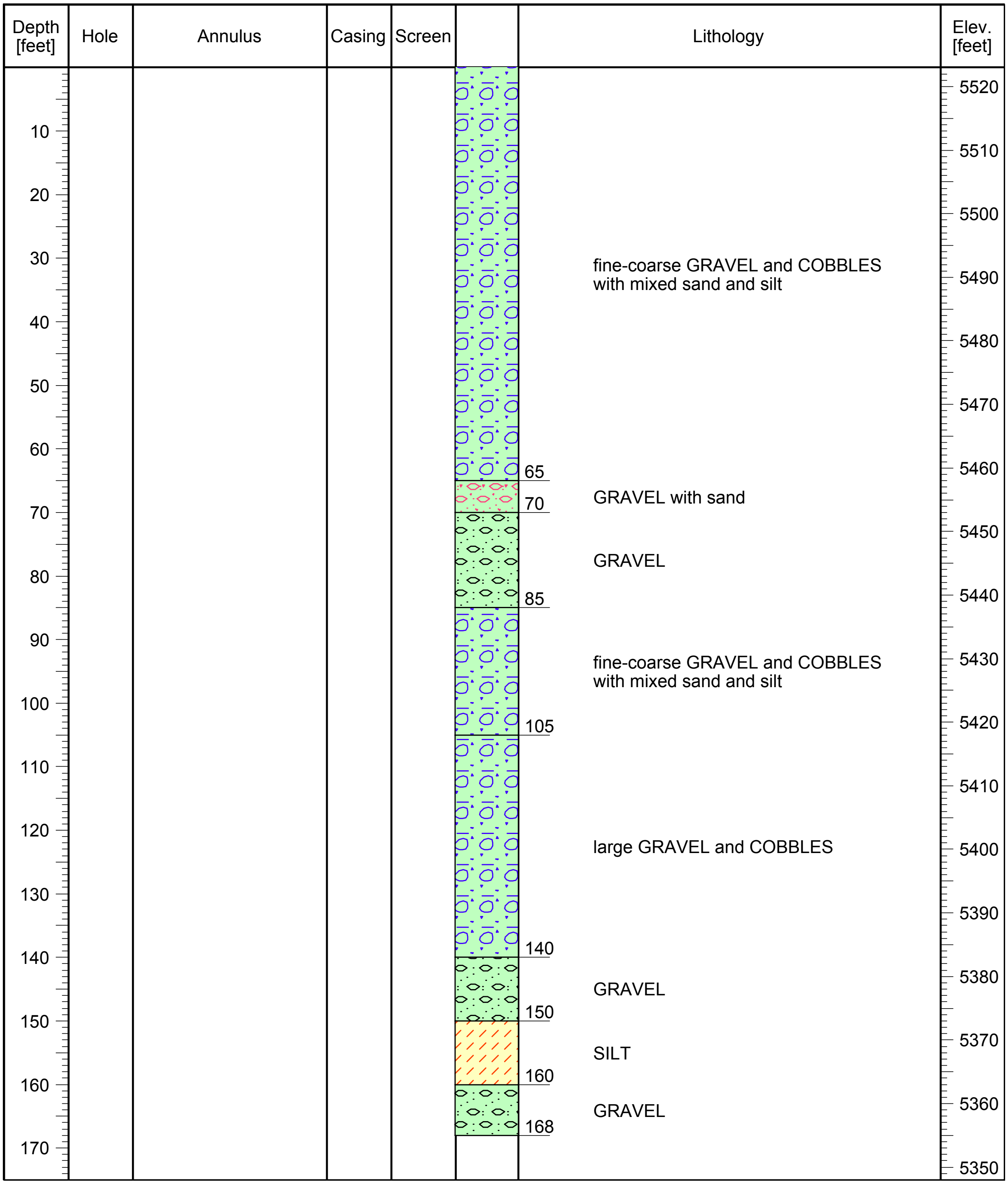
Date Completed 2/12/1952

Well Dia. (in) 24.

Perforated or Screened Interval (ft) 75 - 160

Yield (gpm) 1100

Use none



Well Lithology

Well Identification MATADOR3

MBMG Site # M:110030

Well Name or Well Owner Matador Ranch irrigation well #3

Location 09S 08W 04 ABB

Ground Surface Elev. (ft) 5520.00

Well Depth below m.p. (ft) 154.00

Vertical Scale 275

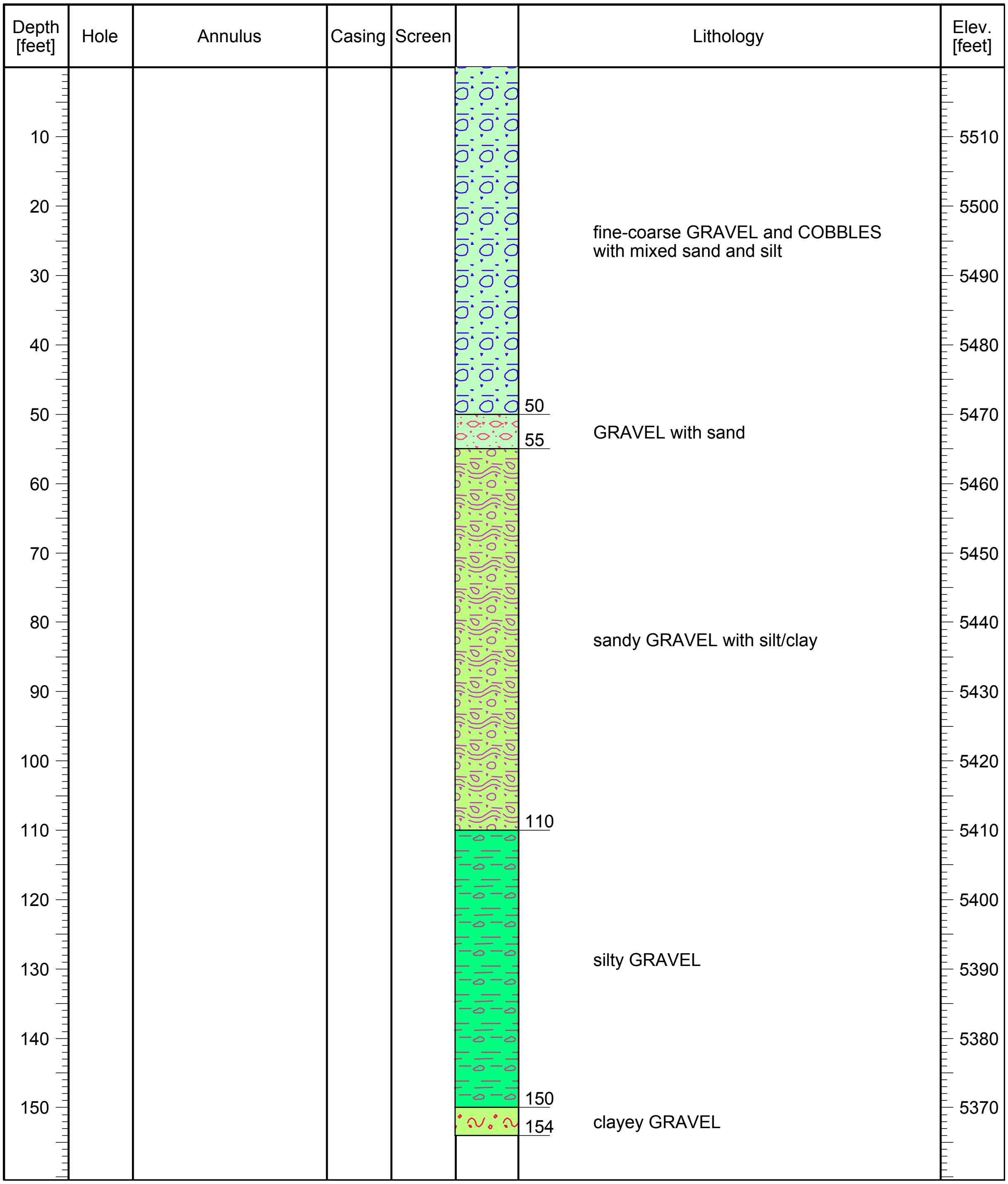
Date Completed 4/14/1952

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 70 - 145

Yield (gpm) 1100

Use none



Well Lithology

Well Identification MATADOR4

MBMG Site # M:109812

Well Name or Well Owner Matador Ranch irrigation well #4

Location 08S 08W 29 CDAA

Ground Surface Elev. (ft) 5444.60

Measuring Point Elev. (ft) 5445.49

Well Depth below m.p. (ft) 172.00

Vertical Scale 300

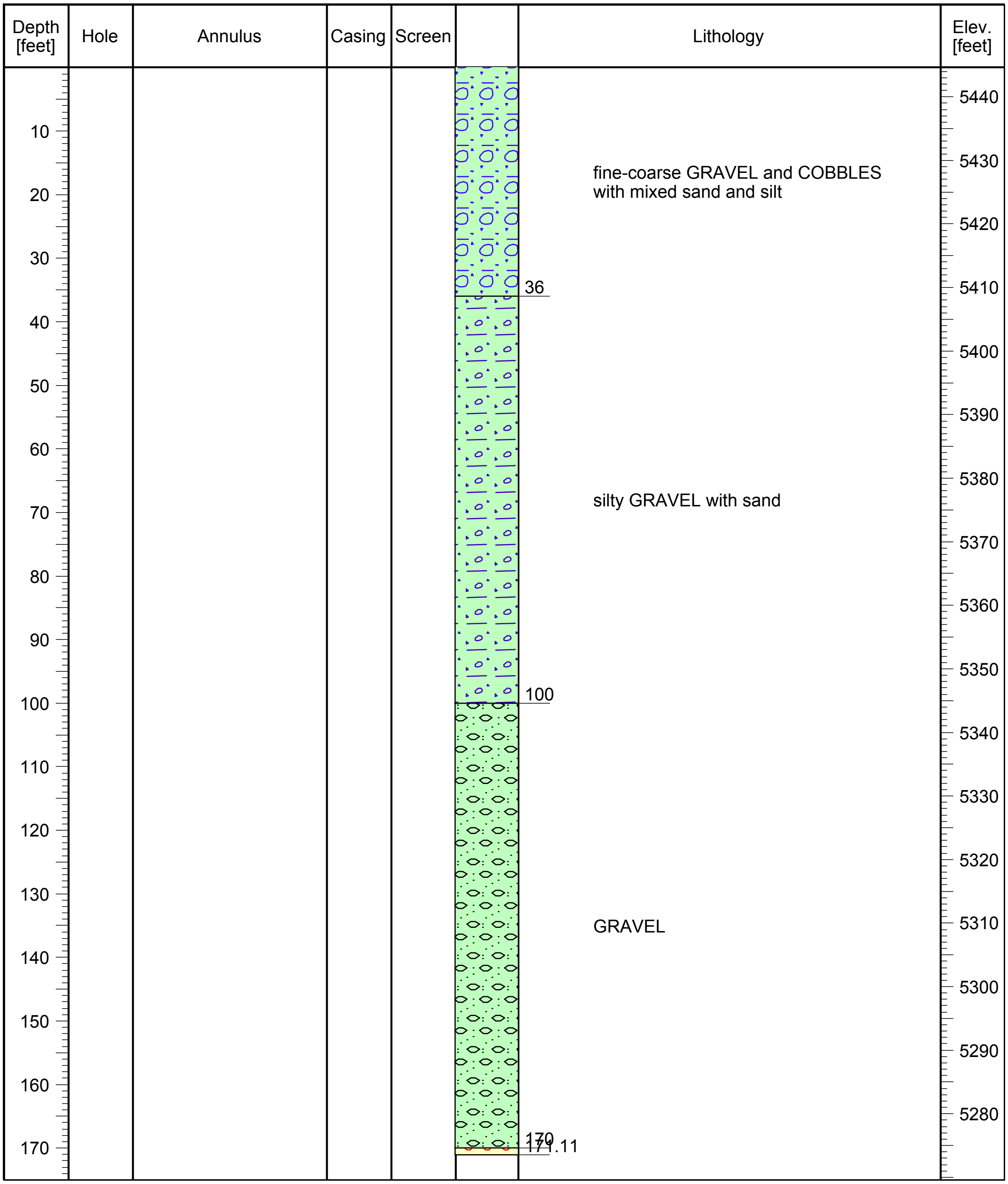
Date Completed 5/14/1952

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 35 - 165

Yield (gpm) 2000

Use irrigation



Well Lithology

Well Identification MATADOR5

MBMG Site # M:110033

Well Name or Well Owner Matador Ranch irrigation well #5

Location 09S 08W 04 CAAC

Ground Surface Elev. (ft) 5534.83

Measuring Point Elev. (ft) 5535.29

Well Depth below m.p. (ft) 150.00

Vertical Scale 275

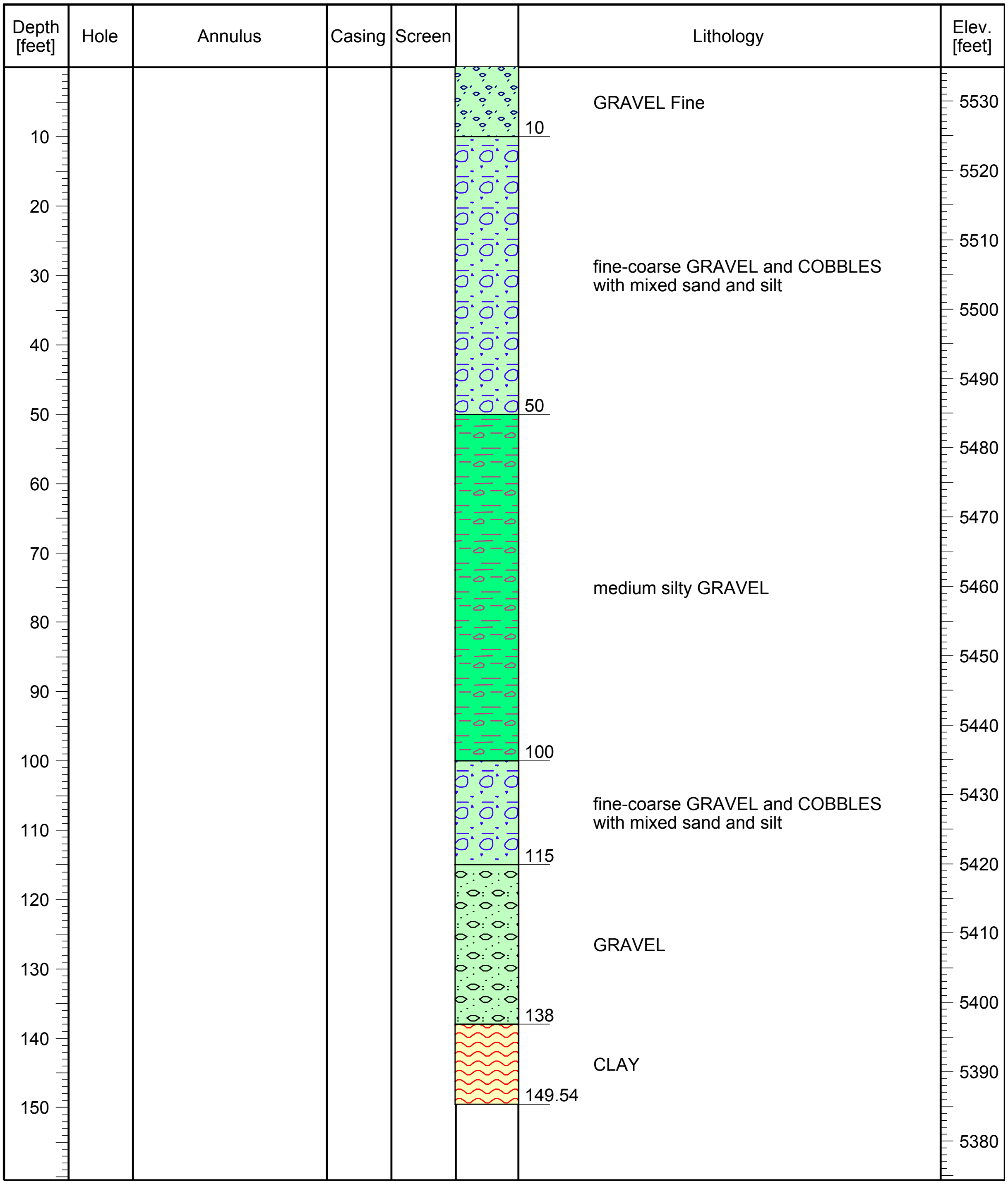
Date Completed 12/16/1952

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 65 - 140

Yield (gpm) 800

Use stock



Well Lithology

Well Identification
MATADOR6

MBMG Site #
M:109813

Well Name or Well Owner
Matador Ranch irrigation well #6

Location
08S 08W 32 ACC

Ground Surface Elev. (ft)
5465.00

Well Depth below m.p. (ft)
170.00

Vertical Scale
300

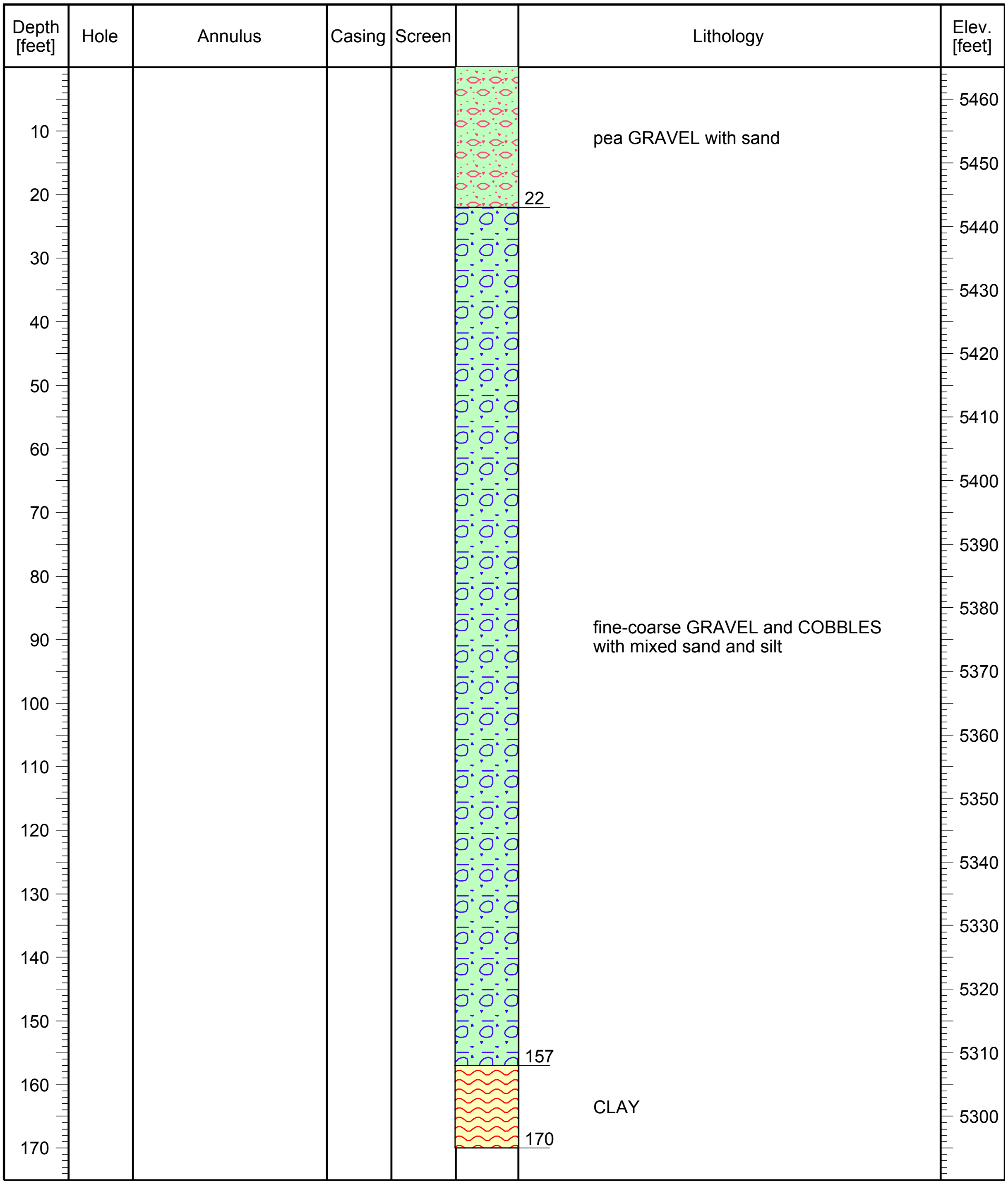
Date Completed
1/20/1953

Well Dia. (in)
20.

Perforated or Screened Interval (ft)
60 - 158

Yield (gpm)
1500

Use
none



Well Lithology

Well Identification MATADOR7

MBMG Site # M:109808

Well Name or Well Owner Matador Ranch irrigation well #7

Location 08S 08W 28 CCA

Ground Surface Elev. (ft) 5460.00

Well Depth below m.p. (ft) 145.00

Vertical Scale 250

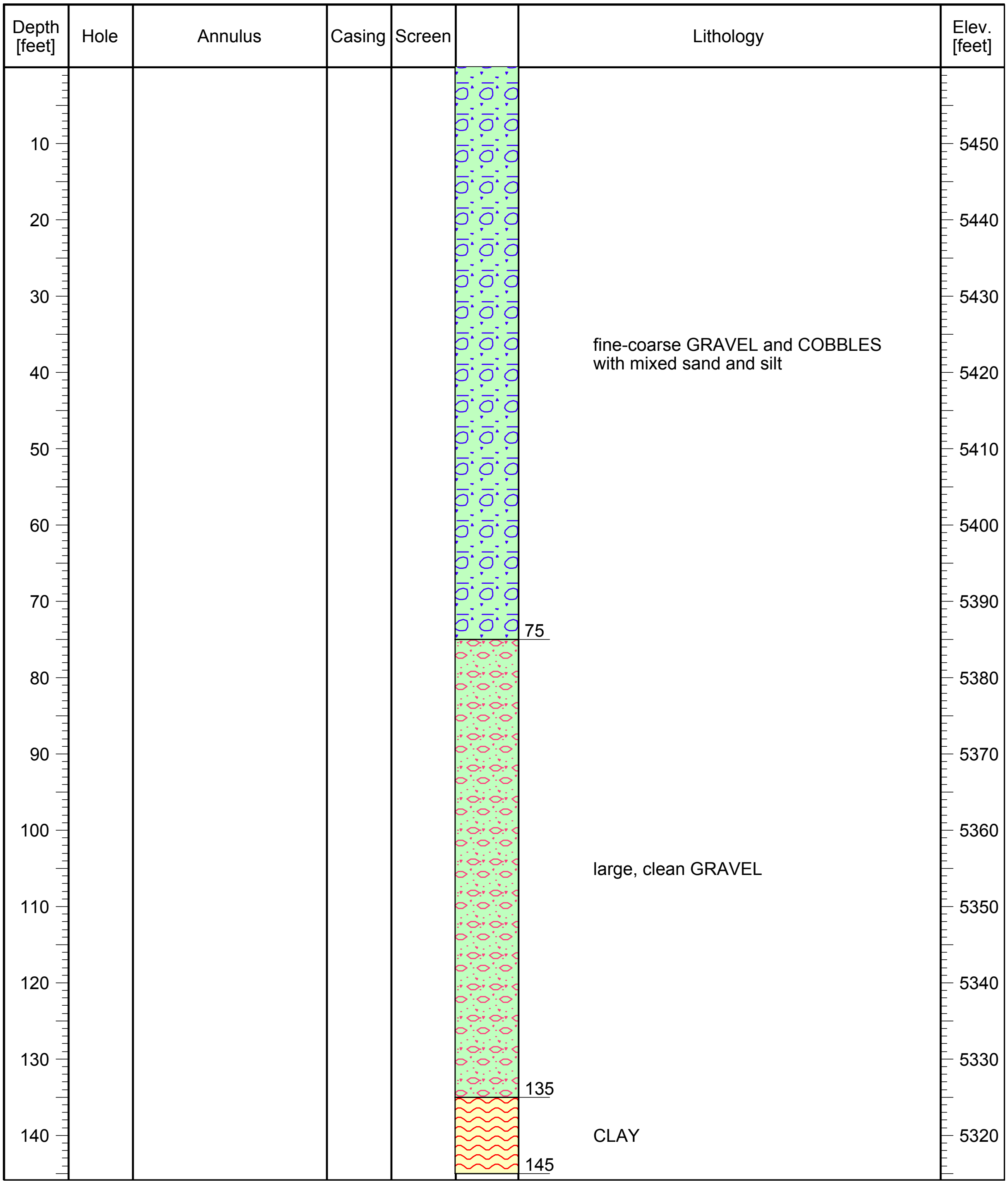
Date Completed 2/16/1953

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 65 - 133

Yield (gpm) 2200

Use none



Well Lithology

Well Identification MATADOR8

MBMG Site # M:110032

Well Name or Well Owner Matador Ranch irrigation well #8

Location 09S 08W 04 BBB

Ground Surface Elev. (ft) 5505.00

Well Depth below m.p. (ft) 175.00

Vertical Scale 300

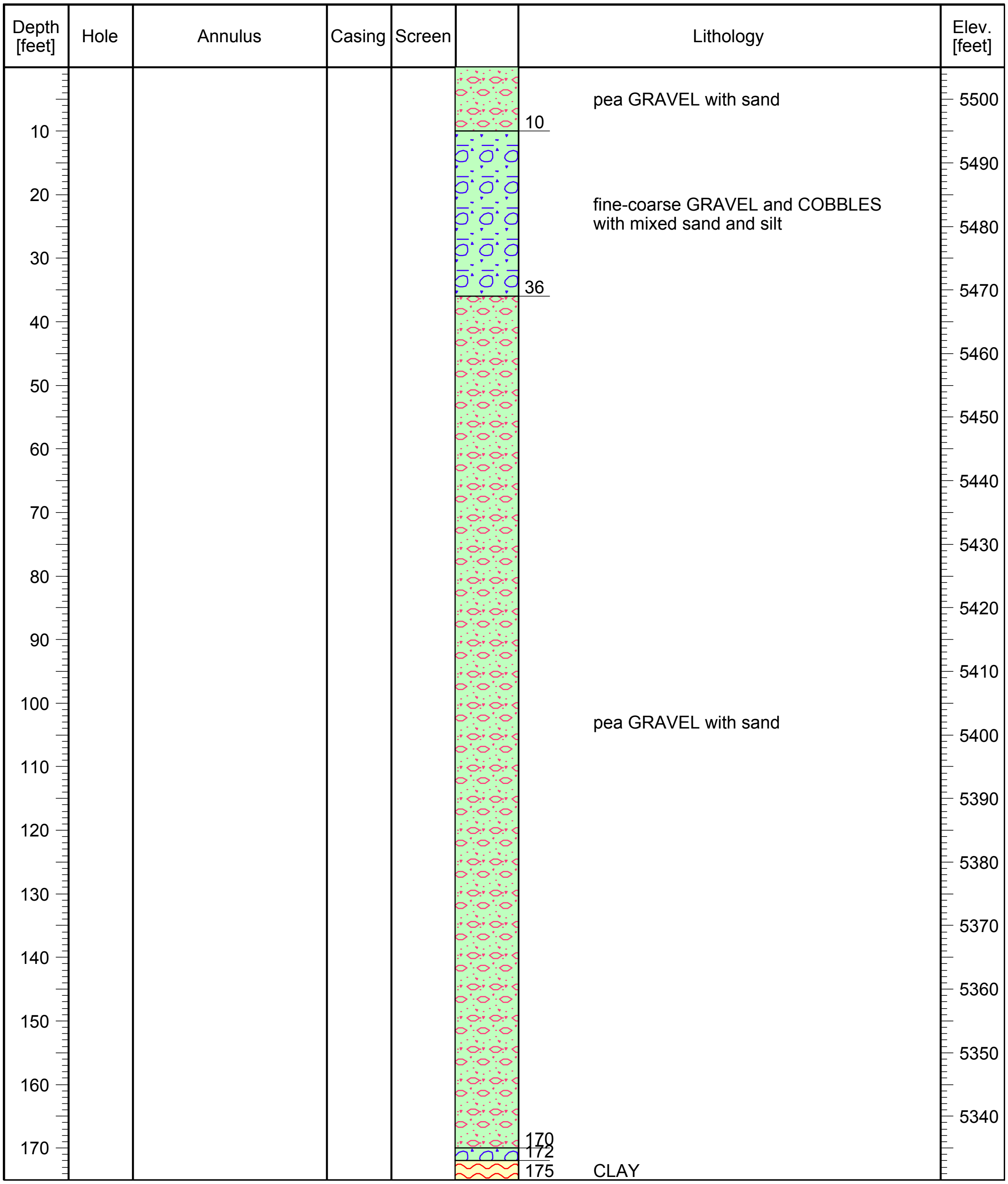
Date Completed 3/15/1953

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 36 - 165

Yield (gpm) 1500

Use none



Well Lithology

Well Identification MATADOR9

MBMG Site # M:109817

Well Name or Well Owner Matador Ranch irrigation well #9

Location 08S 08W 32 DAA

Ground Surface Elev. (ft) 5485.00

Well Depth below m.p. (ft) 160.00

Vertical Scale 275

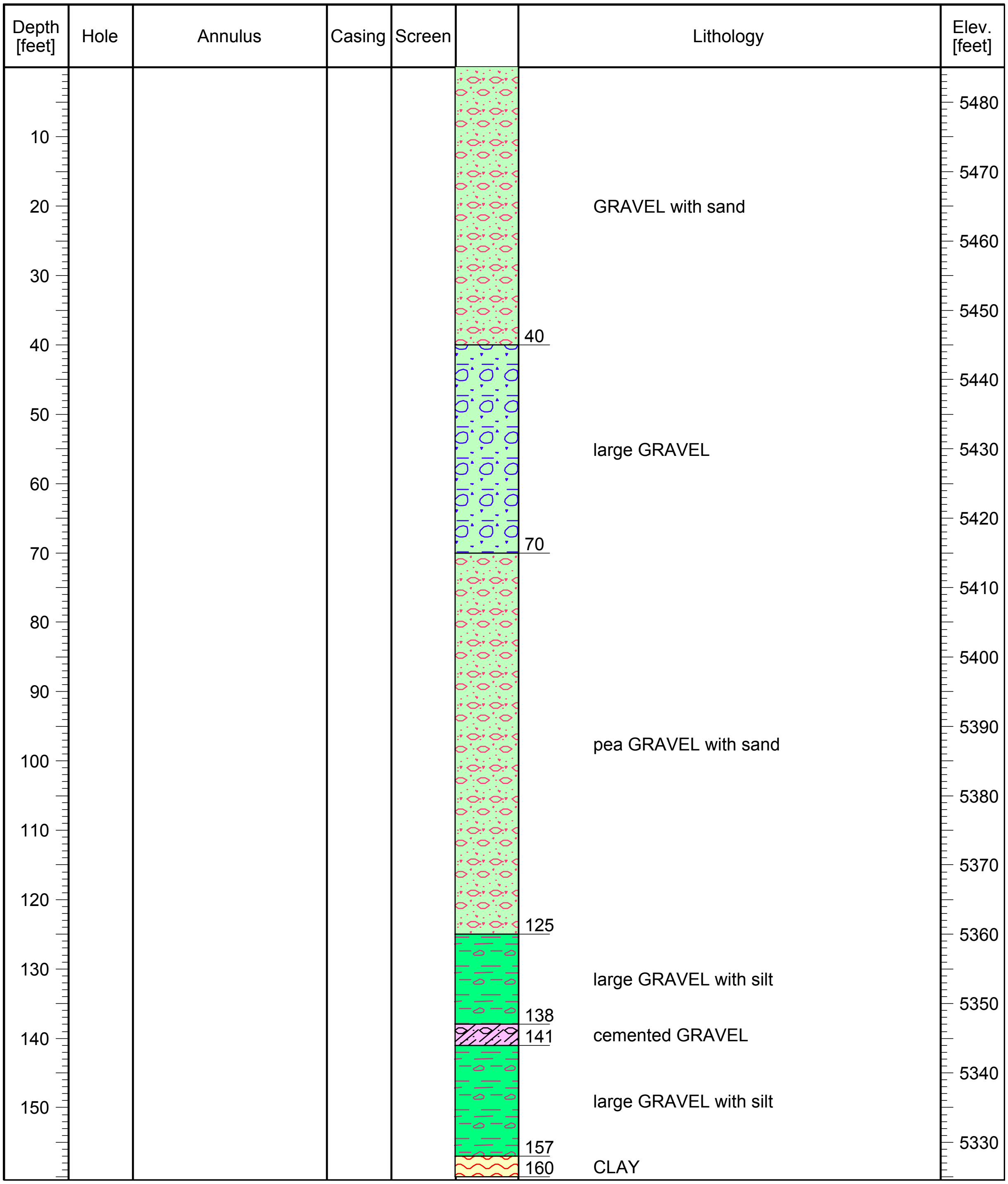
Date Completed 6/8/1960

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 20 - 157

Yield (gpm) 1800

Use none



Well Lithology

Well Identification
MATADOR10

MBMG Site #
M:109807

Well Name or Well Owner
Matador Ranch irrigation well #10

Location
08S 08W 28 CBD

Ground Surface Elev. (ft)
5460.00

Well Depth below m.p. (ft)
146.00

Vertical Scale
275

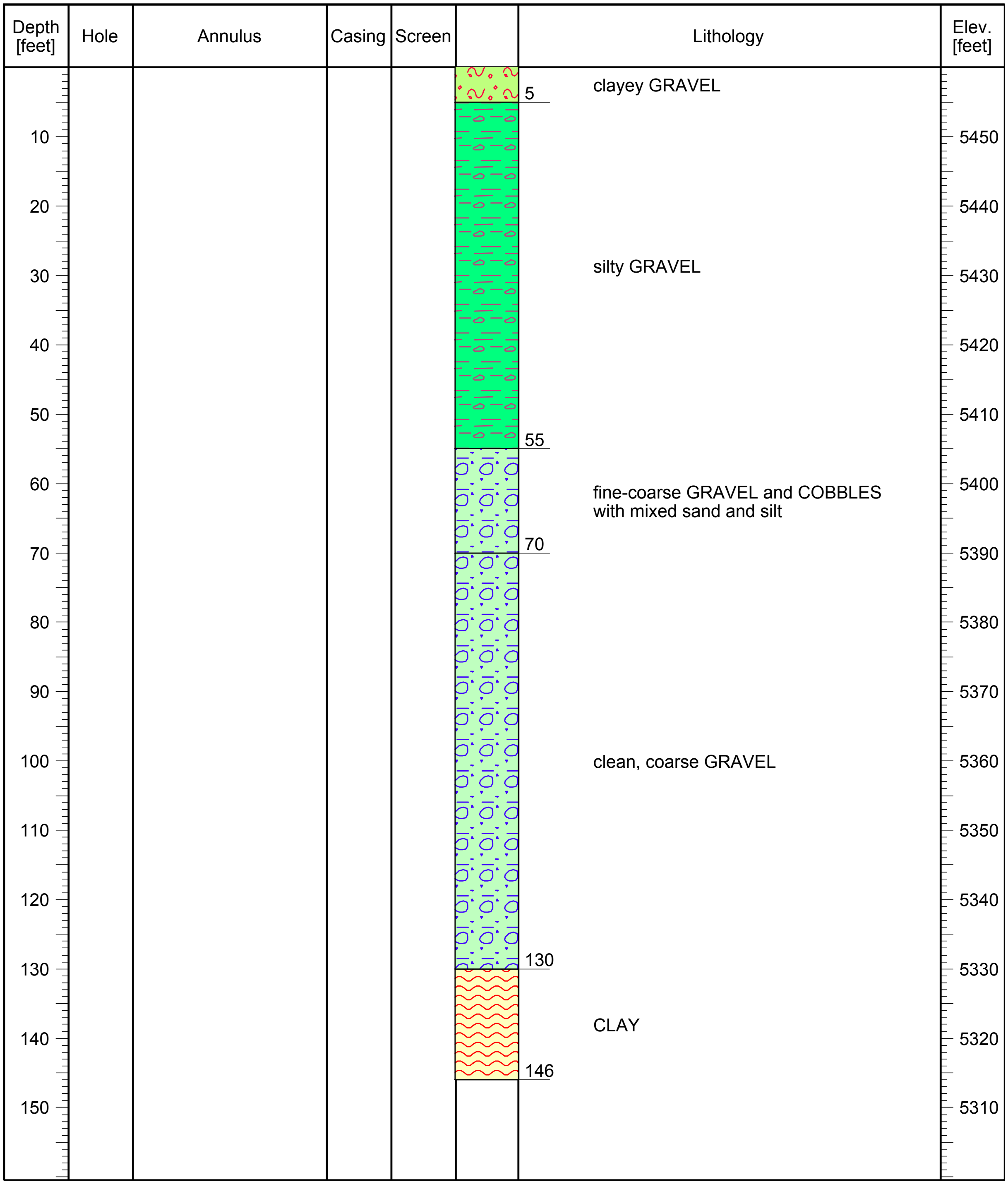
Date Completed
2/3/1961

Well Dia. (in)
20.

Perforated or Screened Interval (ft)
40 - 132

Yield (gpm)
2200

Use
none



Well Lithology

Well Identification
MATADOR11

MBMG Site #
M:109822

Well Name or Well Owner
Matador Ranch irrigation well #11

Location
08S 08W 33 BBA

Ground Surface Elev. (ft)
5470.00

Well Depth below m.p. (ft)
160.00

Vertical Scale
275

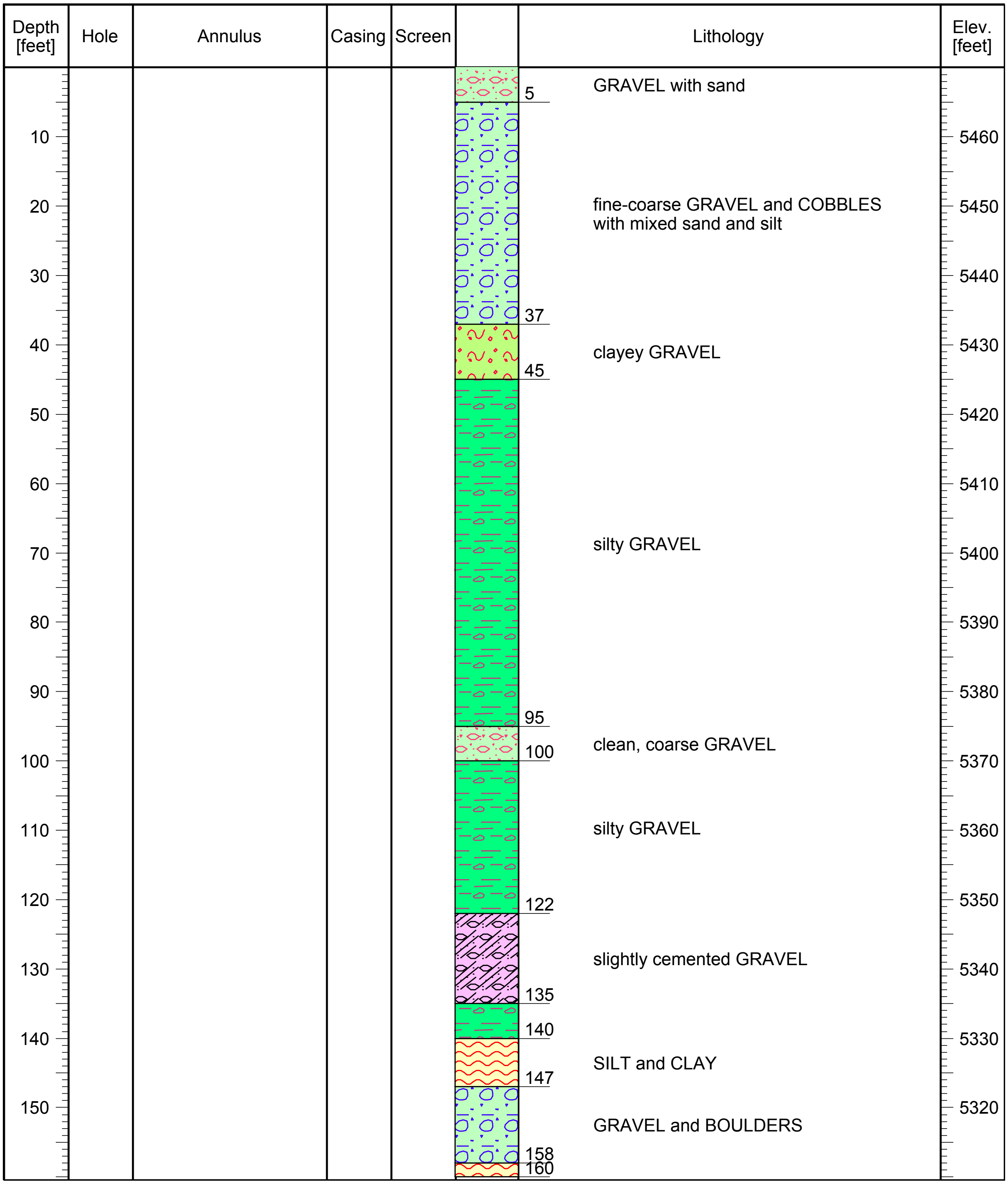
Date Completed
5/20/1961

Well Dia. (in)
20.

Perforated or Screened Interval (ft)
26 - 158

Yield (gpm)
2200

Use
none



Well Lithology

Well Identification MATADOR12

MBMG Site # M:109816

Well Name or Well Owner Matador Ranch irrigation well #12

Location 08S 08W 32 DAB

Ground Surface Elev. (ft) 5482.00

Well Depth below m.p. (ft) 175.00

Vertical Scale 300

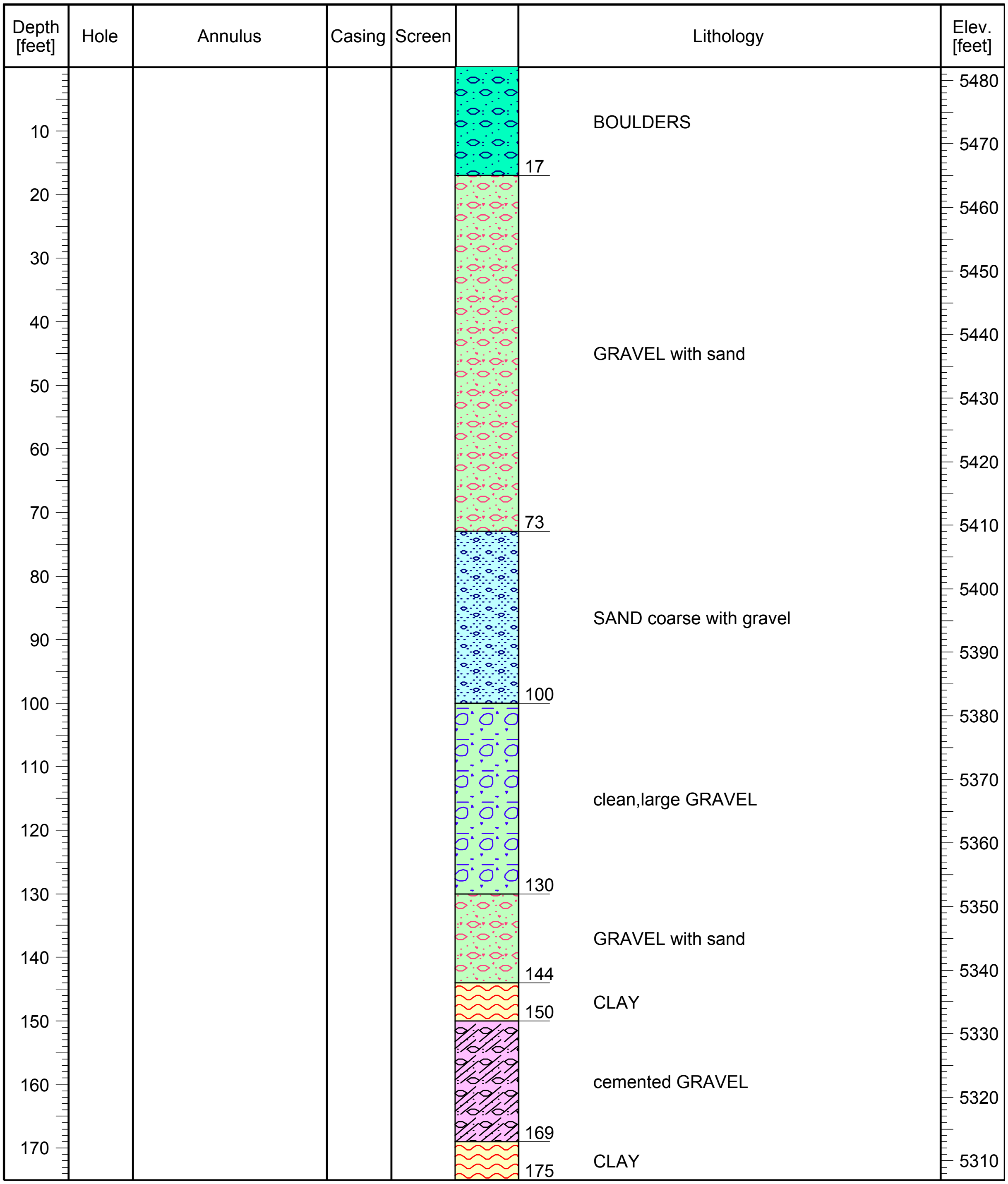
Date Completed 4/17/1961

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 44- 168

Yield (gpm) 1315

Use none



17	BOULDERS
73	GRAVEL with sand
100	SAND coarse with gravel
130	clean,large GRAVEL
144	GRAVEL with sand
150	CLAY
169	cemented GRAVEL
175	CLAY

Well Lithology

Well Identification
MATADOR13

MBMG Site #
M:109820

Well Name or Well Owner
Matador Ranch irrigation well #13

Location
08S 08W 32 DBA

Ground Surface Elev. (ft)
5478.00

Well Depth below m.p. (ft)
185.00

Vertical Scale
325

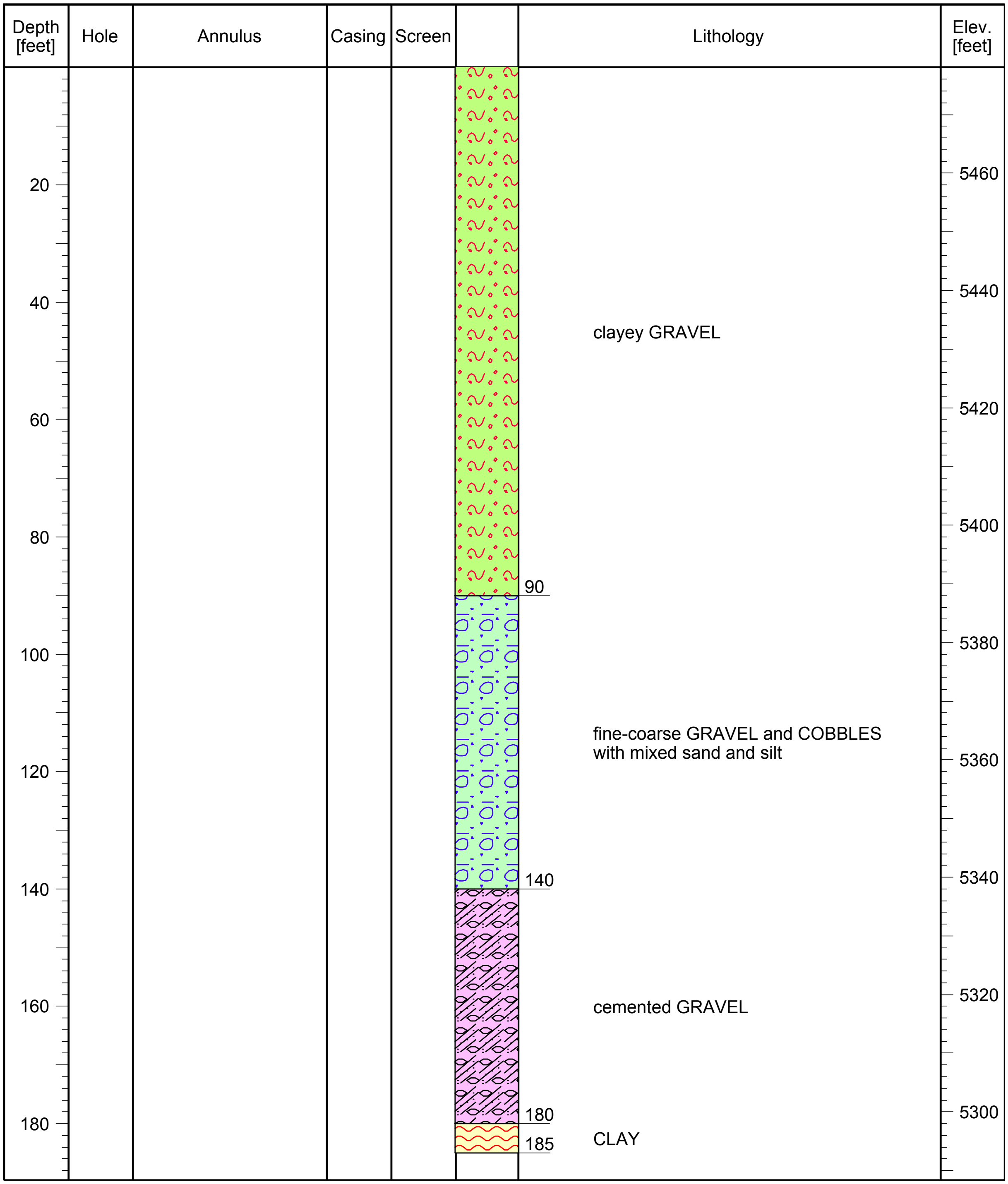
Date Completed
5/15/1962

Well Dia. (in)
20.

Perforated or Screened Interval (ft)
35 - 178

Yield (gpm)
1800

Use
irrigation



Well Lithology

Well Identification
MATADOR14

MBMG Site #
M:109811

Well Name or Well Owner
Matador Ranch irrigation well #14

Location
08S 08W 29 DCC

Ground Surface Elev. (ft)
5445.00

Well Depth below m.p. (ft)
170.00

Vertical Scale
300

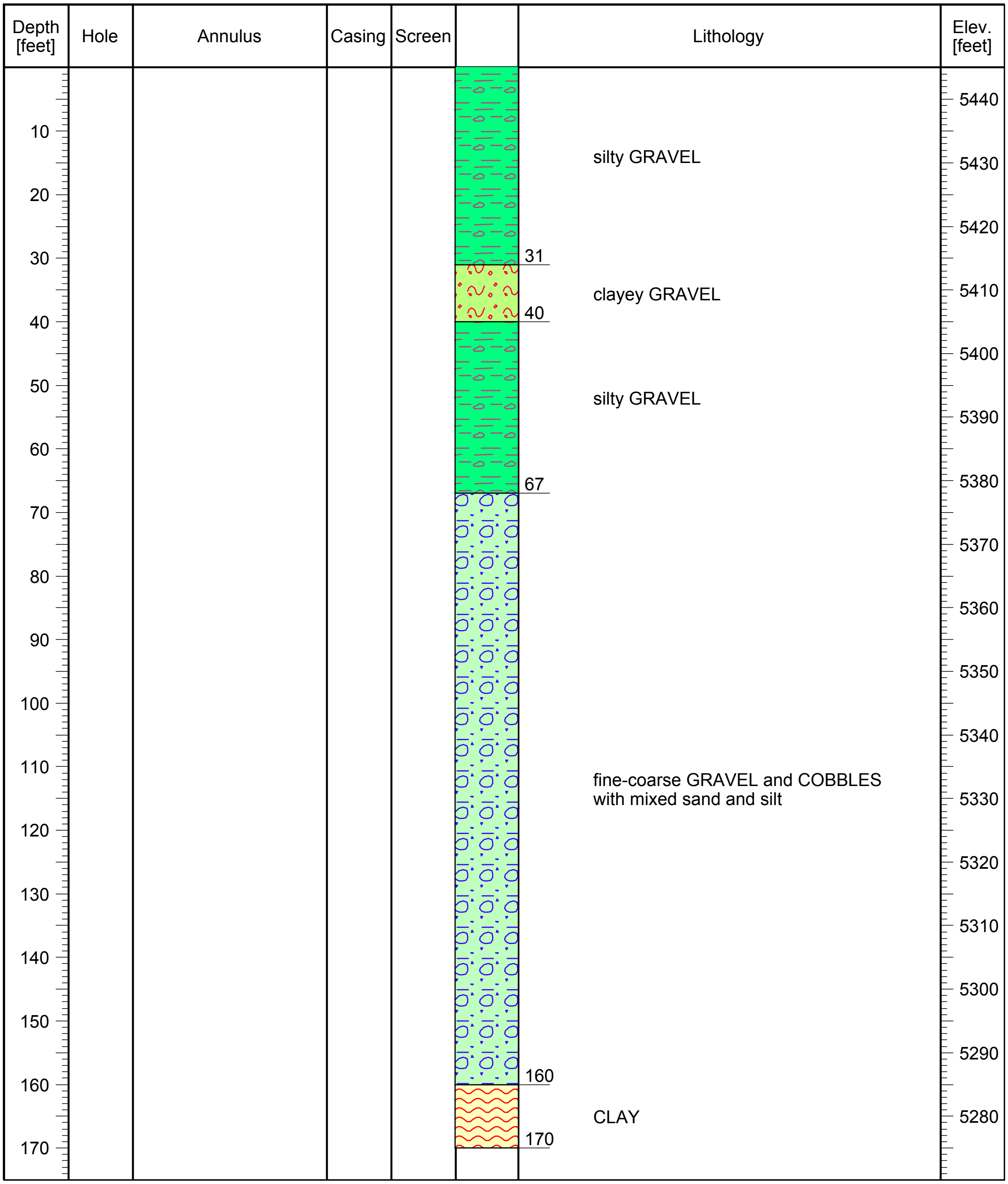
Date Completed
3/25/1962

Well Dia. (in)
20.

Perforated or Screened Interval (ft)
50 - 162

Yield (gpm)
1800

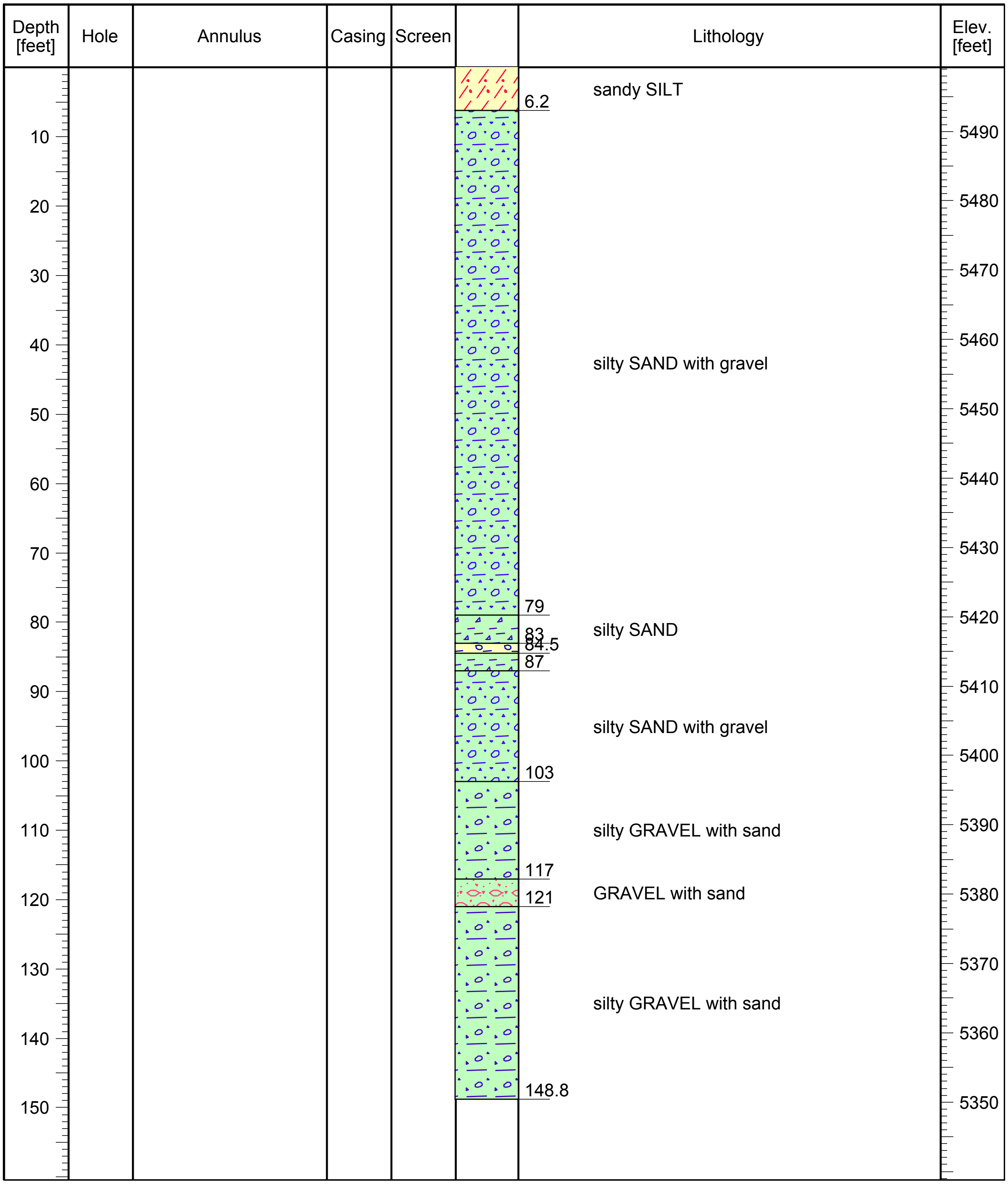
Use
irrigation



Blacktail Range Alluvial Fan

Well Lithology

Well Identification	91-4
MBMG Site #	M:126664
Well Name or Well Owner	MT DNRC Beaverhead Groundwater Project well 91-4
Location	08S 08W 32 CCAB
Ground Surface Elev. (ft)	5499.21
Measuring Point Elev. (ft)	5500.66
Well Depth below m.p. (ft)	150.26
Vertical Scale	275
Date Completed	9/13/1991
Drilling Method	air rotary
Well Dia. (in)	2.0
Perforated or Screened Interval (ft)	142 - 152
Yield (gpm)	5
Use	monitoring



Well Lithology

Well Identification 92-6

MBMG Site # M:133371

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-6

Location 08S 08W 31 CCAA

Ground Surface Elev. (ft) 5520.70

Measuring Point Elev. (ft) 5522.87

Well Depth below m.p. (ft) 207.30

Vertical Scale 375

Date Completed 3/9/1993

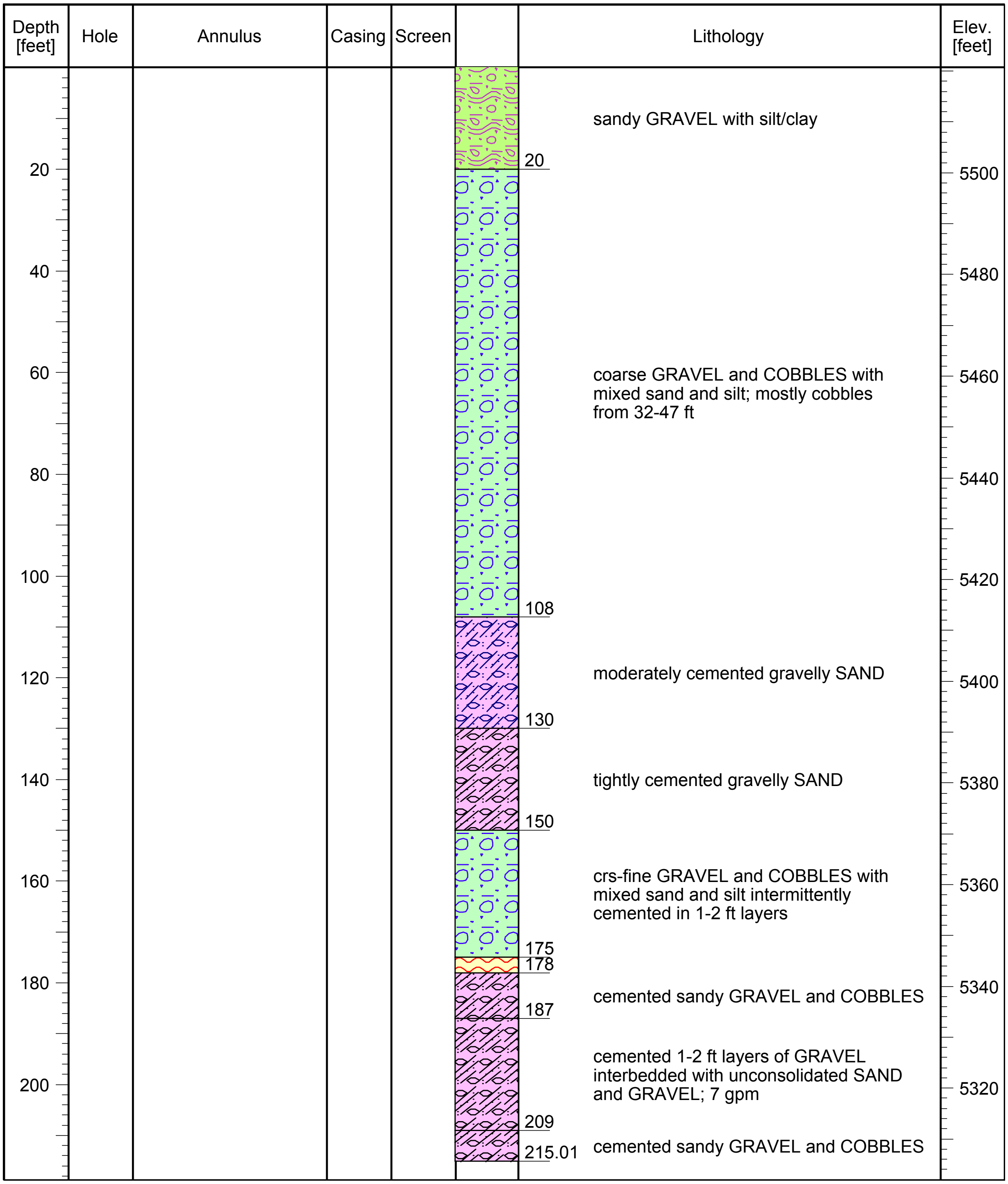
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 207 - 217

Yield (gpm) 7

Use monitoring



sandy GRAVEL with silt/clay

coarse GRAVEL and COBBLES with mixed sand and silt; mostly cobbles from 32-47 ft

moderately cemented gravelly SAND

tightly cemented gravelly SAND

crs-fine GRAVEL and COBBLES with mixed sand and silt intermittently cemented in 1-2 ft layers

cemented sandy GRAVEL and COBBLES

cemented 1-2 ft layers of GRAVEL interbedded with unconsolidated SAND and GRAVEL; 7 gpm

cemented sandy GRAVEL and COBBLES

Well Lithology

Well Identification 92-7

MBMG Site # M:133372

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-7

Location 09S 08W 07 DBDC

Ground Surface Elev. (ft) 5678.08

Measuring Point Elev. (ft) 5679.63

Well Depth below m.p. (ft) 226.36

Vertical Scale 525

Date Completed 5/18/1993

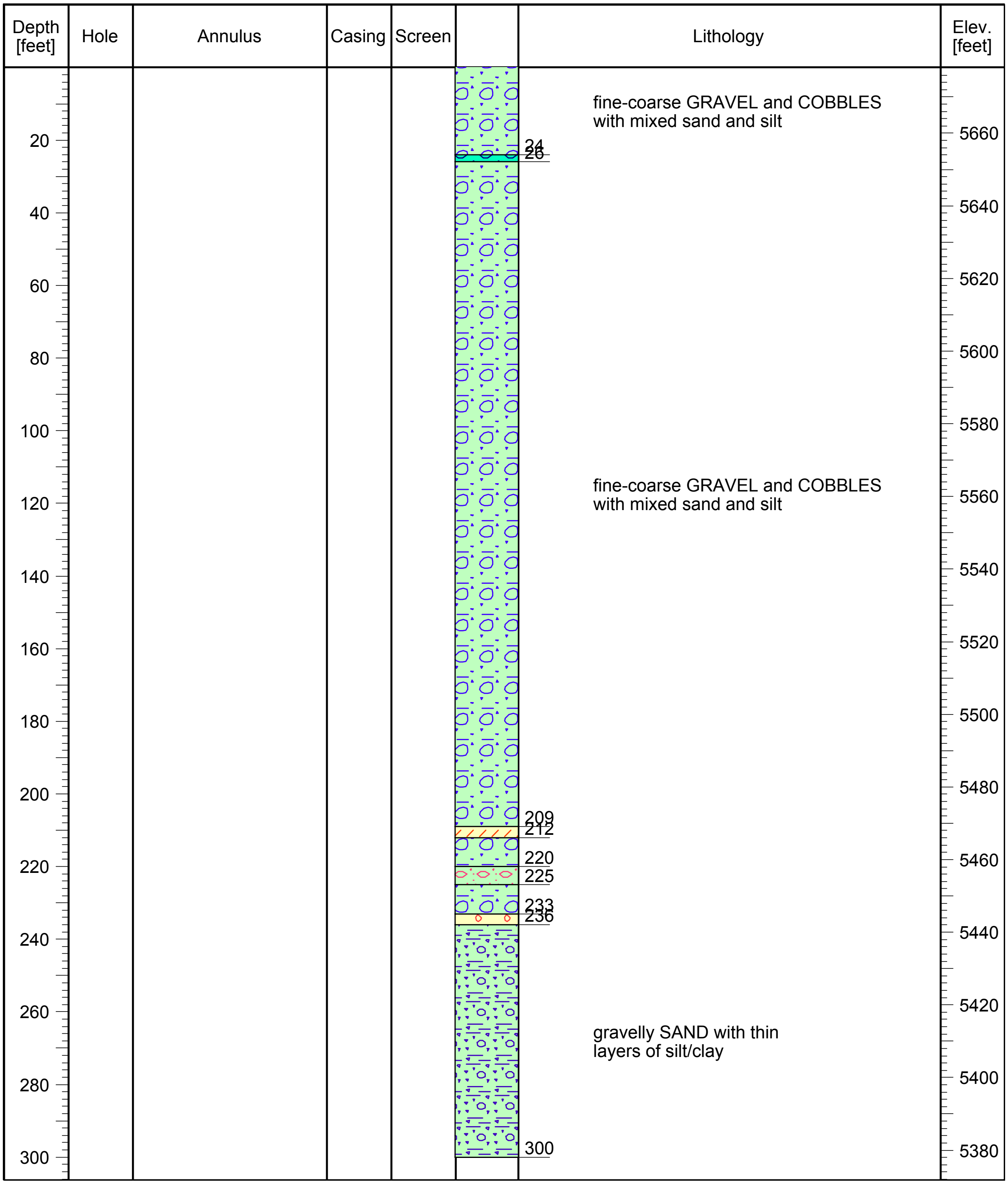
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 205 - 225

Yield (gpm) 30

Use monitoring



Well Lithology

Well Identification 92-8

MBMG Site # M:133373

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-8

Location 08S 08W 30 CCCC

Ground Surface Elev. (ft) 5440.15

Measuring Point Elev. (ft) 5441.56

Well Depth below m.p. (ft) 341.41

Vertical Scale 700

Date Completed 3/5/1993

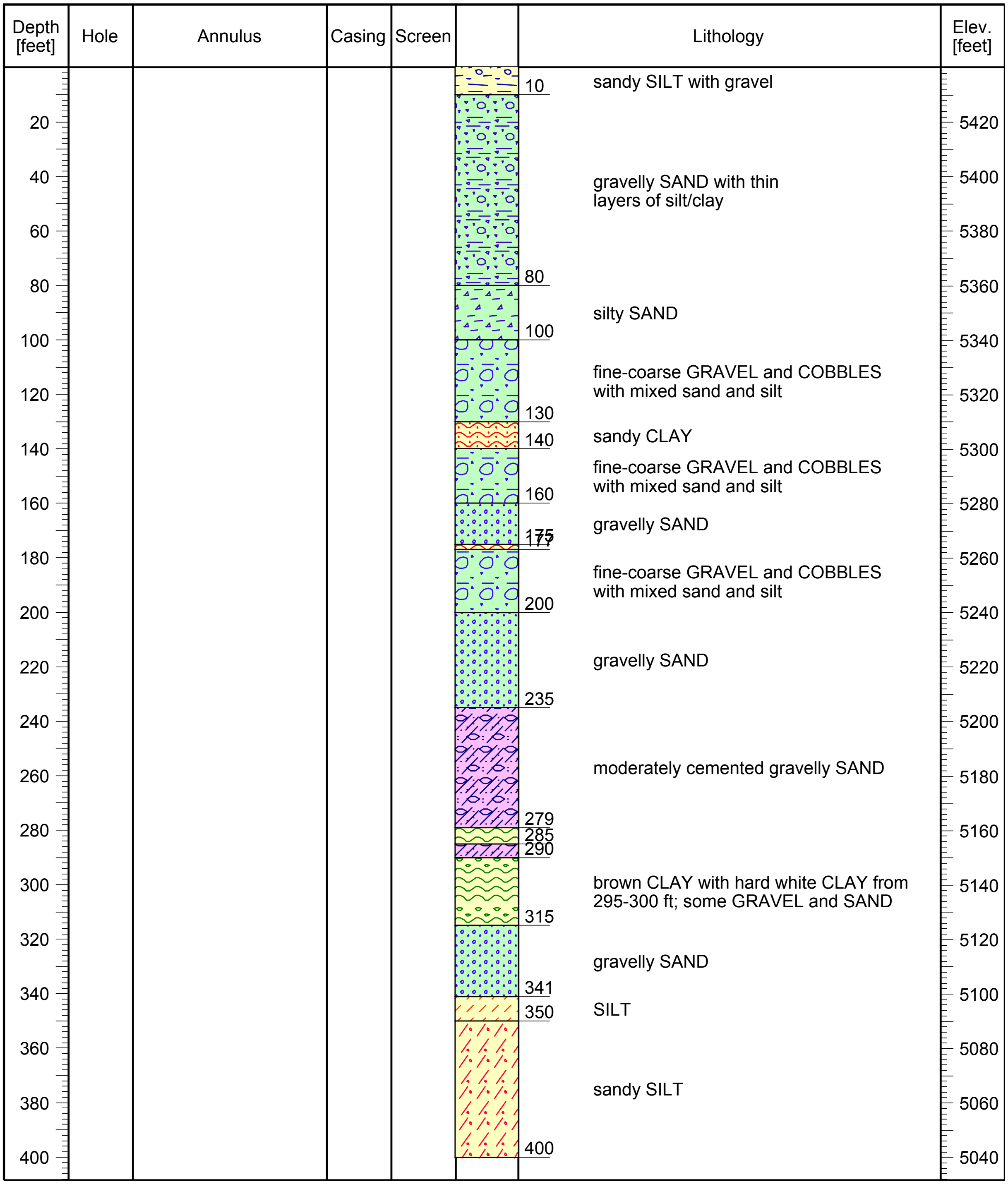
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 323 - 330

Yield (gpm) 30

Use monitoring



sandy SILT with gravel

gravelly SAND with thin layers of silt/clay

silty SAND

fine-coarse GRAVEL and COBBLES with mixed sand and silt

sandy CLAY

fine-coarse GRAVEL and COBBLES with mixed sand and silt

gravelly SAND

fine-coarse GRAVEL and COBBLES with mixed sand and silt

gravelly SAND

moderately cemented gravelly SAND

brown CLAY with hard white CLAY from 295-300 ft; some GRAVEL and SAND

gravelly SAND

SILT

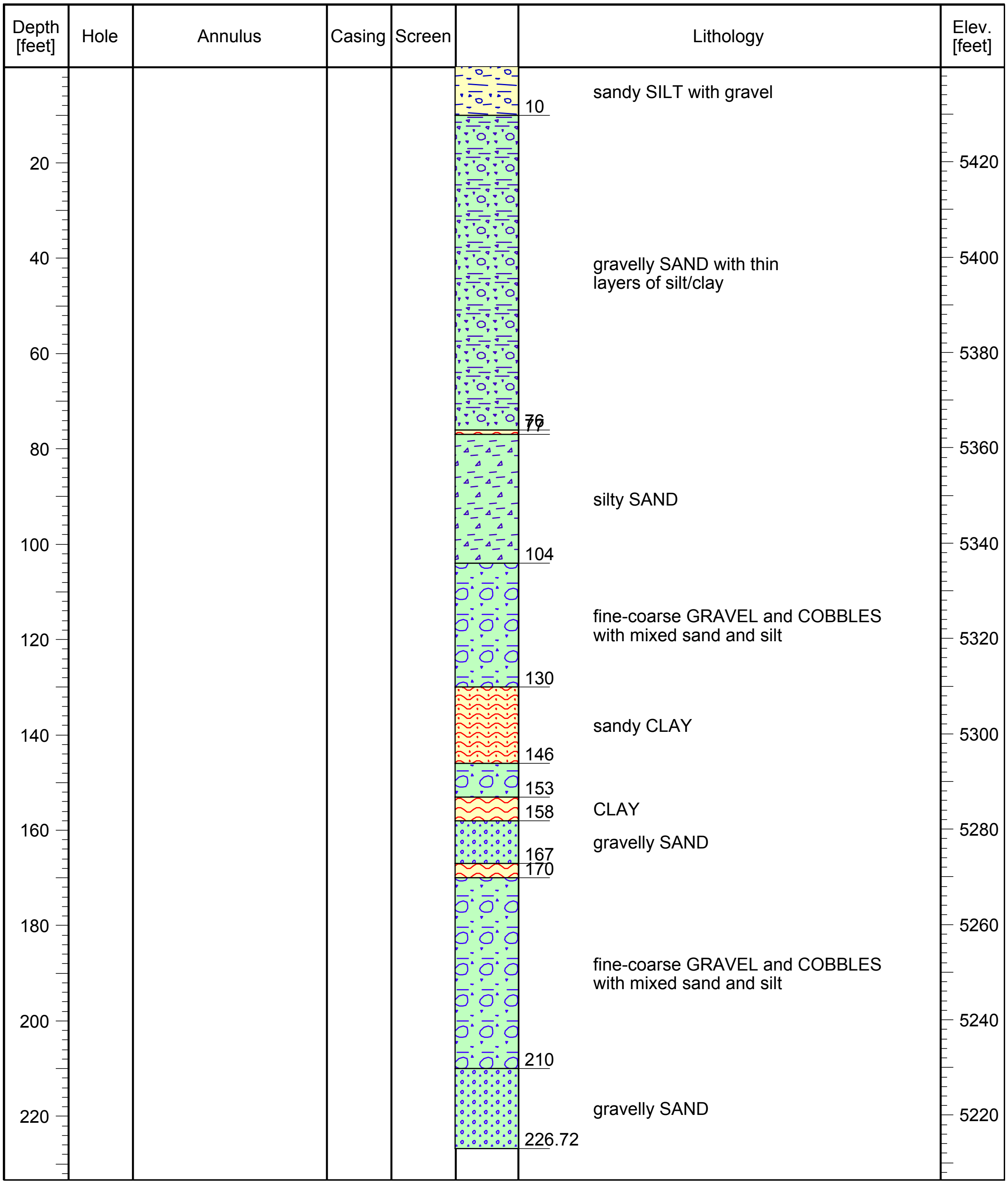
sandy SILT

Well Lithology

Well Identification 92-9	**MBMG Site #** M:133374	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-9

Location 08S 08W 30 CCCC	**Ground Surface Elev. (ft)** 5439.76	**Measuring Point Elev. (ft)** 5442.14	**Well Depth below m.p. (ft)** 229.10	**Vertical Scale** 400

Date Completed 3/9/1993	**Drilling Method** air rotary	**Well Dia. (in)** 6.0	**Perforated or Screened Interval (ft)** 219 - 226	**Yield (gpm)** 20	**Use** monitoring



Well Lithology

Well Identification MATADOR15

MBMG Site # M:110038

Well Name or Well Owner Matador Ranch irrigation well #15

Location 09S 08W 07 DBD

Ground Surface Elev. (ft) 5675.00

Well Depth below m.p. (ft) 350.00

Vertical Scale 600

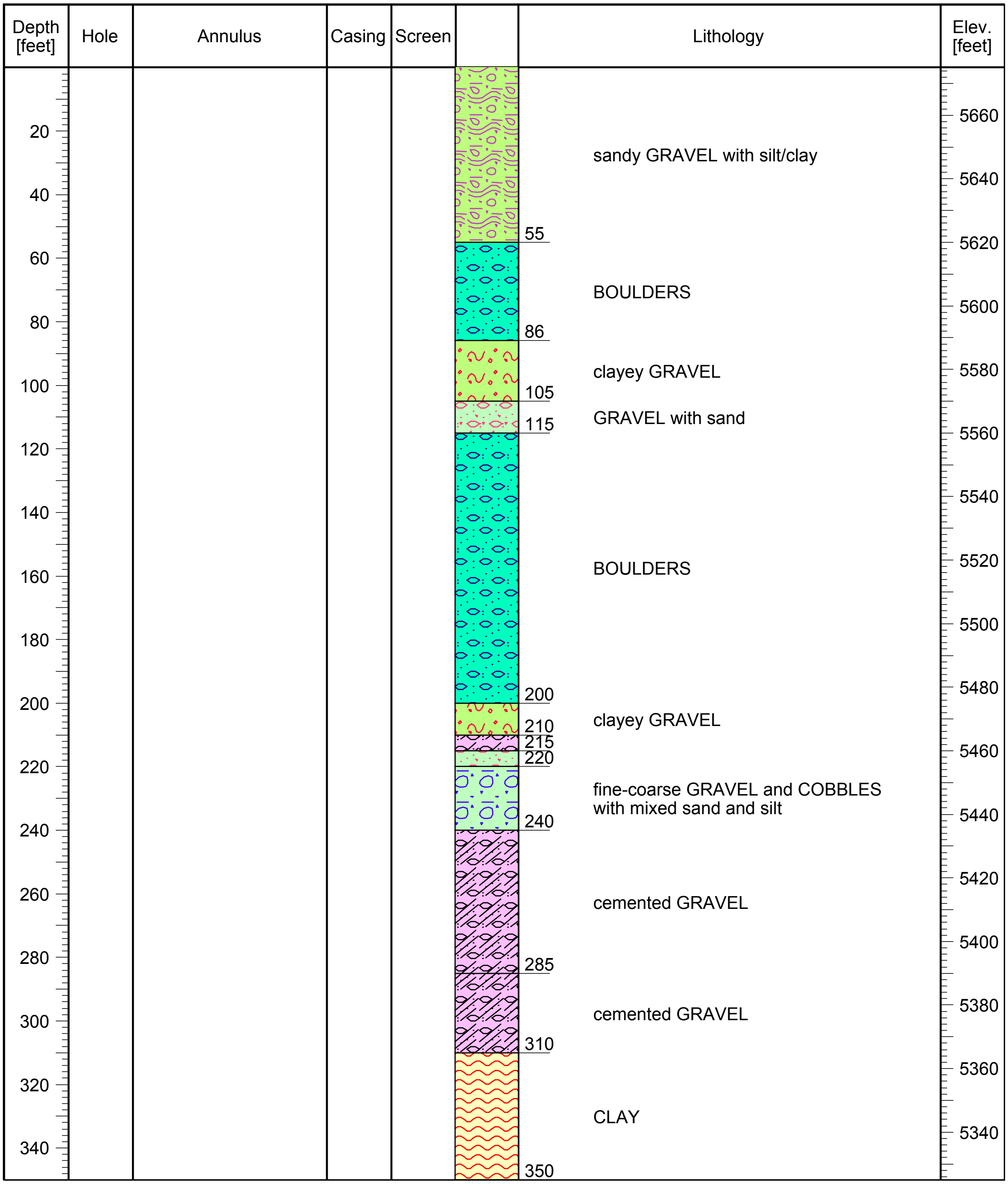
Date Completed 12/21/1963

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 95 - 240

Yield (gpm) 1670

Use irrigation



Depth [feet]	Lithology
55	sandy GRAVEL with silt/clay
86	BOULDERS
105	clayey GRAVEL
115	GRAVEL with sand
200	BOULDERS
210	clayey GRAVEL
215	
220	
240	fine-coarse GRAVEL and COBBLES with mixed sand and silt
285	cemented GRAVEL
310	cemented GRAVEL
350	CLAY

Well Lithology

Well Identification: MATADOR16

MBMG Site #: M:110037

Well Name or Well Owner: Matador Ranch irrigation well #16

Location: 09S 08W 07 DBDB

Ground Surface Elev. (ft): 5666.26

Measuring Point Elev. (ft): 5667.53

Well Depth below m.p. (ft): 405.00

Vertical Scale: 700

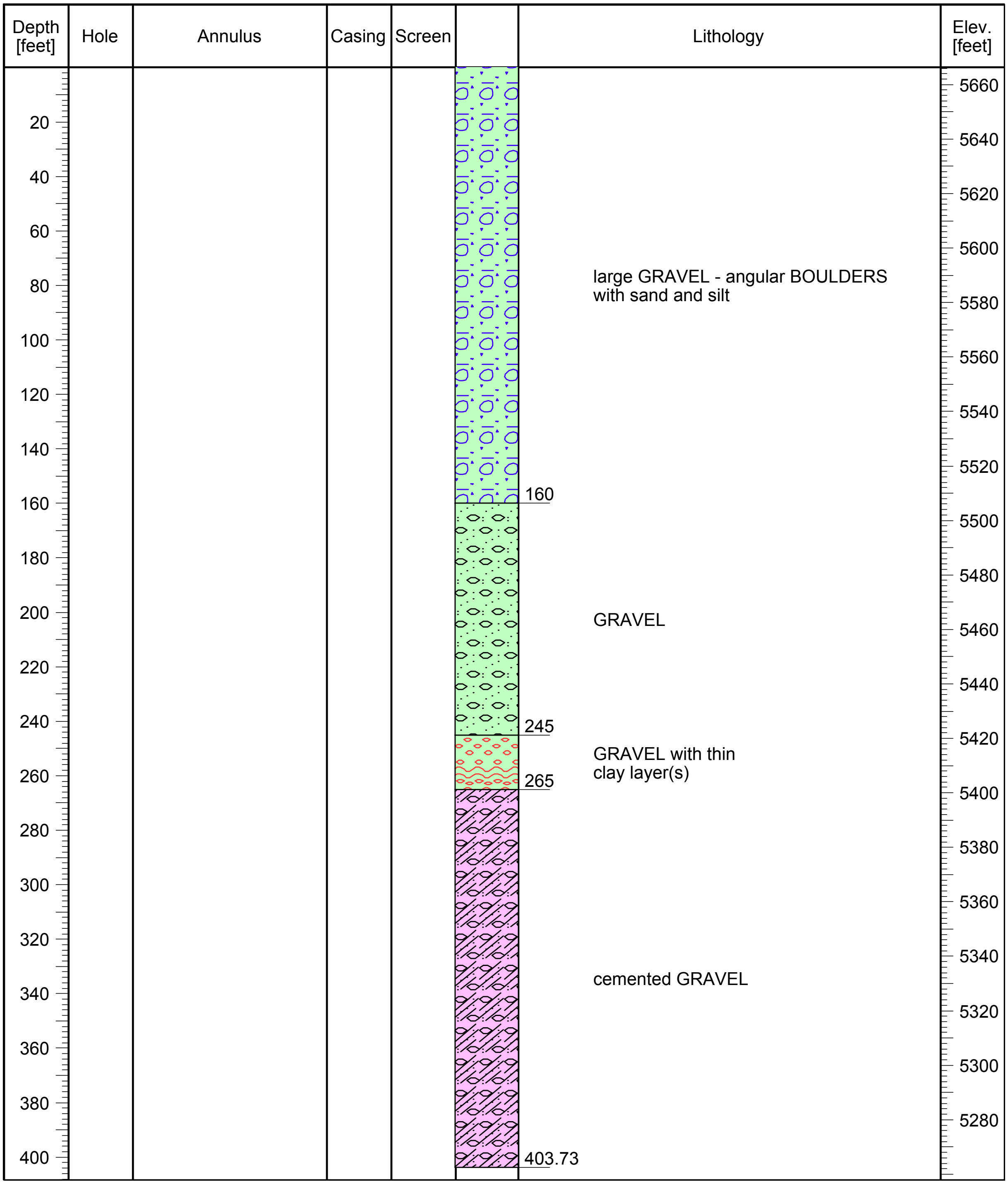
Date Completed: 3/9/1964

Well Dia. (in): 20.

Perforated or Screened Interval (ft): 140 - 360

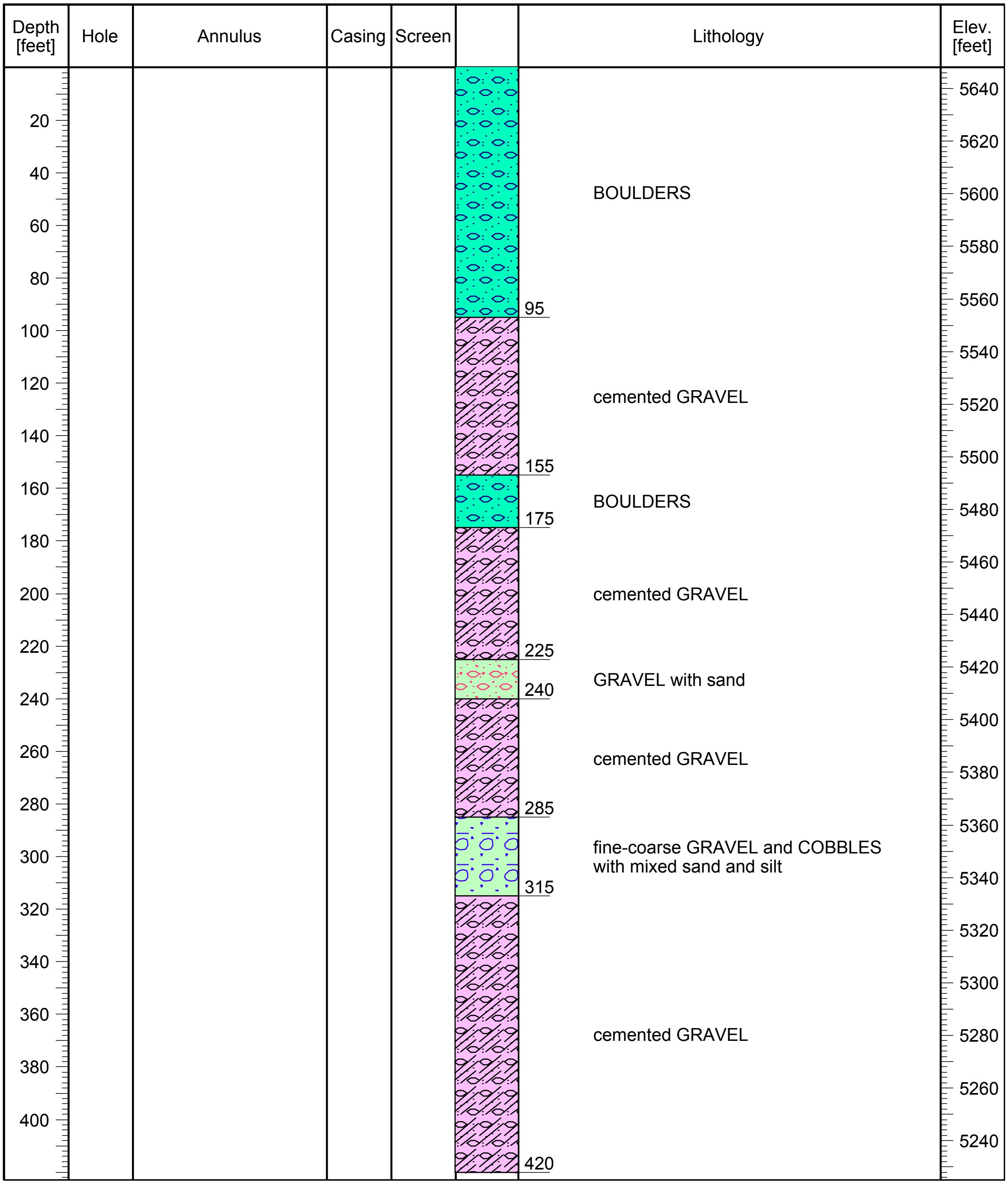
Yield (gpm): 980

Use: irrigation



Well Lithology

Well Identification MATADOR17	**MBMG Site #** M:110036	**Well Name or Well Owner** Matador Ranch irrigation well #17
Location 09S 08W 07 DBA	**Ground Surface Elev. (ft)** 5648.00	**Well Depth below m.p. (ft)** 420.00
Vertical Scale 725	**Date Completed** 3/16/1964	**Well Dia. (in)** 20.
Yield (gpm) 1675	**Use** irrigation	



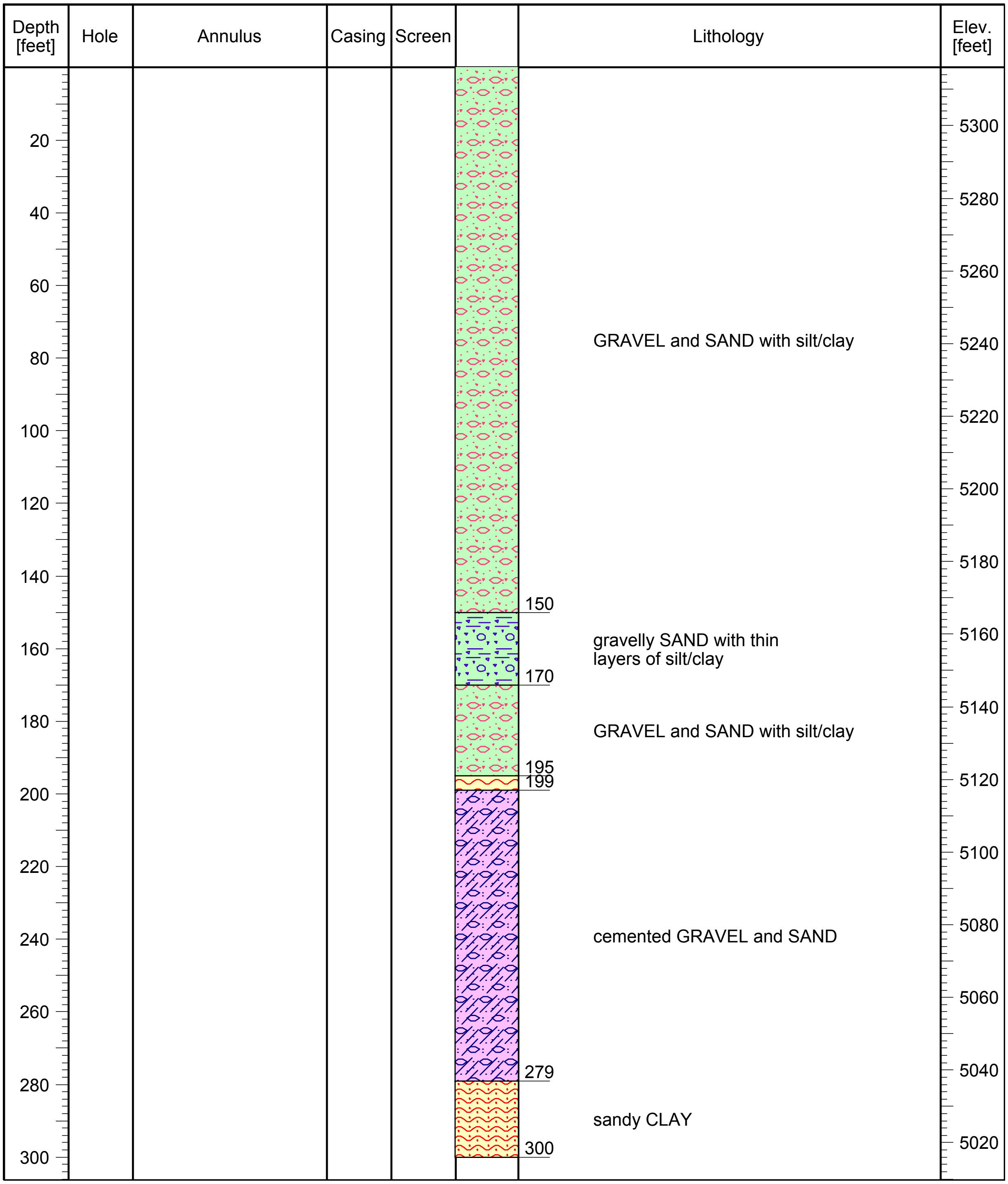
Flynn Lane Well Field Area

Well Lithology

Well Identification 92-10	**MBMG Site #** M:133375	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-10

Location 08S 09W 23 DADD	**Ground Surface Elev. (ft)** 5316.00	**Measuring Point Elev. (ft)** 5317.89	**Well Depth below m.p. (ft)** 281.46	**Vertical Scale** 525

Date Completed 3/24/1993	**Drilling Method** air rotary	**Well Dia. (in)** 6.0	**Perforated or Screened Interval (ft)** 269.5 - 279.5	**Yield (gpm)** 200	**Use** monitoring



Well Lithology

Well Identification
92-11

MBMG Site #
M:133376

Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-11

Location
08S 09W 23 DADD

Ground Surface Elev. (ft)
5316.01

Measuring Point Elev. (ft)
5317.88

Well Depth below m.p. (ft)
100.04

Vertical Scale
175

Date Completed
3/12/1993

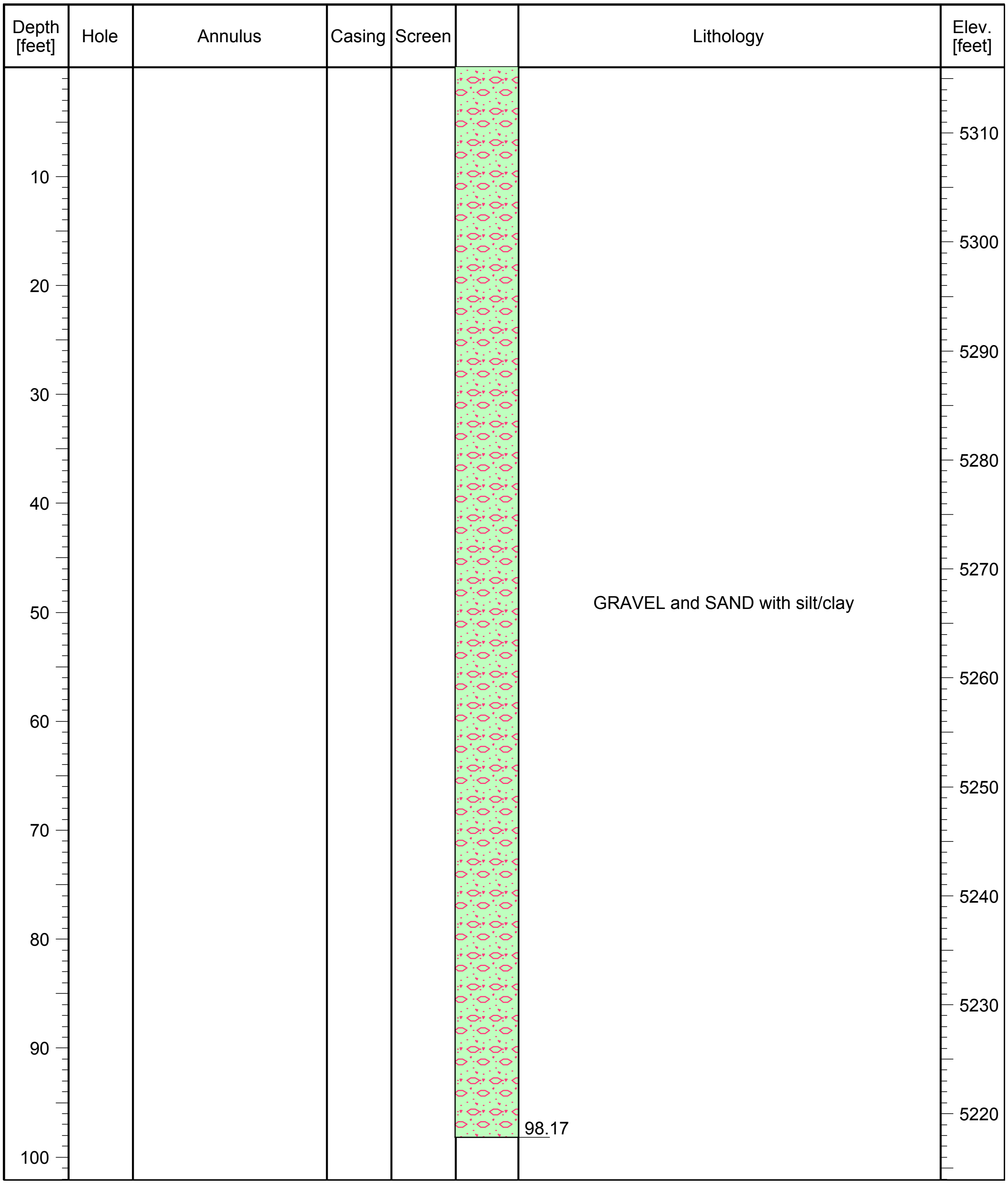
Drilling Method
air rotary

Well Dia. (in)
6.0

Perforated or Screened Interval (ft)
93 - 98

Yield (gpm)
30

Use
monitoring



Well Lithology

Well Identification
92-12

MBMG Site #
M:133377

Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-12

Location
08S 09W 14 ABDD

Ground Surface Elev. (ft)
5268.92

Measuring Point Elev. (ft)
5270.54

Well Depth below m.p. (ft)
401.78

Vertical Scale
700

Date Completed
3/17/1993

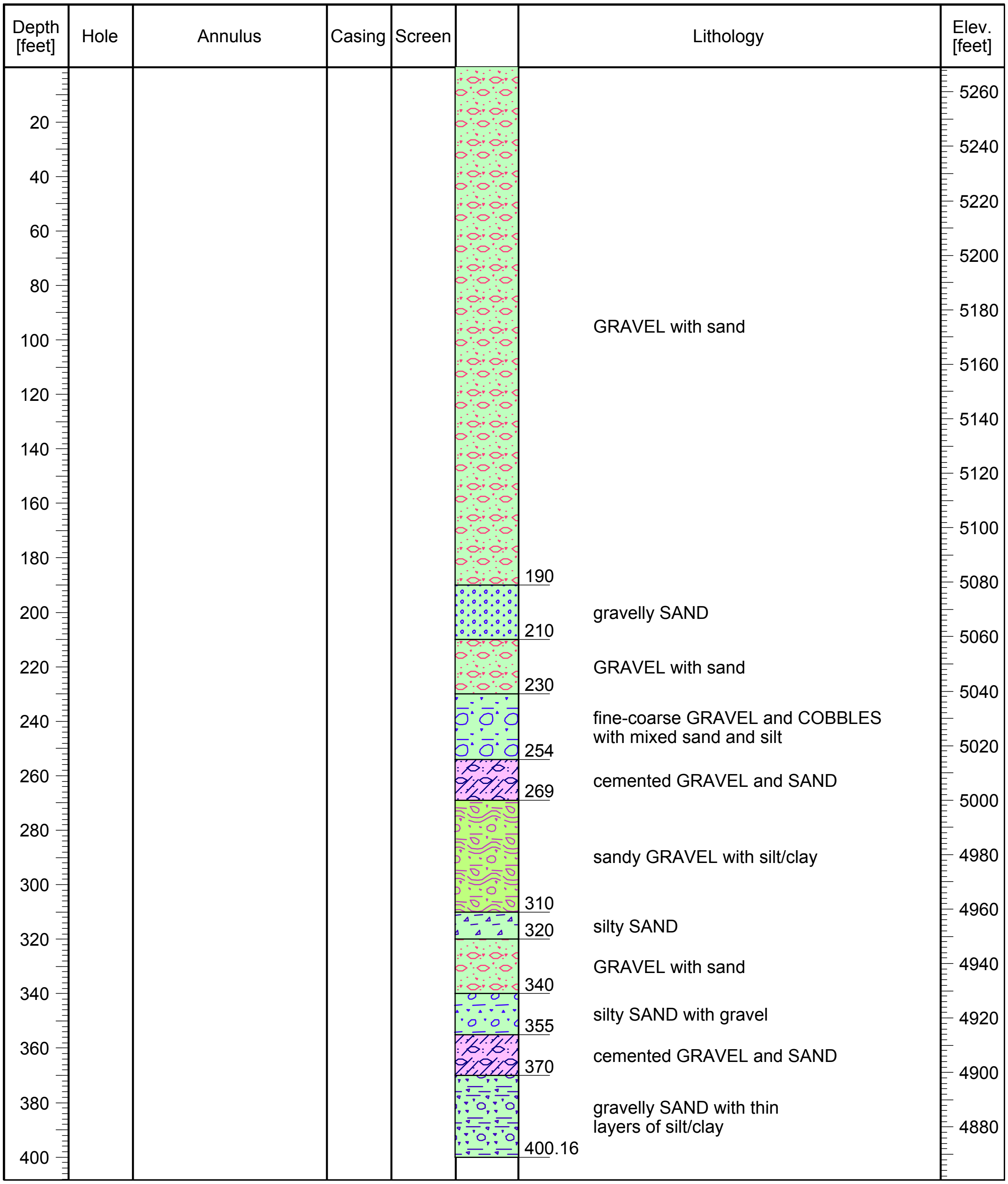
Drilling Method
air rotary

Well Dia. (in)
6.0

Perforated or Screened Interval (ft)
390 - 396

Yield (gpm)
200

Use
monitoring



Well Lithology

Well Identification 92-13

MBMG Site # M:133378

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-13

Location 08S 09W 14 ABDD

Ground Surface Elev. (ft) 5268.88

Measuring Point Elev. (ft) 5270.41

Well Depth below m.p. (ft) 175.30

Vertical Scale 300

Date Completed 3/19/1993

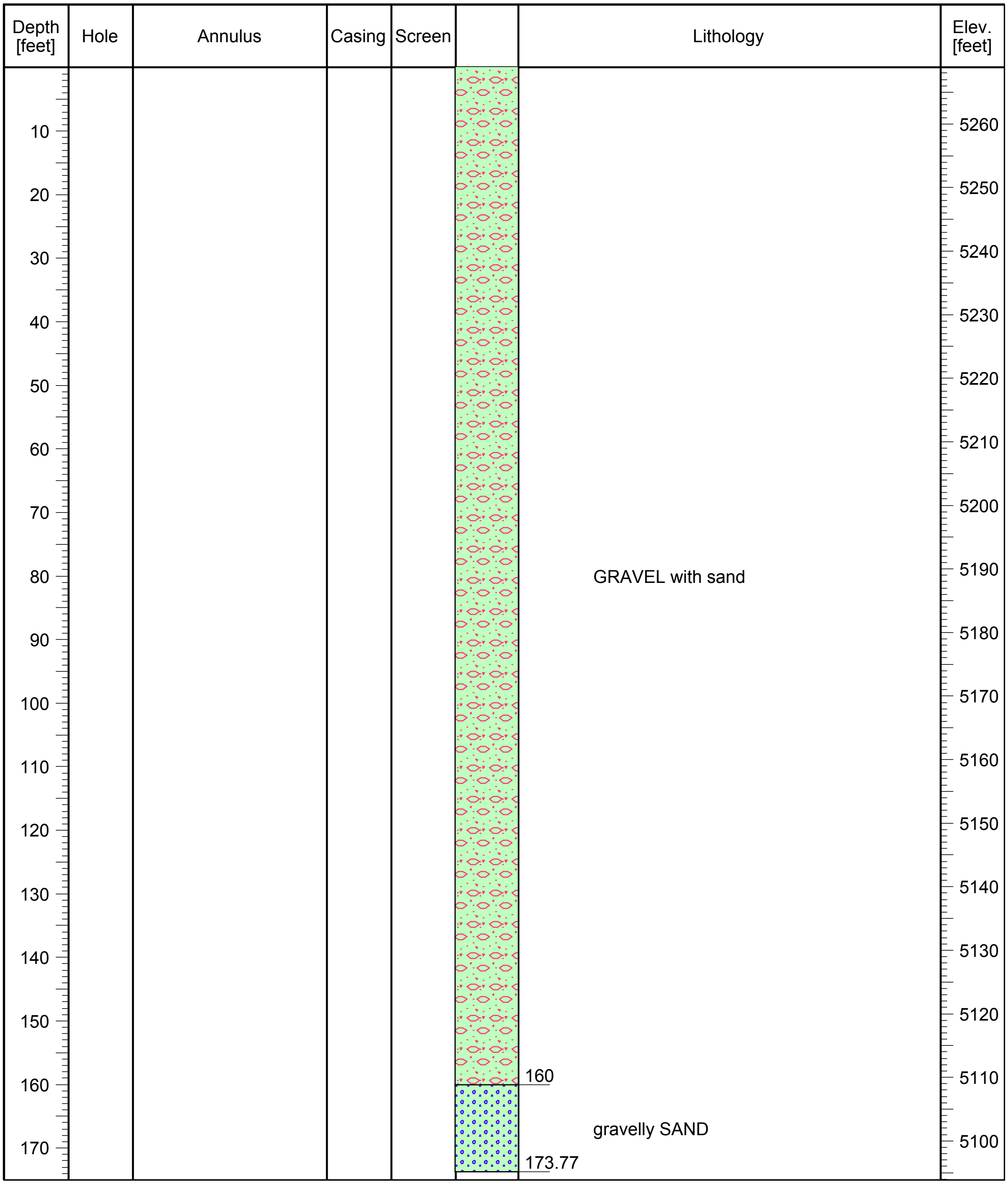
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 100-105, 135-140, 165-170

Yield (gpm) 200

Use monitoring



Well Lithology

Well Identification BLAKE1

MBMG Site # M:109936

Well Name or Well Owner Jim Blake irrigation well #1 (west well)

Location 08S 09W 23 BCDA

Ground Surface Elev. (ft) 5278.29

Measuring Point Elev. (ft) 5278.94

Well Depth below m.p. (ft) 300.00

Vertical Scale 525

Date Completed 2/26/1980

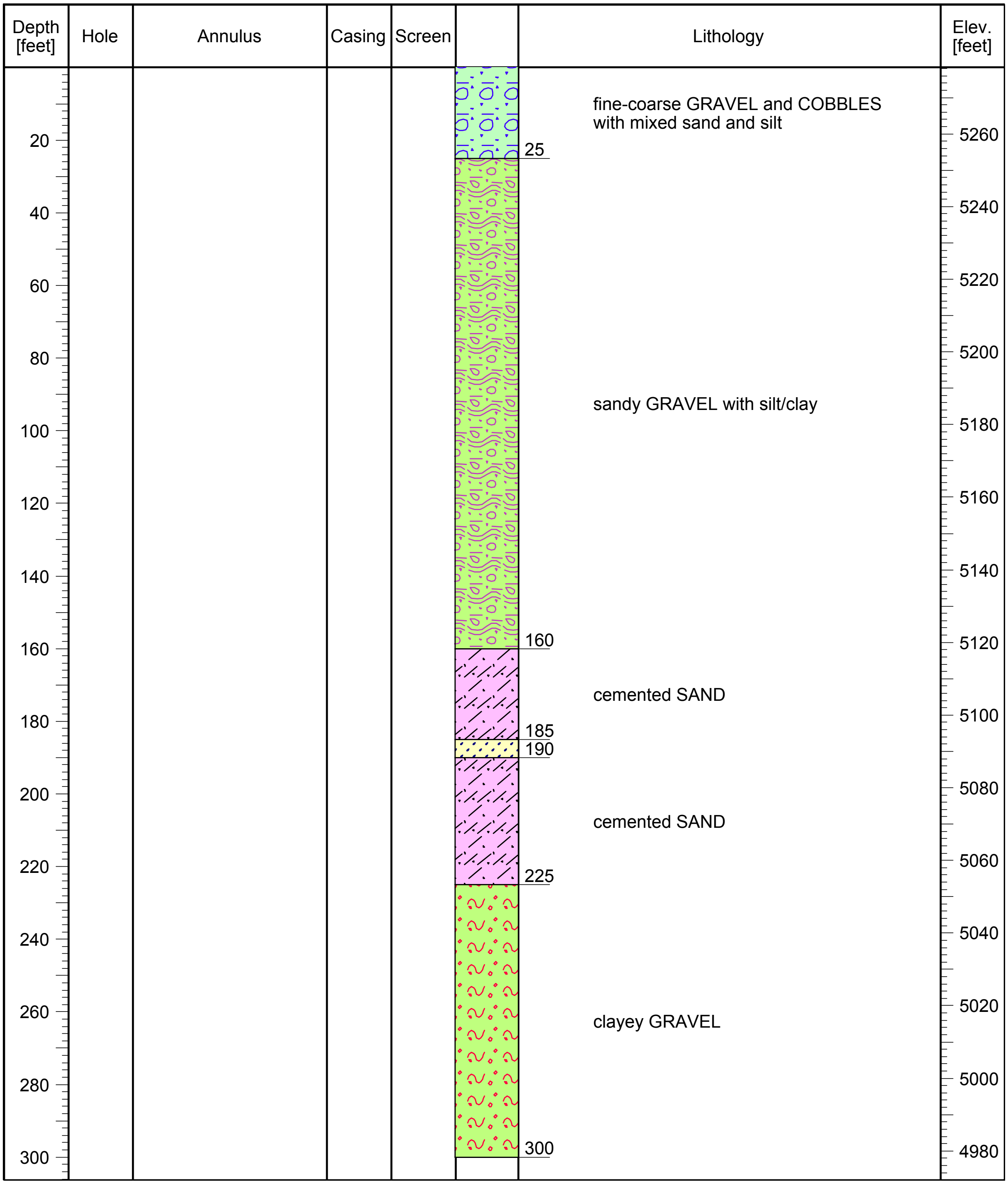
Drilling Method cable tool

Well Dia. (in) 16.

Perforated or Screened Interval (ft) 80 - 300

Yield (gpm) 1800

Use irrigation



Well Lithology

Well Identification BLAKE2

MBMG Site # M:109935

Well Name or Well Owner Jim Blake irrigation well #2 (east well)

Location 08S 09W 23 ADCB

Ground Surface Elev. (ft) 5298.96

Measuring Point Elev. (ft) 5299.81

Well Depth below m.p. (ft) 300.00

Vertical Scale 525

Date Completed 3/20/1980

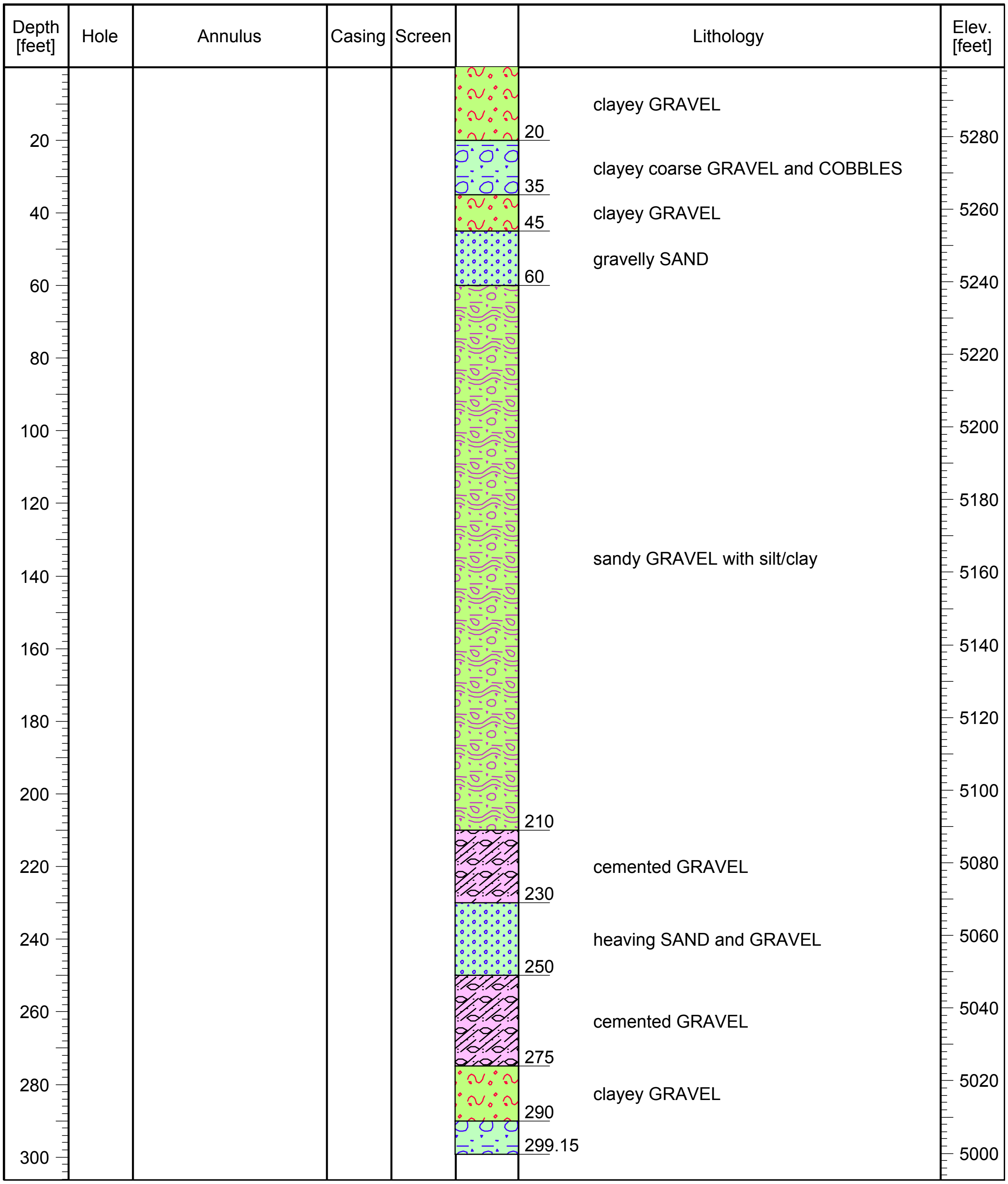
Drilling Method cable tool

Well Dia. (in) 16.

Perforated or Screened Interval (ft) 55 - 300

Yield (gpm) 1800

Use irrigation



20	clayey GRAVEL
35	clayey coarse GRAVEL and COBBLES
45	clayey GRAVEL
60	gravelly SAND
210	sandy GRAVEL with silt/clay
230	cemented GRAVEL
250	heaving SAND and GRAVEL
275	cemented GRAVEL
290	clayey GRAVEL
299.15	

Well Lithology

Well Identification
CAMP-GAASCH

Well Name or Well Owner
Campbell - Gaasch - Meine

Location
08S 09W 24 DB

Ground Surface Elev. (ft)
5340.00

Well Depth below m.p. (ft)
300.00

Vertical Scale
525

Date Completed
4/21/1981

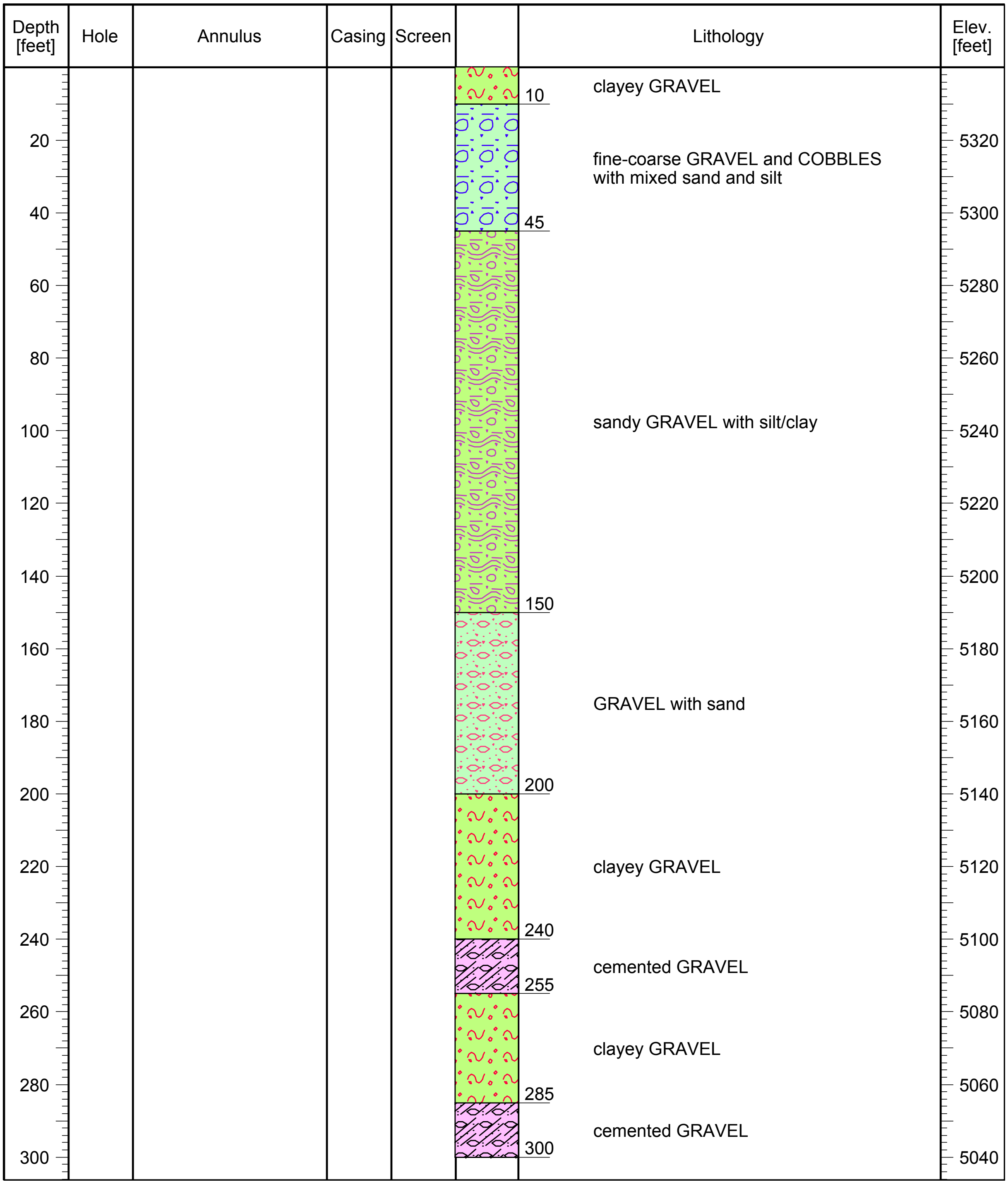
Drilling Method
cable tool

Well Dia. (in)
20.

Perforated or Screened Interval (ft)
100 - 300

Yield (gpm)
2500

Use
irrigation



Well Lithology

Well Identification HIGHMTN3

MBMG Site # M:109896

Well Name or Well Owner High Mountain Ranches irrigation well #3

Location 08S 09W 13 BAAB

Ground Surface Elev. (ft) 5280.33

Measuring Point Elev. (ft) 5281.03

Well Depth below m.p. (ft) 300.00

Vertical Scale 525

Date Completed 3/5/1984

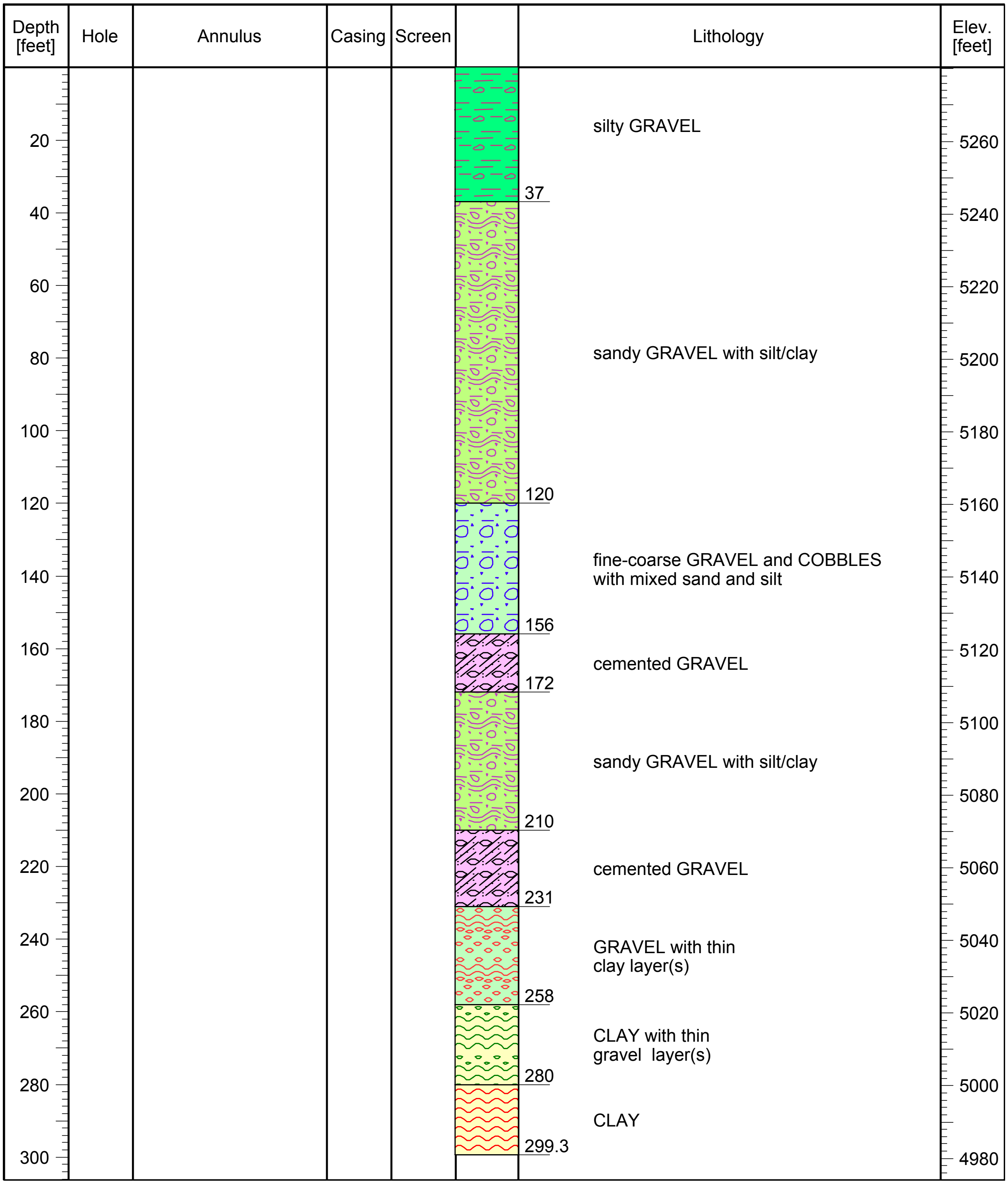
Drilling Method cable tool

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 40 - 280

Yield (gpm) 960

Use irrigation



Well Lithology

Well Identification LADENBT

MBMG Site # M:109901

Well Name or Well Owner Tim Laden

Location 08S 09W 14 AB

Ground Surface Elev. (ft) 5269.00

Well Depth below m.p. (ft) 200.00

Vertical Scale 350

Date Completed 3/26/1987

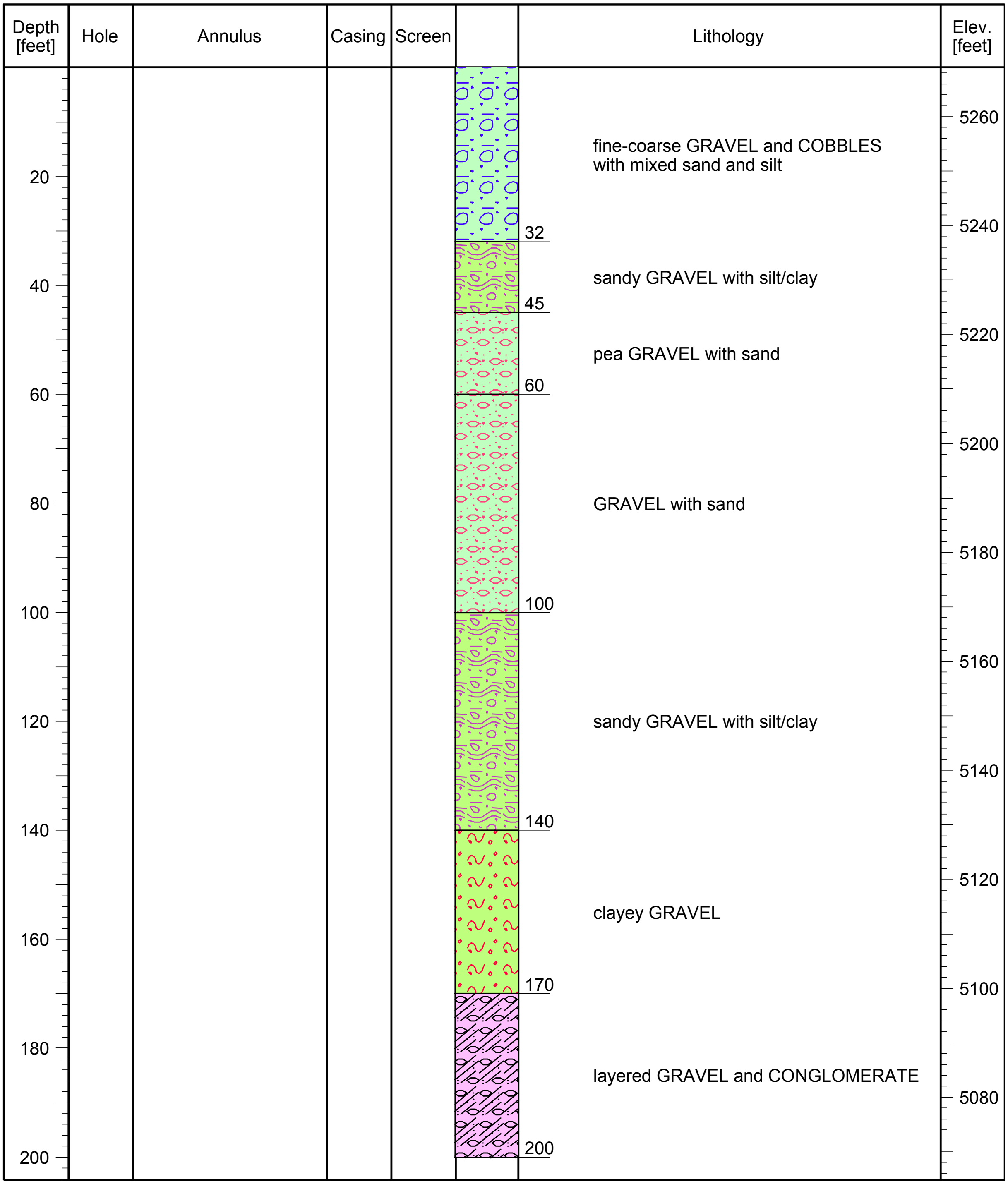
Drilling Method cable tool

Well Dia. (in) 16.

Perforated or Screened Interval (ft) 100 - 170

Yield (gpm) 925

Use irrigation

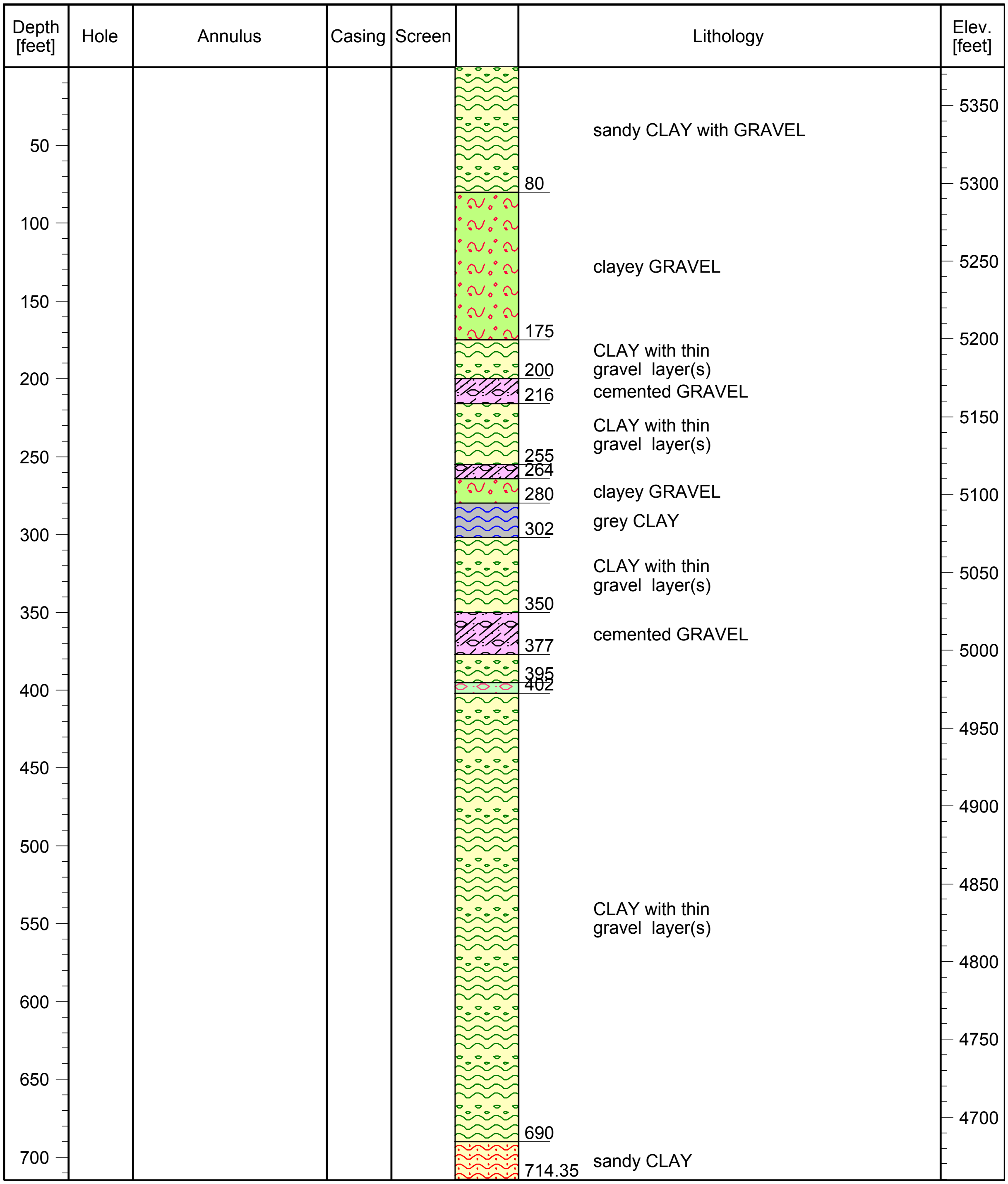


Well Lithology

Well Identification SELKIRK1	**MBMG Site #** M:109951	**Well Name or Well Owner** Zenchiku Ranch irrigation well #1

Location 08S 09W 25 AACD	**Ground Surface Elev. (ft)** 5374.35	**Measuring Point Elev. (ft)** 5375.00	**Well Depth below m.p. (ft)** 715.00	**Vertical Scale** 1225

Date Completed 6/18/1975	**Drilling Method** cable tool	**Well Dia. (in)** 16.	**Perforated or Screened Interval (ft)** 150-185, 200-285, 302-690	**Yield (gpm)** 2250	**Use** irrigation



Well Lithology

Well Identification SELKIRK2

MBMG Site # M:109953

Well Name or Well Owner Zenchiku Ranch irrigation well #2

Location 08S 09W 26 BBDD

Ground Surface Elev. (ft) 5325.00

Measuring Point Elev. (ft) 5325.00

Well Depth below m.p. (ft) 485.00

Vertical Scale 850

Date Completed 11/10/1974

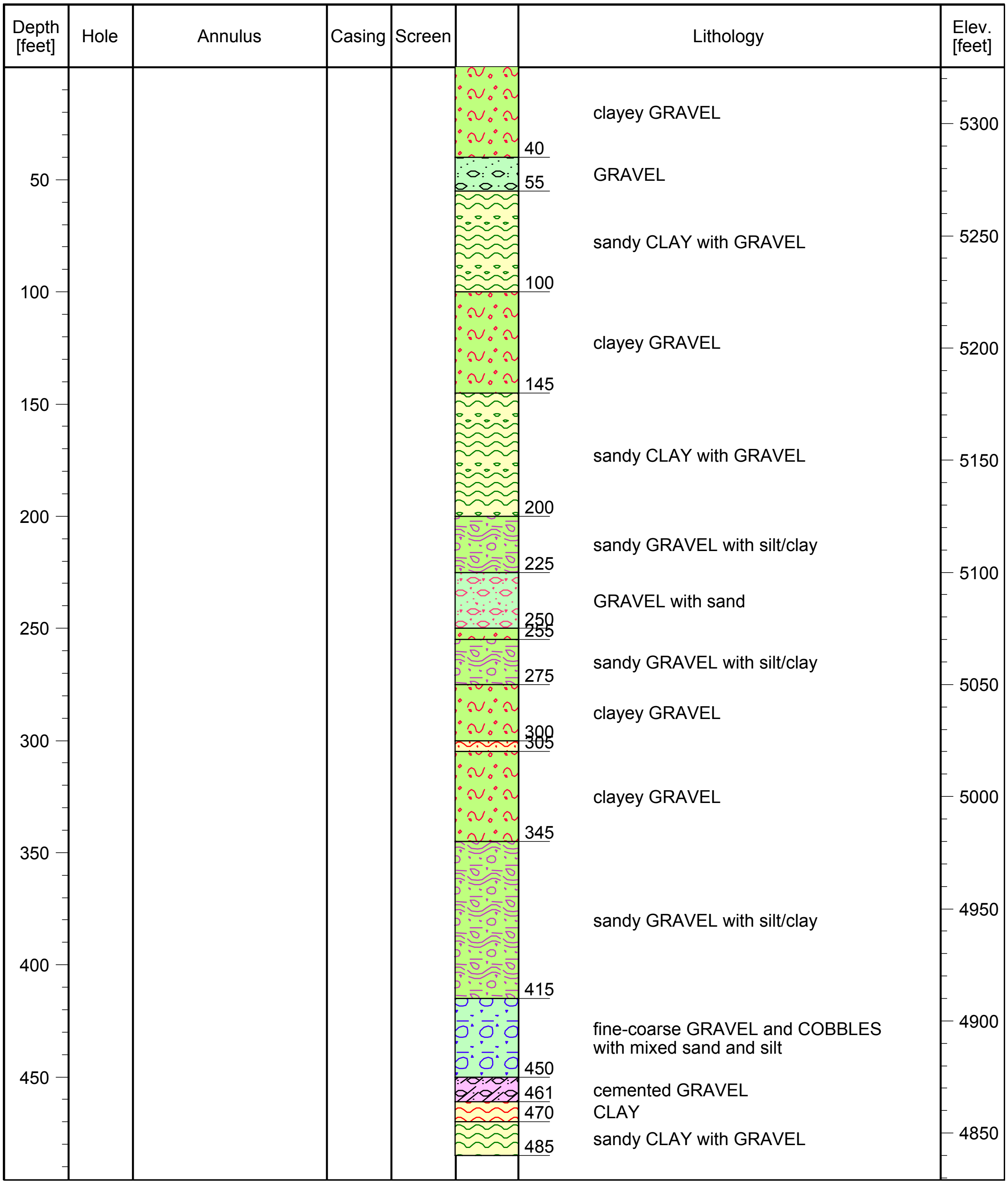
Drilling Method cable tool

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 170 - 450

Yield (gpm) 1000

Use irrigation



40	clayey GRAVEL
55	GRAVEL
100	sandy CLAY with GRAVEL
145	clayey GRAVEL
200	sandy CLAY with GRAVEL
225	sandy GRAVEL with silt/clay
250	GRAVEL with sand
255	
275	sandy GRAVEL with silt/clay
300	clayey GRAVEL
305	
345	clayey GRAVEL
415	sandy GRAVEL with silt/clay
450	fine-coarse GRAVEL and COBBLES with mixed sand and silt
461	cemented GRAVEL
470	CLAY
485	sandy CLAY with GRAVEL

Well Lithology

Well Identification
SELKIRK3

MBMG Site #
M:109952

Well Name or Well Owner
Zenchiku Ranch irrigation well #3

Location
08S 09W 26 ABBA

Ground Surface Elev. (ft)
5317.60

Measuring Point Elev. (ft)
5318.00

Well Depth below m.p. (ft)
415.00

Vertical Scale
725

Date Completed
10/31/1978

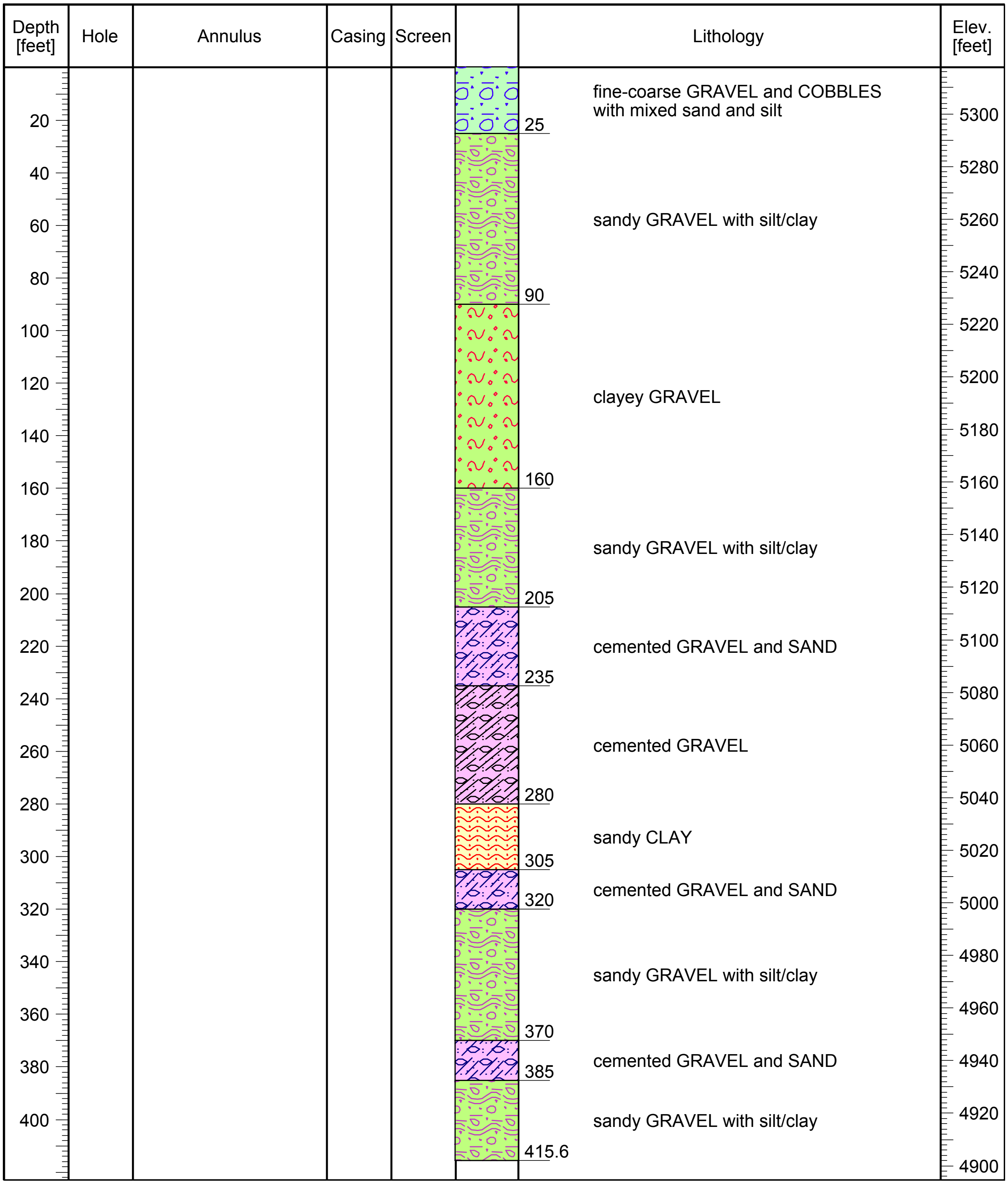
Drilling Method
cable tool

Well Dia. (in)
16.

Perforated or Screened Interval (ft)
75 - 415

Yield (gpm)
2250

Use
irrigation



Well Lithology

Well Identification SELKIRK4

MBMG Site # M:109941

Well Name or Well Owner Zenchiku Ranch irrigation well #4

Location 08S 09W 24 CCCC

Ground Surface Elev. (ft) 5329.60

Measuring Point Elev. (ft) 5330.00

Well Depth below m.p. (ft) 435.00

Vertical Scale 750

Date Completed 3/7/1975

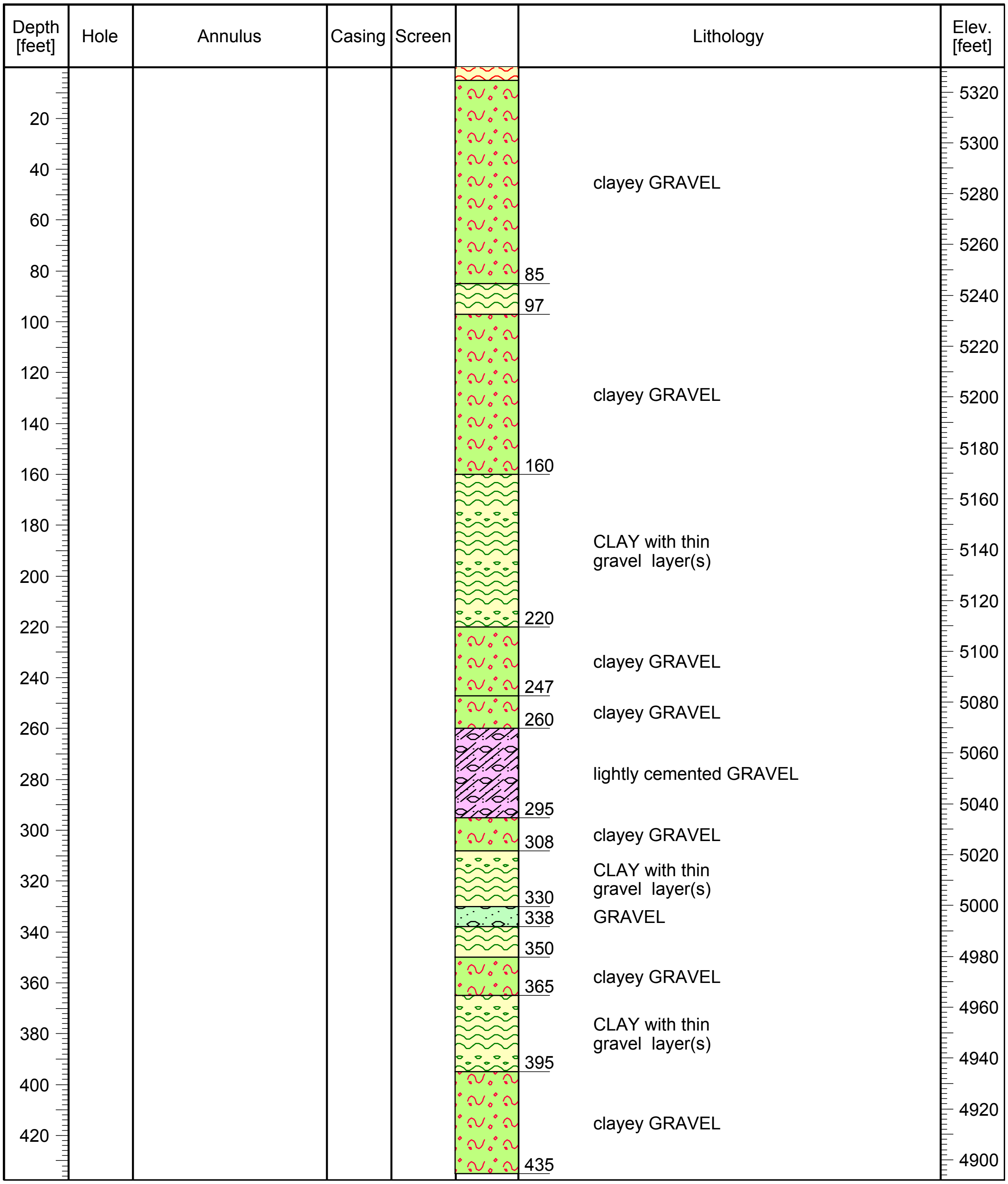
Drilling Method cable tool

Well Dia. (in) 16.

Perforated or Screened Interval (ft) 160 - 365

Yield (gpm) 1800

Use irrigation



Well Lithology

Well Identification
SELKIRK_ABAN

MBMG Site #
M:120061

Well Name or Well Owner
Zenchiku Ranch

Location
08S 09W 24 C

Well Depth below m.p. (ft)
605.00

Vertical Scale
1050

Date Completed
12/3/1975

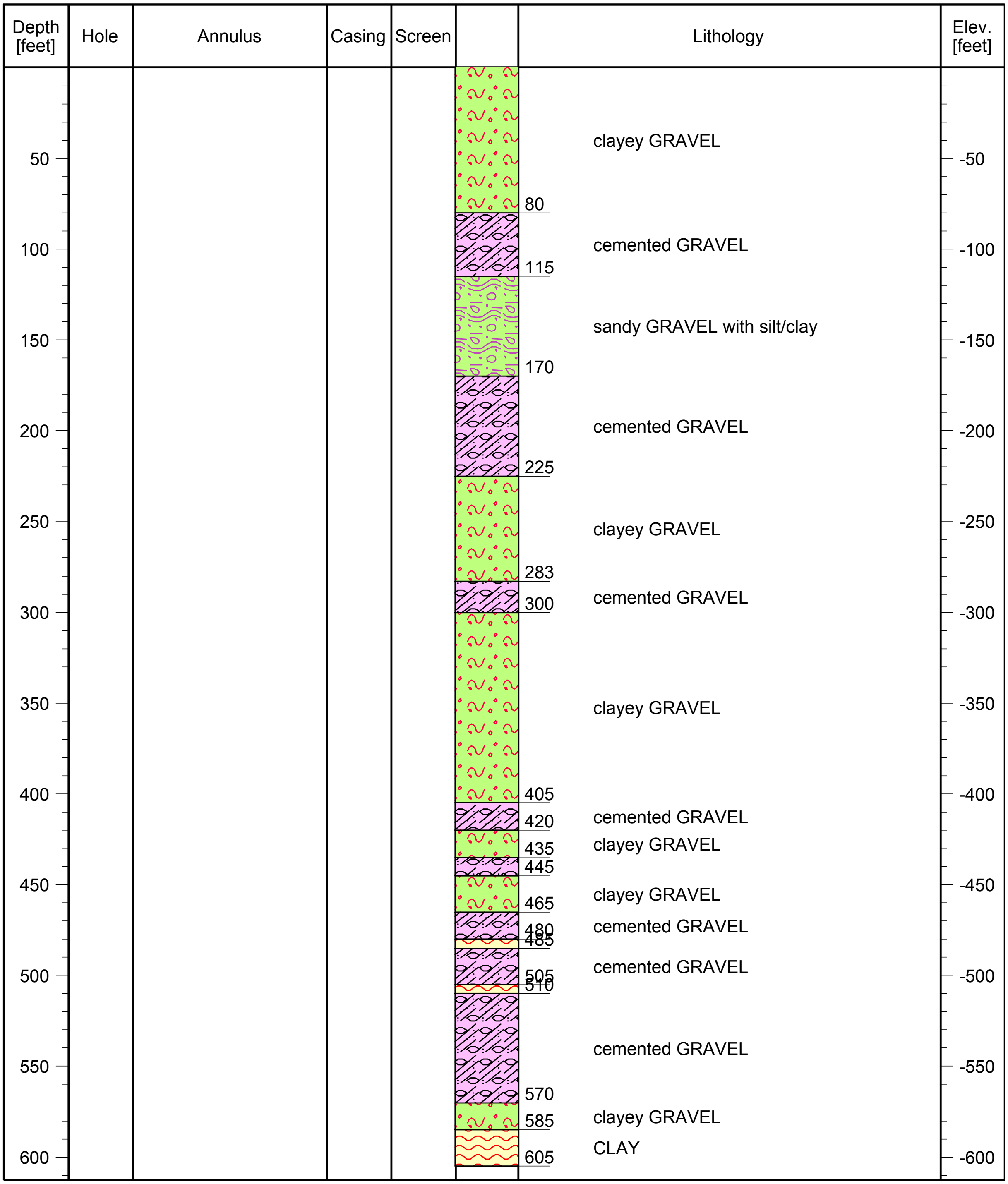
Drilling Method
cable tool

Well Dia. (in)
16.

Perforated or Screened Interval (ft)
120 - 595

Yield (gpm)
0

Use
abandoned



Middle Blacktail Deer Creek Valley

Well Lithology

Well Identification 91-5

MBMG Site # M:126663

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 91-5

Location 08S 08W 30 AAAA

Ground Surface Elev. (ft) 5397.92

Measuring Point Elev. (ft) 5399.58

Well Depth below m.p. (ft) 106.91

Vertical Scale 185

Date Completed 9/16/1991

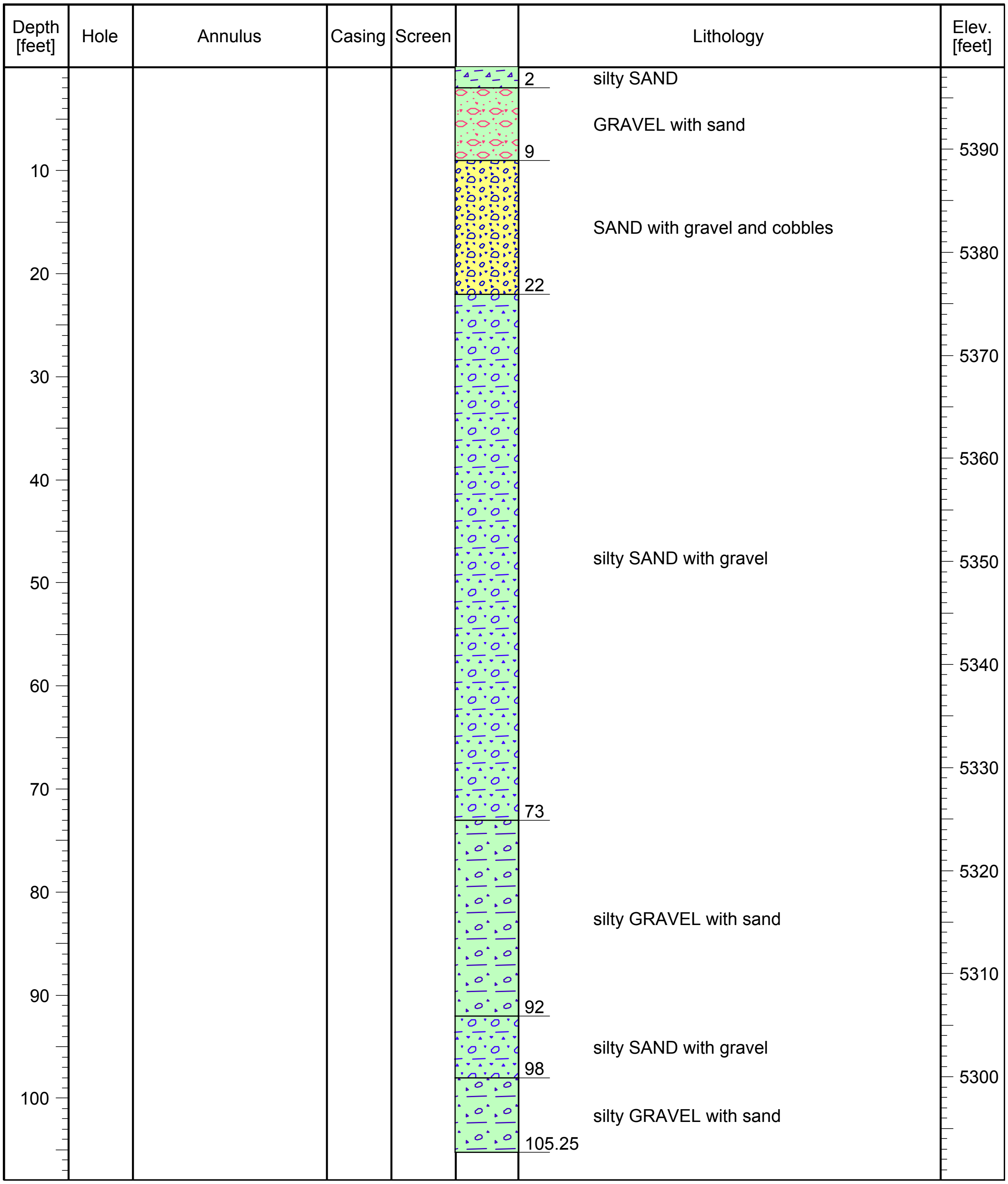
Drilling Method air rotary

Well Dia. (in) 2.0

Perforated or Screened Interval (ft) 95.5 - 105.5

Yield (gpm) 5

Use monitoring

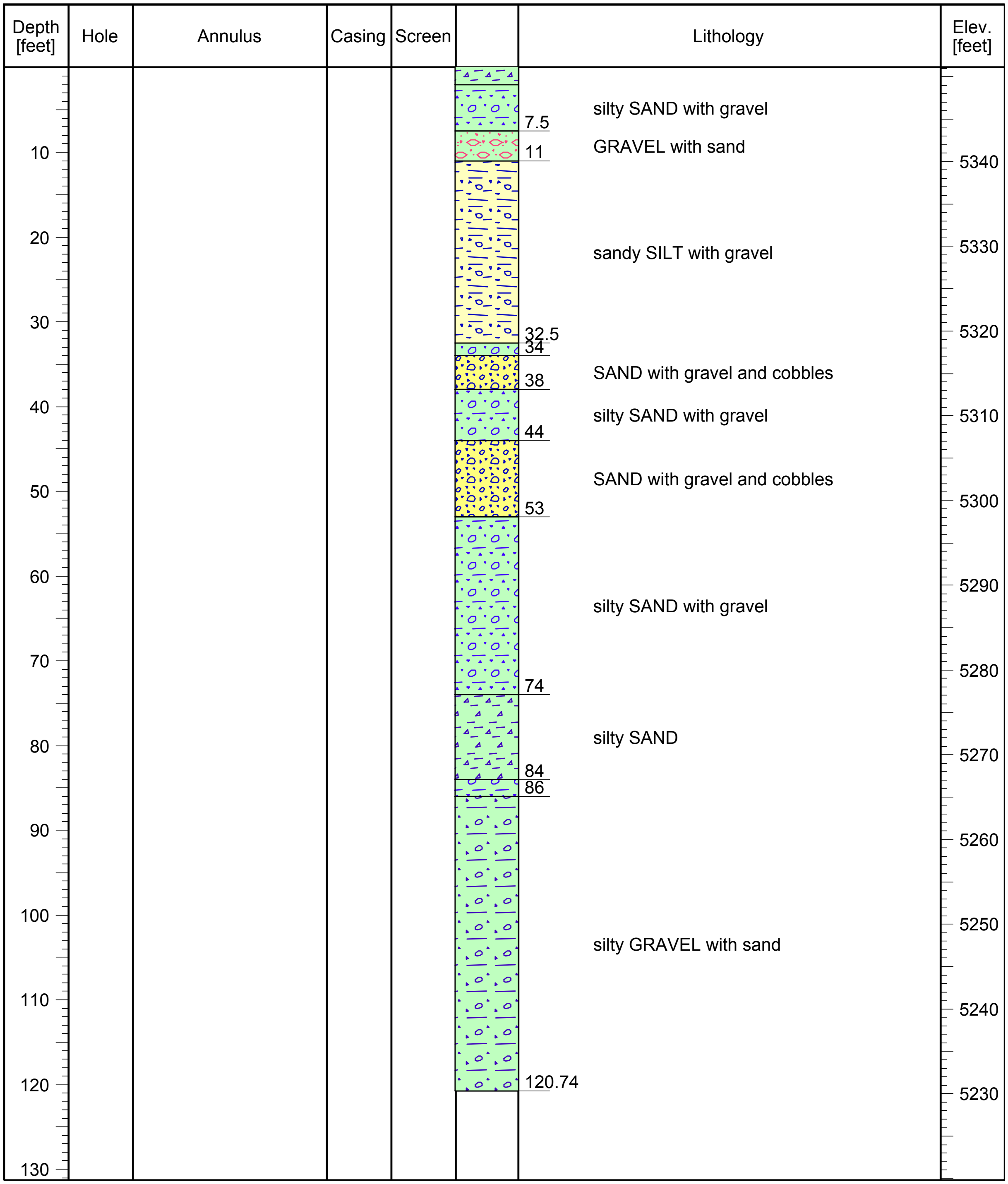


Well Lithology

Well Identification 91-6	**MBMG Site #** M:126661	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 91-6

Location 08S 08W 18 DCCD	**Ground Surface Elev. (ft)** 5351.09	**Measuring Point Elev. (ft)** 5352.83	**Well Depth below m.p. (ft)** 122.48	**Vertical Scale** 225

Date Completed 9/18/1991	**Drilling Method** air rotary	**Well Dia. (in)** 2.0	**Perforated or Screened Interval (ft)** 110.5 - 120.5	**Yield (gpm)** 5	**Use** monitoring



Well Lithology

Well Identification
91-7

MBMG Site #
M:133329

Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 91-7

Location
08S 09W 01 DDAA

Ground Surface Elev. (ft)
5248.66

Measuring Point Elev. (ft)
5250.64

Well Depth below m.p. (ft)
62.29

Vertical Scale
125

Date Completed
9/26/1991

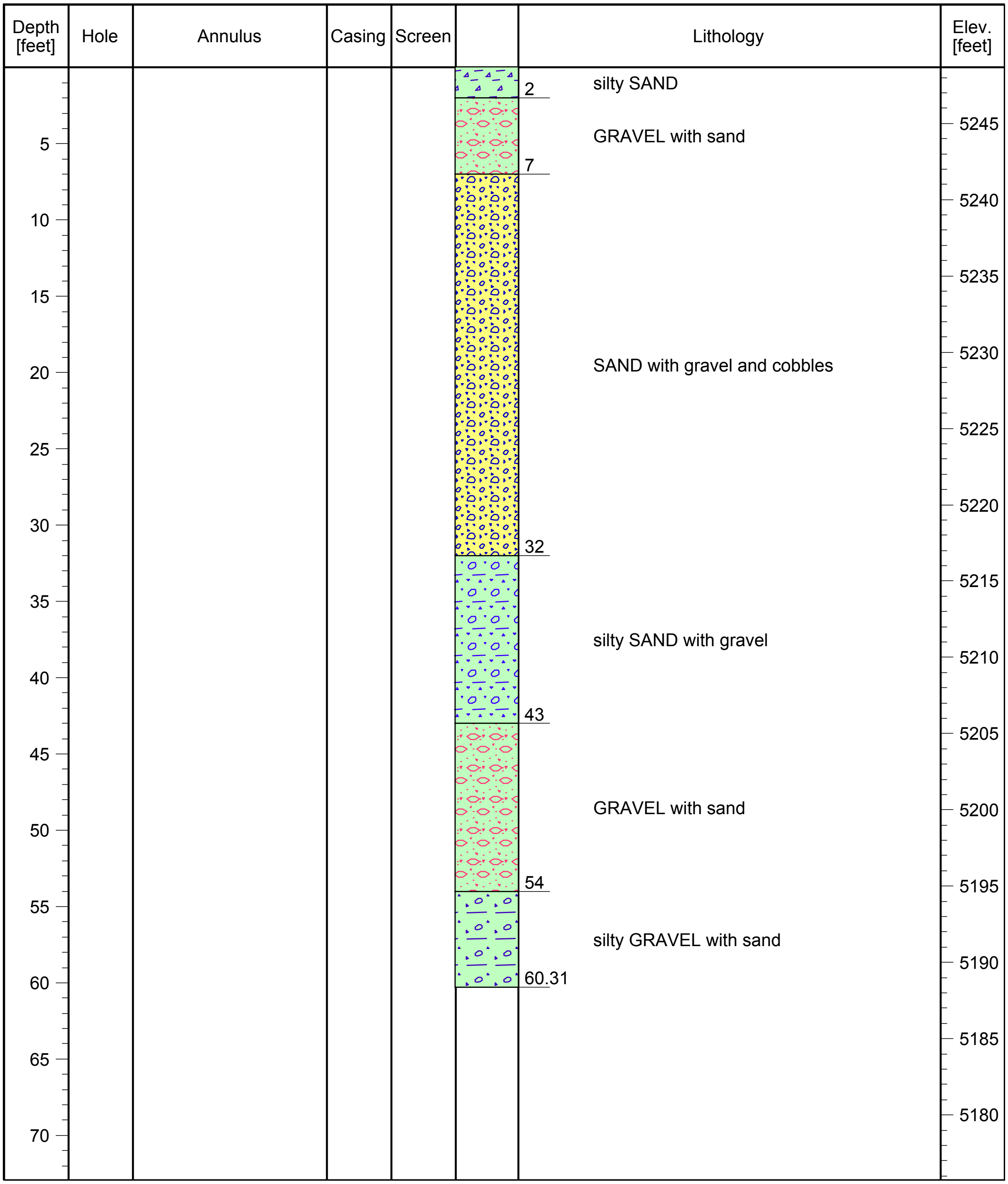
Drilling Method
air rotary

Well Dia. (in)
2.0

Perforated or Screened Interval (ft)
50.5 - 60.5

Yield (gpm)
5

Use
monitoring

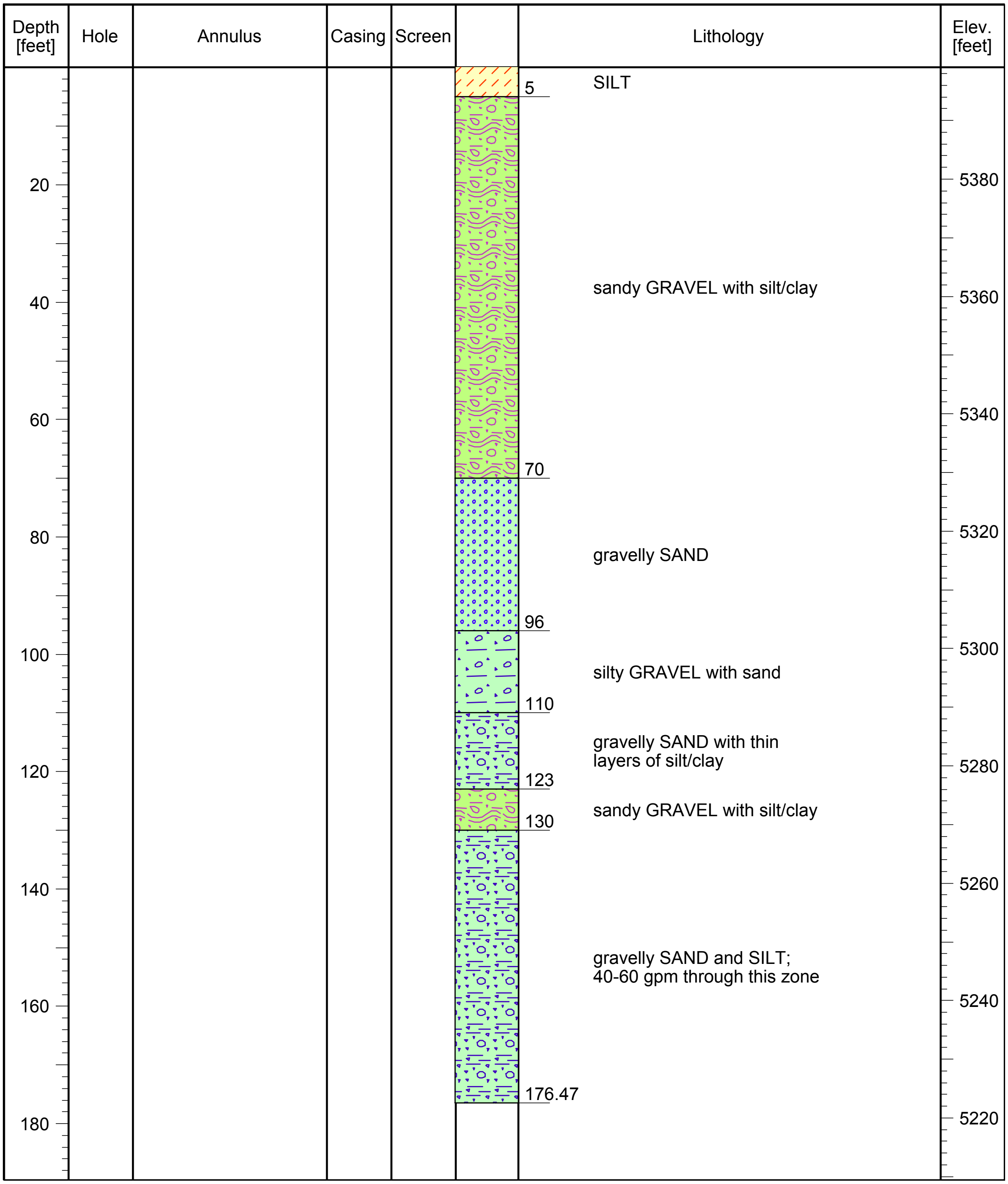


Well Lithology

Well Identification 92-5	**MBMG Site #** M:133332	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-5

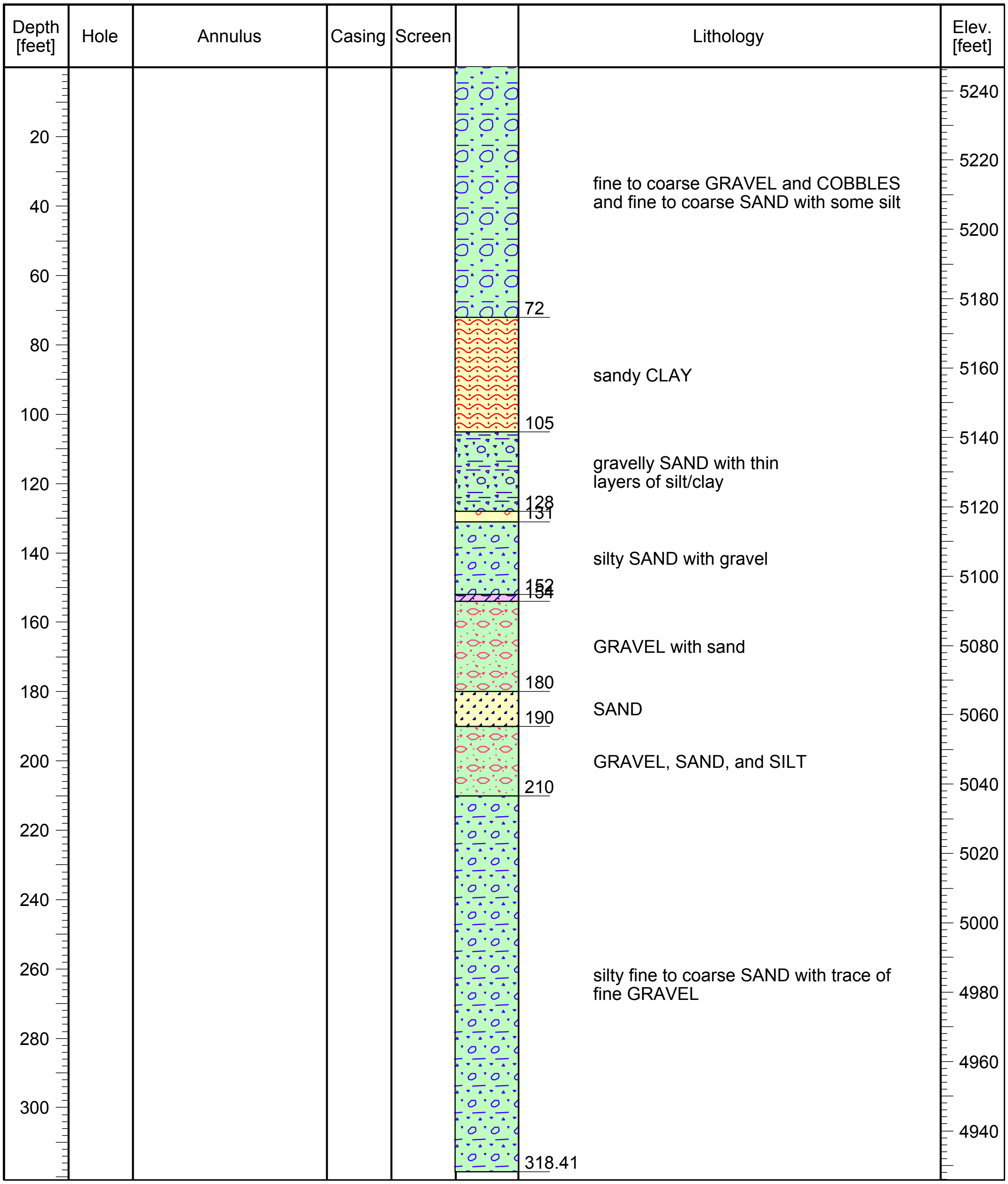
Location 08S 08W 20 ACCA	**Ground Surface Elev. (ft)** 5399.03	**Measuring Point Elev. (ft)** 5400.45	**Well Depth below m.p. (ft)** 177.89	**Vertical Scale** 325

Date Completed 4/22/1993	**Drilling Method** air rotary	**Well Dia. (in)** 6.0	**Perforated or Screened Interval (ft)** 86-91, 124-127, 147-152, 164-169	**Yield (gpm)** 60	**Use** monitoring



Well Lithology

Well Identification 92-14	**MBMG Site #** M:140582	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-14		
Location 08S 08W 06 CBDD	**Ground Surface Elev. (ft)** 5246.69	**Measuring Point Elev. (ft)** 5248.30	**Well Depth below m.p. (ft)** 320.02	**Vertical Scale** 550
Date Completed 11/10/1993	**Drilling Method** air rotary	**Well Dia. (in)** 6.0	**Perforated or Screened Interval (ft)** 52-57,70-76,140-150,239-245,253-258	**Yield (gpm)** 75
Use monitoring				



Well Lithology

Well Identification
ANDERSON

MBMG Site #
M:122792

Well Name or Well Owner
J. B. Anderson

Location
08S 08W 6 CB

Ground Surface Elev. (ft)
5248.00

Well Depth below m.p. (ft)
325.00

Vertical Scale
575

Date Completed
5/16/1991

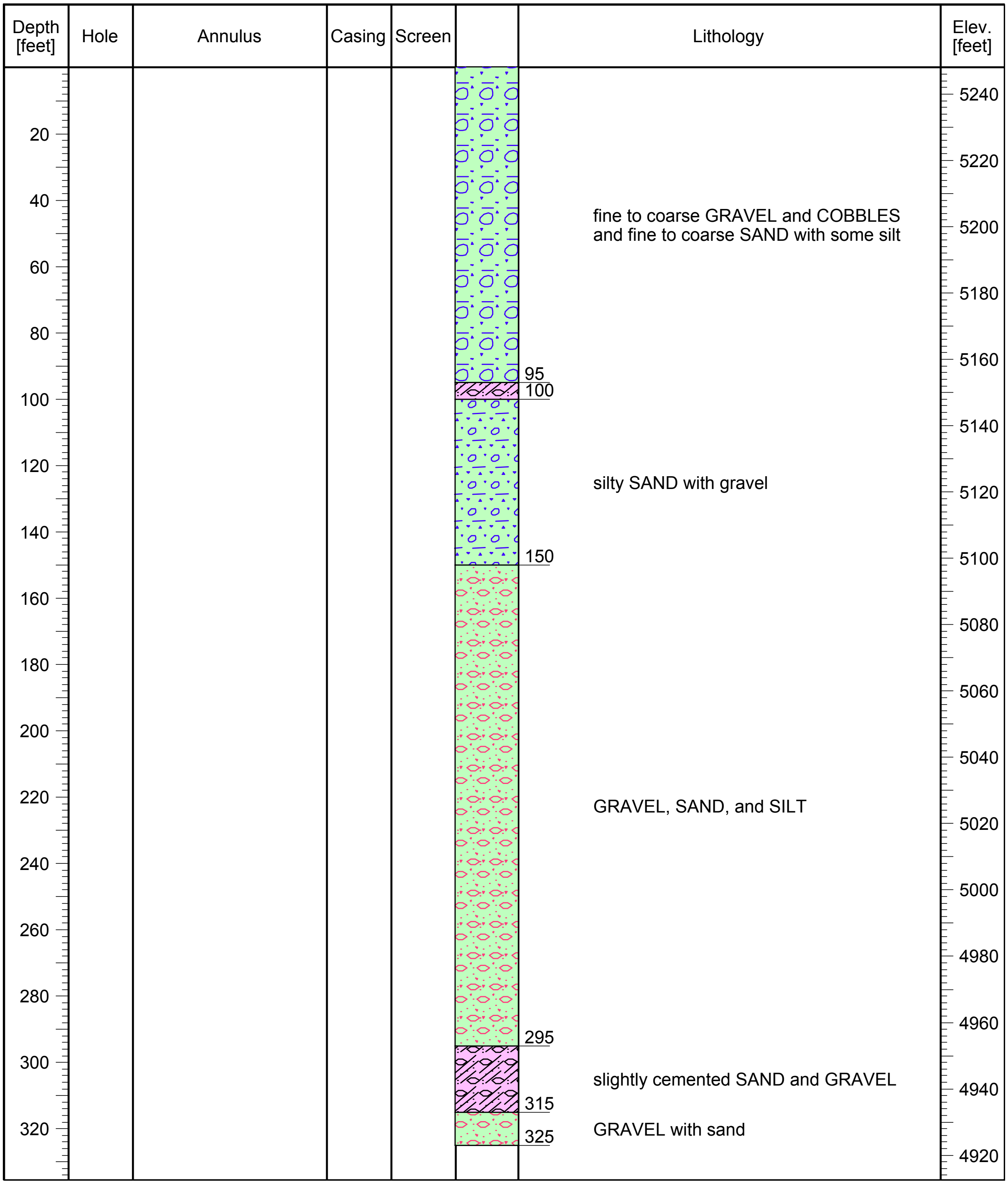
Drilling Method
cable tool

Well Dia. (in)
20.

Perforated or Screened Interval (ft)
50 - 315

Yield (gpm)
1240

Use
irrigation



Well Lithology

Well Identification FORRIRRG

MBMG Site # M:109803

Well Name or Well Owner Forrester irrigation well #1

Location 08S 08W 20 ACCA

Ground Surface Elev. (ft) 5400.11

Measuring Point Elev. (ft) 5400.11

Well Depth below m.p. (ft) 183.73

Vertical Scale 375

Date Completed 5/1951

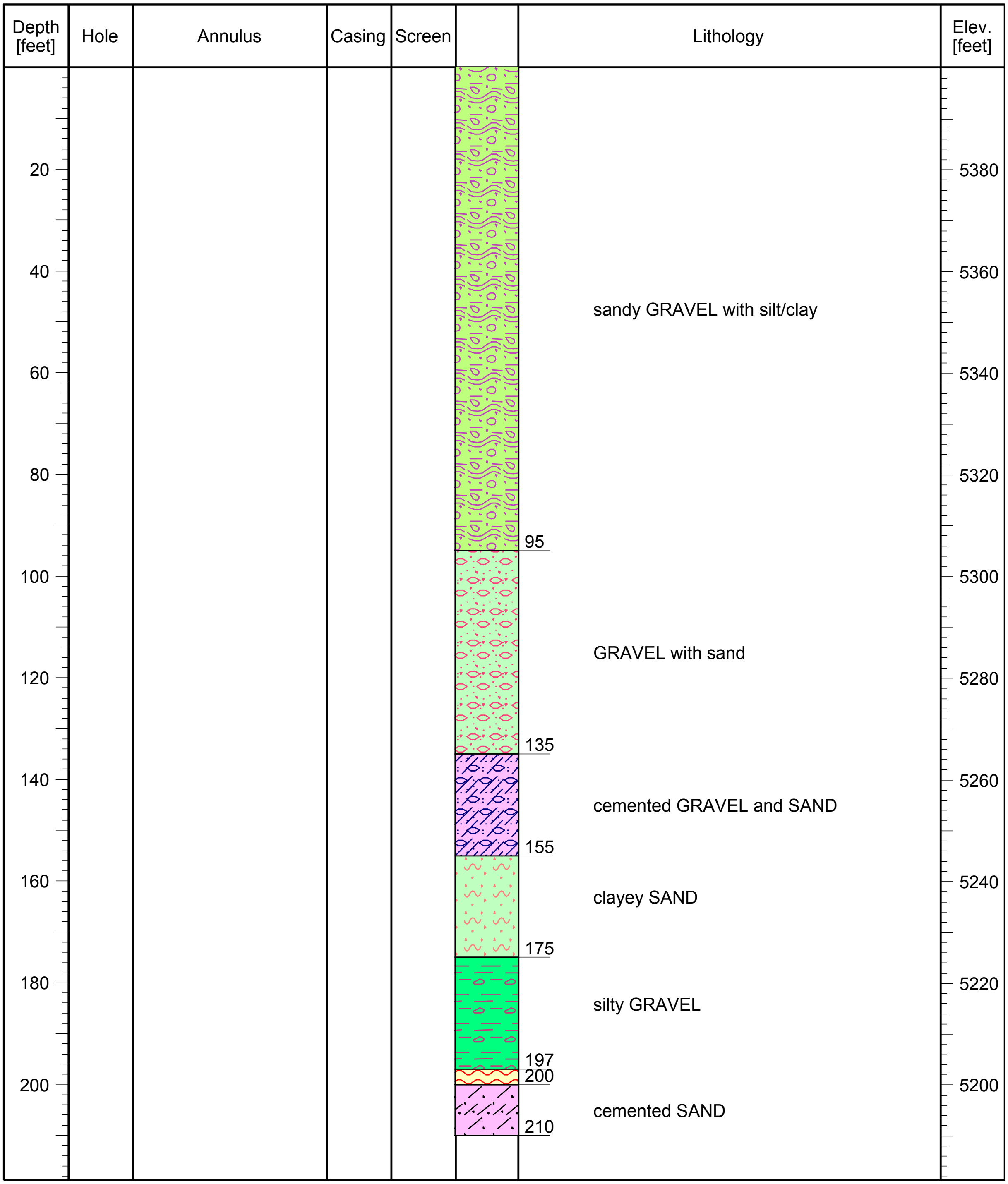
Drilling Method cable tool

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 45 - 185

Yield (gpm) 1300

Use irrigation

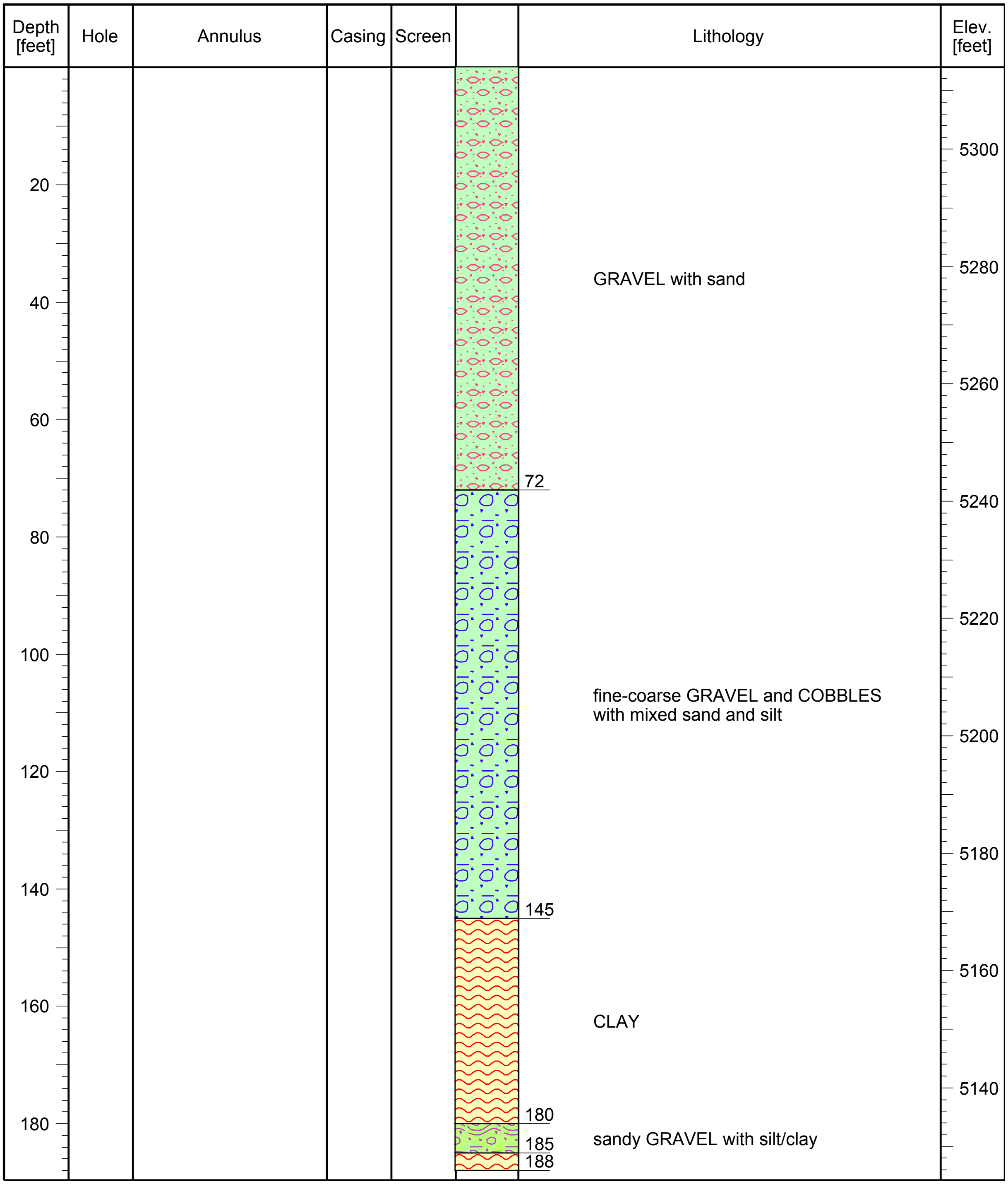


Well Lithology

Well Identification HIGHMTN1	**MBMG Site #** M:109796	**Well Name or Well Owner** High Mountain Ranches irrigation well #1

Location 08S 08W 07 DDDD	**Ground Surface Elev. (ft)** 5313.90	**Measuring Point Elev. (ft)** 5315.09	**Well Depth below m.p. (ft)** 186.00	**Vertical Scale** 325

Date Completed 9/1951	**Drilling Method** cable tool	**Well Dia. (in)** 20.	**Perforated or Screened Interval (ft)** 60 - 170	**Yield (gpm)** 2300	**Use** irrigation

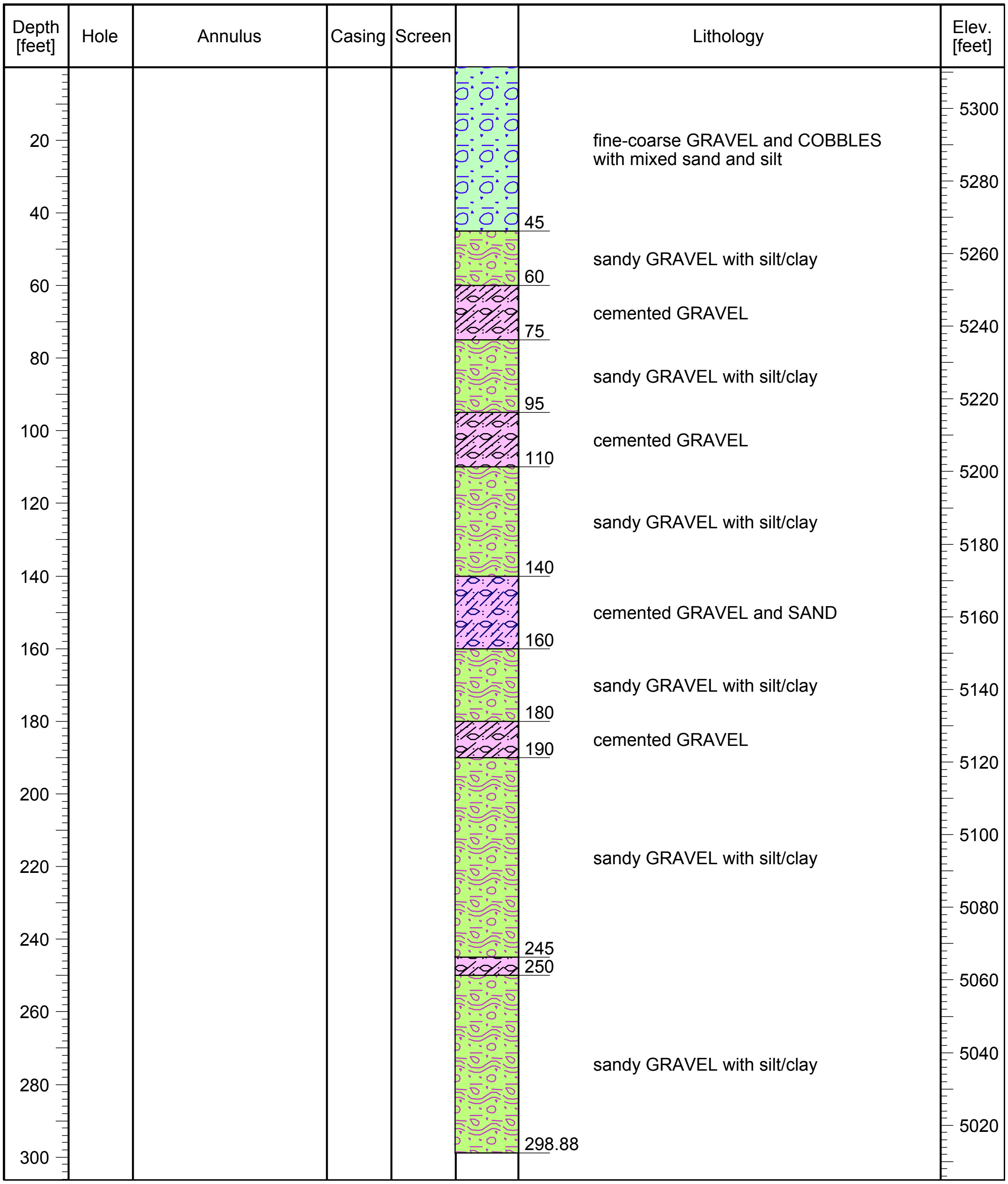


Well Lithology

Well Identification HIGHMTN2	**MBMG Site #** M:109800	**Well Name or Well Owner** High Mountain Ranches irrigation well #2

Location 08S 08W 07 DDDC	**Ground Surface Elev. (ft)** 5311.23	**Measuring Point Elev. (ft)** 5312.35	**Well Depth below m.p. (ft)** 300.00	**Vertical Scale** 525

Date Completed 11/15/1977	**Drilling Method** cable tool	**Well Dia. (in)** 20.	**Perforated or Screened Interval (ft)** 50 - 302	**Yield (gpm)** 2100	**Use** irrigation



Well Lithology

Well Identification
HIGHMTN4

MBMG Site #
M:109800

Well Name or Well Owner
High Mountain Ranches irrigation well #4

Location
08S 08W 20 DC

Ground Surface Elev. (ft)
5408.00

Well Depth below m.p. (ft)
140.00

Vertical Scale
250

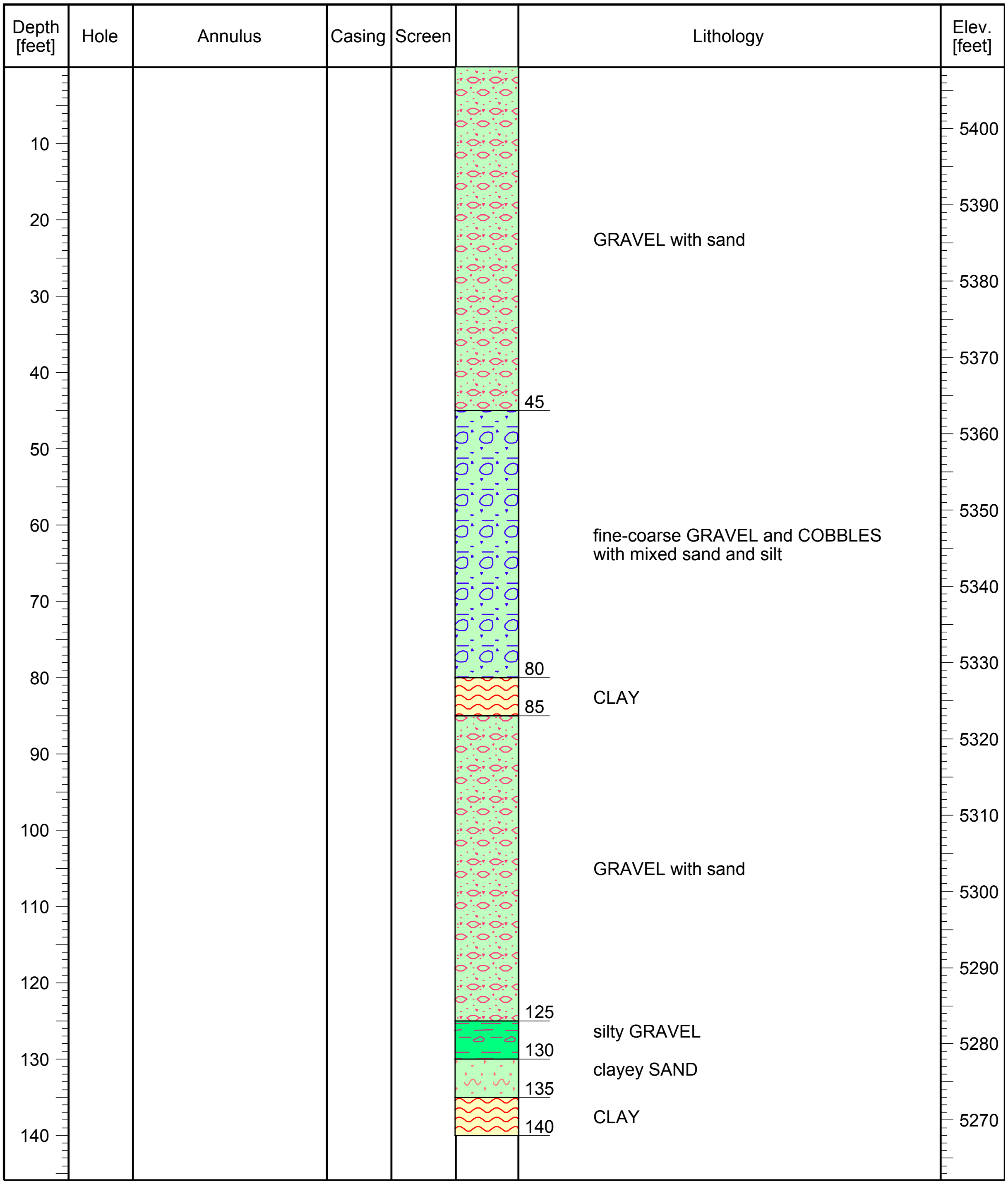
Date Completed
1952

Drilling Method
cable tool

Well Dia. (in)
20.

Yield (gpm)
1200

Use
irrigation



Well Lithology

Well Identification ROLANDSON

MBMG Site # M:122793

Well Name or Well Owner Ken Rolandson

Location 08S 09W 12 BA

Ground Surface Elev. (ft) 5248.00

Well Depth below m.p. (ft) 180.00

Vertical Scale 325

Date Completed 3/20/1991

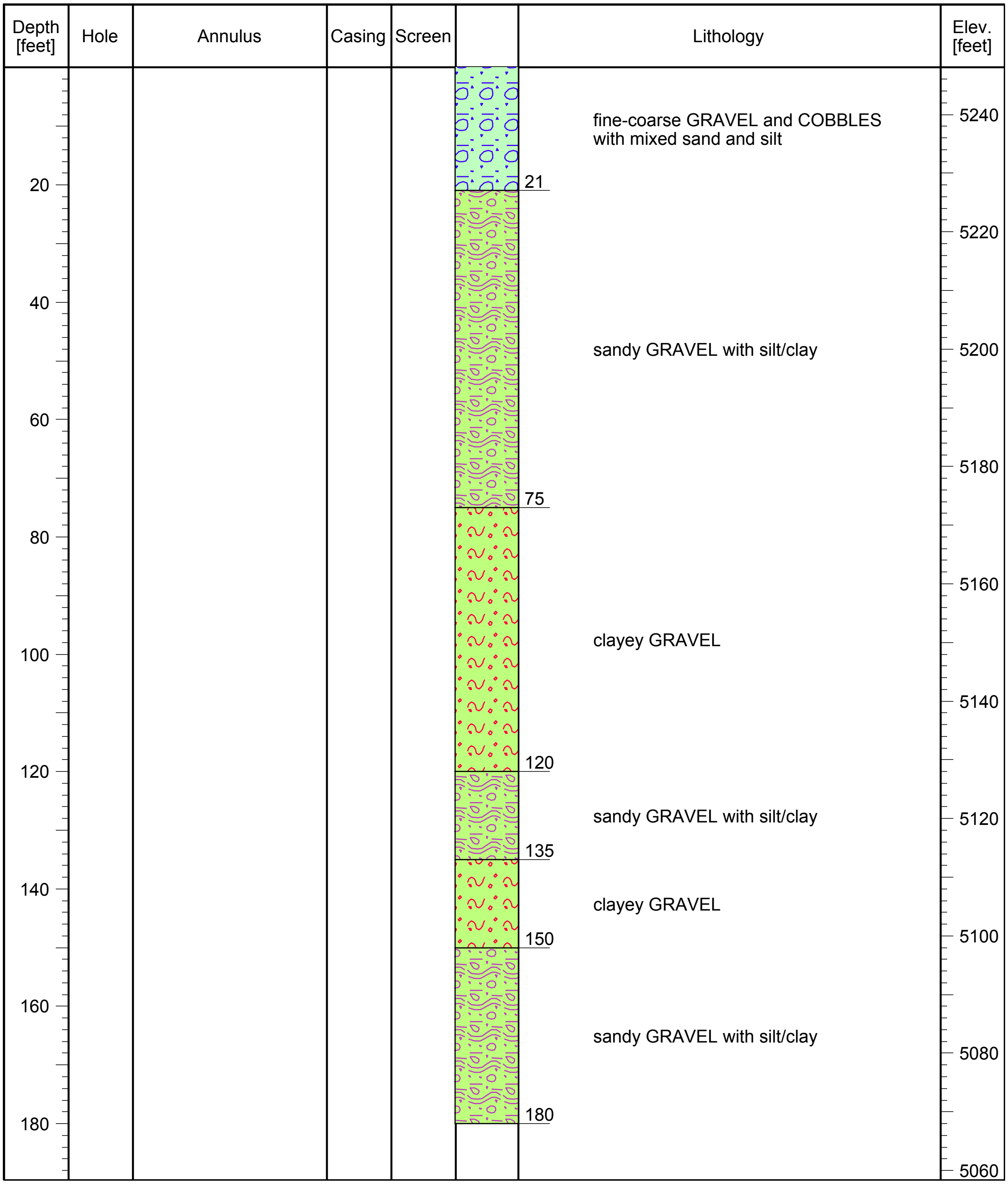
Drilling Method cable tool

Well Dia. (in) 16.

Perforated or Screened Interval (ft) 40 - 180

Yield (gpm) 1335

Use irrigation



Lower Blacktail Deer Creek Valley

Well Lithology

Well Identification 92-15

MBMG Site # M:133380

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-15

Location 07S 08W 31 BCAD

Ground Surface Elev. (ft) 5216.77

Measuring Point Elev. (ft) 5218.45

Well Depth below m.p. (ft) 510.68

Vertical Scale 950

Date Completed 11/4/1993

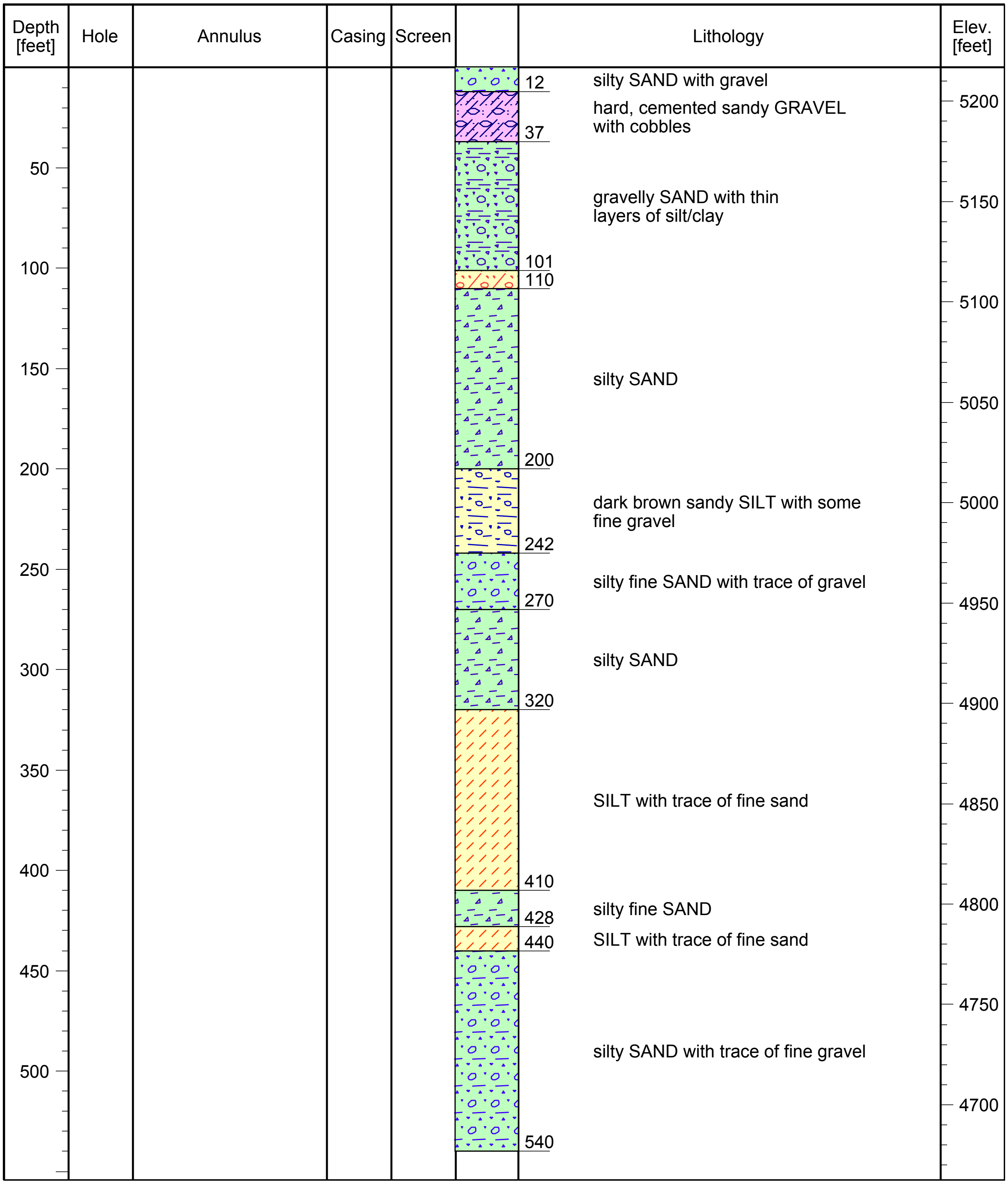
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) none

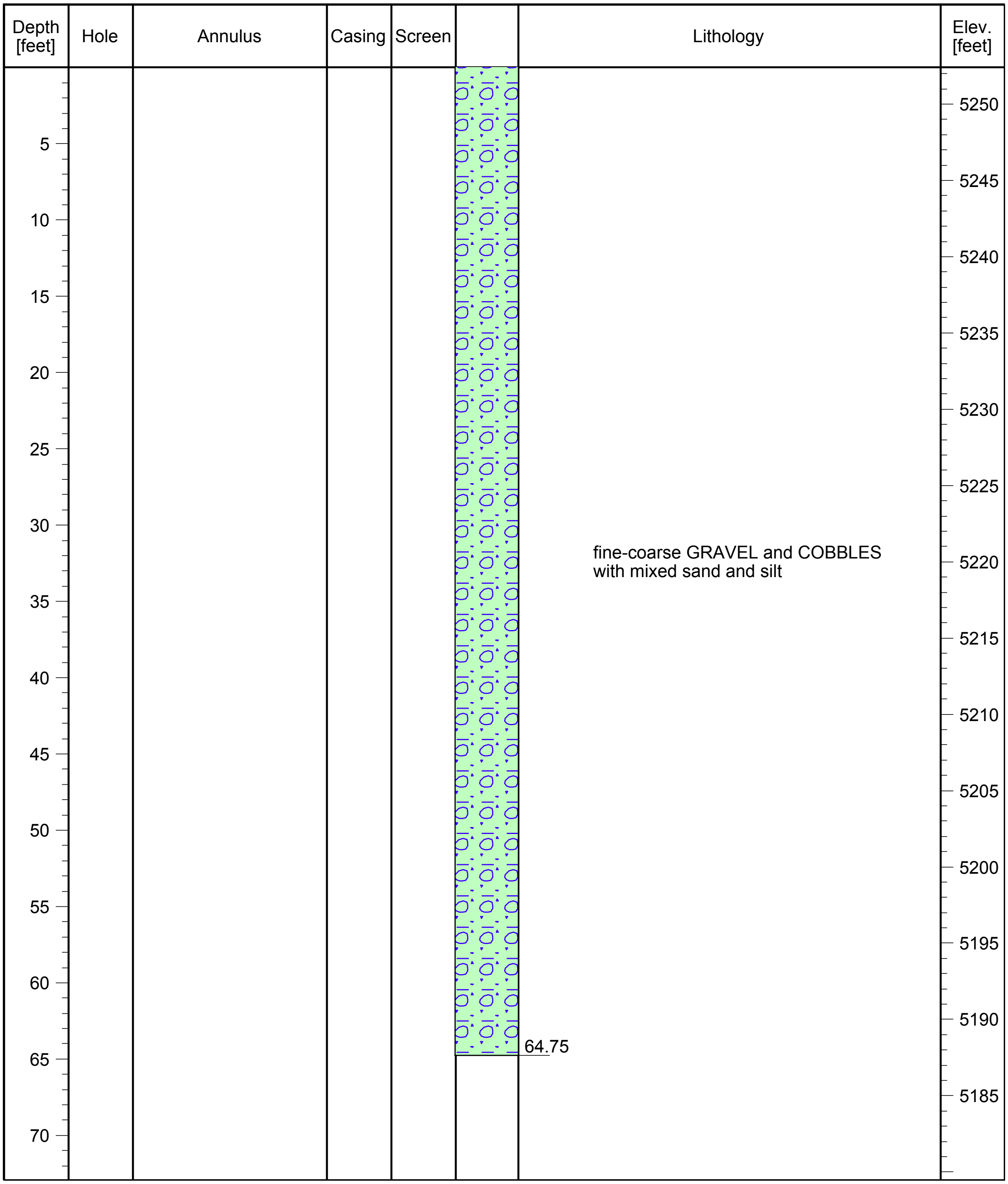
Yield (gpm) 15

Use monitoring



Well Lithology

Well Identification	92-34
MBMG Site #	M:140585
Well Name or Well Owner	MT DNRC Beaverhead Groundwater Project well 92-34
Location	08S 09W 22 ABAA
Ground Surface Elev. (ft)	5252.40
Measuring Point Elev. (ft)	5253.90
Well Depth below m.p. (ft)	66.25
Vertical Scale	125
Date Completed	11/10/1993
Drilling Method	air rotary
Well Dia. (in)	6.0
Perforated or Screened Interval (ft)	61.5 - 63
Yield (gpm)	15
Use	monitoring



Well Lithology

Well Identification
92-35

MBMG Site #
M:140586

Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-35

Location
08S 09W 22 ABAA

Ground Surface Elev. (ft)
5246.28

Measuring Point Elev. (ft)
5247.92

Well Depth below m.p. (ft)
61.78

Vertical Scale
125

Date Completed
11/10/1993

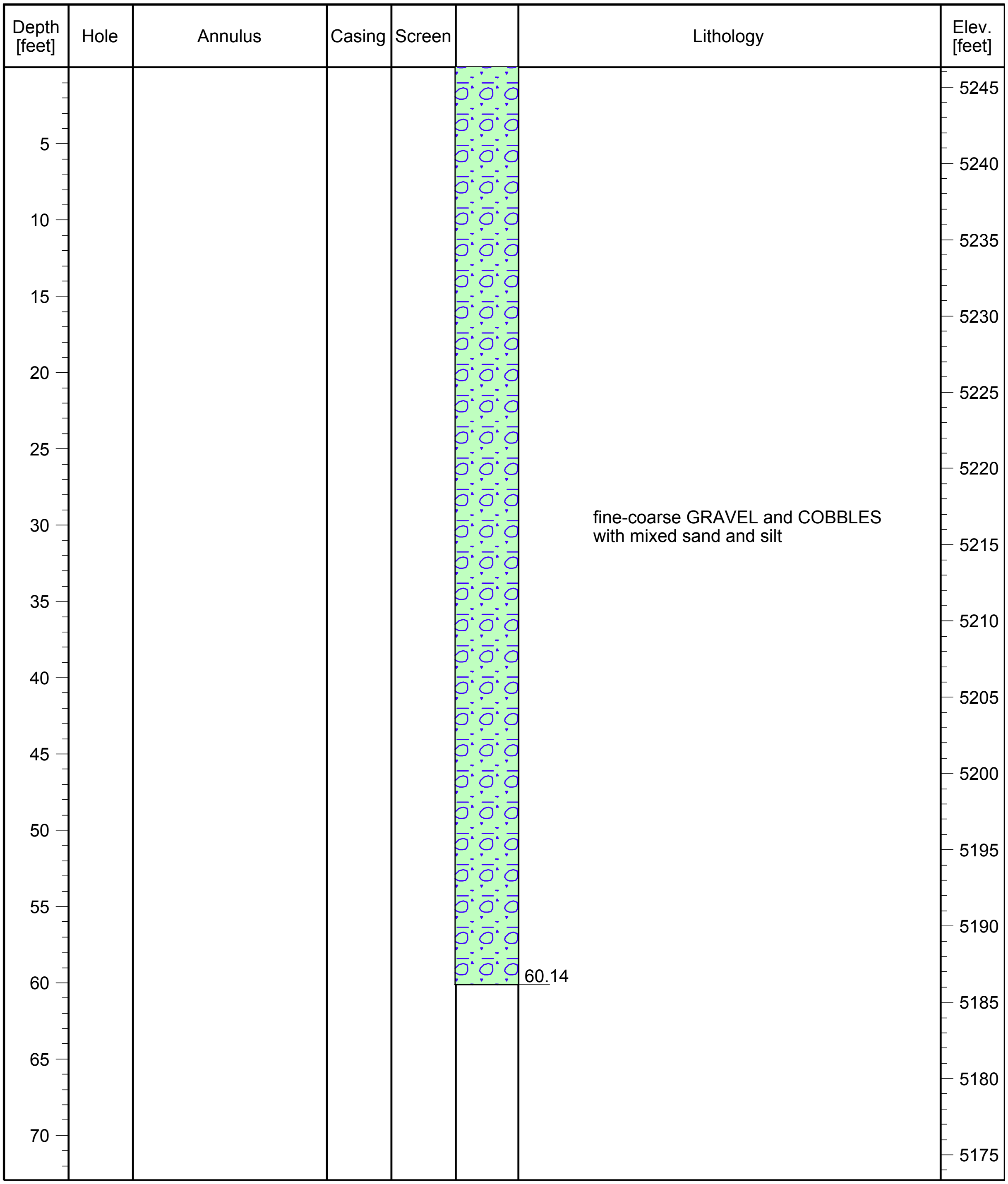
Drilling Method
air rotary

Well Dia. (in)
6.0

Perforated or Screened Interval (ft)
57 - 58.5

Yield (gpm)
20

Use
monitoring



fine-coarse GRAVEL and COBBLES
with mixed sand and silt

Well Lithology

Well Identification 94-2

MBMG Site # M:149512

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 94-2

Location 07S 09W 36 CCAA

Ground Surface Elev. (ft) 5193.19

Measuring Point Elev. (ft) 5195.05

Well Depth below m.p. (ft) 358.31

Vertical Scale 700

Date Completed 6/8/1995

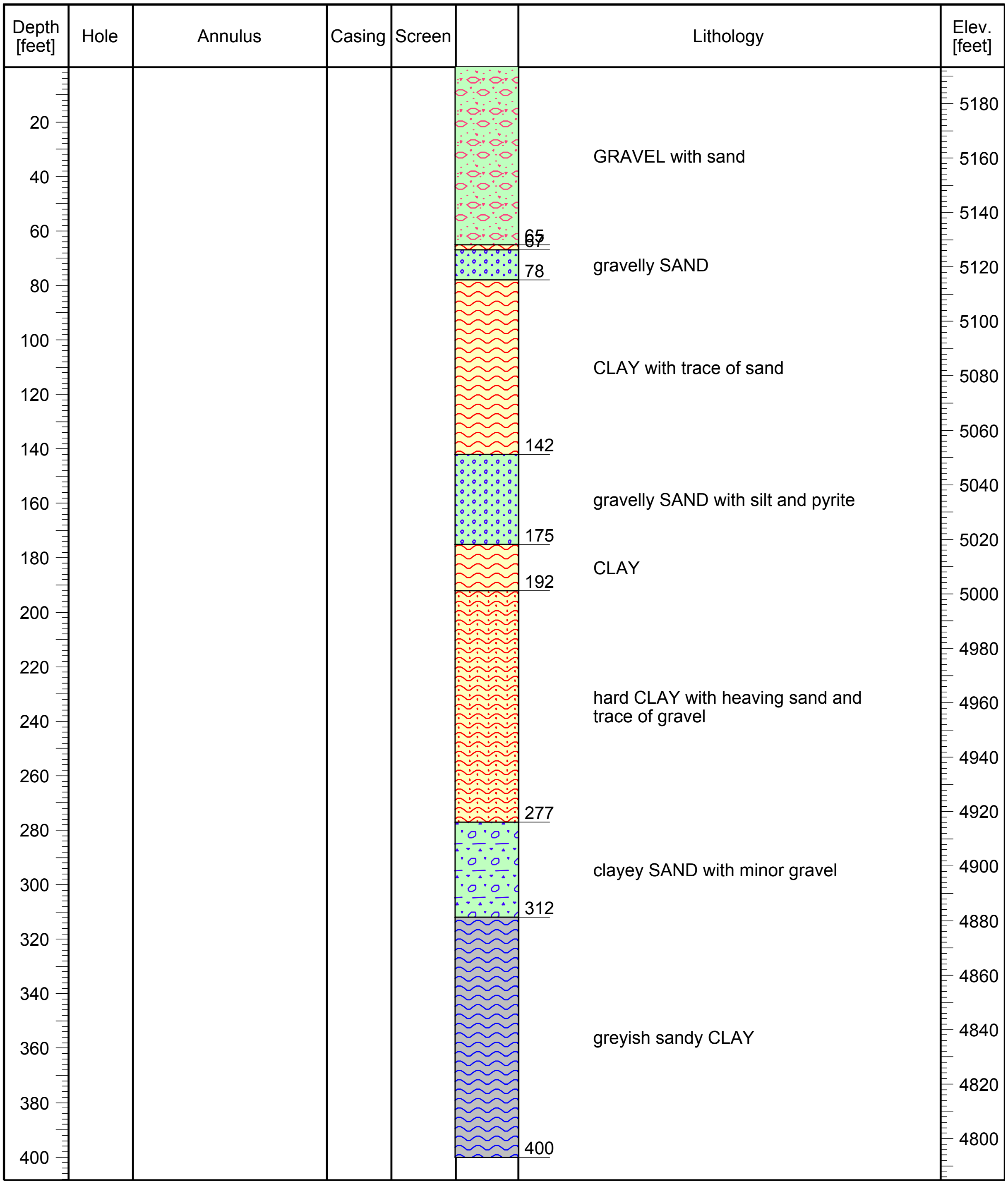
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 275 - 280, 285 - 300

Yield (gpm) 20

Use monitoring



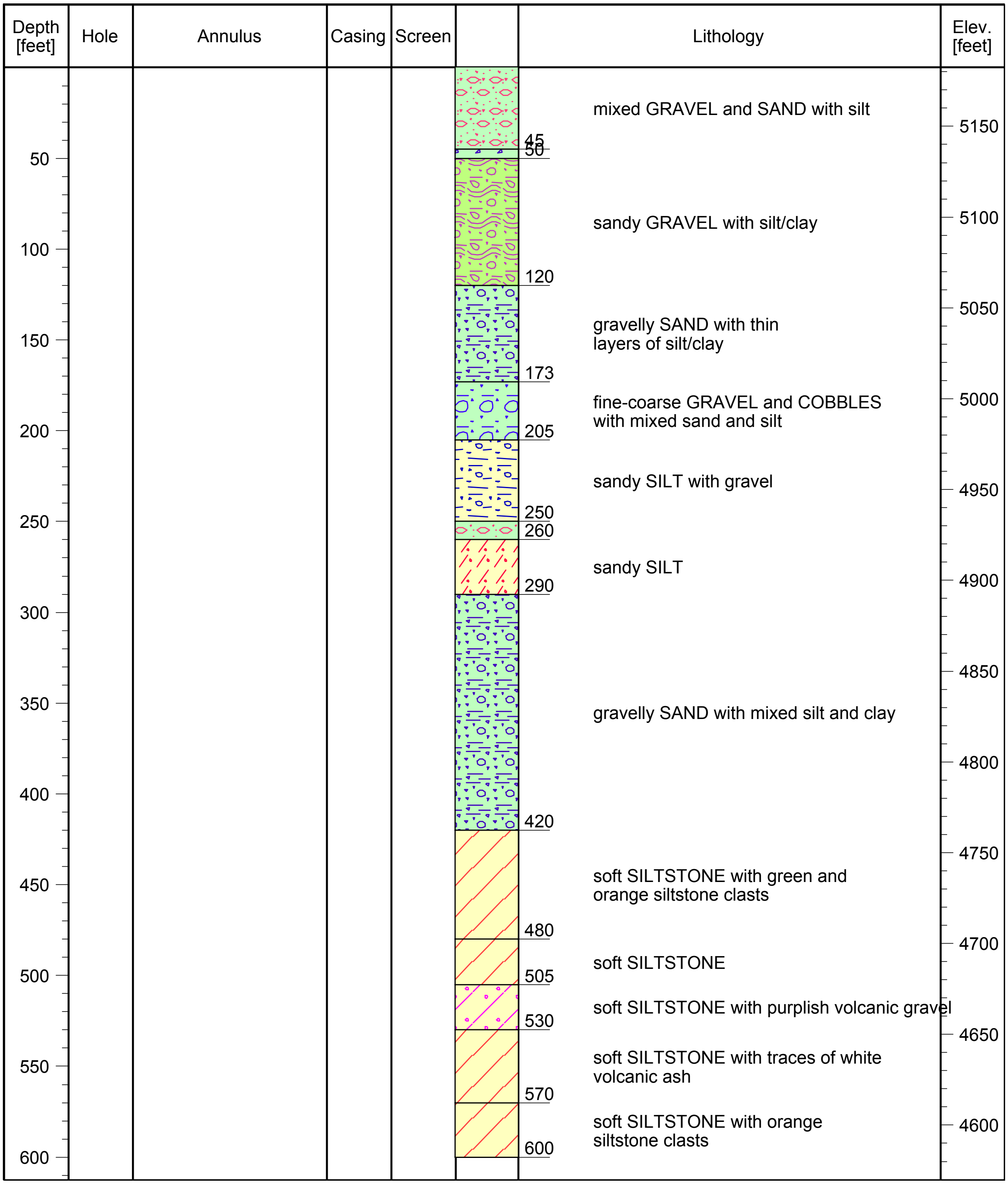
Beaverhead River Floodplain near Barretts

Well Lithology

Well Identification 92-21	**MBMG Site #** M:133392	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-21

Location 08S 09W 03 DACC	**Ground Surface Elev. (ft)** 5182.36	**Measuring Point Elev. (ft)** 5184.61	**Well Depth below m.p. (ft)** 487.30	**Vertical Scale** 1050

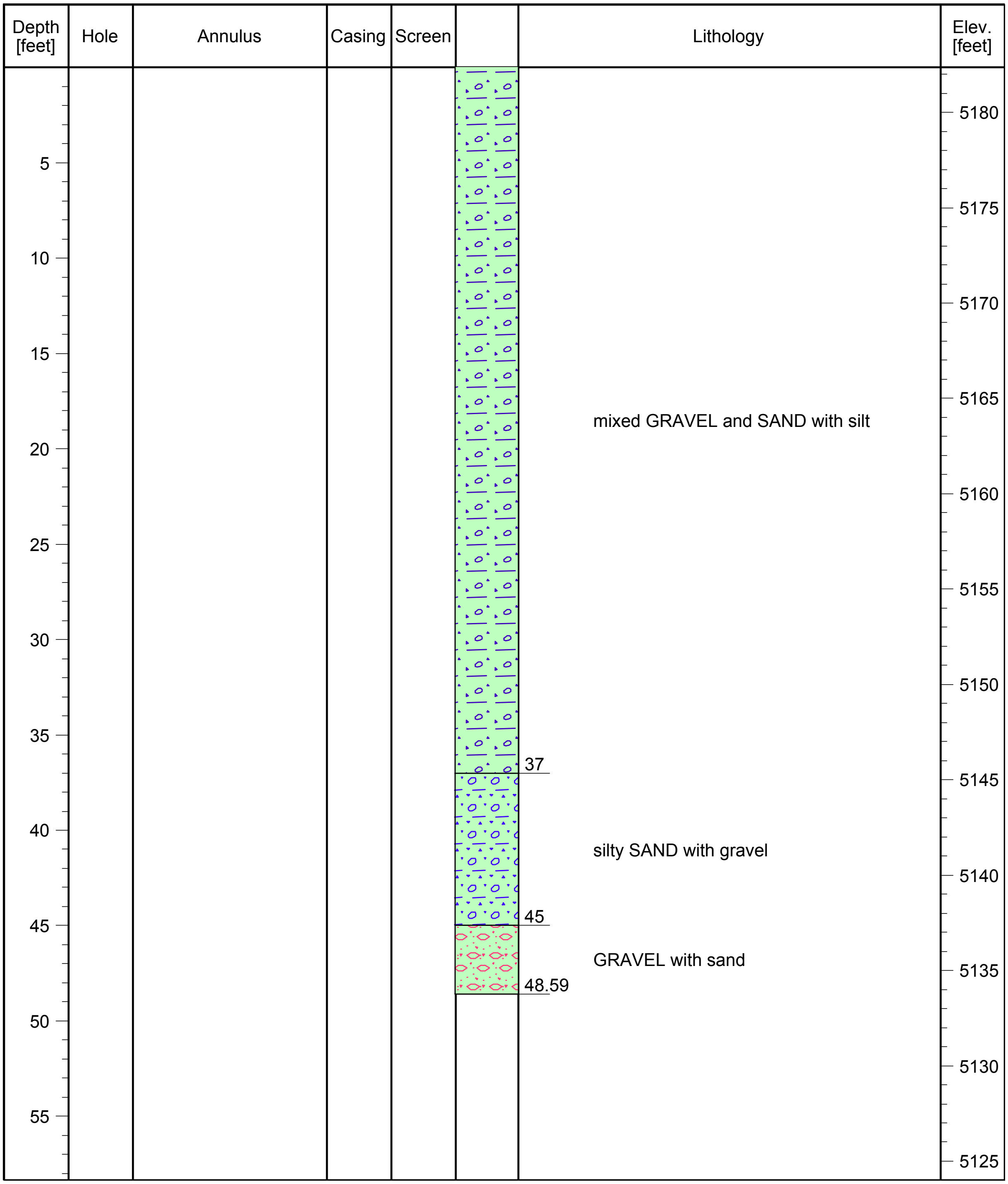
Date Completed 3/30/1994	**Drilling Method** air rotary	**Well Dia. (in)** 6.0	**Perforated or Screened Interval (ft)** 475 - 485	**Yield (gpm)** 15	**Use** monitoring



45 50	mixed GRAVEL and SAND with silt
120	sandy GRAVEL with silt/clay
173	gravelly SAND with thin layers of silt/clay
205	fine-coarse GRAVEL and COBBLES with mixed sand and silt
250 260	sandy SILT with gravel
290	sandy SILT
420	gravelly SAND with mixed silt and clay
480	soft SILTSTONE with green and orange siltstone clasts
505	soft SILTSTONE
530	soft SILTSTONE with purplish volcanic gravel
570	soft SILTSTONE with traces of white volcanic ash
600	soft SILTSTONE with orange siltstone clasts

Well Lithology

Well Identification 92-22	**MBMG Site #** M:133394	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-22			
Location 08S 09W 03 DACC	**Ground Surface Elev. (ft)** 5182.35	**Measuring Point Elev. (ft)** 5184.57	**Well Depth below m.p. (ft)** 50.81	**Vertical Scale** 100	
Date Completed 3/11/1993	**Drilling Method** air rotary	**Well Dia. (in)** 6.0	**Perforated or Screened Interval (ft)** 43 - 48	**Yield (gpm)** 30	**Use** monitoring

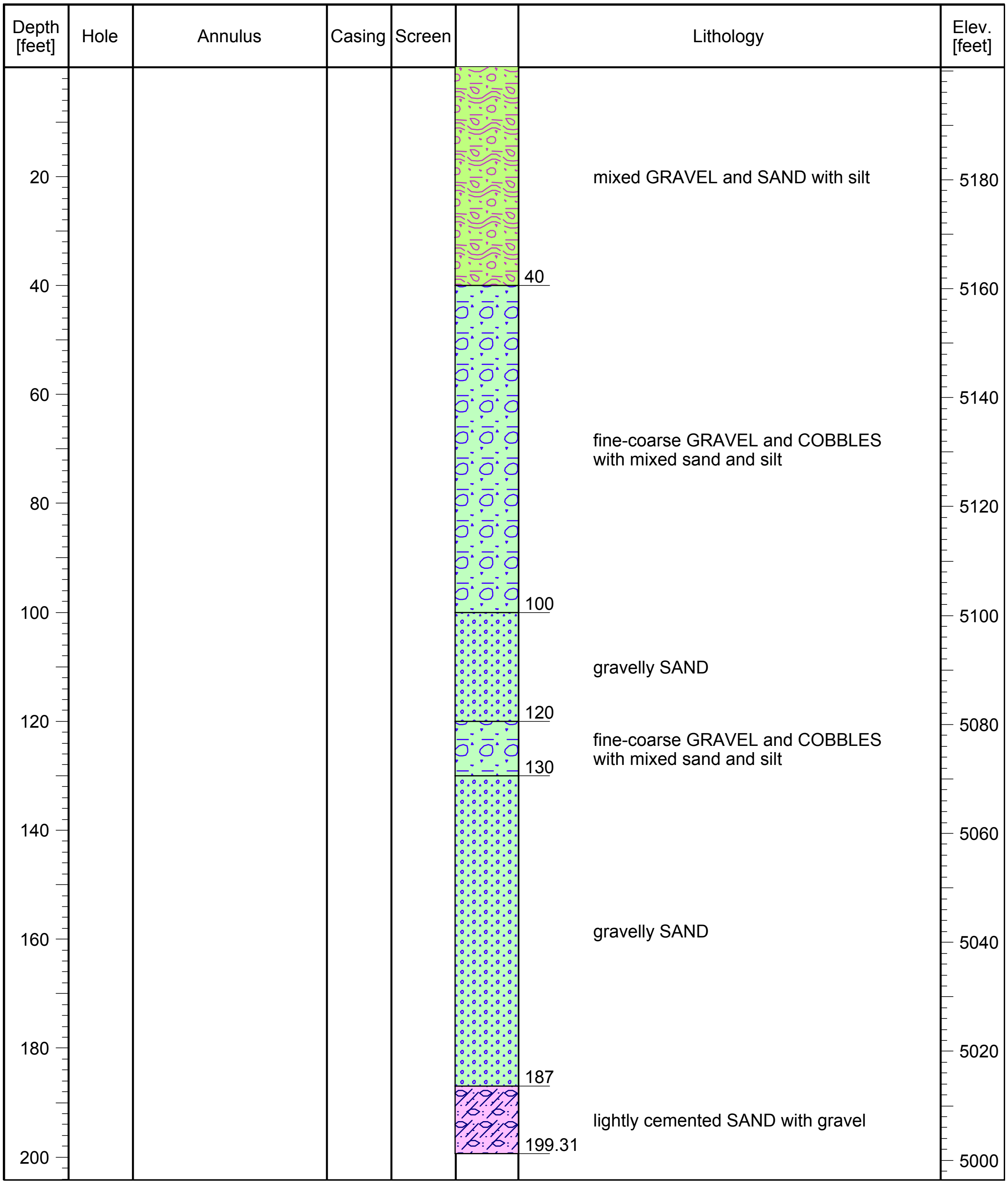


Well Lithology

Well Identification 92-23	**MBMG Site #** M:133395	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-23

Location 08S 09W 09 ADDB	**Ground Surface Elev. (ft)** 5200.58	**Measuring Point Elev. (ft)** 5202.63	**Well Depth below m.p. (ft)** 201.36	**Vertical Scale** 350

Date Completed 11/12/1993	**Drilling Method** air rotary	**Well Dia. (in)** 6.0	**Perforated or Screened Interval (ft)** 191 - 196	**Yield (gpm)** 200	**Use** monitoring



Well Lithology

Well Identification 92-24

MBMG Site # M:133396

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-24

Location 08S 09W 09 ADDB

Ground Surface Elev. (ft) 5200.53

Measuring Point Elev. (ft) 5202.33

Well Depth below m.p. (ft) 52.47

Vertical Scale 100

Date Completed 11/13/1993

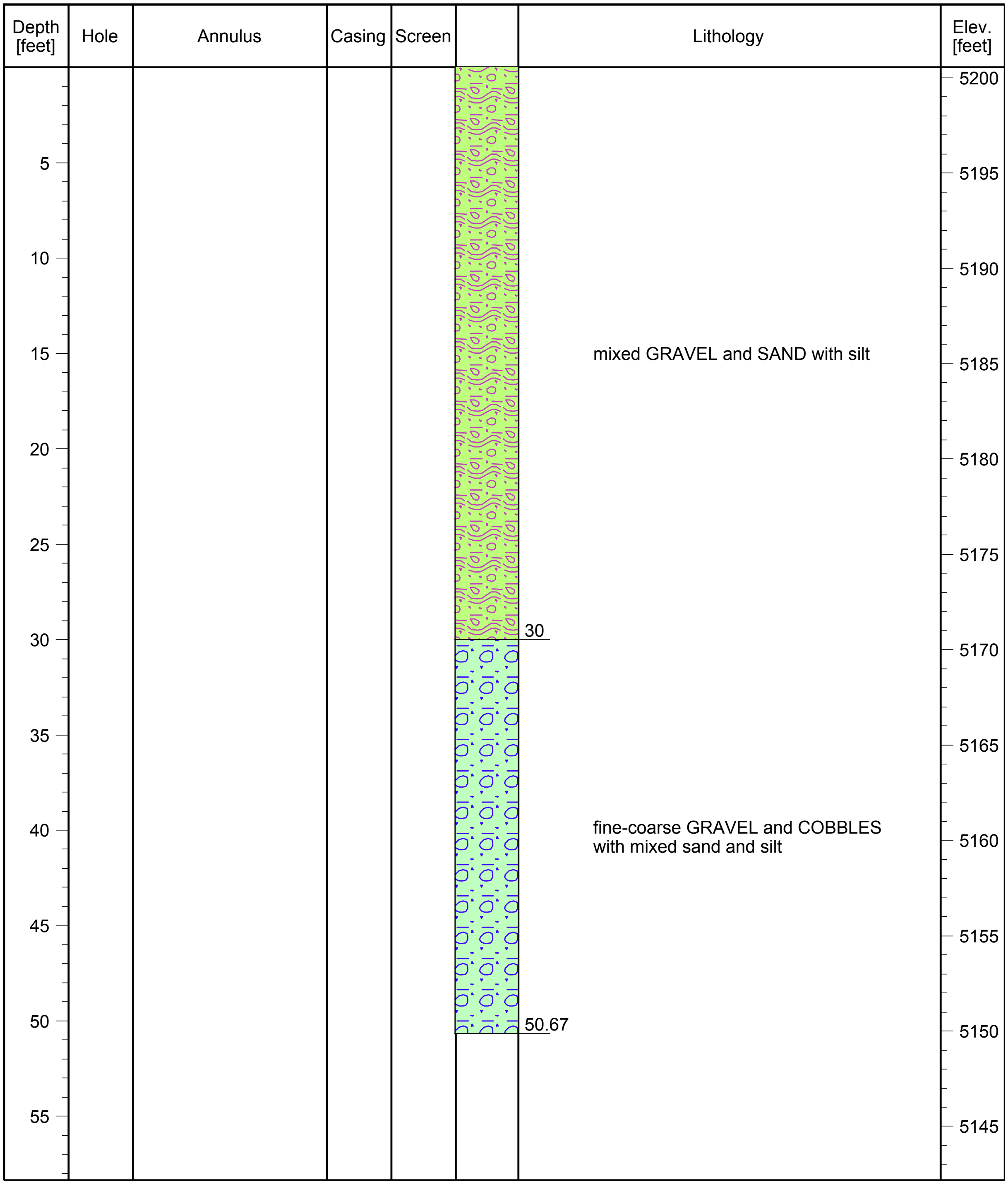
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 43 - 48

Yield (gpm) 80

Use monitoring



Well Lithology

Well Identification 92-25

MBMG Site # M:133397

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-25

Location 08S 09W 17 DCBA

Ground Surface Elev. (ft) 5245.01

Measuring Point Elev. (ft) 5247.17

Well Depth below m.p. (ft) 52.98

Vertical Scale 100

Date Completed 10/6/1992

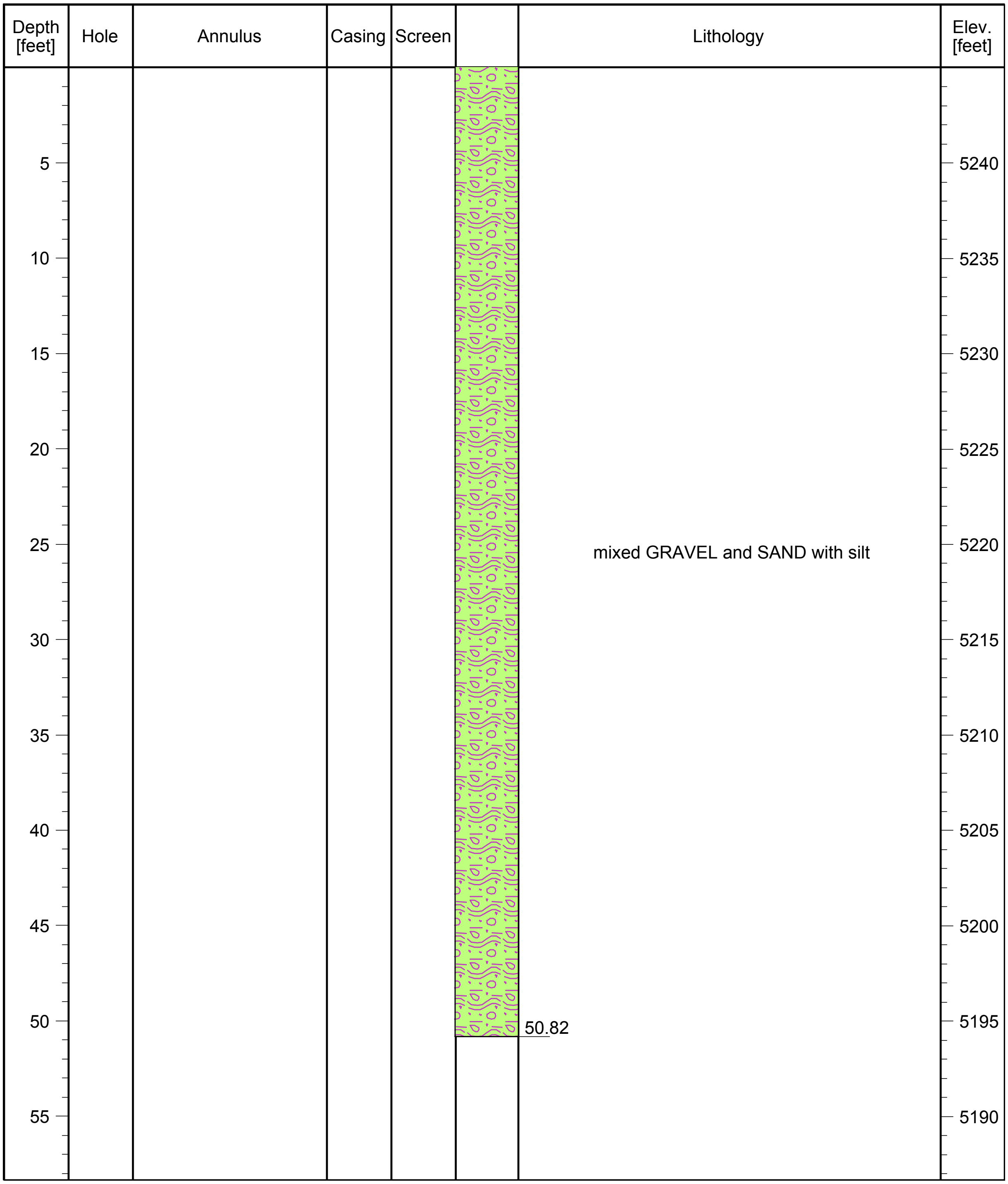
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 43.5 - 47.5

Yield (gpm) 50

Use monitoring



Well Lithology

Well Identification
92-32

MBMG Site #
M:133406

Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-32

Location
08S 09W 16 BDAC

Ground Surface Elev. (ft)
5224.61

Measuring Point Elev. (ft)
5227.26

Well Depth below m.p. (ft)
368.85

Vertical Scale
700

Date Completed
6/1/1993

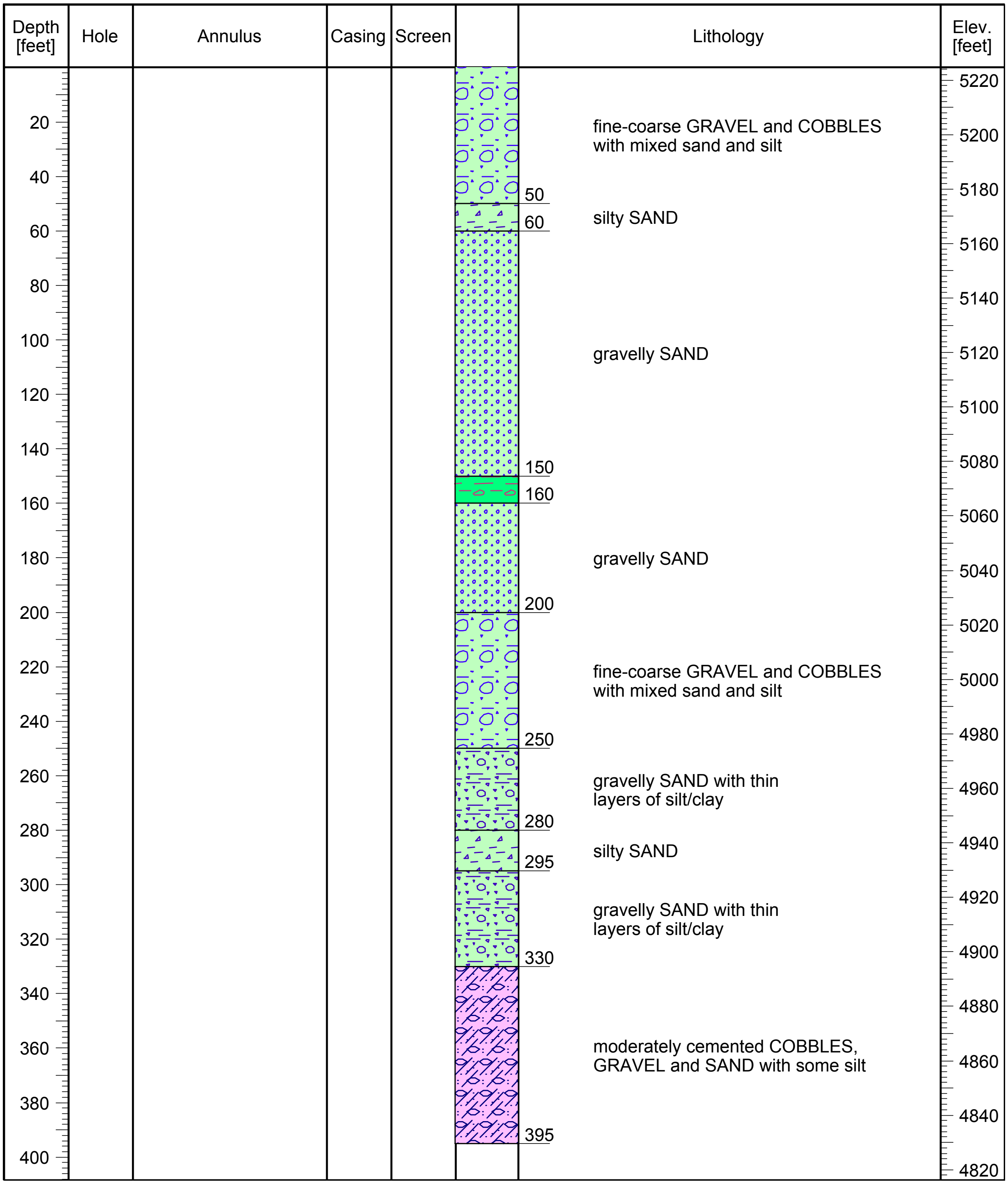
Drilling Method
air rotary

Well Dia. (in)
6.0

Perforated or Screened Interval (ft)
none

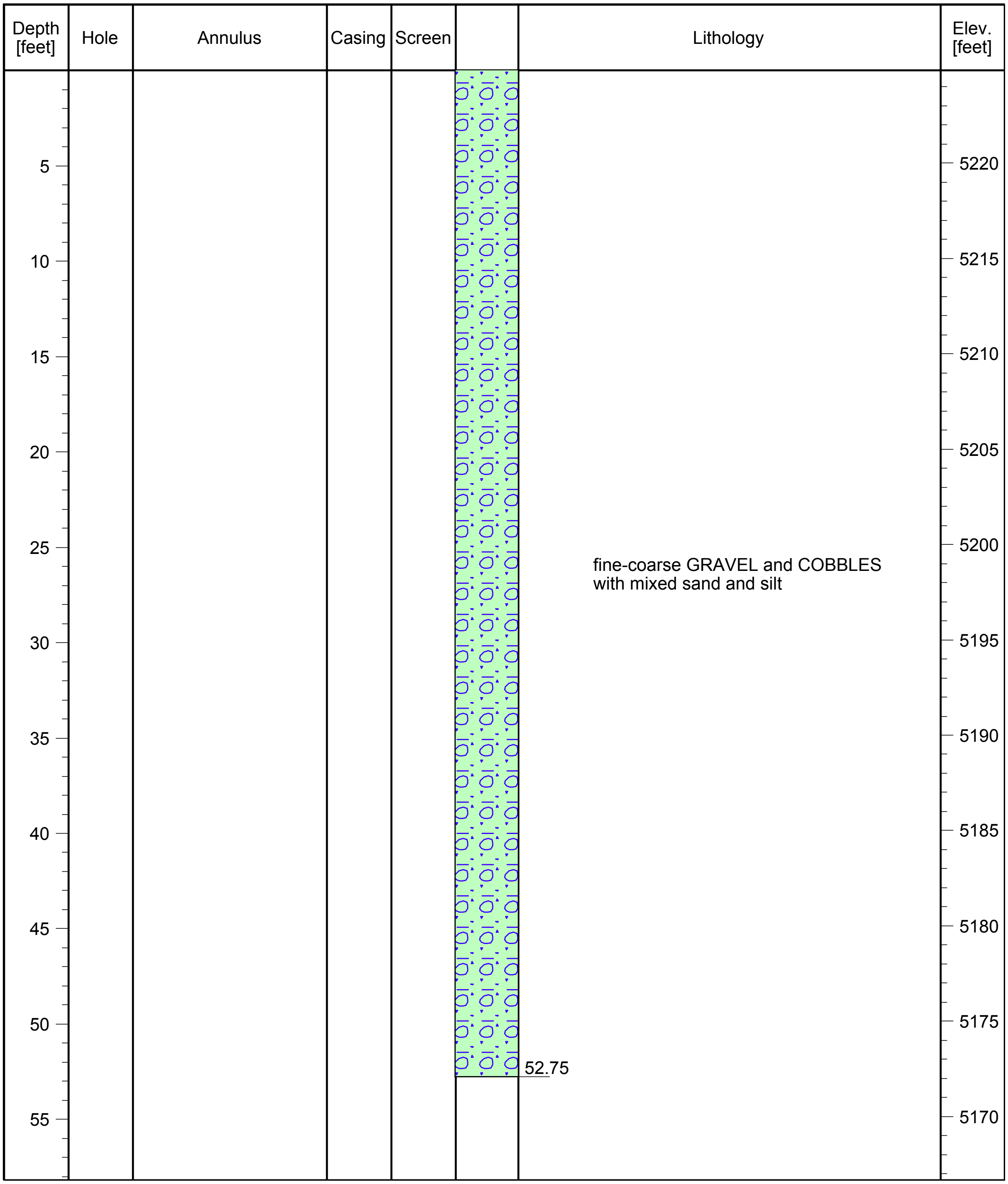
Yield (gpm)
25

Use
monitoring



Well Lithology

Well Identification 92-33	**MBMG Site #** M:133409	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-33			
Location 08S 09W 16 BDAC	**Ground Surface Elev. (ft)** 5224.85	**Measuring Point Elev. (ft)** 5227.66	**Well Depth below m.p. (ft)** 55.56	**Vertical Scale** 100	
Date Completed 6/1/1993	**Drilling Method** air rotary	**Well Dia. (in)** 6.0	**Perforated or Screened Interval (ft)** 46 - 51	**Yield (gpm)** 40	**Use** monitoring



Well Lithology

Well Identification 93-3

MBMG Site # M:144017

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 93-3

Location 08S 09W 17 CAAB

Ground Surface Elev. (ft) 5248.00

Measuring Point Elev. (ft) 5248.00

Well Depth below m.p. (ft) 420.00

Vertical Scale 725

Date Completed 11/9/1994

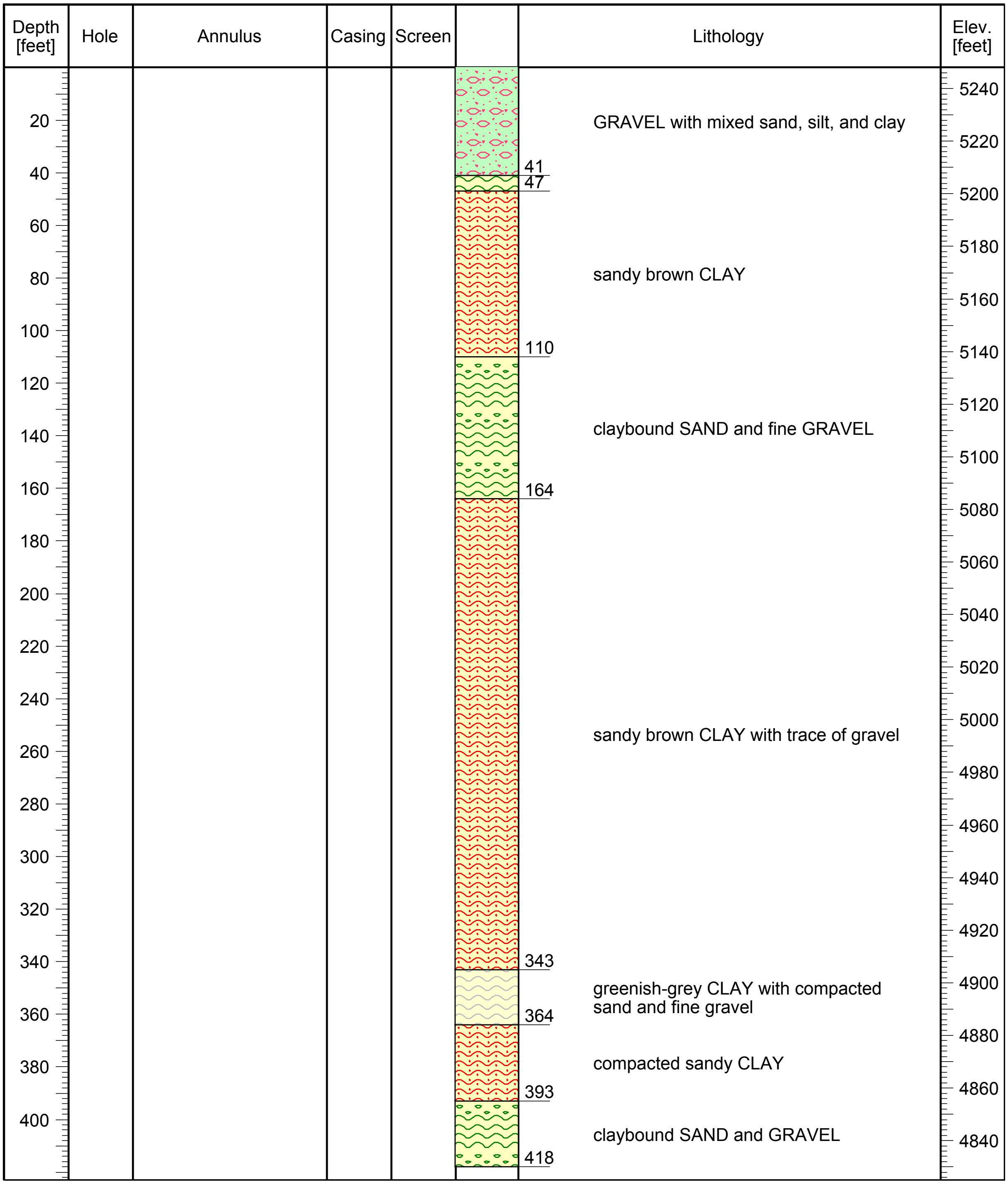
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) none

Yield (gpm) 0

Use abandoned



Lower Rattlesnake Creek Valley

Well Lithology

Well Identification 92-26

MBMG Site # M:133398

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-26

Location 07S 09W 33 DAAA

Ground Surface Elev. (ft) 5172.61

Measuring Point Elev. (ft) 5174.76

Well Depth below m.p. (ft) 94.52

Vertical Scale 175

Date Completed 11/19/1992

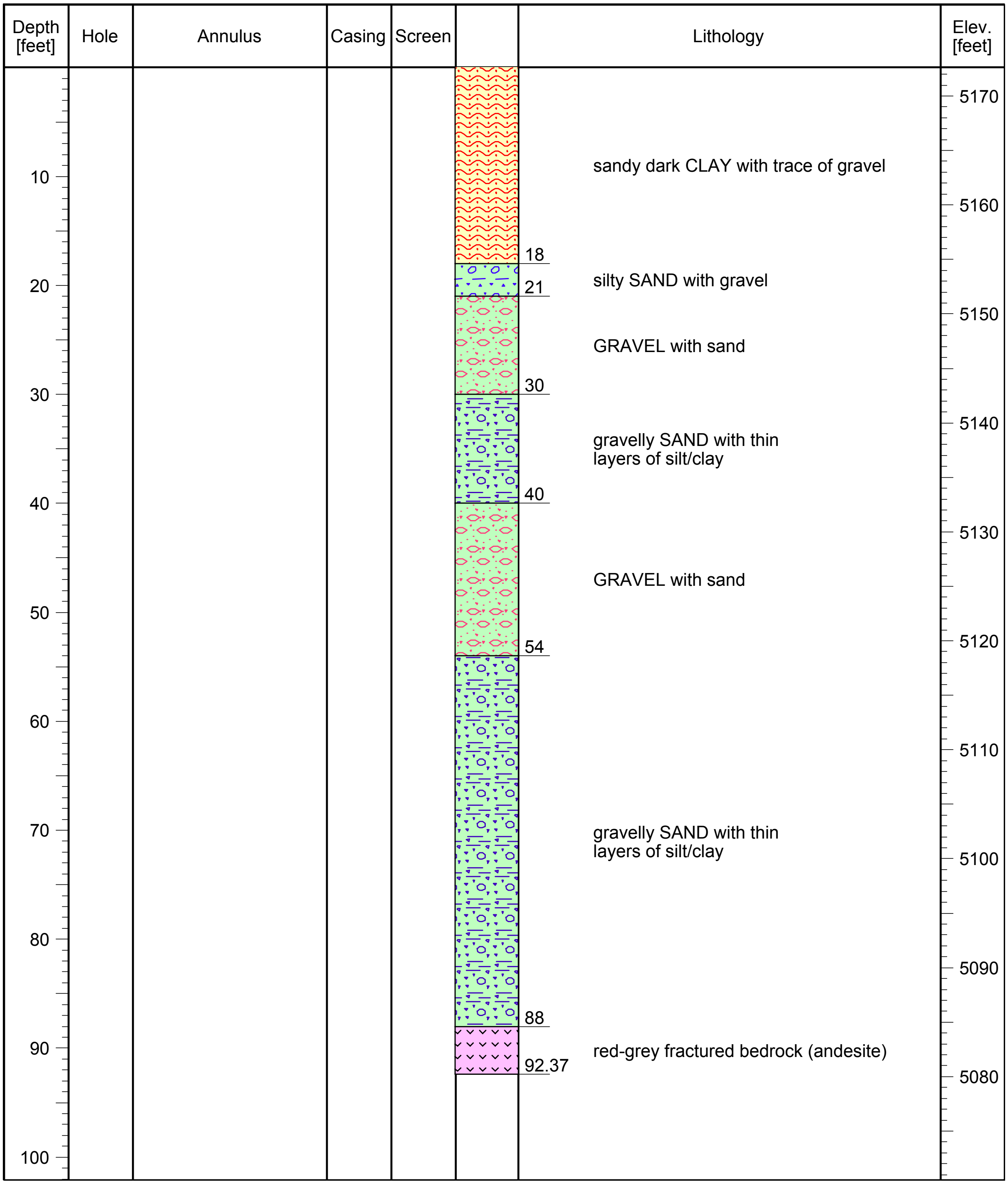
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 81 - 86

Yield (gpm) 90

Use monitoring



0 - 18	sandy dark CLAY with trace of gravel
18 - 21	silty SAND with gravel
21 - 30	GRAVEL with sand
30 - 40	gravelly SAND with thin layers of silt/clay
40 - 54	GRAVEL with sand
54 - 88	gravelly SAND with thin layers of silt/clay
88 - 92.37	red-grey fractured bedrock (andesite)

Well Lithology

Well Identification
92-27

MBMG Site #
M:133399

Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-27

Location
07S 09W 33 CBDD

Ground Surface Elev. (ft)
5188.77

Measuring Point Elev. (ft)
5190.24

Well Depth below m.p. (ft)
182.97

Vertical Scale
350

Date Completed
4/13/1993

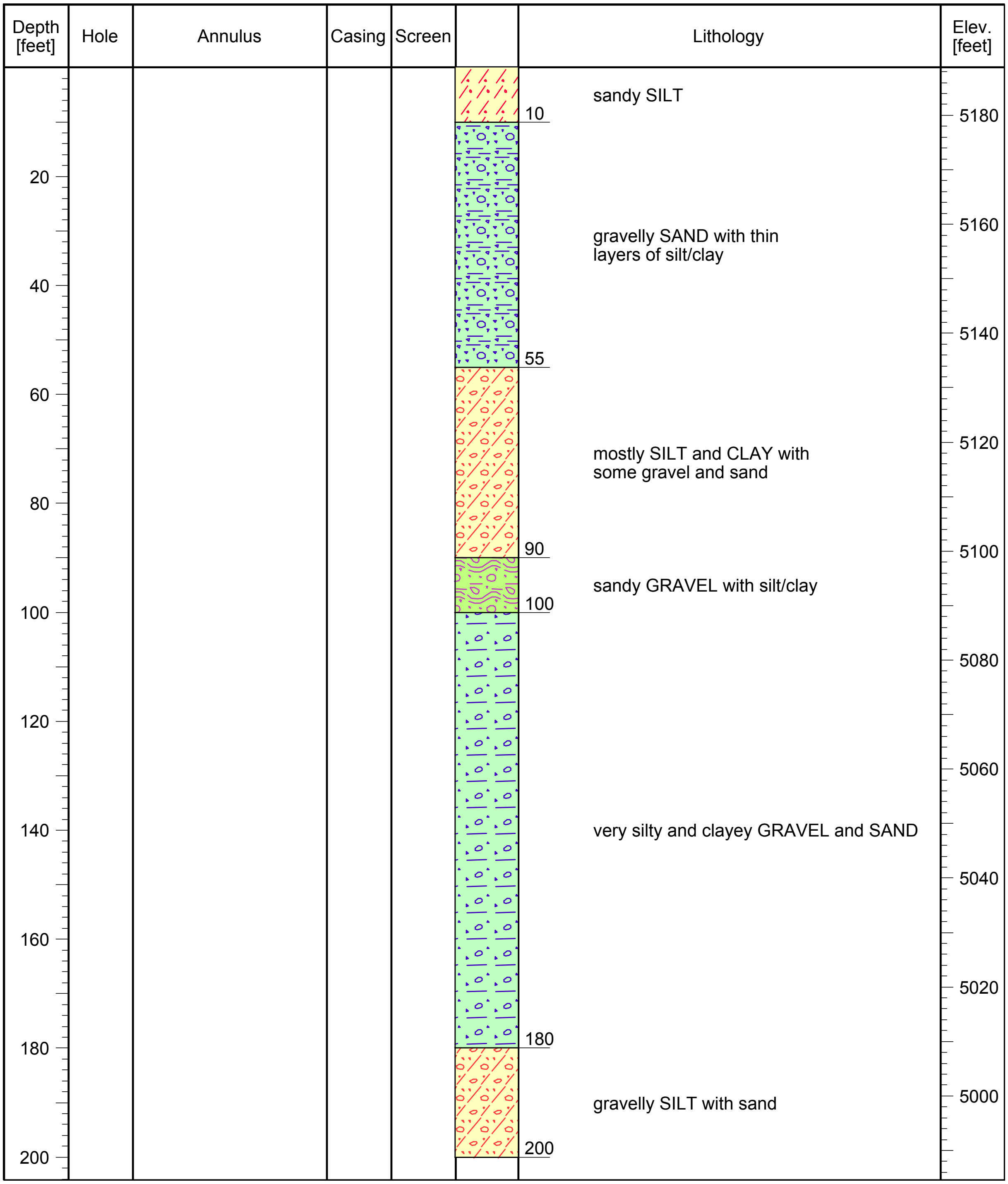
Drilling Method
air rotary

Well Dia. (in)
6.0

Perforated or Screened Interval (ft)
65-70, 160-165, 168-175

Yield (gpm)
40

Use
monitoring



Well Lithology

Well Identification 94-1

MBMG Site # M:149511

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 94-1

Location 08S 09W 08 AAAA

Ground Surface Elev. (ft) 5212.14

Measuring Point Elev. (ft) 5214.06

Well Depth below m.p. (ft) 276.81

Vertical Scale 475

Date Completed 6/14/1995

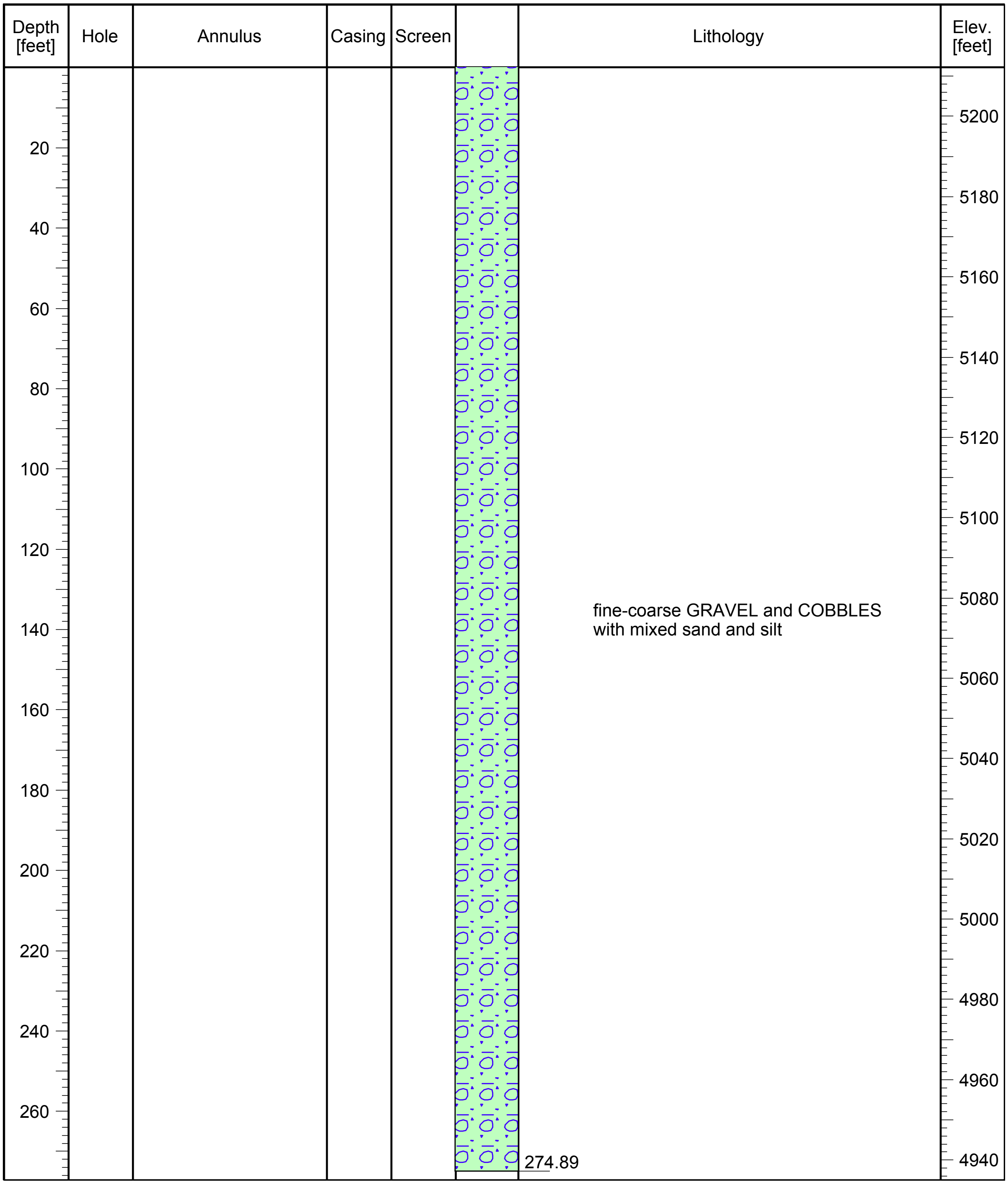
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) none

Yield (gpm) 150

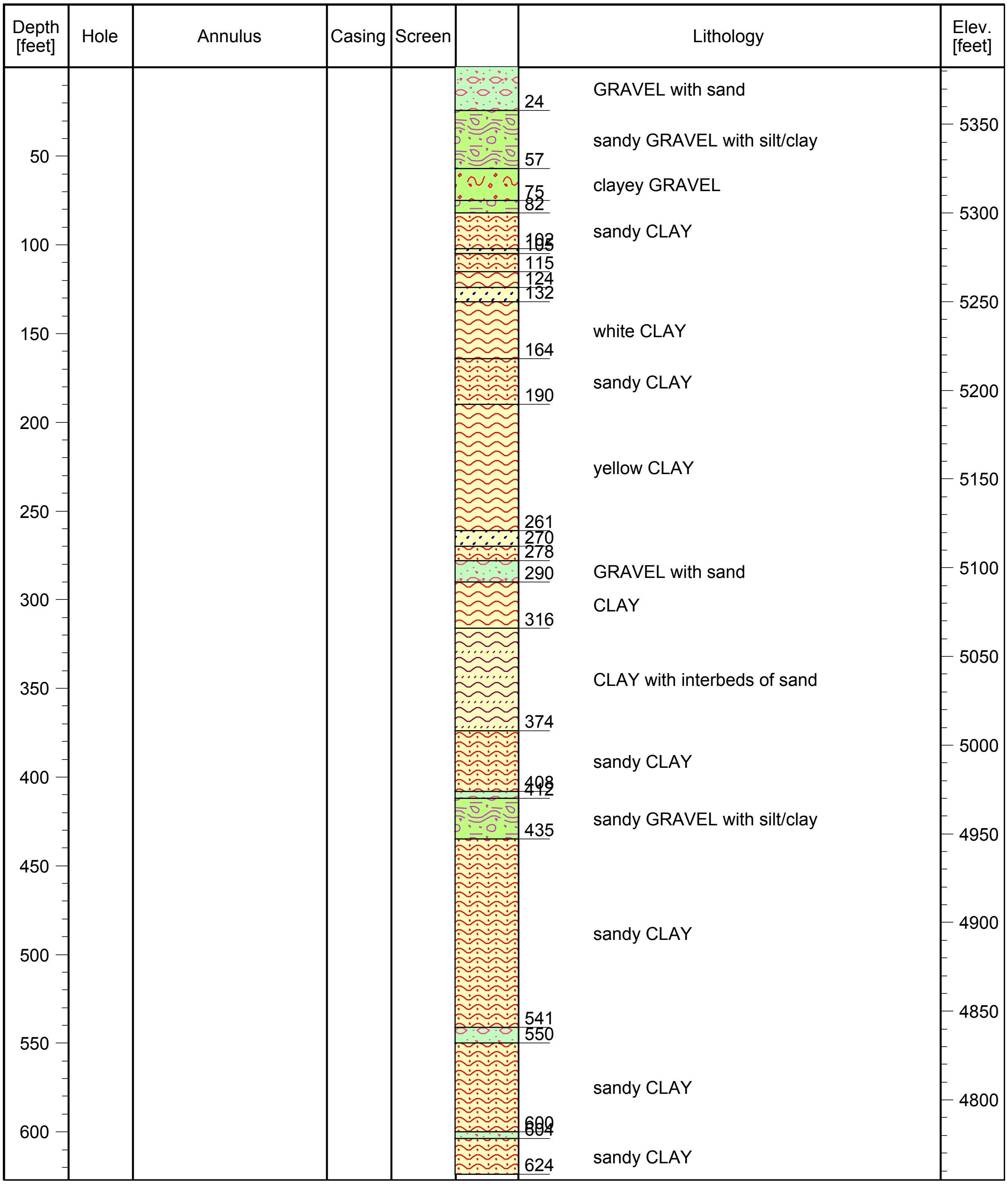
Use monitoring



fine-coarse GRAVEL and COBBLES with mixed sand and silt

Well Lithology

Well Identification HOLLIRRG	**MBMG Site #** M:109741	**Well Name or Well Owner** Ben Holland
Location 07S 10W 25 DBB	**Ground Surface Elev. (ft)** 5382.00	**Well Depth below m.p. (ft)** 624.00
Vertical Scale 1075	**Date Completed** 10/21/1980	**Drilling Method** reverse rotary
Well Dia. (in) 16.	**Perforated or Screened Interval (ft)** 102-132,261-291,316-363,370-497,502-559	**Yield (gpm)** 500
Use irrigation		



Well Lithology

Well Identification
HURSHIR

MBMG Site #
M:109686

Well Name or Well Owner
Tery Hursh irrigation well

Location
07S 09W 29 CCCA

Ground Surface Elev. (ft)
5279.32

Measuring Point Elev. (ft)
5279.54

Well Depth below m.p. (ft)
220.00

Vertical Scale
400

Date Completed
12/1979

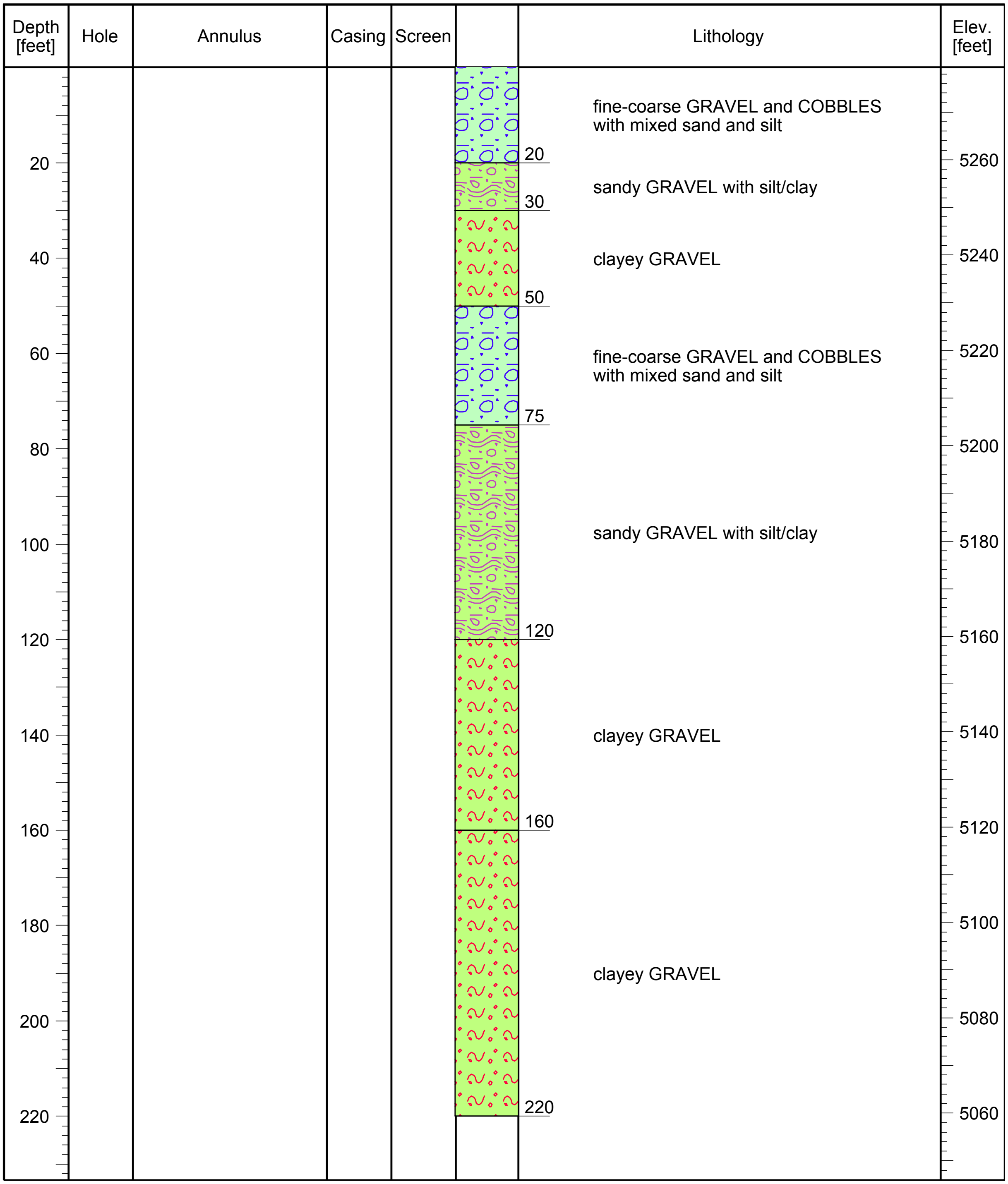
Drilling Method
cable tool

Well Dia. (in)
20.

Perforated or Screened Interval (ft)
10 - 185

Yield (gpm)
600

Use
irrigation



20	fine-coarse GRAVEL and COBBLES with mixed sand and silt
30	sandy GRAVEL with silt/clay
50	clayey GRAVEL
75	fine-coarse GRAVEL and COBBLES with mixed sand and silt
120	sandy GRAVEL with silt/clay
160	clayey GRAVEL
220	clayey GRAVEL

Well Lithology

Well Identification JOHNSON

MBMG Site # M:109691

Well Name or Well Owner Ron Johnson irrigation well near Pallet Mill

Location 07S 09W 33 DAAA

Ground Surface Elev. (ft) 5171.92

Measuring Point Elev. (ft) 5172.65

Well Depth below m.p. (ft) 80.00

Vertical Scale 150

Date Completed 1978

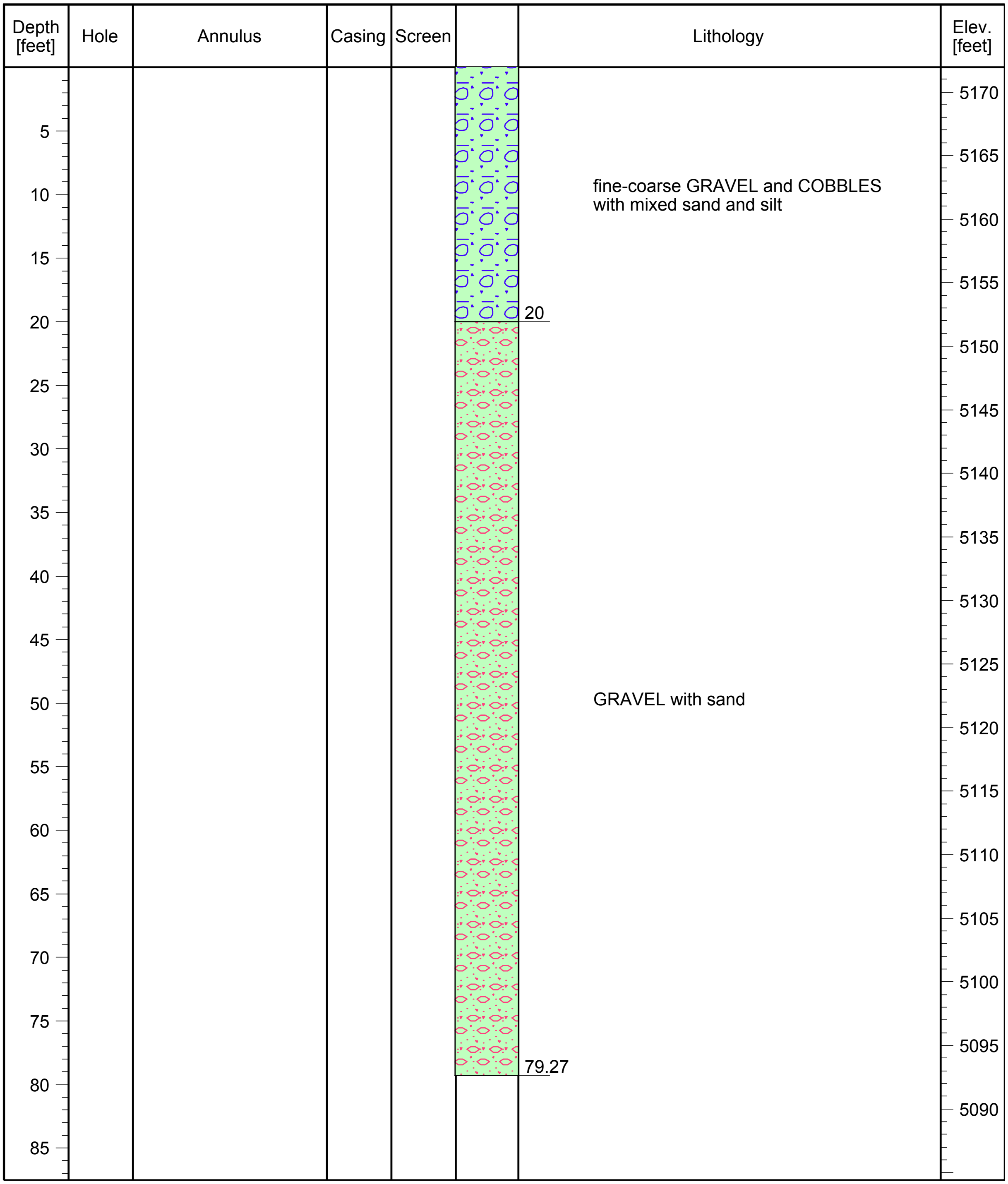
Drilling Method cable tool

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 20 - 80

Yield (gpm) 1800

Use irrigation



Well Lithology

Well Identification JOHNSON2

MBMG Site # M:121425

Well Name or Well Owner Ron Johnson

Location 07S 09W 33 ACB

Ground Surface Elev. (ft) 5180.00

Well Depth below m.p. (ft) 112.00

Vertical Scale 200

Date Completed 10/20/1989

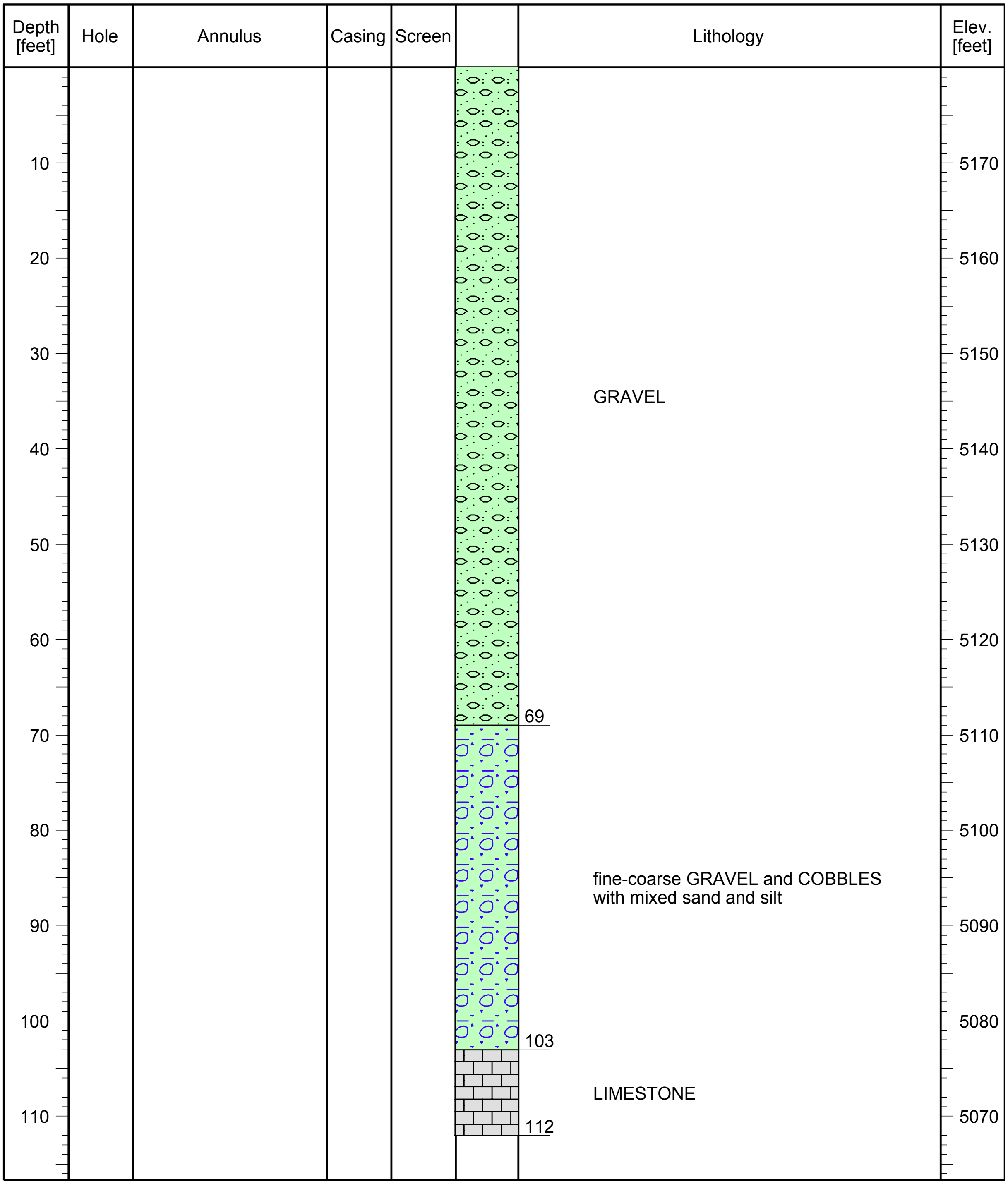
Drilling Method cable tool

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 22 - 90

Yield (gpm) 1200

Use irrigation



Well Lithology

Well Identification JOHNSON3

MBMG Site # M:109684

Well Name or Well Owner Ron Johnson

Location 07S 09W 32 ACD

Ground Surface Elev. (ft) 5225.00

Well Depth below m.p. (ft) 200.00

Vertical Scale 350

Date Completed 1985

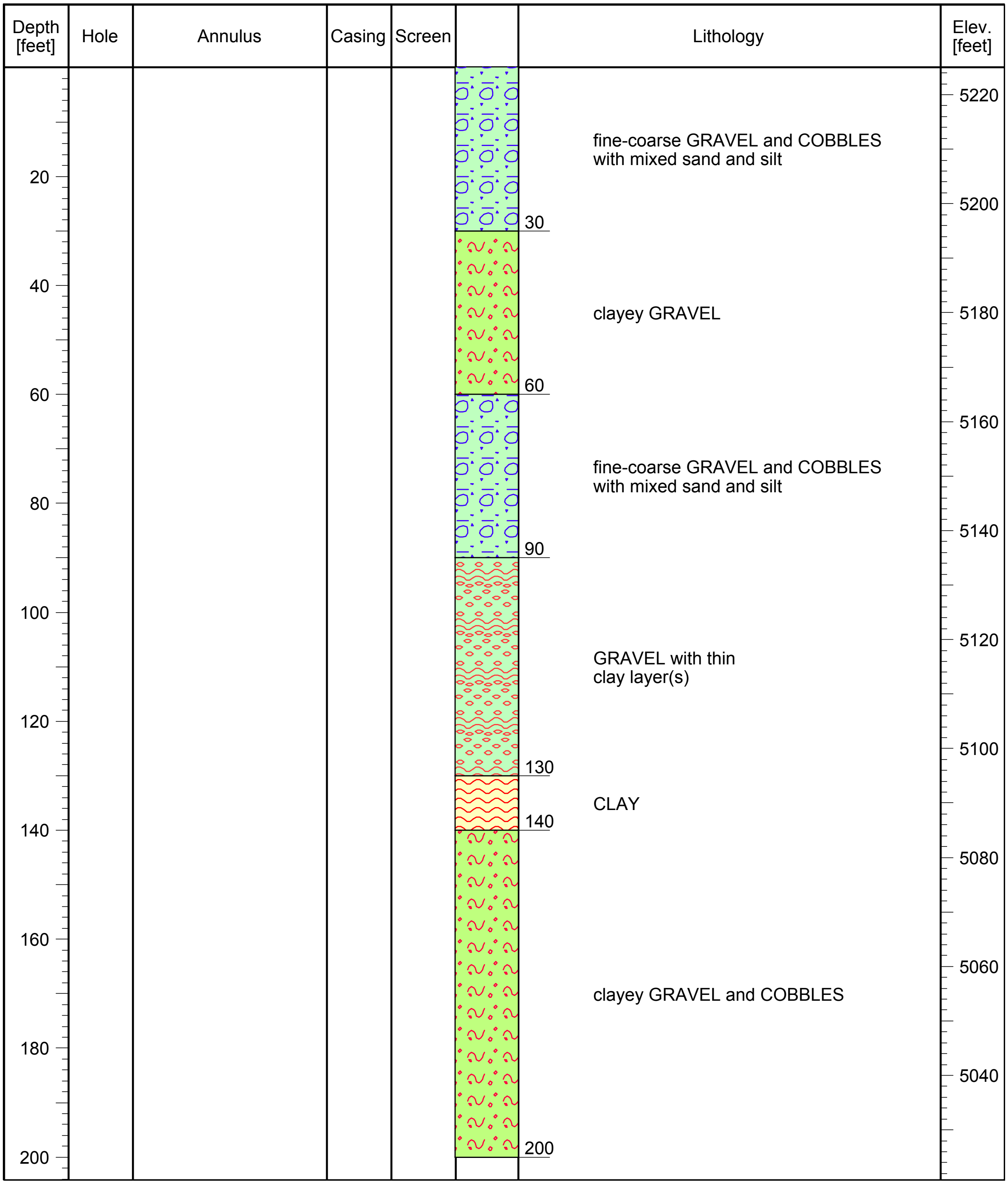
Drilling Method cable tool

Well Dia. (in) 20.

Perforated or Screened Interval (ft) 20 - 200

Yield (gpm) 1200

Use irrigation



fine-coarse GRAVEL and COBBLES with mixed sand and silt

clayey GRAVEL

fine-coarse GRAVEL and COBBLES with mixed sand and silt

GRAVEL with thin clay layer(s)

CLAY

clayey GRAVEL and COBBLES

Well Lithology

Well Identification
LADEN

MBMG Site #
M:109699

Well Name or Well Owner
Tim Laden irrigation well along Rattlesnake Creek

Location
07S 09W 33 CACC

Ground Surface Elev. (ft)
5190.11

Measuring Point Elev. (ft)
5190.49

Well Depth below m.p. (ft)
200.00

Vertical Scale
350

Date Completed
7/10/1982

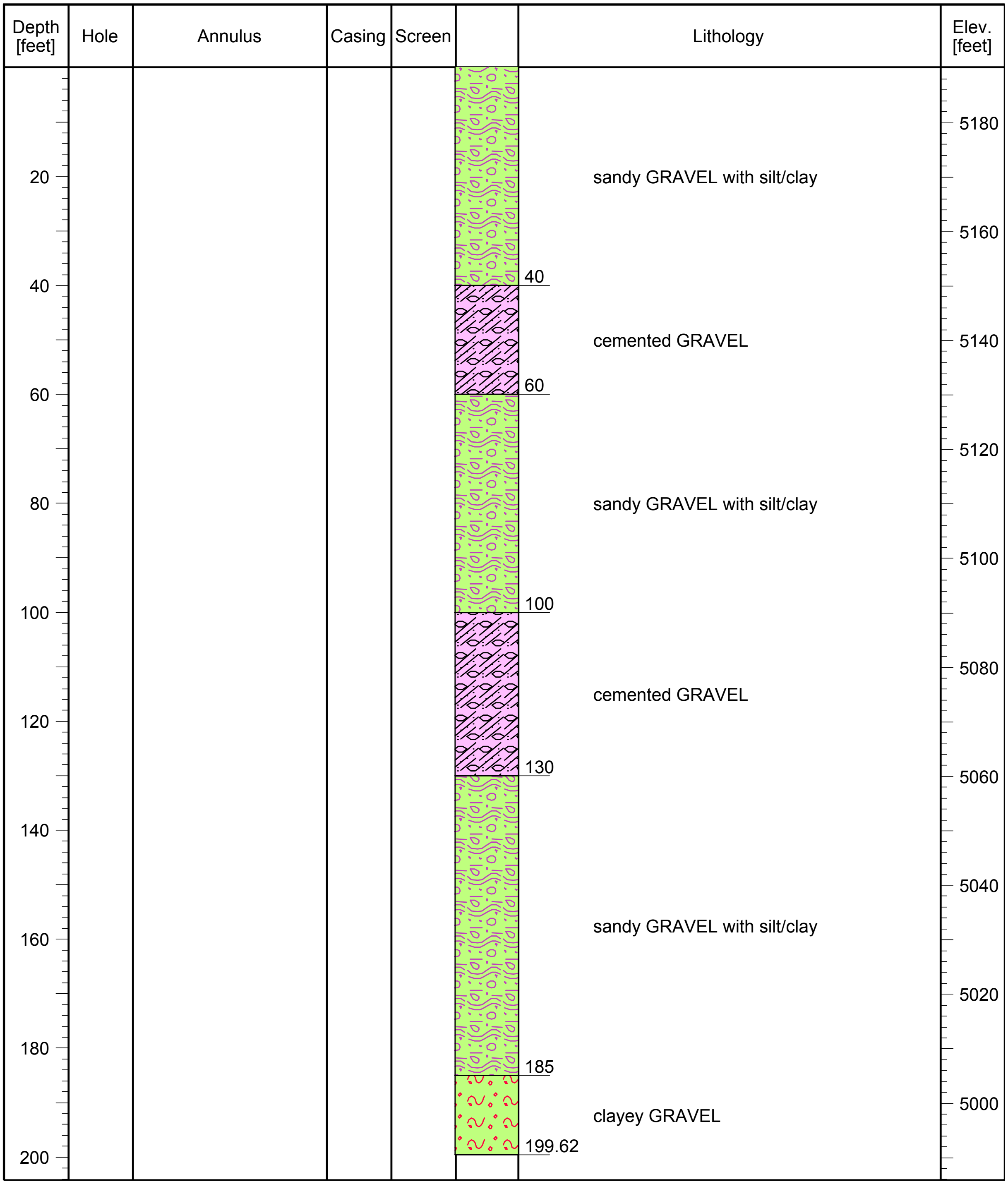
Drilling Method
cable tool

Well Dia. (in)
20.

Perforated or Screened Interval (ft)
20 - 200

Yield (gpm)
1120

Use
irrigation



Well Lithology

Well Identification
LARSON

MBMG Site #
M:109739

Well Name or Well Owner
Tom Larson

Location
07S 10W 24 BDB

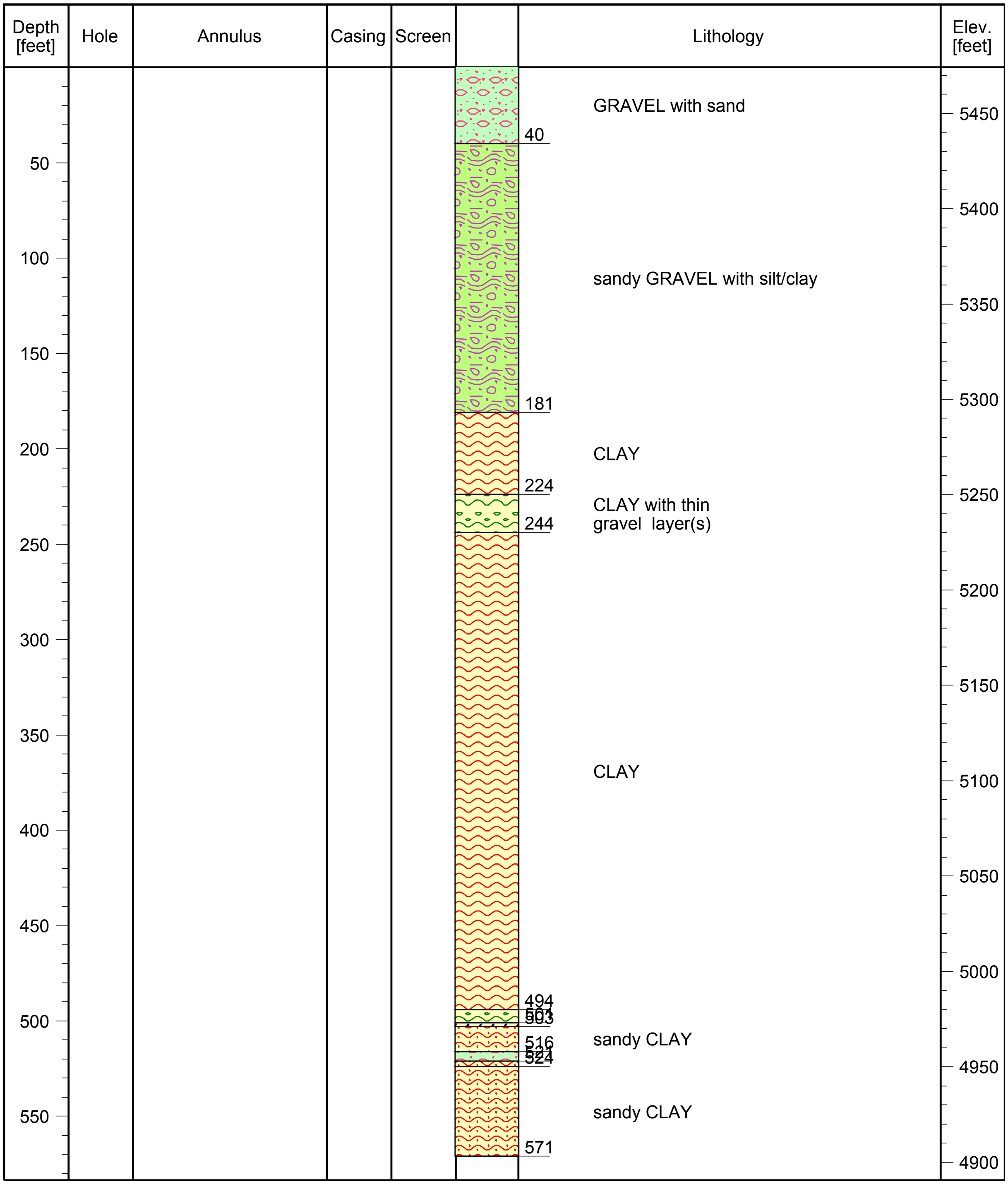
Ground Surface Elev. (ft)
5474.00

Well Depth below m.p. (ft)
571.00

Vertical Scale
1000

Date Completed
9/29/1980

Drilling Method
reverse rotary



Well Lithology

Well Identification
PETERSON

Well Name or Well Owner
H. R. Peterson

Location
07S 09W 34 C

Ground Surface Elev. (ft)
5178.00

Well Depth below m.p. (ft)
76.00

Vertical Scale
150

Date Completed
6/11/1963

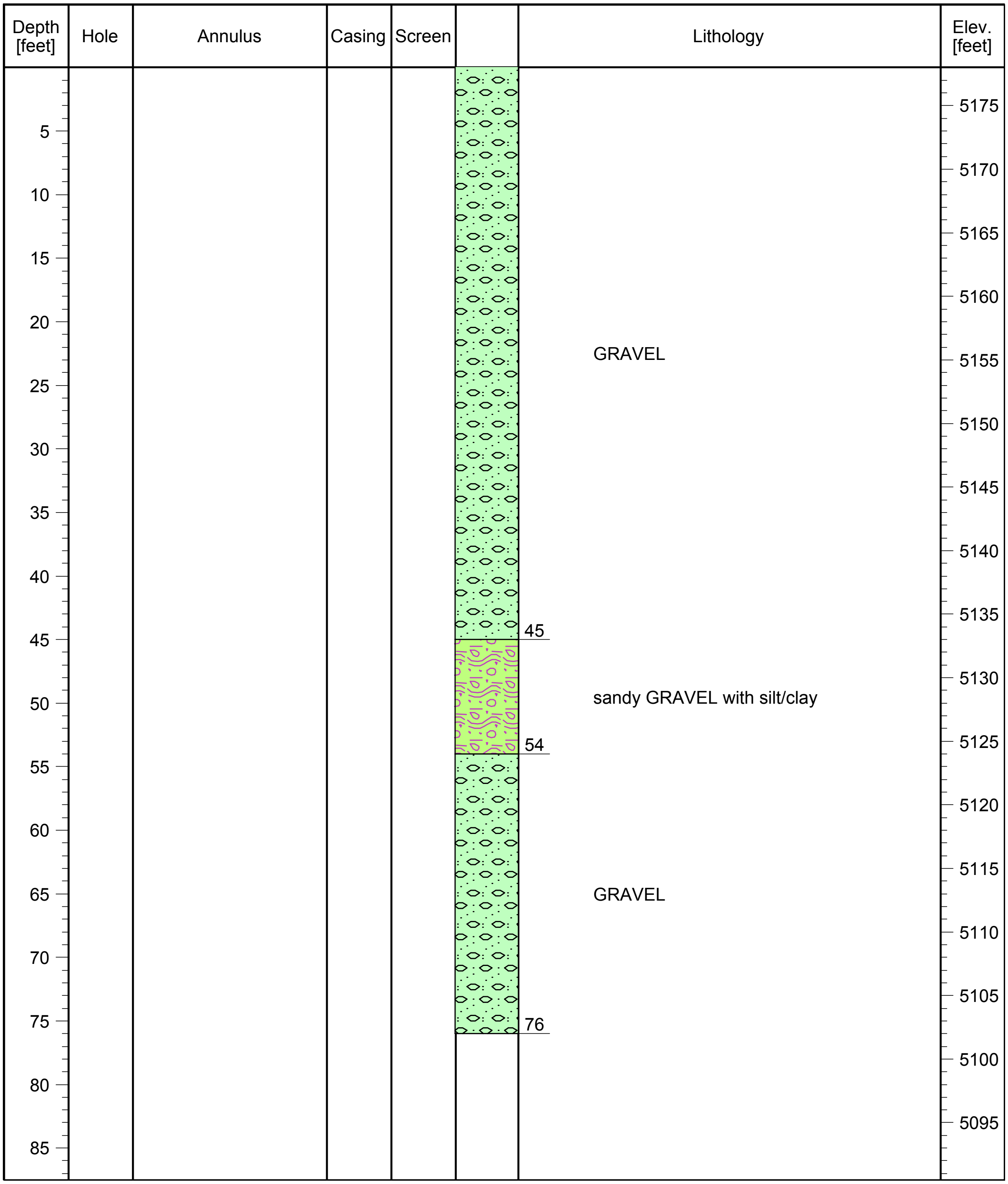
Drilling Method
churn drill

Well Dia. (in)
14.

Perforated or Screened Interval (ft)
15 - 72

Yield (gpm)
210

Use
irr, stock

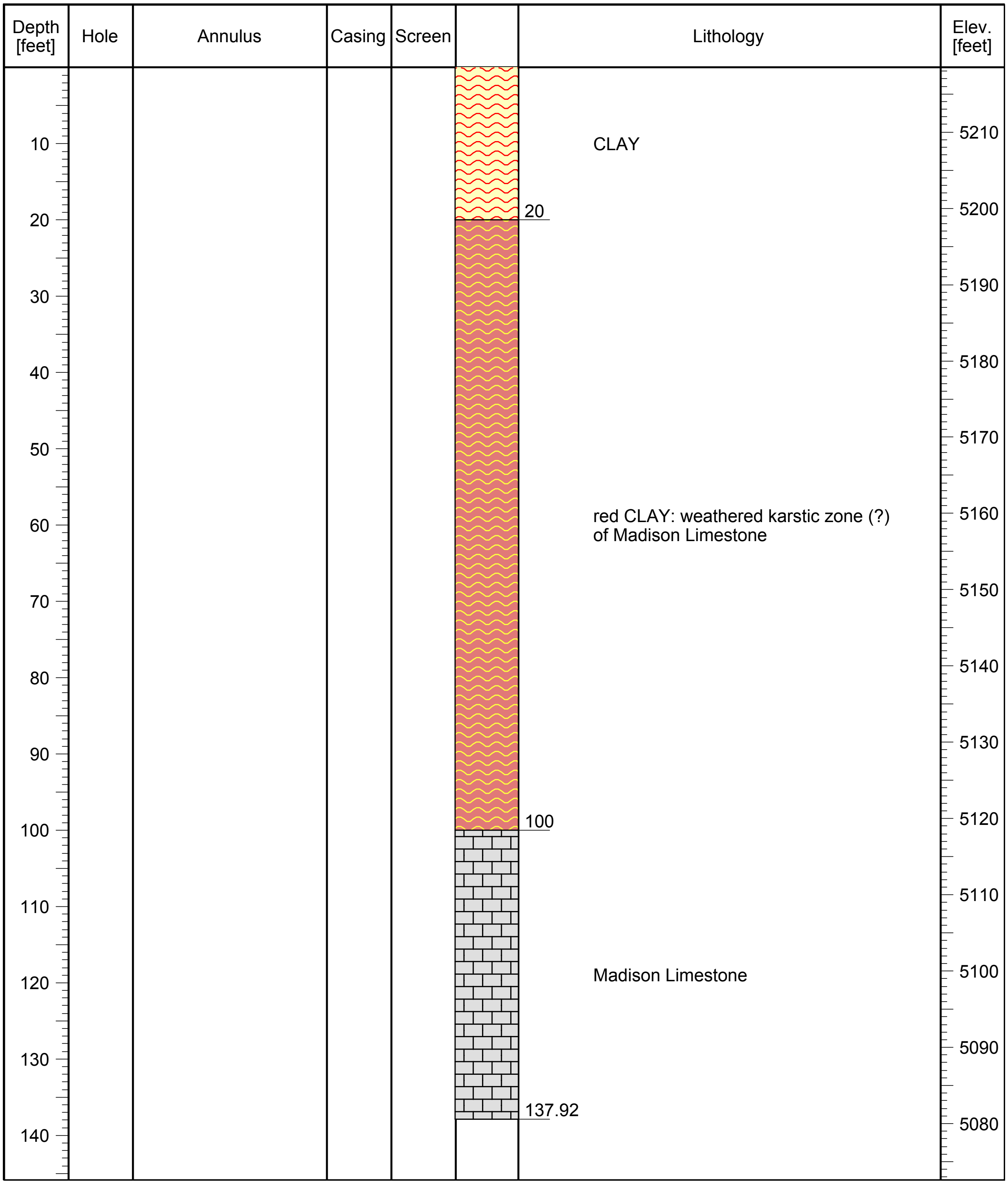


Well Lithology

Well Identification STEWARTI	**MBMG Site #** M:109678	**Well Name or Well Owner** Marvin Stewart irrigation well

Location 07S 09W 28 CDDB	**Ground Surface Elev. (ft)** 5218.46	**Measuring Point Elev. (ft)** 5220.54	**Well Depth below m.p. (ft)** 140.00	**Vertical Scale** 250

Date Completed 8/28/1985	**Drilling Method** cable tool	**Well Dia. (in)** 20.	**Perforated or Screened Interval (ft)** 18 - 112	**Yield (gpm)** 350	**Use** irrigation



CLAY

red CLAY: weathered karstic zone (?) of Madison Limestone

Madison Limestone

Beaverhead River Floodplain near Dillon

Well Lithology

Well Identification 92-16

MBMG Site # M:133382

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-16

Location 07S 09W 24 CBDB

Ground Surface Elev. (ft) 5115.33

Measuring Point Elev. (ft) 5117.49

Well Depth below m.p. (ft) 204.67

Vertical Scale 400

Date Completed 4/20/1993

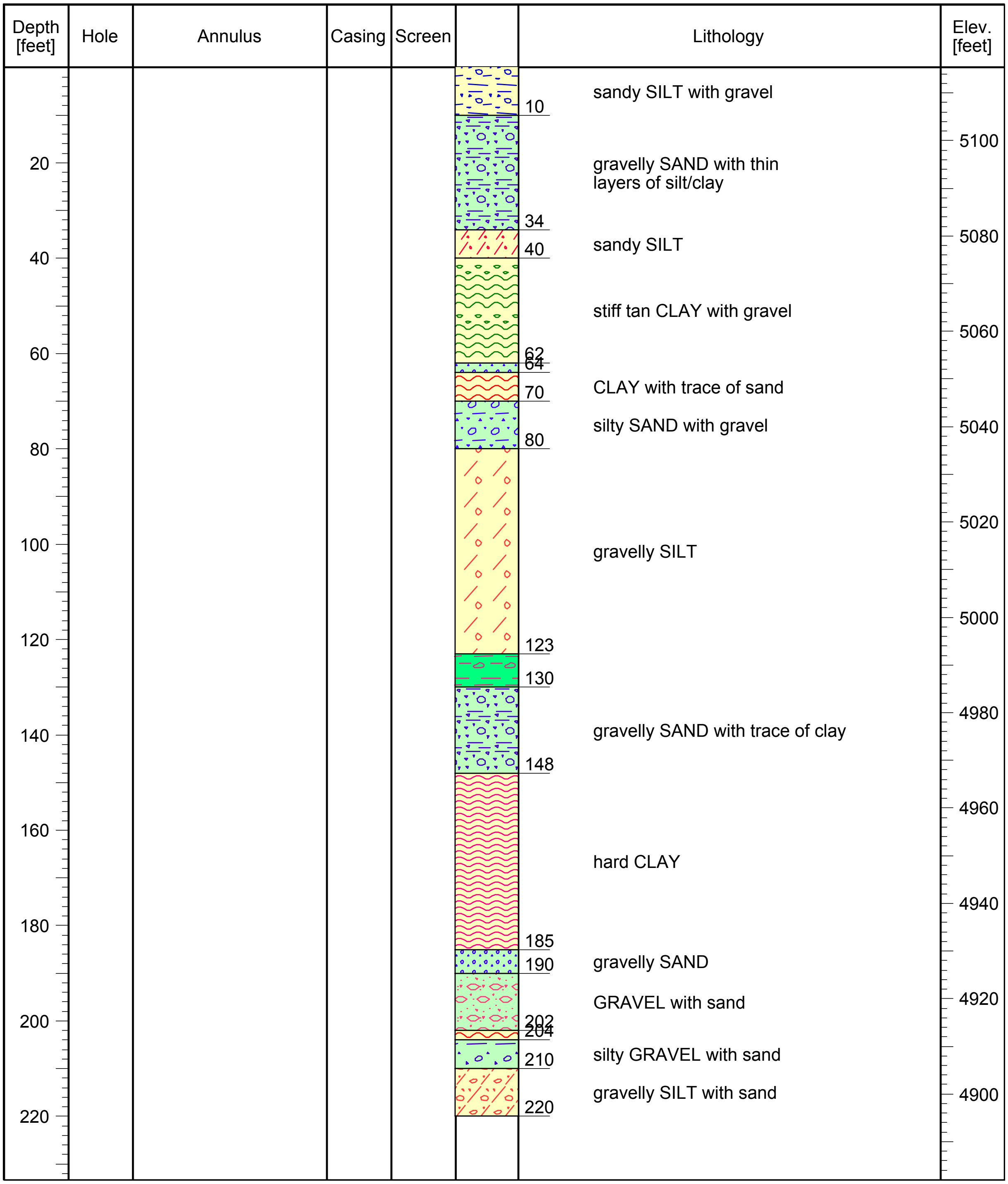
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 190 - 197

Yield (gpm) 60

Use monitoring



Well Lithology

Well Identification 92-17

MBMG Site # M:133384

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-17

Location 07S 08W 19 BADD

Ground Surface Elev. (ft) 5087.39

Measuring Point Elev. (ft) 5089.00

Well Depth below m.p. (ft) 327.16

Vertical Scale 700

Date Completed 4/8/1993

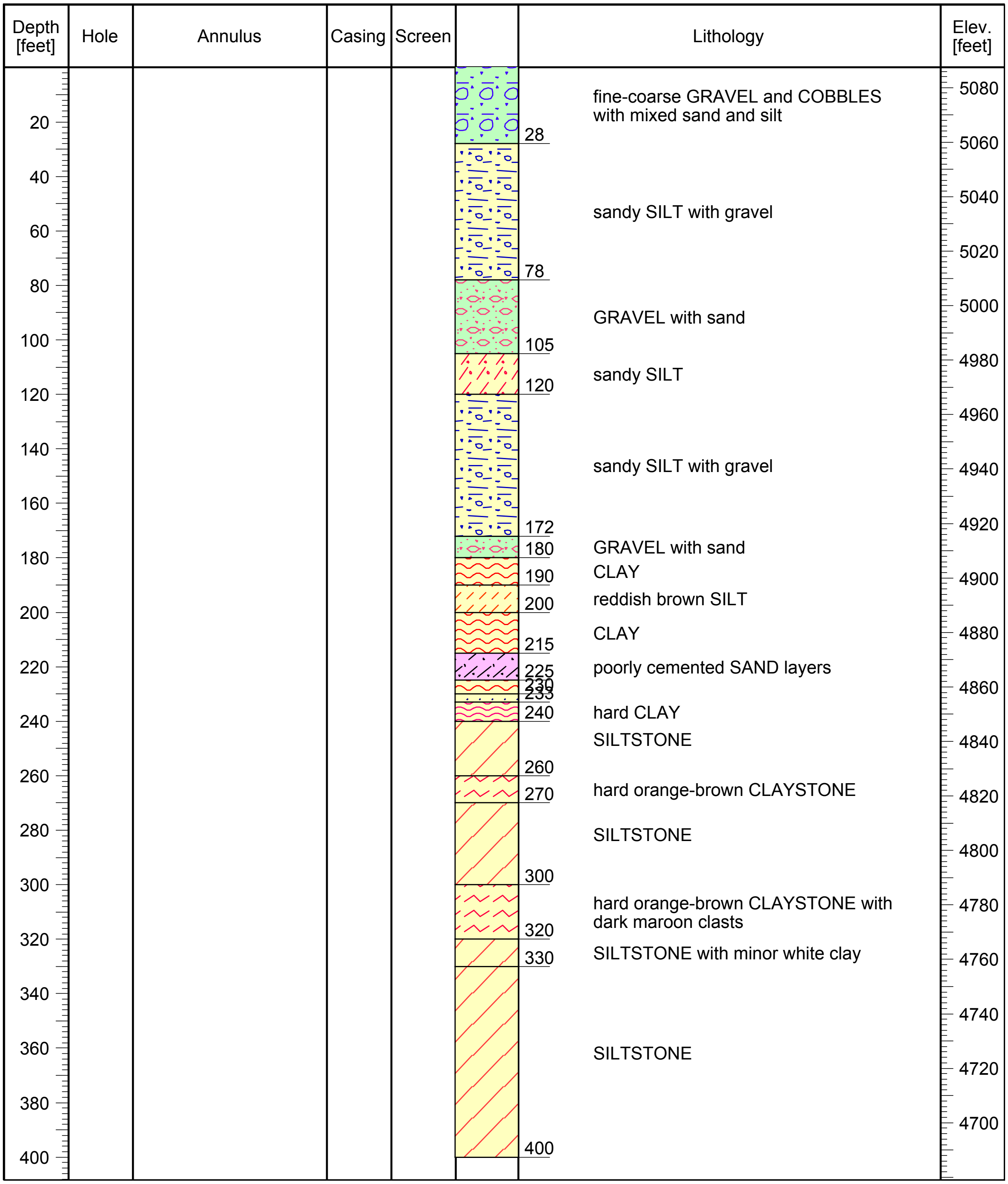
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 315.5 - 325.5

Yield (gpm) 20

Use monitoring

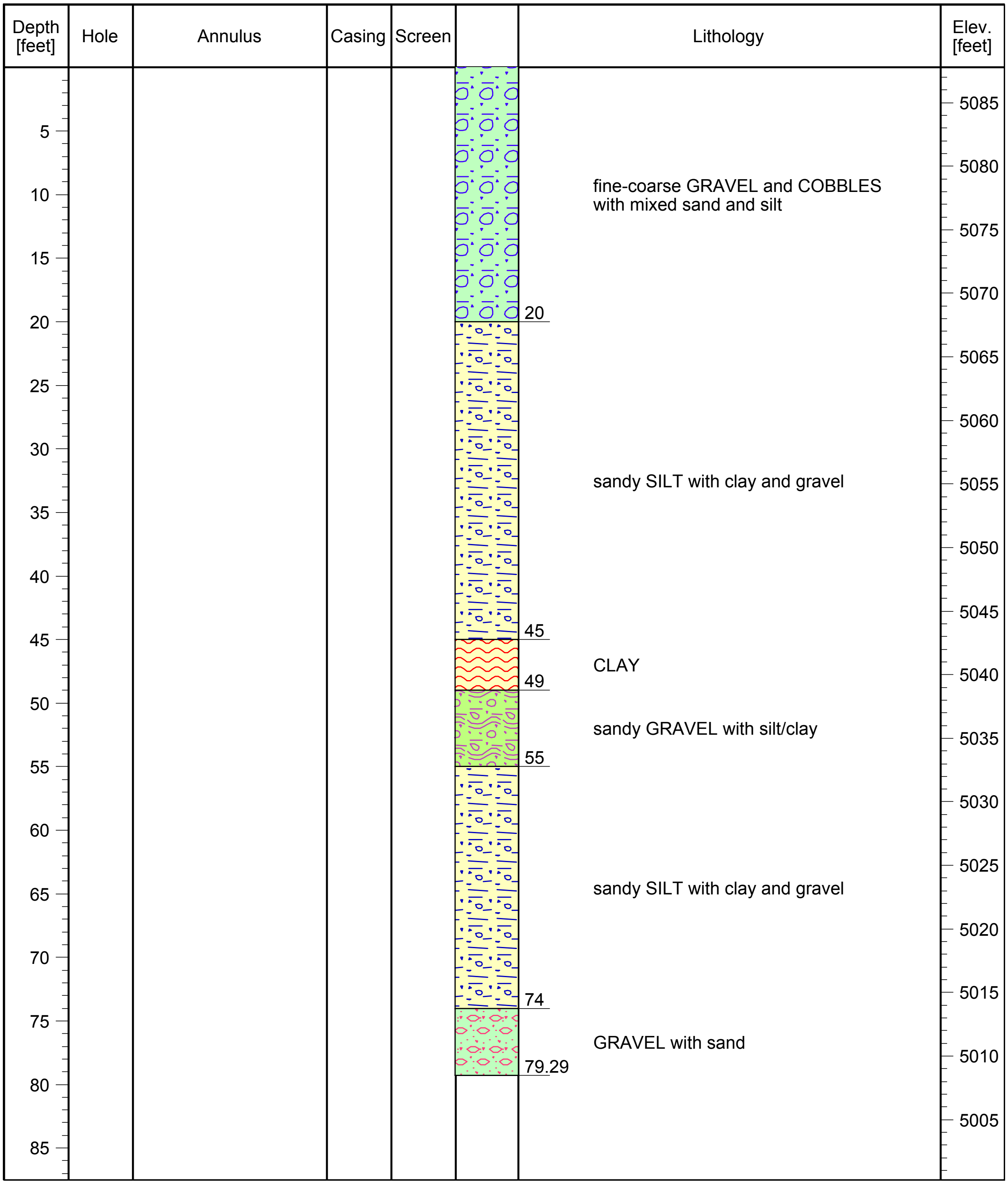


Well Lithology

Well Identification 92-18	**MBMG Site #** M:133386	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-18

Location 07S 08W 19 BADD	**Ground Surface Elev. (ft)** 5087.76	**Measuring Point Elev. (ft)** 5089.13	**Well Depth below m.p. (ft)** 80.66	**Vertical Scale** 150

Date Completed 3/15/1993	**Drilling Method** air rotary	**Well Dia. (in)** 6.0	**Perforated or Screened Interval (ft)** 74 - 77.5	**Yield (gpm)** 35	**Use** monitoring



Well Lithology

Well Identification 92-19

MBMG Site # M:133387

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-19

Location 07S 09W 26 CDAD

Ground Surface Elev. (ft) 5141.31

Measuring Point Elev. (ft) 5143.55

Well Depth below m.p. (ft) 149.53

Vertical Scale 275

Date Completed 11/17/92

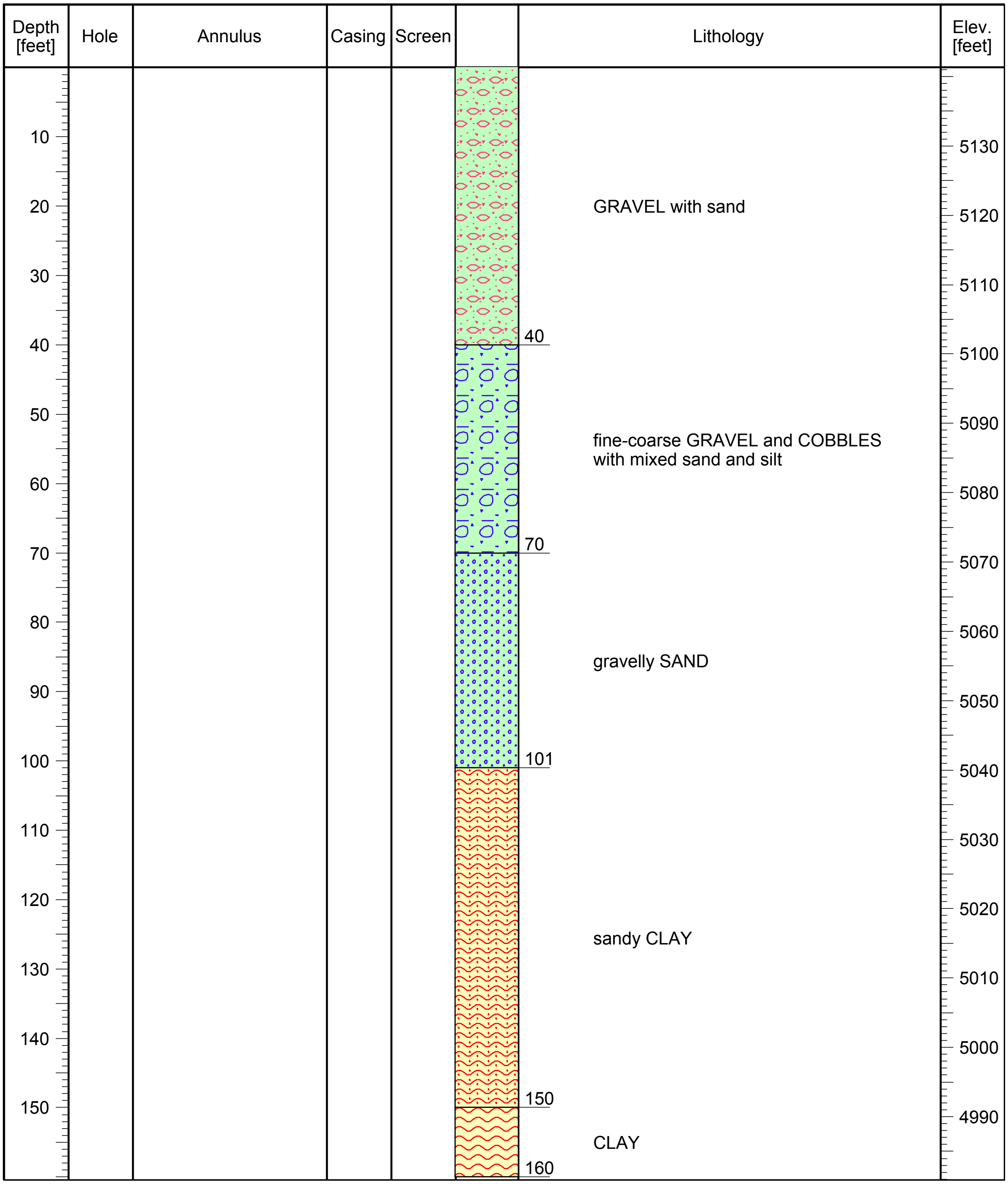
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 96 - 100

Yield (gpm) 20

Use monitoring



Well Lithology

Well Identification 92-20

MBMG Site # M:133390

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-20

Location 07S 09W 26 CDAD

Ground Surface Elev. (ft) 5141.72

Measuring Point Elev. (ft) 5144.11

Well Depth below m.p. (ft) 20.28

Vertical Scale 50

Date Completed 11/18/1992

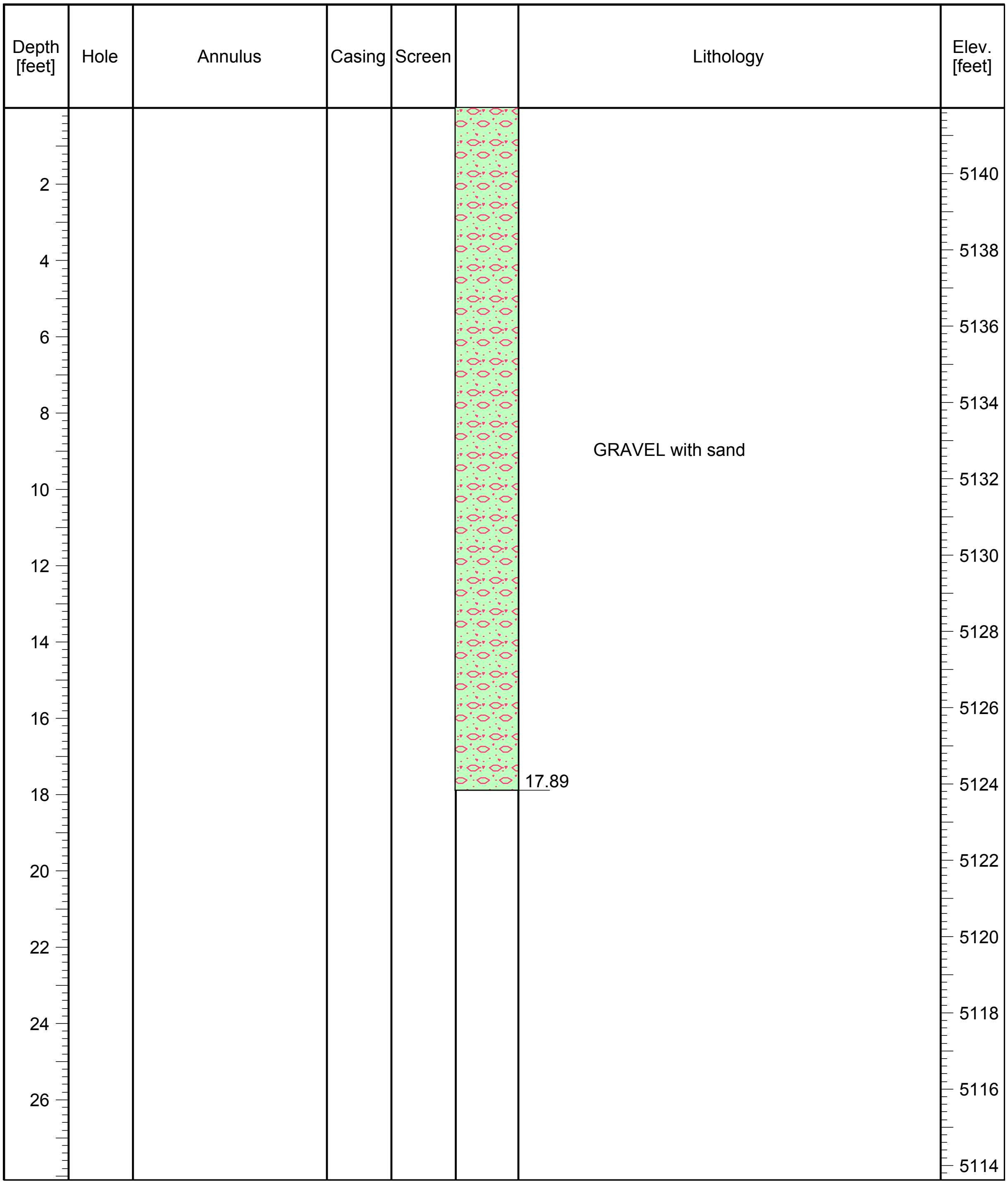
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) none

Yield (gpm) 35

Use monitoring



Well Lithology

Well Identification 92-28

MBMG Site # M:133400

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-28

Location 07S 09W 23 CACD

Ground Surface Elev. (ft) 5119.51

Measuring Point Elev. (ft) 5121.86

Well Depth below m.p. (ft) 87.12

Vertical Scale 150

Date Completed 4/14/1993

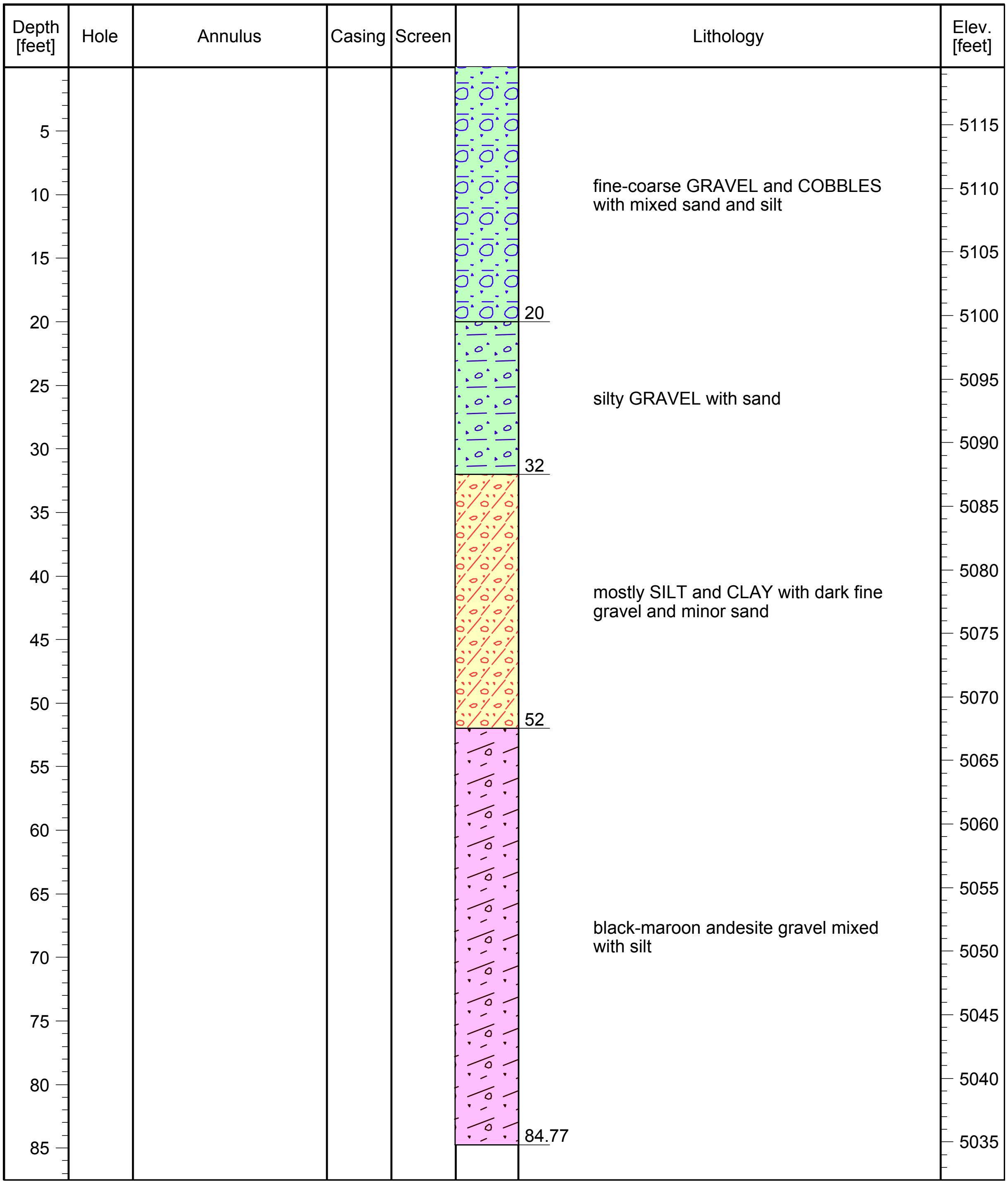
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 76 - 80

Yield (gpm) 4

Use monitoring



Well Lithology

Well Identification 92-29

MBMG Site # M:133402

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-29

Location 07S 09W 23 CACD

Ground Surface Elev. (ft) 5119.35

Measuring Point Elev. (ft) 5121.69

Well Depth below m.p. (ft) 22.09

Vertical Scale 50

Date Completed 4/14/1993

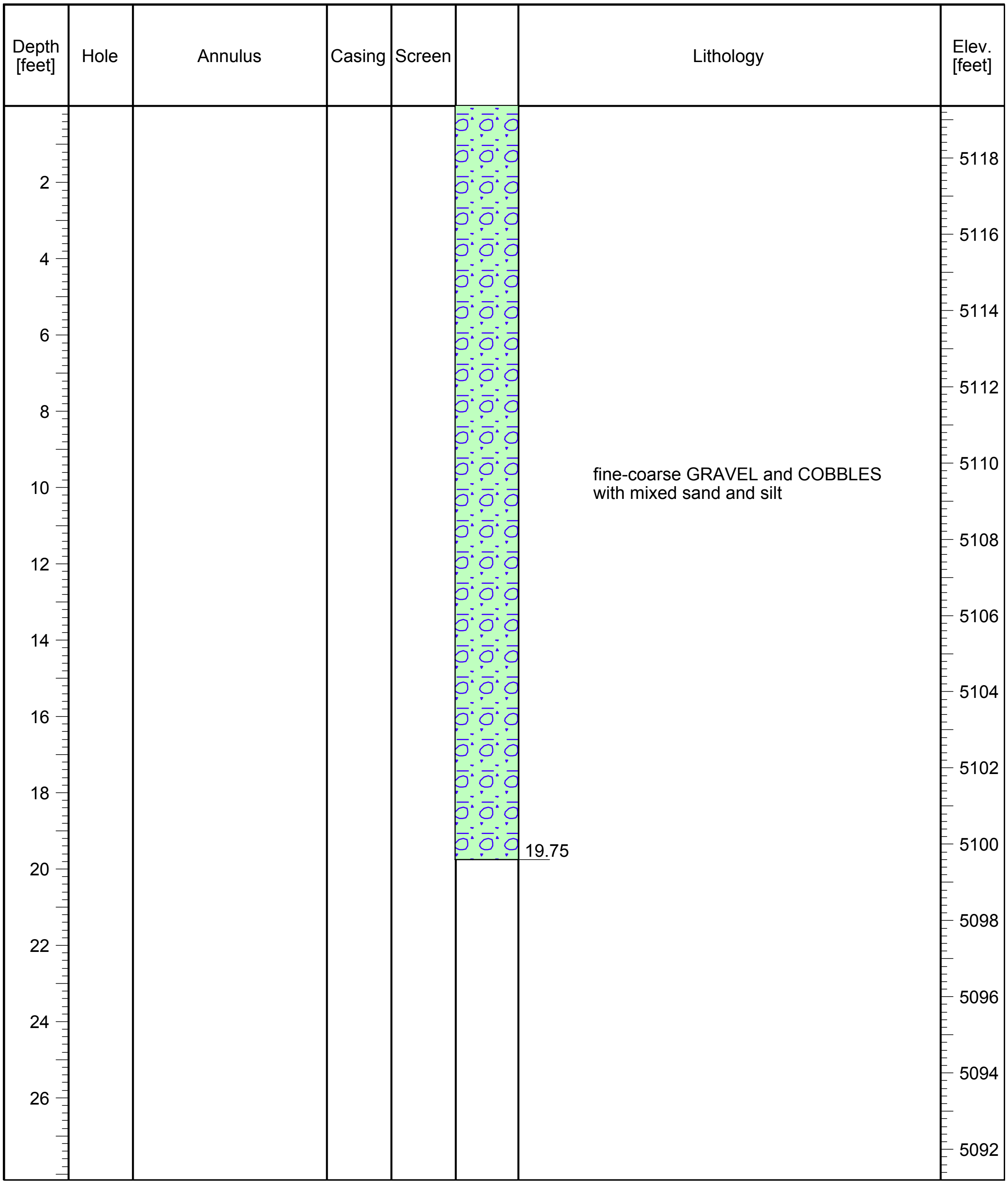
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 17.5 - 19

Yield (gpm) 5

Use monitoring



fine-coarse GRAVEL and COBBLES with mixed sand and silt

Well Lithology

Well Identification
92-30

MBMG Site #
M:133403

Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-30

Location
07S 09W 24 BABA

Ground Surface Elev. (ft)
5099.84

Measuring Point Elev. (ft)
5101.06

Well Depth below m.p. (ft)
32.37

Vertical Scale
75

Date Completed
4/5/1993

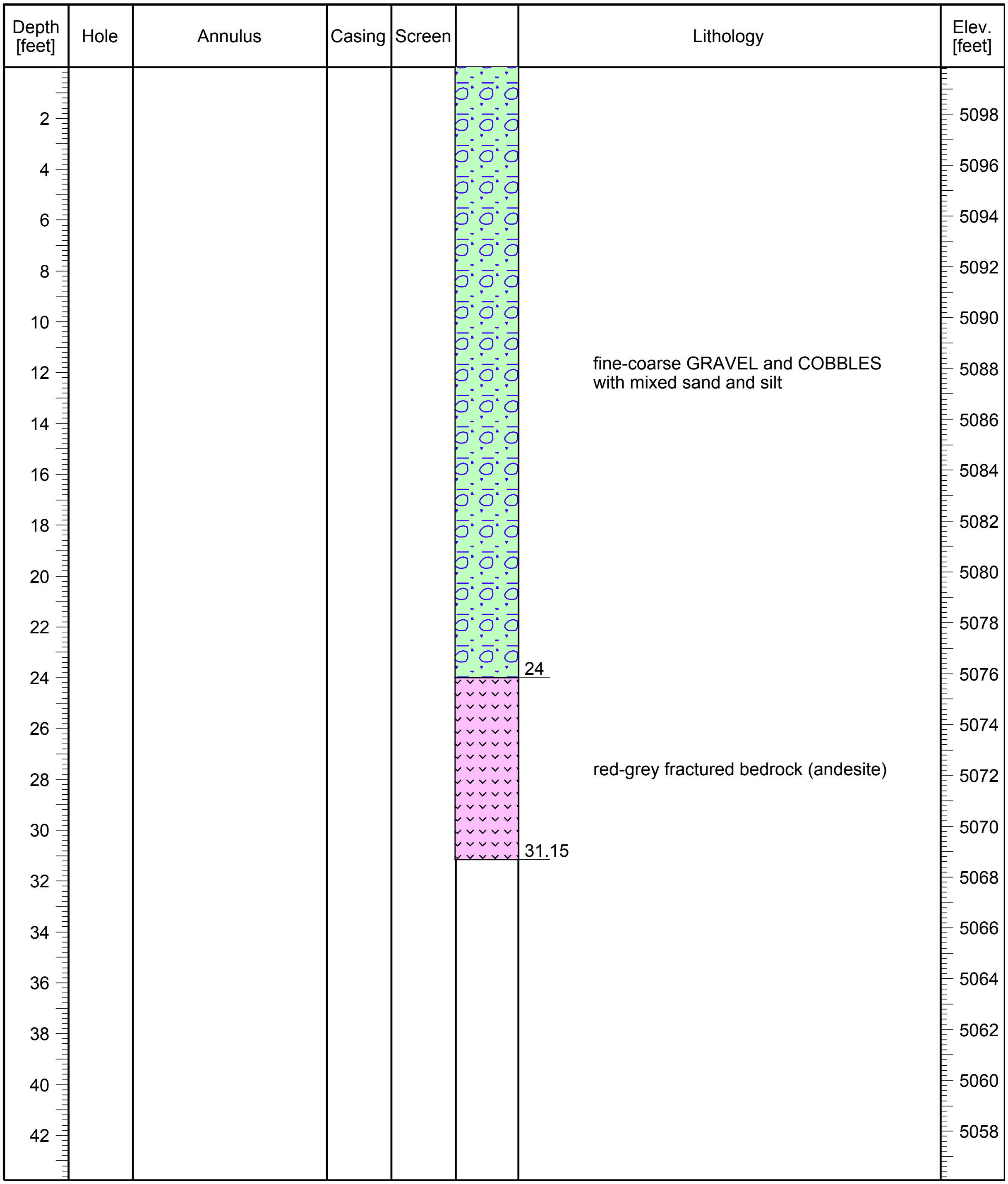
Drilling Method
air rotary

Well Dia. (in)
6.0

Perforated or Screened Interval (ft)
22 - 24

Yield (gpm)
5

Use
monitoring



fine-coarse GRAVEL and COBBLES with mixed sand and silt

red-grey fractured bedrock (andesite)

Well Lithology

Well Identification 92-31

MBMG Site # M:140584

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-31

Location 07S 09W 13 CDDD

Ground Surface Elev. (ft) 5094.80

Measuring Point Elev. (ft) 5097.07

Well Depth below m.p. (ft) 34.26

Vertical Scale 150

Date Completed 4/15/1993

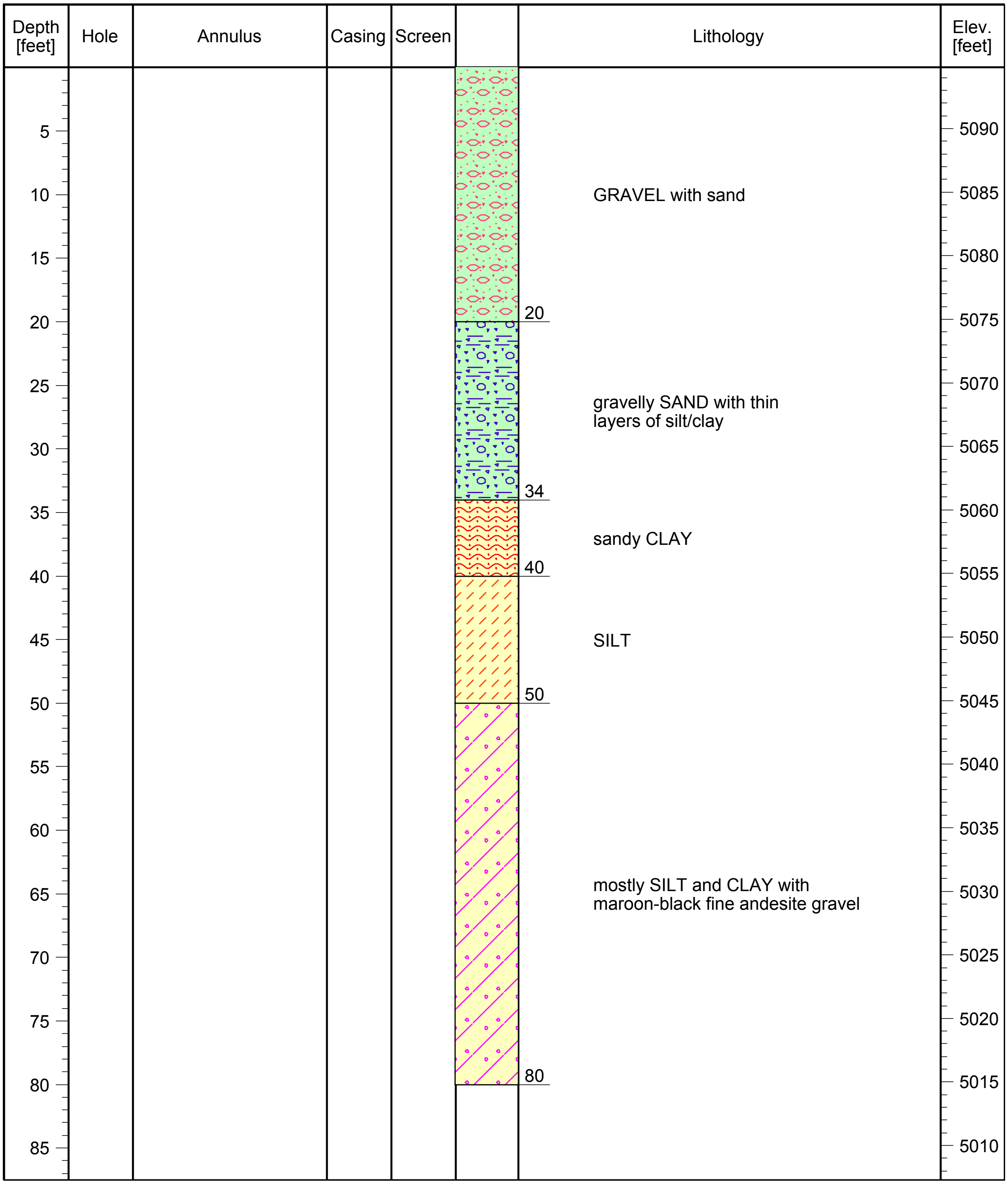
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 20 - 31

Yield (gpm) 3

Use monitoring



Well Lithology

Well Identification 93-1

MBMG Site # M:144014

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 93-1

Location 07S 09W 27 BDDB

Ground Surface Elev. (ft) 5159.33

Measuring Point Elev. (ft) 5160.84

Well Depth below m.p. (ft) 81.00

Vertical Scale 150

Date Completed 10/14/1994

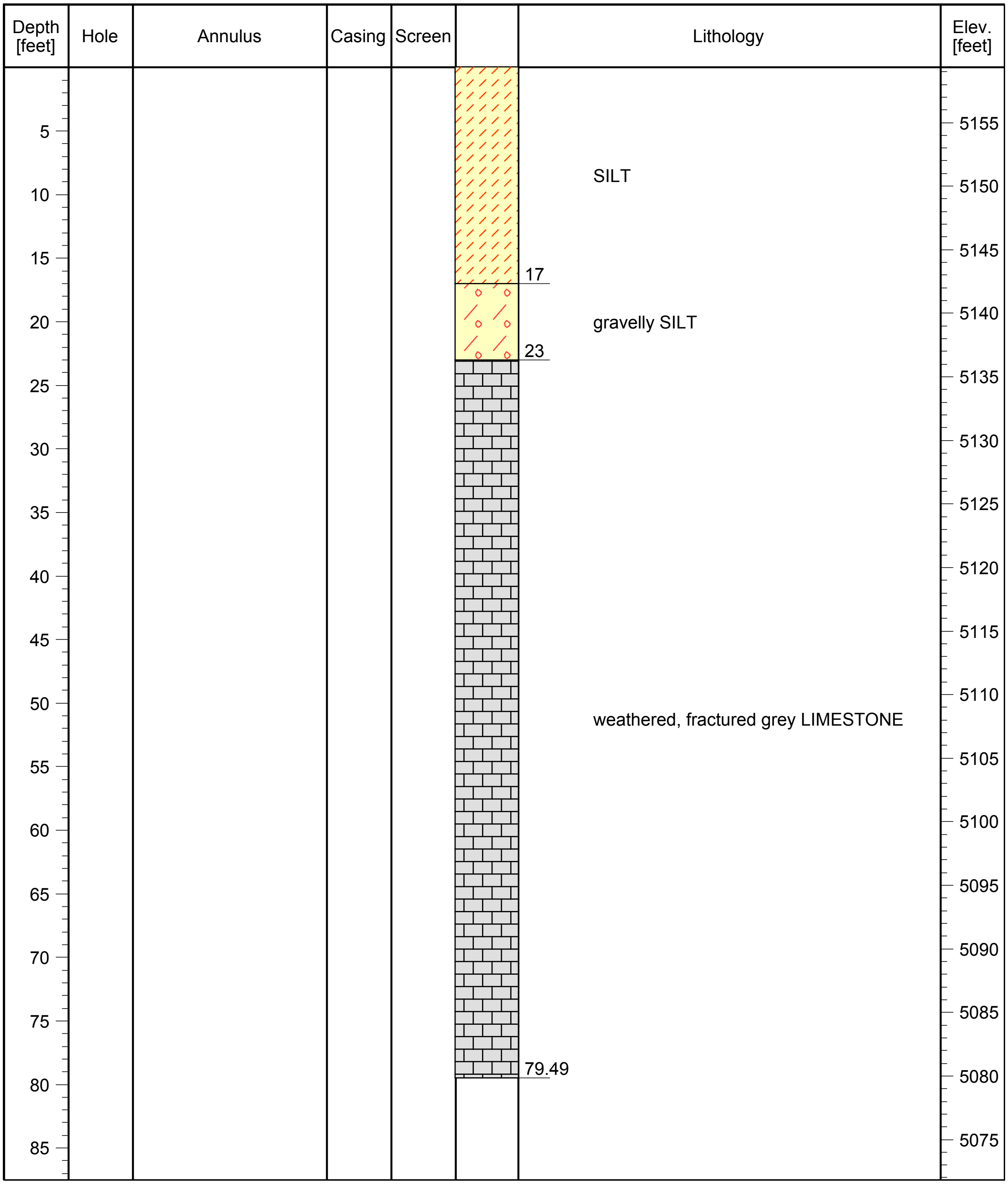
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 61 - 81

Yield (gpm) 23

Use monitoring



Well Lithology

Well Identification 93-2

MBMG Site # M:144016

Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 93-2

Location 07S 09W 34 ABBA

Ground Surface Elev. (ft) 5152.78

Measuring Point Elev. (ft) 5154.30

Well Depth below m.p. (ft) 41.43

Vertical Scale 75

Date Completed 10/14/1993

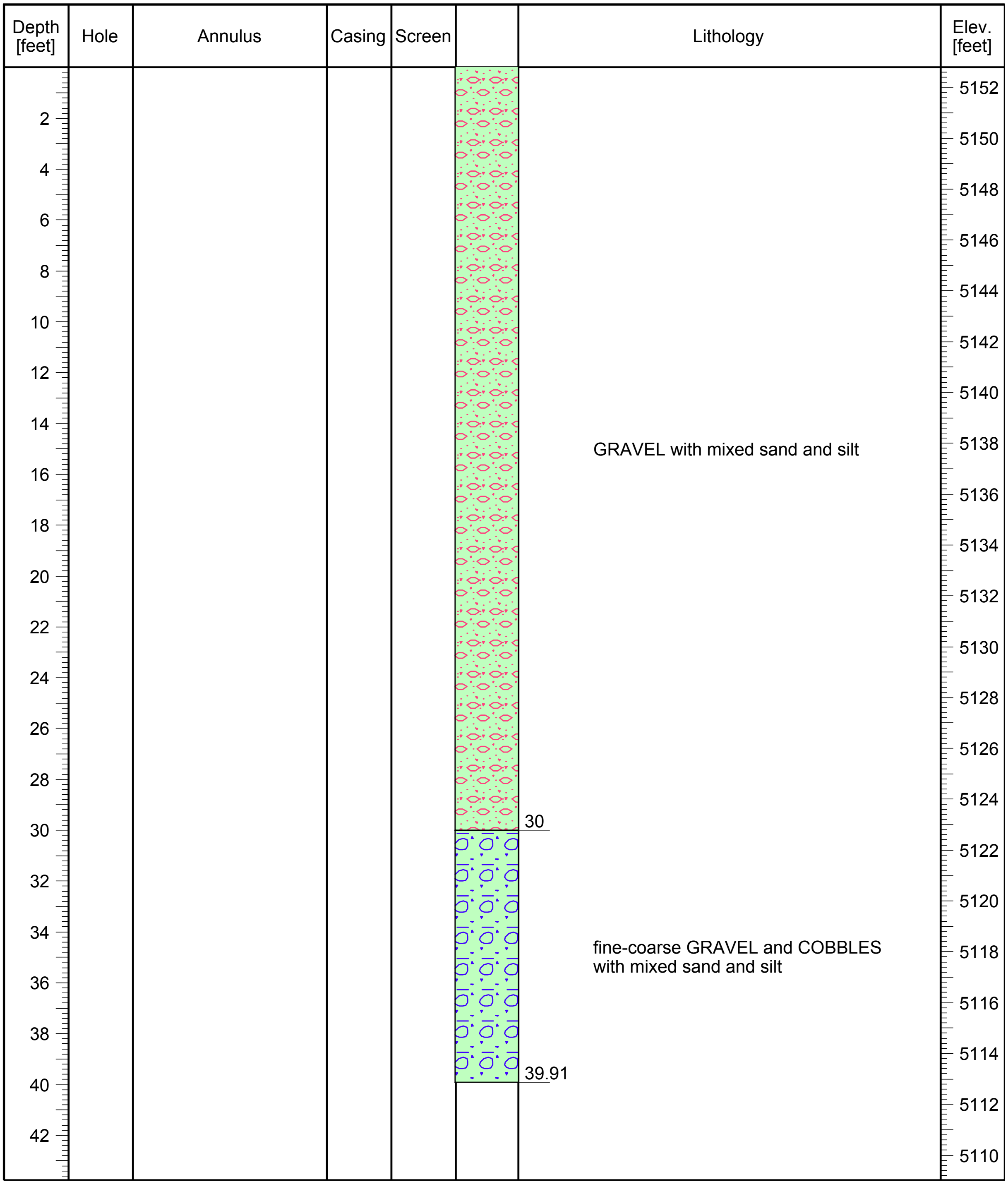
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) none

Yield (gpm) 23

Use monitoring



GRAVEL with mixed sand and silt

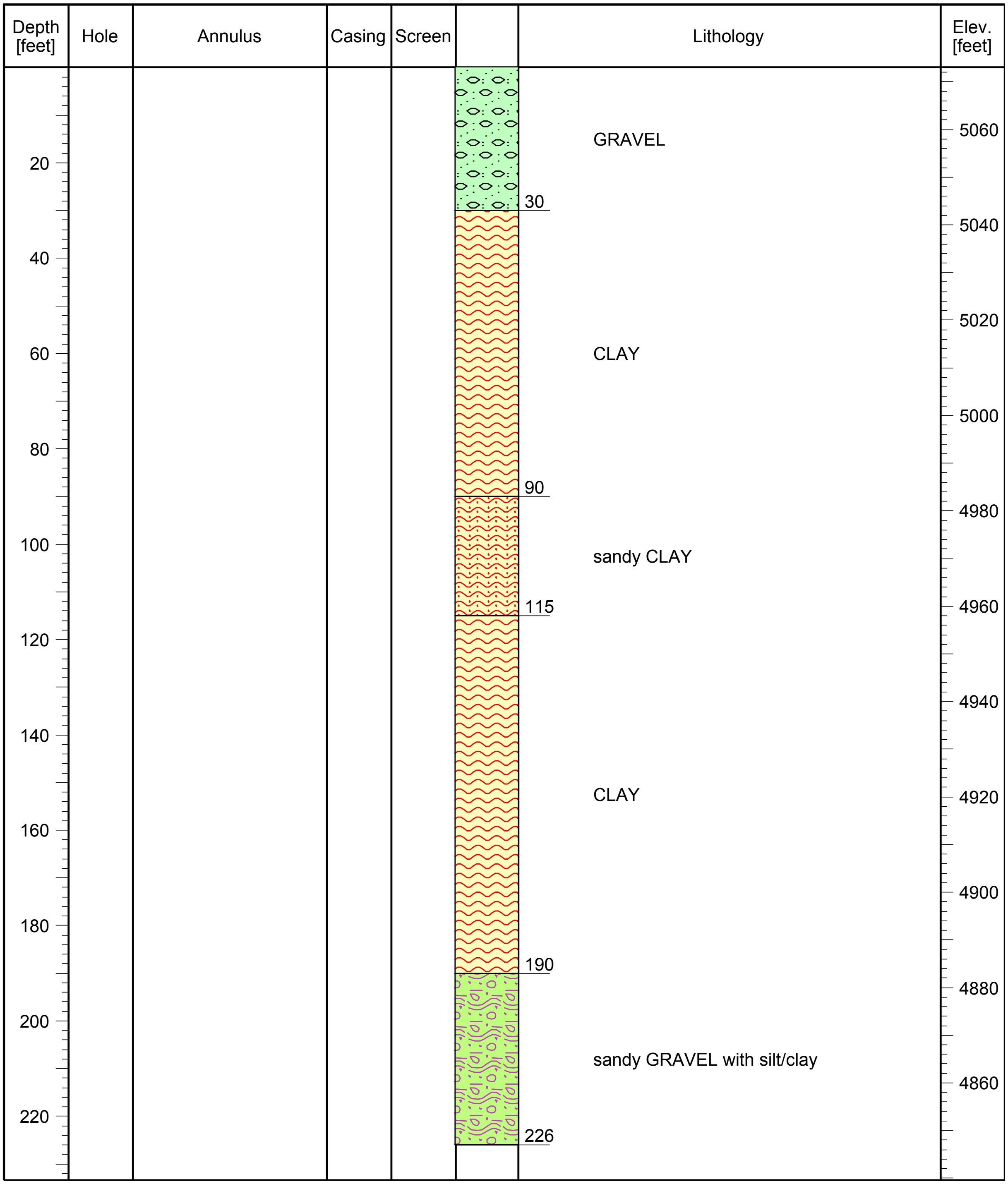
fine-coarse GRAVEL and COBBLES with mixed sand and silt

Well Lithology

Well Identification BEAVIRRG	**MBMG Site #** M:109425	**Well Name or Well Owner** Beaverhead Irrigation

Location 07S 08W 18 AA	**Ground Surface Elev. (ft)** 5073.00	**Well Depth below m.p. (ft)** 225.00	**Vertical Scale** 400

Date Completed 5/27/1981	**Drilling Method** cable tool	**Well Dia. (in)** 6.0	**Perforated or Screened Interval (ft)** 215 - 225	**Yield (gpm)** 25	**Use** domestic



Well Lithology

Well Identification DILLON1

MBMG Site # M:149185

Well Name or Well Owner City of Dillon municipal well #1

Location 07S 09W 23 BDA

Ground Surface Elev. (ft) 5135.00

Well Depth below m.p. (ft) 124.00

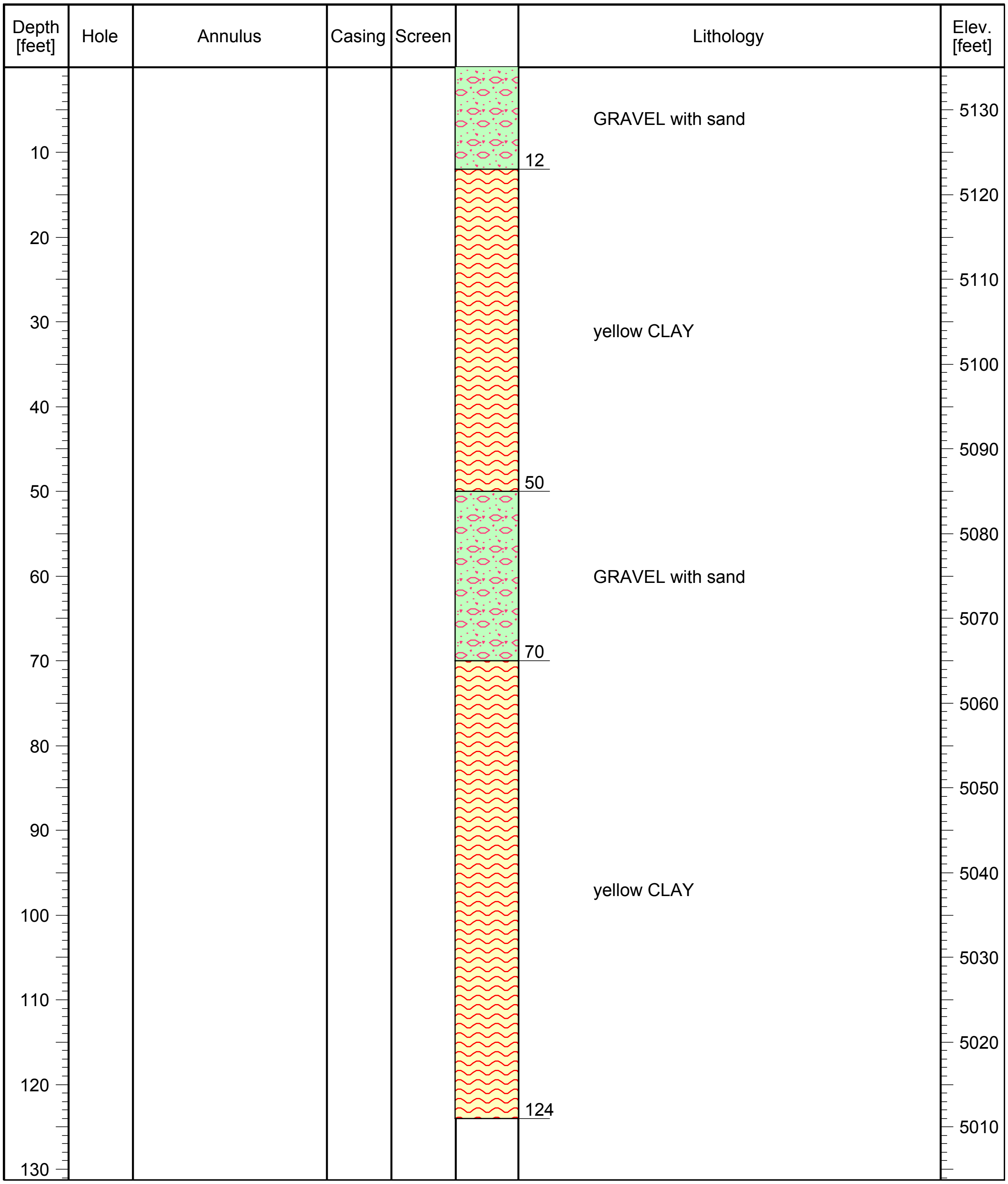
Vertical Scale 225

Date Completed 3/26/1948

Well Dia. (in) 10.

Yield (gpm) 500

Use municipal



Well Lithology

Well Identification DILLON2

Well Name or Well Owner City of Dillon municipal well #2

Location 07S 09W 23 BDA

Ground Surface Elev. (ft) 5150.00

Well Depth below m.p. (ft) 84.00

Vertical Scale 175

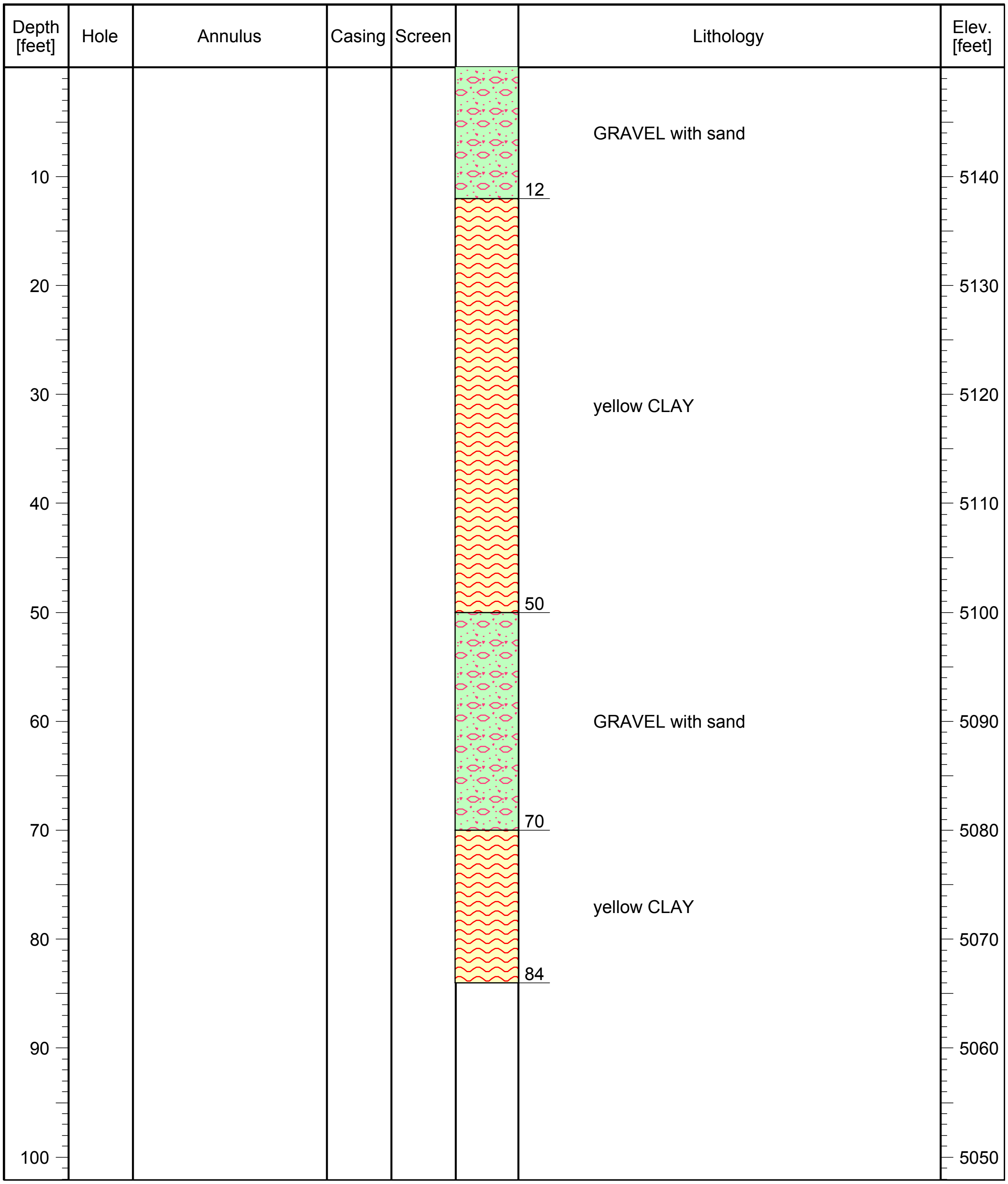
Date Completed 1/28/1960

Well Dia. (in) 12.

Perforated or Screened Interval (ft) 50 - 70

Yield (gpm) 500

Use municipal



Well Lithology

Well Identification DILLON3

MBMG Site # M:109444

Well Name or Well Owner City of Dillon municipal well #3

Location 07S 08W 18 CDCC

Ground Surface Elev. (ft) 5091.46

Measuring Point Elev. (ft) 5091.96

Well Depth below m.p. (ft) 61.00

Vertical Scale 125

Date Completed 3/2/1963

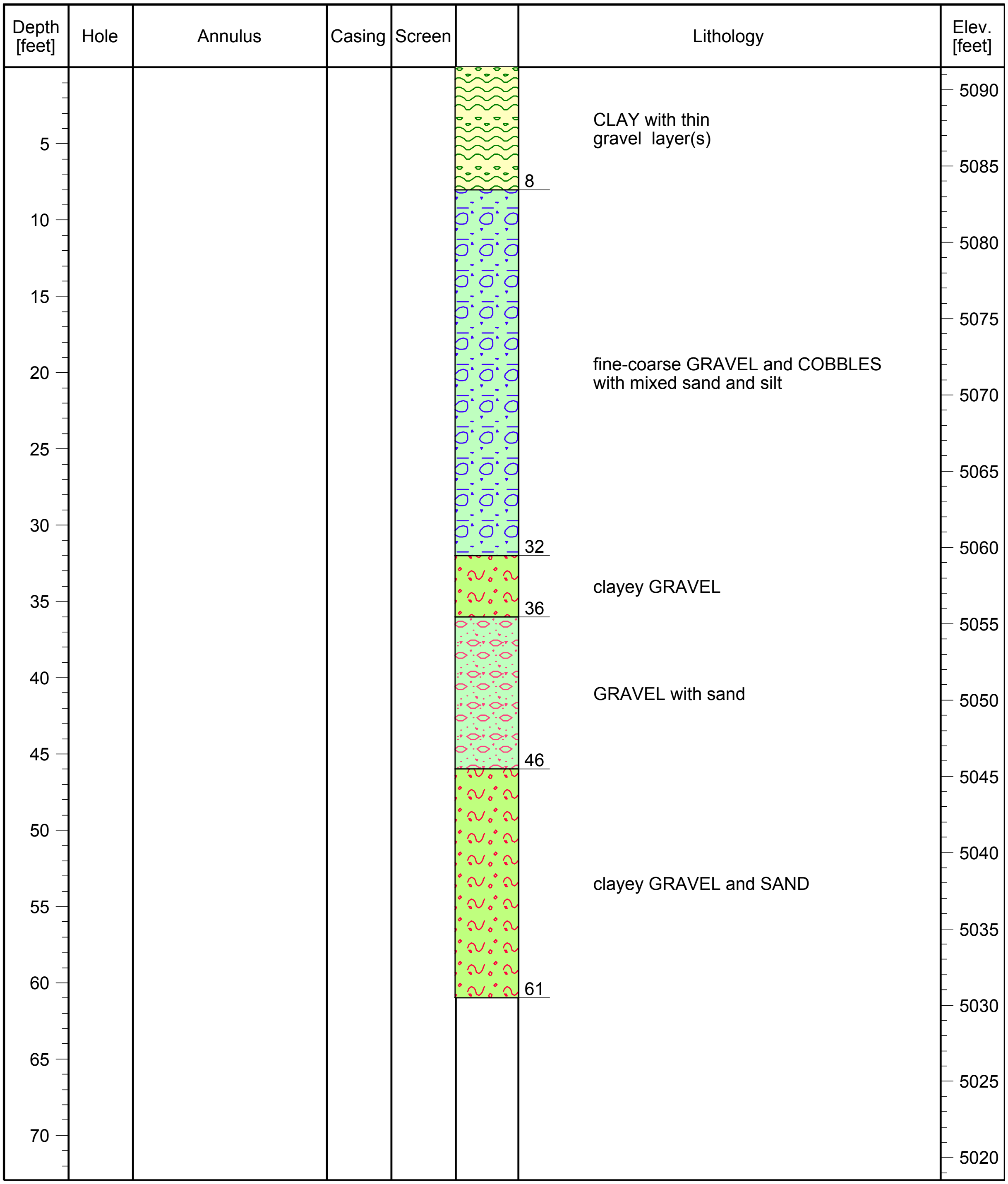
Drilling Method cable tool

Well Dia. (in) 14.

Perforated or Screened Interval (ft) 20 - 46

Yield (gpm) 1000

Use municipal



Well Lithology

Well Identification DILLON4

MBMG Site # M:151327

Well Name or Well Owner City of Dillon municpal well #4

Location 07S 08W 19 BAD

Ground Surface Elev. (ft) 5087.00

Well Depth below m.p. (ft) 82.00

Vertical Scale 150

Date Completed 6/20/1973

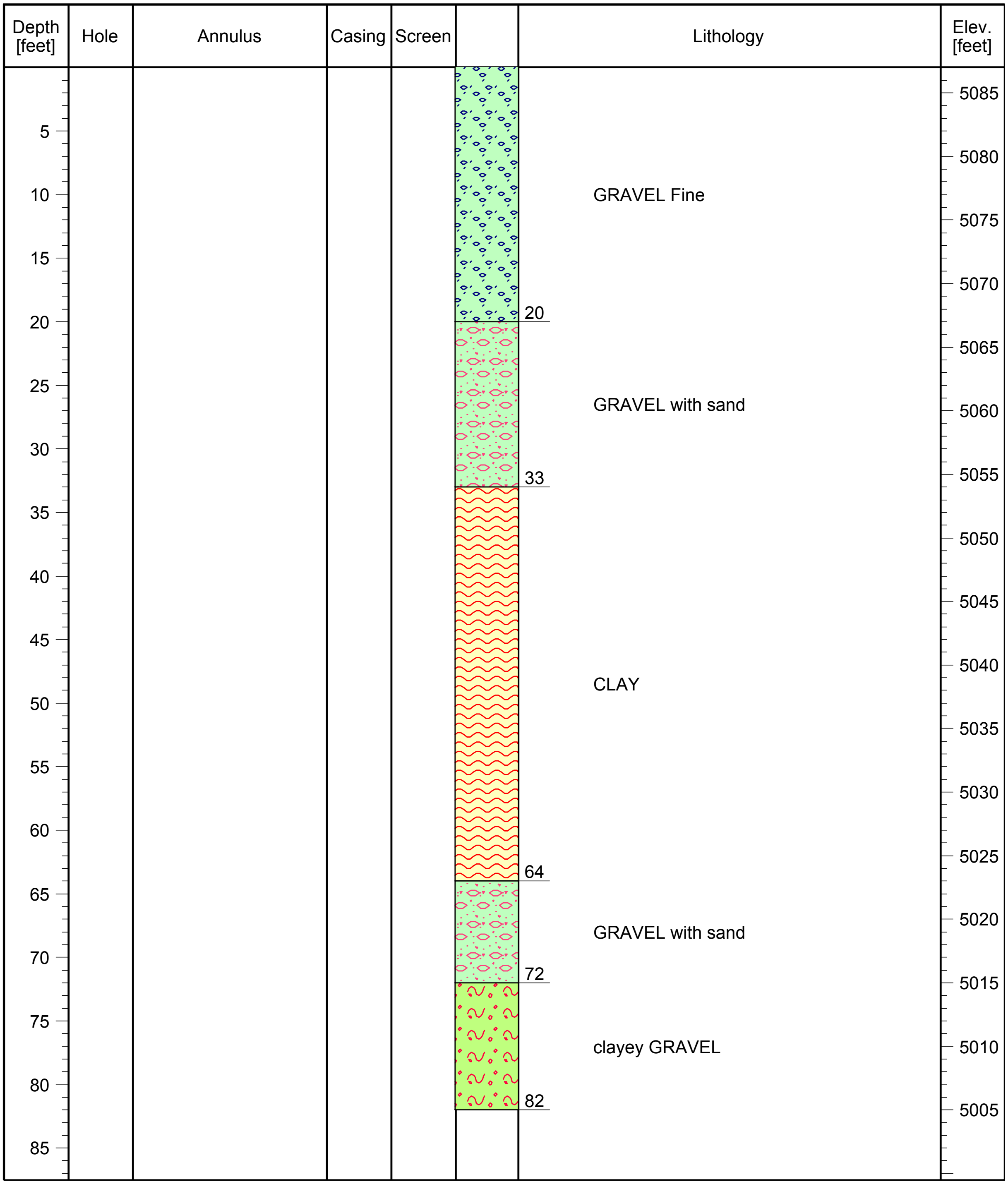
Drilling Method cable tool

Well Dia. (in) 16.

Perforated or Screened Interval (ft) 20-33, 64-72

Yield (gpm) 750

Use municipal

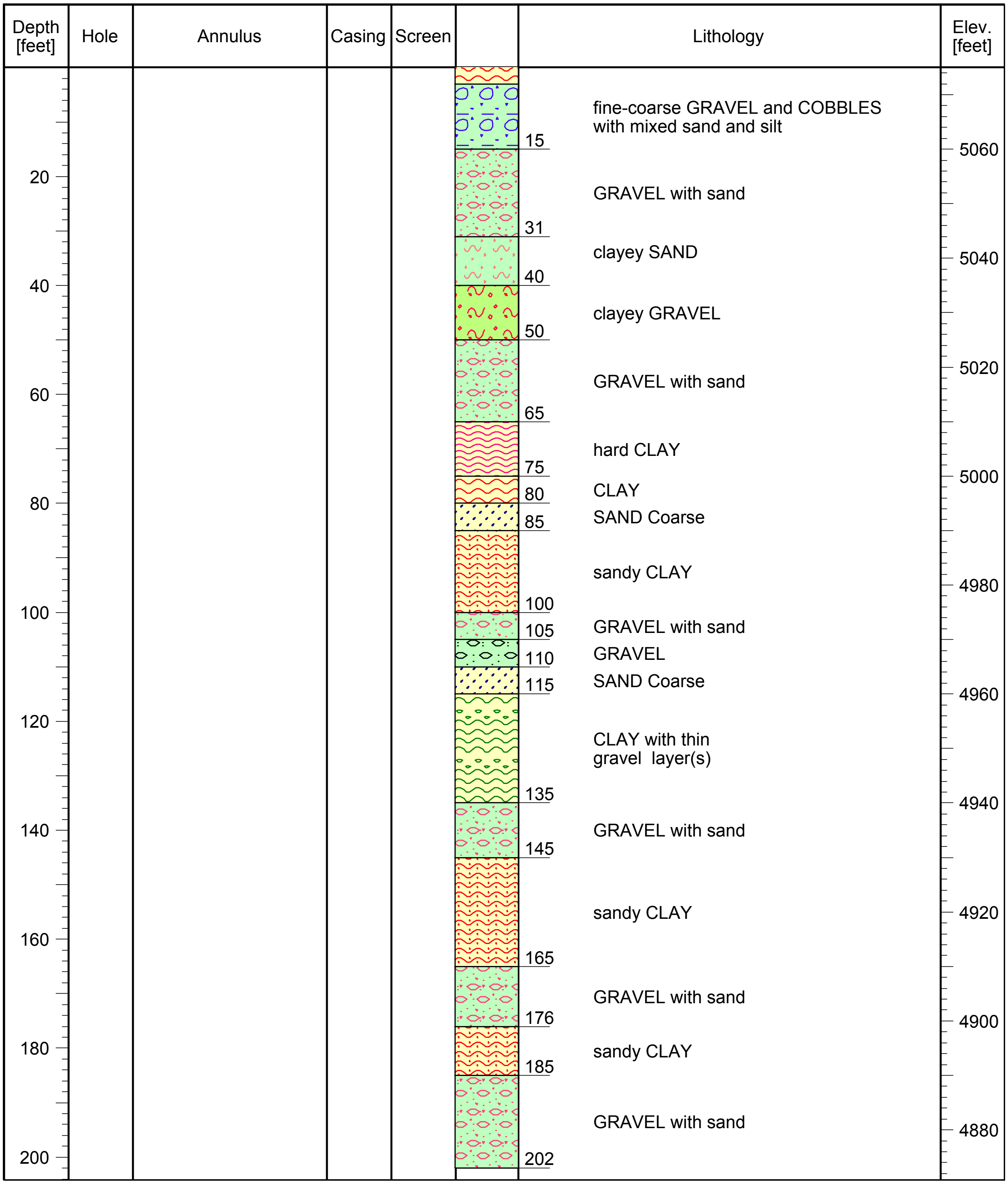


Well Lithology

Well Identification DILLON5	**MBMG Site #** M:109439	**Well Name or Well Owner** City of Dillon municipal well #5

Location 07S 08W 18 ADB	**Ground Surface Elev. (ft)** 5075.00	**Well Depth below m.p. (ft)** 202.00	**Vertical Scale** 350

Date Completed 10/13/1977	**Drilling Method** cable tool	**Well Dia. (in)** 6.0	**Perforated or Screened Interval (ft)** 170-175, 185-200	**Yield (gpm)** 300	**Use** municipal



Well Lithology

Well Identification OWEN

MBMG Site # M:109443

Well Name or Well Owner Bennett Owen

Location 07S 08W 18 BD

Ground Surface Elev. (ft) 5068.00

Well Depth below m.p. (ft) 146.00

Vertical Scale 275

Date Completed 7/21/1980

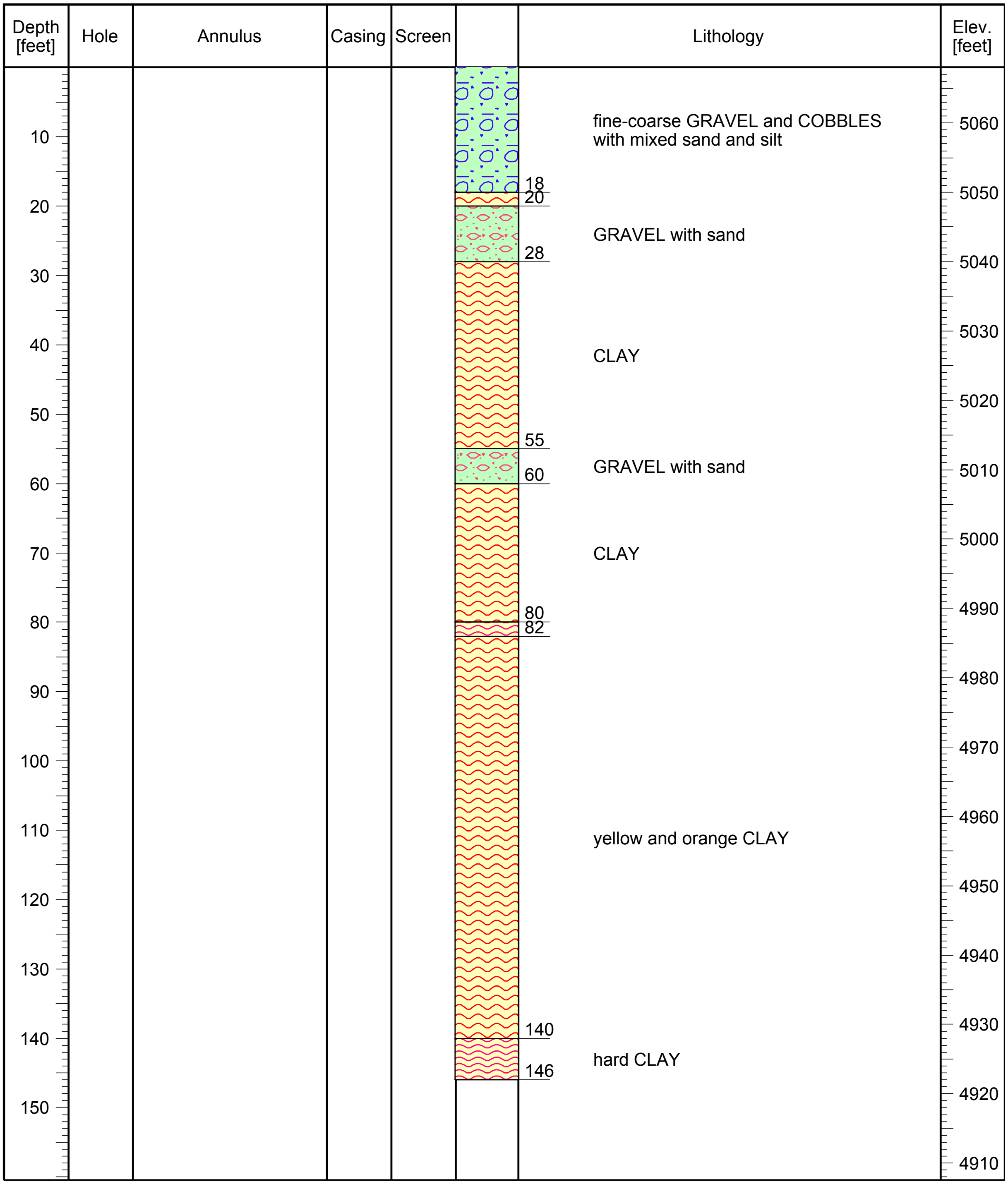
Drilling Method cable tool

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 132 - 140

Yield (gpm) 15

Use domestic



Well Lithology

Well Identification THOMAS

MBMG Site # M:109454

Well Name or Well Owner Ray Thomas

Location 07S 08W 18 DB

Ground Surface Elev. (ft) 5080.00

Well Depth below m.p. (ft) 260.00

Vertical Scale 450

Date Completed 10/25/1989

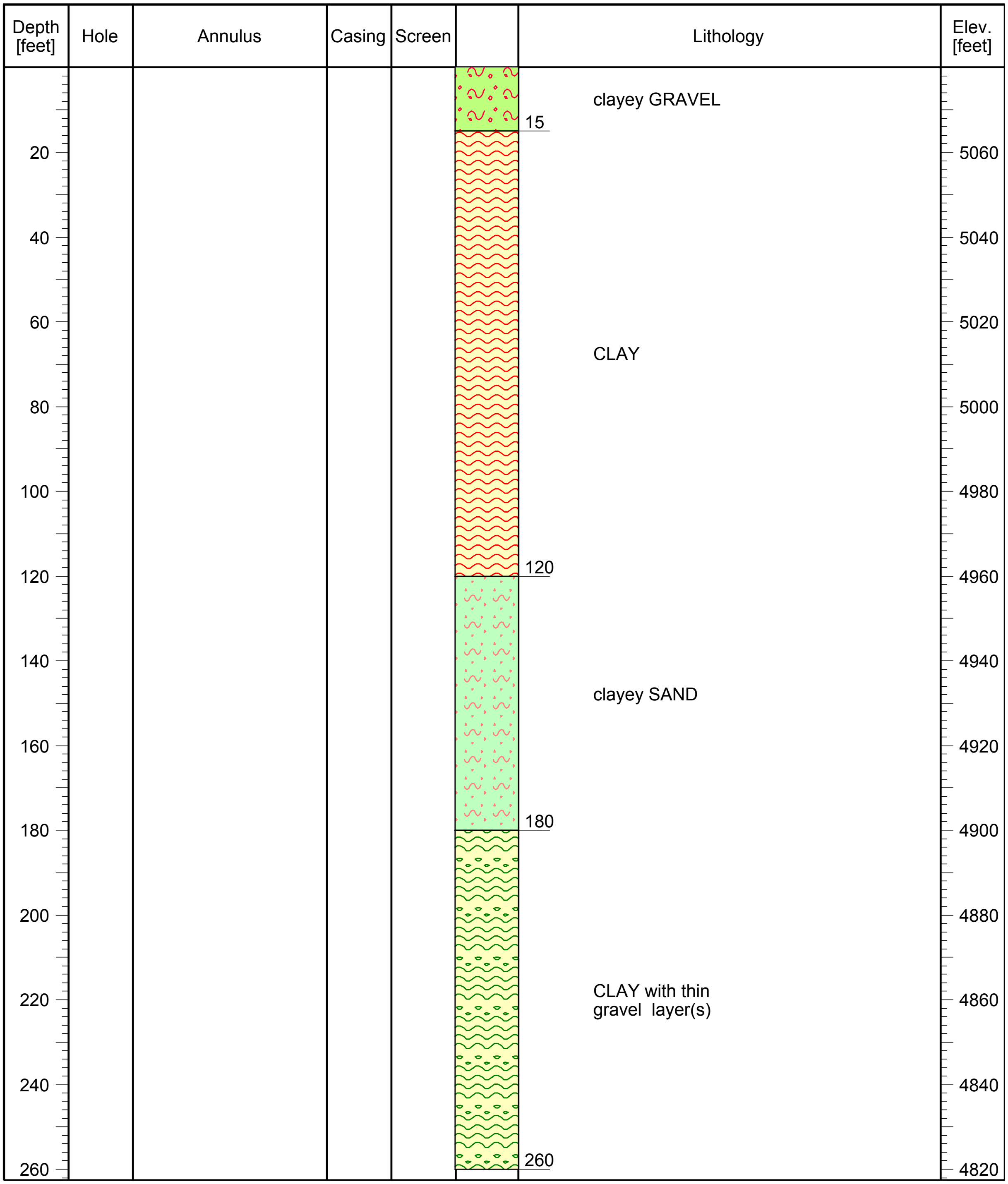
Drilling Method air rotary

Well Dia. (in) 6.0

Perforated or Screened Interval (ft) 180 - 260

Yield (gpm) 20

Use domestic



Appendix B

Groundwater Occurrence and Movement

Appendix B1. Groundwater Hydrographs and Groundwater-Level Data

Upper Blacktail Deer Creek Valley

Groundwater Hydrograph

Well Identification 91-1

MBMG Site # M:126669

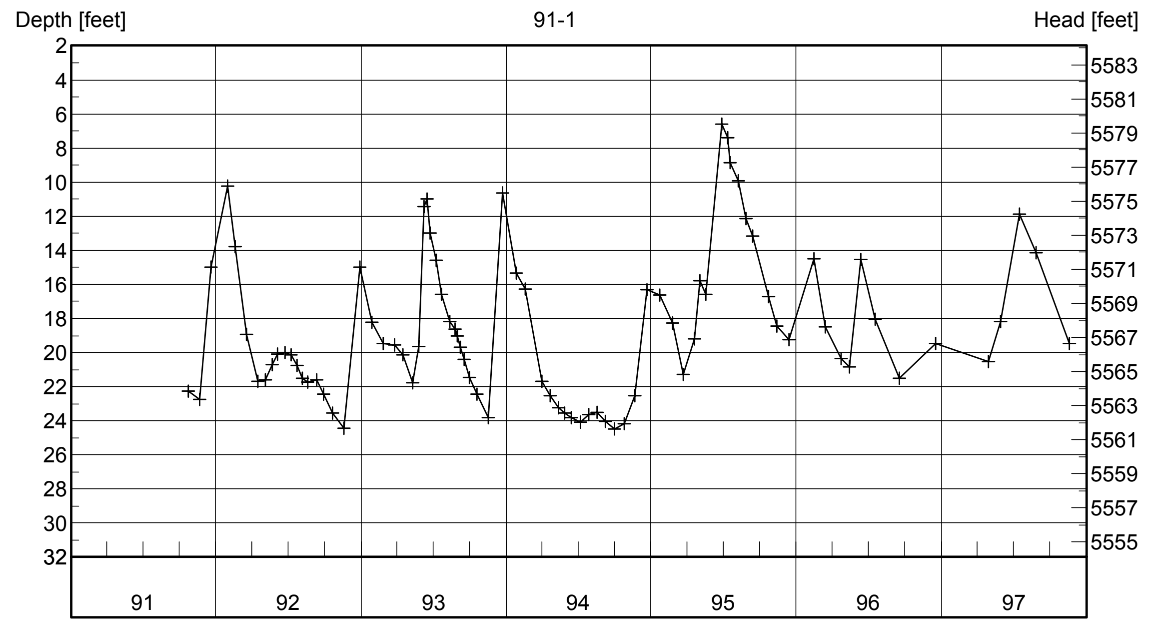
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 91-1

Location 09S 08W 10 BCDC

Ground Surface Elev. (ft) 5584.41

Measuring Point Elev. (ft) 5586.11

Well Depth below m.p. (ft) 57.02



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
10/24/1991	22.25	5563.86
11/20/1991	22.75	5563.36
12/19/1991	15.00	5571.11
01/30/1992	10.22	5575.89
02/19/1992	13.80	5572.31
03/18/1992	18.92	5567.19
04/16/1992	21.66	5564.45
05/05/1992	21.60	5564.51
05/21/1992	20.70	5565.41
06/04/1992	20.07	5566.04
06/22/1992	19.98	5566.13
07/09/1992	20.12	5565.99
07/23/1992	20.77	5565.34
08/06/1992	21.51	5564.60
08/19/1992	21.71	5564.40
09/10/1992	21.60	5564.51
09/28/1992	22.45	5563.66
10/21/1992	23.55	5562.56
11/18/1992	24.42	5561.69
12/28/1992	14.99	5571.12
01/27/1993	18.23	5567.88
02/25/1993	19.47	5566.64
03/26/1993	19.57	5566.54
04/15/1993	20.12	5565.99
05/10/1993	21.79	5564.32
05/25/1993	19.63	5566.48
06/08/1993	11.41	5574.70
06/15/1993	10.97	5575.14
06/24/1993	12.97	5573.14
07/08/1993	14.56	5571.55
07/21/1993	16.58	5569.53
08/12/1993	18.16	5567.95
08/25/1993	18.63	5567.48
08/31/1993	19.00	5567.11
09/08/1993	19.70	5566.41
09/16/1993	20.38	5565.73
09/30/1993	21.46	5564.65
10/19/1993	22.44	5563.67
11/17/1993	23.79	5562.32
12/22/1993	10.61	5575.50
01/26/1994	15.32	5570.79
02/17/1994	16.25	5569.86
03/31/1994	21.68	5564.43
04/21/1994	22.53	5563.58
05/12/1994	23.25	5562.86
05/27/1994	23.56	5562.55
06/14/1994	23.81	5562.30
07/07/1994	24.09	5562.02
07/28/1994	23.62	5562.49
08/17/1994	23.52	5562.59
09/07/1994	24.04	5562.07
09/30/1994	24.46	5561.65
10/26/1994	24.17	5561.94
11/21/1994	22.54	5563.57
12/22/1994	16.30	5569.81
01/23/1995	16.61	5569.50
02/23/1995	18.26	5567.85
03/22/1995	21.28	5564.83
04/20/1995	19.20	5566.91
05/04/1995	15.78	5570.33
05/18/1995	16.60	5569.51
06/28/1995	6.60	5579.51
07/12/1995	7.40	5578.71
07/19/1995	8.86	5577.25
08/08/1995	9.93	5576.18
08/28/1995	12.16	5573.95
09/14/1995	13.18	5572.93
10/23/1995	16.72	5569.39
11/14/1995	18.45	5567.66
12/14/1995	19.26	5566.85
02/15/1996	14.50	5571.61
03/14/1996	18.47	5567.64
04/24/1996	20.33	5565.78
05/15/1996	20.83	5565.28
06/11/1996	14.52	5571.59
07/18/1996	18.05	5568.06
09/17/1996	21.50	5564.61
12/17/1996	19.48	5566.63
04/29/1997	20.54	5565.57
05/29/1997	18.19	5567.92
07/17/1997	11.88	5574.23
08/27/1997	14.12	5571.99
11/19/1997	19.47	5566.64

Groundwater Hydrograph

Well Identification
91-2

MBMG Site #
M:126666

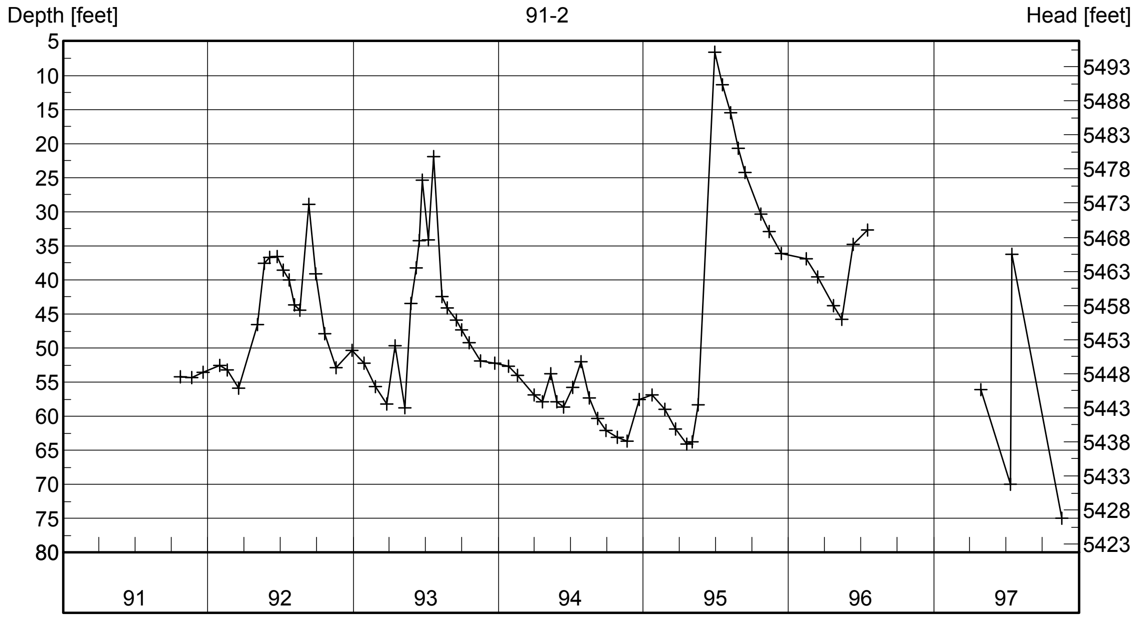
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 91-2

Location
08S 08W 33 CDBB

Ground Surface Elev. (ft)
5499.49

Measuring Point Elev. (ft)
5501.24

Well Depth below m.p. (ft)
96.25



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
10/24/1991	54.19	5447.05
11/20/1991	54.35	5446.89
12/19/1991	53.51	5447.73
01/30/1992	52.54	5448.70
02/19/1992	53.22	5448.02
03/18/1992	55.84	5445.40
05/05/1992	46.52	5454.72
05/21/1992	37.55	5463.69
06/04/1992	36.65	5464.59
06/22/1992	36.61	5464.63
07/09/1992	38.60	5462.64
07/23/1992	39.97	5461.27
08/06/1992	43.65	5457.59
08/19/1992	44.48	5456.76
09/10/1992	28.88	5472.36
09/28/1992	39.11	5462.13
10/21/1992	47.90	5453.34
11/18/1992	52.88	5448.36
12/28/1992	50.33	5450.91
01/27/1993	52.26	5448.98
02/25/1993	55.62	5445.62
03/26/1993	58.24	5443.00
04/15/1993	49.63	5451.61
05/10/1993	58.78	5442.46
05/25/1993	43.43	5457.81
06/08/1993	38.22	5463.02
06/15/1993	34.18	5467.06
06/24/1993	25.37	5475.87
07/08/1993	34.16	5467.08
07/21/1993	21.93	5479.31
08/12/1993	42.50	5458.74
08/25/1993	44.14	5457.10
09/16/1993	45.92	5455.32
09/30/1993	47.38	5453.86
10/19/1993	49.24	5452.00
11/17/1993	51.90	5449.34
12/22/1993	52.20	5449.04
01/26/1994	52.63	5448.61
02/17/1994	53.93	5447.31
03/31/1994	56.92	5444.32
04/21/1994	57.88	5443.36
05/12/1994	53.78	5447.46
05/27/1994	57.84	5443.40
06/14/1994	58.69	5442.55
07/07/1994	55.78	5445.46
07/27/1994	51.99	5449.25
08/17/1994	57.34	5443.90
09/07/1994	60.26	5440.98
09/29/1994	62.05	5439.19
10/27/1994	63.07	5438.17
11/21/1994	63.68	5437.56
12/22/1994	57.55	5443.69
01/23/1995	56.84	5444.40
02/23/1995	58.99	5442.25
03/22/1995	61.83	5439.41
04/20/1995	64.07	5437.17
05/04/1995	63.74	5437.50
05/18/1995	58.32	5442.92
06/29/1995	6.62	5494.62
07/19/1995	11.43	5489.81
08/08/1995	15.44	5485.80
08/28/1995	20.68	5480.56
09/14/1995	24.25	5476.99
10/23/1995	30.36	5470.88
11/14/1995	32.95	5468.29
12/14/1995	36.12	5465.12
02/15/1996	36.95	5464.29
03/14/1996	39.60	5461.64
04/24/1996	43.82	5457.42
05/15/1996	45.82	5455.42
06/11/1996	34.74	5466.50
07/18/1996	32.67	5468.57
04/29/1997	56.06	5445.18
07/12/1997	70.00	5431.24
07/17/1997	36.21	5465.03
11/19/1997	75.00	5426.24

Groundwater Hydrograph

Well Identification
91-3

MBMG Site #
M:126662

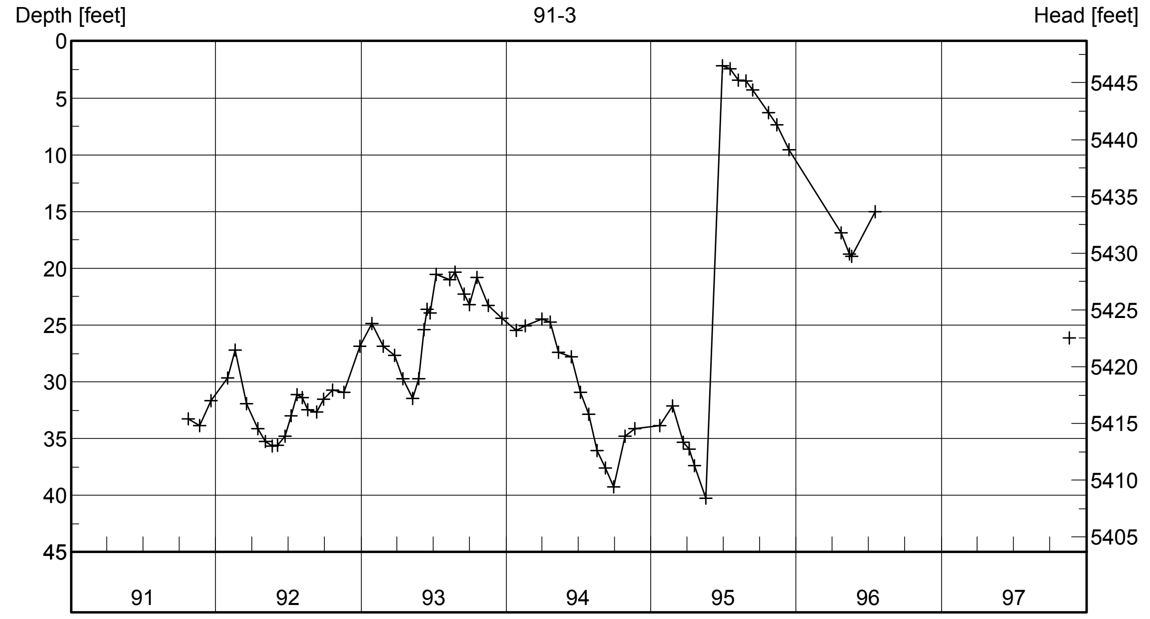
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 91-3

Location
08S 08W 28 CBDA

Ground Surface Elev. (ft)
5446.96

Measuring Point Elev. (ft)
5448.66

Well Depth below m.p. (ft)
66.79



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
10/24/1991	33.23	5415.43
11/20/1991	33.83	5414.83
12/19/1991	31.62	5417.04
01/30/1992	29.64	5419.02
02/19/1992	27.16	5421.50
03/18/1992	31.91	5416.75
04/16/1992	34.14	5414.52
05/05/1992	35.27	5413.39
05/21/1992	35.67	5412.99
06/04/1992	35.57	5413.09
06/22/1992	34.78	5413.88
07/09/1992	32.98	5415.68
07/23/1992	31.12	5417.54
08/06/1992	31.42	5417.24
08/19/1992	32.42	5416.24
09/10/1992	32.67	5415.99
09/28/1992	31.50	5417.16
10/21/1992	30.71	5417.95
11/18/1992	30.89	5417.77
12/28/1992	26.86	5421.80
01/27/1993	24.89	5423.77
02/25/1993	26.88	5421.78
03/26/1993	27.66	5421.00
04/15/1993	29.70	5418.96
05/10/1993	31.48	5417.18
05/25/1993	29.69	5418.97
06/08/1993	25.37	5423.29
06/15/1993	23.58	5425.08
06/24/1993	23.90	5424.76
07/08/1993	20.56	5428.10
08/12/1993	20.99	5427.67
08/25/1993	20.31	5428.35
09/16/1993	22.24	5426.42
09/30/1993	23.17	5425.49
10/19/1993	20.77	5427.89
11/17/1993	23.25	5425.41
12/21/1993	24.40	5424.26
01/26/1994	25.47	5423.19
02/17/1994	25.08	5423.58
03/31/1994	24.48	5424.18
04/21/1994	24.76	5423.90
05/12/1994	27.37	5421.29
06/14/1994	27.78	5420.88
07/07/1994	30.95	5417.71
07/27/1994	32.88	5415.78
08/17/1994	36.05	5412.61
09/07/1994	37.55	5411.11
09/29/1994	39.21	5409.45
10/27/1994	34.79	5413.87
11/21/1994	34.09	5414.57
01/23/1995	33.82	5414.84
02/23/1995	32.11	5416.55
03/22/1995	35.30	5413.36
04/06/1995	35.92	5412.74
04/20/1995	37.37	5411.29
05/18/1995	40.26	5408.40
06/29/1995	2.18	5446.48
07/19/1995	2.43	5446.23
08/08/1995	3.46	5445.20
08/28/1995	3.52	5445.14
09/14/1995	4.31	5444.35
10/23/1995	6.28	5442.38
11/14/1995	7.36	5441.30
12/14/1995	9.55	5439.11
04/24/1996	16.89	5431.77
05/15/1996	18.73	5429.93
05/20/1996	18.95	5429.71
07/18/1996	15.03	5433.63
11/19/1997	26.15	5422.51

Groundwater Hydrograph

Well Identification 92-1

MBMG Site # M:131129

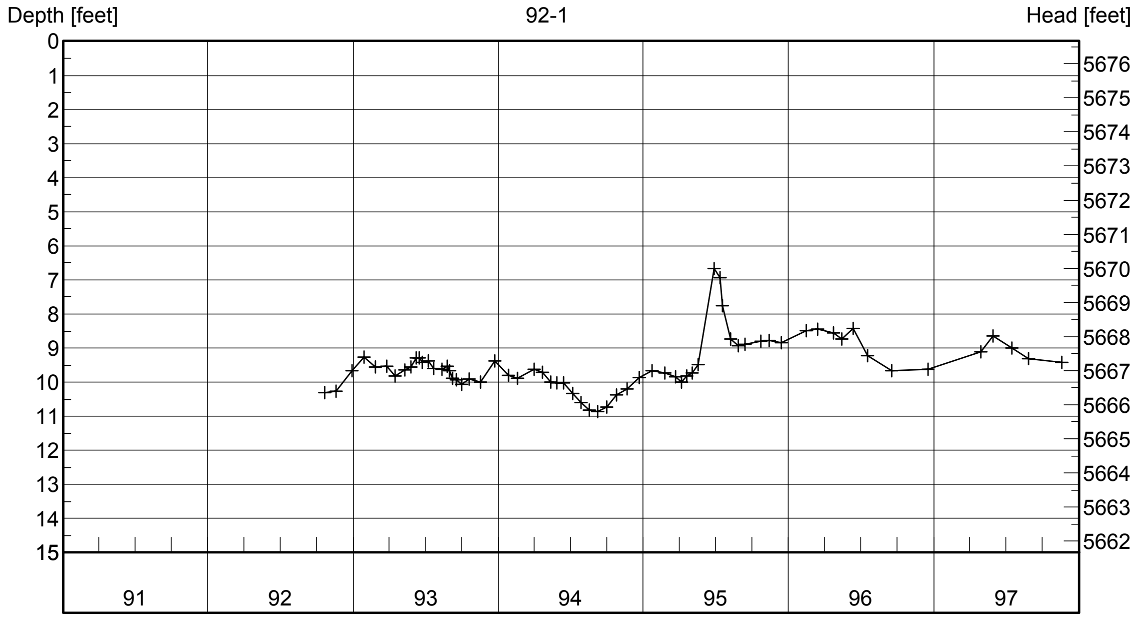
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-1

Location 09S 08W 14 CDAD

Ground Surface Elev. (ft) 5675.01

Measuring Point Elev. (ft) 5676.66

Well Depth below m.p. (ft) 120.90



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
10/21/1992	10.31	5666.35
11/18/1992	10.27	5666.39
12/28/1992	9.67	5666.99
01/27/1993	9.27	5667.39
02/25/1993	9.56	5667.10
03/26/1993	9.54	5667.12
04/15/1993	9.82	5666.84
05/10/1993	9.65	5667.01
05/25/1993	9.56	5667.10
06/08/1993	9.28	5667.38
06/15/1993	9.29	5667.37
06/24/1993	9.42	5667.24
07/08/1993	9.37	5667.29
07/21/1993	9.60	5667.06
08/12/1993	9.61	5667.05
08/25/1993	9.52	5667.14
08/31/1993	9.66	5667.00
09/08/1993	9.89	5666.77
09/16/1993	9.94	5666.72
09/30/1993	10.07	5666.59
10/19/1993	9.91	5666.75
11/17/1993	10.00	5666.66
12/22/1993	9.37	5667.29
01/26/1994	9.80	5666.86
02/17/1994	9.89	5666.77
03/31/1994	9.63	5667.03
04/21/1994	9.70	5666.96
05/12/1994	10.00	5666.66
05/27/1994	10.02	5666.64
06/14/1994	10.01	5666.65
07/07/1994	10.32	5666.34
07/28/1994	10.60	5666.06
08/17/1994	10.81	5665.85
09/07/1994	10.86	5665.80
09/30/1994	10.73	5665.93
10/26/1994	10.38	5666.28
11/21/1994	10.20	5666.46
12/22/1994	9.87	5666.79
01/23/1995	9.67	5666.99
02/23/1995	9.73	5666.93
03/22/1995	9.84	5666.82
04/06/1995	10.00	5666.66
04/20/1995	9.82	5666.84
05/04/1995	9.74	5666.92
05/18/1995	9.48	5667.18
06/28/1995	6.66	5670.00
07/12/1995	6.93	5669.73
07/19/1995	7.75	5668.91
08/08/1995	8.73	5667.93
08/28/1995	8.93	5667.73
09/14/1995	8.88	5667.78
10/23/1995	8.80	5667.86
11/14/1995	8.78	5667.88
12/14/1995	8.85	5667.81
02/15/1996	8.49	5668.17
03/14/1996	8.44	5668.22
04/24/1996	8.56	5668.10
05/15/1996	8.73	5667.93
06/11/1996	8.42	5668.24
07/18/1996	9.22	5667.44
09/17/1996	9.67	5666.99
12/17/1996	9.62	5667.04
04/29/1997	9.11	5667.55
05/29/1997	8.65	5668.01
07/17/1997	9.00	5667.66
08/27/1997	9.31	5667.35
11/19/1997	9.42	5667.24

Groundwater Hydrograph

Well Identification 92-2

MBMG Site # M:131130

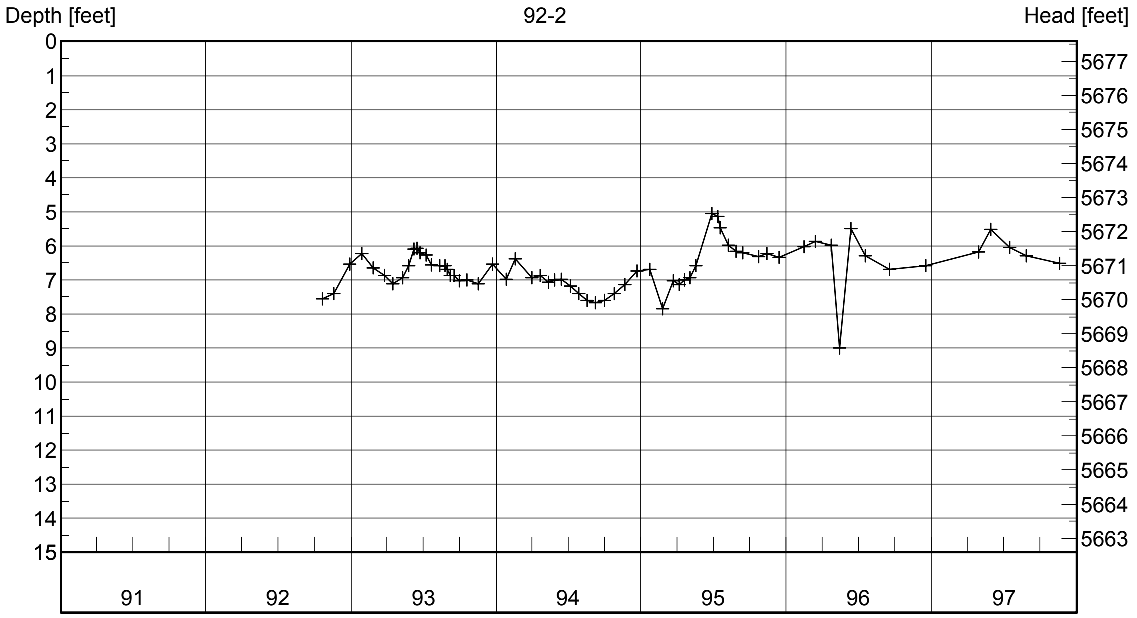
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-2

Location 09S 08W 14 CDAD

Ground Surface Elev. (ft) 5674.93

Measuring Point Elev. (ft) 5677.08

Well Depth below m.p. (ft) 27.13



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
10/21/1992	7.56	5669.52
11/18/1992	7.39	5669.69
12/28/1992	6.53	5670.55
01/27/1993	6.22	5670.86
02/25/1993	6.65	5670.43
03/26/1993	6.86	5670.22
04/15/1993	7.11	5669.97
05/10/1993	6.94	5670.14
05/25/1993	6.58	5670.50
06/08/1993	6.10	5670.98
06/15/1993	6.06	5671.02
06/24/1993	6.20	5670.88
07/08/1993	6.26	5670.82
07/21/1993	6.55	5670.53
08/12/1993	6.58	5670.50
08/25/1993	6.58	5670.50
08/31/1993	6.70	5670.38
09/08/1993	6.86	5670.22
09/16/1993	6.87	5670.21
09/30/1993	7.02	5670.06
10/19/1993	7.00	5670.08
11/17/1993	7.11	5669.97
12/22/1993	6.53	5670.55
01/26/1994	6.98	5670.10
02/17/1994	6.39	5670.69
03/31/1994	6.93	5670.15
04/21/1994	6.87	5670.21
05/12/1994	7.07	5670.01
05/27/1994	6.99	5670.09
06/14/1994	6.98	5670.10
07/07/1994	7.18	5669.90
07/28/1994	7.40	5669.68
08/17/1994	7.60	5669.48
09/07/1994	7.67	5669.41
09/30/1994	7.61	5669.47
10/26/1994	7.40	5669.68
11/21/1994	7.14	5669.94
12/22/1994	6.74	5670.34
01/23/1995	6.68	5670.40
02/23/1995	7.84	5669.24
03/22/1995	7.02	5670.06
04/06/1995	7.13	5669.95
04/20/1995	7.01	5670.07
05/04/1995	6.93	5670.15
05/18/1995	6.57	5670.51
06/28/1995	5.05	5672.03
07/12/1995	5.13	5671.95
07/19/1995	5.47	5671.61
08/08/1995	5.99	5671.09
08/28/1995	6.16	5670.92
09/14/1995	6.21	5670.87
10/23/1995	6.32	5670.76
11/14/1995	6.23	5670.85
12/14/1995	6.34	5670.74
02/15/1996	6.02	5671.06
03/14/1996	5.87	5671.21
04/24/1996	5.99	5671.09
05/15/1996	9.00	5668.08
06/11/1996	5.50	5671.58
07/18/1996	6.28	5670.80
09/17/1996	6.69	5670.39
12/17/1996	6.58	5670.50
04/29/1997	6.19	5670.89
05/29/1997	5.52	5671.56
07/17/1997	6.05	5671.03
08/27/1997	6.30	5670.78
11/19/1997	6.51	5670.57

Groundwater Hydrograph

Well Identification 92-4

MBMG Site # M:131122

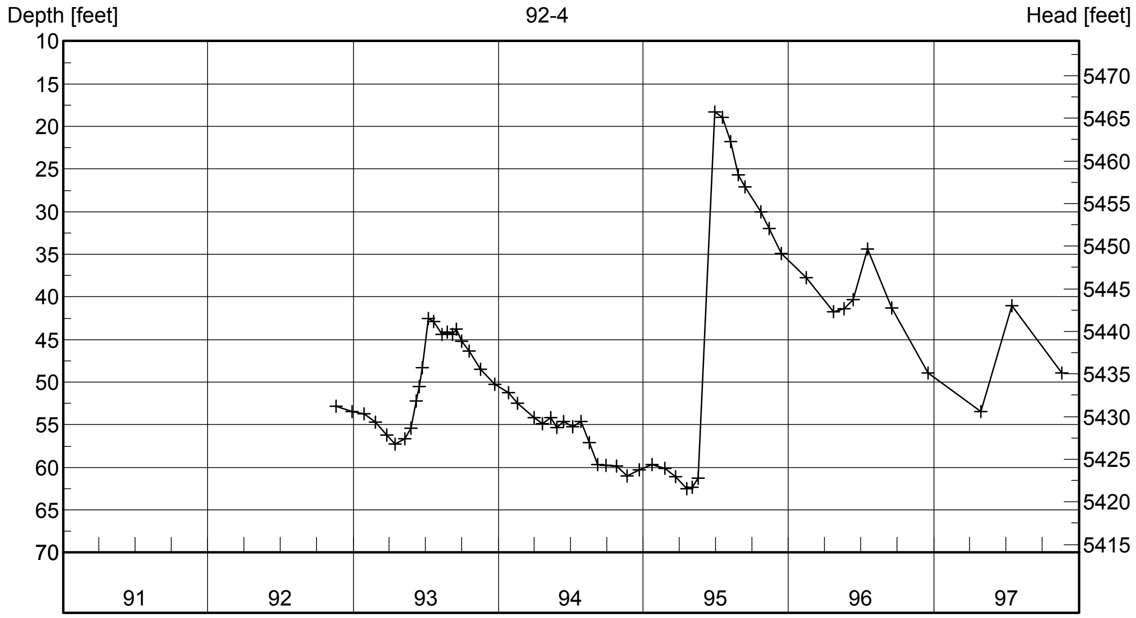
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-4

Location 08S 08W 32 DABD

Ground Surface Elev. (ft) 5482.09

Measuring Point Elev. (ft) 5484.03

Well Depth below m.p. (ft) 160.42



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/18/1992	52.81	5431.22	01/26/1994	51.24	5432.79	06/29/1995	18.30	5465.73			
12/28/1992	53.49	5430.54	02/17/1994	52.45	5431.58	07/19/1995	18.93	5465.10			
01/27/1993	53.71	5430.32	03/31/1994	54.15	5429.88	08/08/1995	21.79	5462.24			
02/25/1993	54.66	5429.37	04/21/1994	54.90	5429.13	08/28/1995	25.68	5458.35			
03/26/1993	56.24	5427.79	05/12/1994	54.16	5429.87	09/14/1995	27.11	5456.92			
04/15/1993	57.27	5426.76	05/27/1994	55.31	5428.72	10/23/1995	30.05	5453.98			
05/10/1993	56.61	5427.42	06/14/1994	54.57	5429.46	11/14/1995	31.93	5452.10			
05/25/1993	55.40	5428.63	07/07/1994	55.26	5428.77	12/14/1995	34.94	5449.09			
06/08/1993	52.19	5431.84	07/27/1994	54.64	5429.39	02/15/1996	37.74	5446.29			
06/15/1993	50.53	5433.50	08/17/1994	57.07	5426.96	04/24/1996	41.77	5442.26			
06/24/1993	48.32	5435.71	09/07/1994	59.69	5424.34	05/20/1996	41.37	5442.66			
07/08/1993	42.56	5441.47	09/29/1994	59.74	5424.29	06/11/1996	40.35	5443.68			
07/21/1993	42.90	5441.13	10/26/1994	59.88	5424.15	07/18/1996	34.40	5449.63			
08/12/1993	44.41	5439.62	11/21/1994	61.03	5423.00	09/17/1996	41.31	5442.72			
08/25/1993	44.15	5439.88	12/22/1994	60.27	5423.76	12/17/1996	48.90	5435.13			
09/08/1993	44.36	5439.67	01/23/1995	59.66	5424.37	04/29/1997	53.42	5430.61			
09/16/1993	43.74	5440.29	02/23/1995	60.07	5423.96	07/17/1997	41.01	5443.02			
09/30/1993	45.17	5438.86	03/22/1995	61.11	5422.92	11/19/1997	48.90	5435.13			
10/19/1993	46.32	5437.71	04/20/1995	62.47	5421.56						
11/17/1993	48.44	5435.59	05/04/1995	62.36	5421.67						
12/22/1993	50.29	5433.74	05/18/1995	61.25	5422.78						

Groundwater Hydrograph

Well Identification
MATADOR1

MBMG Site #
M:109819

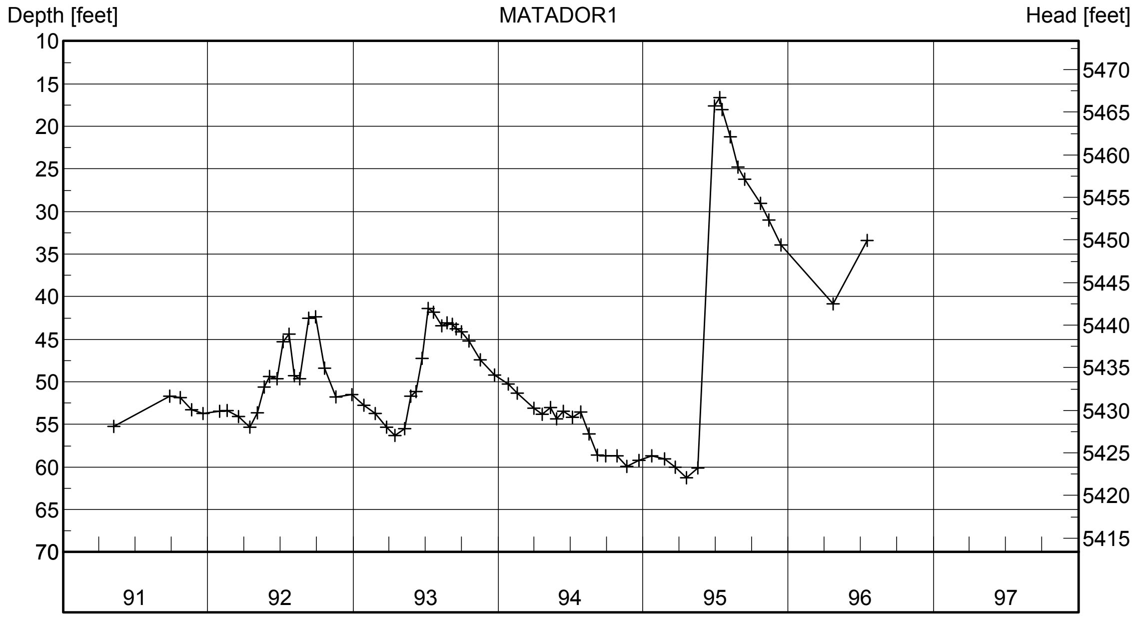
Well Name or Well Owner
Matador Ranch irrigation well #1

Location
08S 08W 32 DACA

Ground Surface Elev. (ft)
5483.09

Measuring Point Elev. (ft)
5483.34

Well Depth below m.p. (ft)
165.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
05/08/1991	55.19	5428.15
09/26/1991	51.68	5431.66
10/24/1991	51.87	5431.47
11/20/1991	53.25	5430.09
12/19/1991	53.71	5429.63
01/30/1992	53.48	5429.86
02/19/1992	53.33	5430.01
03/18/1992	54.06	5429.28
04/16/1992	55.28	5428.06
05/05/1992	53.58	5429.76
05/21/1992	50.65	5432.69
06/04/1992	49.39	5433.95
06/22/1992	49.61	5433.73
07/09/1992	45.32	5438.02
07/23/1992	44.42	5438.92
08/06/1992	49.30	5434.04
08/19/1992	49.62	5433.72
09/10/1992	42.57	5440.77
09/28/1992	42.35	5440.99
10/21/1992	48.42	5434.92
11/18/1992	51.76	5431.58
12/28/1992	51.48	5431.86
01/27/1993	52.73	5430.61
02/25/1993	53.70	5429.64
03/26/1993	55.28	5428.06
04/15/1993	56.28	5427.06
05/10/1993	55.50	5427.84
05/25/1993	51.70	5431.64
06/08/1993	51.11	5432.23
06/24/1993	47.22	5436.12
07/08/1993	41.41	5441.93
07/21/1993	41.86	5441.48
08/12/1993	43.44	5439.90
08/25/1993	43.06	5440.28
09/08/1993	43.28	5440.06
09/16/1993	43.74	5439.60
09/30/1993	44.09	5439.25
10/19/1993	45.19	5438.15
11/17/1993	47.37	5435.97
12/22/1993	49.22	5434.12
01/26/1994	50.22	5433.12
02/17/1994	51.33	5432.01
03/31/1994	53.09	5430.25
04/21/1994	53.83	5429.51
05/12/1994	53.04	5430.30
05/27/1994	54.31	5429.03
06/14/1994	53.48	5429.86
07/07/1994	54.16	5429.18
07/27/1994	53.54	5429.80
08/17/1994	56.09	5427.25
09/07/1994	58.62	5424.72
09/29/1994	58.65	5424.69
10/27/1994	58.70	5424.64
11/21/1994	59.92	5423.42
12/22/1994	59.22	5424.12
01/23/1995	58.64	5424.70
02/23/1995	59.04	5424.30
03/22/1995	60.04	5423.30
04/20/1995	61.28	5422.06
05/18/1995	60.07	5423.27
06/29/1995	17.58	5465.76
07/12/1995	16.58	5466.76
07/19/1995	18.06	5465.28
08/08/1995	21.24	5462.10
08/28/1995	24.81	5458.53
09/14/1995	26.19	5457.15
10/23/1995	29.07	5454.27
11/14/1995	30.96	5452.38
12/14/1995	33.96	5449.38
04/24/1996	40.82	5442.52
07/18/1996	33.43	5449.91

Groundwater Hydrograph

Well Identification
MATADOR4

MBMG Site #
M:109812

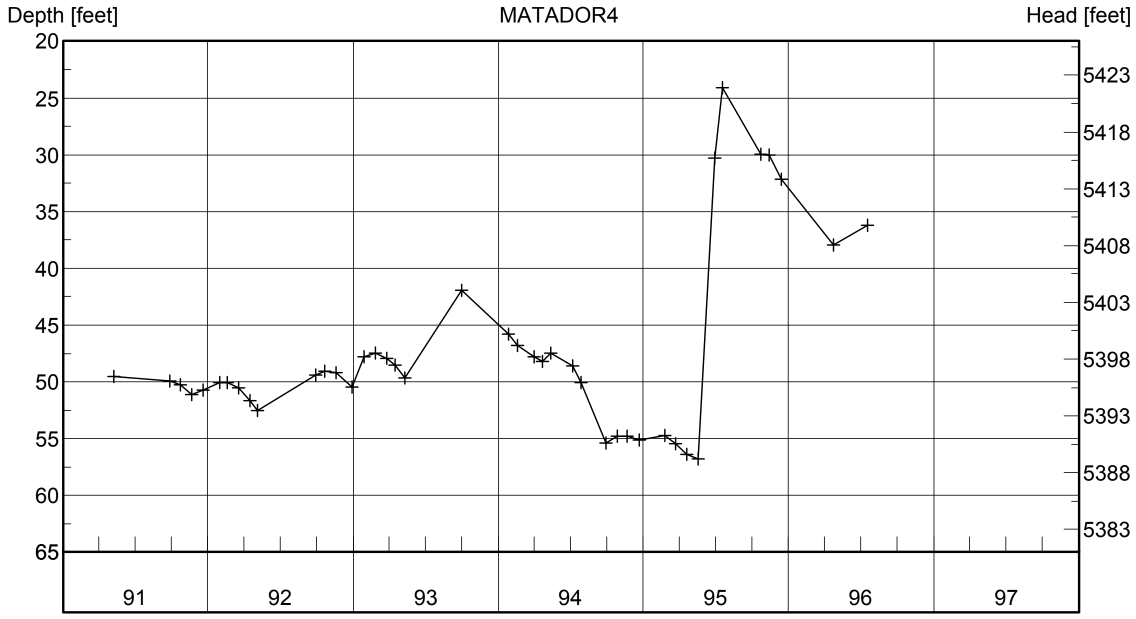
Well Name or Well Owner
Matador Ranch irrigation well #4

Location
08S 08W 29 CDAA

Ground Surface Elev. (ft)
5444.60

Measuring Point Elev. (ft)
5445.49

Well Depth below m.p. (ft)
172.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
05/08/1991	49.54	5395.95	02/17/1994	46.77	5398.72						
09/26/1991	49.93	5395.56	03/31/1994	47.78	5397.71						
10/24/1991	50.25	5395.24	04/21/1994	48.18	5397.31						
11/20/1991	51.13	5394.36	05/12/1994	47.44	5398.05						
12/19/1991	50.69	5394.80	07/07/1994	48.62	5396.87						
01/30/1992	50.08	5395.41	07/28/1994	50.07	5395.42						
02/19/1992	50.03	5395.46	09/29/1994	55.35	5390.14						
03/18/1992	50.52	5394.97	10/27/1994	54.75	5390.74						
04/16/1992	51.67	5393.82	11/21/1994	54.81	5390.68						
05/05/1992	52.51	5392.98	12/22/1994	55.14	5390.35						
09/28/1992	49.42	5396.07	02/23/1995	54.69	5390.80						
10/21/1992	49.04	5396.45	03/22/1995	55.45	5390.04						
11/18/1992	49.16	5396.33	04/20/1995	56.38	5389.11						
12/28/1992	50.46	5395.03	05/18/1995	56.76	5388.73						
01/27/1993	47.78	5397.71	06/29/1995	30.26	5415.23						
02/25/1993	47.47	5398.02	07/19/1995	24.07	5421.42						
03/26/1993	47.90	5397.59	10/23/1995	29.98	5415.51						
04/15/1993	48.55	5396.94	11/14/1995	30.01	5415.48						
05/10/1993	49.68	5395.81	12/14/1995	32.17	5413.32						
09/30/1993	41.91	5403.58	04/24/1996	37.95	5407.54						
01/26/1994	45.78	5399.71	07/18/1996	36.19	5409.30						

Groundwater Hydrograph

Well Identification
MATADOR5

MBMG Site #
M:110033

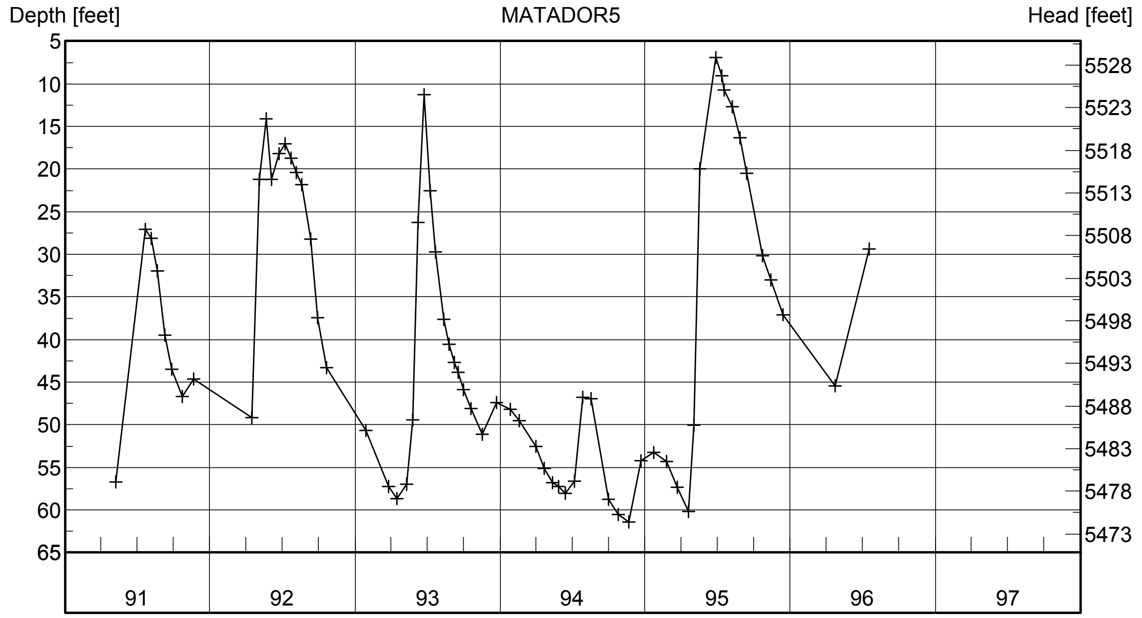
Well Name or Well Owner
Matador Ranch irrigation well #5

Location
09S 08W 04 CAAC

Ground Surface Elev. (ft)
5534.83

Measuring Point Elev. (ft)
5535.29

Well Depth below m.p. (ft)
150.00



Depth to groundwater and head are reported from measuring point

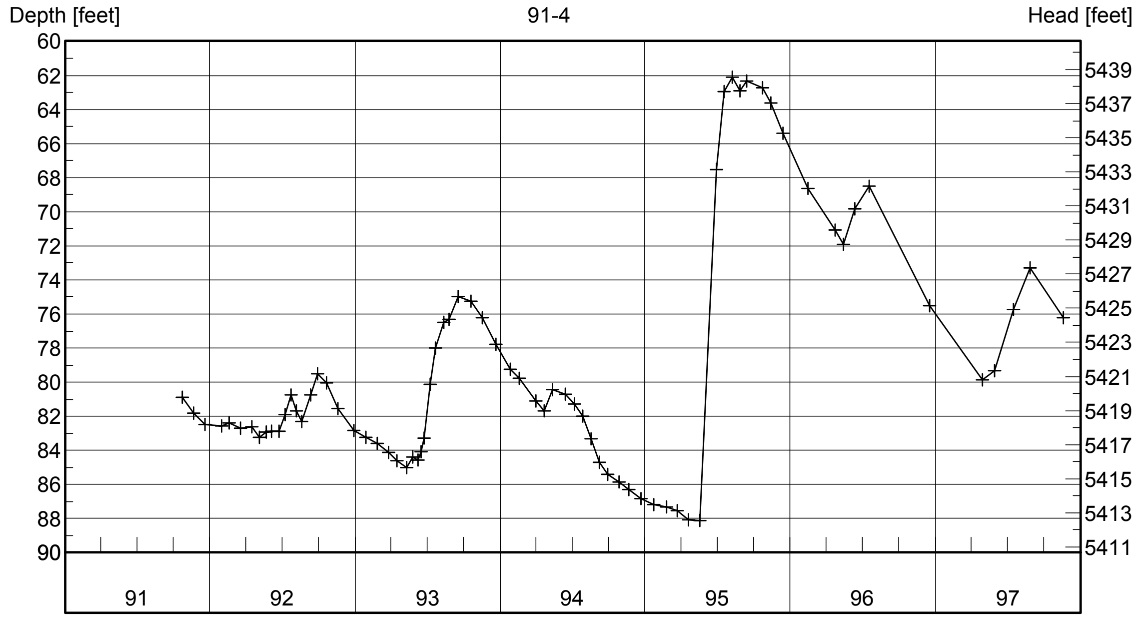
Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
05/08/1991	56.67	5478.62	03/26/1993	57.24	5478.05	05/27/1994	57.20	5478.09	10/23/1995	30.15	5505.14
07/22/1991	27.04	5508.25	04/15/1993	58.64	5476.65	06/14/1994	58.02	5477.27	11/14/1995	33.00	5502.29
08/07/1991	28.13	5507.16	05/10/1993	57.00	5478.29	07/07/1994	56.60	5478.69	12/14/1995	37.11	5498.18
08/21/1991	31.93	5503.36	05/25/1993	49.43	5485.86	07/28/1994	46.75	5488.54	04/24/1996	45.42	5489.87
09/10/1991	39.51	5495.78	06/08/1993	26.29	5509.00	08/17/1994	46.95	5488.34	07/18/1996	29.38	5505.91
09/26/1991	43.46	5491.83	06/24/1993	11.27	5524.02	09/30/1994	58.76	5476.53			
10/23/1991	46.64	5488.65	07/08/1993	22.52	5512.77	10/26/1994	60.53	5474.76			
11/20/1991	44.67	5490.62	07/21/1993	29.73	5505.56	11/21/1994	61.43	5473.86			
04/16/1992	49.18	5486.11	08/12/1993	37.65	5497.64	12/22/1994	54.25	5481.04			
05/05/1992	21.19	5514.10	08/25/1993	40.51	5494.78	01/23/1995	53.26	5482.03			
05/21/1992	14.13	5521.16	09/08/1993	42.66	5492.63	02/23/1995	54.28	5481.01			
06/04/1992	21.16	5514.13	09/16/1993	43.80	5491.49	03/22/1995	57.36	5477.93			
06/22/1992	18.14	5517.15	09/30/1993	45.86	5489.43	04/20/1995	60.12	5475.17			
07/09/1992	17.02	5518.27	10/19/1993	48.12	5487.17	05/04/1995	50.02	5485.27			
07/23/1992	18.70	5516.59	11/17/1993	51.09	5484.20	05/18/1995	19.95	5515.34			
08/06/1992	20.39	5514.90	12/22/1993	47.35	5487.94	06/28/1995	6.95	5528.34			
08/19/1992	21.86	5513.43	01/26/1994	48.14	5487.15	07/12/1995	9.05	5526.24			
09/10/1992	28.23	5507.06	02/17/1994	49.50	5485.79	07/19/1995	10.70	5524.59			
09/28/1992	37.42	5497.87	03/31/1994	52.51	5482.78	08/08/1995	12.70	5522.59			
10/21/1992	43.33	5491.96	04/21/1994	55.06	5480.23	08/28/1995	16.34	5518.95			
01/27/1993	50.67	5484.62	05/12/1994	56.81	5478.48	09/14/1995	20.52	5514.77			

Blacktail Range Alluvial Fan

Groundwater Hydrograph

Well Identification	MBMG Site #	Well Name or Well Owner
91-4	M:126664	MT DNRC Beaverhead Groundwater Project well 91-4

Location	Ground Surface Elev. (ft)	Measuring Point Elev. (ft)	Well Depth below m.p. (ft)
08S 08W 32 CCAB	5499.21	5500.66	150.26



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
10/24/1991	80.90	5419.76	02/25/1993	83.57	5417.09	06/13/1994	80.70	5419.96	12/14/1995	65.40	5435.26
11/20/1991	81.82	5418.84	03/26/1993	84.13	5416.53	07/07/1994	81.30	5419.36	02/15/1996	68.65	5432.01
12/19/1991	82.48	5418.18	04/15/1993	84.61	5416.05	07/27/1994	82.00	5418.66	04/24/1996	71.09	5429.57
01/30/1992	82.55	5418.11	05/10/1993	85.00	5415.66	08/17/1994	83.34	5417.32	05/15/1996	71.90	5428.76
02/19/1992	82.38	5418.28	05/25/1993	84.37	5416.29	09/07/1994	84.68	5415.98	06/11/1996	69.81	5430.85
03/18/1992	82.69	5417.97	06/08/1993	84.58	5416.08	09/29/1994	85.40	5415.26	07/18/1996	68.48	5432.18
04/16/1992	82.61	5418.05	06/15/1993	84.09	5416.57	10/27/1994	85.83	5414.83	12/17/1996	75.49	5425.17
05/05/1992	83.23	5417.43	06/24/1993	83.29	5417.37	11/21/1994	86.28	5414.38	04/29/1997	79.86	5420.80
05/21/1992	82.90	5417.76	07/08/1993	80.11	5420.55	12/22/1994	86.81	5413.85	05/29/1997	79.33	5421.33
06/04/1992	82.88	5417.78	07/21/1993	78.00	5422.66	01/23/1995	87.17	5413.49	07/17/1997	75.75	5424.91
06/22/1992	82.87	5417.79	08/12/1993	76.50	5424.16	02/23/1995	87.31	5413.35	08/27/1997	73.28	5427.38
07/09/1992	81.91	5418.75	08/25/1993	76.32	5424.34	03/22/1995	87.52	5413.14	11/19/1997	76.20	5424.46
07/23/1992	80.74	5419.92	09/16/1993	74.98	5425.68	04/20/1995	88.06	5412.60			
08/06/1992	81.70	5418.96	10/19/1993	75.23	5425.43	05/18/1995	88.11	5412.55			
08/19/1992	82.28	5418.38	11/17/1993	76.22	5424.44	06/29/1995	67.53	5433.13			
09/10/1992	80.75	5419.91	12/21/1993	77.79	5422.87	07/19/1995	62.93	5437.73			
09/28/1992	79.50	5421.16	01/26/1994	79.22	5421.44	08/08/1995	62.11	5438.55			
10/21/1992	80.05	5420.61	02/17/1994	79.76	5420.90	08/28/1995	62.91	5437.75			
11/18/1992	81.54	5419.12	03/31/1994	81.08	5419.58	09/14/1995	62.33	5438.33			
12/29/1992	82.83	5417.83	04/21/1994	81.70	5418.96	10/23/1995	62.72	5437.94			
01/27/1993	83.22	5417.44	05/12/1994	80.43	5420.23	11/14/1995	63.60	5437.06			

Groundwater Hydrograph

Well Identification 92-6

MBMG Site # M:133371

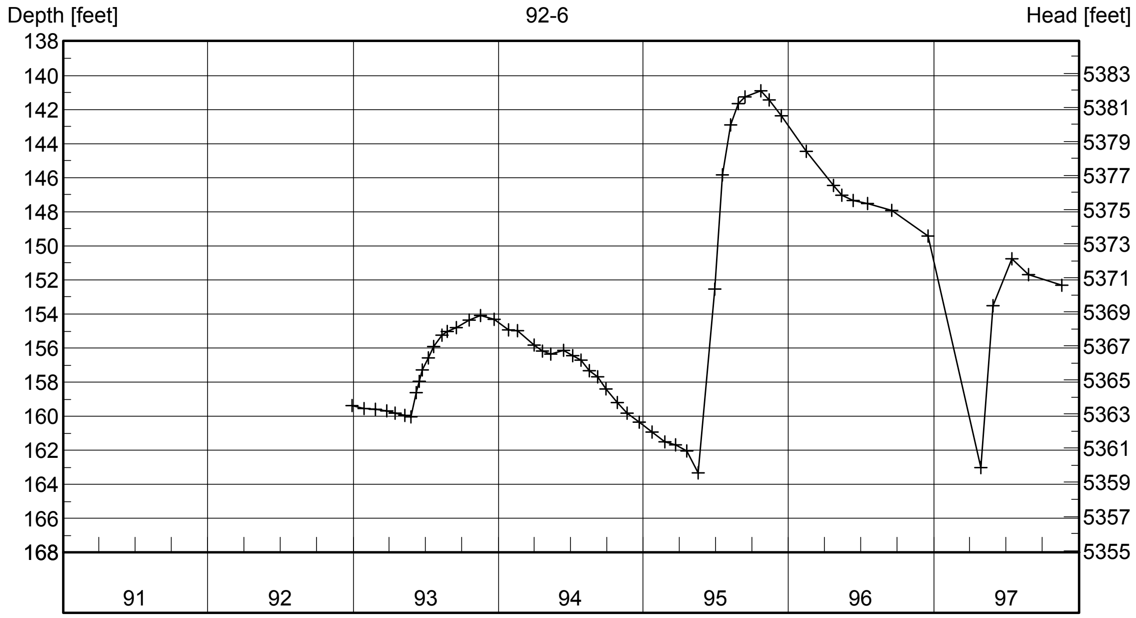
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-6

Location 08S 08W 31 CCAA

Ground Surface Elev. (ft) 5520.70

Measuring Point Elev. (ft) 5522.87

Well Depth below m.p. (ft) 207.30



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
12/29/1992	159.37	5363.50	04/21/1994	156.18	5366.69	10/23/1995	140.89	5381.98			
01/27/1993	159.55	5363.32	05/12/1994	156.33	5366.54	11/14/1995	141.46	5381.41			
02/25/1993	159.57	5363.30	06/13/1994	156.11	5366.76	12/14/1995	142.37	5380.50			
03/26/1993	159.68	5363.19	07/07/1994	156.46	5366.41	02/15/1996	144.46	5378.41			
04/15/1993	159.79	5363.08	07/27/1994	156.72	5366.15	04/24/1996	146.47	5376.40			
05/10/1993	159.95	5362.92	08/17/1994	157.31	5365.56	05/15/1996	147.05	5375.82			
05/25/1993	160.04	5362.83	09/07/1994	157.70	5365.17	06/11/1996	147.36	5375.51			
06/08/1993	158.63	5364.24	09/29/1994	158.41	5364.46	07/18/1996	147.50	5375.37			
06/15/1993	157.96	5364.91	10/27/1994	159.21	5363.66	09/17/1996	147.91	5374.96			
06/24/1993	157.29	5365.58	11/21/1994	159.82	5363.05	12/17/1996	149.44	5373.43			
07/08/1993	156.59	5366.28	12/22/1994	160.35	5362.52	04/29/1997	163.00	5359.87			
07/21/1993	155.92	5366.95	01/23/1995	160.92	5361.95	05/29/1997	153.52	5369.35			
08/12/1993	155.23	5367.64	02/23/1995	161.48	5361.39	07/17/1997	150.74	5372.13			
08/25/1993	155.00	5367.87	03/22/1995	161.69	5361.18	08/27/1997	151.69	5371.18			
09/16/1993	154.80	5368.07	04/20/1995	162.01	5360.86	11/19/1997	152.33	5370.54			
10/19/1993	154.34	5368.53	05/18/1995	163.31	5359.56						
11/17/1993	154.08	5368.79	06/29/1995	152.52	5370.35						
12/21/1993	154.30	5368.57	07/19/1995	145.82	5377.05						
01/26/1994	154.92	5367.95	08/08/1995	142.89	5379.98						
02/17/1994	154.96	5367.91	08/28/1995	141.64	5381.23						
03/31/1994	155.81	5367.06	09/14/1995	141.24	5381.63						

Groundwater Hydrograph

Well Identification 92-7

MBMG Site # M:133372

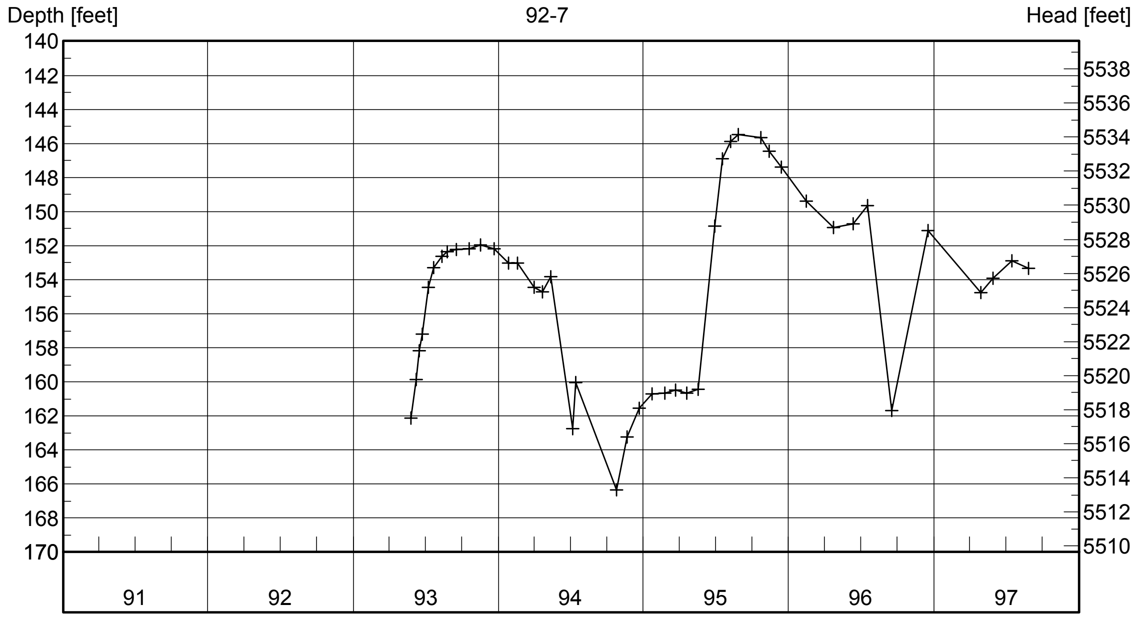
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-7

Location 09S 08W 07 DBDC

Ground Surface Elev. (ft) 5678.08

Measuring Point Elev. (ft) 5679.63

Well Depth below m.p. (ft) 226.36



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
05/25/1993	162.11	5517.52
06/08/1993	159.85	5519.78
06/15/1993	158.17	5521.46
06/24/1993	157.19	5522.44
07/08/1993	154.46	5525.17
07/21/1993	153.27	5526.36
08/12/1993	152.63	5527.00
08/25/1993	152.38	5527.25
09/16/1993	152.23	5527.40
10/19/1993	152.20	5527.43
11/17/1993	151.95	5527.68
12/21/1993	152.17	5527.46
01/26/1994	153.03	5526.60
02/17/1994	153.04	5526.59
03/31/1994	154.43	5525.20
04/21/1994	154.72	5524.91
05/12/1994	153.81	5525.82
07/07/1994	162.74	5516.89
07/14/1994	160.04	5519.59
10/26/1994	166.36	5513.27
11/21/1994	163.25	5516.38
12/22/1994	161.56	5518.07
01/23/1995	160.69	5518.94
02/23/1995	160.68	5518.95
03/22/1995	160.50	5519.13
04/20/1995	160.67	5518.96
05/18/1995	160.43	5519.20
06/29/1995	150.84	5528.79
07/19/1995	146.88	5532.75
08/08/1995	145.88	5533.75
08/28/1995	145.48	5534.15
10/23/1995	145.65	5533.98
11/14/1995	146.46	5533.17
12/14/1995	147.38	5532.25
02/15/1996	149.39	5530.24
04/24/1996	150.96	5528.67
06/11/1996	150.73	5528.90
07/18/1996	149.65	5529.98
09/17/1996	161.69	5517.94
12/17/1996	151.11	5528.52
04/29/1997	154.75	5524.88
05/29/1997	153.93	5525.70
07/17/1997	152.88	5526.75
08/27/1997	153.33	5526.30

Groundwater Hydrograph

Well Identification
92-8

MBMG Site #
M:133373

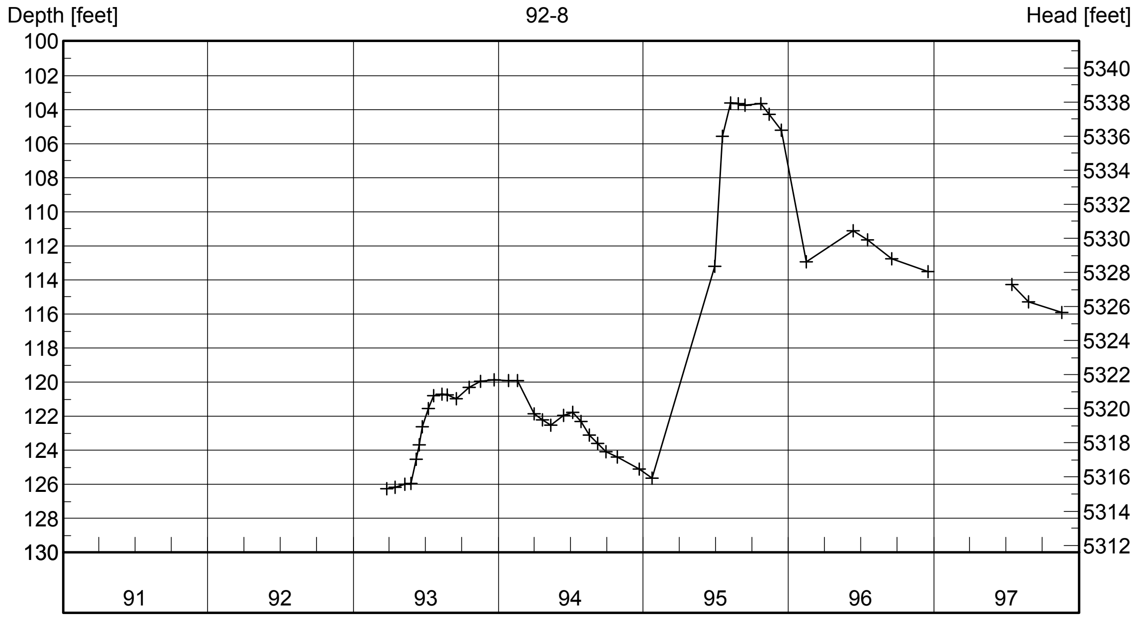
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-8

Location
08S 08W 30 CCCC

Ground Surface Elev. (ft)
5440.15

Measuring Point Elev. (ft)
5441.56

Well Depth below m.p. (ft)
341.41



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
03/26/1993	126.23	5315.33	07/07/1994	121.75	5319.81	07/17/1997	114.27	5327.29			
04/15/1993	126.14	5315.42	07/27/1994	122.32	5319.24	08/27/1997	115.30	5326.26			
05/10/1993	125.99	5315.57	08/17/1994	123.09	5318.47	11/19/1997	115.92	5325.64			
05/25/1993	125.93	5315.63	09/07/1994	123.60	5317.96						
06/08/1993	124.53	5317.03	09/29/1994	124.07	5317.49						
06/15/1993	123.68	5317.88	10/27/1994	124.40	5317.16						
06/24/1993	122.62	5318.94	12/22/1994	125.11	5316.45						
07/08/1993	121.53	5320.03	01/23/1995	125.61	5315.95						
07/21/1993	120.79	5320.77	06/29/1995	113.22	5328.34						
08/12/1993	120.71	5320.85	07/19/1995	105.58	5335.98						
08/25/1993	120.73	5320.83	08/08/1995	103.62	5337.94						
09/16/1993	120.95	5320.61	08/28/1995	103.68	5337.88						
10/19/1993	120.32	5321.24	09/14/1995	103.73	5337.83						
11/17/1993	119.94	5321.62	10/23/1995	103.64	5337.92						
12/21/1993	119.86	5321.70	11/14/1995	104.28	5337.28						
01/26/1994	119.91	5321.65	12/14/1995	105.23	5336.33						
02/17/1994	119.92	5321.64	02/15/1996	112.92	5328.64						
03/31/1994	121.84	5319.72	06/11/1996	111.11	5330.45						
04/21/1994	122.19	5319.37	07/18/1996	111.64	5329.92						
05/12/1994	122.54	5319.02	09/17/1996	112.74	5328.82						
06/13/1994	121.95	5319.61	12/17/1996	113.50	5328.06						

Groundwater Hydrograph

Well Identification
92-9

MBMG Site #
M:133374

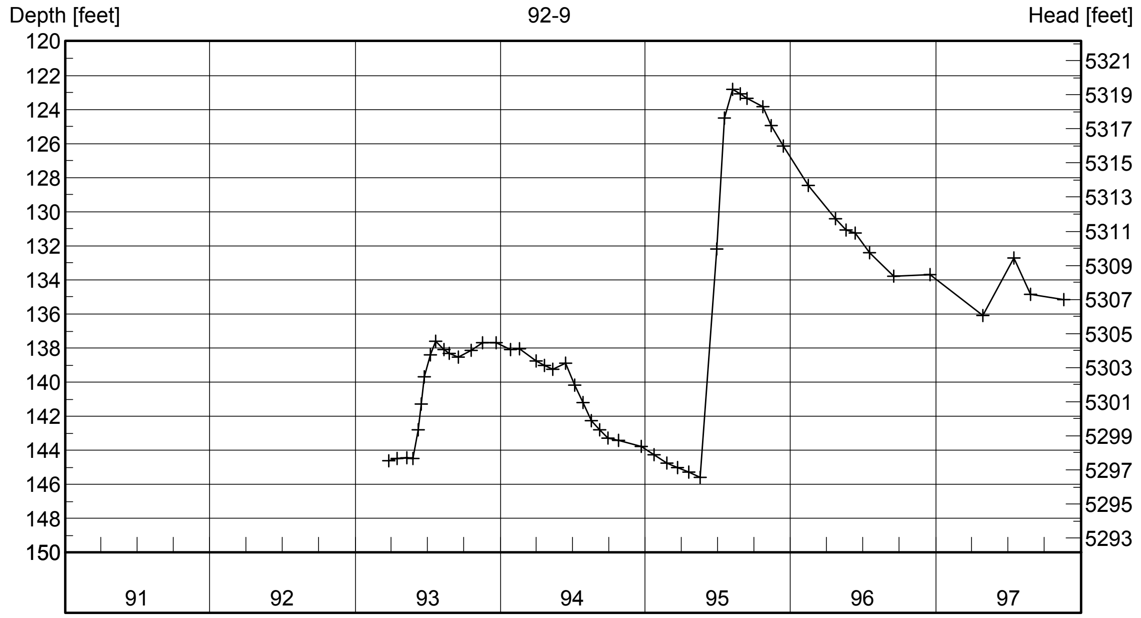
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-9

Location
08S 08W 30 CCCC

Ground Surface Elev. (ft)
5439.76

Measuring Point Elev. (ft)
5442.14

Well Depth below m.p. (ft)
229.10



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
03/26/1993	144.63	5297.51	07/07/1994	140.17	5301.97	04/24/1996	130.40	5311.74			
04/15/1993	144.48	5297.66	07/27/1994	141.18	5300.96	05/20/1996	131.07	5311.07			
05/10/1993	144.42	5297.72	08/17/1994	142.27	5299.87	06/11/1996	131.25	5310.89			
05/25/1993	144.48	5297.66	09/07/1994	142.80	5299.34	07/18/1996	132.40	5309.74			
06/08/1993	142.81	5299.33	09/29/1994	143.27	5298.87	09/17/1996	133.80	5308.34			
06/15/1993	141.30	5300.84	10/26/1994	143.42	5298.72	12/17/1996	133.67	5308.47			
06/24/1993	139.68	5302.46	12/22/1994	143.78	5298.36	04/29/1997	136.10	5306.04			
07/08/1993	138.40	5303.74	01/23/1995	144.24	5297.90	07/17/1997	132.70	5309.44			
07/21/1993	137.61	5304.53	02/23/1995	144.75	5297.39	08/27/1997	134.85	5307.29			
08/12/1993	138.07	5304.07	03/22/1995	145.00	5297.14	11/19/1997	135.17	5306.97			
08/25/1993	138.29	5303.85	04/20/1995	145.29	5296.85						
09/16/1993	138.53	5303.61	05/18/1995	145.58	5296.56						
10/19/1993	138.11	5304.03	06/29/1995	132.16	5309.98						
11/17/1993	137.70	5304.44	07/19/1995	124.52	5317.62						
12/21/1993	137.68	5304.46	08/08/1995	122.81	5319.33						
01/26/1994	138.08	5304.06	08/28/1995	123.10	5319.04						
02/17/1994	138.02	5304.12	09/14/1995	123.35	5318.79						
03/31/1994	138.75	5303.39	10/23/1995	123.85	5318.29						
04/21/1994	139.01	5303.13	11/14/1995	124.94	5317.20						
05/12/1994	139.26	5302.88	12/14/1995	126.13	5316.01						
06/14/1994	138.87	5303.27	02/15/1996	128.47	5313.67						

Groundwater Hydrograph

Well Identification MATADOR16

MBMG Site # M:110037

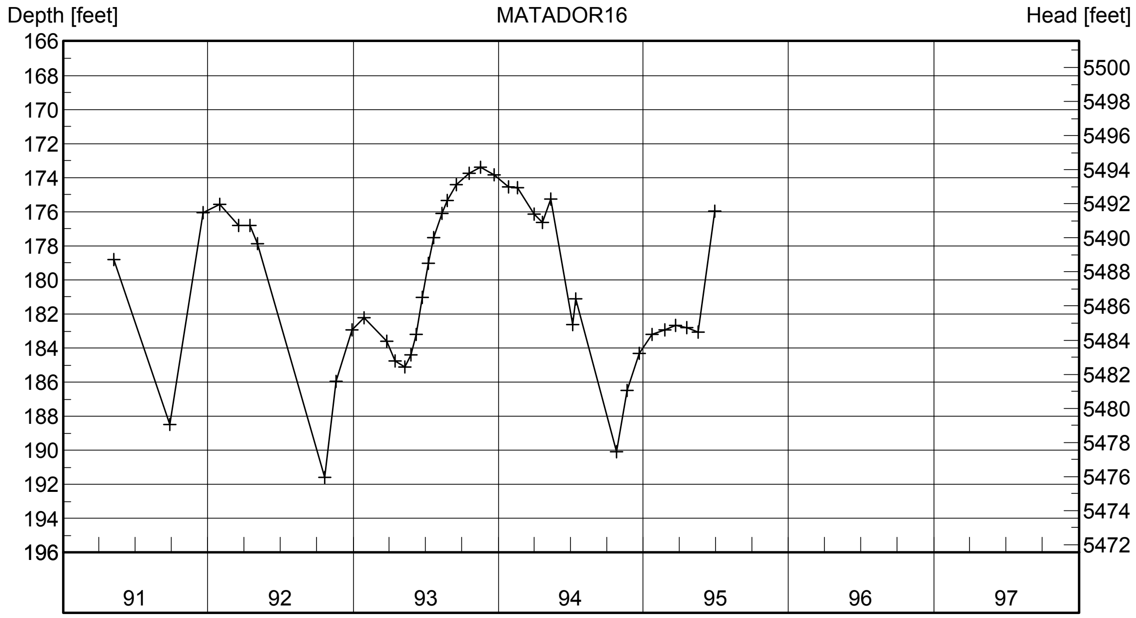
Well Name or Well Owner Matador Ranch irrigation well #16

Location 09S 08W 07 DBDB

Ground Surface Elev. (ft) 5666.26

Measuring Point Elev. (ft) 5667.53

Well Depth below m.p. (ft) 405.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
05/08/1991	178.81	5488.72	09/16/1993	174.40	5493.13						
09/26/1991	188.50	5479.03	10/19/1993	173.76	5493.77						
12/19/1991	176.04	5491.49	11/17/1993	173.40	5494.13						
01/30/1992	175.56	5491.97	12/21/1993	173.83	5493.70						
03/18/1992	176.80	5490.73	01/26/1994	174.56	5492.97						
04/16/1992	176.79	5490.74	02/17/1994	174.58	5492.95						
05/05/1992	177.85	5489.68	03/31/1994	176.16	5491.37						
10/21/1992	191.60	5475.93	04/21/1994	176.61	5490.92						
11/18/1992	185.95	5481.58	05/12/1994	175.27	5492.26						
12/29/1992	182.95	5484.58	07/07/1994	182.61	5484.92						
01/27/1993	182.24	5485.29	07/14/1994	181.12	5486.41						
03/26/1993	183.58	5483.95	10/26/1994	190.07	5477.46						
04/15/1993	184.74	5482.79	11/21/1994	186.47	5481.06						
05/10/1993	185.12	5482.41	12/22/1994	184.30	5483.23						
05/25/1993	184.41	5483.12	01/23/1995	183.18	5484.35						
06/08/1993	183.18	5484.35	02/23/1995	182.93	5484.60						
06/24/1993	181.01	5486.52	03/22/1995	182.65	5484.88						
07/08/1993	179.04	5488.49	04/20/1995	182.81	5484.72						
07/21/1993	177.51	5490.02	05/18/1995	183.08	5484.45						
08/12/1993	176.11	5491.42	06/29/1995	175.95	5491.58						
08/25/1993	175.36	5492.17									

Flynn Lane Well Field Area

Groundwater Hydrograph

Well Identification 92-10

MBMG Site # M:133375

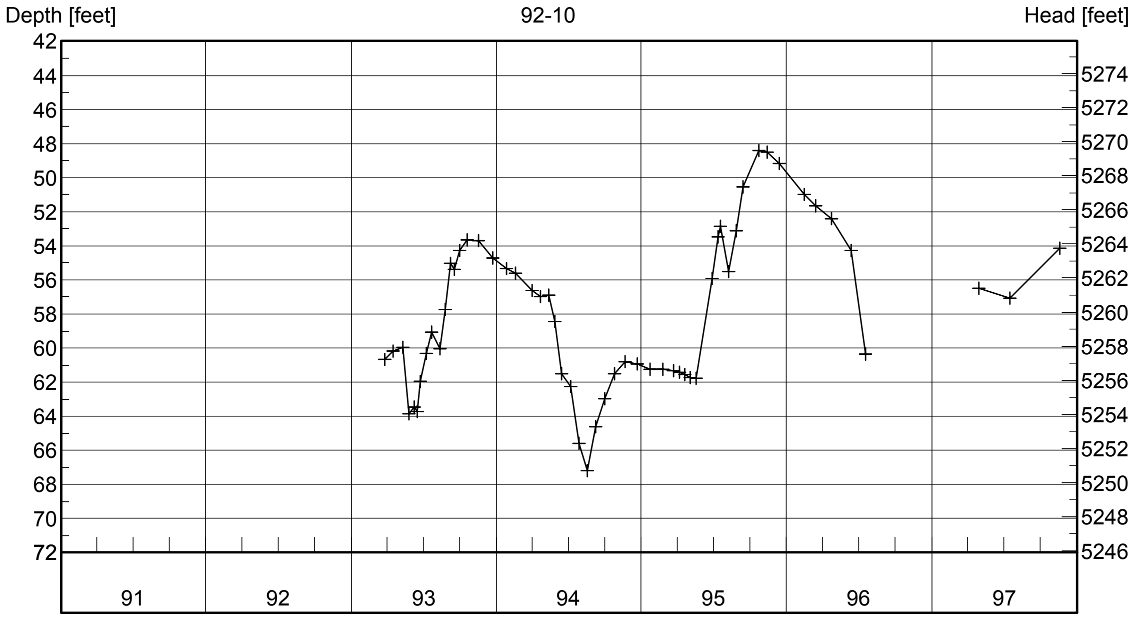
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-10

Location 08S 09W 23 DADD

Ground Surface Elev. (ft) 5316.00

Measuring Point Elev. (ft) 5317.89

Well Depth below m.p. (ft) 281.46



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
03/26/1993	60.65	5257.24
04/15/1993	60.19	5257.70
05/10/1993	59.93	5257.96
05/25/1993	63.85	5254.04
06/08/1993	63.44	5254.45
06/15/1993	63.71	5254.18
06/24/1993	61.95	5255.94
07/08/1993	60.32	5257.57
07/21/1993	59.06	5258.83
08/12/1993	60.04	5257.85
08/25/1993	57.75	5260.14
09/08/1993	55.02	5262.87
09/16/1993	55.38	5262.51
09/30/1993	54.27	5263.62
10/19/1993	53.67	5264.22
11/17/1993	53.69	5264.20
12/22/1993	54.73	5263.16
01/26/1994	55.34	5262.55
02/17/1994	55.59	5262.30
03/31/1994	56.61	5261.28
04/21/1994	56.96	5260.93
05/12/1994	56.89	5261.00
05/27/1994	58.44	5259.45
06/14/1994	61.49	5256.40
07/07/1994	62.27	5255.62
07/28/1994	65.57	5252.32
08/17/1994	67.19	5250.70
09/07/1994	64.61	5253.28
09/30/1994	62.98	5254.91
10/26/1994	61.50	5256.39
11/21/1994	60.79	5257.10
12/22/1994	60.91	5256.98
01/23/1995	61.25	5256.64
02/23/1995	61.25	5256.64
03/22/1995	61.33	5256.56
04/06/1995	61.40	5256.49
04/20/1995	61.56	5256.33
05/04/1995	61.72	5256.17
05/18/1995	61.79	5256.10
06/28/1995	55.92	5261.97
07/12/1995	53.48	5264.41
07/19/1995	52.84	5265.05
08/08/1995	55.50	5262.39
08/28/1995	53.13	5264.76
09/14/1995	50.56	5267.33
10/23/1995	48.41	5269.48
11/14/1995	48.52	5269.37
12/14/1995	49.18	5268.71
02/15/1996	50.97	5266.92
03/14/1996	51.67	5266.22
04/24/1996	52.40	5265.49
06/11/1996	54.28	5263.61
07/18/1996	60.35	5257.54
04/29/1997	56.50	5261.39
07/17/1997	57.08	5260.81
11/19/1997	54.15	5263.74

Groundwater Hydrograph

Well Identification 92-11

MBMG Site # M:133376

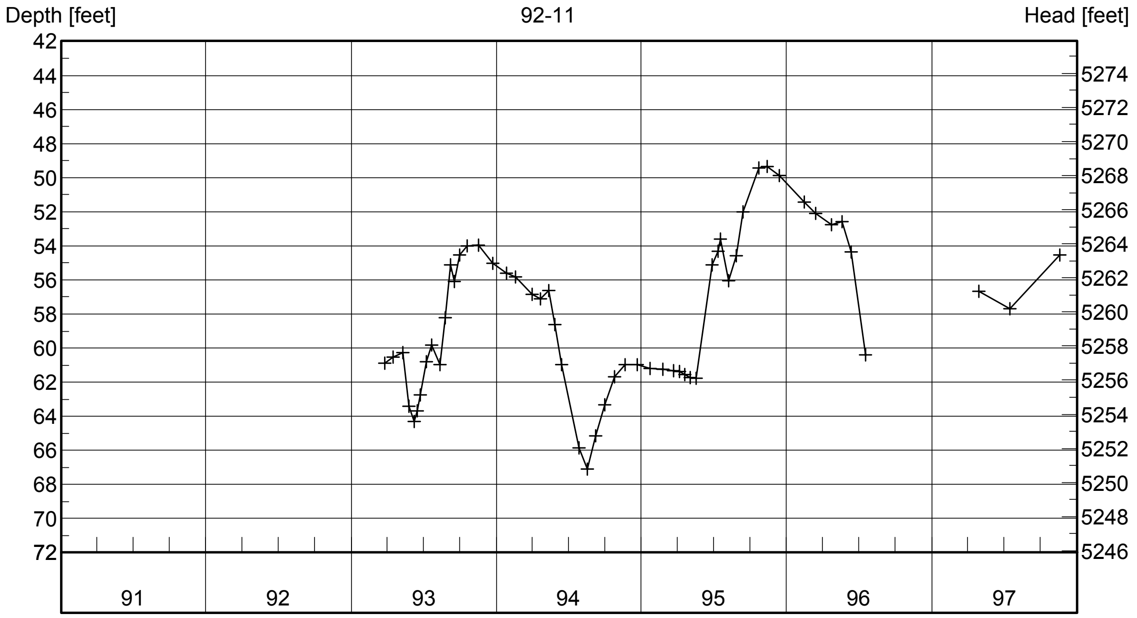
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-11

Location 08S 09W 23 DADD

Ground Surface Elev. (ft) 5316.01

Measuring Point Elev. (ft) 5317.88

Well Depth below m.p. (ft) 100.04



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
03/26/1993	60.89	5256.99
04/15/1993	60.54	5257.34
05/10/1993	60.25	5257.63
05/25/1993	63.40	5254.48
06/08/1993	64.28	5253.60
06/15/1993	63.70	5254.18
06/24/1993	62.73	5255.15
07/08/1993	60.78	5257.10
07/21/1993	59.80	5258.08
08/12/1993	60.99	5256.89
08/25/1993	58.24	5259.64
09/08/1993	55.12	5262.76
09/16/1993	56.10	5261.78
09/30/1993	54.53	5263.35
10/19/1993	54.01	5263.87
11/17/1993	53.97	5263.91
12/22/1993	55.04	5262.84
01/26/1994	55.59	5262.29
02/17/1994	55.83	5262.05
03/31/1994	56.84	5261.04
04/21/1994	57.11	5260.77
05/12/1994	56.62	5261.26
05/27/1994	58.62	5259.26
06/14/1994	60.99	5256.89
07/28/1994	65.85	5252.03
08/17/1994	67.08	5250.80
09/07/1994	65.14	5252.74
09/30/1994	63.33	5254.55
10/26/1994	61.67	5256.21
11/21/1994	60.99	5256.89
12/22/1994	60.97	5256.91
01/23/1995	61.21	5256.67
02/23/1995	61.24	5256.64
03/22/1995	61.33	5256.55
04/06/1995	61.39	5256.49
04/20/1995	61.56	5256.32
05/04/1995	61.72	5256.16
05/18/1995	61.78	5256.10
06/28/1995	55.12	5262.76
07/12/1995	54.32	5263.56
07/19/1995	53.62	5264.26
08/08/1995	56.06	5261.82
08/28/1995	54.60	5263.28
09/14/1995	52.00	5265.88
10/23/1995	49.44	5268.44
11/14/1995	49.34	5268.54
12/14/1995	49.88	5268.00
02/15/1996	51.43	5266.45
03/14/1996	52.11	5265.77
04/24/1996	52.74	5265.14
05/20/1996	52.59	5265.29
06/11/1996	54.35	5263.53
07/18/1996	60.41	5257.47
04/29/1997	56.67	5261.21
07/17/1997	57.68	5260.20
11/19/1997	54.52	5263.36

Groundwater Hydrograph

Well Identification
92-12

MBMG Site #
M:133377

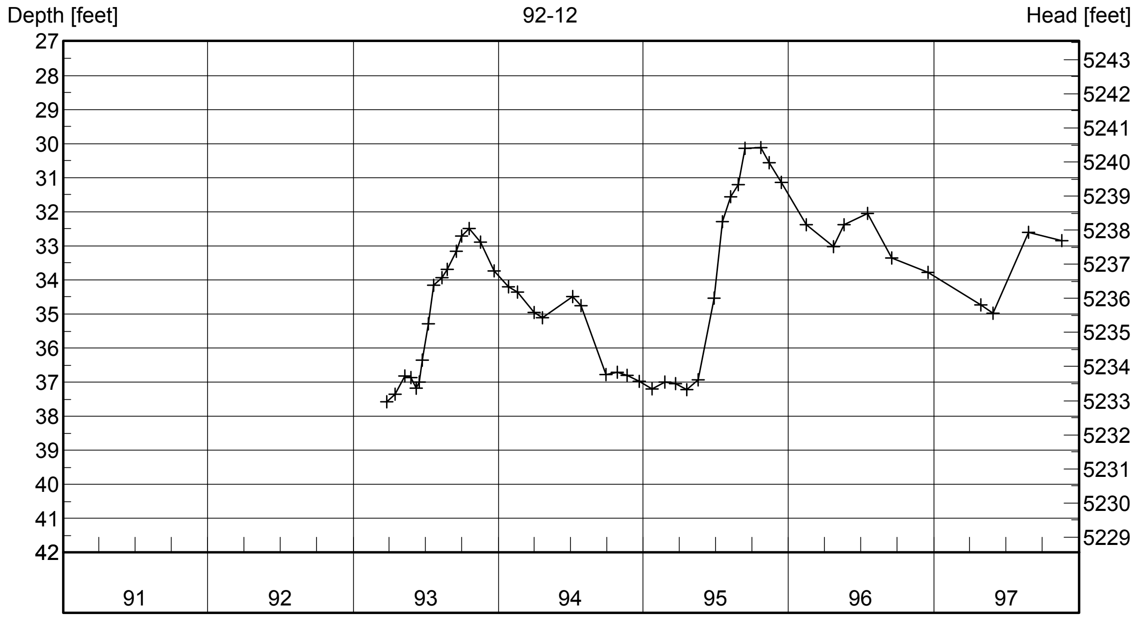
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-12

Location
08S 09W 14 ABDD

Ground Surface Elev. (ft)
5268.92

Measuring Point Elev. (ft)
5270.54

Well Depth below m.p. (ft)
401.78



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
03/26/1993	37.57	5232.97
04/15/1993	37.35	5233.19
05/10/1993	36.81	5233.73
05/25/1993	36.87	5233.67
06/08/1993	37.17	5233.37
06/15/1993	36.99	5233.55
06/24/1993	36.36	5234.18
07/08/1993	35.28	5235.26
07/21/1993	34.15	5236.39
08/12/1993	33.93	5236.61
08/25/1993	33.69	5236.85
09/16/1993	33.15	5237.39
09/30/1993	32.72	5237.82
10/19/1993	32.49	5238.05
11/17/1993	32.89	5237.65
12/21/1993	33.73	5236.81
01/26/1994	34.19	5236.35
02/17/1994	34.35	5236.19
03/31/1994	34.96	5235.58
04/21/1994	35.11	5235.43
07/07/1994	34.50	5236.04
07/27/1994	34.75	5235.79
09/29/1994	36.78	5233.76
10/27/1994	36.70	5233.84
11/21/1994	36.80	5233.74
12/22/1994	36.97	5233.57
01/23/1995	37.19	5233.35
02/24/1995	37.00	5233.54
03/22/1995	37.04	5233.50
04/20/1995	37.21	5233.33
05/18/1995	36.93	5233.61
06/28/1995	34.54	5236.00
07/19/1995	32.29	5238.25
08/08/1995	31.55	5238.99
08/28/1995	31.20	5239.34
09/14/1995	30.15	5240.39
10/23/1995	30.12	5240.42
11/14/1995	30.56	5239.98
12/14/1995	31.14	5239.40
02/15/1996	32.37	5238.17
04/24/1996	33.02	5237.52
05/20/1996	32.39	5238.15
07/18/1996	32.05	5238.49
09/17/1996	33.36	5237.18
12/17/1996	33.78	5236.76
04/29/1997	34.74	5235.80
05/29/1997	34.98	5235.56
08/27/1997	32.60	5237.94
11/19/1997	32.85	5237.69

Groundwater Hydrograph

Well Identification
92-13

MBMG Site #
M:133378

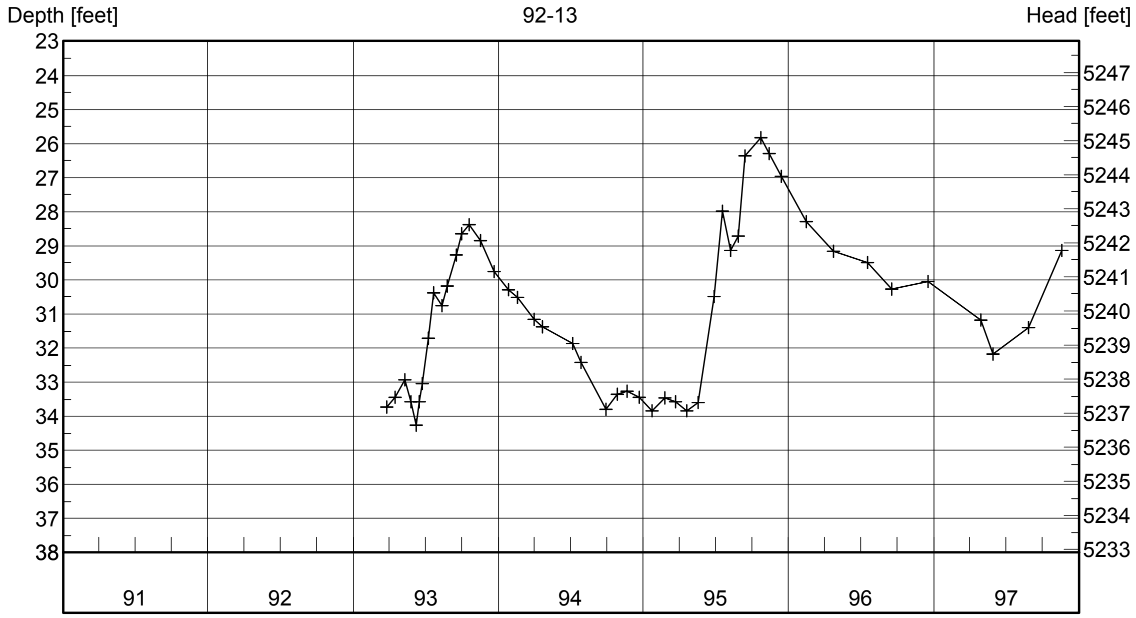
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-13

Location
08S 09W 14 ABDD

Ground Surface Elev. (ft)
5268.88

Measuring Point Elev. (ft)
5270.41

Well Depth below m.p. (ft)
175.30



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
03/26/1993	33.73	5236.68
04/15/1993	33.45	5236.96
05/10/1993	32.94	5237.47
05/25/1993	33.57	5236.84
06/08/1993	34.26	5236.15
06/15/1993	33.58	5236.83
06/24/1993	33.04	5237.37
07/08/1993	31.70	5238.71
07/21/1993	30.38	5240.03
08/12/1993	30.75	5239.66
08/25/1993	30.18	5240.23
09/16/1993	29.27	5241.14
09/30/1993	28.64	5241.77
10/19/1993	28.37	5242.04
11/17/1993	28.85	5241.56
12/21/1993	29.75	5240.66
01/26/1994	30.28	5240.13
02/17/1994	30.51	5239.90
03/31/1994	31.15	5239.26
04/21/1994	31.37	5239.04
07/07/1994	31.87	5238.54
07/27/1994	32.41	5238.00
09/29/1994	33.80	5236.61
10/27/1994	33.35	5237.06
11/21/1994	33.26	5237.15
12/22/1994	33.45	5236.96
01/23/1995	33.84	5236.57
02/24/1995	33.46	5236.95
03/22/1995	33.58	5236.83
04/20/1995	33.84	5236.57
05/18/1995	33.59	5236.82
06/28/1995	30.48	5239.93
07/19/1995	27.98	5242.43
08/08/1995	29.14	5241.27
08/28/1995	28.71	5241.70
09/14/1995	26.36	5244.05
10/23/1995	25.82	5244.59
11/14/1995	26.29	5244.12
12/14/1995	26.96	5243.45
02/15/1996	28.30	5242.11
04/24/1996	29.15	5241.26
07/18/1996	29.50	5240.91
09/17/1996	30.26	5240.15
12/17/1996	30.04	5240.37
04/29/1997	31.17	5239.24
05/29/1997	32.18	5238.23
08/27/1997	31.39	5239.02
11/19/1997	29.13	5241.28

Groundwater Hydrograph

Well Identification
BLAKE1

MBMG Site #
M:109936

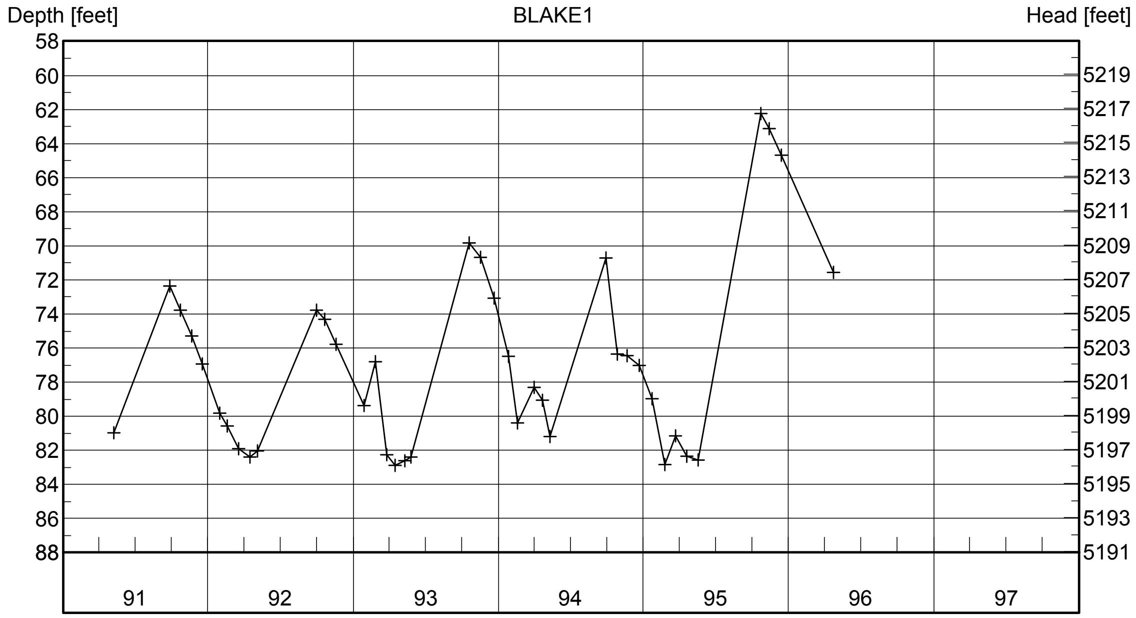
Well Name or Well Owner
Jim Blake irrigation well #1 (west well)

Location
08S 09W 23 BCDA

Ground Surface Elev. (ft)
5278.29

Measuring Point Elev. (ft)
5278.94

Well Depth below m.p. (ft)
300.00



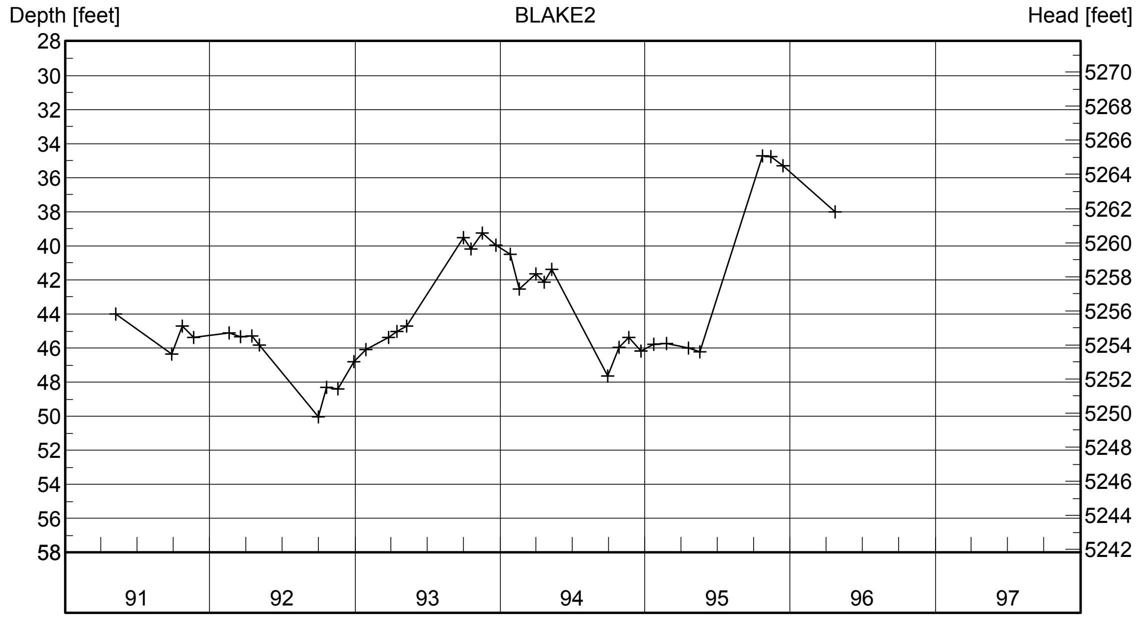
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
05/08/1991	80.98	5197.96	12/21/1993	73.07	5205.87						
09/26/1991	72.34	5206.60	01/26/1994	76.48	5202.46						
10/24/1991	73.78	5205.16	02/17/1994	80.38	5198.56						
11/21/1991	75.30	5203.64	03/31/1994	78.32	5200.62						
12/18/1991	76.93	5202.01	04/21/1994	79.04	5199.90						
01/31/1992	79.79	5199.15	05/11/1994	81.21	5197.73						
02/19/1992	80.58	5198.36	09/29/1994	70.70	5208.24						
03/18/1992	81.90	5197.04	10/27/1994	76.37	5202.57						
04/16/1992	82.40	5196.54	11/21/1994	76.44	5202.50						
05/05/1992	82.05	5196.89	12/22/1994	77.00	5201.94						
09/29/1992	73.78	5205.16	01/23/1995	78.97	5199.97						
10/21/1992	74.30	5204.64	02/24/1995	82.83	5196.11						
11/18/1992	75.79	5203.15	03/22/1995	81.13	5197.81						
01/27/1993	79.39	5199.55	04/20/1995	82.32	5196.62						
02/25/1993	76.78	5202.16	05/18/1995	82.57	5196.37						
03/26/1993	82.27	5196.67	10/23/1995	62.26	5216.68						
04/15/1993	82.87	5196.07	11/14/1995	63.14	5215.80						
05/10/1993	82.59	5196.35	12/14/1995	64.70	5214.24						
05/25/1993	82.40	5196.54	04/24/1996	71.55	5207.39						
10/19/1993	69.81	5209.13									
11/17/1993	70.65	5208.29									

Groundwater Hydrograph

Well Identification	MBMG Site #	Well Name or Well Owner
BLAKE2	M:109935	Jim Blake irrigation well #2 (east well)

Location	Ground Surface Elev. (ft)	Measuring Point Elev. (ft)	Well Depth below m.p. (ft)
08S 09W 23 ADCB	5298.96	5299.81	300.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
05/08/1991	44.01	5255.80	02/17/1994	42.55	5257.26						
09/26/1991	46.35	5253.46	03/31/1994	41.65	5258.16						
10/24/1991	44.69	5255.12	04/21/1994	42.13	5257.68						
11/21/1991	45.37	5254.44	05/11/1994	41.38	5258.43						
02/19/1992	45.13	5254.68	09/29/1994	47.62	5252.19						
03/18/1992	45.31	5254.50	10/27/1994	45.97	5253.84						
04/16/1992	45.29	5254.52	11/21/1994	45.38	5254.43						
05/05/1992	45.81	5254.00	12/22/1994	46.18	5253.63						
09/29/1992	50.05	5249.76	01/23/1995	45.76	5254.05						
10/21/1992	48.32	5251.49	02/24/1995	45.72	5254.09						
11/18/1992	48.40	5251.41	04/20/1995	46.01	5253.80						
12/28/1992	46.80	5253.01	05/18/1995	46.22	5253.59						
01/27/1993	46.09	5253.72	10/23/1995	34.72	5265.09						
03/26/1993	45.39	5254.42	11/14/1995	34.75	5265.06						
04/15/1993	45.03	5254.78	12/14/1995	35.30	5264.51						
05/10/1993	44.73	5255.08	04/24/1996	38.02	5261.79						
09/30/1993	39.52	5260.29									
10/19/1993	40.20	5259.61									
11/17/1993	39.25	5260.56									
12/21/1993	39.98	5259.83									
01/26/1994	40.51	5259.30									

Groundwater Hydrograph

Well Identification CASEY

MBMG Site # M:109904

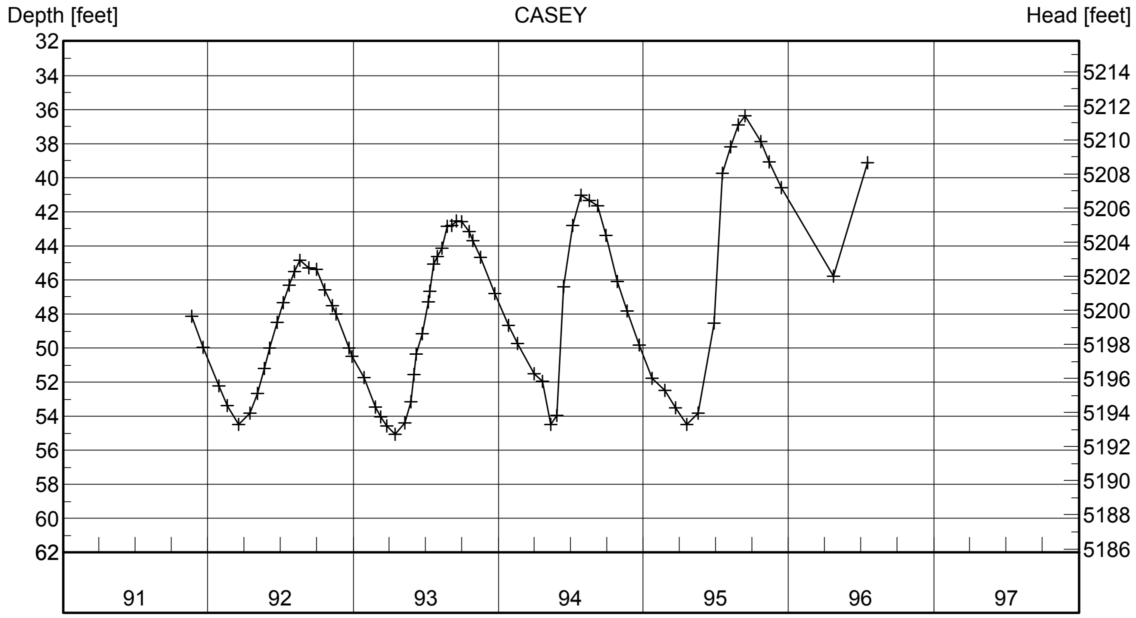
Well Name or Well Owner Joe Casey

Location 08S 09W 14 CBBB

Ground Surface Elev. (ft) 5246.12

Measuring Point Elev. (ft) 5247.78

Well Depth below m.p. (ft) 80.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/21/1991	48.15	5199.63	01/27/1993	51.71	5196.07	11/17/1993	44.66	5203.12	05/18/1995	53.83	5193.95
12/19/1991	49.93	5197.85	02/25/1993	53.44	5194.34	12/22/1993	46.79	5200.99	06/28/1995	48.54	5199.24
01/29/1992	52.21	5195.57	03/11/1993	54.05	5193.73	01/26/1994	48.66	5199.12	07/19/1995	39.74	5208.04
02/19/1992	53.35	5194.43	03/26/1993	54.58	5193.20	02/17/1994	49.75	5198.03	08/08/1995	38.17	5209.61
03/18/1992	54.49	5193.29	04/15/1993	55.05	5192.73	03/31/1994	51.50	5196.28	08/28/1995	36.92	5210.86
04/16/1992	53.79	5193.99	05/10/1993	54.38	5193.40	04/21/1994	51.94	5195.84	09/14/1995	36.39	5211.39
05/05/1992	52.68	5195.10	05/25/1993	53.16	5194.62	05/12/1994	54.46	5193.32	10/23/1995	37.86	5209.92
05/21/1992	51.19	5196.59	06/03/1993	51.54	5196.24	05/27/1994	53.96	5193.82	11/14/1995	39.06	5208.72
06/04/1992	50.00	5197.78	06/08/1993	50.37	5197.41	06/14/1994	46.38	5201.40	12/14/1995	40.60	5207.18
06/23/1992	48.47	5199.31	06/24/1993	49.16	5198.62	07/07/1994	42.82	5204.96	04/24/1996	45.78	5202.00
07/09/1992	47.35	5200.43	07/08/1993	47.27	5200.51	07/27/1994	41.01	5206.77	07/18/1996	39.14	5208.64
07/23/1992	46.30	5201.48	07/12/1993	46.68	5201.10	08/17/1994	41.32	5206.46			
08/06/1992	45.53	5202.25	07/21/1993	45.05	5202.73	09/07/1994	41.65	5206.13			
08/19/1992	44.86	5202.92	08/01/1993	44.62	5203.16	09/29/1994	43.40	5204.38			
09/10/1992	45.30	5202.48	08/12/1993	44.12	5203.66	10/27/1994	46.07	5201.71			
09/29/1992	45.36	5202.42	08/25/1993	42.84	5204.94	11/21/1994	47.82	5199.96			
10/21/1992	46.58	5201.20	09/06/1993	42.80	5204.98	12/22/1994	49.82	5197.96			
11/09/1992	47.51	5200.27	09/16/1993	42.54	5205.24	01/23/1995	51.75	5196.03			
11/18/1992	48.02	5199.76	09/30/1993	42.58	5205.20	02/23/1995	52.48	5195.30			
12/20/1992	50.01	5197.77	10/19/1993	43.17	5204.61	03/22/1995	53.52	5194.26			
12/28/1992	50.48	5197.30	10/29/1993	43.70	5204.08	04/20/1995	54.48	5193.30			

Groundwater Hydrograph

Well Identification
GAASCH

MBMG Site #
M:109945

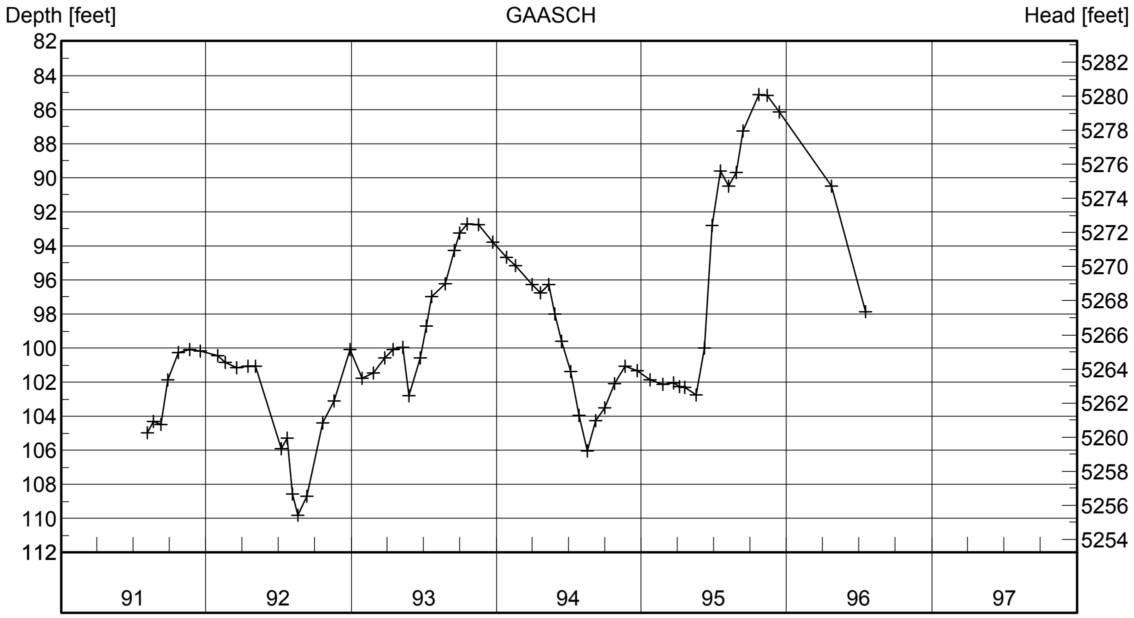
Well Name or Well Owner
High Mountain Ranches (former Gaasch residence)

Location
08S 09W 24 DDDD

Ground Surface Elev. (ft)
5364.03

Measuring Point Elev. (ft)
5365.22

Well Depth below m.p. (ft)
119.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
08/07/1991	104.96	5260.26
08/21/1991	104.28	5260.94
09/09/1991	104.50	5260.72
09/26/1991	101.86	5263.36
10/23/1991	100.25	5264.97
11/20/1991	100.09	5265.13
12/18/1991	100.19	5265.03
01/30/1992	100.44	5264.78
02/19/1992	100.83	5264.39
03/18/1992	101.13	5264.09
04/16/1992	101.06	5264.16
05/05/1992	101.08	5264.14
07/09/1992	105.90	5259.32
07/23/1992	105.27	5259.95
08/06/1992	108.56	5256.66
08/19/1992	109.81	5255.41
09/10/1992	108.69	5256.53
10/21/1992	104.41	5260.81
11/18/1992	103.08	5262.14
12/28/1992	100.08	5265.14
01/27/1993	101.77	5263.45
02/25/1993	101.44	5263.78
03/26/1993	100.56	5264.66
04/15/1993	100.09	5265.13
05/10/1993	99.97	5265.25
05/25/1993	102.79	5262.43
06/24/1993	100.57	5264.65
07/08/1993	98.69	5266.53
07/21/1993	96.98	5268.24
08/25/1993	96.21	5269.01
09/16/1993	94.28	5270.94
09/30/1993	93.25	5271.97
10/19/1993	92.70	5272.52
11/17/1993	92.75	5272.47
12/22/1993	93.80	5271.42
01/26/1994	94.67	5270.55
02/17/1994	95.14	5270.08
03/31/1994	96.25	5268.97
04/21/1994	96.76	5268.46
05/12/1994	96.28	5268.94
05/27/1994	97.99	5267.23
06/14/1994	99.61	5265.61
07/07/1994	101.39	5263.83
07/28/1994	103.93	5261.29
08/17/1994	106.02	5259.20
09/07/1994	104.26	5260.96
09/30/1994	103.51	5261.71
10/26/1994	102.08	5263.14
11/21/1994	101.07	5264.15
12/22/1994	101.32	5263.90
01/23/1995	101.84	5263.38
02/23/1995	102.11	5263.11
03/22/1995	102.03	5263.19
04/06/1995	102.26	5262.96
04/20/1995	102.30	5262.92
05/18/1995	102.75	5262.47
06/08/1995	100.00	5265.22
06/28/1995	92.79	5272.43
07/19/1995	89.63	5275.59
08/08/1995	90.49	5274.73
08/28/1995	89.69	5275.53
09/14/1995	87.26	5277.96
10/23/1995	85.12	5280.10
11/14/1995	85.18	5280.04
12/14/1995	86.17	5279.05
04/24/1996	90.48	5274.74
07/18/1996	97.85	5267.37

Groundwater Hydrograph

Well Identification
HEMSLEY

MBMG Site #
M:109940

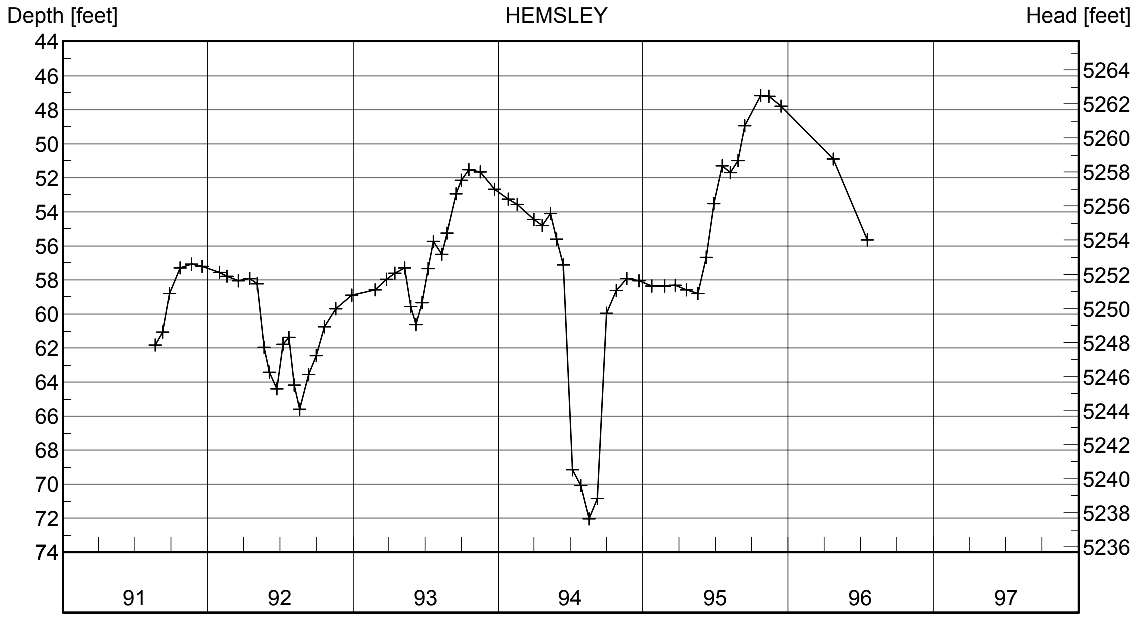
Well Name or Well Owner
Kelley Hemsley

Location
08S 09W 24 BBBC

Ground Surface Elev. (ft)
5308.39

Measuring Point Elev. (ft)
5309.67

Well Depth below m.p. (ft)
82.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
08/21/1991	61.80	5247.87	11/18/1992	59.70	5249.97	04/21/1994	54.79	5254.88	08/28/1995	51.01	5258.66
09/09/1991	61.06	5248.61	12/28/1992	58.91	5250.76	05/12/1994	54.08	5255.59	09/14/1995	48.97	5260.70
09/26/1991	58.82	5250.85	02/25/1993	58.56	5251.11	05/27/1994	55.62	5254.05	10/23/1995	47.18	5262.49
10/23/1991	57.29	5252.38	03/26/1993	57.96	5251.71	06/14/1994	57.12	5252.55	11/14/1995	47.21	5262.46
11/20/1991	57.06	5252.61	04/15/1993	57.59	5252.08	07/07/1994	69.14	5240.53	12/14/1995	47.80	5261.87
12/18/1991	57.20	5252.47	05/10/1993	57.27	5252.40	07/28/1994	70.09	5239.58	04/24/1996	50.92	5258.75
01/30/1992	57.54	5252.13	05/25/1993	59.54	5250.13	08/17/1994	72.02	5237.65	07/18/1996	55.65	5254.02
02/19/1992	57.80	5251.87	06/08/1993	60.62	5249.05	09/07/1994	70.82	5238.85			
03/18/1992	58.05	5251.62	06/24/1993	59.35	5250.32	09/30/1994	59.96	5249.71			
04/16/1992	57.93	5251.74	07/08/1993	57.32	5252.35	10/26/1994	58.62	5251.05			
05/05/1992	58.21	5251.46	07/21/1993	55.76	5253.91	11/21/1994	57.93	5251.74			
05/21/1992	61.97	5247.70	08/12/1993	56.48	5253.19	12/22/1994	58.04	5251.63			
06/04/1992	63.41	5246.26	08/25/1993	55.26	5254.41	01/23/1995	58.37	5251.30			
06/22/1992	64.41	5245.26	09/16/1993	52.93	5256.74	02/23/1995	58.37	5251.30			
07/09/1992	61.78	5247.89	09/30/1993	52.15	5257.52	03/22/1995	58.33	5251.34			
07/23/1992	61.38	5248.29	10/19/1993	51.54	5258.13	04/20/1995	58.57	5251.10			
08/06/1992	64.17	5245.50	11/17/1993	51.67	5258.00	05/18/1995	58.79	5250.88			
08/19/1992	65.58	5244.09	12/22/1993	52.68	5256.99	06/08/1995	56.67	5253.00			
09/10/1992	63.54	5246.13	01/26/1994	53.24	5256.43	06/28/1995	53.53	5256.14			
09/29/1992	62.43	5247.24	02/17/1994	53.56	5256.11	07/19/1995	51.29	5258.38			
10/21/1992	60.77	5248.90	03/31/1994	54.45	5255.22	08/08/1995	51.72	5257.95			

Groundwater Hydrograph

Well Identification HIGHMTN3

MBMG Site # M:109896

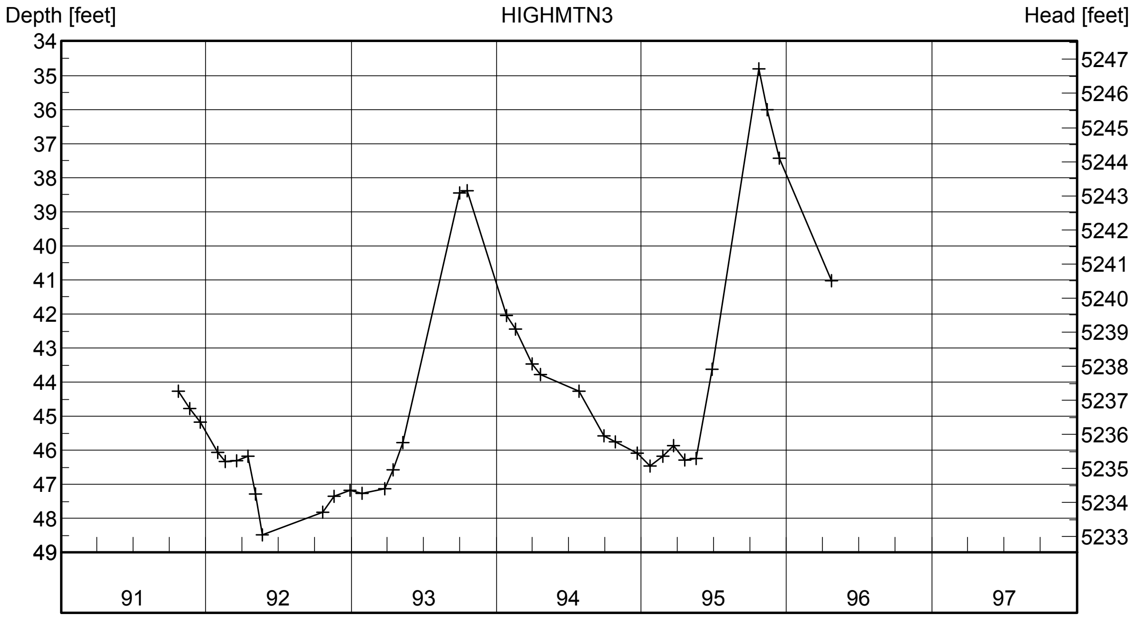
Well Name or Well Owner High Mountain Ranches irrigation well #3

Location 08S 09W 13 BAAB

Ground Surface Elev. (ft) 5280.33

Measuring Point Elev. (ft) 5281.03

Well Depth below m.p. (ft) 300.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
10/24/1991	44.27	5236.76	04/21/1994	43.78	5237.25						
11/21/1991	44.78	5236.25	07/27/1994	44.26	5236.77						
12/18/1991	45.18	5235.85	09/29/1994	45.57	5235.46						
01/31/1992	46.05	5234.98	10/27/1994	45.74	5235.29						
02/19/1992	46.32	5234.71	12/22/1994	46.08	5234.95						
03/18/1992	46.30	5234.73	01/23/1995	46.46	5234.57						
04/16/1992	46.16	5234.87	02/24/1995	46.18	5234.85						
05/05/1992	47.28	5233.75	03/22/1995	45.86	5235.17						
05/21/1992	48.48	5232.55	04/20/1995	46.29	5234.74						
10/21/1992	47.81	5233.22	05/18/1995	46.23	5234.80						
11/18/1992	47.35	5233.68	06/28/1995	43.61	5237.42						
12/28/1992	47.18	5233.85	10/23/1995	34.81	5246.22						
01/27/1993	47.25	5233.78	11/14/1995	36.01	5245.02						
03/26/1993	47.12	5233.91	12/14/1995	37.43	5243.60						
04/15/1993	46.57	5234.46	04/24/1996	41.02	5240.01						
05/10/1993	45.77	5235.26									
09/30/1993	38.46	5242.57									
10/19/1993	38.39	5242.64									
01/26/1994	42.04	5238.99									
02/17/1994	42.44	5238.59									
03/31/1994	43.46	5237.57									

Groundwater Hydrograph

Well Identification
MEINE

MBMG Site #
M:131128

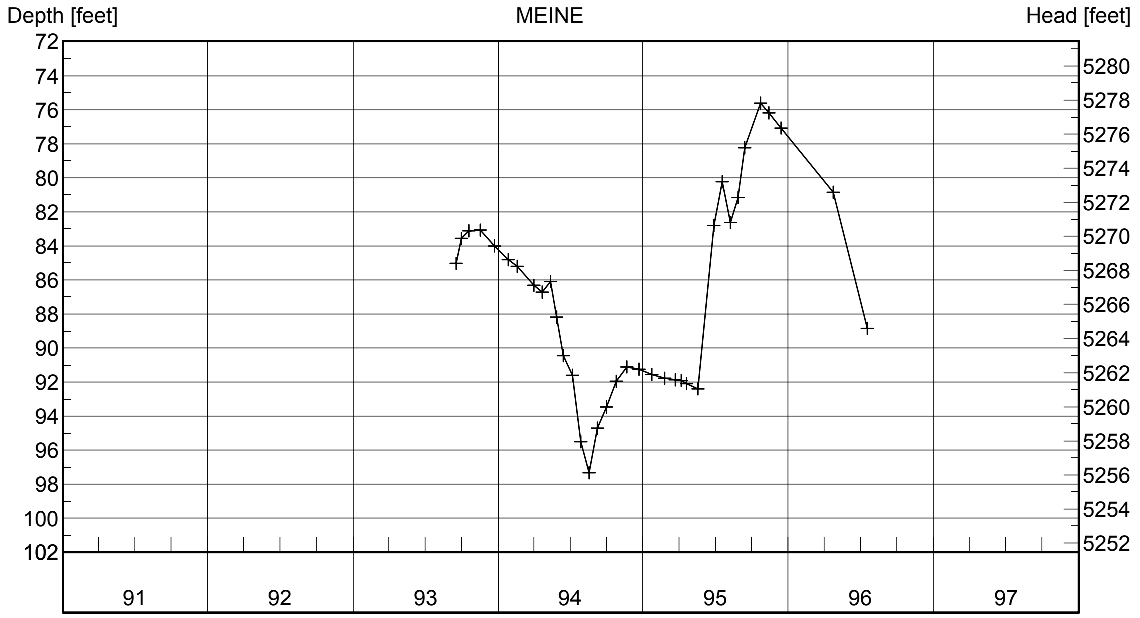
Well Name or Well Owner
Bob Meine

Location
08S 09W 24 DCDC

Ground Surface Elev. (ft)
5351.94

Measuring Point Elev. (ft)
5353.44

Well Depth below m.p. (ft)
117.00



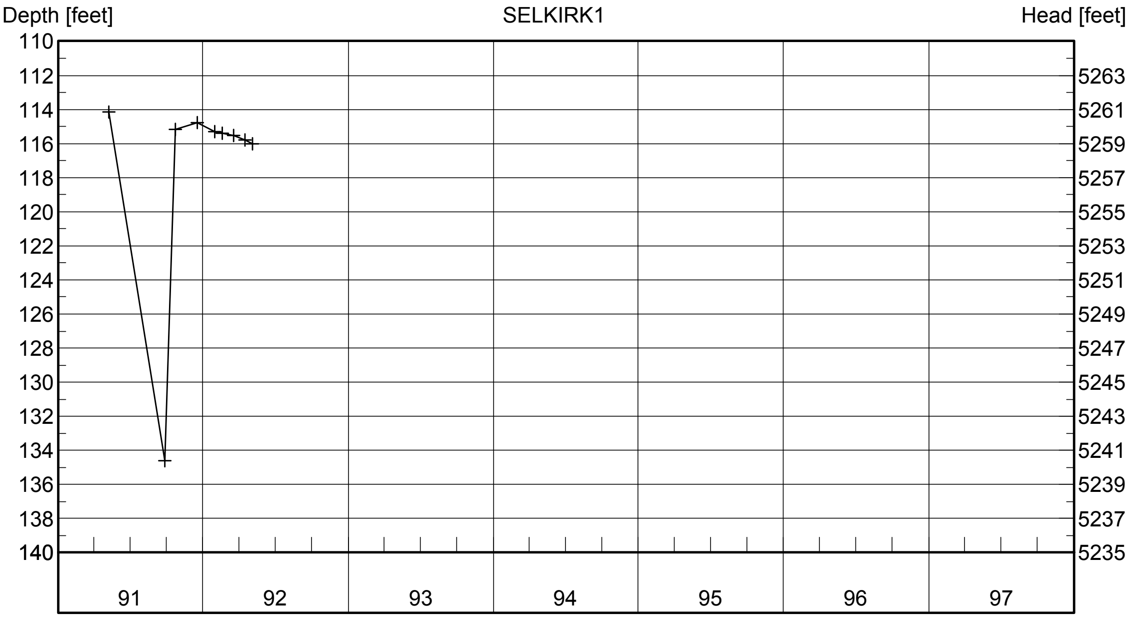
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
09/16/1993	85.02	5268.42	02/23/1995	91.76	5261.68						
09/30/1993	83.58	5269.86	03/22/1995	91.84	5261.60						
10/19/1993	83.10	5270.34	04/06/1995	91.91	5261.53						
11/17/1993	83.07	5270.37	04/20/1995	92.09	5261.35						
12/22/1993	84.02	5269.42	05/18/1995	92.38	5261.06						
01/26/1994	84.81	5268.63	06/28/1995	82.80	5270.64						
02/17/1994	85.20	5268.24	07/19/1995	80.25	5273.19						
03/31/1994	86.32	5267.12	08/08/1995	82.63	5270.81						
04/21/1994	86.73	5266.71	08/28/1995	81.15	5272.29						
05/12/1994	86.11	5267.33	09/14/1995	78.24	5275.20						
05/27/1994	88.18	5265.26	10/23/1995	75.61	5277.83						
06/14/1994	90.42	5263.02	11/14/1995	76.20	5277.24						
07/07/1994	91.58	5261.86	12/14/1995	77.07	5276.37						
07/28/1994	95.49	5257.95	04/24/1996	80.87	5272.57						
08/17/1994	97.32	5256.12	07/18/1996	88.85	5264.59						
09/07/1994	94.69	5258.75									
09/30/1994	93.45	5259.99									
10/26/1994	91.95	5261.49									
11/21/1994	91.12	5262.32									
12/22/1994	91.24	5262.20									
01/23/1995	91.56	5261.88									

Groundwater Hydrograph

Well Identification SELKIRK1	**MBMG Site #** M:109951	**Well Name or Well Owner** Zenchiku Ranch irrigation well #1

Location 08S 09W 25 AACD	**Ground Surface Elev. (ft)** 5374.35	**Measuring Point Elev. (ft)** 5375.00	**Well Depth below m.p. (ft)** 715.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
05/08/1991	114.14	5260.86									
09/27/1991	134.63	5240.37									
10/24/1991	115.16	5259.84									
12/18/1991	114.79	5260.21									
01/31/1992	115.29	5259.71									
02/19/1992	115.40	5259.60									
03/18/1992	115.52	5259.48									
04/16/1992	115.78	5259.22									
05/05/1992	116.02	5258.98									

Groundwater Hydrograph

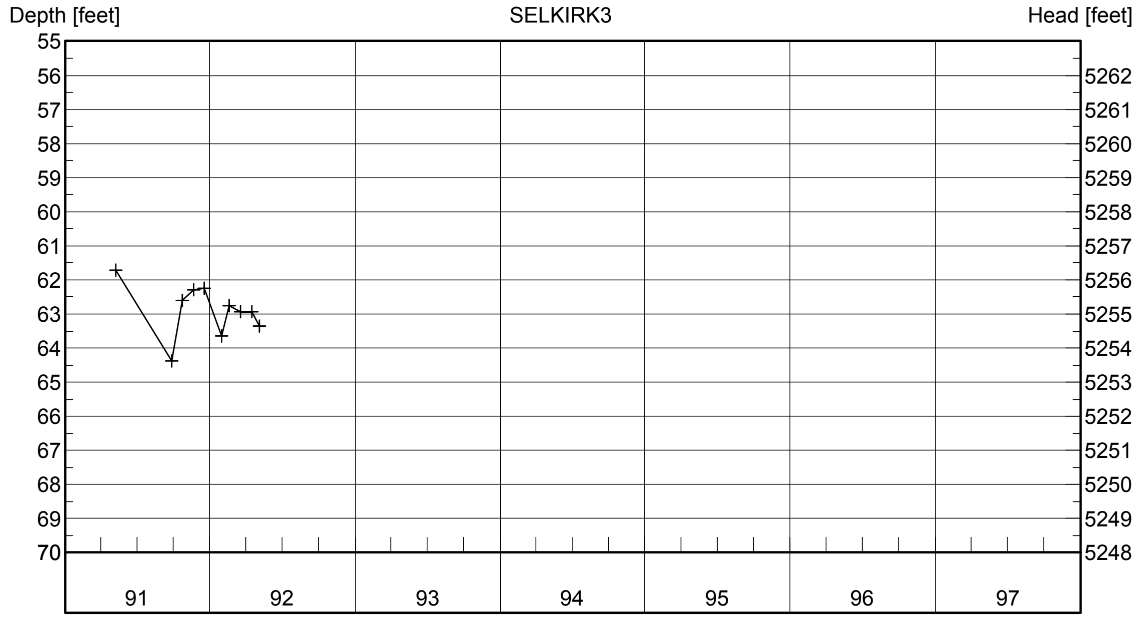
Well Identification	SELKIRK2
MBMG Site #	M:109953
Well Name or Well Owner	Zenchiku Ranch irrigation well #2
Location	08S 09W 26 BBDD
Ground Surface Elev. (ft)	5325.00
Measuring Point Elev. (ft)	5325.00
Well Depth below m.p. (ft)	485.00

Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
05/08/1991	123.00	5202.00									
09/27/1991	121.54	5203.46									
10/24/1991	120.07	5204.93									
11/21/1991	120.06	5204.94									
12/18/1991	120.11	5204.89									
01/31/1992	121.11	5203.89									
02/19/1992	121.57	5203.43									
03/18/1992	122.31	5202.69									
04/16/1992	122.85	5202.15									
05/05/1992	122.76	5202.24									
05/21/1992	123.20	5201.80									

Groundwater Hydrograph

Well Identification SELKIRK3	**MBMG Site #** M:109952	**Well Name or Well Owner** Zenchiku Ranch irrigation well #3		
Location 08S 09W 26 ABBA	**Ground Surface Elev. (ft)** 5317.60	**Measuring Point Elev. (ft)** 5318.00	**Well Depth below m.p. (ft)** 415.00	



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
05/08/1991	61.72	5256.28									
09/27/1991	64.37	5253.63									
10/24/1991	62.59	5255.41									
11/21/1991	62.30	5255.70									
12/18/1991	62.25	5255.75									
01/31/1992	63.65	5254.35									
02/19/1992	62.76	5255.24									
03/18/1992	62.94	5255.06									
04/16/1992	62.94	5255.06									
05/05/1992	63.35	5254.65									

Groundwater Hydrograph

Well Identification SELKIRK5	**MBMG Site #** M:149188	**Well Name or Well Owner** Zenchiku Ranch irrigation well #5

Location 08S 09W 14 CDDD	**Ground Surface Elev. (ft)** 5274.70	**Measuring Point Elev. (ft)** 5275.00	**Well Depth below m.p. (ft)** 405.00

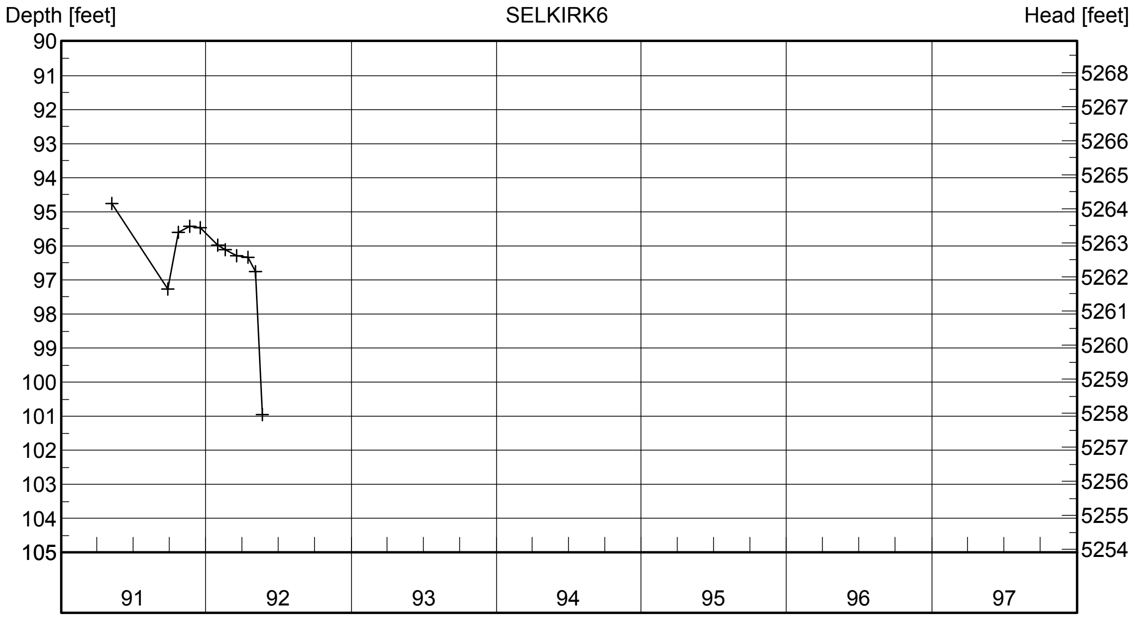
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
05/08/1991	88.29	5186.71
10/24/1991	85.80	5189.20
11/21/1991	81.99	5193.01
12/18/1991	83.55	5191.45
01/31/1992	81.17	5193.83
05/05/1992	87.88	5187.12
05/21/1992	87.17	5187.83

Groundwater Hydrograph

Well Identification SELKIRK6	**MBMG Site #** M:151492	**Well Name or Well Owner** Zenchiku Ranch irrigation well #6

Location 08S 09W 25 BAAA	**Ground Surface Elev. (ft)** 5357.86	**Measuring Point Elev. (ft)** 5358.41	**Well Depth below m.p. (ft)** 400.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
05/08/1991	94.77	5263.64
09/27/1991	97.27	5261.14
10/24/1991	95.60	5262.81
11/21/1991	95.42	5262.99
12/18/1991	95.46	5262.95
01/31/1992	95.97	5262.44
02/19/1992	96.11	5262.30
03/18/1992	96.28	5262.13
04/16/1992	96.33	5262.08
05/05/1992	96.76	5261.65
05/21/1992	100.95	5257.46

Groundwater Hydrograph

Well Identification WHARTON

MBMG Site # M:123861

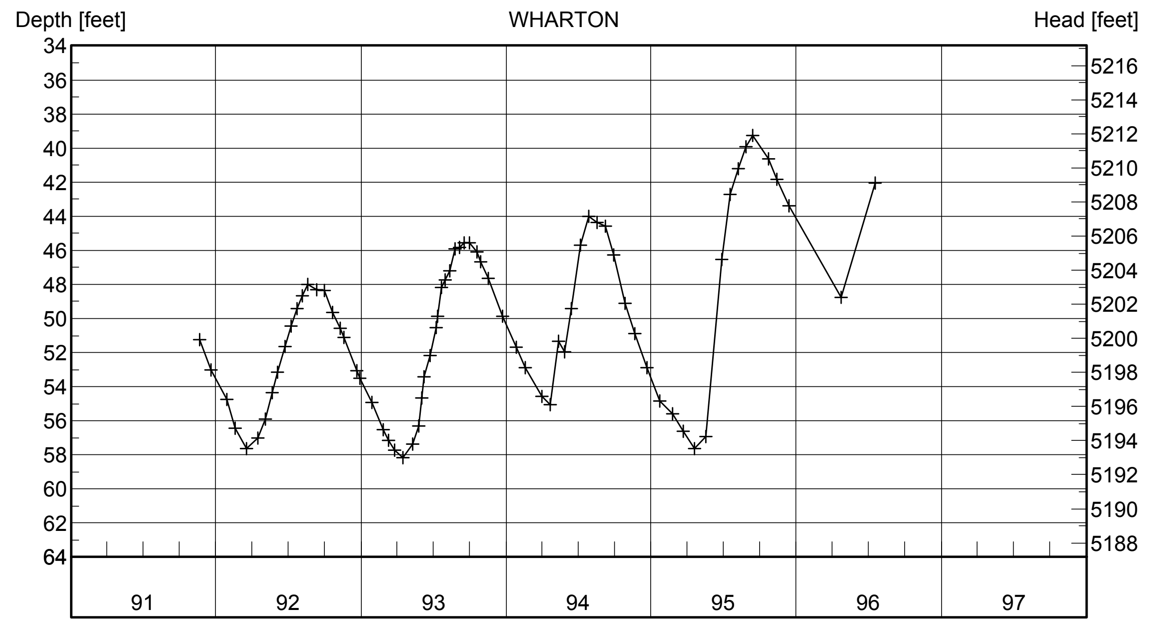
Well Name or Well Owner Charles Wharton

Location 08S 09W 14 CBBC

Ground Surface Elev. (ft) 5249.02

Measuring Point Elev. (ft) 5251.16

Well Depth below m.p. (ft) 80.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
11/21/1991	51.24	5199.92
12/19/1991	53.02	5198.14
01/29/1992	54.76	5196.40
02/19/1992	56.44	5194.72
03/18/1992	57.63	5193.53
04/16/1992	57.00	5194.16
05/05/1992	55.88	5195.28
05/21/1992	54.36	5196.80
06/04/1992	53.13	5198.03
06/23/1992	51.66	5199.50
07/09/1992	50.46	5200.70
07/23/1992	49.42	5201.74
08/06/1992	48.66	5202.50
08/19/1992	48.01	5203.15
09/10/1992	48.33	5202.83
09/29/1992	48.35	5202.81
10/21/1992	49.66	5201.50
11/09/1992	50.58	5200.58
11/18/1992	51.09	5200.07
12/20/1992	53.07	5198.09
12/28/1992	53.49	5197.67
01/27/1993	54.93	5196.23
02/25/1993	56.54	5194.62
03/11/1993	57.16	5194.00
03/26/1993	57.70	5193.46
04/15/1993	58.17	5192.99
05/10/1993	57.37	5193.79
05/25/1993	56.32	5194.84
06/03/1993	54.65	5196.51
06/08/1993	53.43	5197.73
06/24/1993	52.17	5198.99
07/08/1993	50.54	5200.62
07/12/1993	49.85	5201.31
07/21/1993	48.20	5202.96
08/01/1993	47.72	5203.44
08/12/1993	47.20	5203.96
08/25/1993	45.90	5205.26
09/06/1993	45.83	5205.33
09/16/1993	45.54	5205.62
09/30/1993	45.58	5205.58
10/19/1993	46.09	5205.07
10/29/1993	46.67	5204.49
11/17/1993	47.63	5203.53
12/22/1993	49.85	5201.31
01/26/1994	51.70	5199.46
02/17/1994	52.89	5198.27
03/31/1994	54.59	5196.57
04/21/1994	55.06	5196.10
05/12/1994	51.31	5199.85
05/27/1994	51.96	5199.20
06/14/1994	49.44	5201.72
07/07/1994	45.69	5205.47
07/27/1994	44.02	5207.14
08/17/1994	44.36	5206.80
09/07/1994	44.59	5206.57
09/29/1994	46.29	5204.87
10/27/1994	49.09	5202.07
11/21/1994	50.88	5200.28
12/22/1994	52.87	5198.29
01/23/1995	54.83	5196.33
02/23/1995	55.58	5195.58
03/22/1995	56.63	5194.53
04/20/1995	57.61	5193.55
05/18/1995	56.94	5194.22
06/28/1995	46.54	5204.62
07/19/1995	42.71	5208.45
08/08/1995	41.21	5209.95
08/28/1995	39.93	5211.23
09/14/1995	39.24	5211.92
10/23/1995	40.65	5210.51
11/14/1995	41.83	5209.33
12/14/1995	43.39	5207.77
04/24/1996	48.74	5202.42
07/18/1996	42.06	5209.10

Groundwater Hydrograph

Well Identification
WOODY

MBMG Site #
M:120986

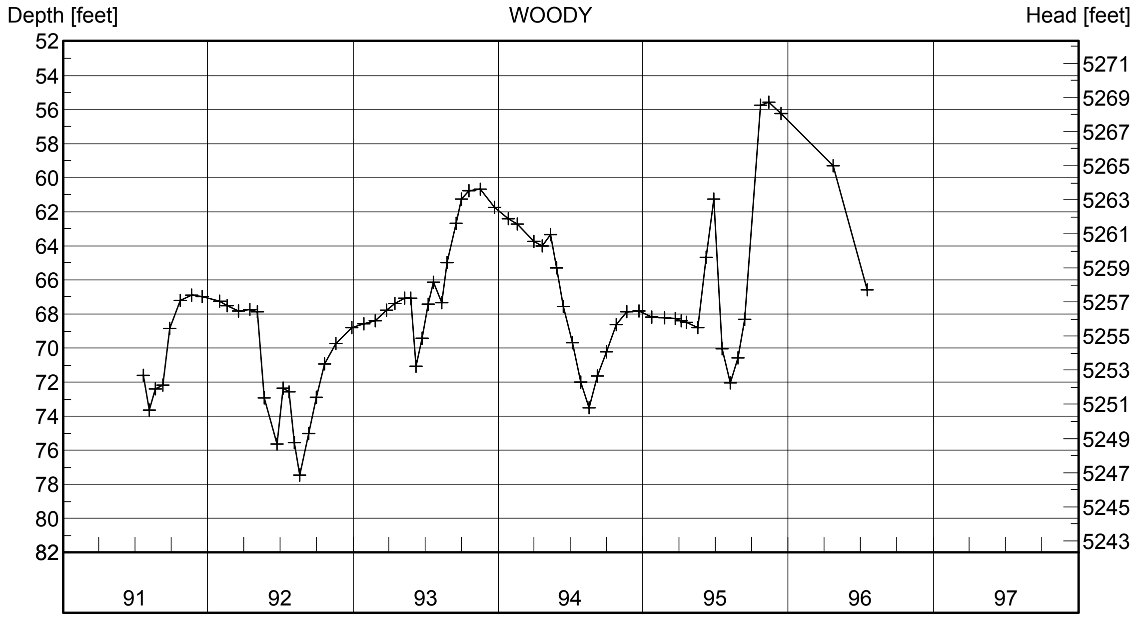
Well Name or Well Owner
Bob Woody

Location
08S 09W 24 CBAC

Ground Surface Elev. (ft)
5323.44

Measuring Point Elev. (ft)
5324.30

Well Depth below m.p. (ft)
100.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/22/1991	71.60	5252.70
08/07/1991	73.63	5250.67
08/21/1991	72.41	5251.89
09/09/1991	72.18	5252.12
09/26/1991	68.86	5255.44
10/23/1991	67.19	5257.11
11/20/1991	66.88	5257.42
12/18/1991	66.97	5257.33
01/30/1992	67.24	5257.06
02/19/1992	67.51	5256.79
03/18/1992	67.81	5256.49
04/16/1992	67.74	5256.56
05/05/1992	67.86	5256.44
05/21/1992	72.94	5251.36
06/23/1992	75.65	5248.65
07/09/1992	72.35	5251.95
07/23/1992	72.56	5251.74
08/06/1992	75.56	5248.74
08/19/1992	77.43	5246.87
09/10/1992	75.00	5249.30
09/29/1992	72.86	5251.44

Date	Depth (ft)	Head (ft)
10/21/1992	70.94	5253.36
11/18/1992	69.73	5254.57
12/28/1992	68.81	5255.49
01/27/1993	68.56	5255.74
02/25/1993	68.38	5255.92
03/26/1993	67.79	5256.51
04/15/1993	67.39	5256.91
05/10/1993	67.08	5257.22
05/25/1993	67.06	5257.24
06/08/1993	71.04	5253.26
06/24/1993	69.42	5254.88
07/08/1993	67.41	5256.89
07/21/1993	66.15	5258.15
08/12/1993	67.34	5256.96
08/25/1993	65.00	5259.30
09/16/1993	62.69	5261.61
09/30/1993	61.27	5263.03
10/19/1993	60.75	5263.55
11/17/1993	60.68	5263.62
12/22/1993	61.76	5262.54
01/26/1994	62.41	5261.89

Date	Depth (ft)	Head (ft)
02/17/1994	62.71	5261.59
03/31/1994	63.72	5260.58
04/21/1994	64.02	5260.28
05/12/1994	63.34	5260.96
05/27/1994	65.30	5259.00
06/14/1994	67.56	5256.74
07/07/1994	69.70	5254.60
07/28/1994	71.98	5252.32
08/17/1994	73.50	5250.80
09/07/1994	71.64	5252.66
09/30/1994	70.22	5254.08
10/26/1994	68.61	5255.69
11/21/1994	67.85	5256.45
12/22/1994	67.84	5256.46
01/23/1995	68.19	5256.11
02/23/1995	68.24	5256.06
03/22/1995	68.25	5256.05
04/06/1995	68.40	5255.90
04/20/1995	68.48	5255.82
05/18/1995	68.78	5255.52
06/08/1995	64.65	5259.65

Date	Depth (ft)	Head (ft)
06/28/1995	61.27	5263.03
07/19/1995	70.06	5254.24
08/08/1995	72.04	5252.26
08/28/1995	70.58	5253.72
09/14/1995	68.29	5256.01
10/23/1995	55.76	5268.54
11/14/1995	55.59	5268.71
12/14/1995	56.25	5268.05
04/24/1996	59.30	5265.00
07/18/1996	66.60	5257.70

Middle Blacktail Deer Creek Valley

Groundwater Hydrograph

Well Identification
91-5

MBMG Site #
M:126663

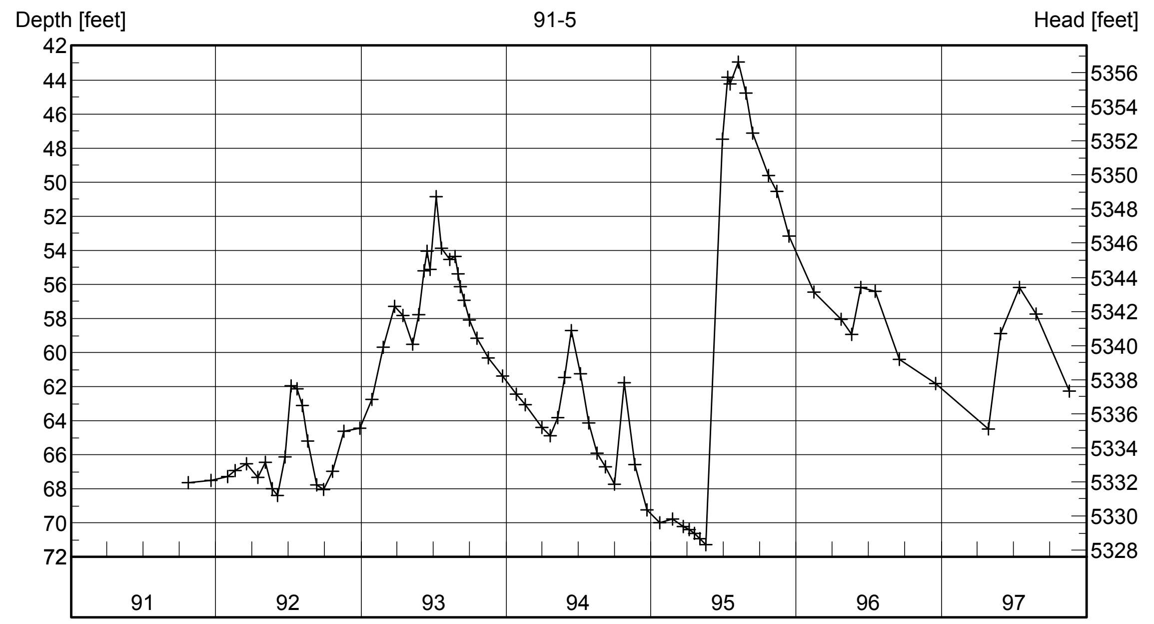
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 91-5

Location
08S 08W 30 AAAA

Ground Surface Elev. (ft)
5397.92

Measuring Point Elev. (ft)
5399.58

Well Depth below m.p. (ft)
106.91



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
10/24/1991	67.65	5331.93
12/19/1991	67.51	5332.07
01/30/1992	67.28	5332.30
02/19/1992	66.93	5332.65
03/18/1992	66.54	5333.04
04/16/1992	67.33	5332.25
05/05/1992	66.45	5333.13
05/21/1992	67.98	5331.60
06/04/1992	68.37	5331.21
06/22/1992	66.10	5333.48
07/09/1992	61.93	5337.65
07/23/1992	62.12	5337.46
08/06/1992	63.09	5336.49
08/19/1992	65.18	5334.40
09/10/1992	67.75	5331.83
09/28/1992	68.03	5331.55
10/21/1992	66.97	5332.61
11/18/1992	64.60	5334.98
12/28/1992	64.44	5335.14
01/27/1993	62.73	5336.85
02/25/1993	59.67	5339.91
03/26/1993	57.29	5342.29
04/15/1993	57.81	5341.77
05/10/1993	59.49	5340.09
05/25/1993	57.79	5341.79
06/08/1993	55.19	5344.39
06/15/1993	54.07	5345.51
06/24/1993	55.13	5344.45
07/08/1993	50.85	5348.73
07/21/1993	53.86	5345.72
08/12/1993	54.55	5345.03
08/25/1993	54.36	5345.22
09/01/1993	55.39	5344.19
09/08/1993	56.14	5343.44
09/16/1993	56.92	5342.66
09/30/1993	58.08	5341.50
10/19/1993	59.16	5340.42
11/17/1993	60.30	5339.28
12/22/1993	61.37	5338.21
01/26/1994	62.45	5337.13
02/17/1994	63.05	5336.53
03/31/1994	64.39	5335.19
04/21/1994	64.89	5334.69
05/11/1994	63.82	5335.76
05/27/1994	61.44	5338.14
06/14/1994	58.69	5340.89
07/07/1994	61.26	5338.32
07/27/1994	64.13	5335.45
08/17/1994	65.89	5333.69
09/07/1994	66.69	5332.89
09/30/1994	67.73	5331.85
10/26/1994	61.75	5337.83
11/21/1994	66.58	5333.00
12/22/1994	69.24	5330.34
01/23/1995	69.98	5329.60
02/23/1995	69.78	5329.80
03/22/1995	70.20	5329.38
04/06/1995	70.40	5329.18
04/20/1995	70.62	5328.96
05/04/1995	70.92	5328.66
05/18/1995	71.28	5328.30
06/29/1995	47.48	5352.10
07/12/1995	43.84	5355.74
07/19/1995	44.24	5355.34
08/08/1995	42.96	5356.62
08/28/1995	44.77	5354.81
09/14/1995	47.11	5352.47
10/23/1995	49.61	5349.97
11/14/1995	50.54	5349.04
12/14/1995	53.15	5346.43
02/15/1996	56.45	5343.13
04/24/1996	58.04	5341.54
05/20/1996	58.95	5340.63
06/11/1996	56.17	5343.41
07/18/1996	56.38	5343.20
09/17/1996	60.40	5339.18
12/17/1996	61.83	5337.75
04/29/1997	64.49	5335.09
05/29/1997	58.87	5340.71
07/17/1997	56.16	5343.42
08/27/1997	57.74	5341.84
11/19/1997	62.24	5337.34

Groundwater Hydrograph

Well Identification
91-6

MBMG Site #
M:126661

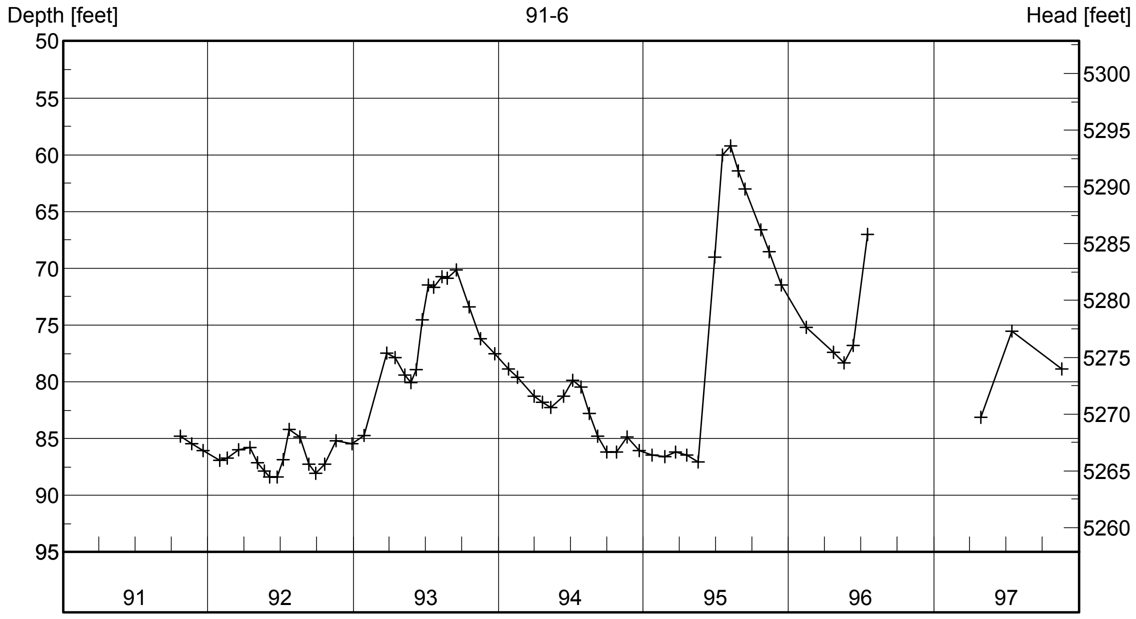
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 91-6

Location
08S 08W 18 DCCD

Ground Surface Elev. (ft)
5351.09

Measuring Point Elev. (ft)
5352.83

Well Depth below m.p. (ft)
122.48



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
10/24/1991	84.79	5268.04	04/15/1993	77.84	5274.99	08/17/1994	82.81	5270.02	05/20/1996	78.33	5274.50
11/20/1991	85.44	5267.39	05/10/1993	79.41	5273.42	09/07/1994	84.76	5268.07	06/11/1996	76.82	5276.01
12/19/1991	86.04	5266.79	05/25/1993	80.05	5272.78	09/30/1994	86.19	5266.64	07/18/1996	67.04	5285.79
01/30/1992	86.92	5265.91	06/08/1993	78.90	5273.93	10/26/1994	86.15	5266.68	04/29/1997	83.09	5269.74
02/19/1992	86.68	5266.15	06/24/1993	74.52	5278.31	11/21/1994	84.87	5267.96	07/17/1997	75.56	5277.27
03/18/1992	86.01	5266.82	07/08/1993	71.45	5281.38	12/22/1994	86.03	5266.80	11/19/1997	78.83	5274.00
04/16/1992	85.80	5267.03	07/21/1993	71.66	5281.17	01/23/1995	86.47	5266.36			
05/05/1992	87.12	5265.71	08/12/1993	70.76	5282.07	02/24/1995	86.59	5266.24			
05/21/1992	87.83	5265.00	08/25/1993	70.84	5281.99	03/22/1995	86.17	5266.66			
06/04/1992	88.35	5264.48	09/16/1993	70.15	5282.68	04/20/1995	86.45	5266.38			
06/22/1992	88.36	5264.47	10/19/1993	73.43	5279.40	05/18/1995	87.07	5265.76			
07/09/1992	86.87	5265.96	11/17/1993	76.21	5276.62	06/29/1995	68.98	5283.85			
07/23/1992	84.16	5268.67	12/22/1993	77.55	5275.28	07/19/1995	60.05	5292.78			
08/19/1992	84.85	5267.98	01/26/1994	78.88	5273.95	08/08/1995	59.20	5293.63			
09/10/1992	87.26	5265.57	02/17/1994	79.61	5273.22	08/28/1995	61.44	5291.39			
09/28/1992	88.07	5264.76	03/31/1994	81.25	5271.58	09/14/1995	63.01	5289.82			
10/21/1992	87.26	5265.57	04/21/1994	81.80	5271.03	10/23/1995	66.58	5286.25			
11/18/1992	85.20	5267.63	05/12/1994	82.25	5270.58	11/14/1995	68.52	5284.31			
12/28/1992	85.46	5267.37	06/14/1994	81.27	5271.56	12/14/1995	71.44	5281.39			
01/27/1993	84.69	5268.14	07/07/1994	79.88	5272.95	02/15/1996	75.18	5277.65			
03/26/1993	77.46	5275.37	07/27/1994	80.43	5272.40	04/24/1996	77.41	5275.42			

Groundwater Hydrograph

Well Identification 91-7

MBMG Site # M:133329

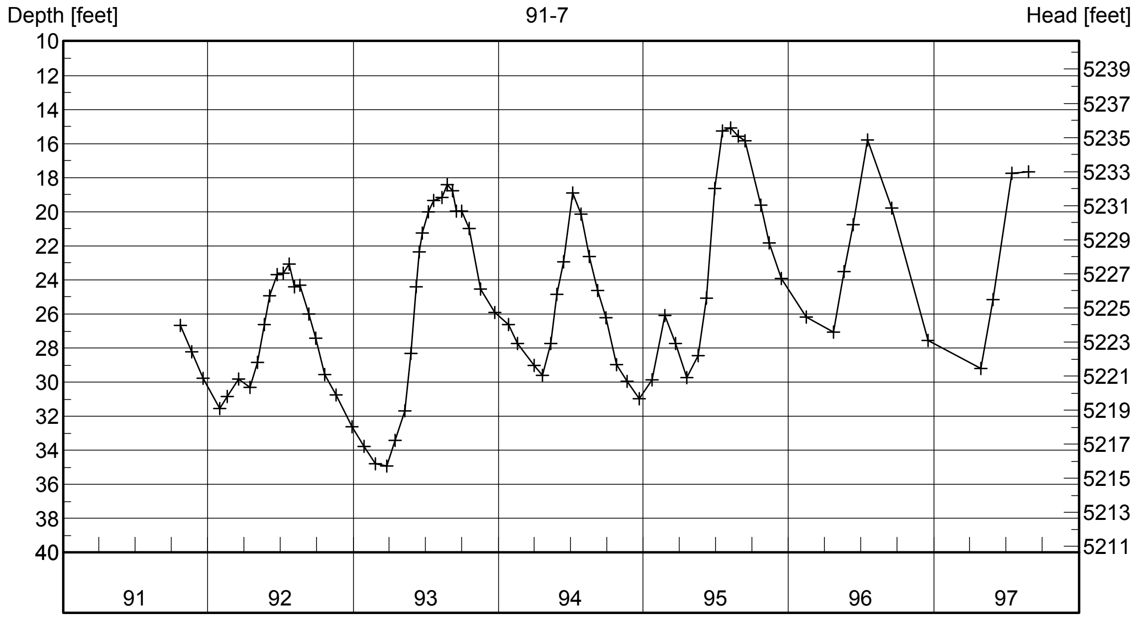
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 91-7

Location 08S 09W 01 DDAA

Ground Surface Elev. (ft) 5248.66

Measuring Point Elev. (ft) 5250.64

Well Depth below m.p. (ft) 62.29



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
10/24/1991	26.68	5223.96
11/20/1991	28.20	5222.44
12/19/1991	29.75	5220.89
01/30/1992	31.56	5219.08
02/19/1992	30.84	5219.80
03/18/1992	29.81	5220.83
04/16/1992	30.30	5220.34
05/05/1992	28.83	5221.81
05/21/1992	26.60	5224.04
06/04/1992	24.95	5225.69
06/22/1992	23.67	5226.97
07/09/1992	23.60	5227.04
07/23/1992	23.06	5227.58
08/06/1992	24.39	5226.25
08/19/1992	24.32	5226.32
09/10/1992	26.01	5224.63
09/28/1992	27.43	5223.21
10/21/1992	29.55	5221.09
11/18/1992	30.75	5219.89
12/28/1992	32.59	5218.05
01/27/1993	33.77	5216.87
02/25/1993	34.78	5215.86
03/26/1993	34.90	5215.74
04/15/1993	33.42	5217.22
05/10/1993	31.67	5218.97
05/25/1993	28.29	5222.35
06/08/1993	24.41	5226.23
06/15/1993	22.35	5228.29
06/24/1993	21.25	5229.39
07/08/1993	20.00	5230.64
07/21/1993	19.34	5231.30
08/12/1993	19.15	5231.49
08/25/1993	18.43	5232.21
09/08/1993	18.78	5231.86
09/16/1993	19.97	5230.67
09/30/1993	19.97	5230.67
10/19/1993	20.98	5229.66
11/17/1993	24.54	5226.10
12/22/1993	25.92	5224.72
01/26/1994	26.64	5224.00
02/17/1994	27.74	5222.90
03/31/1994	29.00	5221.64
04/21/1994	29.60	5221.04
05/12/1994	27.72	5222.92
05/27/1994	24.84	5225.80
06/14/1994	22.92	5227.72
07/07/1994	18.92	5231.72
07/27/1994	20.13	5230.51
08/17/1994	22.62	5228.02
09/07/1994	24.61	5226.03
09/29/1994	26.23	5224.41
10/26/1994	28.95	5221.69
11/21/1994	29.95	5220.69
12/22/1994	30.96	5219.68
01/23/1995	29.86	5220.78
02/23/1995	26.08	5224.56
03/22/1995	27.75	5222.89
04/20/1995	29.73	5220.91
05/18/1995	28.46	5222.18
06/08/1995	25.05	5225.59
06/29/1995	18.65	5231.99
07/19/1995	15.28	5235.36
08/08/1995	15.06	5235.58
08/28/1995	15.58	5235.06
09/14/1995	15.85	5234.79
10/23/1995	19.60	5231.04
11/14/1995	21.82	5228.82
12/14/1995	23.90	5226.74
02/15/1996	26.16	5224.48
04/24/1996	27.07	5223.57
05/20/1996	23.52	5227.12
06/11/1996	20.77	5229.87
07/18/1996	15.77	5234.87
09/17/1996	19.80	5230.84
12/17/1996	27.55	5223.09
04/29/1997	29.19	5221.45
05/29/1997	25.14	5225.50
07/17/1997	17.74	5232.90
08/27/1997	17.67	5232.97

Groundwater Hydrograph

Well Identification
92-5

MBMG Site #
M:133332

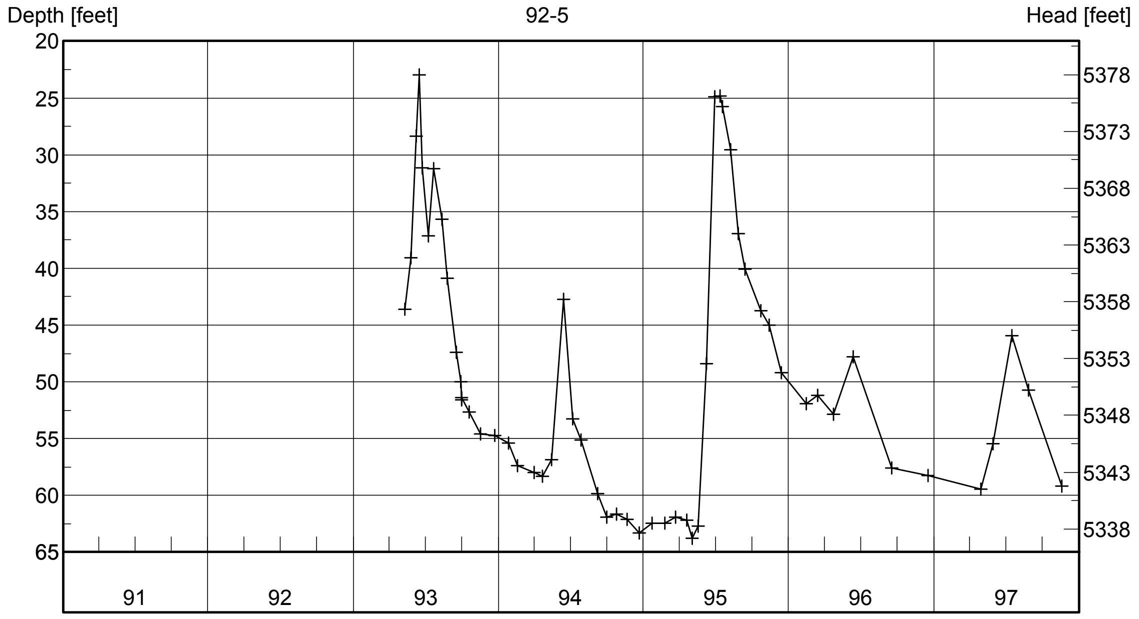
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-5

Location
08S 08W 20 ACCA

Ground Surface Elev. (ft)
5399.03

Measuring Point Elev. (ft)
5400.45

Well Depth below m.p. (ft)
177.89



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
05/10/1993	43.63	5356.82
05/25/1993	39.08	5361.37
06/08/1993	28.34	5372.11
06/15/1993	22.96	5377.49
06/24/1993	31.14	5369.31
07/08/1993	37.14	5363.31
07/21/1993	31.20	5369.25
08/12/1993	35.70	5364.75
08/25/1993	40.85	5359.60
09/16/1993	47.42	5353.03
09/28/1993	49.99	5350.46
09/30/1993	51.56	5348.89
10/01/1993	51.39	5349.06
10/19/1993	52.62	5347.83
11/17/1993	54.57	5345.88
12/22/1993	54.71	5345.74
01/26/1994	55.38	5345.07
02/17/1994	57.36	5343.09
03/31/1994	57.95	5342.50
04/21/1994	58.28	5342.17
05/15/1994	56.85	5343.60
06/14/1994	42.73	5357.72
07/07/1994	53.26	5347.19
07/28/1994	55.12	5345.33
09/07/1994	59.84	5340.61
09/30/1994	61.89	5338.56
10/26/1994	61.64	5338.81
11/21/1994	62.11	5338.34
12/22/1994	63.28	5337.17
01/23/1995	62.45	5338.00
02/23/1995	62.41	5338.04
03/22/1995	61.92	5338.53
04/20/1995	62.20	5338.25
05/04/1995	63.75	5336.70
05/18/1995	62.68	5337.77
06/08/1995	48.42	5352.03
06/29/1995	24.90	5375.55
07/12/1995	24.82	5375.63
07/19/1995	25.73	5374.72
08/08/1995	29.52	5370.93
08/28/1995	36.92	5363.53
09/14/1995	40.06	5360.39
10/23/1995	43.72	5356.73
11/14/1995	44.98	5355.47
12/14/1995	49.16	5351.29
02/15/1996	51.90	5348.55
03/14/1996	51.18	5349.27
04/24/1996	52.84	5347.61
06/11/1996	47.81	5352.64
09/17/1996	57.55	5342.90
12/17/1996	58.22	5342.23
04/29/1997	59.45	5341.00
05/29/1997	55.48	5344.97
07/17/1997	45.95	5354.50
08/27/1997	50.69	5349.76
11/19/1997	59.17	5341.28

Groundwater Hydrograph

Well Identification 92-14

MBMG Site # M:140582

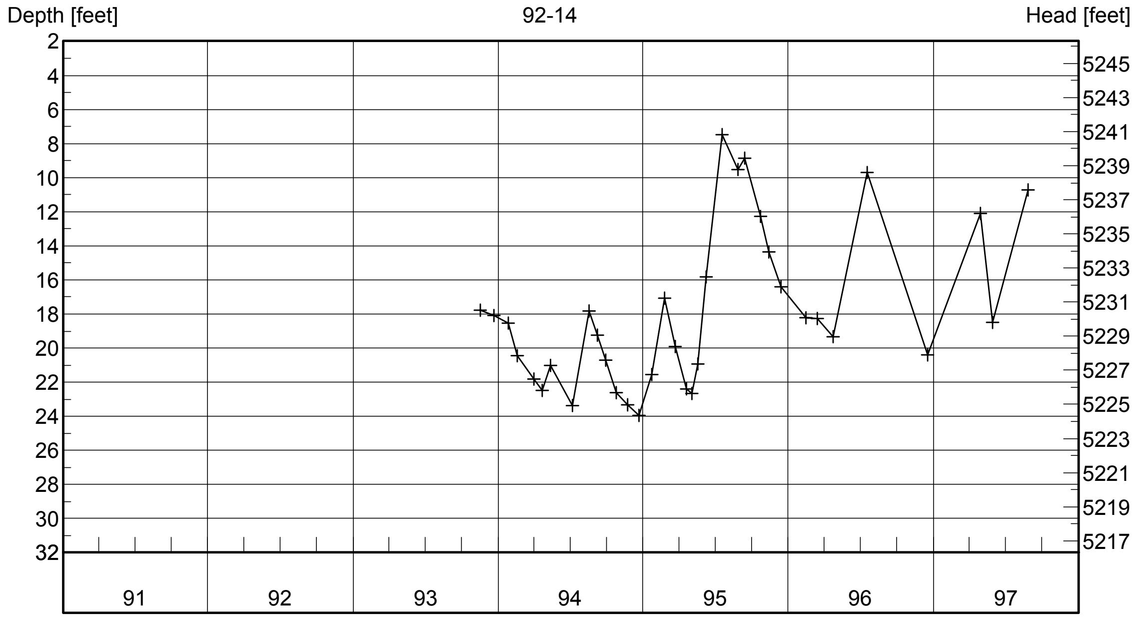
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-14

Location 08S 08W 06 CBDD

Ground Surface Elev. (ft) 5246.69

Measuring Point Elev. (ft) 5248.30

Well Depth below m.p. (ft) 320.02



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
11/17/1993	17.78	5230.52
12/21/1993	18.10	5230.20
01/26/1994	18.52	5229.78
02/17/1994	20.45	5227.85
03/31/1994	21.81	5226.49
04/21/1994	22.49	5225.81
05/12/1994	21.00	5227.30
07/07/1994	23.36	5224.94
08/17/1994	17.83	5230.47
09/07/1994	19.22	5229.08
09/29/1994	20.69	5227.61
10/26/1994	22.62	5225.68
11/22/1994	23.34	5224.96
12/22/1994	23.95	5224.35
01/23/1995	21.53	5226.77
02/23/1995	17.08	5231.22
03/22/1995	19.90	5228.40
04/20/1995	22.38	5225.92
05/04/1995	22.66	5225.64
05/18/1995	20.93	5227.37
06/08/1995	15.84	5232.46
07/19/1995	7.49	5240.81
08/28/1995	9.54	5238.76
09/14/1995	8.84	5239.46
10/23/1995	12.27	5236.03
11/14/1995	14.36	5233.94
12/14/1995	16.40	5231.90
02/15/1996	18.22	5230.08
03/14/1996	18.28	5230.02
04/24/1996	19.31	5228.99
07/18/1996	9.69	5238.61
12/17/1996	20.38	5227.92
04/29/1997	12.10	5236.20
05/29/1997	18.49	5229.81
08/27/1997	10.74	5237.56

Groundwater Hydrograph

Well Identification
FORRIRRG

MBMG Site #
M:109803

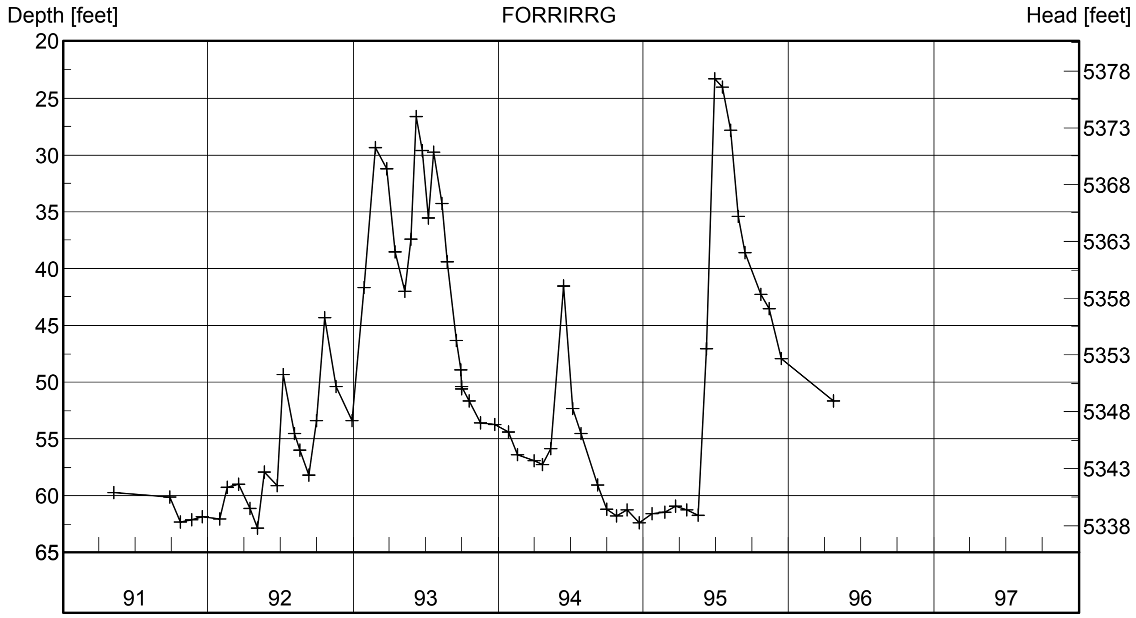
Well Name or Well Owner
Forrester irrigation well #1

Location
08S 08W 20 ACCA

Ground Surface Elev. (ft)
5400.11

Measuring Point Elev. (ft)
5400.11

Well Depth below m.p. (ft)
183.73



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
05/08/1991	59.70	5340.41
09/26/1991	60.14	5339.97
10/23/1991	62.30	5337.81
11/20/1991	62.10	5338.01
12/18/1991	61.85	5338.26
01/30/1992	62.01	5338.10
02/19/1992	59.26	5340.85
03/18/1992	58.99	5341.12
04/16/1992	61.09	5339.02
05/05/1992	62.82	5337.29
05/21/1992	57.90	5342.21
06/22/1992	59.12	5340.99
07/09/1992	49.34	5350.77
08/06/1992	54.51	5345.60
08/19/1992	55.96	5344.15
09/10/1992	58.18	5341.93
09/29/1992	53.40	5346.71
10/21/1992	44.34	5355.77
11/18/1992	50.38	5349.73
12/28/1992	53.41	5346.70
01/27/1993	41.68	5358.43
02/25/1993	29.38	5370.73
03/26/1993	31.24	5368.87
04/15/1993	38.55	5361.56
05/10/1993	42.02	5358.09
05/25/1993	37.41	5362.70
06/08/1993	26.61	5373.50
06/24/1993	29.62	5370.49
07/08/1993	35.55	5364.56
07/21/1993	29.75	5370.36
08/12/1993	34.30	5365.81
08/25/1993	39.40	5360.71
09/16/1993	46.30	5353.81
09/28/1993	48.95	5351.16
09/30/1993	50.59	5349.52
10/01/1993	50.42	5349.69
10/19/1993	51.64	5348.47
11/17/1993	53.60	5346.51
12/22/1993	53.73	5346.38
01/26/1994	54.35	5345.76
02/17/1994	56.39	5343.72
03/31/1994	56.89	5343.22
04/21/1994	57.27	5342.84
05/12/1994	55.85	5344.26
06/14/1994	41.53	5358.58
07/07/1994	52.34	5347.77
07/28/1994	54.53	5345.58
09/07/1994	59.06	5341.05
09/30/1994	61.14	5338.97
10/26/1994	61.74	5338.37
11/21/1994	61.24	5338.87
12/22/1994	62.40	5337.71
01/23/1995	61.55	5338.56
02/23/1995	61.46	5338.65
03/22/1995	60.88	5339.23
04/20/1995	61.22	5338.89
05/18/1995	61.71	5338.40
06/08/1995	47.07	5353.04
06/29/1995	23.27	5376.84
07/19/1995	24.02	5376.09
08/08/1995	27.84	5372.27
08/28/1995	35.40	5364.71
09/14/1995	38.63	5361.48
10/23/1995	42.28	5357.83
11/14/1995	43.53	5356.58
12/14/1995	47.94	5352.17
04/24/1996	51.65	5348.46

Groundwater Hydrograph

Well Identification
HIGHMTN1

MBMG Site #
M:109796

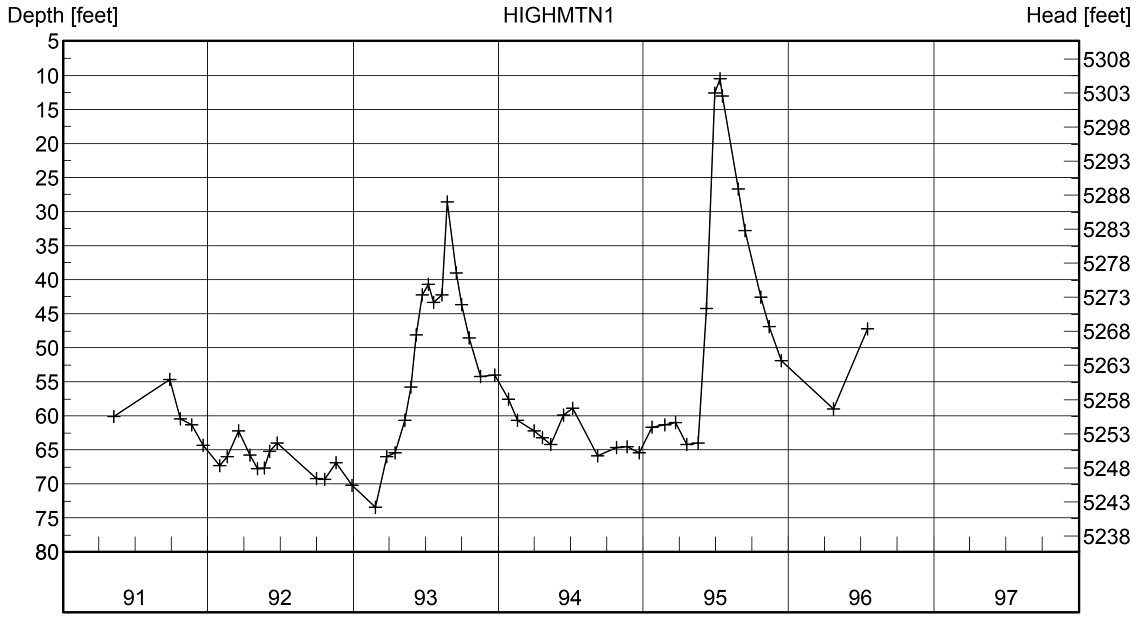
Well Name or Well Owner
High Mountain Ranches irrigation well #1

Location
08S 08W 07 DDDD

Ground Surface Elev. (ft)
5313.90

Measuring Point Elev. (ft)
5315.09

Well Depth below m.p. (ft)
186.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
05/08/1991	60.08	5255.01	05/25/1993	55.74	5259.35	11/21/1994	64.50	5250.59			
09/26/1991	54.60	5260.49	06/08/1993	48.10	5266.99	12/22/1994	65.40	5249.69			
10/23/1991	60.41	5254.68	06/24/1993	42.26	5272.83	01/23/1995	61.65	5253.44			
11/20/1991	61.31	5253.78	07/08/1993	40.66	5274.43	02/23/1995	61.27	5253.82			
12/19/1991	64.32	5250.77	07/21/1993	43.29	5271.80	03/22/1995	60.96	5254.13			
01/30/1992	67.32	5247.77	08/12/1993	42.18	5272.91	04/20/1995	64.23	5250.86			
02/19/1992	65.92	5249.17	08/25/1993	28.53	5286.56	05/18/1995	63.92	5251.17			
03/18/1992	62.17	5252.92	09/16/1993	38.95	5276.14	06/08/1995	44.21	5270.88			
04/16/1992	65.73	5249.36	09/30/1993	43.67	5271.42	06/29/1995	12.57	5302.52			
05/05/1992	67.69	5247.40	10/19/1993	48.53	5266.56	07/12/1995	10.46	5304.63			
05/21/1992	67.61	5247.48	11/17/1993	54.21	5260.88	07/19/1995	13.02	5302.07			
06/04/1992	65.23	5249.86	12/22/1993	53.99	5261.10	08/28/1995	26.74	5288.35			
06/22/1992	64.02	5251.07	01/26/1994	57.50	5257.59	09/14/1995	32.84	5282.25			
09/29/1992	69.15	5245.94	02/17/1994	60.59	5254.50	10/23/1995	42.60	5272.49			
10/21/1992	69.32	5245.77	03/31/1994	62.17	5252.92	11/14/1995	46.85	5268.24			
11/18/1992	66.82	5248.27	04/21/1994	63.20	5251.89	12/14/1995	51.85	5263.24			
12/28/1992	70.16	5244.93	05/12/1994	64.15	5250.94	04/24/1996	59.03	5256.06			
02/25/1993	73.36	5241.73	06/14/1994	59.81	5255.28	07/18/1996	47.26	5267.83			
03/26/1993	65.95	5249.14	07/07/1994	58.86	5256.23						
04/15/1993	65.38	5249.71	09/07/1994	65.90	5249.19						
05/10/1993	60.62	5254.47	10/26/1994	64.68	5250.41						

Groundwater Hydrograph

Well Identification
HIGHMTN2

MBMG Site #
M:109800

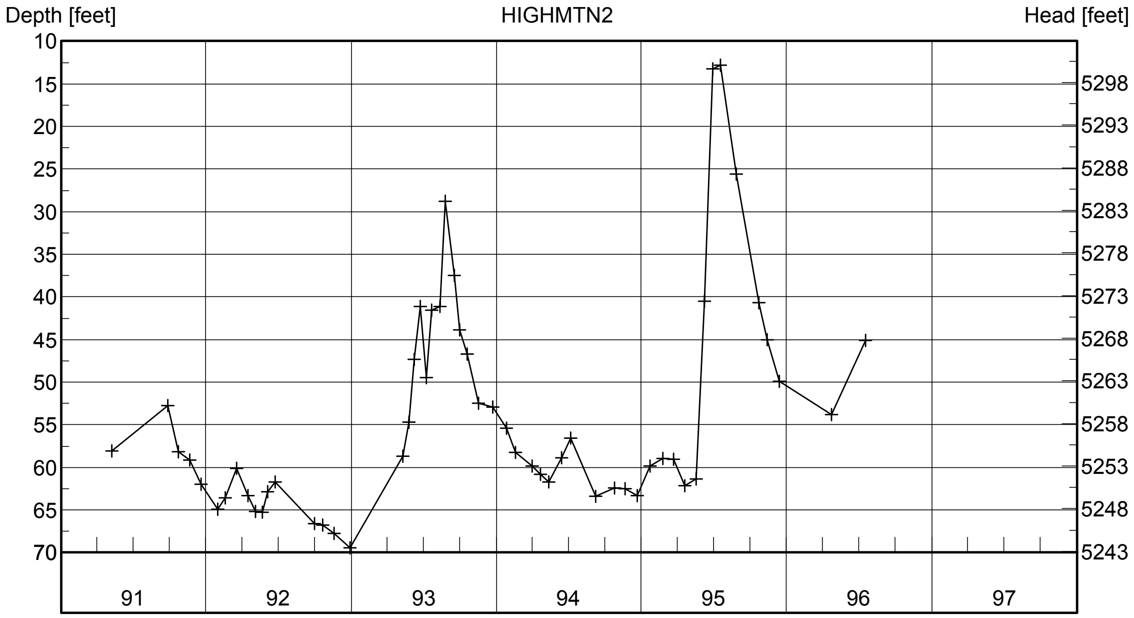
Well Name or Well Owner
High Mountain Ranches irrigation well #2

Location
08S 08W 07 DDDC

Ground Surface Elev. (ft)
5311.23

Measuring Point Elev. (ft)
5312.35

Well Depth below m.p. (ft)
300.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
05/08/1991	58.08	5254.27	07/08/1993	49.43	5262.92	02/23/1995	58.91	5253.44			
09/26/1991	52.71	5259.64	07/21/1993	41.54	5270.81	03/22/1995	59.01	5253.34			
10/23/1991	58.17	5254.18	08/12/1993	41.15	5271.20	04/20/1995	62.15	5250.20			
11/20/1991	59.17	5253.18	08/25/1993	28.75	5283.60	05/18/1995	61.36	5250.99			
12/19/1991	61.96	5250.39	09/16/1993	37.49	5274.86	06/08/1995	40.50	5271.85			
01/30/1992	64.94	5247.41	09/30/1993	43.83	5268.52	06/29/1995	13.22	5299.13			
02/19/1992	63.55	5248.80	10/19/1993	46.70	5265.65	07/19/1995	12.79	5299.56			
03/18/1992	60.11	5252.24	11/17/1993	52.43	5259.92	08/28/1995	25.61	5286.74			
04/16/1992	63.34	5249.01	12/22/1993	52.95	5259.40	10/23/1995	40.68	5271.67			
05/05/1992	65.15	5247.20	01/26/1994	55.36	5256.99	11/14/1995	45.03	5267.32			
05/21/1992	65.22	5247.13	02/17/1994	58.24	5254.11	12/14/1995	49.89	5262.46			
06/04/1992	62.84	5249.51	03/31/1994	59.85	5252.50	04/24/1996	53.80	5258.55			
06/22/1992	61.70	5250.65	04/21/1994	60.82	5251.53	07/18/1996	45.10	5267.25			
09/29/1992	66.55	5245.80	05/12/1994	61.68	5250.67						
10/21/1992	66.77	5245.58	06/14/1994	58.90	5253.45						
11/18/1992	67.74	5244.61	07/07/1994	56.56	5255.79						
12/28/1992	69.45	5242.90	09/07/1994	63.40	5248.95						
05/10/1993	58.71	5253.64	10/26/1994	62.45	5249.90						
05/25/1993	54.66	5257.69	11/21/1994	62.49	5249.86						
06/08/1993	47.32	5265.03	12/22/1994	63.34	5249.01						
06/24/1993	41.11	5271.24	01/23/1995	59.87	5252.48						

Groundwater Hydrograph

Well Identification
HIMTNDOM

MBMG Site #
M:109794

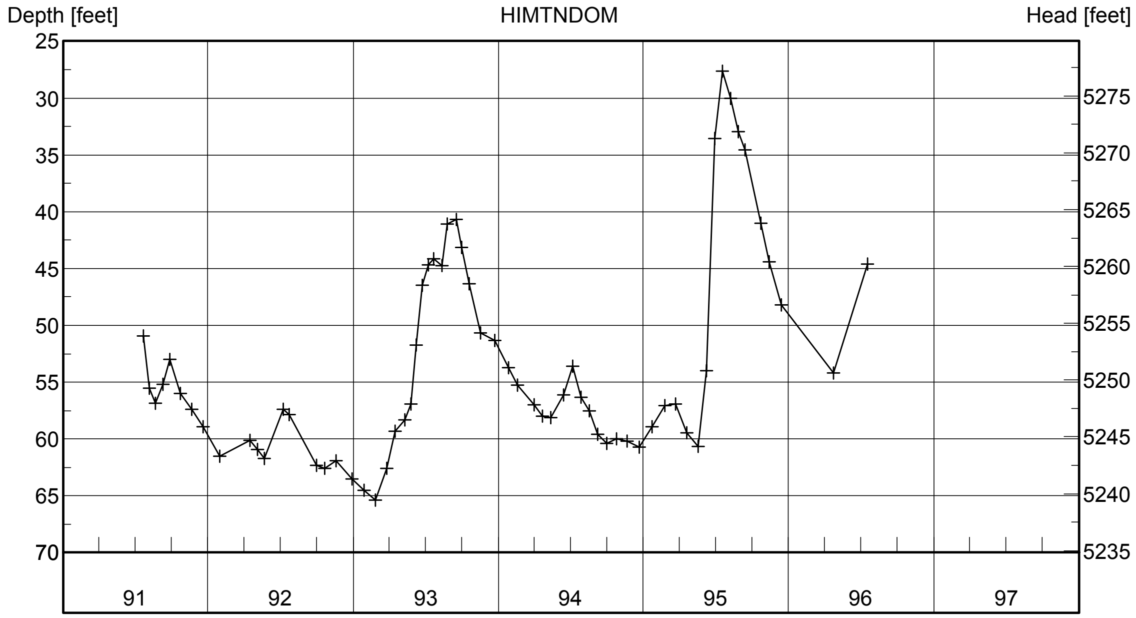
Well Name or Well Owner
High Mountain Ranches domestic/stock well

Location
08S 08W 07 DCCC

Ground Surface Elev. (ft)
5302.43

Measuring Point Elev. (ft)
5304.81

Well Depth below m.p. (ft)
80.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/22/1991	50.96	5253.85
08/07/1991	55.49	5249.32
08/21/1991	56.83	5247.98
09/10/1991	55.22	5249.59
09/26/1991	53.02	5251.79
10/23/1991	56.02	5248.79
11/20/1991	57.36	5247.45
12/19/1991	58.94	5245.87
01/30/1992	61.52	5243.29
04/16/1992	60.10	5244.71
05/05/1992	60.90	5243.91
05/21/1992	61.69	5243.12
07/09/1992	57.37	5247.44
07/23/1992	57.84	5246.97
09/29/1992	62.32	5242.49
10/21/1992	62.61	5242.20
11/18/1992	61.88	5242.93
12/28/1992	63.51	5241.30
01/27/1993	64.51	5240.30
02/25/1993	65.38	5239.43
03/26/1993	62.59	5242.22
04/15/1993	59.32	5245.49
05/10/1993	58.35	5246.46
05/25/1993	56.94	5247.87
06/08/1993	51.72	5253.09
06/24/1993	46.45	5258.36
07/08/1993	44.68	5260.13
07/21/1993	44.13	5260.68
08/12/1993	44.73	5260.08
08/25/1993	41.05	5263.76
09/16/1993	40.70	5264.11
09/30/1993	43.12	5261.69
10/19/1993	46.33	5258.48
11/17/1993	50.63	5254.18
12/22/1993	51.32	5253.49
01/26/1994	53.75	5251.06
02/17/1994	55.28	5249.53
03/31/1994	57.00	5247.81
04/21/1994	57.97	5246.84
05/12/1994	58.14	5246.67
06/14/1994	56.10	5248.71
07/07/1994	53.56	5251.25
07/28/1994	56.30	5248.51
08/17/1994	57.54	5247.27
09/07/1994	59.60	5245.21
09/30/1994	60.38	5244.43
10/26/1994	59.96	5244.85
11/21/1994	60.19	5244.62
12/22/1994	60.70	5244.11
01/23/1995	58.92	5245.89
02/23/1995	57.03	5247.78
03/22/1995	56.94	5247.87
04/20/1995	59.43	5245.38
05/18/1995	60.64	5244.17
06/08/1995	54.02	5250.79
06/29/1995	33.53	5271.28
07/19/1995	27.61	5277.20
08/08/1995	30.05	5274.76
08/28/1995	32.95	5271.86
09/14/1995	34.55	5270.26
10/23/1995	41.01	5263.80
11/14/1995	44.40	5260.41
12/14/1995	48.23	5256.58
04/24/1996	54.18	5250.63
07/18/1996	44.63	5260.18

Groundwater Hydrograph

Well Identification HUMPHREY

MBMG Site # M:109789

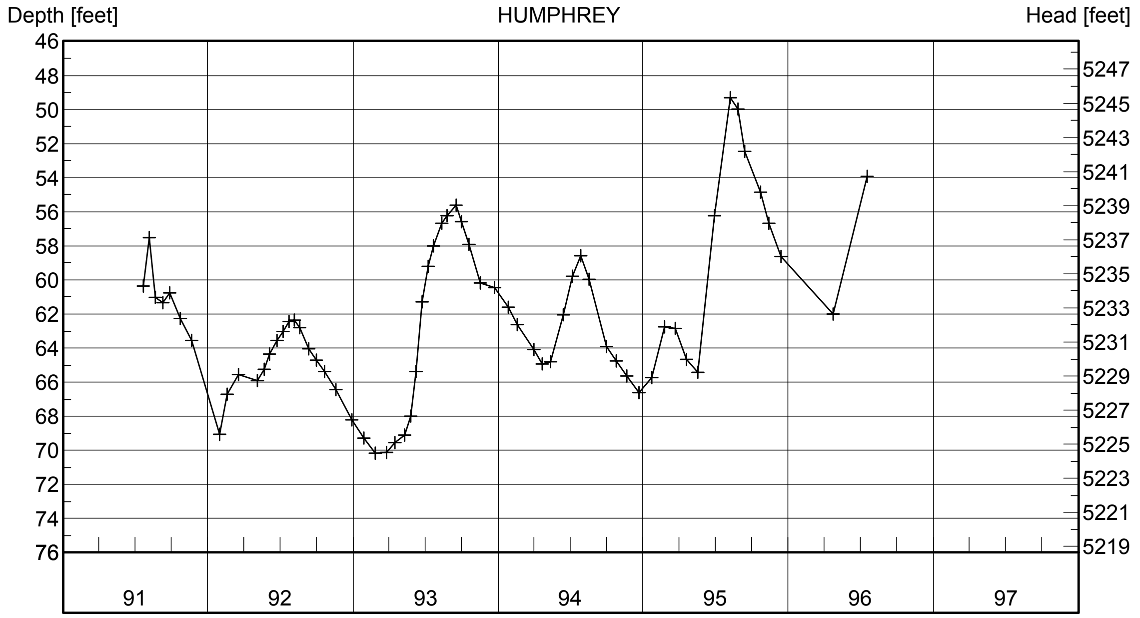
Well Name or Well Owner Nyles Humphrey

Location 08S 08W 06 ADDD

Ground Surface Elev. (ft) 5293.08

Measuring Point Elev. (ft) 5294.64

Well Depth below m.p. (ft) 94.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/22/1991	60.37	5234.27
08/07/1991	57.52	5237.12
08/21/1991	61.02	5233.62
09/10/1991	61.33	5233.31
09/26/1991	60.77	5233.87
10/23/1991	62.25	5232.39
11/20/1991	63.57	5231.07
01/30/1992	69.05	5225.59
02/19/1992	66.70	5227.94
03/18/1992	65.56	5229.08
05/05/1992	65.89	5228.75
05/21/1992	65.26	5229.38
06/04/1992	64.33	5230.31
06/22/1992	63.56	5231.08
07/09/1992	63.01	5231.63
07/23/1992	62.46	5232.18
08/06/1992	62.34	5232.30
08/19/1992	62.79	5231.85
09/10/1992	64.05	5230.59
09/29/1992	64.69	5229.95
10/21/1992	65.39	5229.25
11/18/1992	66.42	5228.22
12/28/1992	68.20	5226.44
01/27/1993	69.28	5225.36
02/25/1993	70.15	5224.49
03/26/1993	70.12	5224.52
04/15/1993	69.54	5225.10
05/10/1993	69.11	5225.53
05/25/1993	67.98	5226.66
06/08/1993	65.39	5229.25
06/24/1993	61.30	5233.34
07/08/1993	59.22	5235.42
07/21/1993	58.00	5236.64
08/12/1993	56.66	5237.98
08/25/1993	56.24	5238.40
09/16/1993	55.62	5239.02
09/30/1993	56.57	5238.07
10/19/1993	57.91	5236.73
11/17/1993	60.18	5234.46
12/22/1993	60.46	5234.18
01/26/1994	61.58	5233.06
02/17/1994	62.62	5232.02
03/31/1994	64.08	5230.56
04/21/1994	64.93	5229.71
05/12/1994	64.81	5229.83
06/14/1994	62.05	5232.59
07/07/1994	59.76	5234.88
07/27/1994	58.60	5236.04
08/17/1994	59.96	5234.68
09/30/1994	63.92	5230.72
10/26/1994	64.73	5229.91
11/21/1994	65.62	5229.02
12/22/1994	66.60	5228.04
01/23/1995	65.72	5228.92
02/23/1995	62.76	5231.88
03/22/1995	62.82	5231.82
04/20/1995	64.66	5229.98
05/18/1995	65.42	5229.22
06/29/1995	56.25	5238.39
08/08/1995	49.31	5245.33
08/28/1995	49.96	5244.68
09/14/1995	52.46	5242.18
10/23/1995	54.85	5239.79
11/14/1995	56.69	5237.95
12/14/1995	58.64	5236.00
04/24/1996	61.98	5232.66
07/18/1996	53.94	5240.70

Groundwater Hydrograph

Well Identification
RIPLEY

MBMG Site #
M:109795

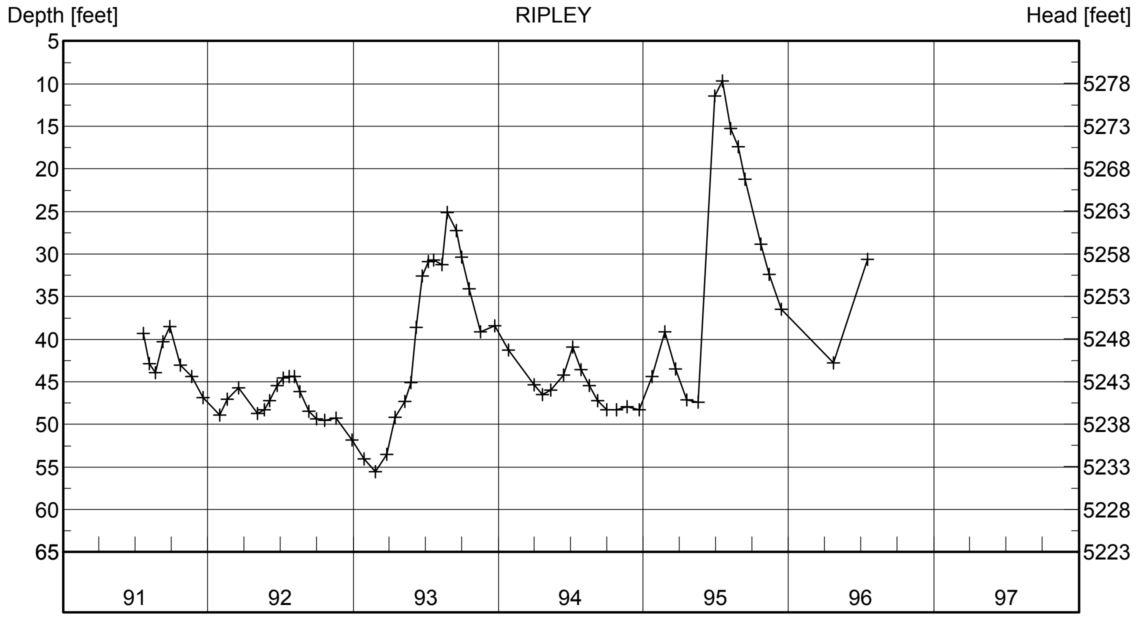
Well Name or Well Owner
Jack Ripley

Location
08S 08W 07 DAAC

Ground Surface Elev. (ft)
5285.72

Measuring Point Elev. (ft)
5287.46

Well Depth below m.p. (ft)
75.00



Depth to groundwater and head are reported from measuring point

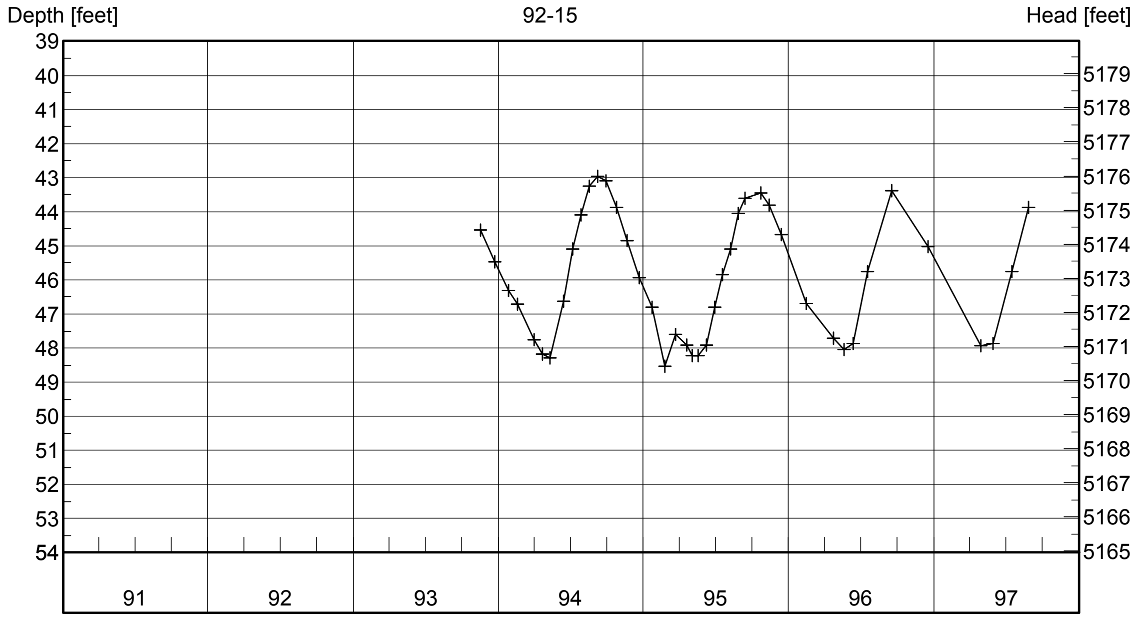
Date	Depth (ft)	Head (ft)
07/22/1991	39.32	5248.14
08/07/1991	42.82	5244.64
08/21/1991	43.94	5243.52
09/10/1991	40.32	5247.14
09/26/1991	38.51	5248.95
10/23/1991	43.00	5244.46
11/20/1991	44.34	5243.12
12/19/1991	46.87	5240.59
01/30/1992	48.91	5238.55
02/19/1992	47.00	5240.46
03/18/1992	45.71	5241.75
05/05/1992	48.67	5238.79
05/21/1992	48.23	5239.23
06/04/1992	47.16	5240.30
06/22/1992	45.47	5241.99
07/09/1992	44.50	5242.96
07/23/1992	44.40	5243.06
08/06/1992	44.39	5243.07
08/19/1992	46.18	5241.28
09/10/1992	48.47	5238.99
09/29/1992	49.35	5238.11
10/21/1992	49.47	5237.99
11/18/1992	49.28	5238.18
12/28/1992	51.85	5235.61
01/27/1993	54.07	5233.39
02/25/1993	55.56	5231.90
03/26/1993	53.50	5233.96
04/15/1993	49.13	5238.33
05/10/1993	47.25	5240.21
05/25/1993	45.06	5242.40
06/08/1993	38.62	5248.84
06/24/1993	32.60	5254.86
07/08/1993	30.84	5256.62
07/21/1993	30.69	5256.77
08/12/1993	31.23	5256.23
08/25/1993	25.06	5262.40
09/16/1993	27.23	5260.23
09/30/1993	30.36	5257.10
10/19/1993	34.08	5253.38
11/17/1993	39.09	5248.37
12/22/1993	38.46	5249.00
01/26/1994	41.25	5246.21
03/31/1994	45.32	5242.14
04/21/1994	46.46	5241.00
05/12/1994	45.97	5241.49
06/14/1994	44.21	5243.25
07/07/1994	40.93	5246.53
07/28/1994	43.55	5243.91
08/17/1994	45.42	5242.04
09/07/1994	47.22	5240.24
09/30/1994	48.23	5239.23
10/26/1994	48.29	5239.17
11/21/1994	47.92	5239.54
12/22/1994	48.23	5239.23
01/23/1995	44.35	5243.11
02/23/1995	39.16	5248.30
03/22/1995	43.49	5243.97
04/20/1995	47.10	5240.36
05/18/1995	47.42	5240.04
06/29/1995	11.40	5276.06
07/19/1995	9.67	5277.79
08/08/1995	15.29	5272.17
08/28/1995	17.41	5270.05
09/14/1995	21.23	5266.23
10/23/1995	28.81	5258.65
11/14/1995	32.41	5255.05
12/14/1995	36.50	5250.96
04/24/1996	42.80	5244.66
07/18/1996	30.63	5256.83

Lower Blacktail Deer Creek Valley

Groundwater Hydrograph

Well Identification 92-15	**MBMG Site #** M:133380	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-15

Location 07S 08W 31 BCAD	**Ground Surface Elev. (ft)** 5216.77	**Measuring Point Elev. (ft)** 5218.45	**Well Depth below m.p. (ft)** 510.68



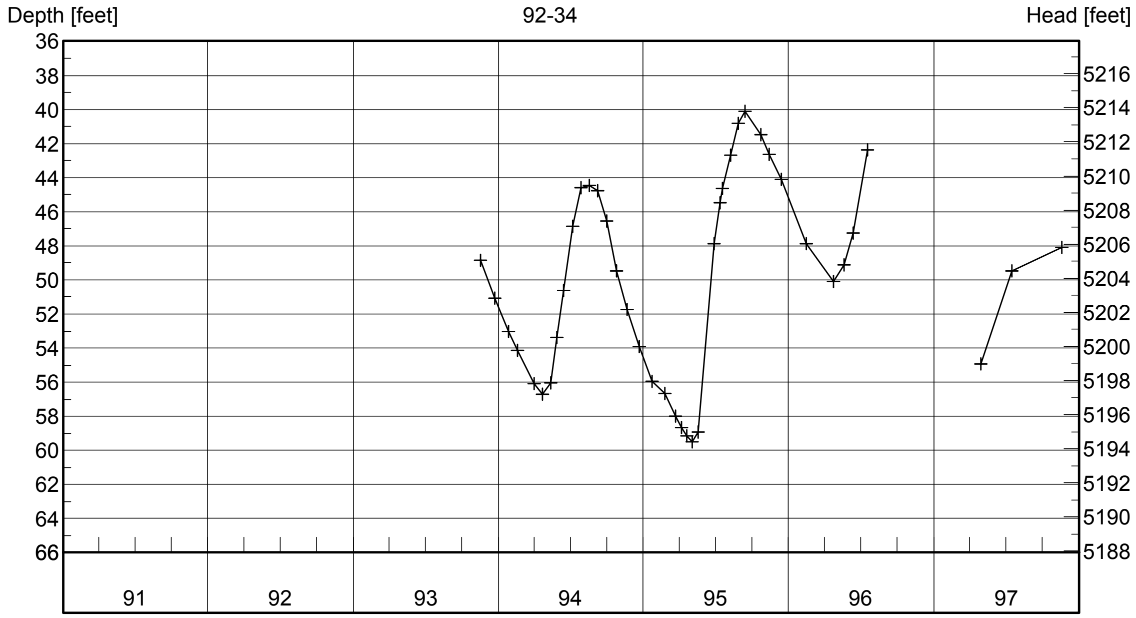
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
11/17/1993	44.53	5173.92
12/22/1993	45.46	5172.99
01/26/1994	46.32	5172.13
02/17/1994	46.70	5171.75
03/31/1994	47.75	5170.70
04/21/1994	48.18	5170.27
05/11/1994	48.28	5170.17
06/14/1994	46.62	5171.83
07/07/1994	45.08	5173.37
07/27/1994	44.09	5174.36
08/17/1994	43.25	5175.20
09/07/1994	42.97	5175.48
09/29/1994	43.10	5175.35
10/26/1994	43.86	5174.59
11/21/1994	44.85	5173.60
12/22/1994	45.93	5172.52
01/23/1995	46.80	5171.65
02/24/1995	48.52	5169.93
03/22/1995	47.59	5170.86
04/20/1995	47.91	5170.54
05/04/1995	48.22	5170.23
05/18/1995	48.23	5170.22
06/08/1995	47.91	5170.54
06/29/1995	46.79	5171.66
07/19/1995	45.84	5172.61
08/08/1995	45.08	5173.37
08/28/1995	44.05	5174.40
09/14/1995	43.60	5174.85
10/23/1995	43.44	5175.01
11/14/1995	43.80	5174.65
12/14/1995	44.68	5173.77
02/15/1996	46.69	5171.76
04/24/1996	47.72	5170.73
05/20/1996	48.05	5170.40
06/11/1996	47.86	5170.59
07/18/1996	45.75	5172.70
09/17/1996	43.39	5175.06
12/17/1996	45.03	5173.42
04/29/1997	47.93	5170.52
05/29/1997	47.87	5170.58
07/17/1997	45.76	5172.69
08/27/1997	43.86	5174.59

Groundwater Hydrograph

Well Identification	MBMG Site #	Well Name or Well Owner
92-34	M:140585	MT DNRC Beaverhead Groundwater Project well 92-34

Location	Ground Surface Elev. (ft)	Measuring Point Elev. (ft)	Well Depth below m.p. (ft)
08S 09W 22 ABAA	5252.40	5253.90	66.25

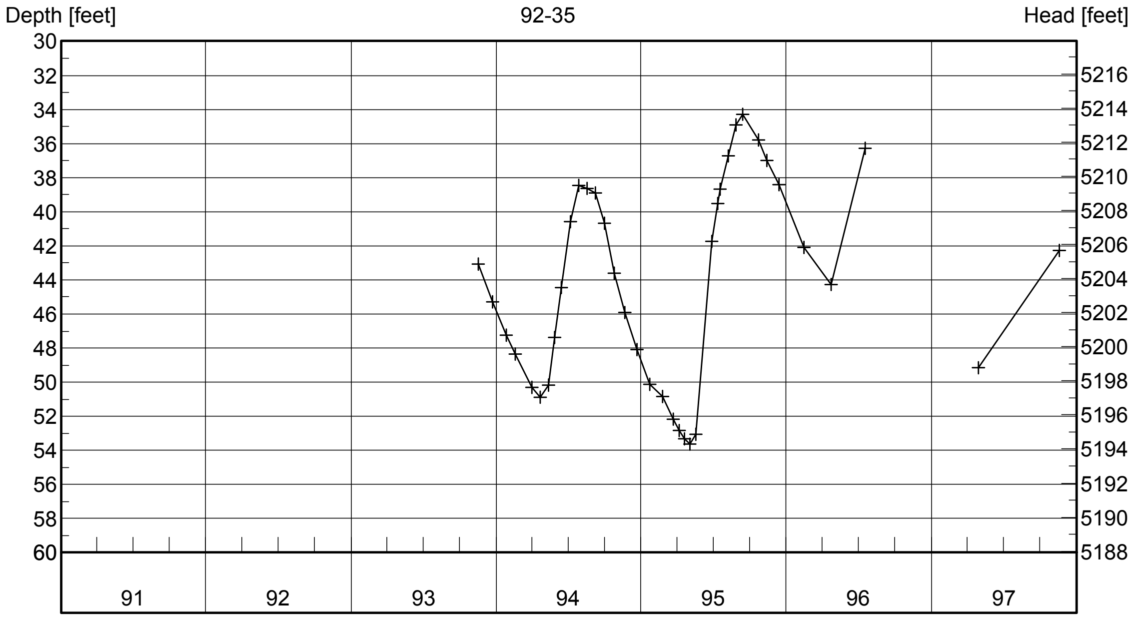


Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/17/1993	48.85	5205.05	04/20/1995	59.16	5194.74						
12/22/1993	51.07	5202.83	05/04/1995	59.49	5194.41						
01/26/1994	53.03	5200.87	05/18/1995	58.93	5194.97						
02/17/1994	54.11	5199.79	06/28/1995	47.85	5206.05						
03/31/1994	56.10	5197.80	07/12/1995	45.49	5208.41						
04/21/1994	56.69	5197.21	07/19/1995	44.63	5209.27						
05/12/1994	56.05	5197.85	08/08/1995	42.70	5211.20						
05/27/1994	53.39	5200.51	08/28/1995	40.81	5213.09						
06/14/1994	50.63	5203.27	09/14/1995	40.12	5213.78						
07/07/1994	46.84	5207.06	10/23/1995	41.47	5212.43						
07/28/1994	44.60	5209.30	11/14/1995	42.63	5211.27						
08/17/1994	44.44	5209.46	12/14/1995	44.10	5209.80						
09/07/1994	44.75	5209.15	02/15/1996	47.89	5206.01						
09/30/1994	46.54	5207.36	04/24/1996	50.08	5203.82						
10/26/1994	49.45	5204.45	05/20/1996	49.13	5204.77						
11/21/1994	51.73	5202.17	06/11/1996	47.24	5206.66						
12/22/1994	53.92	5199.98	07/18/1996	42.35	5211.55						
01/23/1995	55.96	5197.94	04/29/1997	54.94	5198.96						
02/23/1995	56.64	5197.26	07/17/1997	49.49	5204.41						
03/22/1995	57.98	5195.92	11/19/1997	48.09	5205.81						
04/06/1995	58.65	5195.25									

Groundwater Hydrograph

Well Identification 92-35	**MBMG Site #** M:140586	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-35	
Location 08S 09W 22 ABAA	**Ground Surface Elev. (ft)** 5246.28	**Measuring Point Elev. (ft)** 5247.92	**Well Depth below m.p. (ft)** 61.78



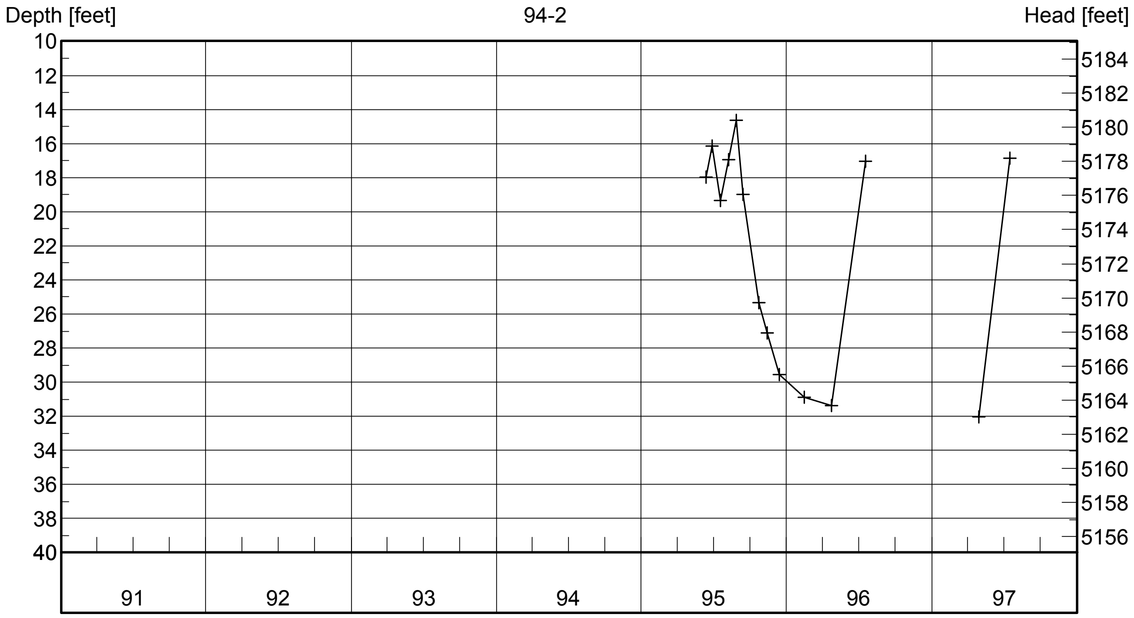
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/17/1993	43.07	5204.85	04/20/1995	53.32	5194.60						
12/22/1993	45.29	5202.63	05/04/1995	53.65	5194.27						
01/26/1994	47.24	5200.68	05/18/1995	53.07	5194.85						
02/17/1994	48.35	5199.57	06/28/1995	41.74	5206.18						
03/31/1994	50.31	5197.61	07/12/1995	39.50	5208.42						
04/21/1994	50.89	5197.03	07/19/1995	38.69	5209.23						
05/12/1994	50.15	5197.77	08/08/1995	36.72	5211.20						
05/27/1994	47.38	5200.54	08/28/1995	34.91	5213.01						
06/14/1994	44.46	5203.46	09/14/1995	34.30	5213.62						
07/07/1994	40.58	5207.34	10/23/1995	35.79	5212.13						
07/28/1994	38.45	5209.47	11/14/1995	36.99	5210.93						
08/17/1994	38.62	5209.30	12/14/1995	38.42	5209.50						
09/07/1994	38.90	5209.02	02/15/1996	42.11	5205.81						
09/30/1994	40.67	5207.25	04/24/1996	44.25	5203.67						
10/26/1994	43.58	5204.34	07/18/1996	36.29	5211.63						
11/21/1994	45.91	5202.01	04/29/1997	49.13	5198.79						
12/22/1994	48.08	5199.84	11/19/1997	42.28	5205.64						
01/23/1995	50.13	5197.79									
02/23/1995	50.82	5197.10									
03/22/1995	52.15	5195.77									
04/06/1995	52.85	5195.07									

Groundwater Hydrograph

Well Identification 94-2	**MBMG Site #** M:149512	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 94-2

Location 07S 09W 36 CCAA	**Ground Surface Elev. (ft)** 5193.19	**Measuring Point Elev. (ft)** 5195.05	**Well Depth below m.p. (ft)** 358.31



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
06/13/1995	17.97	5177.08
06/28/1995	16.16	5178.89
07/19/1995	19.32	5175.73
08/08/1995	16.94	5178.11
08/28/1995	14.63	5180.42
09/14/1995	19.00	5176.05
10/23/1995	25.32	5169.73
11/14/1995	27.12	5167.93
12/14/1995	29.53	5165.52
02/15/1996	30.88	5164.17
04/24/1996	31.39	5163.66
07/18/1996	17.04	5178.01
04/29/1997	32.03	5163.02
07/17/1997	16.84	5178.21

Groundwater Hydrograph

Well Identification
CORNELL

MBMG Site #
M:109658

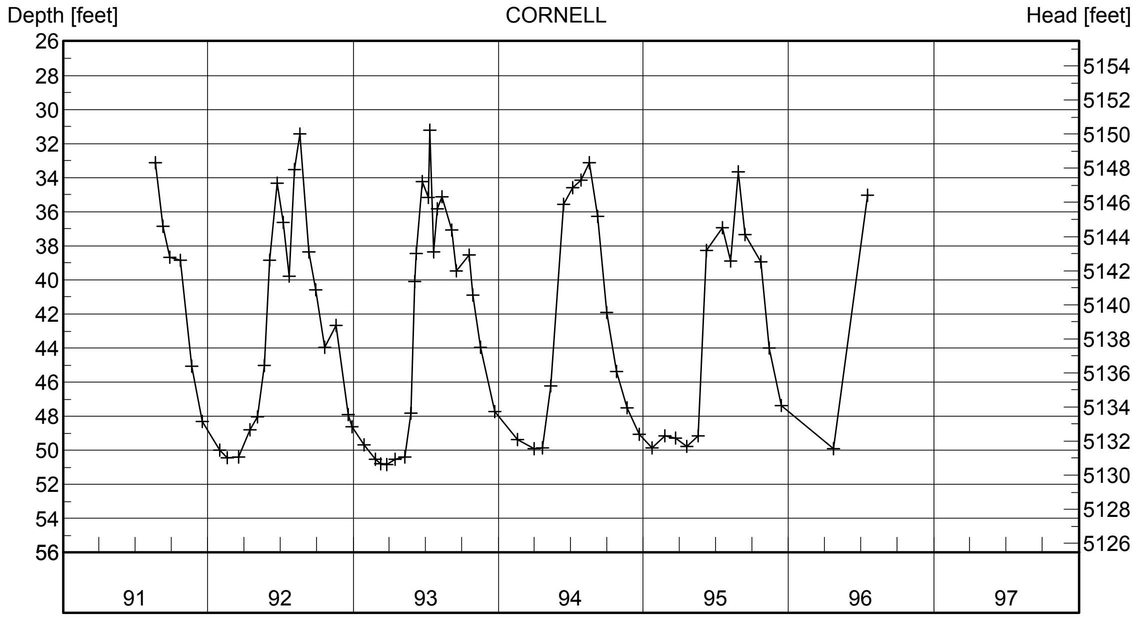
Well Name or Well Owner
Roy Cornell

Location
07S 09W 25 AADD

Ground Surface Elev. (ft)
5178.86

Measuring Point Elev. (ft)
5181.45

Well Depth below m.p. (ft)
69.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
08/21/1991	33.14	5148.31
09/10/1991	36.85	5144.60
09/26/1991	38.67	5142.78
10/23/1991	38.86	5142.59
11/21/1991	45.05	5136.40
12/18/1991	48.28	5133.17
01/30/1992	50.00	5131.45
02/19/1992	50.42	5131.03
03/18/1992	50.40	5131.05
04/16/1992	48.77	5132.68
05/05/1992	48.02	5133.43
05/21/1992	45.03	5136.42
06/04/1992	38.83	5142.62
06/23/1992	34.31	5147.14
07/09/1992	36.62	5144.83
07/23/1992	39.77	5141.68
08/06/1992	33.51	5147.94
08/19/1992	31.45	5150.00
09/10/1992	38.36	5143.09
09/28/1992	40.57	5140.88
10/21/1992	43.96	5137.49
11/18/1992	42.66	5138.79
12/19/1992	47.92	5133.53
12/28/1992	48.59	5132.86
01/27/1993	49.66	5131.79
02/25/1993	50.50	5130.95
03/11/1993	50.79	5130.66
03/26/1993	50.81	5130.64
04/15/1993	50.53	5130.92
05/10/1993	50.37	5131.08
05/25/1993	47.81	5133.64
06/04/1993	40.08	5141.37
06/08/1993	38.45	5143.00
06/24/1993	34.22	5147.23
07/08/1993	35.16	5146.29
07/12/1993	31.21	5150.24
07/21/1993	38.36	5143.09
08/01/1993	35.81	5145.64
08/12/1993	35.12	5146.33
09/06/1993	37.09	5144.36
09/16/1993	39.45	5142.00
10/19/1993	38.52	5142.93
10/29/1993	40.87	5140.58
11/17/1993	43.97	5137.48
12/22/1993	47.72	5133.73
02/17/1994	49.36	5132.09
03/31/1994	49.92	5131.53
04/21/1994	49.85	5131.60
05/12/1994	46.22	5135.23
06/14/1994	35.58	5145.87
07/07/1994	34.57	5146.88
07/28/1994	34.14	5147.31
08/18/1994	33.14	5148.31
09/07/1994	36.26	5145.19
09/30/1994	41.93	5139.52
10/26/1994	45.36	5136.09
11/21/1994	47.52	5133.93
12/22/1994	49.05	5132.40
01/23/1995	49.86	5131.59
02/23/1995	49.14	5132.31
03/22/1995	49.26	5132.19
04/20/1995	49.76	5131.69
05/18/1995	49.16	5132.29
06/08/1995	38.25	5143.20
07/19/1995	36.96	5144.49
08/08/1995	38.88	5142.57
08/28/1995	33.64	5147.81
09/14/1995	37.33	5144.12
10/23/1995	38.93	5142.52
11/14/1995	44.00	5137.45
12/14/1995	47.38	5134.07
04/24/1996	49.89	5131.56
07/18/1996	35.05	5146.40

Groundwater Hydrograph

Well Identification
DOWNEY

MBMG Site #
M:109659

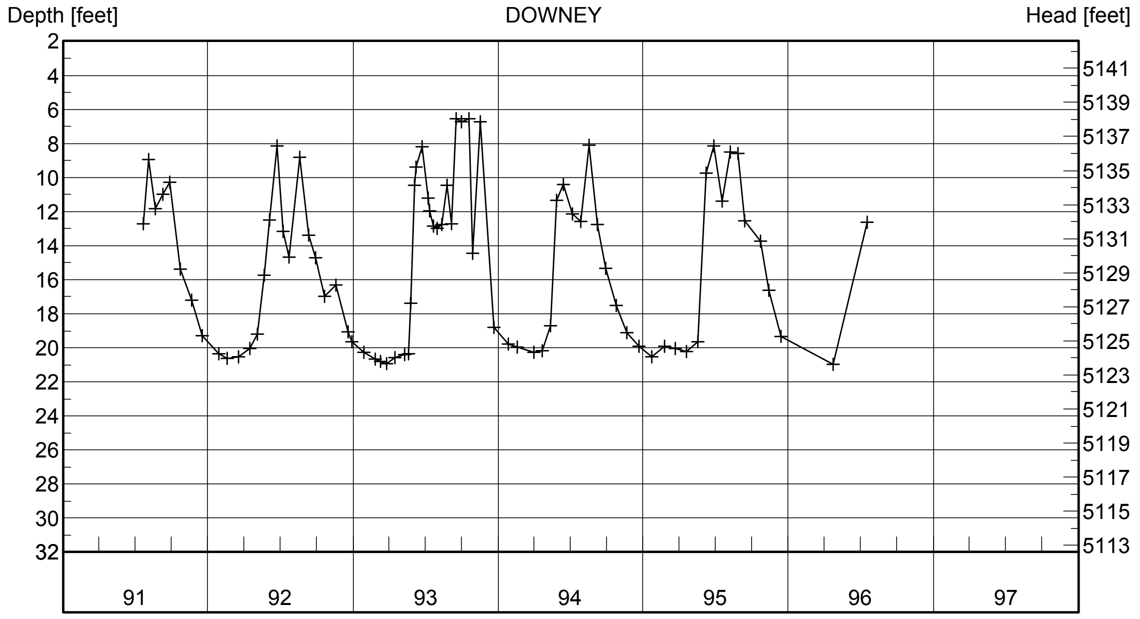
Well Name or Well Owner
Dan Downey

Location
07S 09W 25 ACAB

Ground Surface Elev. (ft)
5143.29

Measuring Point Elev. (ft)
5144.59

Well Depth below m.p. (ft)
40.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/22/1991	12.72	5131.87
08/05/1991	8.95	5135.64
08/21/1991	11.84	5132.75
09/09/1991	10.97	5133.62
09/27/1991	10.28	5134.31
10/23/1991	15.36	5129.23
11/21/1991	17.21	5127.38
12/18/1991	19.30	5125.29
01/29/1992	20.35	5124.24
02/19/1992	20.62	5123.97
03/18/1992	20.55	5124.04
04/16/1992	20.05	5124.54
05/05/1992	19.19	5125.40
05/21/1992	15.75	5128.84
06/04/1992	12.50	5132.09
06/23/1992	8.15	5136.44
07/09/1992	13.17	5131.42
07/23/1992	14.69	5129.90
08/19/1992	8.80	5135.79
09/10/1992	13.40	5131.19
09/28/1992	14.73	5129.86
10/21/1992	16.96	5127.63
11/18/1992	16.32	5128.27
12/19/1992	19.07	5125.52
12/29/1992	19.65	5124.94
01/27/1993	20.24	5124.35
02/25/1993	20.66	5123.93
03/11/1993	20.81	5123.78
03/26/1993	20.93	5123.66
04/15/1993	20.56	5124.03
05/10/1993	20.39	5124.20
05/19/1993	20.36	5124.23
05/25/1993	17.38	5127.21
06/04/1993	10.45	5134.14
06/08/1993	9.40	5135.19
06/24/1993	8.18	5136.41
07/08/1993	11.19	5133.40
07/12/1993	11.97	5132.62
07/21/1993	12.83	5131.76
08/01/1993	12.98	5131.61
08/12/1993	12.77	5131.82
08/25/1993	10.47	5134.12
09/06/1993	12.72	5131.87
09/16/1993	6.56	5138.03
09/30/1993	6.74	5137.85
10/19/1993	6.57	5138.02
10/29/1993	14.44	5130.15
11/17/1993	6.72	5137.87
12/21/1993	18.81	5125.78
01/26/1994	19.76	5124.83
02/17/1994	19.97	5124.62
03/31/1994	20.27	5124.32
04/21/1994	20.18	5124.41
05/12/1994	18.72	5125.87
05/27/1994	11.34	5133.25
06/14/1994	10.42	5134.17
07/07/1994	12.16	5132.43
07/28/1994	12.57	5132.02
08/17/1994	8.08	5136.51
09/07/1994	12.75	5131.84
09/29/1994	15.33	5129.26
10/26/1994	17.50	5127.09
11/21/1994	19.12	5125.47
12/22/1994	19.90	5124.69
01/23/1995	20.52	5124.07
02/24/1995	19.89	5124.70
03/22/1995	20.02	5124.57
04/20/1995	20.20	5124.39
05/18/1995	19.62	5124.97
06/08/1995	9.76	5134.83
06/27/1995	8.16	5136.43
07/19/1995	11.37	5133.22
08/08/1995	8.48	5136.11
08/28/1995	8.58	5136.01
09/14/1995	12.55	5132.04
10/23/1995	13.73	5130.86
11/14/1995	16.64	5127.95
12/14/1995	19.31	5125.28
04/24/1996	20.95	5123.64
07/18/1996	12.61	5131.98

Groundwater Hydrograph

Well Identification EBERLINE

MBMG Site # M:145386

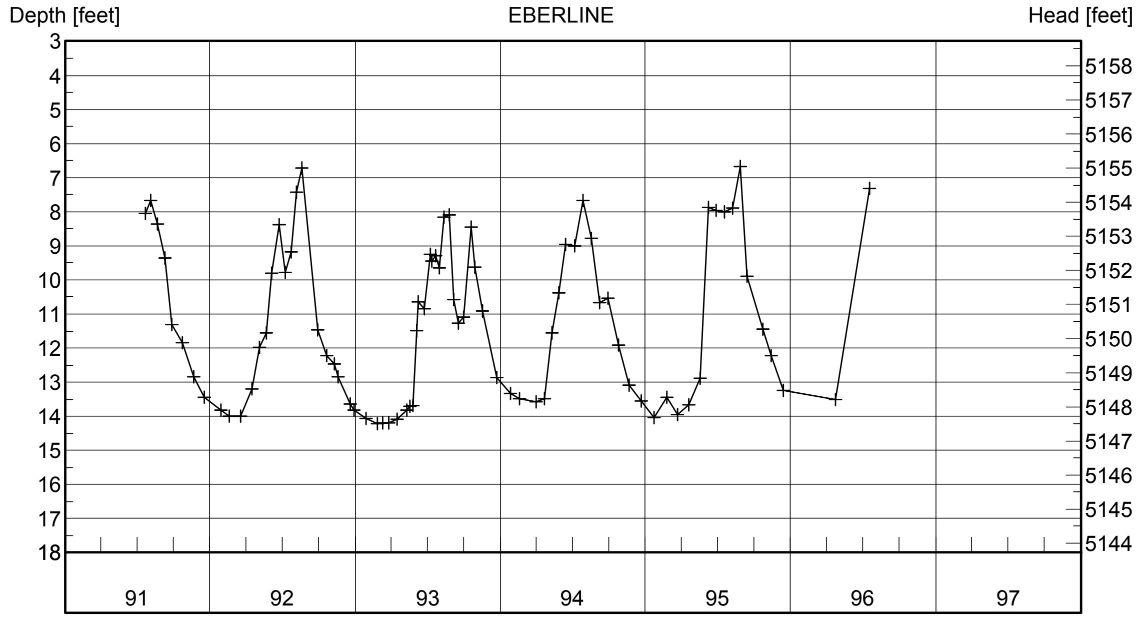
Well Name or Well Owner Rich Eberline

Location 07S 09W 35 ACBD

Ground Surface Elev. (ft) 5160.40

Measuring Point Elev. (ft) 5161.72

Well Depth below m.p. (ft) 40.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/22/1991	8.04	5153.68
08/05/1991	7.66	5154.06
08/21/1991	8.36	5153.36
09/09/1991	9.36	5152.36
09/27/1991	11.31	5150.41
10/23/1991	11.84	5149.88
11/21/1991	12.83	5148.89
12/18/1991	13.45	5148.27
01/29/1992	13.82	5147.90
02/19/1992	14.00	5147.72
03/18/1992	14.00	5147.72
04/16/1992	13.20	5148.52
05/05/1992	11.97	5149.75
05/21/1992	11.56	5150.16
06/04/1992	9.80	5151.92
06/23/1992	8.38	5153.34
07/09/1992	9.78	5151.94
07/23/1992	9.17	5152.55
08/06/1992	7.42	5154.30
08/19/1992	6.71	5155.01
09/28/1992	11.46	5150.26
10/21/1992	12.23	5149.49
11/08/1992	12.47	5149.25
11/18/1992	12.83	5148.89
12/19/1992	13.63	5148.09
12/29/1992	13.81	5147.91
01/27/1993	14.06	5147.66
02/25/1993	14.22	5147.50
03/11/1993	14.20	5147.52
03/26/1993	14.20	5147.52
04/15/1993	14.09	5147.63
05/10/1993	13.81	5147.91
05/18/1993	13.70	5148.02
05/25/1993	13.68	5148.04
06/04/1993	11.48	5150.24
06/08/1993	10.65	5151.07
06/24/1993	10.85	5150.87
07/08/1993	9.24	5152.48
07/12/1993	9.44	5152.28
07/21/1993	9.28	5152.44
08/01/1993	9.65	5152.07
08/12/1993	8.16	5153.56
08/25/1993	8.09	5153.63
09/06/1993	10.58	5151.14
09/16/1993	11.26	5150.46
09/30/1993	11.08	5150.64
10/19/1993	8.44	5153.28
10/29/1993	9.63	5152.09
11/17/1993	10.90	5150.82
12/22/1993	12.86	5148.86
01/26/1994	13.32	5148.40
02/17/1994	13.48	5148.24
03/31/1994	13.58	5148.14
04/21/1994	13.48	5148.24
05/11/1994	11.56	5150.16
05/27/1994	10.38	5151.34
06/14/1994	8.96	5152.76
07/07/1994	9.01	5152.71
07/28/1994	7.67	5154.05
08/17/1994	8.79	5152.93
09/07/1994	10.67	5151.05
09/29/1994	10.53	5151.19
10/26/1994	11.91	5149.81
11/21/1994	13.09	5148.63
12/22/1994	13.54	5148.18
01/23/1995	14.03	5147.69
02/24/1995	13.44	5148.28
03/22/1995	13.96	5147.76
04/20/1995	13.66	5148.06
05/18/1995	12.89	5148.83
06/08/1995	7.86	5153.86
06/27/1995	7.96	5153.76
07/19/1995	8.01	5153.71
08/08/1995	7.89	5153.83
08/28/1995	6.67	5155.05
09/14/1995	9.90	5151.82
10/23/1995	11.45	5150.27
11/14/1995	12.21	5149.51
12/14/1995	13.25	5148.47
04/24/1996	13.50	5148.22
07/18/1996	7.31	5154.41

Groundwater Hydrograph

Well Identification
GAASCHD

MBMG Site #
M:145391

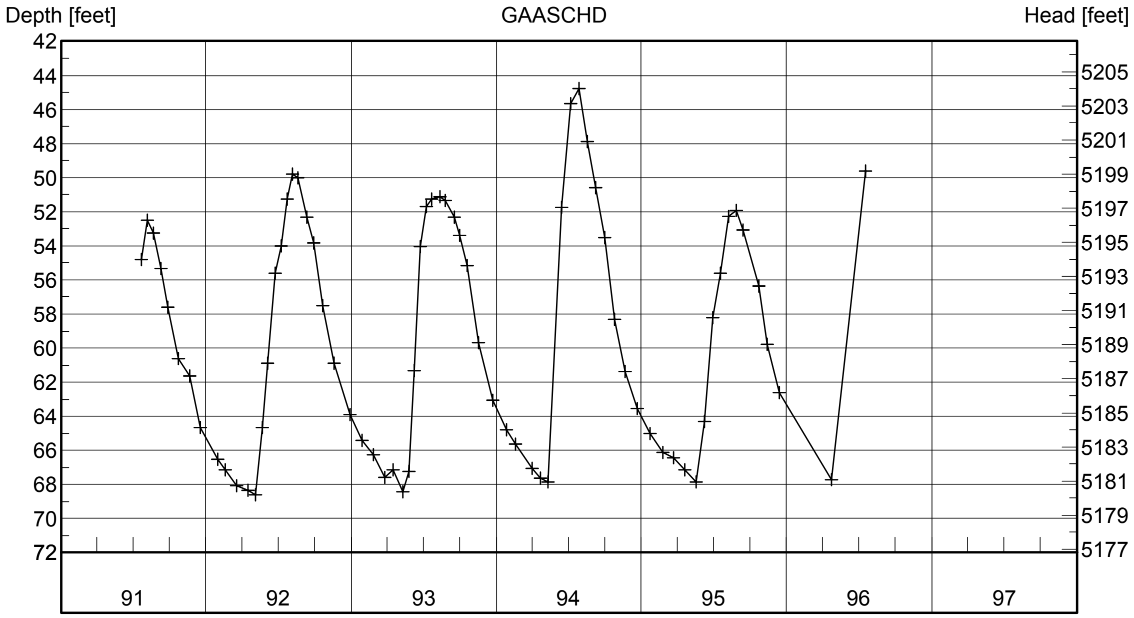
Well Name or Well Owner
Dorothy Gaasch

Location
07S 08W 30 DCDA

Ground Surface Elev. (ft)
5248.02

Measuring Point Elev. (ft)
5248.79

Well Depth below m.p. (ft)
150.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/22/1991	54.80	5193.99
08/07/1991	52.49	5196.30
08/21/1991	53.24	5195.55
09/10/1991	55.34	5193.45
09/26/1991	57.61	5191.18
10/23/1991	60.62	5188.17
11/21/1991	61.65	5187.14
12/18/1991	64.65	5184.14
01/30/1992	66.50	5182.29
02/19/1992	67.16	5181.63
03/18/1992	68.08	5180.71
04/16/1992	68.34	5180.45
05/05/1992	68.62	5180.17
05/21/1992	64.66	5184.13
06/04/1992	60.88	5187.91
06/23/1992	55.58	5193.21
07/09/1992	54.02	5194.77
07/23/1992	51.27	5197.52
08/06/1992	49.81	5198.98
08/19/1992	50.02	5198.77
09/10/1992	52.33	5196.46
09/28/1992	53.84	5194.95
10/21/1992	57.49	5191.30
11/18/1992	60.89	5187.90
12/28/1992	63.92	5184.87
01/27/1993	65.43	5183.36
02/25/1993	66.25	5182.54
03/26/1993	67.57	5181.22
04/15/1993	67.16	5181.63
05/10/1993	68.42	5180.37
05/25/1993	67.25	5181.54
06/08/1993	61.32	5187.47
06/24/1993	54.04	5194.75
07/08/1993	51.71	5197.08
07/21/1993	51.24	5197.55
08/12/1993	51.12	5197.67
08/25/1993	51.35	5197.44
09/16/1993	52.30	5196.49
09/30/1993	53.40	5195.39
10/19/1993	55.16	5193.63
11/17/1993	59.70	5189.09
12/22/1993	63.04	5185.75
01/26/1994	64.79	5184.00
02/17/1994	65.63	5183.16
03/31/1994	67.06	5181.73
04/21/1994	67.65	5181.14
05/11/1994	67.85	5180.94
06/14/1994	51.73	5197.06
07/07/1994	45.65	5203.14
07/28/1994	44.79	5204.00
08/17/1994	47.88	5200.91
09/07/1994	50.58	5198.21
09/30/1994	53.50	5195.29
10/26/1994	58.30	5190.49
11/21/1994	61.37	5187.42
12/22/1994	63.54	5185.25
01/23/1995	65.03	5183.76
02/23/1995	66.10	5182.69
03/22/1995	66.43	5182.36
04/20/1995	67.15	5181.64
05/18/1995	67.83	5180.96
06/08/1995	64.30	5184.49
06/29/1995	58.24	5190.55
07/19/1995	55.62	5193.17
08/08/1995	52.26	5196.53
08/28/1995	51.90	5196.89
09/14/1995	53.07	5195.72
10/23/1995	56.37	5192.42
11/14/1995	59.77	5189.02
12/14/1995	62.60	5186.19
04/24/1996	67.70	5181.09
07/18/1996	49.60	5199.19

Groundwater Hydrograph

Well Identification
GUNDREAM

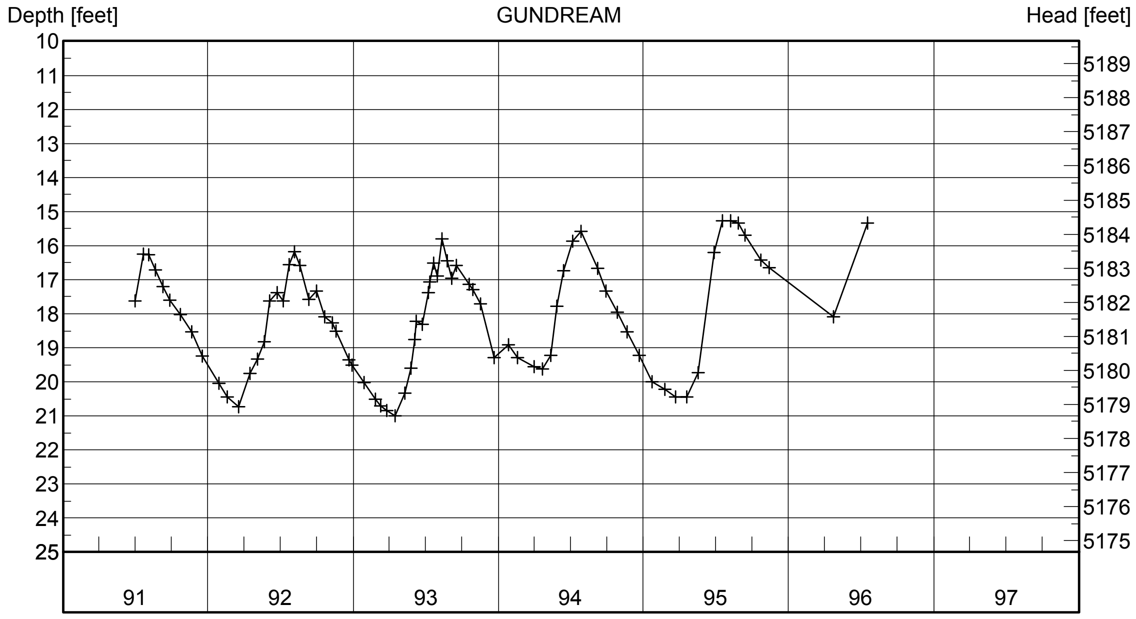
MBMG Site #
M:145388

Well Name or Well Owner
Gund-Ream Ranch cabin well

Location
08S 09W 03 DADD

Ground Surface Elev. (ft)
5197.52

Measuring Point Elev. (ft)
5199.16



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/02/1991	17.62	5181.54
07/22/1991	16.24	5182.92
08/05/1991	16.27	5182.89
08/21/1991	16.71	5182.45
09/09/1991	17.21	5181.95
09/27/1991	17.59	5181.57
10/23/1991	18.02	5181.14
11/21/1991	18.53	5180.63
12/18/1991	19.24	5179.92
01/29/1992	20.04	5179.12
02/19/1992	20.44	5178.72
03/18/1992	20.73	5178.43
04/16/1992	19.75	5179.41
05/05/1992	19.34	5179.82
05/21/1992	18.82	5180.34
06/04/1992	17.62	5181.54
06/23/1992	17.38	5181.78
07/09/1992	17.62	5181.54
07/23/1992	16.56	5182.60
08/06/1992	16.19	5182.97
08/19/1992	16.58	5182.58
09/10/1992	17.57	5181.59
09/29/1992	17.34	5181.82
10/21/1992	18.08	5181.08
11/08/1992	18.26	5180.90
11/18/1992	18.52	5180.64
12/20/1992	19.35	5179.81
12/29/1992	19.50	5179.66
01/27/1993	20.02	5179.14
02/25/1993	20.50	5178.66
03/11/1993	20.71	5178.45
03/26/1993	20.84	5178.32
04/15/1993	20.99	5178.17
05/10/1993	20.33	5178.83
05/25/1993	19.60	5179.56
06/04/1993	18.75	5180.41
06/08/1993	18.23	5180.93
06/24/1993	18.32	5180.84
07/08/1993	17.38	5181.78
07/12/1993	17.06	5182.10
07/21/1993	16.51	5182.65
08/01/1993	16.88	5182.28
08/12/1993	15.80	5183.36
08/25/1993	16.45	5182.71
09/06/1993	16.96	5182.20
09/16/1993	16.59	5182.57
10/19/1993	17.14	5182.02
10/29/1993	17.28	5181.88
11/17/1993	17.71	5181.45
12/21/1993	19.29	5179.87
01/26/1994	18.90	5180.26
02/17/1994	19.29	5179.87
03/31/1994	19.56	5179.60
04/21/1994	19.62	5179.54
05/12/1994	19.22	5179.94
05/27/1994	17.78	5181.38
06/14/1994	16.73	5182.43
07/07/1994	15.86	5183.30
07/27/1994	15.58	5183.58
09/07/1994	16.66	5182.50
09/29/1994	17.33	5181.83
10/27/1994	17.95	5181.21
11/21/1994	18.53	5180.63
12/22/1994	19.21	5179.95
01/23/1995	20.00	5179.16
02/23/1995	20.22	5178.94
03/22/1995	20.43	5178.73
04/20/1995	20.44	5178.72
05/18/1995	19.74	5179.42
06/28/1995	16.21	5182.95
07/19/1995	15.26	5183.90
08/08/1995	15.28	5183.88
08/28/1995	15.33	5183.83
09/14/1995	15.70	5183.46
10/23/1995	16.43	5182.73
11/14/1995	16.65	5182.51
04/24/1996	18.09	5181.07
07/18/1996	15.34	5183.82

Groundwater Hydrograph

Well Identification MITCHSTK

MBMG Site # M:145390

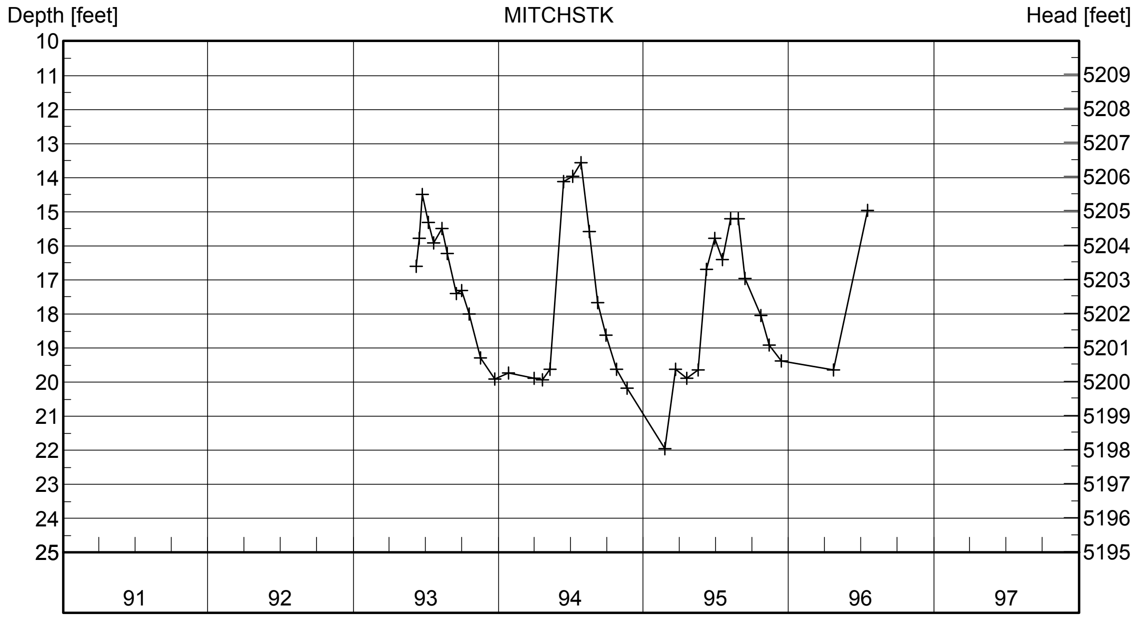
Well Name or Well Owner Tom Mitchell stock well

Location 07S 08W 31 BCAD

Ground Surface Elev. (ft) 5217.74

Measuring Point Elev. (ft) 5219.97

Well Depth below m.p. (ft) 93.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
06/08/1993	16.60	5203.37
06/15/1993	15.78	5204.19
06/24/1993	14.50	5205.47
07/08/1993	15.31	5204.66
07/21/1993	15.92	5204.05
08/12/1993	15.50	5204.47
08/25/1993	16.23	5203.74
09/16/1993	17.40	5202.57
09/30/1993	17.32	5202.65
10/19/1993	17.99	5201.98
11/17/1993	19.29	5200.68
12/22/1993	19.90	5200.07
01/26/1994	19.74	5200.23
03/31/1994	19.89	5200.08
04/21/1994	19.94	5200.03
05/11/1994	19.63	5200.34
06/14/1994	14.11	5205.86
07/07/1994	13.95	5206.02
07/27/1994	13.56	5206.41
08/17/1994	15.59	5204.38
09/07/1994	17.66	5202.31
09/29/1994	18.61	5201.36
10/26/1994	19.62	5200.35
11/21/1994	20.18	5199.79
02/24/1995	21.95	5198.02
03/22/1995	19.63	5200.34
04/20/1995	19.88	5200.09
05/18/1995	19.64	5200.33
06/08/1995	16.69	5203.28
06/29/1995	15.77	5204.20
07/19/1995	16.40	5203.57
08/08/1995	15.21	5204.76
08/28/1995	15.20	5204.77
09/14/1995	16.96	5203.01
10/23/1995	18.05	5201.92
11/14/1995	18.90	5201.07
12/14/1995	19.38	5200.59
04/24/1996	19.65	5200.32
07/18/1996	14.97	5205.00

Groundwater Hydrograph

Well Identification PETERSEN

MBMG Site # M:109717

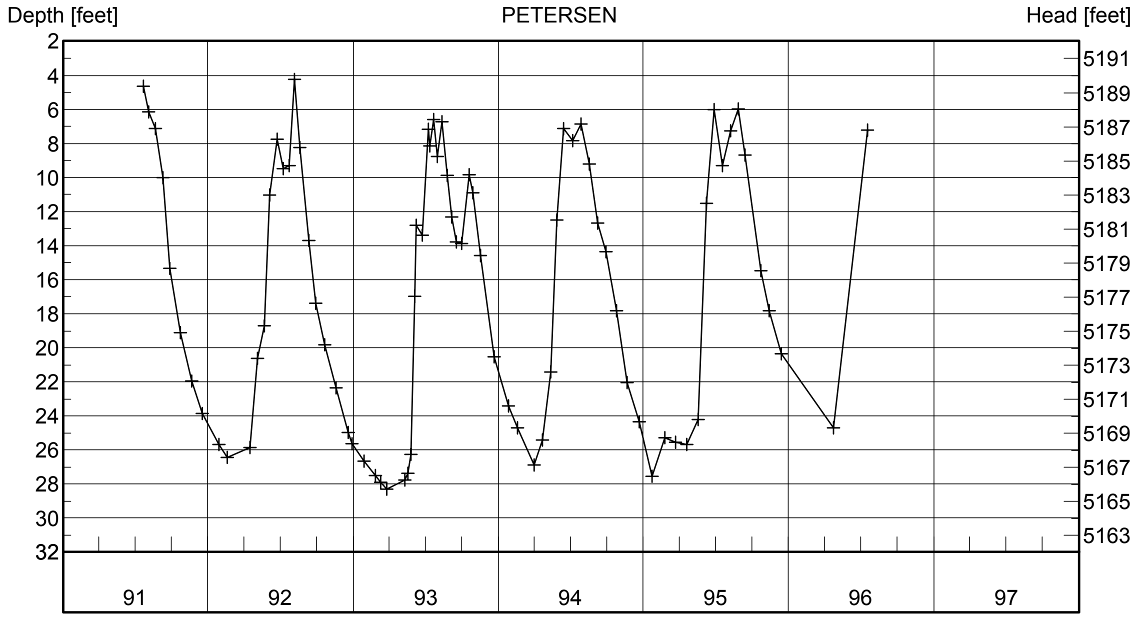
Well Name or Well Owner Jim Petersen domestic well @ old house

Location 07S 09W 36 CDBB

Ground Surface Elev. (ft) 5193.05

Measuring Point Elev. (ft) 5194.02

Well Depth below m.p. (ft) 41.00



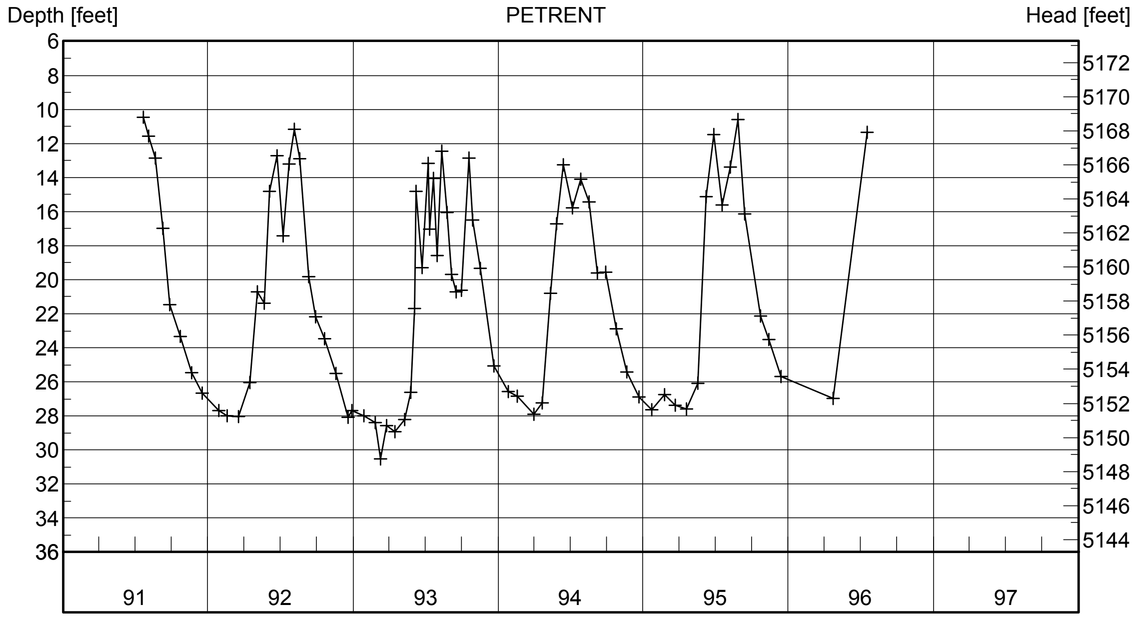
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/22/1991	4.63	5189.39
08/05/1991	6.15	5187.87
08/21/1991	7.12	5186.90
09/09/1991	10.01	5184.01
09/27/1991	15.34	5178.68
10/23/1991	19.09	5174.93
11/21/1991	21.94	5172.08
12/18/1991	23.87	5170.15
01/29/1992	25.68	5168.34
02/19/1992	26.44	5167.58
04/16/1992	25.85	5168.17
05/05/1992	20.63	5173.39
05/21/1992	18.73	5175.29
06/04/1992	11.03	5182.99
06/23/1992	7.74	5186.28
07/09/1992	9.47	5184.55
07/23/1992	9.28	5184.74
08/06/1992	4.23	5189.79
08/19/1992	8.22	5185.80
09/10/1992	13.68	5180.34
09/28/1992	17.36	5176.66
10/21/1992	19.81	5174.21
11/18/1992	22.35	5171.67
12/19/1992	24.97	5169.05
12/29/1992	25.62	5168.40
01/27/1993	26.67	5167.35
02/25/1993	27.51	5166.51
03/11/1993	27.90	5166.12
03/26/1993	28.28	5165.74
05/10/1993	27.76	5166.26
05/18/1993	27.37	5166.65
05/25/1993	26.27	5167.75
06/04/1993	16.97	5177.05
06/08/1993	12.80	5181.22
06/24/1993	13.40	5180.62
07/08/1993	7.19	5186.83
07/12/1993	8.14	5185.88
07/21/1993	6.58	5187.44
08/01/1993	8.76	5185.26
08/12/1993	6.74	5187.28
08/25/1993	9.86	5184.16
09/06/1993	12.34	5181.68
09/16/1993	13.77	5180.25
09/30/1993	13.85	5180.17
10/19/1993	9.85	5184.17
10/29/1993	10.92	5183.10
11/17/1993	14.59	5179.43
12/21/1993	20.54	5173.48
01/26/1994	23.41	5170.61
02/17/1994	24.71	5169.31
03/31/1994	26.88	5167.14
04/21/1994	25.41	5168.61
05/12/1994	21.43	5172.59
05/27/1994	12.48	5181.54
06/14/1994	7.12	5186.90
07/07/1994	7.82	5186.20
07/28/1994	6.86	5187.16
08/17/1994	9.23	5184.79
09/07/1994	12.66	5181.36
09/29/1994	14.38	5179.64
10/26/1994	17.82	5176.20
11/21/1994	22.04	5171.98
12/22/1994	24.36	5169.66
01/23/1995	27.52	5166.50
02/24/1995	25.28	5168.74
03/22/1995	25.56	5168.46
04/20/1995	25.66	5168.36
05/18/1995	24.20	5169.82
06/08/1995	11.51	5182.51
06/27/1995	6.00	5188.02
07/19/1995	9.28	5184.74
08/08/1995	7.26	5186.76
08/28/1995	5.99	5188.03
09/14/1995	8.68	5185.34
10/23/1995	15.48	5178.54
11/14/1995	17.81	5176.21
12/14/1995	20.36	5173.66
04/24/1996	24.72	5169.30
07/18/1996	7.20	5186.82

Groundwater Hydrograph

Well Identification **PETRENT**	**MBMG Site #** **M:109715**	**Well Name or Well Owner** **Jim Petersen well @ rental house**

Location **07S 09W 36 BCCC**	**Ground Surface Elev. (ft)** **5179.26**	**Measuring Point Elev. (ft)** **5179.26**	**Well Depth below m.p. (ft)** **42.00**



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/22/1991	10.45	5168.81
08/05/1991	11.55	5167.71
08/21/1991	12.87	5166.39
09/09/1991	16.98	5162.28
09/27/1991	21.47	5157.79
10/23/1991	23.33	5155.93
11/20/1991	25.45	5153.81
12/18/1991	26.67	5152.59
01/29/1992	27.68	5151.58
02/19/1992	27.99	5151.27
03/18/1992	28.02	5151.24
04/16/1992	26.05	5153.21
05/05/1992	20.70	5158.56
05/21/1992	21.36	5157.90
06/04/1992	14.82	5164.44
06/23/1992	12.73	5166.53
07/09/1992	17.43	5161.83
07/23/1992	13.22	5166.04
08/06/1992	11.19	5168.07
08/19/1992	12.89	5166.37
09/10/1992	19.84	5159.42
09/28/1992	22.16	5157.10
10/21/1992	23.48	5155.78
11/18/1992	25.52	5153.74
12/19/1992	28.07	5151.19
12/29/1992	27.70	5151.56
01/27/1993	27.97	5151.29
02/25/1993	28.38	5150.88
03/11/1993	30.50	5148.76
03/26/1993	28.57	5150.69
04/15/1993	28.94	5150.32
05/10/1993	28.19	5151.07
05/25/1993	26.60	5152.66
06/04/1993	21.70	5157.56
06/08/1993	14.82	5164.44
06/24/1993	19.29	5159.97
07/08/1993	13.15	5166.11
07/12/1993	17.04	5162.22
07/21/1993	14.04	5165.22
08/01/1993	18.60	5160.66
08/12/1993	12.47	5166.79
08/25/1993	16.06	5163.20
09/06/1993	19.67	5159.59
09/16/1993	20.70	5158.56
09/30/1993	20.61	5158.65
10/19/1993	12.85	5166.41
10/29/1993	16.50	5162.76
11/17/1993	19.35	5159.91
12/21/1993	25.04	5154.22
01/26/1994	26.59	5152.67
02/17/1994	26.85	5152.41
03/31/1994	27.89	5151.37
04/21/1994	27.25	5152.01
05/12/1994	20.80	5158.46
05/27/1994	16.72	5162.54
06/14/1994	13.27	5165.99
07/07/1994	15.78	5163.48
07/28/1994	14.10	5165.16
08/17/1994	15.42	5163.84
09/07/1994	19.59	5159.67
09/29/1994	19.54	5159.72
10/26/1994	22.87	5156.39
11/21/1994	25.42	5153.84
12/22/1994	26.90	5152.36
01/23/1995	27.63	5151.63
02/24/1995	26.76	5152.50
03/22/1995	27.38	5151.88
04/20/1995	27.57	5151.69
05/18/1995	26.07	5153.19
06/08/1995	15.10	5164.16
06/27/1995	11.50	5167.76
07/19/1995	15.62	5163.64
08/08/1995	13.38	5165.88
08/28/1995	10.61	5168.65
09/14/1995	16.12	5163.14
10/23/1995	22.12	5157.14
11/14/1995	23.50	5155.76
12/14/1995	25.69	5153.57
04/24/1996	26.99	5152.27
07/18/1996	11.35	5167.91

Groundwater Hydrograph

Well Identification
PILON

MBMG Site #
M:109713

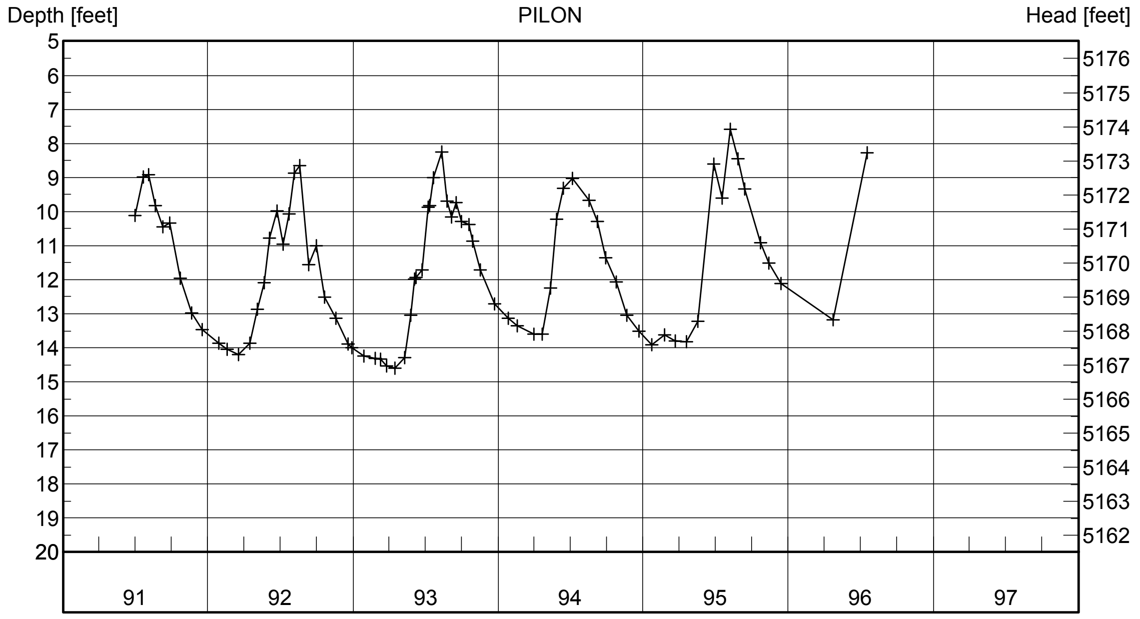
Well Name or Well Owner
Dan Pilon

Location
07S 09W 35 CDCC

Ground Surface Elev. (ft)
5179.64

Measuring Point Elev. (ft)
5181.01

Well Depth below m.p. (ft)
30.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
07/02/1991	10.12	5170.89	09/10/1992	11.56	5169.45	09/06/1993	10.16	5170.85	01/23/1995	13.92	5167.09
07/22/1991	8.98	5172.03	09/29/1992	11.01	5170.00	09/16/1993	9.73	5171.28	02/23/1995	13.61	5167.40
08/05/1991	8.91	5172.10	10/21/1992	12.52	5168.49	09/30/1993	10.30	5170.71	03/22/1995	13.80	5167.21
08/21/1991	9.82	5171.19	11/18/1992	13.13	5167.88	10/19/1993	10.37	5170.64	04/20/1995	13.82	5167.19
09/09/1991	10.45	5170.56	12/19/1992	13.88	5167.13	10/29/1993	10.88	5170.13	05/18/1995	13.23	5167.78
09/27/1991	10.34	5170.67	12/29/1992	14.00	5167.01	11/17/1993	11.71	5169.30	06/28/1995	8.61	5172.40
10/23/1991	11.95	5169.06	01/27/1993	14.25	5166.76	12/22/1993	12.72	5168.29	07/19/1995	9.60	5171.41
11/21/1991	12.97	5168.04	02/25/1993	14.30	5166.71	01/26/1994	13.14	5167.87	08/08/1995	7.59	5173.42
12/18/1991	13.47	5167.54	03/11/1993	14.32	5166.69	02/17/1994	13.36	5167.65	08/28/1995	8.46	5172.55
01/29/1992	13.87	5167.14	03/26/1993	14.53	5166.48	03/31/1994	13.60	5167.41	09/14/1995	9.33	5171.68
02/19/1992	14.04	5166.97	04/15/1993	14.59	5166.42	04/21/1994	13.60	5167.41	10/23/1995	10.92	5170.09
03/18/1992	14.20	5166.81	05/10/1993	14.29	5166.72	05/12/1994	12.24	5168.77	11/14/1995	11.51	5169.50
04/16/1992	13.87	5167.14	05/25/1993	13.04	5167.97	05/27/1994	10.22	5170.79	12/14/1995	12.11	5168.90
05/05/1992	12.87	5168.14	06/04/1993	11.97	5169.04	06/14/1994	9.31	5171.70	04/24/1996	13.17	5167.84
05/21/1992	12.10	5168.91	06/08/1993	11.93	5169.08	07/07/1994	9.02	5171.99	07/18/1996	8.28	5172.73
06/04/1992	10.79	5170.22	06/24/1993	11.71	5169.30	08/17/1994	9.66	5171.35			
06/23/1992	9.99	5171.02	07/08/1993	9.88	5171.13	09/07/1994	10.29	5170.72			
07/09/1992	10.96	5170.05	07/12/1993	9.83	5171.18	09/29/1994	11.36	5169.65			
07/23/1992	10.07	5170.94	07/21/1993	9.01	5172.00	10/26/1994	12.07	5168.94			
08/06/1992	8.88	5172.13	08/12/1993	8.25	5172.76	11/21/1994	13.04	5167.97			
08/19/1992	8.64	5172.37	08/25/1993	9.69	5171.32	12/22/1994	13.50	5167.51			

Groundwater Hydrograph

Well Identification
REYNOLDS

MBMG Site #
M:109662

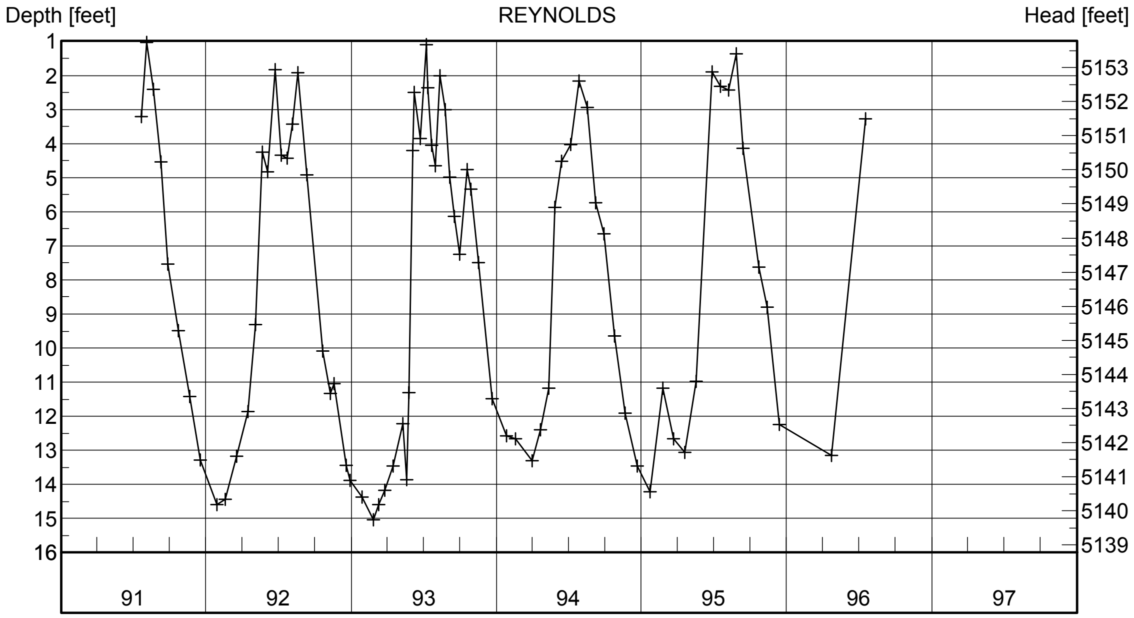
Well Name or Well Owner
Tom Reynolds

Location
07S 09W 25 DCCC

Ground Surface Elev. (ft)
5156.70

Measuring Point Elev. (ft)
5154.77

Well Depth below m.p. (ft)
26.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/22/1991	3.20	5151.57
08/05/1991	1.04	5153.73
08/21/1991	2.42	5152.35
09/09/1991	4.55	5150.22
09/27/1991	7.53	5147.24
10/23/1991	9.48	5145.29
11/20/1991	11.41	5143.36
12/18/1991	13.28	5141.49
01/29/1992	14.58	5140.19
02/19/1992	14.44	5140.33
03/18/1992	13.18	5141.59
04/16/1992	11.86	5142.91
05/05/1992	9.32	5145.45
05/21/1992	4.25	5150.52
06/04/1992	4.82	5149.95
06/23/1992	1.84	5152.93
07/09/1992	4.33	5150.44
07/23/1992	4.42	5150.35
08/06/1992	3.42	5151.35
08/19/1992	1.92	5152.85
09/10/1992	4.92	5149.85
10/21/1992	10.08	5144.69
11/08/1992	11.34	5143.43
11/18/1992	11.04	5143.73
12/19/1992	13.43	5141.34
12/29/1992	13.89	5140.88
01/27/1993	14.38	5140.39
02/25/1993	15.03	5139.74
03/11/1993	14.58	5140.19
03/26/1993	14.17	5140.60
04/15/1993	13.47	5141.30
05/10/1993	12.21	5142.56
05/19/1993	13.85	5140.92
05/25/1993	11.31	5143.46
06/04/1993	4.20	5150.57
06/08/1993	2.49	5152.28
06/24/1993	3.85	5150.92
07/08/1993	1.10	5153.67
07/12/1993	2.36	5152.41
07/21/1993	4.06	5150.71
08/01/1993	4.65	5150.12
08/12/1993	2.00	5152.77
08/25/1993	3.01	5151.76
09/06/1993	4.98	5149.79
09/16/1993	6.13	5148.64
09/30/1993	7.24	5147.53
10/19/1993	4.76	5150.01
10/29/1993	5.33	5149.44
11/17/1993	7.49	5147.28
12/21/1993	11.49	5143.28
01/26/1994	12.58	5142.19
02/17/1994	12.65	5142.12
03/31/1994	13.31	5141.46
04/21/1994	12.39	5142.38
05/12/1994	11.18	5143.59
05/27/1994	5.87	5148.90
06/14/1994	4.51	5150.26
07/07/1994	4.02	5150.75
07/28/1994	2.16	5152.61
08/17/1994	2.94	5151.83
09/07/1994	5.74	5149.03
09/29/1994	6.65	5148.12
10/26/1994	9.64	5145.13
11/21/1994	11.91	5142.86
12/22/1994	13.45	5141.32
01/23/1995	14.21	5140.56
02/24/1995	11.18	5143.59
03/22/1995	12.67	5142.10
04/20/1995	13.05	5141.72
05/18/1995	10.97	5143.80
06/27/1995	1.90	5152.87
07/19/1995	2.32	5152.45
08/08/1995	2.43	5152.34
08/28/1995	1.36	5153.41
09/14/1995	4.15	5150.62
10/23/1995	7.62	5147.15
11/14/1995	8.80	5145.97
12/14/1995	12.24	5142.53
04/24/1996	13.14	5141.63
07/18/1996	3.27	5151.50

Groundwater Hydrograph

Well Identification
SCHUETT

MBMG Site #
M:109891

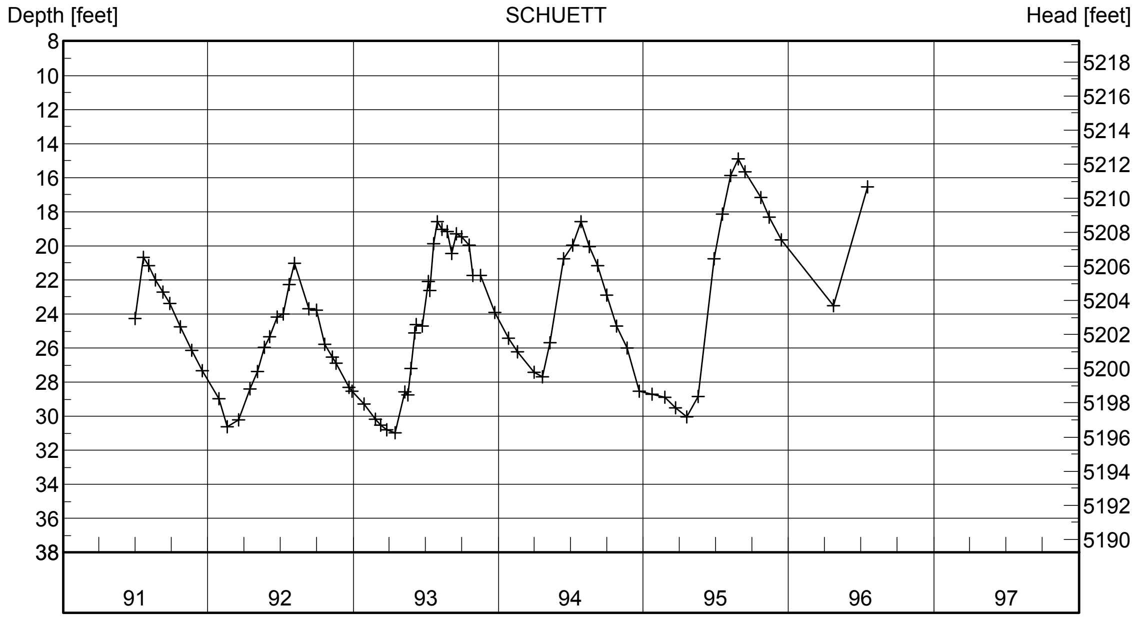
Well Name or Well Owner
David Schuett well @ rental house,2925 Carrigan Ln

Location
08S 09W 11 BDDB

Ground Surface Elev. (ft)
5232.78

Measuring Point Elev. (ft)
5227.21

Well Depth below m.p. (ft)
54.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/02/1991	24.27	5202.94
07/22/1991	20.68	5206.53
08/05/1991	21.15	5206.06
08/22/1991	22.01	5205.20
09/09/1991	22.71	5204.50
09/27/1991	23.38	5203.83
10/23/1991	24.76	5202.45
11/21/1991	26.14	5201.07
12/18/1991	27.34	5199.87
01/29/1992	28.98	5198.23
02/19/1992	30.61	5196.60
03/18/1992	30.21	5197.00
04/16/1992	28.40	5198.81
05/05/1992	27.37	5199.84
05/21/1992	25.95	5201.26
06/04/1992	25.32	5201.89
06/23/1992	24.16	5203.05
07/09/1992	24.02	5203.19
07/23/1992	22.26	5204.95
08/06/1992	21.02	5206.19
09/10/1992	23.67	5203.54
09/29/1992	23.76	5203.45
10/21/1992	25.76	5201.45
11/08/1992	26.52	5200.69
11/18/1992	26.88	5200.33
12/20/1992	28.29	5198.92
12/29/1992	28.51	5198.70
01/27/1993	29.30	5197.91
02/25/1993	30.18	5197.03
03/11/1993	30.51	5196.70
03/26/1993	30.81	5196.40
04/15/1993	30.97	5196.24
05/10/1993	28.55	5198.66
05/18/1993	28.75	5198.46
05/25/1993	27.18	5200.03
06/04/1993	25.12	5202.09
06/08/1993	24.60	5202.61
06/24/1993	24.71	5202.50
07/08/1993	22.11	5205.10
07/12/1993	22.63	5204.58
07/21/1993	19.88	5207.33
08/01/1993	18.60	5208.61
08/12/1993	19.03	5208.18
08/25/1993	19.17	5208.04
09/06/1993	20.45	5206.76
09/16/1993	19.31	5207.90
09/30/1993	19.47	5207.74
10/19/1993	19.95	5207.26
10/29/1993	21.72	5205.49
11/17/1993	21.74	5205.47
12/22/1993	23.90	5203.31
01/26/1994	25.42	5201.79
02/17/1994	26.23	5200.98
03/31/1994	27.42	5199.79
04/21/1994	27.70	5199.51
05/11/1994	25.68	5201.53
06/14/1994	20.77	5206.44
07/07/1994	19.94	5207.27
07/28/1994	18.59	5208.62
08/18/1994	20.05	5207.16
09/07/1994	21.15	5206.06
09/30/1994	22.90	5204.31
10/26/1994	24.73	5202.48
11/21/1994	26.00	5201.21
12/22/1994	28.52	5198.69
01/23/1995	28.70	5198.51
02/23/1995	28.88	5198.33
03/22/1995	29.52	5197.69
04/20/1995	30.04	5197.17
05/18/1995	28.85	5198.36
06/28/1995	20.74	5206.47
07/19/1995	18.12	5209.09
08/08/1995	15.86	5211.35
08/28/1995	14.92	5212.29
09/14/1995	15.64	5211.57
10/23/1995	17.17	5210.04
11/14/1995	18.33	5208.88
12/14/1995	19.65	5207.56
04/24/1996	23.53	5203.68
07/18/1996	16.55	5210.66

Groundwater Hydrograph

Well Identification
SVENDSEN

MBMG Site #
M:121424

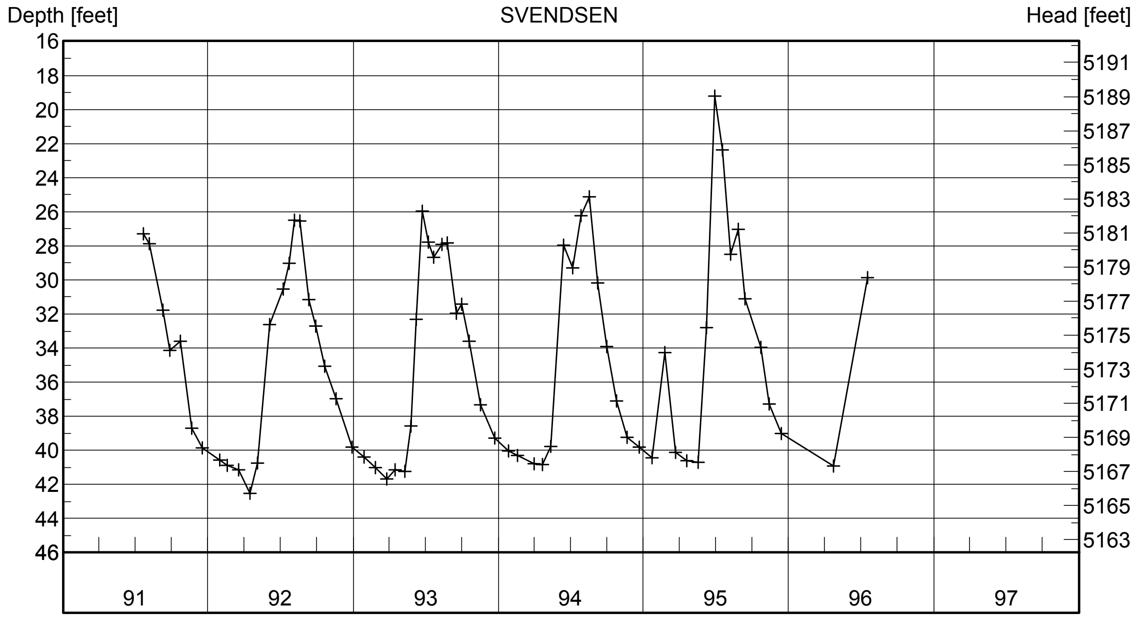
Well Name or Well Owner
Ed Svendsen

Location
07S 08W 30 CADC

Ground Surface Elev. (ft)
5205.77

Measuring Point Elev. (ft)
5208.24

Well Depth below m.p. (ft)
130.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/22/1991	27.28	5180.96
08/07/1991	27.89	5180.35
09/10/1991	31.78	5176.46
09/26/1991	34.12	5174.12
10/23/1991	33.59	5174.65
11/21/1991	38.70	5169.54
12/18/1991	39.85	5168.39
01/30/1992	40.56	5167.68
02/19/1992	40.86	5167.38
03/18/1992	41.16	5167.08
04/16/1992	42.50	5165.74
05/05/1992	40.73	5167.51
06/04/1992	32.62	5175.62
07/09/1992	30.52	5177.72
07/23/1992	29.02	5179.22
08/06/1992	26.49	5181.75
08/19/1992	26.54	5181.70
09/10/1992	31.14	5177.10
09/28/1992	32.72	5175.52
10/21/1992	35.05	5173.19
11/18/1992	36.97	5171.27
12/28/1992	39.80	5168.44
01/27/1993	40.38	5167.86
02/25/1993	41.02	5167.22
03/26/1993	41.68	5166.56
04/15/1993	41.16	5167.08
05/10/1993	41.22	5167.02
05/25/1993	38.55	5169.69
06/08/1993	32.30	5175.94
06/24/1993	25.97	5182.27
07/08/1993	27.77	5180.47
07/21/1993	28.66	5179.58
08/12/1993	27.90	5180.34
08/25/1993	27.82	5180.42
09/16/1993	31.95	5176.29
09/30/1993	31.41	5176.83
10/19/1993	33.58	5174.66
11/17/1993	37.31	5170.93
12/22/1993	39.26	5168.98
01/26/1994	40.01	5168.23
02/17/1994	40.29	5167.95
03/31/1994	40.80	5167.44
04/21/1994	40.85	5167.39
05/12/1994	39.77	5168.47
06/14/1994	27.98	5180.26
07/07/1994	29.29	5178.95
07/28/1994	26.25	5181.99
08/17/1994	25.12	5183.12
09/07/1994	30.18	5178.06
09/30/1994	33.92	5174.32
10/26/1994	37.08	5171.16
11/21/1994	39.25	5168.99
12/22/1994	39.81	5168.43
01/23/1995	40.42	5167.82
02/23/1995	34.26	5173.98
03/22/1995	40.13	5168.11
04/20/1995	40.61	5167.63
05/18/1995	40.71	5167.53
06/08/1995	32.79	5175.45
06/29/1995	19.22	5189.02
07/19/1995	22.39	5185.85
08/08/1995	28.51	5179.73
08/28/1995	27.02	5181.22
09/14/1995	31.11	5177.13
10/23/1995	33.97	5174.27
11/14/1995	37.26	5170.98
12/14/1995	39.02	5169.22
04/24/1996	40.90	5167.34
07/18/1996	29.87	5178.37

Groundwater Hydrograph

Well Identification
USGS

MBMG Site #
M:135736

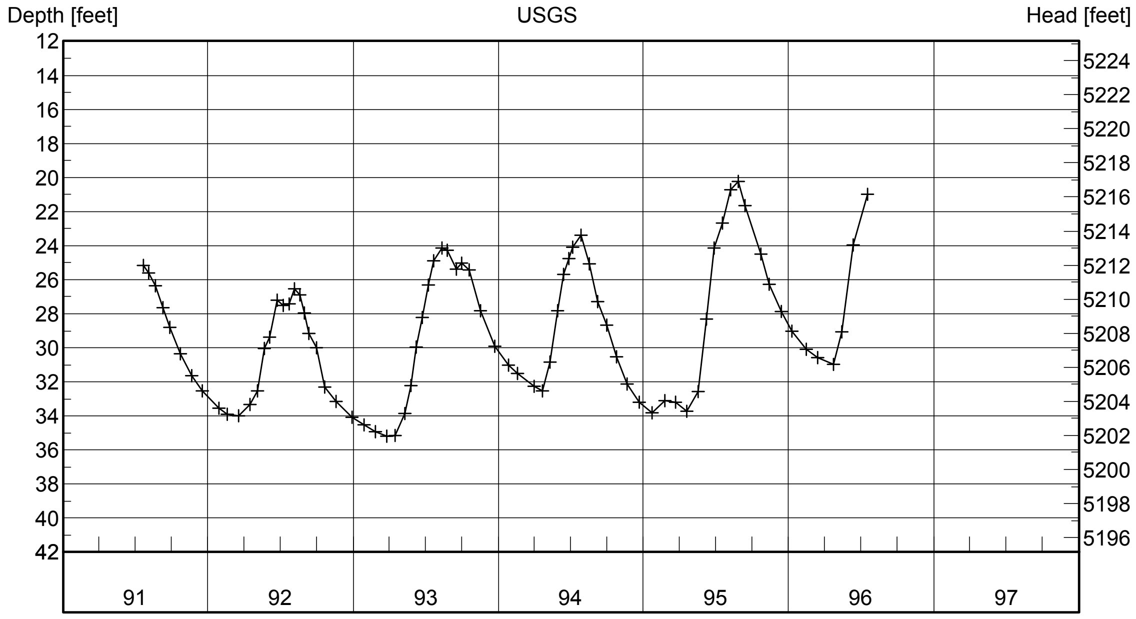
Well Name or Well Owner
U. S. Geological Survey monitoring well

Location
08S 09W 01 CCCC

Ground Surface Elev. (ft)
5235.05

Measuring Point Elev. (ft)
5237.14

Well Depth below m.p. (ft)
47.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/22/1991	25.16	5211.98
08/05/1991	25.58	5211.56
08/21/1991	26.37	5210.77
09/09/1991	27.64	5209.50
09/27/1991	28.81	5208.33
10/23/1991	30.33	5206.81
11/20/1991	31.63	5205.51
12/18/1991	32.53	5204.61
01/29/1992	33.54	5203.60
02/19/1992	33.90	5203.24
03/18/1992	33.99	5203.15
04/16/1992	33.31	5203.83
05/05/1992	32.51	5204.63
05/21/1992	30.02	5207.12
06/04/1992	29.37	5207.77
06/23/1992	27.21	5209.93
07/09/1992	27.51	5209.63
07/23/1992	27.44	5209.70
08/06/1992	26.53	5210.61
08/19/1992	26.90	5210.24
08/30/1992	27.96	5209.18
09/10/1992	29.17	5207.97
09/29/1992	29.99	5207.15
10/21/1992	32.32	5204.82
11/18/1992	33.16	5203.98
12/29/1992	34.09	5203.05
01/27/1993	34.52	5202.62
02/25/1993	34.90	5202.24
03/26/1993	35.19	5201.95
04/15/1993	35.14	5202.00
05/10/1993	33.86	5203.28
05/25/1993	32.21	5204.93
06/08/1993	29.95	5207.19
06/24/1993	28.23	5208.91
07/08/1993	26.31	5210.83
07/21/1993	24.90	5212.24
08/12/1993	24.14	5213.00
08/25/1993	24.29	5212.85
09/16/1993	25.39	5211.75
09/30/1993	25.04	5212.10
10/19/1993	25.41	5211.73
11/17/1993	27.80	5209.34
12/22/1993	29.92	5207.22
01/26/1994	31.03	5206.11
02/17/1994	31.49	5205.65
03/31/1994	32.26	5204.88
04/21/1994	32.53	5204.61
05/11/1994	30.84	5206.30
05/30/1994	27.82	5209.32
06/14/1994	25.68	5211.46
06/28/1994	24.74	5212.40
07/07/1994	24.09	5213.05
07/28/1994	23.37	5213.77
08/18/1994	25.09	5212.05
09/07/1994	27.31	5209.83
09/30/1994	28.65	5208.49
10/26/1994	30.52	5206.62
11/21/1994	32.12	5205.02
12/22/1994	33.19	5203.95
01/23/1995	33.81	5203.33
02/23/1995	33.09	5204.05
03/22/1995	33.19	5203.95
04/20/1995	33.73	5203.41
05/18/1995	32.59	5204.55
06/08/1995	28.33	5208.81
06/28/1995	24.14	5213.00
07/19/1995	22.66	5214.48
08/08/1995	20.71	5216.43
08/28/1995	20.22	5216.92
09/14/1995	21.64	5215.50
10/23/1995	24.48	5212.66
11/14/1995	26.28	5210.86
12/14/1995	27.86	5209.28
01/10/1996	29.02	5208.12
02/15/1996	30.07	5207.07
03/14/1996	30.56	5206.58
04/24/1996	30.97	5206.17
05/15/1996	29.08	5208.06
06/11/1996	23.96	5213.18
07/18/1996	20.99	5216.15

Groundwater Hydrograph

Well Identification
WEEKES

MBMG Site #
M:109890

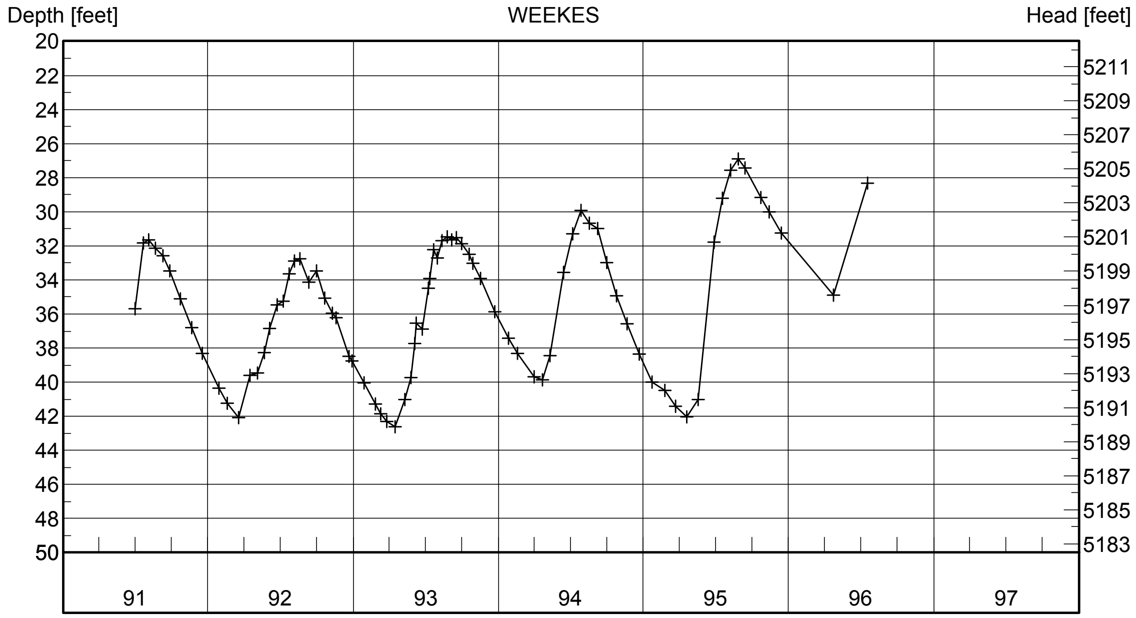
Well Name or Well Owner
Ron Weekes

Location
08S 09W 10 DDAA

Ground Surface Elev. (ft)
5230.49

Measuring Point Elev. (ft)
5232.49

Well Depth below m.p. (ft)
58.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/02/1991	35.67	5196.82
07/22/1991	31.83	5200.66
08/05/1991	31.67	5200.82
08/21/1991	32.12	5200.37
09/09/1991	32.58	5199.91
09/27/1991	33.48	5199.01
10/23/1991	35.10	5197.39
11/20/1991	36.79	5195.70
12/18/1991	38.32	5194.17
01/29/1992	40.33	5192.16
02/19/1992	41.25	5191.24
03/18/1992	42.10	5190.39
04/16/1992	39.58	5192.91
05/05/1992	39.47	5193.02
05/21/1992	38.27	5194.22
06/04/1992	36.85	5195.64
06/23/1992	35.45	5197.04
07/09/1992	35.26	5197.23
07/23/1992	33.63	5198.86
08/06/1992	32.89	5199.60
08/19/1992	32.75	5199.74
09/10/1992	34.14	5198.35
09/29/1992	33.47	5199.02
10/21/1992	35.05	5197.44
11/08/1992	35.95	5196.54
11/18/1992	36.22	5196.27
12/20/1992	38.48	5194.01
12/29/1992	38.77	5193.72
01/27/1993	40.05	5192.44
02/25/1993	41.30	5191.19
03/11/1993	41.87	5190.62
03/26/1993	42.32	5190.17
04/15/1993	42.62	5189.87
05/10/1993	41.00	5191.49
05/25/1993	39.72	5192.77
06/04/1993	37.72	5194.77
06/08/1993	36.51	5195.98
06/24/1993	36.87	5195.62
07/08/1993	34.50	5197.99
07/12/1993	33.92	5198.57
07/21/1993	32.21	5200.28
08/01/1993	32.72	5199.77
08/12/1993	31.69	5200.80
08/25/1993	31.45	5201.04
09/06/1993	31.64	5200.85
09/16/1993	31.50	5200.99
09/30/1993	31.85	5200.64
10/19/1993	32.51	5199.98
10/29/1993	33.02	5199.47
11/17/1993	33.93	5198.56
12/22/1993	35.87	5196.62
01/26/1994	37.41	5195.08
02/17/1994	38.31	5194.18
03/31/1994	39.68	5192.81
04/21/1994	39.84	5192.65
05/11/1994	38.45	5194.04
06/14/1994	33.54	5198.95
07/07/1994	31.30	5201.19
07/28/1994	29.93	5202.56
08/18/1994	30.67	5201.82
09/07/1994	30.98	5201.51
09/30/1994	32.98	5199.51
10/26/1994	34.94	5197.55
11/21/1994	36.58	5195.91
12/22/1994	38.34	5194.15
01/23/1995	40.00	5192.49
02/23/1995	40.50	5191.99
03/22/1995	41.43	5191.06
04/20/1995	42.05	5190.44
05/18/1995	41.01	5191.48
06/28/1995	31.77	5200.72
07/19/1995	29.21	5203.28
08/08/1995	27.55	5204.94
08/28/1995	26.91	5205.58
09/14/1995	27.42	5205.07
10/23/1995	29.15	5203.34
11/14/1995	29.99	5202.50
12/14/1995	31.24	5201.25
04/24/1996	34.87	5197.62
07/18/1996	28.31	5204.18

Beaverhead River Floodplain near Barretts

Groundwater Hydrograph

Well Identification 92-21

MBMG Site # M:133392

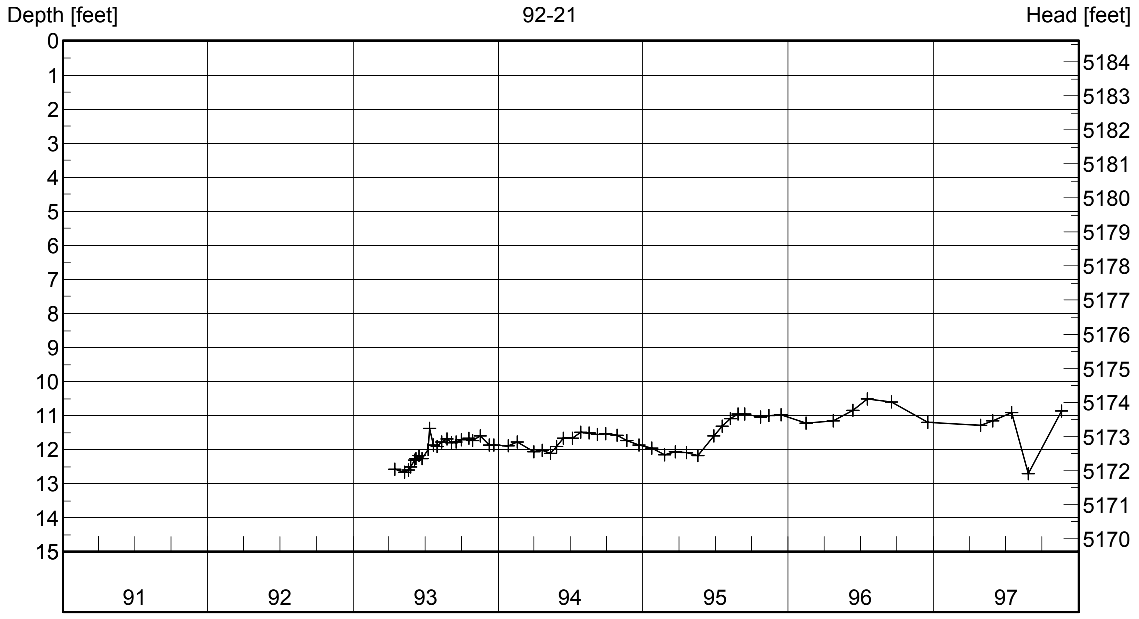
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-21

Location 08S 09W 03 DACC

Ground Surface Elev. (ft) 5182.36

Measuring Point Elev. (ft) 5184.61

Well Depth below m.p. (ft) 487.30



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
04/15/1993	12.58	5172.03	12/21/1993	11.86	5172.75	06/28/1995	11.59	5173.02			
05/10/1993	12.65	5171.96	01/26/1994	11.88	5172.73	07/19/1995	11.30	5173.31			
05/19/1993	12.60	5172.01	02/17/1994	11.78	5172.83	08/08/1995	11.09	5173.52			
05/25/1993	12.51	5172.10	03/31/1994	12.06	5172.55	08/28/1995	10.94	5173.67			
06/04/1993	12.31	5172.30	04/21/1994	12.02	5172.59	09/14/1995	10.96	5173.65			
06/08/1993	12.25	5172.36	05/12/1994	12.10	5172.51	10/23/1995	11.03	5173.58			
06/15/1993	12.17	5172.44	05/27/1994	11.90	5172.71	11/14/1995	11.00	5173.61			
06/24/1993	12.26	5172.35	06/14/1994	11.66	5172.95	12/14/1995	10.98	5173.63			
07/08/1993	12.00	5172.61	07/07/1994	11.66	5172.95	02/15/1996	11.22	5173.39			
07/12/1993	11.37	5173.24	07/27/1994	11.48	5173.13	04/24/1996	11.16	5173.45			
07/21/1993	11.86	5172.75	08/18/1994	11.51	5173.10	06/11/1996	10.83	5173.78			
08/01/1993	11.91	5172.70	09/07/1994	11.56	5173.05	07/18/1996	10.51	5174.10			
08/12/1993	11.78	5172.83	09/29/1994	11.52	5173.09	09/17/1996	10.59	5174.02			
08/25/1993	11.68	5172.93	10/27/1994	11.58	5173.03	12/17/1996	11.20	5173.41			
09/06/1993	11.80	5172.81	11/21/1994	11.72	5172.89	04/29/1997	11.29	5173.32			
09/16/1993	11.78	5172.83	12/22/1994	11.87	5172.74	05/29/1997	11.15	5173.46			
09/30/1993	11.70	5172.91	01/23/1995	11.95	5172.66	07/17/1997	10.91	5173.70			
10/19/1993	11.67	5172.94	02/23/1995	12.14	5172.47	08/27/1997	12.70	5171.91			
10/29/1993	11.72	5172.89	03/22/1995	12.05	5172.56	11/19/1997	10.86	5173.75			
11/17/1993	11.59	5173.02	04/20/1995	12.08	5172.53						
12/09/1993	11.87	5172.74	05/18/1995	12.17	5172.44						

Groundwater Hydrograph

Well Identification
92-22

MBMG Site #
M:133394

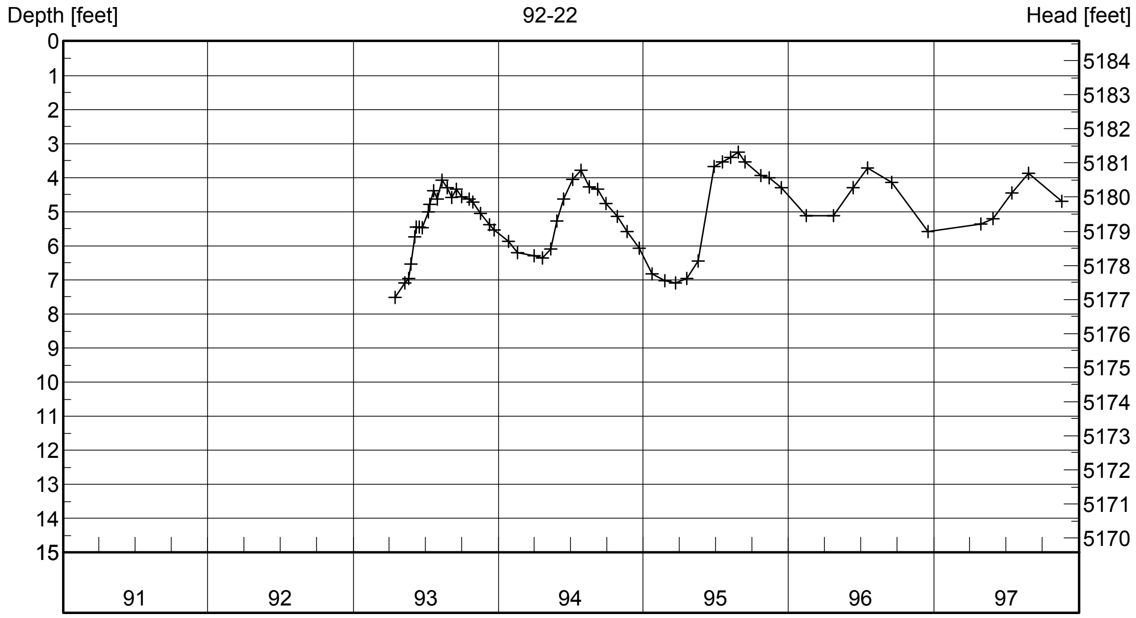
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-22

Location
08S 09W 03 DACC

Ground Surface Elev. (ft)
5182.35

Measuring Point Elev. (ft)
5184.57

Well Depth below m.p. (ft)
50.81



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
04/15/1993	7.50	5177.07
05/10/1993	7.10	5177.47
05/19/1993	6.96	5177.61
05/25/1993	6.53	5178.04
06/04/1993	5.74	5178.83
06/08/1993	5.44	5179.13
06/15/1993	5.44	5179.13
06/24/1993	5.48	5179.09
07/08/1993	5.00	5179.57
07/12/1993	4.79	5179.78
07/21/1993	4.38	5180.19
08/01/1993	4.62	5179.95
08/12/1993	4.07	5180.50
08/25/1993	4.30	5180.27
09/06/1993	4.59	5179.98
09/16/1993	4.33	5180.24
09/30/1993	4.57	5180.00
10/19/1993	4.62	5179.95
10/29/1993	4.72	5179.85
11/17/1993	5.04	5179.53
12/09/1993	5.37	5179.20
12/21/1993	5.54	5179.03
01/26/1994	5.88	5178.69
02/17/1994	6.21	5178.36
03/31/1994	6.30	5178.27
04/21/1994	6.36	5178.21
05/12/1994	6.09	5178.48
05/27/1994	5.28	5179.29
06/14/1994	4.62	5179.95
07/07/1994	4.06	5180.51
07/27/1994	3.79	5180.78
08/18/1994	4.28	5180.29
09/07/1994	4.34	5180.23
09/29/1994	4.75	5179.82
10/27/1994	5.14	5179.43
11/21/1994	5.57	5179.00
12/22/1994	6.07	5178.50
01/23/1995	6.82	5177.75
02/23/1995	7.02	5177.55
03/22/1995	7.08	5177.49
04/20/1995	6.95	5177.62
05/18/1995	6.44	5178.13
06/28/1995	3.68	5180.89
07/19/1995	3.53	5181.04
08/08/1995	3.40	5181.17
08/28/1995	3.26	5181.31
09/14/1995	3.53	5181.04
10/23/1995	3.93	5180.64
11/14/1995	4.01	5180.56
12/14/1995	4.30	5180.27
02/15/1996	5.11	5179.46
04/24/1996	5.12	5179.45
06/11/1996	4.29	5180.28
07/18/1996	3.72	5180.85
09/17/1996	4.13	5180.44
12/17/1996	5.58	5178.99
04/29/1997	5.35	5179.22
05/29/1997	5.20	5179.37
07/17/1997	4.45	5180.12
08/27/1997	3.88	5180.69
11/19/1997	4.70	5179.87

Groundwater Hydrograph

Well Identification 92-23

MBMG Site # M:133395

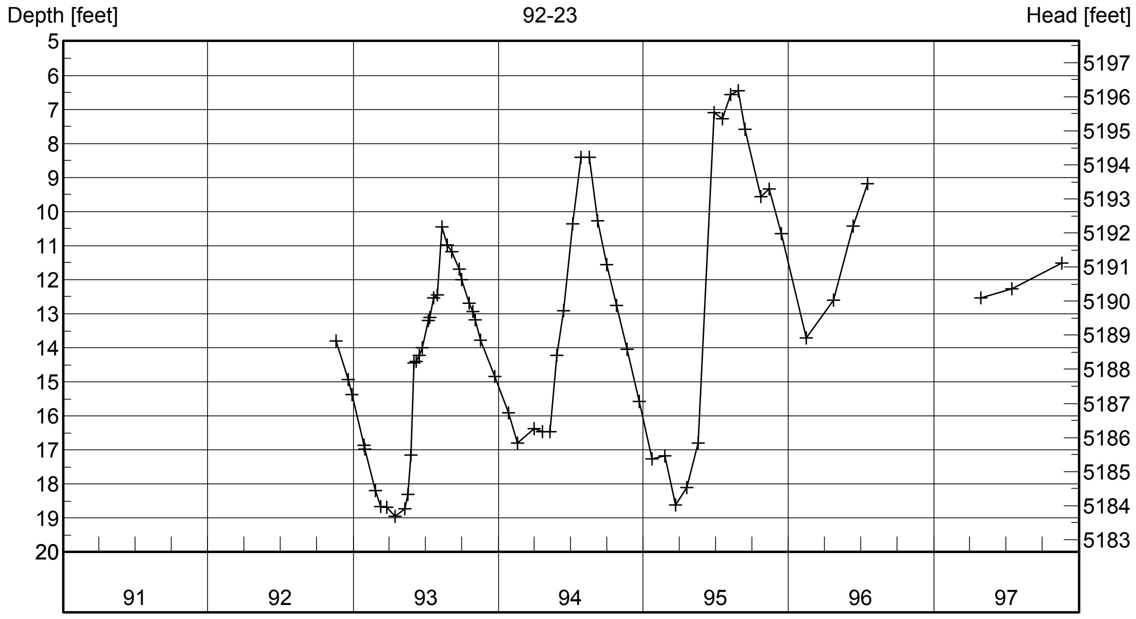
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-23

Location 08S 09W 09 ADDB

Ground Surface Elev. (ft) 5200.58

Measuring Point Elev. (ft) 5202.63

Well Depth below m.p. (ft) 201.36



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
11/18/1992	13.80	5188.83
12/19/1992	14.92	5187.71
12/29/1992	15.37	5187.26
01/27/1993	16.85	5185.78
01/29/1993	16.98	5185.65
02/25/1993	18.19	5184.44
03/11/1993	18.66	5183.97
03/26/1993	18.69	5183.94
04/15/1993	18.94	5183.69
05/10/1993	18.72	5183.91
05/18/1993	18.30	5184.33
05/25/1993	17.15	5185.48
06/03/1993	14.44	5188.19
06/08/1993	14.39	5188.24
06/15/1993	14.23	5188.40
06/24/1993	14.00	5188.63
07/08/1993	13.20	5189.43
07/12/1993	13.11	5189.52
07/21/1993	12.54	5190.09
08/01/1993	12.45	5190.18
08/12/1993	10.45	5192.18
08/25/1993	10.97	5191.66
09/06/1993	11.19	5191.44
09/24/1993	11.70	5190.93
09/30/1993	11.99	5190.64
10/19/1993	12.69	5189.94
10/29/1993	12.94	5189.69
11/04/1993	13.18	5189.45
11/17/1993	13.77	5188.86
12/22/1993	14.83	5187.80
01/26/1994	15.90	5186.73
02/17/1994	16.79	5185.84
03/31/1994	16.38	5186.25
04/21/1994	16.46	5186.17
05/11/1994	16.47	5186.16
05/27/1994	14.23	5188.40
06/14/1994	12.91	5189.72
07/07/1994	10.35	5192.28
07/28/1994	8.40	5194.23
08/18/1994	8.40	5194.23
09/07/1994	10.27	5192.36
09/30/1994	11.56	5191.07
10/26/1994	12.75	5189.88
11/21/1994	14.04	5188.59
12/22/1994	15.57	5187.06
01/23/1995	17.25	5185.38
02/24/1995	17.16	5185.47
03/22/1995	18.62	5184.01
04/20/1995	18.10	5184.53
05/18/1995	16.80	5185.83
06/28/1995	7.10	5195.53
07/19/1995	7.27	5195.36
08/08/1995	6.56	5196.07
08/28/1995	6.45	5196.18
09/14/1995	7.58	5195.05
10/23/1995	9.57	5193.06
11/14/1995	9.33	5193.30
12/14/1995	10.64	5191.99
02/15/1996	13.70	5188.93
04/24/1996	12.60	5190.03
06/11/1996	10.42	5192.21
07/18/1996	9.18	5193.45
04/29/1997	12.54	5190.09
07/17/1997	12.26	5190.37
11/19/1997	11.51	5191.12

Groundwater Hydrograph

Well Identification
92-24

MBMG Site #
M:133396

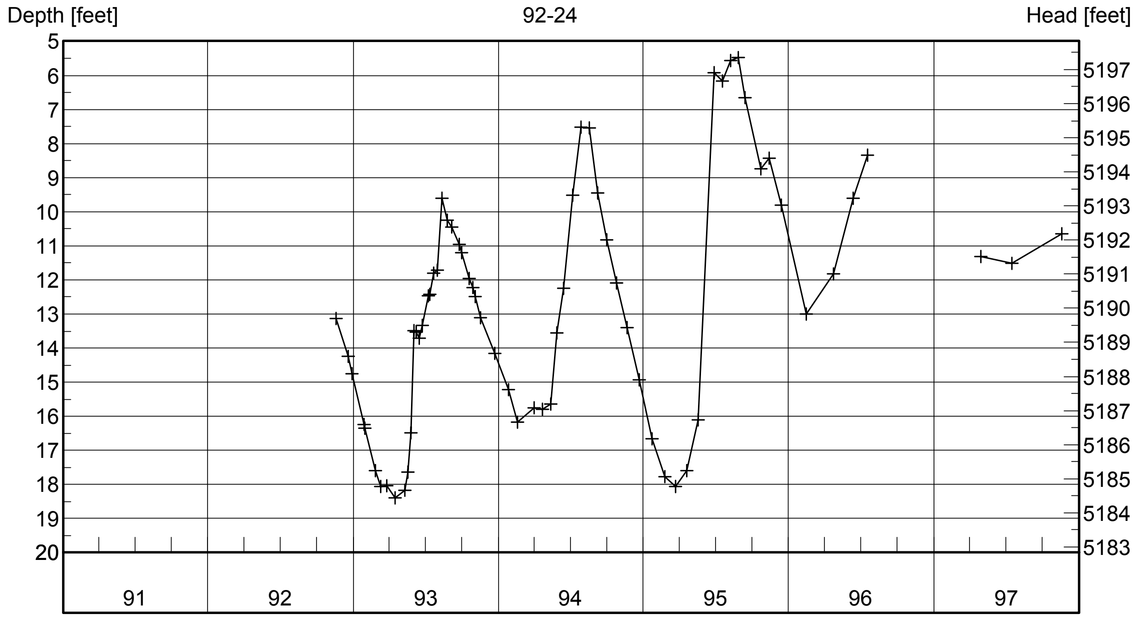
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-24

Location
08S 09W 09 ADDB

Ground Surface Elev. (ft)
5200.53

Measuring Point Elev. (ft)
5202.33

Well Depth below m.p. (ft)
52.47



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
11/18/1992	13.14	5189.19
12/19/1992	14.25	5188.08
12/29/1992	14.75	5187.58
01/27/1993	16.25	5186.08
01/29/1993	16.36	5185.97
02/25/1993	17.60	5184.73
03/11/1993	18.05	5184.28
03/26/1993	18.03	5184.30
04/15/1993	18.39	5183.94
05/10/1993	18.16	5184.17
05/18/1993	17.63	5184.70
05/25/1993	16.48	5185.85
06/03/1993	13.49	5188.84
06/08/1993	13.53	5188.80
06/15/1993	13.70	5188.63
06/24/1993	13.33	5189.00
07/08/1993	12.46	5189.87
07/12/1993	12.42	5189.91
07/21/1993	11.81	5190.52
08/01/1993	11.72	5190.61
08/12/1993	9.61	5192.72
08/25/1993	10.24	5192.09
09/06/1993	10.45	5191.88
09/24/1993	10.96	5191.37
09/30/1993	11.21	5191.12
10/19/1993	11.96	5190.37
10/29/1993	12.23	5190.10
11/04/1993	12.49	5189.84
11/17/1993	13.11	5189.22
12/22/1993	14.15	5188.18
01/26/1994	15.21	5187.12
02/17/1994	16.17	5186.16
03/31/1994	15.74	5186.59
04/21/1994	15.79	5186.54
05/12/1994	15.65	5186.68
05/27/1994	13.55	5188.78
06/14/1994	12.24	5190.09
07/07/1994	9.51	5192.82
07/28/1994	7.52	5194.81
08/18/1994	7.55	5194.78
09/07/1994	9.45	5192.88
09/30/1994	10.83	5191.50
10/26/1994	12.08	5190.25
11/21/1994	13.39	5188.94
12/22/1994	14.94	5187.39
01/23/1995	16.67	5185.66
02/24/1995	17.76	5184.57
03/22/1995	18.06	5184.27
04/20/1995	17.59	5184.74
05/18/1995	16.10	5186.23
06/28/1995	5.92	5196.41
07/19/1995	6.16	5196.17
08/08/1995	5.57	5196.76
08/28/1995	5.48	5196.85
09/14/1995	6.66	5195.67
10/23/1995	8.74	5193.59
11/14/1995	8.42	5193.91
12/14/1995	9.80	5192.53
02/15/1996	13.00	5189.33
04/24/1996	11.83	5190.50
06/11/1996	9.61	5192.72
07/18/1996	8.34	5193.99
04/29/1997	11.32	5191.01
07/17/1997	11.52	5190.81
11/19/1997	10.65	5191.68

Groundwater Hydrograph

Well Identification
92-25

MBMG Site #
M:133397

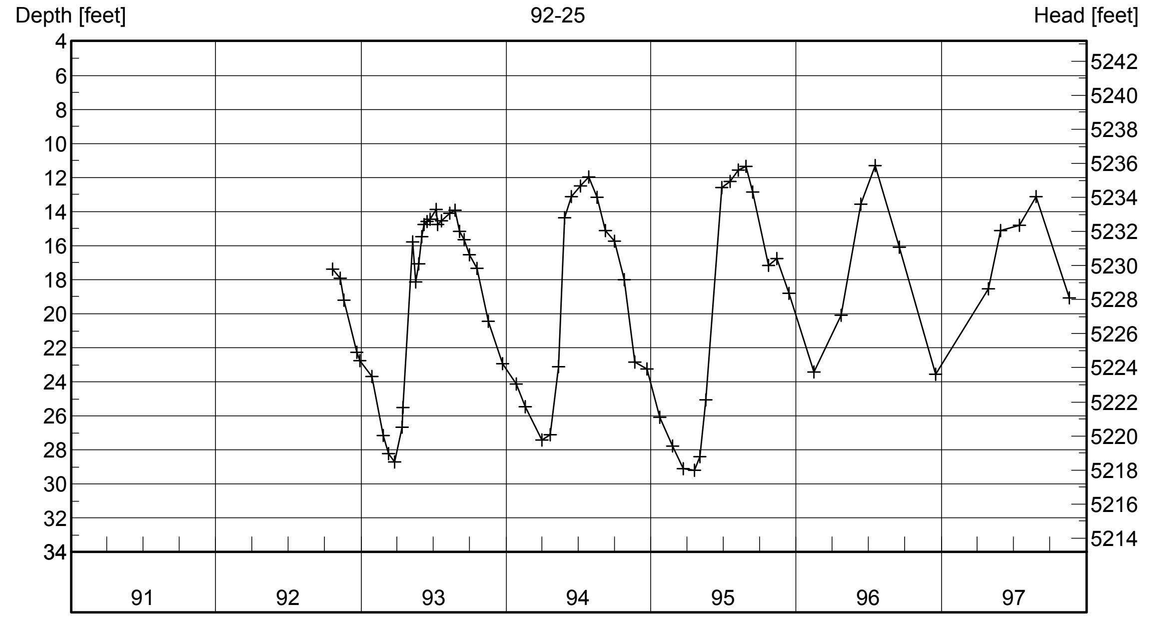
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-25

Location
08S 09W 17 DCBA

Ground Surface Elev. (ft)
5245.01

Measuring Point Elev. (ft)
5247.17

Well Depth below m.p. (ft)
52.98



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
10/21/1992	17.38	5229.79
11/08/1992	17.92	5229.25
11/18/1992	19.18	5227.99
12/20/1992	22.27	5224.90
12/29/1992	22.77	5224.40
01/27/1993	23.67	5223.50
02/25/1993	27.14	5220.03
03/11/1993	28.23	5218.94
03/26/1993	28.69	5218.48
04/14/1993	26.66	5220.51
04/15/1993	25.52	5221.65
05/10/1993	15.79	5231.38
05/18/1993	18.13	5229.04
05/25/1993	17.08	5230.09
06/03/1993	15.46	5231.71
06/08/1993	14.78	5232.39
06/15/1993	14.58	5232.59
06/24/1993	14.45	5232.72
07/08/1993	13.87	5233.30
07/12/1993	14.74	5232.43
07/21/1993	14.54	5232.63
08/12/1993	14.11	5233.06
08/25/1993	13.90	5233.27
09/06/1993	15.17	5232.00
09/16/1993	15.66	5231.51
09/30/1993	16.55	5230.62
10/19/1993	17.32	5229.85
11/17/1993	20.46	5226.71
12/22/1993	22.94	5224.23
01/26/1994	24.12	5223.05
02/17/1994	25.47	5221.70
03/31/1994	27.42	5219.75
04/21/1994	27.12	5220.05
05/12/1994	23.11	5224.06
05/27/1994	14.37	5232.80
06/14/1994	13.13	5234.04
07/07/1994	12.51	5234.66
07/28/1994	11.97	5235.20
08/18/1994	13.15	5234.02
09/07/1994	15.12	5232.05
09/30/1994	15.73	5231.44
10/26/1994	18.00	5229.17
11/21/1994	22.83	5224.34
12/22/1994	23.26	5223.91
01/23/1995	26.08	5221.09
02/23/1995	27.78	5219.39
03/22/1995	29.11	5218.06
04/20/1995	29.20	5217.97
05/04/1995	28.38	5218.79
05/18/1995	25.06	5222.11
06/28/1995	12.60	5234.57
07/19/1995	12.23	5234.94
08/08/1995	11.58	5235.59
08/28/1995	11.35	5235.82
09/14/1995	12.85	5234.32
10/23/1995	17.18	5229.99
11/14/1995	16.78	5230.39
12/14/1995	18.79	5228.38
02/15/1996	23.42	5223.75
04/24/1996	20.07	5227.10
06/11/1996	13.57	5233.60
07/18/1996	11.28	5235.89
09/17/1996	16.11	5231.06
12/17/1996	23.53	5223.64
04/29/1997	18.53	5228.64
05/29/1997	15.10	5232.07
07/17/1997	14.79	5232.38
08/27/1997	13.10	5234.07
11/19/1997	19.07	5228.10

Groundwater Hydrograph

Well Identification
92-32

MBMG Site #
M:133406

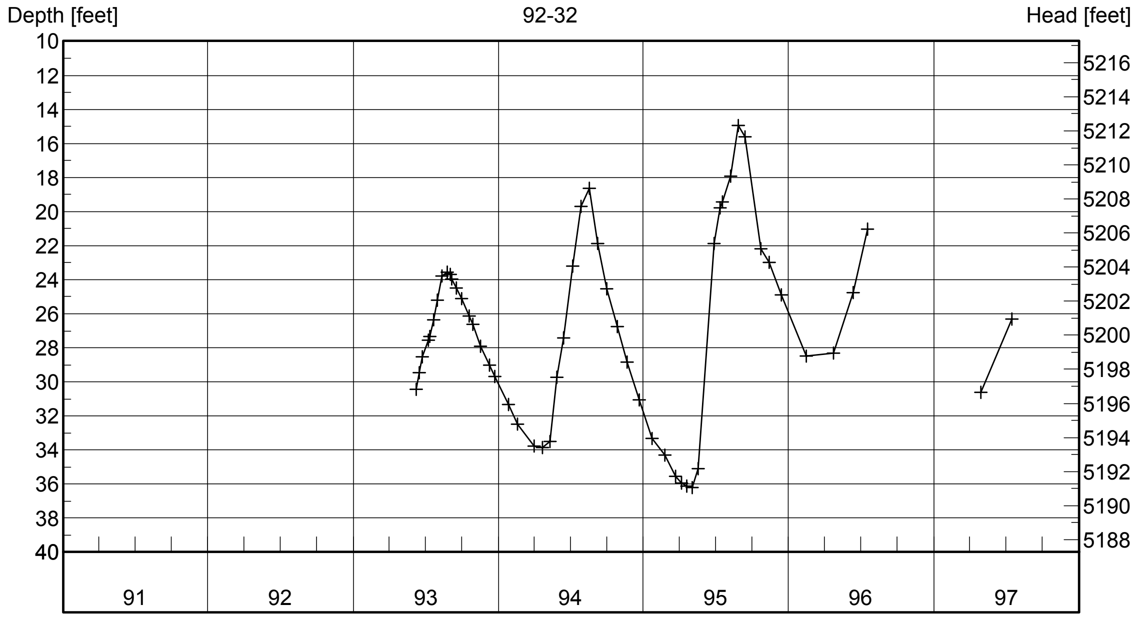
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-32

Location
08S 09W 16 BDAC

Ground Surface Elev. (ft)
5224.61

Measuring Point Elev. (ft)
5227.26

Well Depth below m.p. (ft)
368.85



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
06/08/1993	30.45	5196.81
06/15/1993	29.45	5197.81
06/24/1993	28.52	5198.74
07/08/1993	27.55	5199.71
07/12/1993	27.35	5199.91
07/21/1993	26.37	5200.89
08/01/1993	25.19	5202.07
08/12/1993	23.80	5203.46
08/25/1993	23.55	5203.71
09/01/1993	23.67	5203.59
09/06/1993	23.94	5203.32
09/16/1993	24.48	5202.78
09/30/1993	25.11	5202.15
10/19/1993	26.15	5201.11
10/29/1993	26.62	5200.64
11/17/1993	27.92	5199.34
12/09/1993	29.03	5198.23
12/22/1993	29.67	5197.59
01/26/1994	31.34	5195.92
02/17/1994	32.49	5194.77
03/31/1994	33.77	5193.49
04/21/1994	33.86	5193.40
05/11/1994	33.50	5193.76
05/27/1994	29.73	5197.53
06/14/1994	27.44	5199.82
07/07/1994	23.21	5204.05
07/28/1994	19.71	5207.55
08/18/1994	18.62	5208.64
09/07/1994	21.86	5205.40
09/30/1994	24.55	5202.71
10/27/1994	26.74	5200.52
11/21/1994	28.86	5198.40
12/22/1994	31.07	5196.19
01/23/1995	33.33	5193.93
02/23/1995	34.28	5192.98
03/22/1995	35.52	5191.74
04/06/1995	35.94	5191.32
04/20/1995	36.13	5191.13
05/04/1995	36.19	5191.07
05/18/1995	35.08	5192.18
06/28/1995	21.85	5205.41
07/12/1995	19.77	5207.49
07/19/1995	19.42	5207.84
08/08/1995	17.91	5209.35
08/28/1995	14.97	5212.29
09/14/1995	15.62	5211.64
10/23/1995	22.20	5205.06
11/14/1995	22.99	5204.27
12/14/1995	24.88	5202.38
02/15/1996	28.49	5198.77
04/24/1996	28.32	5198.94
06/11/1996	24.77	5202.49
07/18/1996	21.01	5206.25
04/29/1997	30.61	5196.65
07/17/1997	26.33	5200.93

Groundwater Hydrograph

Well Identification 92-33

MBMG Site # M:133409

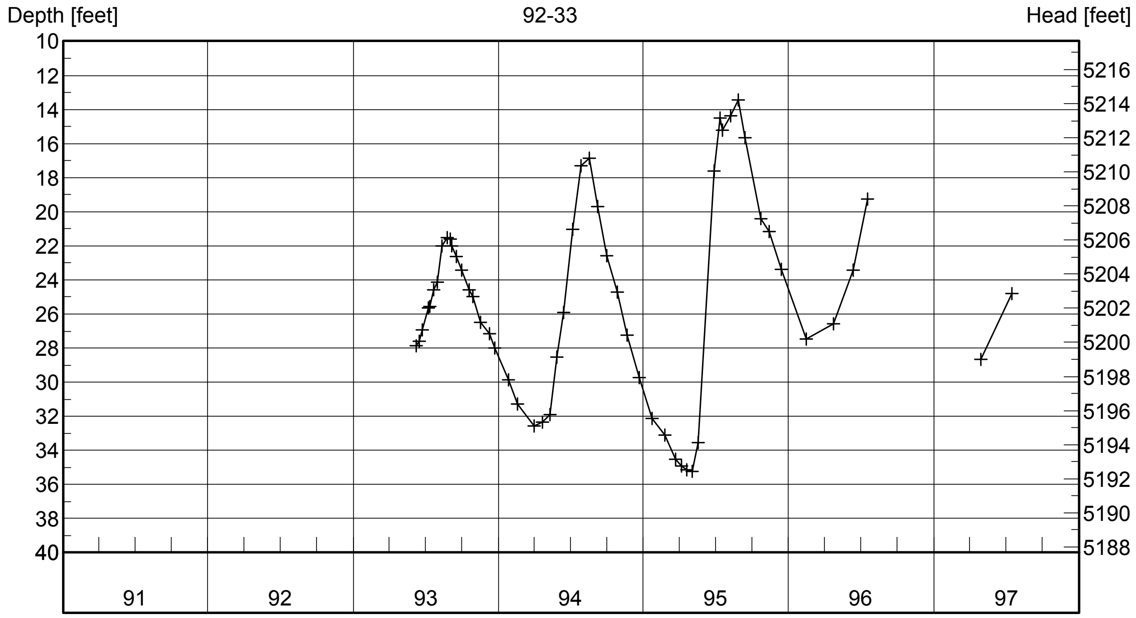
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-33

Location 08S 09W 16 BDAC

Ground Surface Elev. (ft) 5224.85

Measuring Point Elev. (ft) 5227.66

Well Depth below m.p. (ft) 55.56

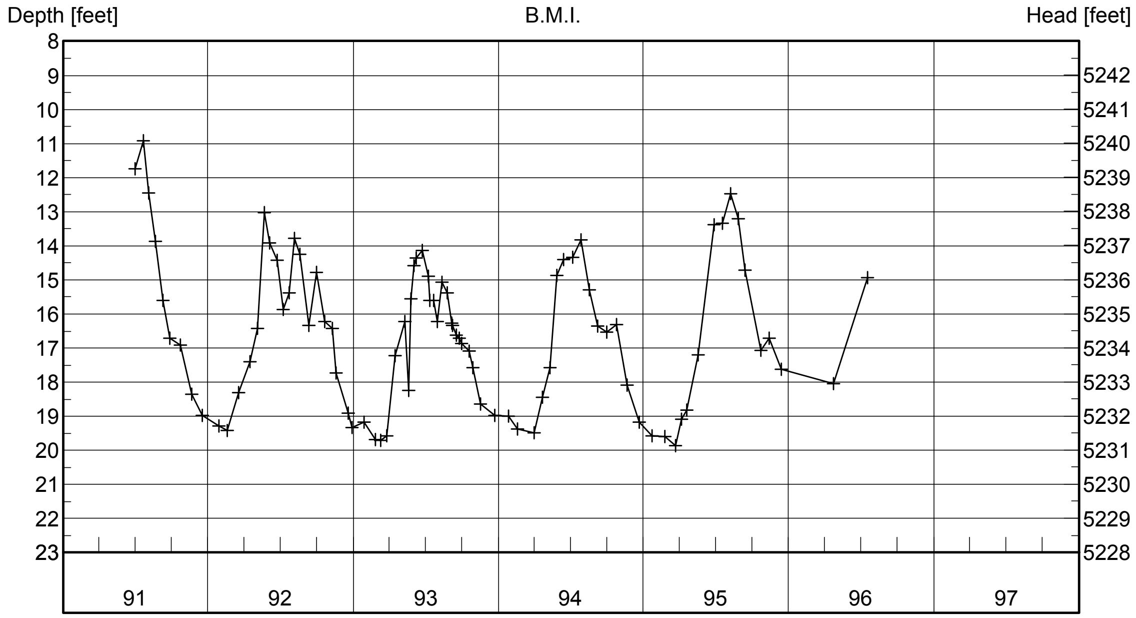


Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
06/08/1993	27.85	5199.81	04/21/1994	32.34	5195.32	07/19/1995	15.20	5212.46			
06/15/1993	27.60	5200.06	05/11/1994	31.92	5195.74	08/08/1995	14.37	5213.29			
06/24/1993	26.92	5200.74	05/27/1994	28.55	5199.11	08/28/1995	13.43	5214.23			
07/08/1993	25.63	5202.03	06/14/1994	25.91	5201.75	09/14/1995	15.64	5212.02			
07/12/1993	25.54	5202.12	07/07/1994	21.04	5206.62	10/23/1995	20.40	5207.26			
07/21/1993	24.56	5203.10	07/28/1994	17.32	5210.34	11/14/1995	21.16	5206.50			
08/01/1993	24.14	5203.52	08/18/1994	16.86	5210.80	12/14/1995	23.37	5204.29			
08/12/1993	22.00	5205.66	09/07/1994	19.68	5207.98	02/15/1996	27.47	5200.19			
08/25/1993	21.50	5206.16	09/30/1994	22.60	5205.06	04/24/1996	26.57	5201.09			
09/01/1993	21.61	5206.05	10/27/1994	24.70	5202.96	06/11/1996	23.41	5204.25			
09/06/1993	22.01	5205.65	11/21/1994	27.23	5200.43	07/18/1996	19.26	5208.40			
09/16/1993	22.62	5205.04	12/22/1994	29.74	5197.92	04/29/1997	28.66	5199.00			
09/30/1993	23.44	5204.22	01/23/1995	32.13	5195.53	07/17/1997	24.79	5202.87			
10/19/1993	24.57	5203.09	02/23/1995	33.08	5194.58						
10/29/1993	24.96	5202.70	03/22/1995	34.50	5193.16						
11/17/1993	26.49	5201.17	04/06/1995	34.94	5192.72						
12/09/1993	27.14	5200.52	04/20/1995	35.16	5192.50						
12/22/1993	28.01	5199.65	05/04/1995	35.21	5192.45						
01/26/1994	29.86	5197.80	05/18/1995	33.53	5194.13						
02/17/1994	31.28	5196.38	06/28/1995	17.63	5210.03						
03/31/1994	32.57	5195.09	07/12/1995	14.52	5213.14						

Groundwater Hydrograph

Well Identification B.M.I.	**MBMG Site #** M:109925	**Well Name or Well Owner** Barretts Minerals Inc.	
Location 08S 09W 17 CAAC	**Ground Surface Elev. (ft)** 5248.76	**Measuring Point Elev. (ft)** 5250.49	**Well Depth below m.p. (ft)** 45.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/02/1991	11.75	5238.74
07/22/1991	10.92	5239.57
08/05/1991	12.44	5238.05
08/21/1991	13.88	5236.61
09/09/1991	15.60	5234.89
09/27/1991	16.71	5233.78
10/23/1991	16.90	5233.59
11/21/1991	18.36	5232.13
12/18/1991	18.98	5231.51
01/29/1992	19.28	5231.21
02/19/1992	19.42	5231.07
03/18/1992	18.30	5232.19
04/16/1992	17.40	5233.09
05/05/1992	16.42	5234.07
05/21/1992	13.02	5237.47
06/04/1992	13.92	5236.57
06/23/1992	14.43	5236.06
07/09/1992	15.86	5234.63
07/23/1992	15.37	5235.12
08/06/1992	13.79	5236.70
08/19/1992	14.24	5236.25
09/10/1992	16.33	5234.16
09/29/1992	14.78	5235.71
10/21/1992	16.22	5234.27
11/08/1992	16.42	5234.07
11/18/1992	17.74	5232.75
12/19/1992	18.90	5231.59
12/29/1992	19.32	5231.17
01/27/1993	19.18	5231.31
02/25/1993	19.69	5230.80
03/11/1993	19.71	5230.78
03/26/1993	19.58	5230.91
04/15/1993	17.22	5233.27
05/10/1993	16.22	5234.27
05/19/1993	18.25	5232.24
05/25/1993	15.56	5234.93
06/03/1993	14.57	5235.92
06/08/1993	14.36	5236.13
06/24/1993	14.13	5236.36
07/08/1993	14.89	5235.60
07/12/1993	15.61	5234.88
07/21/1993	15.60	5234.89
08/01/1993	16.22	5234.27
08/12/1993	15.06	5235.43
08/25/1993	15.37	5235.12
09/06/1993	16.26	5234.23
09/08/1993	16.34	5234.15
09/16/1993	16.62	5233.87
09/24/1993	16.71	5233.78
09/30/1993	16.86	5233.63
10/19/1993	17.08	5233.41
10/29/1993	17.57	5232.92
11/17/1993	18.64	5231.85
12/22/1993	18.98	5231.51
01/26/1994	19.00	5231.49
02/17/1994	19.37	5231.12
03/31/1994	19.48	5231.01
04/21/1994	18.44	5232.05
05/11/1994	17.58	5232.91
05/27/1994	14.87	5235.62
06/14/1994	14.40	5236.09
07/07/1994	14.34	5236.15
07/28/1994	13.82	5236.67
08/18/1994	15.28	5235.21
09/07/1994	16.35	5234.14
09/30/1994	16.54	5233.95
10/26/1994	16.32	5234.17
11/21/1994	18.09	5232.40
12/22/1994	19.17	5231.32
01/23/1995	19.58	5230.91
02/24/1995	19.60	5230.89
03/22/1995	19.86	5230.63
04/06/1995	19.09	5231.40
04/20/1995	18.82	5231.67
05/18/1995	17.20	5233.29
06/28/1995	13.39	5237.10
07/19/1995	13.34	5237.15
08/08/1995	12.47	5238.02
08/28/1995	13.20	5237.29
09/14/1995	14.72	5235.77
10/23/1995	17.06	5233.43
11/14/1995	16.70	5233.79
12/14/1995	17.63	5232.86
04/24/1996	18.03	5232.46

Groundwater Hydrograph

Well Identification
DAWSON

MBMG Site #
M:109840

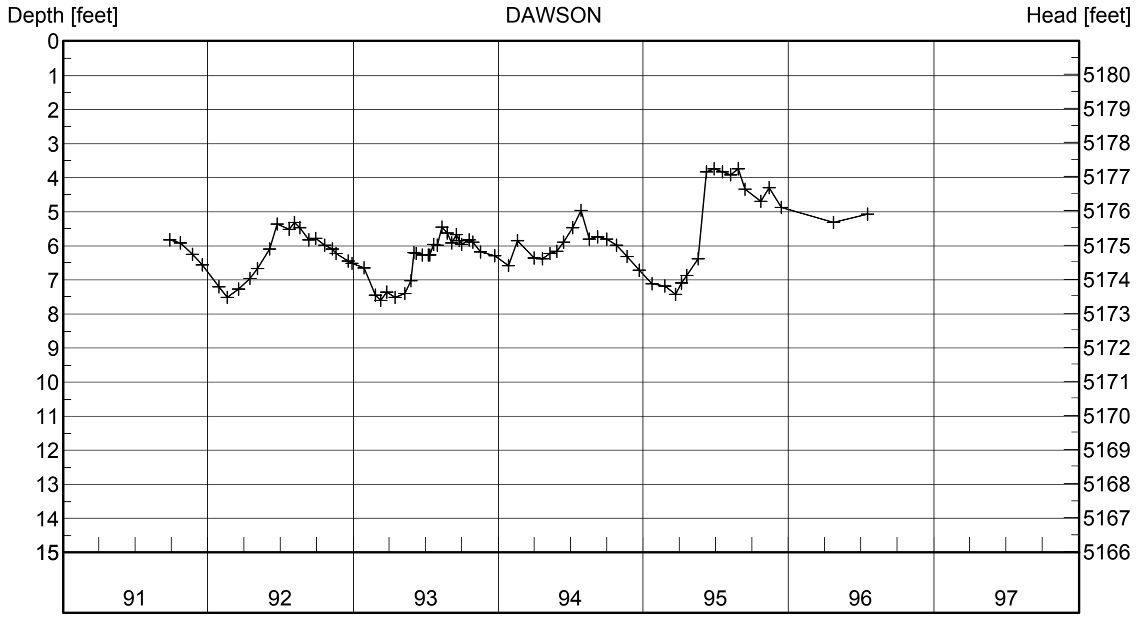
Well Name or Well Owner
Steve Dawson

Location
08S 09W 03 BDDD

Ground Surface Elev. (ft)
5179.89

Measuring Point Elev. (ft)
5180.97

Well Depth below m.p. (ft)
40.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
09/27/1991	5.82	5175.15
10/23/1991	5.91	5175.06
11/22/1991	6.25	5174.72
12/18/1991	6.55	5174.42
01/29/1992	7.20	5173.77
02/19/1992	7.50	5173.47
03/18/1992	7.26	5173.71
04/16/1992	6.95	5174.02
05/05/1992	6.67	5174.30
06/04/1992	6.08	5174.89
06/23/1992	5.36	5175.61
07/23/1992	5.52	5175.45
08/06/1992	5.32	5175.65
08/19/1992	5.47	5175.50
09/10/1992	5.82	5175.15
09/28/1992	5.79	5175.18
10/21/1992	5.99	5174.98
11/09/1992	6.09	5174.88
11/18/1992	6.23	5174.74
12/19/1992	6.45	5174.52
12/29/1992	6.51	5174.46
01/27/1993	6.65	5174.32
02/25/1993	7.44	5173.53
03/11/1993	7.59	5173.38
03/26/1993	7.36	5173.61
04/15/1993	7.52	5173.45
05/10/1993	7.39	5173.58
05/25/1993	7.02	5173.95
06/03/1993	6.20	5174.77
06/08/1993	6.23	5174.74
06/24/1993	6.27	5174.70
07/08/1993	6.27	5174.70
07/12/1993	6.27	5174.70
07/21/1993	5.95	5175.02
08/01/1993	5.97	5175.00
08/12/1993	5.44	5175.53
08/25/1993	5.62	5175.35
09/06/1993	5.91	5175.06
09/16/1993	5.68	5175.29
09/24/1993	5.85	5175.12
09/30/1993	5.95	5175.02
10/19/1993	5.83	5175.14
10/29/1993	5.89	5175.08
11/17/1993	6.17	5174.80
12/22/1993	6.28	5174.69
01/26/1994	6.58	5174.39
02/17/1994	5.84	5175.13
03/31/1994	6.35	5174.62
04/21/1994	6.37	5174.60
05/11/1994	6.23	5174.74
05/27/1994	6.16	5174.81
06/14/1994	5.90	5175.07
07/07/1994	5.46	5175.51
07/28/1994	4.96	5176.01
08/18/1994	5.80	5175.17
09/07/1994	5.73	5175.24
09/30/1994	5.80	5175.17
10/26/1994	5.97	5175.00
11/21/1994	6.32	5174.65
12/22/1994	6.72	5174.25
01/23/1995	7.12	5173.85
02/24/1995	7.18	5173.79
03/22/1995	7.43	5173.54
04/06/1995	7.09	5173.88
04/20/1995	6.87	5174.10
05/18/1995	6.39	5174.58
06/08/1995	3.82	5177.15
06/28/1995	3.74	5177.23
07/19/1995	3.82	5177.15
08/08/1995	3.92	5177.05
08/28/1995	3.73	5177.24
09/14/1995	4.33	5176.64
10/23/1995	4.70	5176.27
11/14/1995	4.30	5176.67
12/14/1995	4.88	5176.09
04/24/1996	5.32	5175.65
07/18/1996	5.07	5175.90

Groundwater Hydrograph

Well Identification
MOONEY

MBMG Site #
M:126665

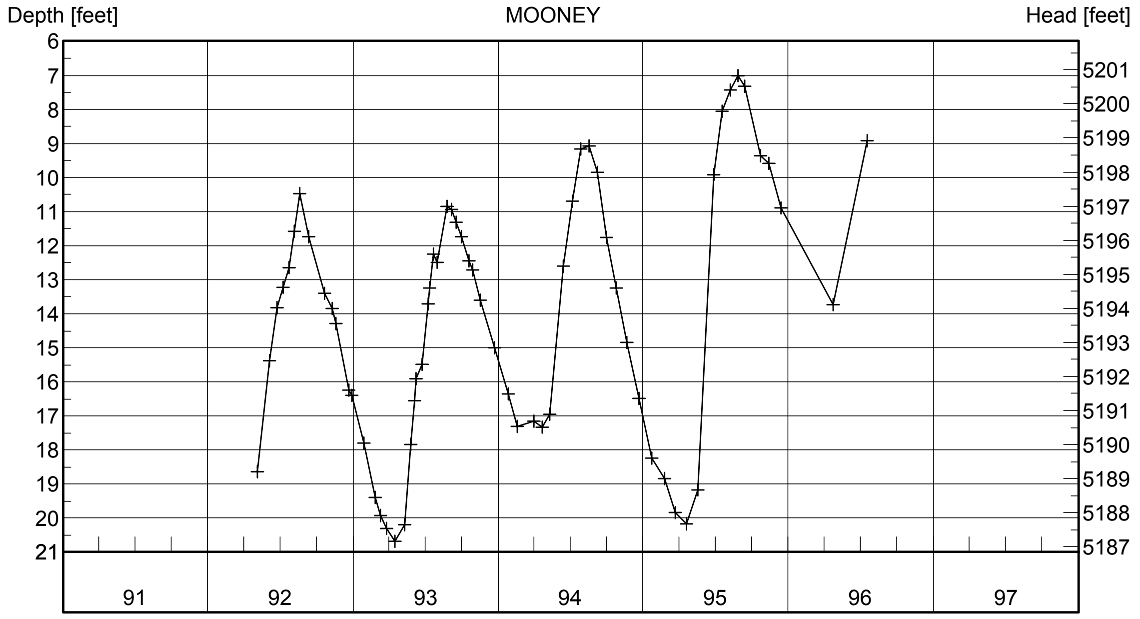
Well Name or Well Owner
Francis Mooney domestic well @ Eliason Lane

Location
08S 09W 10 CDBB

Ground Surface Elev. (ft)
5206.25

Measuring Point Elev. (ft)
5207.84

Well Depth below m.p. (ft)
38.00



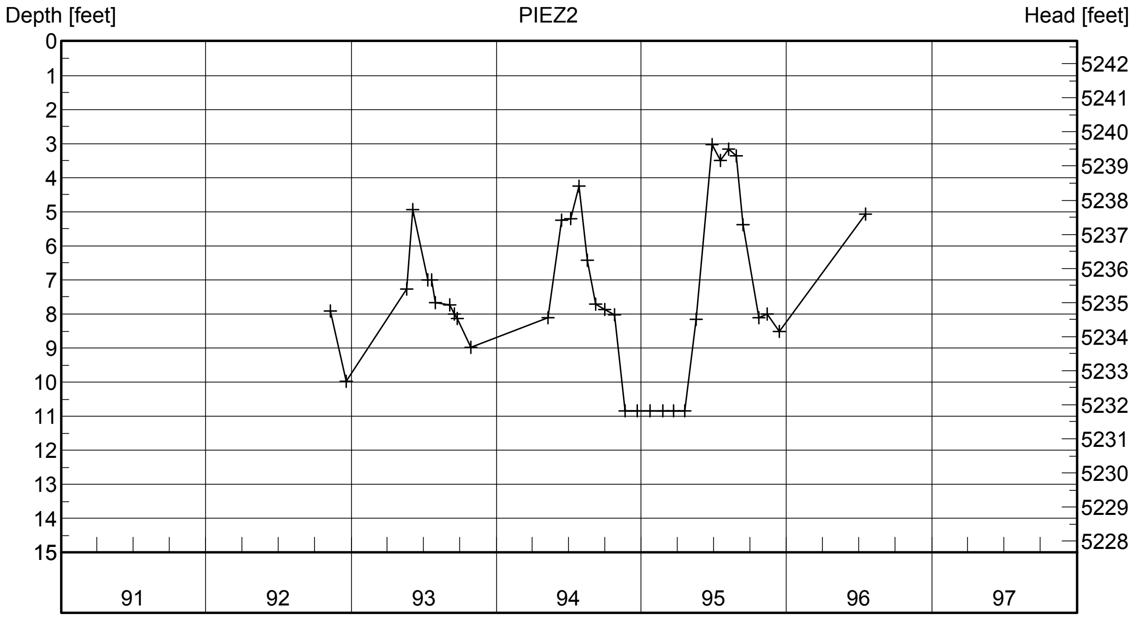
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
05/05/1992	18.63	5189.21
06/04/1992	15.38	5192.46
06/23/1992	13.82	5194.02
07/09/1992	13.22	5194.62
07/23/1992	12.65	5195.19
08/06/1992	11.57	5196.27
08/19/1992	10.47	5197.37
09/10/1992	11.73	5196.11
10/21/1992	13.40	5194.44
11/08/1992	13.85	5193.99
11/18/1992	14.28	5193.56
12/20/1992	16.25	5191.59
12/29/1992	16.39	5191.45
01/27/1993	17.80	5190.04
02/25/1993	19.40	5188.44
03/11/1993	19.93	5187.91
03/26/1993	20.30	5187.54
04/15/1993	20.67	5187.17
05/10/1993	20.20	5187.64
05/25/1993	17.83	5190.01
06/04/1993	16.55	5191.29
06/08/1993	15.91	5191.93
06/24/1993	15.48	5192.36
07/08/1993	13.72	5194.12
07/12/1993	13.25	5194.59
07/21/1993	12.24	5195.60
08/01/1993	12.49	5195.35
08/25/1993	10.85	5196.99
09/06/1993	10.94	5196.90
09/16/1993	11.31	5196.53
09/30/1993	11.73	5196.11
10/19/1993	12.44	5195.40
10/29/1993	12.72	5195.12
11/17/1993	13.60	5194.24
12/22/1993	15.00	5192.84
01/26/1994	16.35	5191.49
02/17/1994	17.31	5190.53
03/31/1994	17.16	5190.68
04/21/1994	17.32	5190.52
05/11/1994	16.95	5190.89
06/14/1994	12.60	5195.24
07/07/1994	10.69	5197.15
07/28/1994	9.17	5198.67
08/18/1994	9.08	5198.76
09/07/1994	9.84	5198.00
09/30/1994	11.75	5196.09
10/26/1994	13.24	5194.60
11/21/1994	14.84	5193.00
12/22/1994	16.49	5191.35
01/23/1995	18.24	5189.60
02/24/1995	18.83	5189.01
03/22/1995	19.83	5188.01
04/20/1995	20.16	5187.68
05/18/1995	19.18	5188.66
06/28/1995	9.92	5197.92
07/19/1995	8.05	5199.79
08/08/1995	7.44	5200.40
08/28/1995	7.00	5200.84
09/14/1995	7.33	5200.51
10/23/1995	9.36	5198.48
11/14/1995	9.58	5198.26
12/14/1995	10.90	5196.94
04/24/1996	13.73	5194.11
07/18/1996	8.92	5198.92

Groundwater Hydrograph

Well Identification	Well Name or Well Owner
PIEZ2	Piezometer #2 (Bolick white piezometer)

Location	Ground Surface Elev. (ft)	Measuring Point Elev. (ft)	Well Depth below m.p. (ft)
08S 09W 17 CADD	5241.59	5242.66	10.84



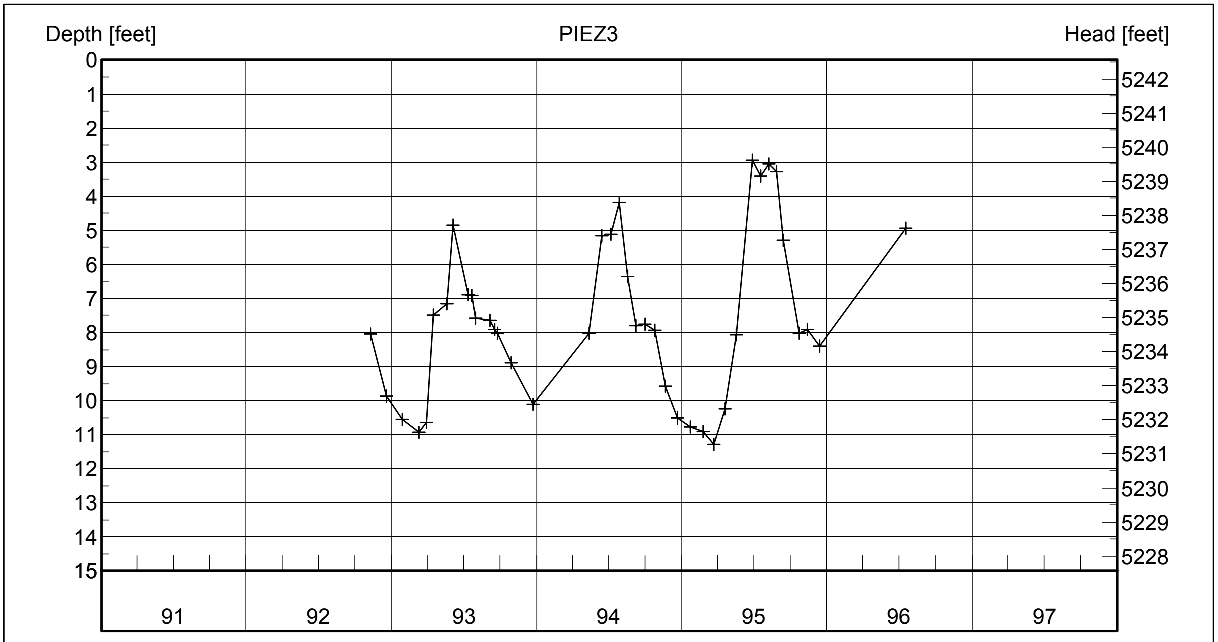
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/08/1992	7.91	5234.75	01/23/1995	10.84	5231.82						
12/19/1992	9.97	5232.69	02/24/1995	10.84	5231.82						
05/19/1993	7.27	5235.39	03/22/1995	10.84	5231.82						
06/04/1993	4.93	5237.73	04/20/1995	10.84	5231.82						
07/12/1993	6.99	5235.67	05/18/1995	8.15	5234.51						
07/21/1993	7.01	5235.65	06/28/1995	3.02	5239.64						
08/01/1993	7.66	5235.00	07/19/1995	3.49	5239.17						
09/06/1993	7.73	5234.93	08/08/1995	3.16	5239.50						
09/17/1993	8.00	5234.66	08/28/1995	3.36	5239.30						
09/24/1993	8.13	5234.53	09/14/1995	5.37	5237.29						
10/29/1993	8.98	5233.68	10/23/1995	8.11	5234.55						
05/11/1994	8.12	5234.54	11/14/1995	7.99	5234.67						
06/14/1994	5.24	5237.42	12/14/1995	8.50	5234.16						
07/07/1994	5.20	5237.46	07/18/1996	5.07	5237.59						
07/28/1994	4.26	5238.40									
08/18/1994	6.43	5236.23									
09/07/1994	7.70	5234.96									
09/30/1994	7.86	5234.80									
10/26/1994	8.02	5234.64									
11/21/1994	10.84	5231.82									
12/22/1994	10.84	5231.82									

Groundwater Hydrograph

Well Identification	Well Name or Well Owner
PIEZ3	Piezometer #3 (Bolick red piezometer)

Location	Ground Surface Elev. (ft)	Measuring Point Elev. (ft)	Well Depth below m.p. (ft)
08S 09W 17 CADD	5241.47	5242.56	15.31



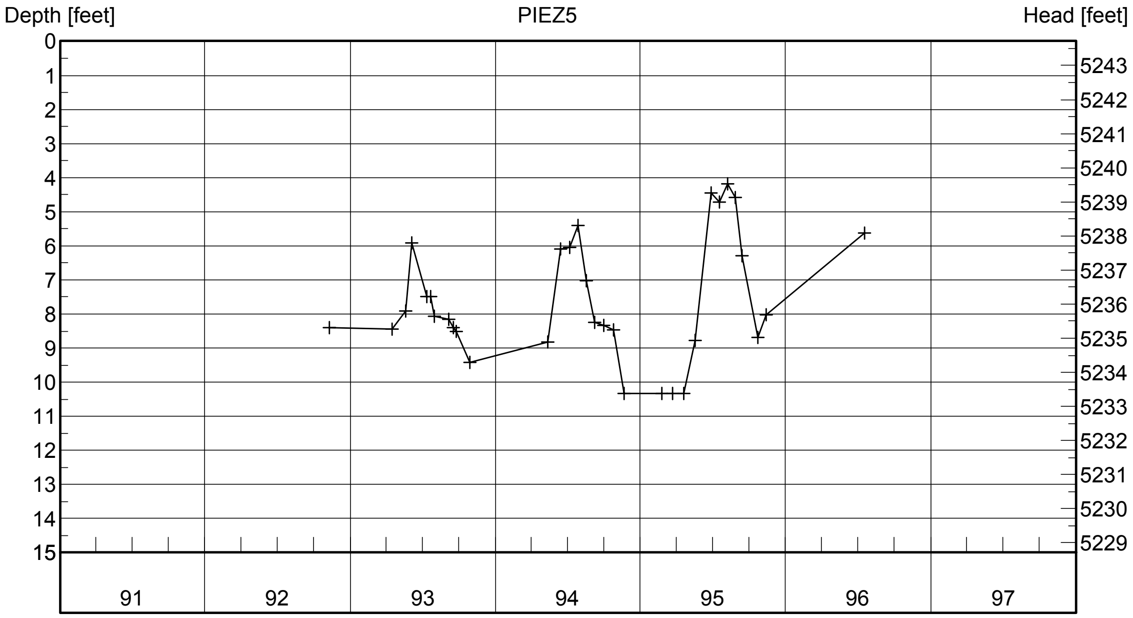
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/08/1992	8.05	5234.51	09/07/1994	7.79	5234.77						
12/19/1992	9.87	5232.69	09/30/1994	7.76	5234.80						
01/27/1993	10.55	5232.01	10/26/1994	7.93	5234.63						
03/11/1993	10.92	5231.64	11/21/1994	9.58	5232.98						
03/29/1993	10.65	5231.91	12/22/1994	10.51	5232.05						
04/15/1993	7.48	5235.08	01/23/1995	10.78	5231.78						
05/19/1993	7.16	5235.40	02/24/1995	10.91	5231.65						
06/04/1993	4.85	5237.71	03/22/1995	11.29	5231.27						
07/12/1993	6.90	5235.66	04/20/1995	10.24	5232.32						
07/21/1993	6.92	5235.64	05/18/1995	8.07	5234.49						
08/01/1993	7.57	5234.99	06/28/1995	2.93	5239.63						
09/06/1993	7.64	5234.92	07/19/1995	3.41	5239.15						
09/17/1993	7.90	5234.66	08/08/1995	3.06	5239.50						
09/24/1993	8.03	5234.53	08/28/1995	3.28	5239.28						
10/29/1993	8.89	5233.67	09/14/1995	5.29	5237.27						
12/22/1993	10.11	5232.45	10/23/1995	8.02	5234.54						
05/12/1994	8.03	5234.53	11/14/1995	7.92	5234.64						
06/14/1994	5.16	5237.40	12/14/1995	8.40	5234.16						
07/07/1994	5.12	5237.44	07/18/1996	4.94	5237.62						
07/28/1994	4.18	5238.38									
08/18/1994	6.35	5236.21									

Groundwater Hydrograph

Well Identification PIEZ5	**Well Name or Well Owner** Piezometer #5 (B.M.I. white piezometer)

Location 08S 09W 17 CADB	**Ground Surface Elev. (ft)** 5242.82	**Measuring Point Elev. (ft)** 5243.71	**Well Depth below m.p. (ft)** 10.34

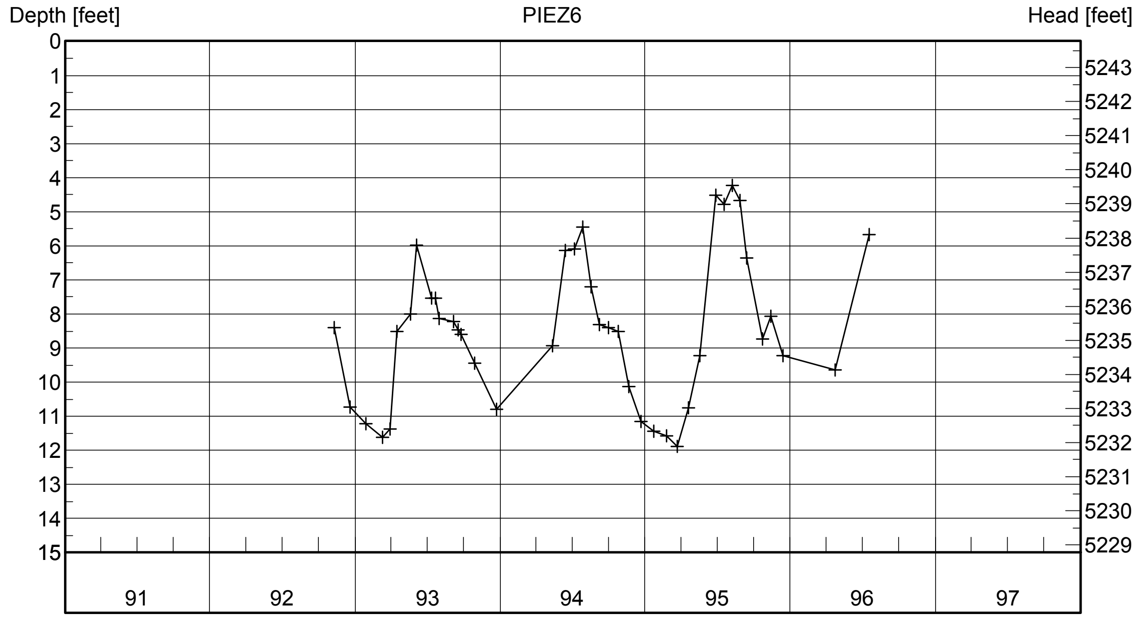


Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/08/1992	8.39	5235.32	03/22/1995	10.34	5233.37						
04/15/1993	8.45	5235.26	04/20/1995	10.34	5233.37						
05/19/1993	7.92	5235.79	05/18/1995	8.78	5234.93						
06/04/1993	5.91	5237.80	06/28/1995	4.46	5239.25						
07/12/1993	7.48	5236.23	07/19/1995	4.72	5238.99						
07/21/1993	7.48	5236.23	08/08/1995	4.18	5239.53						
08/01/1993	8.07	5235.64	08/28/1995	4.59	5239.12						
09/06/1993	8.15	5235.56	09/14/1995	6.30	5237.41						
09/17/1993	8.40	5235.31	10/23/1995	8.69	5235.02						
09/24/1993	8.52	5235.19	11/14/1995	8.03	5235.68						
10/29/1993	9.42	5234.29	07/18/1996	5.62	5238.09						
05/12/1994	8.82	5234.89									
06/14/1994	6.09	5237.62									
07/07/1994	6.04	5237.67									
07/28/1994	5.40	5238.31									
08/18/1994	7.03	5236.68									
09/07/1994	8.25	5235.46									
09/30/1994	8.34	5235.37									
10/26/1994	8.46	5235.25									
11/21/1994	10.34	5233.37									
02/24/1995	10.34	5233.37									

Groundwater Hydrograph

Well Identification **PIEZ6**	**Well Name or Well Owner** **Piezometer #6 (B.M.I. red piezometer)**		
Location **08S 09W 17 CADB**	**Ground Surface Elev. (ft)** **5242.67**	**Measuring Point Elev. (ft)** **5243.77**	**Well Depth below m.p. (ft)** **15.32**



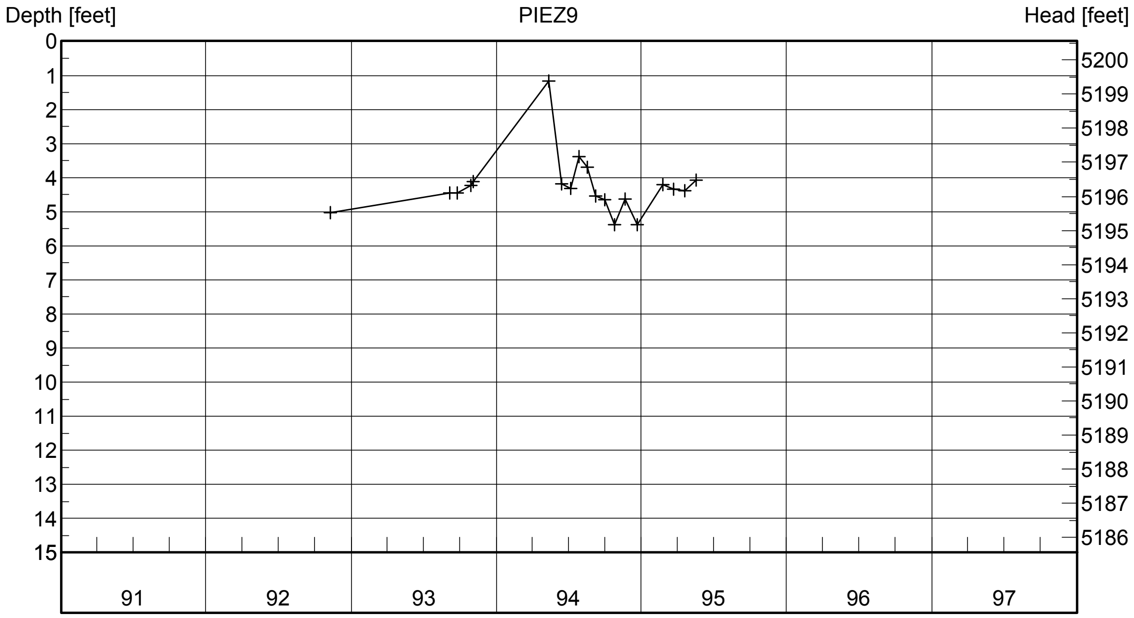
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/08/1992	8.40	5235.37	09/07/1994	8.30	5235.47						
12/19/1992	10.72	5233.05	09/30/1994	8.39	5235.38						
01/27/1993	11.21	5232.56	10/26/1994	8.50	5235.27						
03/11/1993	11.61	5232.16	11/21/1994	10.12	5233.65						
03/29/1993	11.37	5232.40	12/22/1994	11.14	5232.63						
04/15/1993	8.51	5235.26	01/23/1995	11.43	5232.34						
05/19/1993	8.00	5235.77	02/24/1995	11.57	5232.20						
06/04/1993	5.98	5237.79	03/22/1995	11.89	5231.88						
07/12/1993	7.54	5236.23	04/20/1995	10.76	5233.01						
07/21/1993	7.54	5236.23	05/18/1995	9.23	5234.54						
08/01/1993	8.14	5235.63	06/28/1995	4.51	5239.26						
09/06/1993	8.22	5235.55	07/19/1995	4.79	5238.98						
09/17/1993	8.47	5235.30	08/08/1995	4.22	5239.55						
09/24/1993	8.59	5235.18	08/28/1995	4.68	5239.09						
10/29/1993	9.45	5234.32	09/14/1995	6.35	5237.42						
12/22/1993	10.80	5232.97	10/23/1995	8.73	5235.04						
05/12/1994	8.93	5234.84	11/14/1995	8.07	5235.70						
06/14/1994	6.14	5237.63	12/14/1995	9.23	5234.54						
07/07/1994	6.08	5237.69	04/24/1996	9.65	5234.12						
07/28/1994	5.44	5238.33	07/18/1996	5.67	5238.10						
08/18/1994	7.19	5236.58									

Groundwater Hydrograph

Well Identification PIEZ9	**Well Name or Well Owner** Piezometer #9 (Stefanic yellow piezometer)

Location 08S 09W 09 DAAB	**Ground Surface Elev. (ft)** 5198.51	**Measuring Point Elev. (ft)** 5200.55	**Well Depth below m.p. (ft)** 5.38



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
11/08/1992	5.03	5195.52
09/06/1993	4.45	5196.10
09/24/1993	4.44	5196.11
10/29/1993	4.22	5196.33
11/04/1993	4.11	5196.44
05/12/1994	1.16	5199.39
06/14/1994	4.18	5196.37
07/07/1994	4.31	5196.24
07/28/1994	3.38	5197.17
08/18/1994	3.70	5196.85
09/07/1994	4.53	5196.02
09/30/1994	4.64	5195.91
10/26/1994	5.38	5195.17
11/21/1994	4.62	5195.93
12/22/1994	5.38	5195.17
02/24/1995	4.21	5196.34
03/22/1995	4.33	5196.22
04/20/1995	4.38	5196.17
05/18/1995	4.07	5196.48

Groundwater Hydrograph

Well Identification
PIEZ10

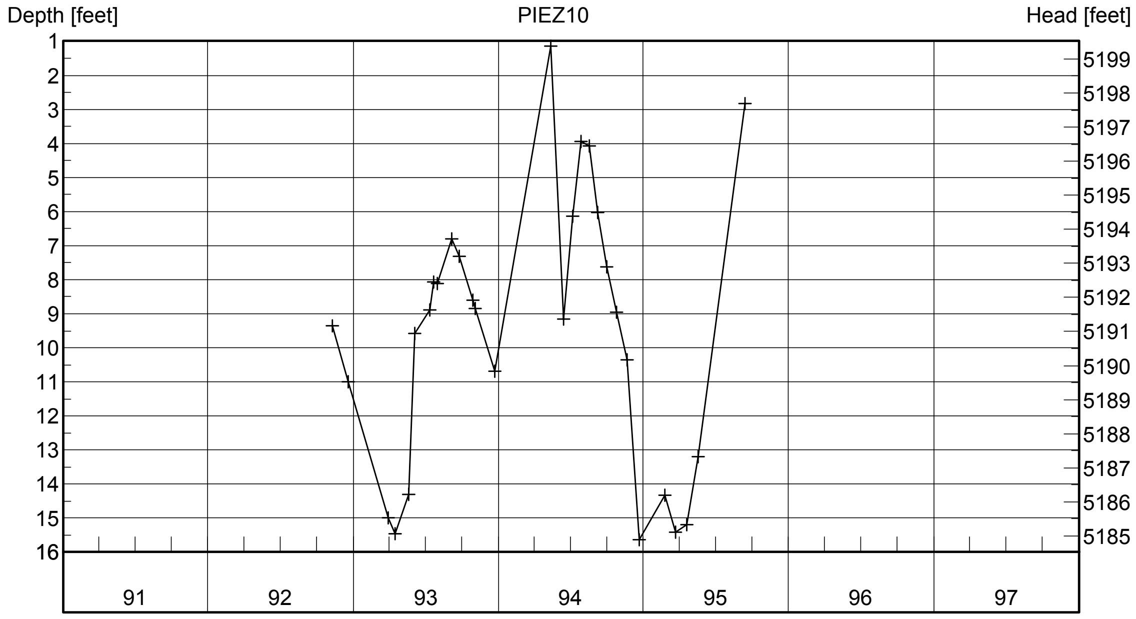
Well Name or Well Owner
Piezometer #10 (Stefanic red piezometer)

Location
08S 09W 09 DAAB

Ground Surface Elev. (ft)
5198.55

Measuring Point Elev. (ft)
5200.52

Well Depth below m.p. (ft)
15.63



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/08/1992	9.35	5191.17	10/26/1994	8.96	5191.56						
12/19/1992	11.00	5189.52	11/21/1994	10.36	5190.16						
03/29/1993	14.98	5185.54	12/22/1994	15.63	5184.89						
04/15/1993	15.45	5185.07	02/24/1995	14.32	5186.20						
05/19/1993	14.31	5186.21	03/22/1995	15.41	5185.11						
06/04/1993	9.58	5190.94	04/20/1995	15.20	5185.32						
07/12/1993	8.88	5191.64	05/18/1995	13.20	5187.32						
07/21/1993	8.06	5192.46	09/14/1995	2.82	5197.70						
08/01/1993	8.12	5192.40									
09/06/1993	6.81	5193.71									
09/24/1993	7.32	5193.20									
10/29/1993	8.60	5191.92									
11/04/1993	8.84	5191.68									
12/22/1993	10.69	5189.83									
05/12/1994	1.15	5199.37									
06/14/1994	9.16	5191.36									
07/07/1994	6.14	5194.38									
07/28/1994	3.95	5196.57									
08/18/1994	4.07	5196.45									
09/07/1994	6.03	5194.49									
09/30/1994	7.63	5192.89									

Groundwater Hydrograph

Well Identification
PIEZ11

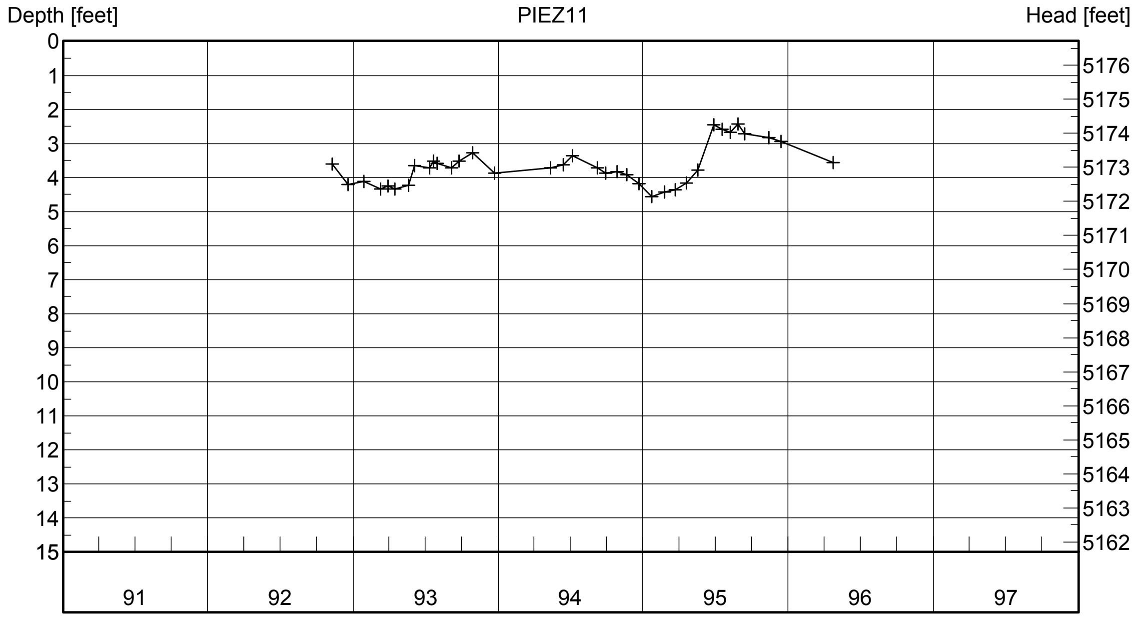
Well Name or Well Owner
Piezometer #11 (Gund-Ream yellow piezometer)

Location
08S 09W 03 ACDB

Ground Surface Elev. (ft)
5175.61

Measuring Point Elev. (ft)
5176.70

Well Depth below m.p. (ft)
6.35



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/08/1992	3.60	5173.10	11/21/1994	3.91	5172.79						
12/19/1992	4.20	5172.50	12/22/1994	4.18	5172.52						
01/27/1993	4.11	5172.59	01/23/1995	4.55	5172.15						
03/11/1993	4.33	5172.37	02/24/1995	4.43	5172.27						
03/29/1993	4.25	5172.45	03/22/1995	4.35	5172.35						
04/15/1993	4.33	5172.37	04/20/1995	4.15	5172.55						
05/19/1993	4.22	5172.48	05/18/1995	3.78	5172.92						
06/04/1993	3.65	5173.05	06/28/1995	2.46	5174.24						
07/12/1993	3.71	5172.99	07/19/1995	2.58	5174.12						
07/21/1993	3.51	5173.19	08/08/1995	2.68	5174.02						
08/01/1993	3.58	5173.12	08/28/1995	2.42	5174.28						
09/06/1993	3.72	5172.98	09/14/1995	2.72	5173.98						
09/24/1993	3.51	5173.19	11/14/1995	2.83	5173.87						
10/29/1993	3.27	5173.43	12/14/1995	2.95	5173.75						
12/22/1993	3.87	5172.83	04/24/1996	3.56	5173.14						
05/12/1994	3.72	5172.98									
06/14/1994	3.62	5173.08									
07/07/1994	3.37	5173.33									
09/07/1994	3.72	5172.98									
09/29/1994	3.88	5172.82									
10/27/1994	3.82	5172.88									

Groundwater Hydrograph

Well Identification
PIEZ12

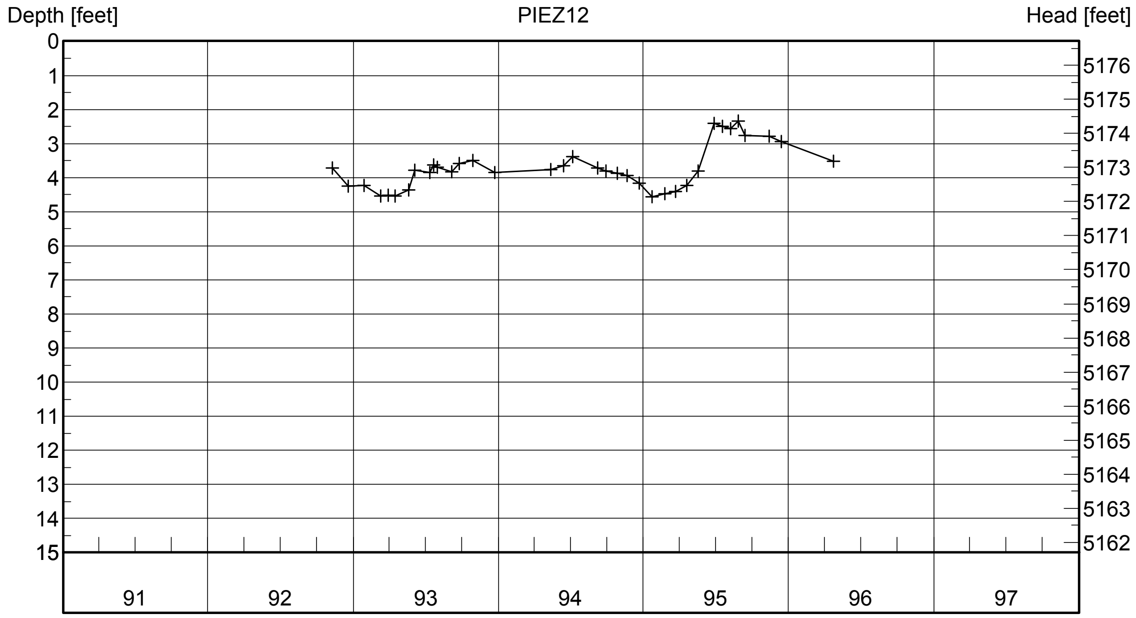
Well Name or Well Owner
Piezometer #12 (Gund-Ream red piezometer)

Location
08S 09W 03 ACDB

Ground Surface Elev. (ft)
5175.61

Measuring Point Elev. (ft)
5176.70

Well Depth below m.p. (ft)
23.68



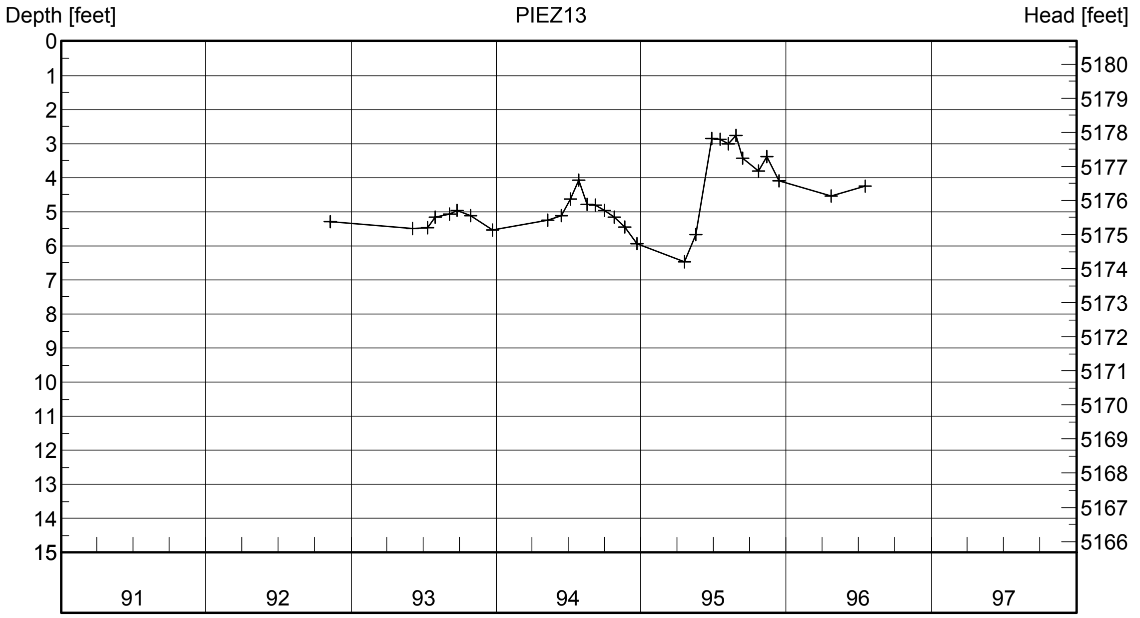
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
11/08/1992	3.72	5172.98
12/19/1992	4.26	5172.44
01/27/1993	4.22	5172.48
03/11/1993	4.54	5172.16
03/29/1993	4.51	5172.19
04/15/1993	4.53	5172.17
05/19/1993	4.36	5172.34
06/04/1993	3.78	5172.92
07/12/1993	3.84	5172.86
07/21/1993	3.62	5173.08
08/01/1993	3.70	5173.00
09/06/1993	3.82	5172.88
09/24/1993	3.59	5173.11
10/29/1993	3.50	5173.20
12/22/1993	3.86	5172.84
05/12/1994	3.76	5172.94
06/14/1994	3.66	5173.04
07/07/1994	3.38	5173.32
09/07/1994	3.72	5172.98
09/29/1994	3.80	5172.90
10/27/1994	3.87	5172.83
11/21/1994	3.93	5172.77
12/22/1994	4.15	5172.55
01/23/1995	4.55	5172.15
02/24/1995	4.47	5172.23
03/22/1995	4.40	5172.30
04/20/1995	4.23	5172.47
05/18/1995	3.80	5172.90
06/28/1995	2.40	5174.30
07/19/1995	2.50	5174.20
08/08/1995	2.56	5174.14
08/28/1995	2.35	5174.35
09/14/1995	2.76	5173.94
11/14/1995	2.79	5173.91
12/14/1995	2.95	5173.75
04/24/1996	3.52	5173.18

Groundwater Hydrograph

Well Identification PIEZ13	**Well Name or Well Owner** Piezometer #13 (Dawson yellow piezometer)

Location 08S 09W 03 BDDC	**Ground Surface Elev. (ft)** 5179.53	**Measuring Point Elev. (ft)** 5180.67	**Well Depth below m.p. (ft)** 6.46



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/08/1992	5.30	5175.37	07/19/1995	2.87	5177.80						
06/04/1993	5.50	5175.17	08/08/1995	3.00	5177.67						
07/12/1993	5.48	5175.19	08/28/1995	2.76	5177.91						
08/01/1993	5.16	5175.51	09/14/1995	3.43	5177.24						
09/06/1993	5.06	5175.61	10/23/1995	3.81	5176.86						
09/24/1993	4.95	5175.72	11/14/1995	3.38	5177.29						
10/29/1993	5.12	5175.55	12/14/1995	4.09	5176.58						
12/22/1993	5.54	5175.13	04/24/1996	4.54	5176.13						
05/11/1994	5.24	5175.43	07/18/1996	4.26	5176.41						
06/14/1994	5.12	5175.55									
07/07/1994	4.62	5176.05									
07/28/1994	4.08	5176.59									
08/18/1994	4.78	5175.89									
09/07/1994	4.80	5175.87									
09/30/1994	4.96	5175.71									
10/26/1994	5.16	5175.51									
11/21/1994	5.45	5175.22									
12/22/1994	5.93	5174.74									
04/20/1995	6.46	5174.21									
05/18/1995	5.68	5174.99									
06/28/1995	2.85	5177.82									

Groundwater Hydrograph

Well Identification
PIEZ14

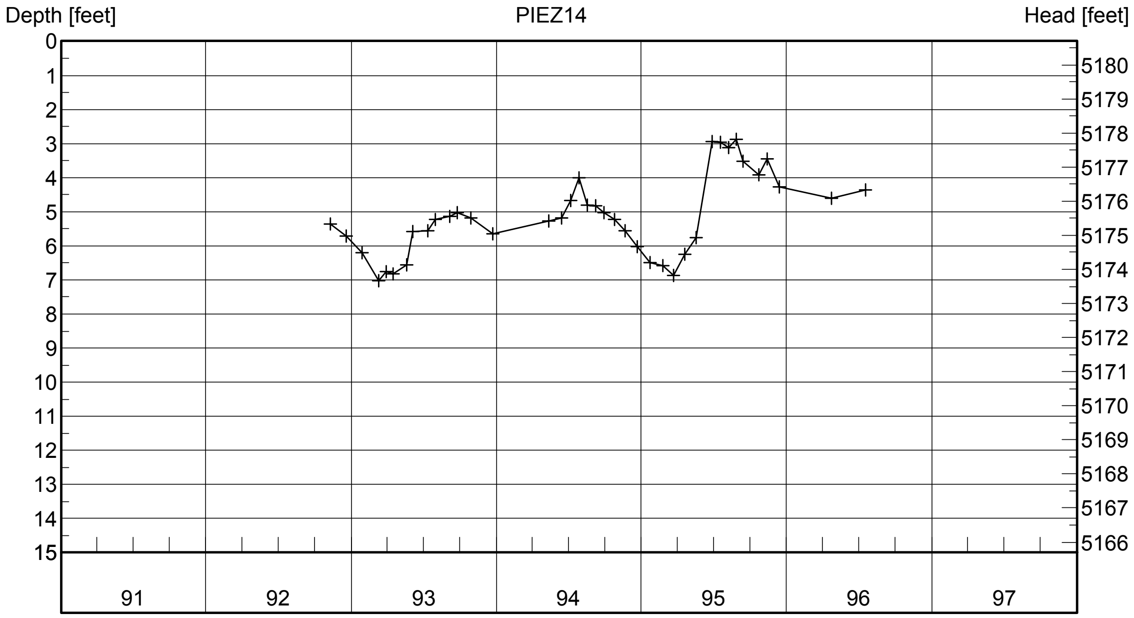
Well Name or Well Owner
Piezometer #14 (Dawson red piezometer)

Location
08S 09W 03 BDDC

Ground Surface Elev. (ft)
5179.61

Measuring Point Elev. (ft)
5180.69

Well Depth below m.p. (ft)
15.81



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/08/1992	5.36	5175.33	10/26/1994	5.22	5175.47						
12/19/1992	5.71	5174.98	11/21/1994	5.55	5175.14						
01/27/1993	6.21	5174.48	12/22/1994	6.03	5174.66						
03/11/1993	7.02	5173.67	01/23/1995	6.50	5174.19						
03/29/1993	6.76	5173.93	02/24/1995	6.57	5174.12						
04/15/1993	6.83	5173.86	03/22/1995	6.86	5173.83						
05/19/1993	6.55	5174.14	04/20/1995	6.24	5174.45						
06/04/1993	5.57	5175.12	05/18/1995	5.76	5174.93						
07/12/1993	5.56	5175.13	06/28/1995	2.94	5177.75						
08/01/1993	5.23	5175.46	07/19/1995	2.96	5177.73						
09/06/1993	5.13	5175.56	08/08/1995	3.11	5177.58						
09/24/1993	5.03	5175.66	08/28/1995	2.87	5177.82						
10/29/1993	5.18	5175.51	09/14/1995	3.52	5177.17						
12/22/1993	5.64	5175.05	10/23/1995	3.92	5176.77						
05/12/1994	5.28	5175.41	11/14/1995	3.46	5177.23						
06/14/1994	5.18	5175.51	12/14/1995	4.27	5176.42						
07/07/1994	4.67	5176.02	04/24/1996	4.61	5176.08						
07/28/1994	4.01	5176.68	07/18/1996	4.35	5176.34						
08/18/1994	4.80	5175.89									
09/07/1994	4.82	5175.87									
09/29/1994	5.02	5175.67									

Groundwater Hydrograph

Well Identification REBICH

MBMG Site # M:125143

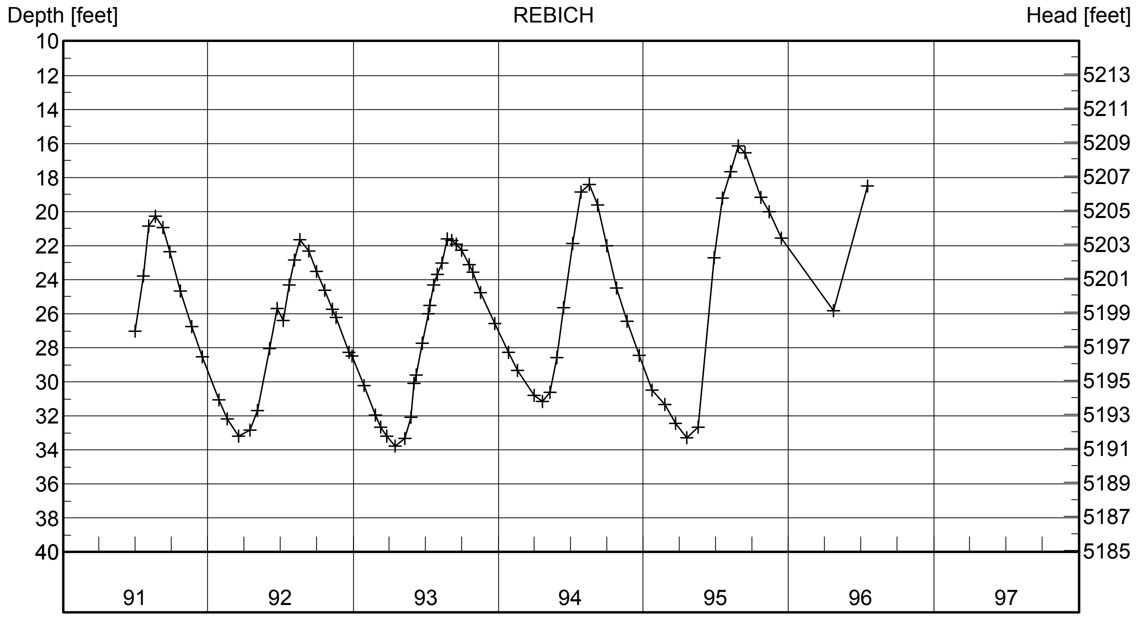
Well Name or Well Owner Phil Rebich

Location 08S 09W 15 CBAB

Ground Surface Elev. (ft) 5224.73

Measuring Point Elev. (ft) 5224.91

Well Depth below m.p. (ft) 41.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/02/1991	27.00	5197.91
07/22/1991	23.78	5201.13
08/05/1991	20.87	5204.04
08/21/1991	20.29	5204.62
09/09/1991	20.94	5203.97
09/27/1991	22.35	5202.56
10/23/1991	24.68	5200.23
11/21/1991	26.77	5198.14
12/18/1991	28.54	5196.37
01/29/1992	31.04	5193.87
02/19/1992	32.15	5192.76
03/18/1992	33.17	5191.74
04/16/1992	32.82	5192.09
05/05/1992	31.68	5193.23
06/04/1992	28.02	5196.89
06/23/1992	25.67	5199.24
07/09/1992	26.38	5198.53
07/23/1992	24.31	5200.60
08/06/1992	22.86	5202.05
08/19/1992	21.64	5203.27
09/10/1992	22.33	5202.58
09/29/1992	23.50	5201.41
10/21/1992	24.62	5200.29
11/09/1992	25.74	5199.17
11/18/1992	26.24	5198.67
12/20/1992	28.26	5196.65
12/29/1992	28.47	5196.44
01/27/1993	30.20	5194.71
02/25/1993	31.95	5192.96
03/11/1993	32.65	5192.26
03/26/1993	33.21	5191.70
04/15/1993	33.75	5191.16
05/10/1993	33.32	5191.59
05/25/1993	32.08	5192.83
06/03/1993	30.09	5194.82
06/08/1993	29.58	5195.33
06/24/1993	27.74	5197.17
07/08/1993	26.00	5198.91
07/12/1993	25.51	5199.40
07/21/1993	24.30	5200.61
08/01/1993	23.68	5201.23
08/12/1993	23.02	5201.89
08/25/1993	21.60	5203.31
09/06/1993	21.69	5203.22
09/16/1993	21.93	5202.98
09/30/1993	22.25	5202.66
10/19/1993	23.10	5201.81
10/29/1993	23.57	5201.34
11/17/1993	24.74	5200.17
12/22/1993	26.56	5198.35
01/26/1994	28.27	5196.64
02/17/1994	29.33	5195.58
03/31/1994	30.79	5194.12
04/21/1994	31.14	5193.77
05/11/1994	30.62	5194.29
05/27/1994	28.57	5196.34
06/14/1994	25.63	5199.28
07/07/1994	21.85	5203.06
07/28/1994	18.85	5206.06
08/18/1994	18.41	5206.50
09/07/1994	19.63	5205.28
09/30/1994	22.02	5202.89
10/26/1994	24.48	5200.43
11/21/1994	26.44	5198.47
12/22/1994	28.44	5196.47
01/23/1995	30.46	5194.45
02/23/1995	31.31	5193.60
03/22/1995	32.45	5192.46
04/20/1995	33.26	5191.65
05/18/1995	32.64	5192.27
06/28/1995	22.71	5202.20
07/19/1995	19.23	5205.68
08/08/1995	17.64	5207.27
08/28/1995	16.13	5208.78
09/14/1995	16.54	5208.37
10/23/1995	19.18	5205.73
11/14/1995	19.99	5204.92
12/14/1995	21.58	5203.33
04/24/1996	25.83	5199.08
07/18/1996	18.51	5206.40

Lower Rattlesnake Creek Valley

Groundwater Hydrograph

Well Identification
92-26

MBMG Site #
M:133398

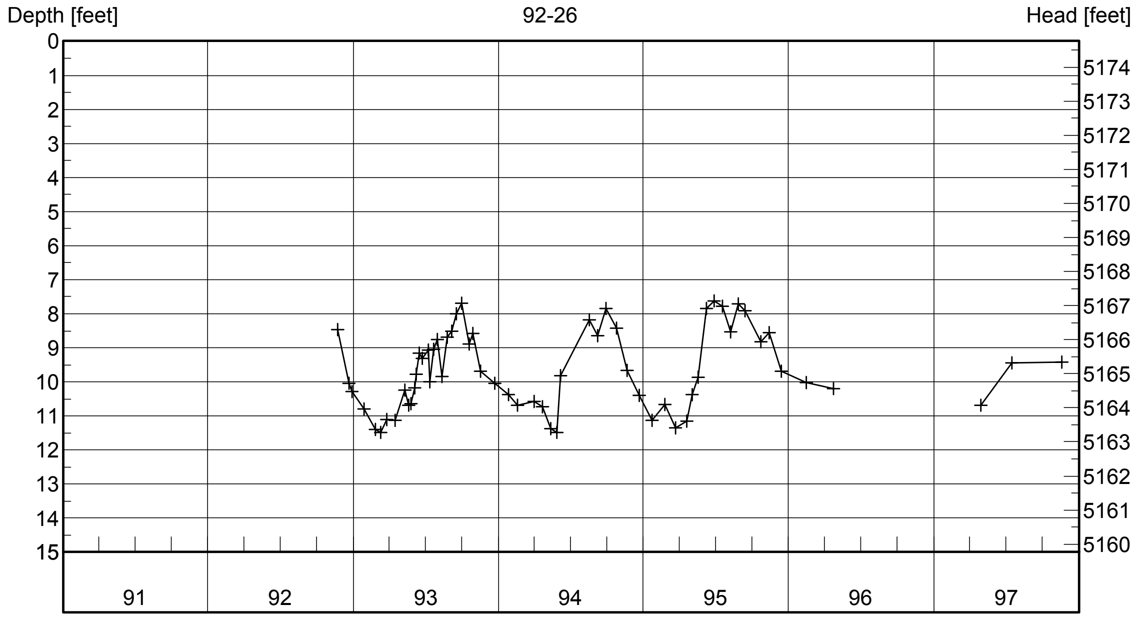
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-26

Location
07S 09W 33 DAAA

Ground Surface Elev. (ft)
5172.61

Measuring Point Elev. (ft)
5174.76

Well Depth below m.p. (ft)
94.52



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
11/23/1992	8.46	5166.30
12/20/1992	10.04	5164.72
12/29/1992	10.28	5164.48
01/27/1993	10.80	5163.96
02/25/1993	11.40	5163.36
03/11/1993	11.48	5163.28
03/26/1993	11.11	5163.65
04/15/1993	11.12	5163.64
05/10/1993	10.23	5164.53
05/19/1993	10.68	5164.08
05/25/1993	10.63	5164.13
06/04/1993	10.17	5164.59
06/08/1993	9.77	5164.99
06/15/1993	9.16	5165.60
06/24/1993	9.30	5165.46
07/08/1993	9.07	5165.69
07/12/1993	9.99	5164.77
07/21/1993	9.05	5165.71
08/01/1993	8.76	5166.00
08/12/1993	9.85	5164.91
08/25/1993	8.68	5166.08
09/06/1993	8.52	5166.24
09/16/1993	8.01	5166.75
09/30/1993	7.69	5167.07
10/19/1993	8.88	5165.88
10/29/1993	8.58	5166.18
11/17/1993	9.68	5165.08
12/22/1993	10.04	5164.72
01/26/1994	10.37	5164.39
02/17/1994	10.68	5164.08
03/31/1994	10.58	5164.18
04/21/1994	10.73	5164.03
05/12/1994	11.37	5163.39
05/27/1994	11.49	5163.27
06/06/1994	9.82	5164.94
08/18/1994	8.17	5166.59
09/07/1994	8.65	5166.11
09/29/1994	7.85	5166.91
10/26/1994	8.41	5166.35
11/21/1994	9.67	5165.09
12/22/1994	10.40	5164.36
01/23/1995	11.12	5163.64
02/24/1995	10.66	5164.10
03/22/1995	11.35	5163.41
04/20/1995	11.15	5163.61
05/04/1995	10.37	5164.39
05/18/1995	9.86	5164.90
06/08/1995	7.85	5166.91
06/27/1995	7.63	5167.13
07/19/1995	7.77	5166.99
08/08/1995	8.54	5166.22
08/28/1995	7.71	5167.05
09/14/1995	7.90	5166.86
10/23/1995	8.83	5165.93
11/14/1995	8.55	5166.21
12/14/1995	9.69	5165.07
02/15/1996	10.01	5164.75
04/24/1996	10.20	5164.56
04/29/1997	10.68	5164.08
07/17/1997	9.44	5165.32
11/19/1997	9.42	5165.34

Groundwater Hydrograph

Well Identification
92-27

MBMG Site #
M:133399

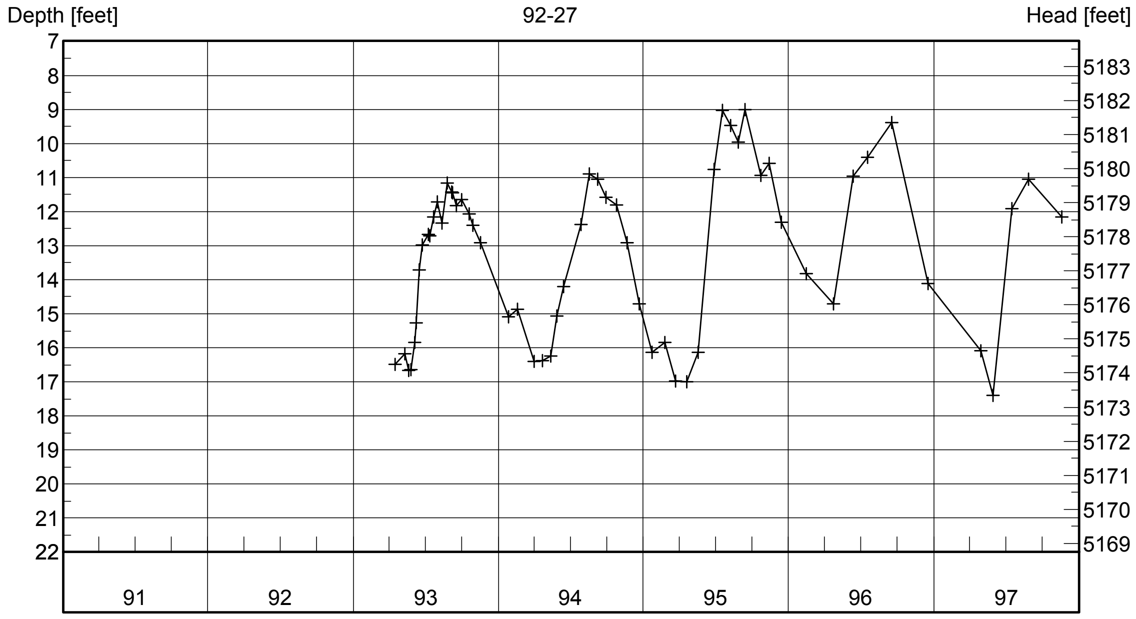
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-27

Location
07S 09W 33 CBDD

Ground Surface Elev. (ft)
5188.77

Measuring Point Elev. (ft)
5190.24

Well Depth below m.p. (ft)
182.97



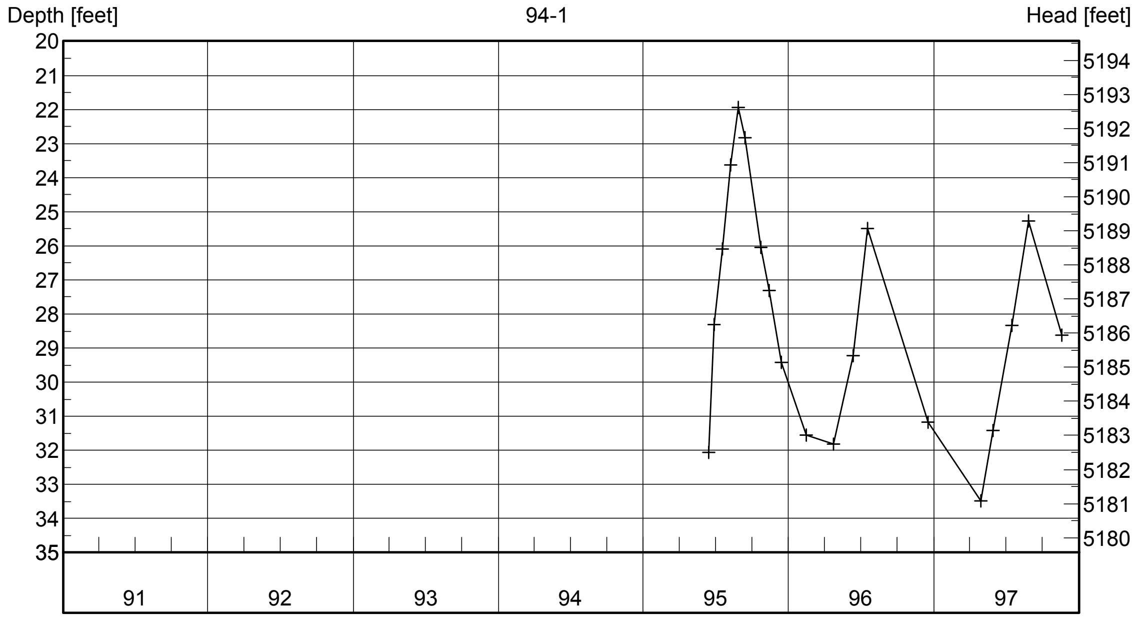
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
04/15/1993	16.49	5173.75	01/26/1994	15.09	5175.15	08/08/1995	9.47	5180.77			
05/10/1993	16.18	5174.06	02/17/1994	14.86	5175.38	08/28/1995	9.97	5180.27			
05/19/1993	16.67	5173.57	03/31/1994	16.39	5173.85	09/14/1995	9.00	5181.24			
05/25/1993	16.64	5173.60	04/21/1994	16.38	5173.86	10/23/1995	10.94	5179.30			
06/04/1993	15.84	5174.40	05/12/1994	16.25	5173.99	11/14/1995	10.59	5179.65			
06/08/1993	15.27	5174.97	05/27/1994	15.07	5175.17	12/14/1995	12.31	5177.93			
06/15/1993	13.72	5176.52	06/14/1994	14.21	5176.03	02/15/1996	13.82	5176.42			
06/24/1993	12.99	5177.25	07/28/1994	12.39	5177.85	04/24/1996	14.70	5175.54			
07/08/1993	12.68	5177.56	08/17/1994	10.89	5179.35	06/11/1996	10.96	5179.28			
07/12/1993	12.71	5177.53	09/07/1994	11.04	5179.20	07/18/1996	10.40	5179.84			
07/21/1993	12.15	5178.09	09/29/1994	11.58	5178.66	09/17/1996	9.39	5180.85			
08/01/1993	11.72	5178.52	10/26/1994	11.81	5178.43	12/17/1996	14.11	5176.13			
08/12/1993	12.33	5177.91	11/21/1994	12.91	5177.33	04/29/1997	16.08	5174.16			
08/25/1993	11.15	5179.09	12/22/1994	14.71	5175.53	05/29/1997	17.39	5172.85			
09/06/1993	11.42	5178.82	01/23/1995	16.14	5174.10	07/17/1997	11.91	5178.33			
09/08/1993	11.45	5178.79	02/24/1995	15.85	5174.39	08/27/1997	11.05	5179.19			
09/17/1993	11.83	5178.41	03/22/1995	16.97	5173.27	11/19/1997	12.15	5178.09			
09/30/1993	11.64	5178.60	04/20/1995	17.00	5173.24						
10/19/1993	12.08	5178.16	05/18/1995	16.14	5174.10						
10/29/1993	12.41	5177.83	06/27/1995	10.77	5179.47						
11/17/1993	12.91	5177.33	07/19/1995	9.03	5181.21						

Groundwater Hydrograph

Well Identification 94-1	**MBMG Site #** M:149511	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 94-1

Location 08S 09W 08 AAAA	**Ground Surface Elev. (ft)** 5212.14	**Measuring Point Elev. (ft)** 5214.06	**Well Depth below m.p. (ft)** 276.81



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
06/14/1995	32.07	5181.99
06/28/1995	28.32	5185.74
07/19/1995	26.10	5187.96
08/08/1995	23.62	5190.44
08/28/1995	21.94	5192.12
09/14/1995	22.84	5191.22
10/23/1995	26.05	5188.01
11/14/1995	27.32	5186.74
12/14/1995	29.42	5184.64
02/15/1996	31.54	5182.52
04/24/1996	31.81	5182.25
06/11/1996	29.22	5184.84
07/18/1996	25.49	5188.57
12/17/1996	31.18	5182.88
04/29/1997	33.49	5180.57
05/29/1997	31.41	5182.65
07/17/1997	28.33	5185.73
08/27/1997	25.28	5188.78
11/19/1997	28.63	5185.43

Groundwater Hydrograph

Well Identification
BOKA

MBMG Site #
M:109869

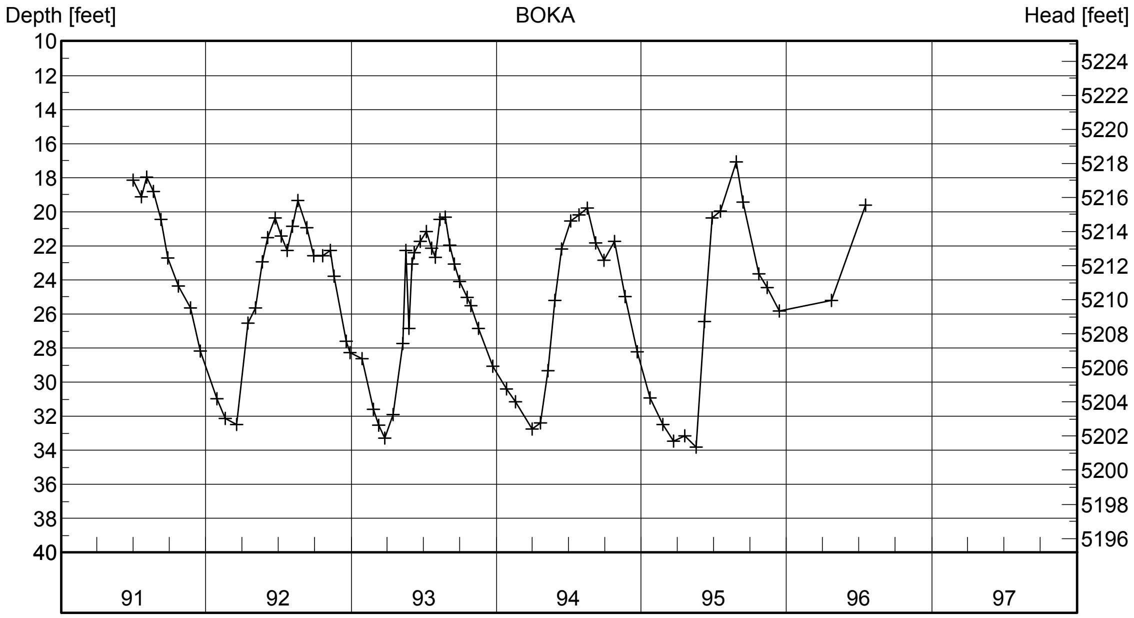
Well Name or Well Owner
Mike Boka

Location
08S 09W 08 DDCB

Ground Surface Elev. (ft)
5233.90

Measuring Point Elev. (ft)
5235.16

Well Depth below m.p. (ft)
60.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
07/02/1991	18.14	5217.02	09/10/1992	20.95	5214.21	08/12/1993	20.45	5214.71	10/26/1994	21.72	5213.44
07/22/1991	19.12	5216.04	09/28/1992	22.59	5212.57	08/25/1993	20.34	5214.82	11/21/1994	24.98	5210.18
08/05/1991	17.95	5217.21	10/21/1992	22.56	5212.60	09/06/1993	21.95	5213.21	12/22/1994	28.23	5206.93
08/21/1991	18.82	5216.34	11/09/1992	22.26	5212.90	09/16/1993	23.07	5212.09	01/23/1995	30.93	5204.23
09/09/1991	20.46	5214.70	11/18/1992	23.76	5211.40	09/30/1993	24.10	5211.06	02/24/1995	32.47	5202.69
09/27/1991	22.70	5212.46	12/19/1992	27.58	5207.58	10/19/1993	25.03	5210.13	03/22/1995	33.46	5201.70
10/23/1991	24.36	5210.80	12/29/1992	28.25	5206.91	10/29/1993	25.52	5209.64	04/20/1995	33.13	5202.03
11/22/1991	25.64	5209.52	01/27/1993	28.61	5206.55	11/17/1993	26.85	5208.31	05/18/1995	33.79	5201.37
12/18/1991	28.19	5206.97	02/25/1993	31.60	5203.56	12/22/1993	29.08	5206.08	06/08/1995	26.46	5208.70
01/29/1992	30.97	5204.19	03/11/1993	32.53	5202.63	01/26/1994	30.38	5204.78	06/28/1995	20.35	5214.81
02/19/1992	32.13	5203.03	03/26/1993	33.27	5201.89	02/17/1994	31.13	5204.03	07/19/1995	19.98	5215.18
03/18/1992	32.50	5202.66	04/15/1993	31.88	5203.28	03/31/1994	32.75	5202.41	08/28/1995	17.08	5218.08
04/16/1992	26.55	5208.61	05/10/1993	27.74	5207.42	04/21/1994	32.39	5202.77	09/14/1995	19.43	5215.73
05/05/1992	25.63	5209.53	05/18/1993	22.29	5212.87	05/11/1994	29.33	5205.83	10/23/1995	23.64	5211.52
05/21/1992	22.92	5212.24	05/25/1993	26.86	5208.30	05/27/1994	25.21	5209.95	11/14/1995	24.45	5210.71
06/04/1992	21.52	5213.64	06/03/1993	23.05	5212.11	06/14/1994	22.16	5213.00	12/14/1995	25.80	5209.36
06/23/1992	20.36	5214.80	06/08/1993	22.42	5212.74	07/07/1994	20.55	5214.61	04/24/1996	25.20	5209.96
07/09/1992	21.43	5213.73	06/24/1993	21.73	5213.43	07/28/1994	20.18	5214.98	07/18/1996	19.62	5215.54
07/23/1992	22.27	5212.89	07/08/1993	21.16	5214.00	08/18/1994	19.80	5215.36			
08/06/1992	20.87	5214.29	07/21/1993	22.12	5213.04	09/07/1994	21.81	5213.35			
08/19/1992	19.34	5215.82	08/01/1993	22.65	5212.51	09/29/1994	22.85	5212.31			

Groundwater Hydrograph

Well Identification
BOTT

MBMG Site #
M:145393

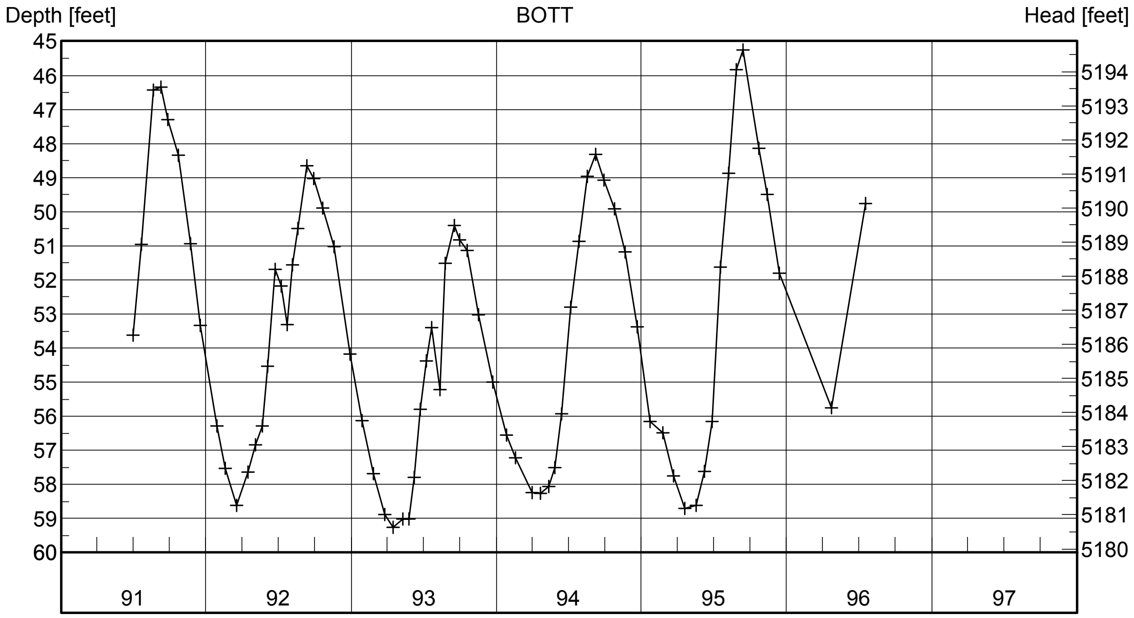
Well Name or Well Owner
Lynn Bott

Location
08S 09W 05 CBCD

Ground Surface Elev. (ft)
5236.13

Measuring Point Elev. (ft)
5239.39

Well Depth below m.p. (ft)
74.91



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/02/1991	53.63	5185.76
07/22/1991	50.96	5188.43
08/21/1991	46.43	5192.96
09/09/1991	46.35	5193.04
09/27/1991	47.29	5192.10
10/23/1991	48.35	5191.04
11/22/1991	50.94	5188.45
12/18/1991	53.34	5186.05
01/29/1992	56.29	5183.10
02/19/1992	57.53	5181.86
03/18/1992	58.62	5180.77
04/16/1992	57.63	5181.76
05/05/1992	56.83	5182.56
05/21/1992	56.29	5183.10
06/04/1992	54.53	5184.86
06/23/1992	51.68	5187.71
07/09/1992	52.18	5187.21
07/23/1992	53.32	5186.07
08/06/1992	51.55	5187.84
08/19/1992	50.49	5188.90
09/10/1992	48.65	5190.74
09/28/1992	49.03	5190.36
10/21/1992	49.89	5189.50
11/18/1992	51.02	5188.37
12/29/1992	54.17	5185.22
01/27/1993	56.13	5183.26
02/25/1993	57.68	5181.71
03/26/1993	58.88	5180.51
04/15/1993	59.26	5180.13
05/10/1993	59.01	5180.38
05/25/1993	59.01	5180.38
06/08/1993	57.80	5181.59
06/24/1993	55.80	5183.59
07/08/1993	54.37	5185.02
07/21/1993	53.40	5185.99
08/12/1993	55.21	5184.18
08/25/1993	51.52	5187.87
09/16/1993	50.41	5188.98
09/30/1993	50.82	5188.57
10/19/1993	51.13	5188.26
11/17/1993	53.03	5186.36
12/22/1993	55.00	5184.39
01/26/1994	56.54	5182.85
02/17/1994	57.21	5182.18
03/31/1994	58.24	5181.15
04/21/1994	58.26	5181.13
05/12/1994	58.06	5181.33
05/27/1994	57.51	5181.88
06/14/1994	55.92	5183.47
07/07/1994	52.79	5186.60
07/28/1994	50.86	5188.53
08/17/1994	48.97	5190.42
09/07/1994	48.32	5191.07
09/29/1994	49.08	5190.31
10/26/1994	49.91	5189.48
11/21/1994	51.17	5188.22
12/22/1994	53.38	5186.01
01/23/1995	56.16	5183.23
02/24/1995	56.48	5182.91
03/22/1995	57.74	5181.65
04/20/1995	58.70	5180.69
05/18/1995	58.61	5180.78
06/08/1995	57.61	5181.78
06/27/1995	56.15	5183.24
07/19/1995	51.63	5187.76
08/08/1995	48.87	5190.52
08/28/1995	45.83	5193.56
09/14/1995	45.25	5194.14
10/23/1995	48.14	5191.25
11/14/1995	49.49	5189.90
12/14/1995	51.79	5187.60
04/24/1996	55.74	5183.65
07/18/1996	49.77	5189.62

Groundwater Hydrograph

Well Identification HARRINGT

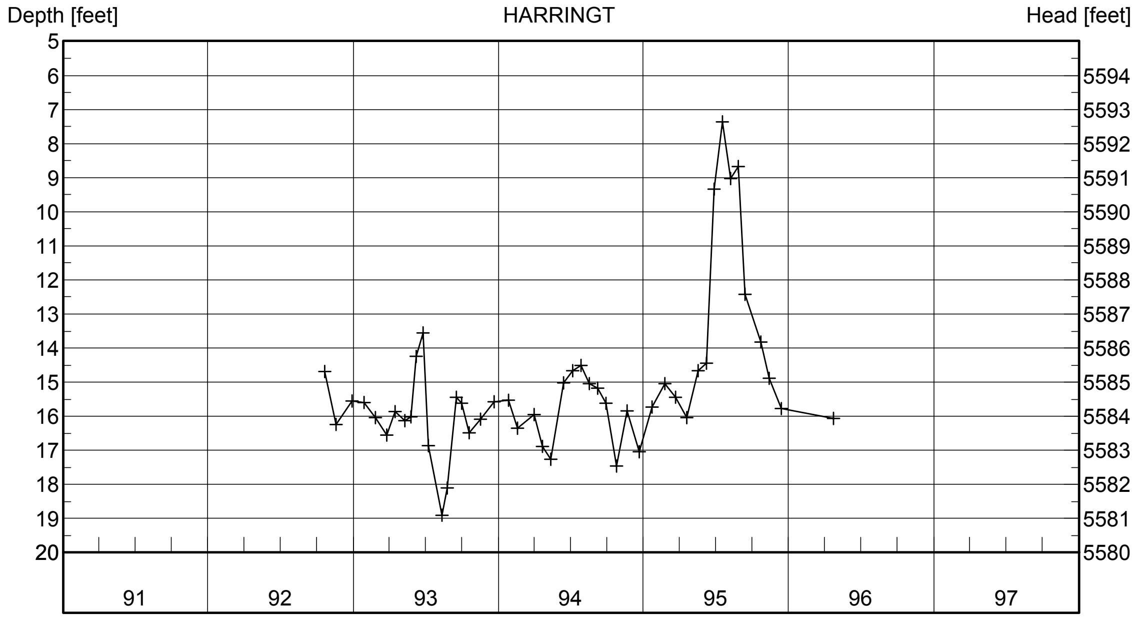
MBMG Site # M:145395

Well Name or Well Owner Don Harrington

Location 07S 10W 12 CBDC

Ground Surface Elev. (ft) 5599.47

Measuring Point Elev. (ft) 5600.00



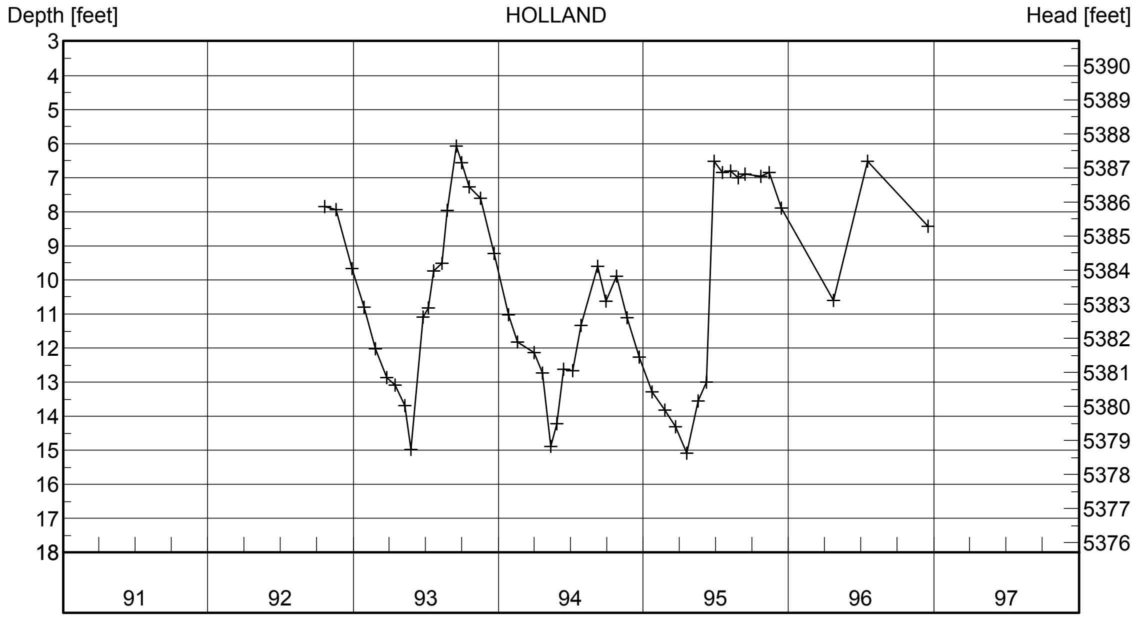
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
10/21/1992	14.68	5585.32
11/18/1992	16.25	5583.75
12/29/1992	15.55	5584.45
01/27/1993	15.60	5584.40
02/25/1993	16.05	5583.95
03/26/1993	16.55	5583.45
04/15/1993	15.87	5584.13
05/10/1993	16.13	5583.87
05/25/1993	16.01	5583.99
06/08/1993	14.24	5585.76
06/25/1993	13.55	5586.45
07/08/1993	16.86	5583.14
08/12/1993	18.91	5581.09
08/25/1993	18.11	5581.89
09/16/1993	15.43	5584.57
09/30/1993	15.62	5584.38
10/19/1993	16.49	5583.51
11/17/1993	16.09	5583.91
12/21/1993	15.58	5584.42
01/26/1994	15.53	5584.47
02/17/1994	16.36	5583.64
03/31/1994	15.96	5584.04
04/21/1994	16.88	5583.12
05/12/1994	17.27	5582.73
06/14/1994	15.02	5584.98
07/07/1994	14.66	5585.34
07/28/1994	14.51	5585.49
08/17/1994	15.04	5584.96
09/07/1994	15.18	5584.82
09/29/1994	15.62	5584.38
10/26/1994	17.46	5582.54
11/21/1994	15.84	5584.16
12/22/1994	17.03	5582.97
01/23/1995	15.73	5584.27
02/24/1995	15.03	5584.97
03/22/1995	15.44	5584.56
04/20/1995	16.04	5583.96
05/18/1995	14.67	5585.33
06/08/1995	14.45	5585.55
06/27/1995	9.34	5590.66
07/19/1995	7.37	5592.63
08/08/1995	9.03	5590.97
08/28/1995	8.68	5591.32
09/14/1995	12.43	5587.57
10/23/1995	13.82	5586.18
11/14/1995	14.89	5585.11
12/14/1995	15.77	5584.23
04/24/1996	16.07	5583.93

Groundwater Hydrograph

Well Identification	**MBMG Site #**	**Well Name or Well Owner**
HOLLAND	M:145396	Ben Holland well @ rental house

Location	**Ground Surface Elev. (ft)**	**Measuring Point Elev. (ft)**
07S 10W 25 AAAB	5391.75	5393.21



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
10/21/1992	7.84	5385.37
11/18/1992	7.94	5385.27
12/29/1992	9.67	5383.54
01/27/1993	10.81	5382.40
02/25/1993	12.03	5381.18
03/26/1993	12.86	5380.35
04/15/1993	13.08	5380.13
05/10/1993	13.68	5379.53
05/25/1993	14.97	5378.24
06/25/1993	11.09	5382.12
07/08/1993	10.83	5382.38
07/21/1993	9.74	5383.47
08/12/1993	9.52	5383.69
08/25/1993	7.97	5385.24
09/16/1993	6.07	5387.14
09/30/1993	6.56	5386.65
10/19/1993	7.28	5385.93
11/17/1993	7.60	5385.61
12/21/1993	9.23	5383.98
01/26/1994	11.03	5382.18
02/17/1994	11.82	5381.39
03/31/1994	12.14	5381.07
04/21/1994	12.73	5380.48
05/12/1994	14.89	5378.32
05/27/1994	14.21	5379.00
06/14/1994	12.61	5380.60
07/07/1994	12.66	5380.55
07/28/1994	11.33	5381.88
09/07/1994	9.61	5383.60
09/29/1994	10.62	5382.59
10/26/1994	9.89	5383.32
11/21/1994	11.12	5382.09
12/22/1994	12.27	5380.94
01/23/1995	13.29	5379.92
02/24/1995	13.81	5379.40
03/22/1995	14.31	5378.90
04/20/1995	15.09	5378.12
05/18/1995	13.54	5379.67
06/08/1995	13.00	5380.21
06/27/1995	6.52	5386.69
07/19/1995	6.86	5386.35
08/08/1995	6.80	5386.41
08/28/1995	7.01	5386.20
09/14/1995	6.90	5386.31
10/23/1995	6.97	5386.24
11/14/1995	6.84	5386.37
12/14/1995	7.90	5385.31
04/24/1996	10.59	5382.62
07/18/1996	6.52	5386.69
12/17/1996	8.43	5384.78

Groundwater Hydrograph

Well Identification
HOLLANDS

MBMG Site #
M:109683

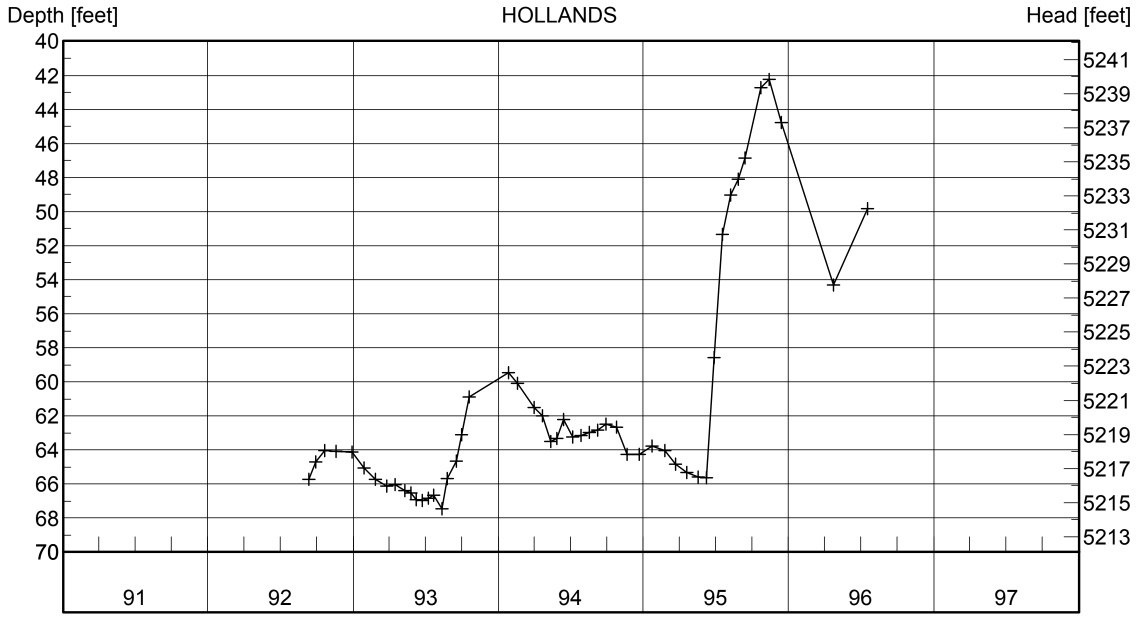
Well Name or Well Owner
Ben Holland stock well

Location
07S 09W 31 DAAA

Ground Surface Elev. (ft)
5280.77

Measuring Point Elev. (ft)
5282.08

Well Depth below m.p. (ft)
80.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
09/10/1992	65.73	5216.35	02/17/1994	60.09	5221.99	07/19/1995	51.34	5230.74			
09/28/1992	64.68	5217.40	03/31/1994	61.51	5220.57	08/08/1995	49.05	5233.03			
10/21/1992	64.03	5218.05	04/21/1994	62.01	5220.07	08/28/1995	48.12	5233.96			
11/18/1992	64.07	5218.01	05/12/1994	63.48	5218.60	09/14/1995	46.86	5235.22			
12/29/1992	64.12	5217.96	05/27/1994	63.34	5218.74	10/23/1995	42.71	5239.37			
01/27/1993	65.03	5217.05	06/14/1994	62.23	5219.85	11/14/1995	42.25	5239.83			
02/25/1993	65.71	5216.37	07/07/1994	63.25	5218.83	12/14/1995	44.78	5237.30			
03/26/1993	66.11	5215.97	07/28/1994	63.15	5218.93	04/24/1996	54.33	5227.75			
04/15/1993	66.05	5216.03	08/17/1994	62.98	5219.10	07/18/1996	49.83	5232.25			
05/10/1993	66.37	5215.71	09/07/1994	62.82	5219.26						
05/25/1993	66.52	5215.56	09/29/1994	62.50	5219.58						
06/08/1993	66.91	5215.17	10/26/1994	62.64	5219.44						
06/24/1993	66.95	5215.13	11/21/1994	64.24	5217.84						
07/08/1993	66.84	5215.24	12/22/1994	64.26	5217.82						
07/21/1993	66.65	5215.43	01/23/1995	63.75	5218.33						
08/12/1993	67.45	5214.63	02/24/1995	64.03	5218.05						
08/25/1993	65.69	5216.39	03/22/1995	64.83	5217.25						
09/16/1993	64.64	5217.44	04/20/1995	65.31	5216.77						
09/30/1993	63.08	5219.00	05/18/1995	65.60	5216.48						
10/19/1993	60.89	5221.19	06/08/1995	65.64	5216.44						
01/26/1994	59.45	5222.63	06/27/1995	58.57	5223.51						

Groundwater Hydrograph

Well Identification
HURSH

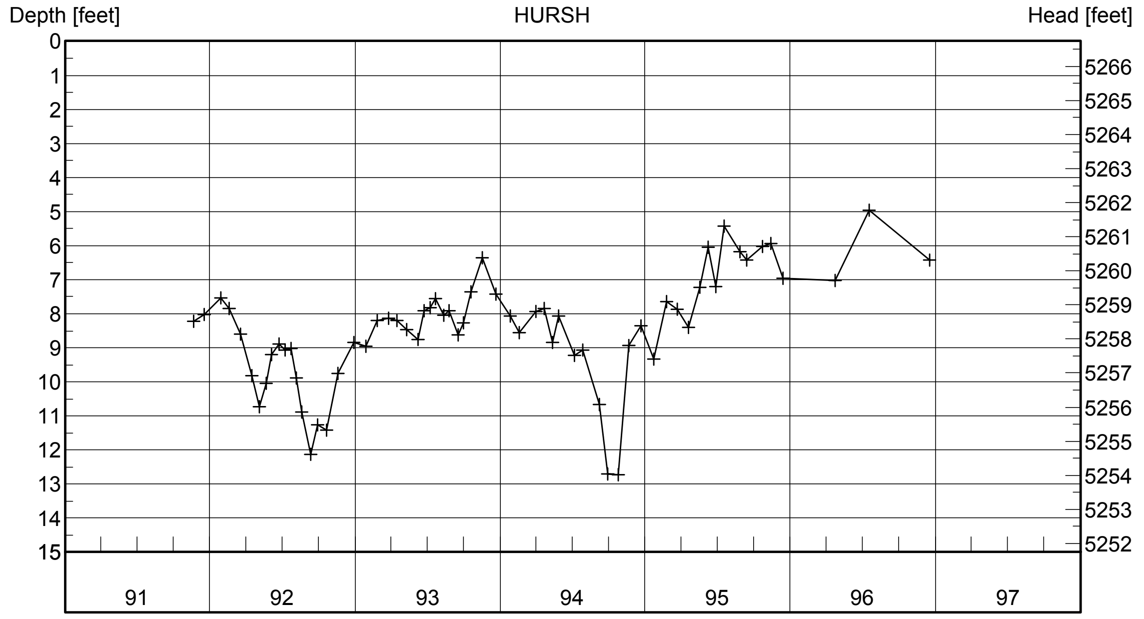
MBMG Site #
M:145394

Well Name or Well Owner
Tery Hursh domestic well

Location
07S 09W 29 CCDD

Ground Surface Elev. (ft)
5264.34

Measuring Point Elev. (ft)
5266.24



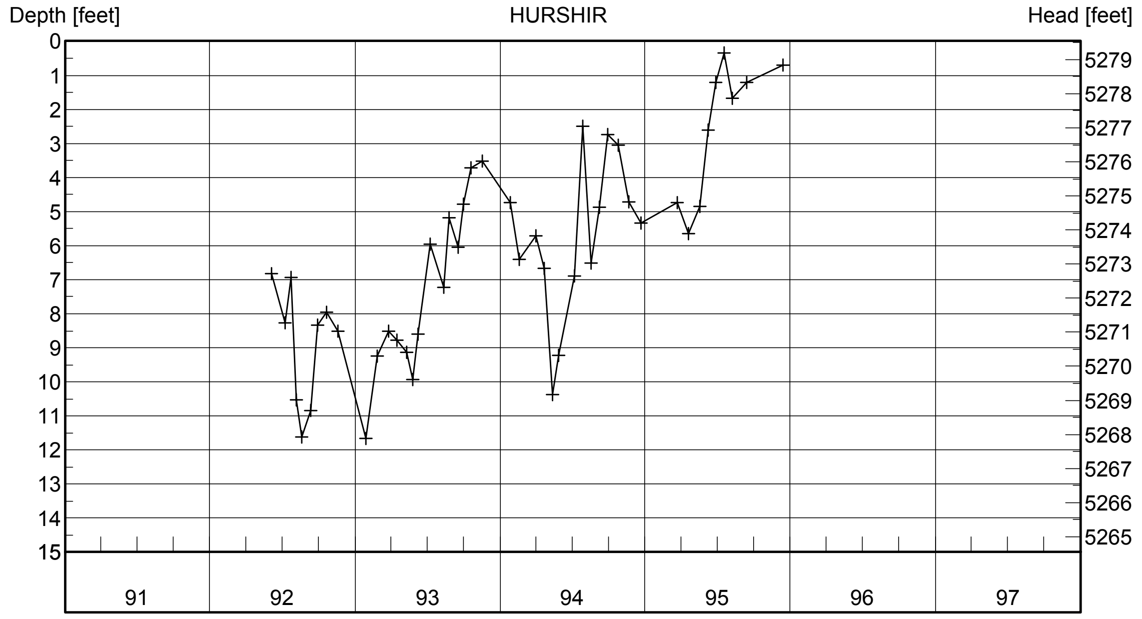
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/21/1991	8.22	5258.02	03/26/1993	8.14	5258.10	07/28/1994	9.06	5257.18	12/17/1996	6.43	5259.81
12/18/1991	8.03	5258.21	04/15/1993	8.21	5258.03	09/07/1994	10.67	5255.57			
01/29/1992	7.53	5258.71	05/10/1993	8.46	5257.78	09/29/1994	12.71	5253.53			
02/19/1992	7.85	5258.39	06/08/1993	8.75	5257.49	10/26/1994	12.73	5253.51			
03/18/1992	8.60	5257.64	06/24/1993	7.90	5258.34	11/21/1994	8.94	5257.30			
04/16/1992	9.82	5256.42	07/08/1993	7.83	5258.41	12/22/1994	8.35	5257.89			
05/05/1992	10.73	5255.51	07/21/1993	7.55	5258.69	01/23/1995	9.32	5256.92			
05/21/1992	10.04	5256.20	08/12/1993	8.04	5258.20	02/24/1995	7.64	5258.60			
06/04/1992	9.19	5257.05	08/25/1993	7.90	5258.34	03/22/1995	7.87	5258.37			
06/23/1992	8.89	5257.35	09/16/1993	8.62	5257.62	04/20/1995	8.40	5257.84			
07/09/1992	9.07	5257.17	09/30/1993	8.27	5257.97	05/18/1995	7.22	5259.02			
07/23/1992	9.03	5257.21	10/19/1993	7.36	5258.88	06/08/1995	6.04	5260.20			
08/06/1992	9.88	5256.36	11/17/1993	6.35	5259.89	06/27/1995	7.20	5259.04			
08/19/1992	10.89	5255.35	12/21/1993	7.42	5258.82	07/19/1995	5.42	5260.82			
09/10/1992	12.13	5254.11	01/26/1994	8.07	5258.17	08/28/1995	6.19	5260.05			
09/28/1992	11.27	5254.97	02/17/1994	8.55	5257.69	09/14/1995	6.43	5259.81			
10/21/1992	11.42	5254.82	03/31/1994	7.94	5258.30	10/23/1995	6.02	5260.22			
11/18/1992	9.75	5256.49	04/21/1994	7.85	5258.39	11/14/1995	5.94	5260.30			
12/29/1992	8.85	5257.39	05/12/1994	8.85	5257.39	12/14/1995	6.96	5259.28			
01/27/1993	8.96	5257.28	05/27/1994	8.06	5258.18	04/24/1996	7.02	5259.22			
02/25/1993	8.21	5258.03	07/07/1994	9.21	5257.03	07/18/1996	4.97	5261.27			

Groundwater Hydrograph

Well Identification	MBMG Site #	Well Name or Well Owner
HURSHIR	M:109686	Tery Hursh irrigation well

Location	Ground Surface Elev. (ft)	Measuring Point Elev. (ft)	Well Depth below m.p. (ft)
07S 09W 29 CCCA	5279.32	5279.54	220.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
06/04/1992	6.82	5272.72	10/19/1993	3.71	5275.83	07/19/1995	0.35	5279.19			
07/09/1992	8.27	5271.27	11/17/1993	3.51	5276.03	08/08/1995	1.68	5277.86			
07/23/1992	6.94	5272.60	01/26/1994	4.74	5274.80	09/14/1995	1.22	5278.32			
08/06/1992	10.52	5269.02	02/17/1994	6.40	5273.14	12/14/1995	0.70	5278.84			
08/19/1992	11.61	5267.93	03/31/1994	5.72	5273.82						
09/10/1992	10.84	5268.70	04/21/1994	6.66	5272.88						
09/28/1992	8.33	5271.21	05/12/1994	10.38	5269.16						
10/21/1992	7.96	5271.58	05/27/1994	9.23	5270.31						
11/18/1992	8.52	5271.02	07/07/1994	6.90	5272.64						
01/27/1993	11.66	5267.88	07/28/1994	2.49	5277.05						
02/25/1993	9.24	5270.30	08/17/1994	6.52	5273.02						
03/26/1993	8.52	5271.02	09/07/1994	4.88	5274.66						
04/15/1993	8.78	5270.76	09/29/1994	2.75	5276.79						
05/10/1993	9.12	5270.42	10/26/1994	3.05	5276.49						
05/25/1993	9.94	5269.60	11/21/1994	4.72	5274.82						
06/08/1993	8.59	5270.95	12/22/1994	5.34	5274.20						
07/08/1993	5.96	5273.58	03/22/1995	4.73	5274.81						
08/12/1993	7.22	5272.32	04/20/1995	5.65	5273.89						
08/25/1993	5.18	5274.36	05/18/1995	4.85	5274.69						
09/16/1993	6.04	5273.50	06/08/1995	2.61	5276.93						
09/30/1993	4.79	5274.75	06/27/1995	1.20	5278.34						

Groundwater Hydrograph

Well Identification
JOHNSON

MBMG Site #
M:109691

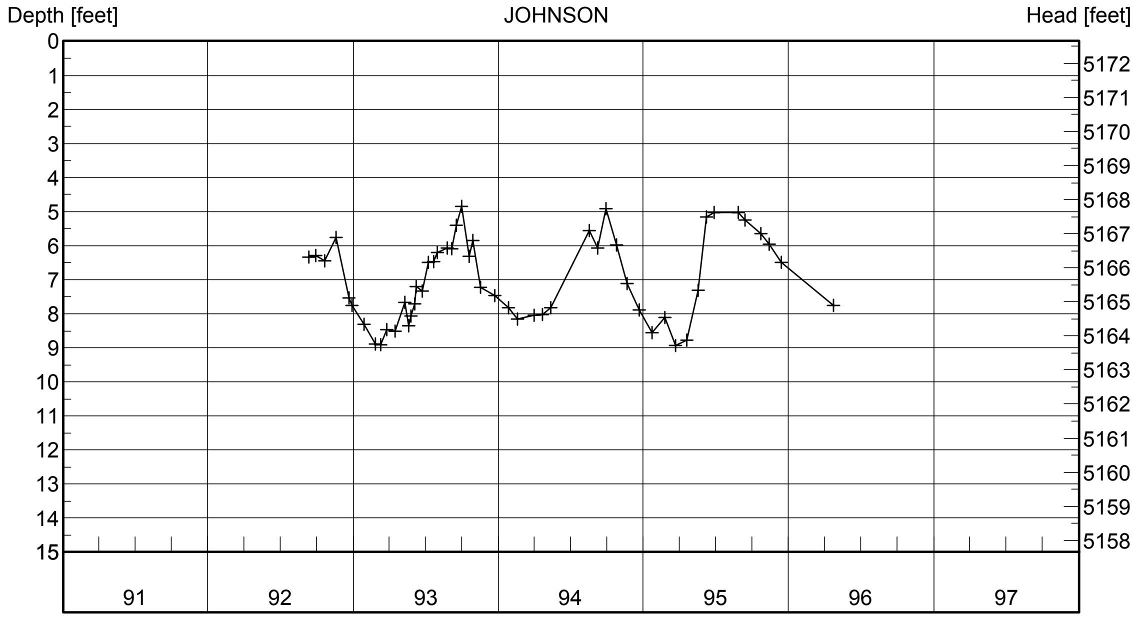
Well Name or Well Owner
Ron Johnson irrigation well near Pallet Mill

Location
07S 09W 33 DAAA

Ground Surface Elev. (ft)
5171.92

Measuring Point Elev. (ft)
5172.65

Well Depth below m.p. (ft)
80.00



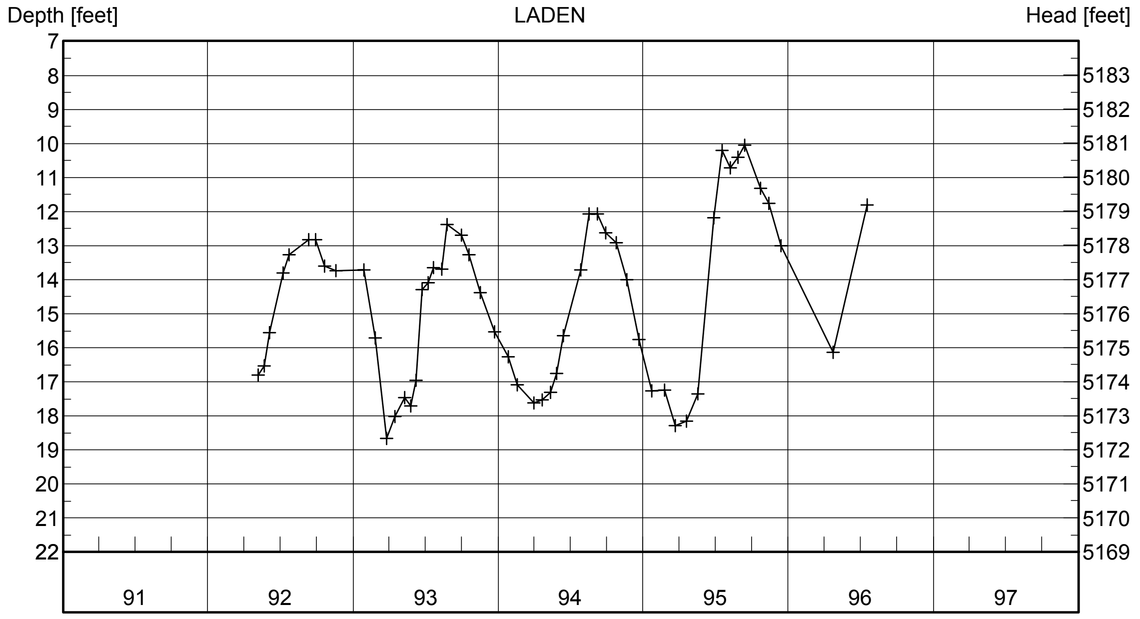
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
09/10/1992	6.34	5166.31
09/28/1992	6.29	5166.36
10/21/1992	6.44	5166.21
11/18/1992	5.75	5166.90
12/20/1992	7.53	5165.12
12/29/1992	7.75	5164.90
01/27/1993	8.32	5164.33
02/25/1993	8.88	5163.77
03/11/1993	8.91	5163.74
03/26/1993	8.47	5164.18
04/15/1993	8.51	5164.14
05/10/1993	7.67	5164.98
05/19/1993	8.36	5164.29
05/25/1993	8.06	5164.59
06/04/1993	7.72	5164.93
06/08/1993	7.19	5165.46
06/24/1993	7.34	5165.31
07/08/1993	6.50	5166.15
07/21/1993	6.46	5166.19
08/01/1993	6.21	5166.44
08/25/1993	6.06	5166.59
09/06/1993	6.08	5166.57
09/16/1993	5.41	5167.24
09/30/1993	4.85	5167.80
10/19/1993	6.32	5166.33
10/29/1993	5.84	5166.81
11/17/1993	7.22	5165.43
12/22/1993	7.47	5165.18
01/26/1994	7.82	5164.83
02/17/1994	8.15	5164.50
03/31/1994	8.04	5164.61
04/21/1994	8.02	5164.63
05/12/1994	7.82	5164.83
08/18/1994	5.56	5167.09
09/07/1994	6.07	5166.58
09/29/1994	4.92	5167.73
10/26/1994	5.98	5166.67
11/21/1994	7.11	5165.54
12/22/1994	7.88	5164.77
01/23/1995	8.56	5164.09
02/24/1995	8.12	5164.53
03/22/1995	8.93	5163.72
04/20/1995	8.77	5163.88
05/18/1995	7.31	5165.34
06/08/1995	5.16	5167.49
06/27/1995	5.02	5167.63
08/28/1995	5.02	5167.63
09/14/1995	5.25	5167.40
10/23/1995	5.64	5167.01
11/14/1995	5.95	5166.70
12/14/1995	6.50	5166.15
04/24/1996	7.75	5164.90

Groundwater Hydrograph

Well Identification	MBMG Site #	Well Name or Well Owner
LADEN	M:109699	Tim Laden irrigation well along Rattlesnake Creek

Location	Ground Surface Elev. (ft)	Measuring Point Elev. (ft)	Well Depth below m.p. (ft)
07S 09W 33 CACC	5190.11	5190.49	200.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
05/07/1992	16.80	5173.69
05/21/1992	16.52	5173.97
06/04/1992	15.55	5174.94
07/09/1992	13.79	5176.70
07/23/1992	13.26	5177.23
09/10/1992	12.83	5177.66
09/28/1992	12.83	5177.66
10/21/1992	13.60	5176.89
11/18/1992	13.74	5176.75
01/27/1993	13.72	5176.77
02/25/1993	15.72	5174.77
03/26/1993	18.67	5171.82
04/15/1993	18.01	5172.48
05/10/1993	17.46	5173.03
05/25/1993	17.70	5172.79
06/08/1993	16.96	5173.53
06/24/1993	14.30	5176.19
07/08/1993	14.08	5176.41
07/21/1993	13.64	5176.85
08/12/1993	13.69	5176.80
08/25/1993	12.38	5178.11
09/30/1993	12.70	5177.79
10/19/1993	13.27	5177.22
11/17/1993	14.37	5176.12
12/22/1993	15.53	5174.96
01/26/1994	16.27	5174.22
02/17/1994	17.08	5173.41
03/31/1994	17.61	5172.88
04/21/1994	17.53	5172.96
05/12/1994	17.31	5173.18
05/27/1994	16.75	5173.74
06/14/1994	15.64	5174.85
07/28/1994	13.71	5176.78
08/17/1994	12.08	5178.41
09/07/1994	12.08	5178.41
09/29/1994	12.63	5177.86
10/26/1994	12.91	5177.58
11/21/1994	14.01	5176.48
12/22/1994	15.76	5174.73
01/23/1995	17.26	5173.23
02/24/1995	17.24	5173.25
03/22/1995	18.29	5172.20
04/20/1995	18.16	5172.33
05/18/1995	17.36	5173.13
06/27/1995	12.18	5178.31
07/19/1995	10.20	5180.29
08/08/1995	10.71	5179.78
08/28/1995	10.41	5180.08
09/14/1995	10.06	5180.43
10/23/1995	11.32	5179.17
11/14/1995	11.75	5178.74
12/14/1995	13.00	5177.49
04/24/1996	16.12	5174.37
07/18/1996	11.80	5178.69

Groundwater Hydrograph

Well Identification MAUTZ

MBMG Site # M:109846

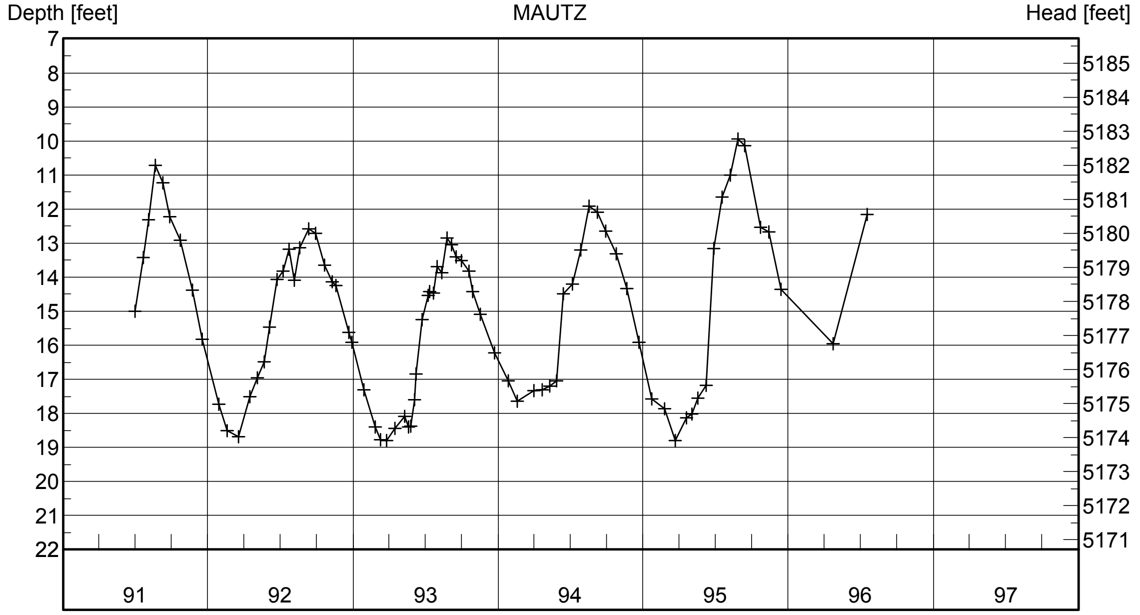
Well Name or Well Owner former Mautz Ranch

Location 08S 09W 04 BDAB

Ground Surface Elev. (ft) 5192.17

Measuring Point Elev. (ft) 5192.71

Well Depth below m.p. (ft) 25.24



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/02/1991	15.00	5177.71
07/22/1991	13.42	5179.29
08/05/1991	12.31	5180.40
08/21/1991	10.71	5182.00
09/09/1991	11.22	5181.49
09/27/1991	12.22	5180.49
10/23/1991	12.92	5179.79
11/22/1991	14.37	5178.34
12/18/1991	15.82	5176.89
01/29/1992	17.73	5174.98
02/19/1992	18.50	5174.21
03/18/1992	18.68	5174.03
04/16/1992	17.51	5175.20
05/05/1992	16.95	5175.76
05/21/1992	16.49	5176.22
06/04/1992	15.46	5177.25
06/23/1992	14.07	5178.64
07/09/1992	13.82	5178.89
07/23/1992	13.18	5179.53
08/06/1992	14.08	5178.63
08/19/1992	13.14	5179.57
09/10/1992	12.57	5180.14
09/28/1992	12.72	5179.99
10/21/1992	13.65	5179.06
11/09/1992	14.14	5178.57
11/18/1992	14.25	5178.46
12/20/1992	15.63	5177.08
12/29/1992	15.90	5176.81
01/27/1993	17.31	5175.40
02/25/1993	18.40	5174.31
03/11/1993	18.78	5173.93
03/26/1993	18.79	5173.92
04/15/1993	18.44	5174.27
05/10/1993	18.09	5174.62
05/19/1993	18.40	5174.31
05/25/1993	18.38	5174.33
06/04/1993	17.59	5175.12
06/08/1993	16.85	5175.86
06/24/1993	15.25	5177.46
07/08/1993	14.53	5178.18
07/12/1993	14.42	5178.29
07/21/1993	14.46	5178.25
08/01/1993	13.70	5179.01
08/12/1993	13.86	5178.85
08/25/1993	12.84	5179.87
09/06/1993	13.05	5179.66
09/16/1993	13.41	5179.30
09/30/1993	13.52	5179.19
10/19/1993	13.83	5178.88
10/29/1993	14.43	5178.28
11/17/1993	15.09	5177.62
12/22/1993	16.23	5176.48
01/26/1994	17.04	5175.67
02/17/1994	17.64	5175.07
03/31/1994	17.32	5175.39
04/21/1994	17.30	5175.41
05/11/1994	17.19	5175.52
05/27/1994	17.03	5175.68
06/14/1994	14.48	5178.23
07/07/1994	14.20	5178.51
07/28/1994	13.21	5179.50
08/17/1994	11.92	5180.79
09/07/1994	12.09	5180.62
09/29/1994	12.65	5180.06
10/26/1994	13.31	5179.40
11/21/1994	14.33	5178.38
12/22/1994	15.91	5176.80
01/23/1995	17.57	5175.14
02/24/1995	17.86	5174.85
03/22/1995	18.79	5173.92
04/20/1995	18.12	5174.59
05/04/1995	18.02	5174.69
05/18/1995	17.55	5175.16
06/08/1995	17.18	5175.53
06/27/1995	13.16	5179.55
07/19/1995	11.65	5181.06
08/08/1995	11.00	5181.71
08/28/1995	9.93	5182.78
09/14/1995	10.13	5182.58
10/23/1995	12.54	5180.17
11/14/1995	12.66	5180.05
12/14/1995	14.36	5178.35
04/24/1996	15.95	5176.76
07/18/1996	12.16	5180.55

Groundwater Hydrograph

Well Identification
PROCTOR

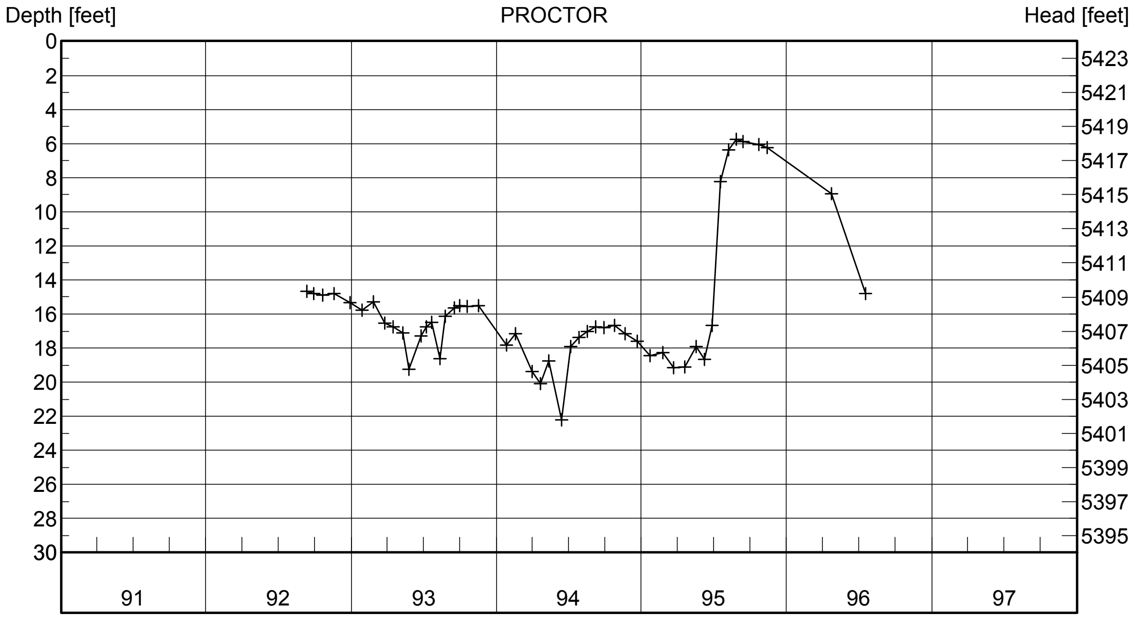
MBMG Site #
M:145397

Well Name or Well Owner
Clyde Proctor

Location
07S 10W 24 CCDD

Ground Surface Elev. (ft)
5423.48

Measuring Point Elev. (ft)
5424.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
09/10/1992	14.67	5409.33	02/17/1994	17.17	5406.83	08/08/1995	6.37	5417.63			
09/28/1992	14.82	5409.18	03/31/1994	19.36	5404.64	08/28/1995	5.75	5418.25			
10/21/1992	14.90	5409.10	04/21/1994	20.06	5403.94	09/14/1995	5.88	5418.12			
11/18/1992	14.82	5409.18	05/12/1994	18.77	5405.23	10/23/1995	6.07	5417.93			
12/29/1992	15.32	5408.68	06/14/1994	22.23	5401.77	11/14/1995	6.24	5417.76			
01/27/1993	15.76	5408.24	07/07/1994	17.90	5406.10	04/24/1996	8.95	5415.05			
02/25/1993	15.27	5408.73	07/28/1994	17.36	5406.64	07/18/1996	14.79	5409.21			
03/26/1993	16.52	5407.48	08/17/1994	17.01	5406.99						
04/15/1993	16.77	5407.23	09/07/1994	16.75	5407.25						
05/10/1993	17.09	5406.91	09/29/1994	16.78	5407.22						
05/25/1993	19.22	5404.78	10/26/1994	16.66	5407.34						
06/25/1993	17.28	5406.72	11/21/1994	17.16	5406.84						
07/08/1993	16.74	5407.26	12/22/1994	17.61	5406.39						
07/21/1993	16.47	5407.53	01/23/1995	18.42	5405.58						
08/12/1993	18.62	5405.38	02/24/1995	18.24	5405.76						
08/25/1993	16.12	5407.88	03/22/1995	19.17	5404.83						
09/16/1993	15.66	5408.34	04/20/1995	19.12	5404.88						
09/30/1993	15.53	5408.47	05/18/1995	17.90	5406.10						
10/19/1993	15.54	5408.46	06/08/1995	18.67	5405.33						
11/17/1993	15.52	5408.48	06/27/1995	16.68	5407.32						
01/26/1994	17.84	5406.16	07/19/1995	8.25	5415.75						

Groundwater Hydrograph

Well Identification
RAPH

MBMG Site #
M:109724

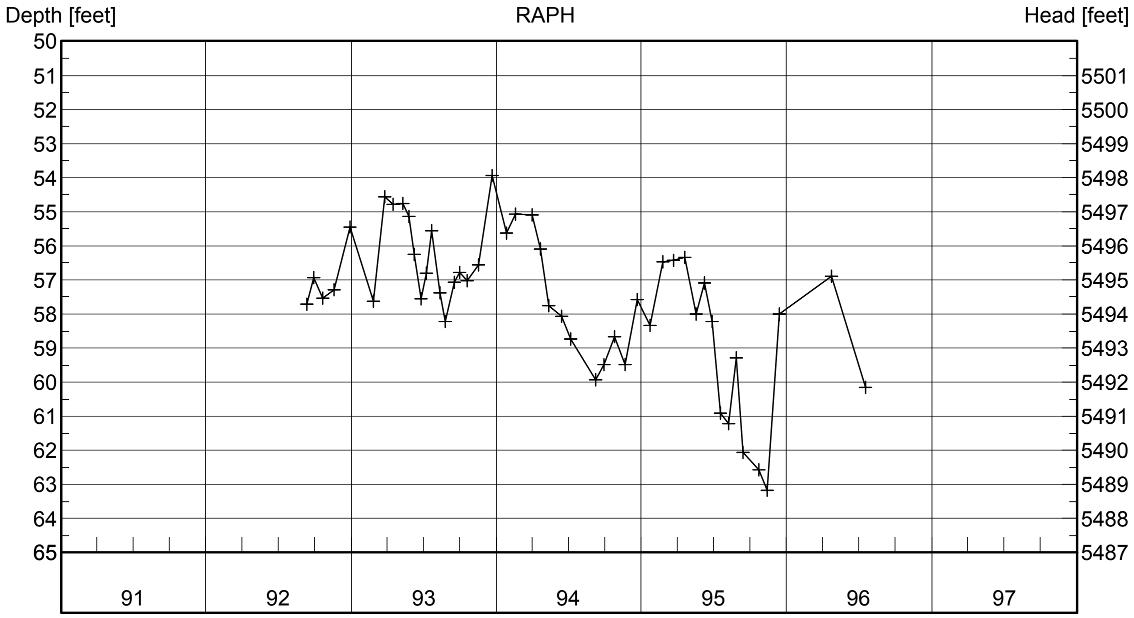
Well Name or Well Owner
Doris Raph domestic well

Location
07S 10W 14 CDDD

Ground Surface Elev. (ft)
5551.75

Measuring Point Elev. (ft)
5552.00

Well Depth below m.p. (ft)
105.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
09/10/1992	57.71	5494.29
09/28/1992	56.94	5495.06
10/21/1992	57.53	5494.47
11/18/1992	57.30	5494.70
12/29/1992	55.44	5496.56
02/25/1993	57.62	5494.38
03/26/1993	54.56	5497.44
04/15/1993	54.78	5497.22
05/10/1993	54.75	5497.25
05/25/1993	55.13	5496.87
06/08/1993	56.24	5495.76
06/25/1993	57.56	5494.44
07/08/1993	56.81	5495.19
07/21/1993	55.55	5496.45
08/12/1993	57.38	5494.62
08/25/1993	58.22	5493.78
09/16/1993	57.06	5494.94
09/30/1993	56.77	5495.23
10/19/1993	57.02	5494.98
11/17/1993	56.55	5495.45
12/21/1993	53.93	5498.07
01/26/1994	55.62	5496.38
02/17/1994	55.07	5496.93
03/31/1994	55.10	5496.90
04/21/1994	56.08	5495.92
05/12/1994	57.76	5494.24
06/14/1994	58.07	5493.93
07/07/1994	58.74	5493.26
09/07/1994	59.94	5492.06
09/29/1994	59.49	5492.51
10/26/1994	58.66	5493.34
11/21/1994	59.48	5492.52
12/22/1994	57.57	5494.43
01/23/1995	58.33	5493.67
02/24/1995	56.47	5495.53
03/22/1995	56.43	5495.57
04/20/1995	56.33	5495.67
05/18/1995	58.01	5493.99
06/08/1995	57.10	5494.90
06/27/1995	58.23	5493.77
07/19/1995	60.90	5491.10
08/08/1995	61.21	5490.79
08/28/1995	59.28	5492.72
09/14/1995	62.06	5489.94
10/23/1995	62.57	5489.43
11/14/1995	63.17	5488.83
12/14/1995	57.99	5494.01
04/24/1996	56.90	5495.10
07/18/1996	60.16	5491.84

Groundwater Hydrograph

Well Identification
RAWSON

MBMG Site #
M:123858

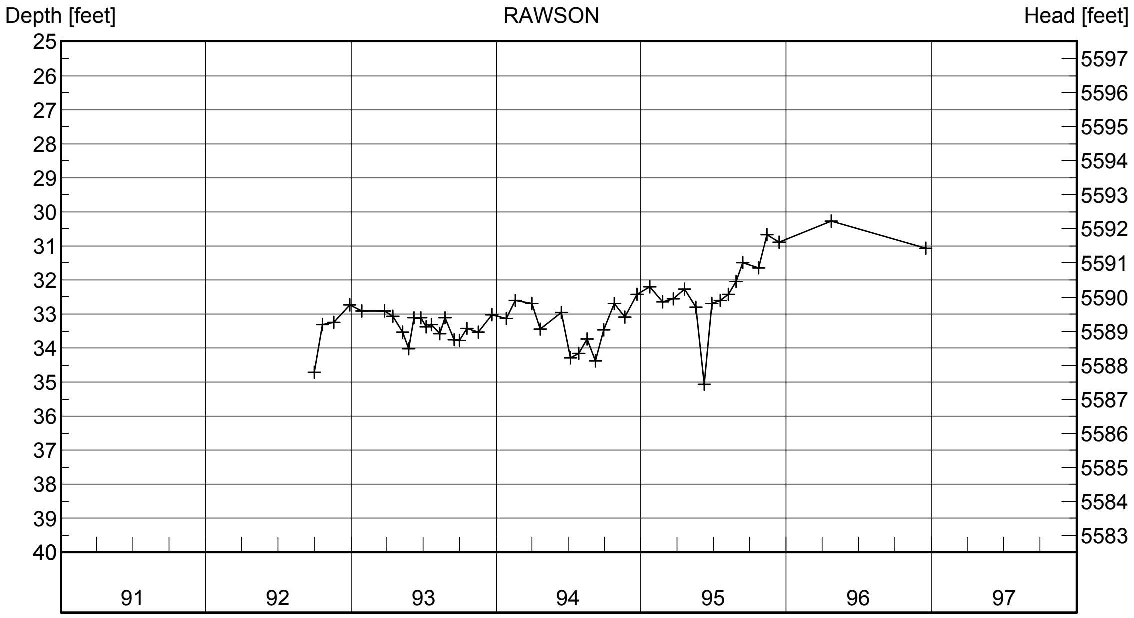
Well Name or Well Owner
Gayle Rawson

Location
07S 10W 15 ADDC

Ground Surface Elev. (ft)
5621.00

Measuring Point Elev. (ft)
5622.00

Well Depth below m.p. (ft)
155.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
09/29/1992	34.71	5587.29
10/21/1992	33.30	5588.70
11/18/1992	33.25	5588.75
12/29/1992	32.74	5589.26
01/27/1993	32.90	5589.10
03/26/1993	32.92	5589.08
04/15/1993	33.07	5588.93
05/10/1993	33.53	5588.47
05/25/1993	34.03	5587.97
06/08/1993	33.11	5588.89
06/25/1993	33.11	5588.89
07/08/1993	33.38	5588.62
07/21/1993	33.30	5588.70
08/12/1993	33.57	5588.43
08/25/1993	33.12	5588.88
09/16/1993	33.76	5588.24
09/30/1993	33.78	5588.22
10/19/1993	33.42	5588.58
11/17/1993	33.54	5588.46
12/21/1993	33.02	5588.98
01/26/1994	33.14	5588.86
02/17/1994	32.59	5589.41
03/31/1994	32.68	5589.32
04/21/1994	33.45	5588.55
06/14/1994	32.96	5589.04
07/07/1994	34.29	5587.71
07/28/1994	34.16	5587.84
08/17/1994	33.73	5588.27
09/07/1994	34.38	5587.62
09/29/1994	33.46	5588.54
10/26/1994	32.68	5589.32
11/21/1994	33.08	5588.92
12/22/1994	32.42	5589.58
01/23/1995	32.21	5589.79
02/24/1995	32.65	5589.35
03/22/1995	32.55	5589.45
04/20/1995	32.26	5589.74
05/18/1995	32.80	5589.20
06/08/1995	35.07	5586.93
06/27/1995	32.69	5589.31
07/19/1995	32.61	5589.39
08/08/1995	32.43	5589.57
08/28/1995	32.05	5589.95
09/14/1995	31.50	5590.50
10/23/1995	31.65	5590.35
11/14/1995	30.66	5591.34
12/14/1995	30.89	5591.11
04/24/1996	30.27	5591.73
12/17/1996	31.07	5590.93

Groundwater Hydrograph

Well Identification
RICE

MBMG Site #
M:109872

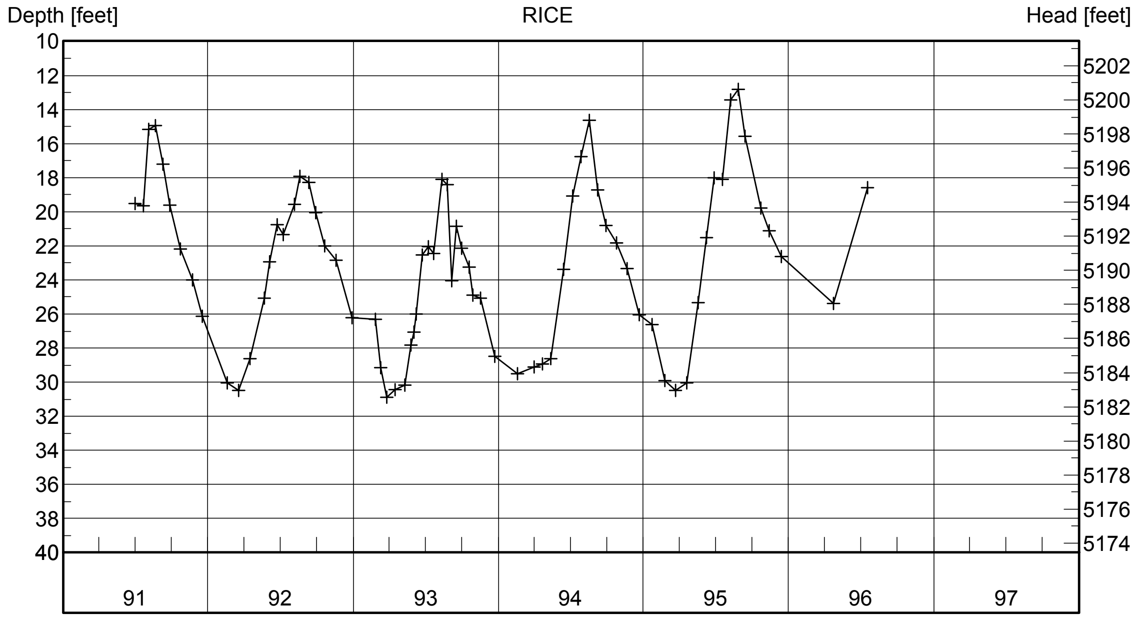
Well Name or Well Owner
Tom Rice

Location
08S 09W 09 BCDD

Ground Surface Elev. (ft)
5217.91

Measuring Point Elev. (ft)
5213.44

Well Depth below m.p. (ft)
52.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/02/1991	19.53	5193.91
07/22/1991	19.65	5193.79
08/05/1991	15.17	5198.27
08/21/1991	14.94	5198.50
09/09/1991	17.23	5196.21
09/27/1991	19.62	5193.82
10/23/1991	22.16	5191.28
11/22/1991	23.98	5189.46
12/18/1991	26.13	5187.31
02/19/1992	30.03	5183.41
03/18/1992	30.50	5182.94
04/16/1992	28.63	5184.81
05/21/1992	25.08	5188.36
06/04/1992	22.93	5190.51
06/23/1992	20.78	5192.66
07/09/1992	21.35	5192.09
08/06/1992	19.57	5193.87
08/19/1992	17.93	5195.51
09/10/1992	18.28	5195.16
09/28/1992	20.06	5193.38
10/21/1992	22.02	5191.42
11/18/1992	22.83	5190.61
12/29/1992	26.20	5187.24
02/25/1993	26.29	5187.15
03/11/1993	29.13	5184.31
03/26/1993	30.88	5182.56
04/15/1993	30.43	5183.01
05/10/1993	30.18	5183.26
05/25/1993	27.82	5185.62
06/03/1993	27.05	5186.39
06/08/1993	26.02	5187.42
06/24/1993	22.52	5190.92
07/08/1993	22.06	5191.38
07/21/1993	22.46	5190.98
08/12/1993	18.09	5195.35
08/25/1993	18.42	5195.02
09/06/1993	24.06	5189.38
09/16/1993	20.86	5192.58
09/30/1993	22.13	5191.31
10/19/1993	23.24	5190.20
10/29/1993	24.87	5188.57
11/17/1993	25.05	5188.39
12/22/1993	28.50	5184.94
02/17/1994	29.51	5183.93
03/31/1994	29.11	5184.33
04/21/1994	28.92	5184.52
05/12/1994	28.60	5184.84
06/14/1994	23.36	5190.08
07/07/1994	19.09	5194.35
07/28/1994	16.78	5196.66
08/18/1994	14.63	5198.81
09/07/1994	18.72	5194.72
09/29/1994	20.79	5192.65
10/26/1994	21.84	5191.60
11/21/1994	23.33	5190.11
12/22/1994	26.05	5187.39
01/23/1995	26.60	5186.84
02/24/1995	29.91	5183.53
03/22/1995	30.46	5182.98
04/20/1995	30.05	5183.39
05/18/1995	25.34	5188.10
06/08/1995	21.53	5191.91
06/28/1995	18.00	5195.44
07/19/1995	18.09	5195.35
08/08/1995	13.42	5200.02
08/28/1995	12.83	5200.61
09/14/1995	15.56	5197.88
10/23/1995	19.78	5193.66
11/14/1995	21.10	5192.34
12/14/1995	22.62	5190.82
04/24/1996	25.36	5188.08
07/18/1996	18.60	5194.84

Groundwater Hydrograph

Well Identification STEWART

MBMG Site # M:109675

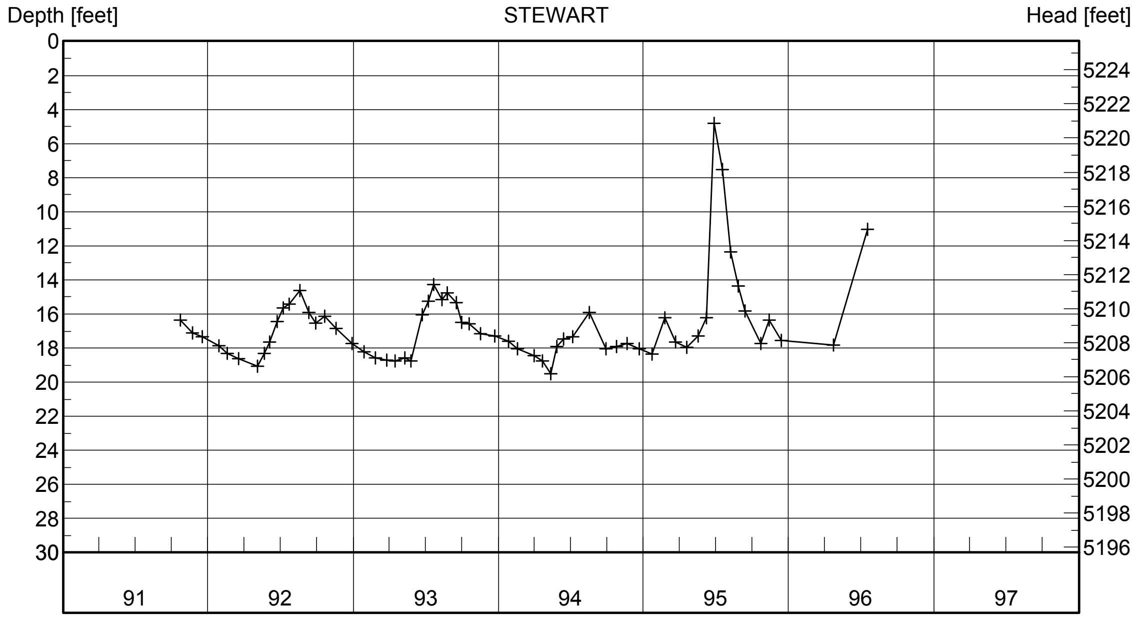
Well Name or Well Owner Marvin Stewart domestic well

Location 07S 09W 28 CDAC

Ground Surface Elev. (ft) 5224.29

Measuring Point Elev. (ft) 5225.68

Well Depth below m.p. (ft) 38.00



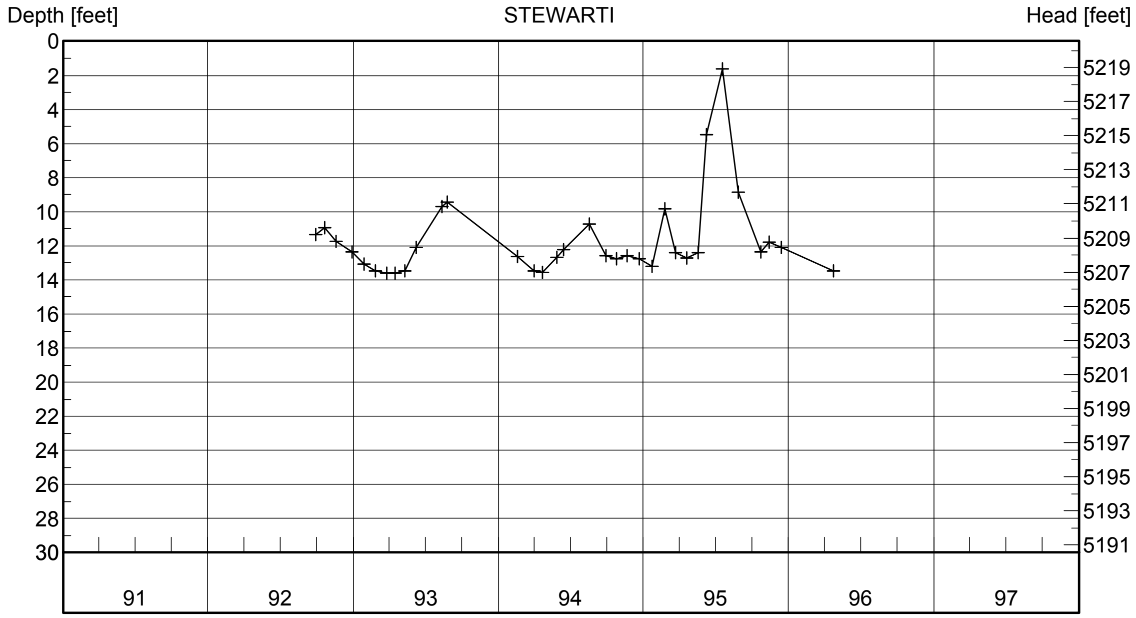
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
10/23/1991	16.36	5209.32	04/15/1993	18.74	5206.94	08/17/1994	15.91	5209.77			
11/22/1991	17.10	5208.58	05/10/1993	18.59	5207.09	09/29/1994	18.03	5207.65			
12/18/1991	17.35	5208.33	05/25/1993	18.77	5206.91	10/26/1994	17.89	5207.79			
01/29/1992	17.87	5207.81	06/24/1993	16.03	5209.65	11/21/1994	17.75	5207.93			
02/19/1992	18.30	5207.38	07/08/1993	15.25	5210.43	12/22/1994	18.06	5207.62			
03/18/1992	18.63	5207.05	07/21/1993	14.27	5211.41	01/23/1995	18.37	5207.31			
05/05/1992	19.07	5206.61	08/12/1993	15.14	5210.54	02/24/1995	16.24	5209.44			
05/21/1992	18.32	5207.36	08/25/1993	14.77	5210.91	03/22/1995	17.62	5208.06			
06/04/1992	17.63	5208.05	09/16/1993	15.32	5210.36	04/20/1995	17.95	5207.73			
06/23/1992	16.46	5209.22	09/30/1993	16.48	5209.20	05/18/1995	17.30	5208.38			
07/09/1992	15.64	5210.04	10/19/1993	16.59	5209.09	06/08/1995	16.22	5209.46			
07/23/1992	15.43	5210.25	11/17/1993	17.17	5208.51	06/27/1995	4.80	5220.88			
08/19/1992	14.62	5211.06	12/22/1993	17.28	5208.40	07/19/1995	7.54	5218.14			
09/10/1992	15.91	5209.77	01/26/1994	17.59	5208.09	08/08/1995	12.38	5213.30			
09/28/1992	16.54	5209.14	02/17/1994	18.06	5207.62	08/28/1995	14.34	5211.34			
10/21/1992	16.14	5209.54	03/31/1994	18.46	5207.22	09/14/1995	15.82	5209.86			
11/18/1992	16.85	5208.83	04/21/1994	18.77	5206.91	10/23/1995	17.73	5207.95			
12/29/1992	17.74	5207.94	05/12/1994	19.49	5206.19	11/14/1995	16.35	5209.33			
01/27/1993	18.22	5207.46	05/27/1994	17.90	5207.78	12/14/1995	17.56	5208.12			
02/25/1993	18.59	5207.09	06/14/1994	17.46	5208.22	04/24/1996	17.81	5207.87			
03/26/1993	18.72	5206.96	07/07/1994	17.31	5208.37	07/18/1996	11.03	5214.65			

Groundwater Hydrograph

Well Identification STEWARTI	**MBMG Site #** M:109678	**Well Name or Well Owner** Marvin Stewart irrigation well

Location 07S 09W 28 CDDB	**Ground Surface Elev. (ft)** 5218.46	**Measuring Point Elev. (ft)** 5220.54	**Well Depth below m.p. (ft)** 140.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
09/28/1992	11.36	5209.18	12/22/1994	12.75	5207.79						
10/21/1992	10.93	5209.61	01/23/1995	13.20	5207.34						
11/18/1992	11.74	5208.80	02/24/1995	9.83	5210.71						
12/29/1992	12.34	5208.20	03/22/1995	12.39	5208.15						
01/27/1993	13.07	5207.47	04/20/1995	12.72	5207.82						
02/25/1993	13.45	5207.09	05/18/1995	12.40	5208.14						
03/26/1993	13.61	5206.93	06/08/1995	5.49	5215.05						
04/15/1993	13.62	5206.92	07/19/1995	1.64	5218.90						
05/10/1993	13.46	5207.08	08/28/1995	8.85	5211.69						
06/08/1993	12.10	5208.44	10/23/1995	12.37	5208.17						
08/12/1993	9.69	5210.85	11/14/1995	11.78	5208.76						
08/25/1993	9.41	5211.13	12/14/1995	12.10	5208.44						
02/17/1994	12.63	5207.91	04/24/1996	13.49	5207.05						
03/31/1994	13.49	5207.05									
04/21/1994	13.54	5207.00									
05/27/1994	12.66	5207.88									
06/14/1994	12.24	5208.30									
08/17/1994	10.71	5209.83									
09/29/1994	12.59	5207.95									
10/26/1994	12.74	5207.80									
11/21/1994	12.57	5207.97									

Groundwater Hydrograph

Well Identification
UNRUH

MBMG Site #
M:145398

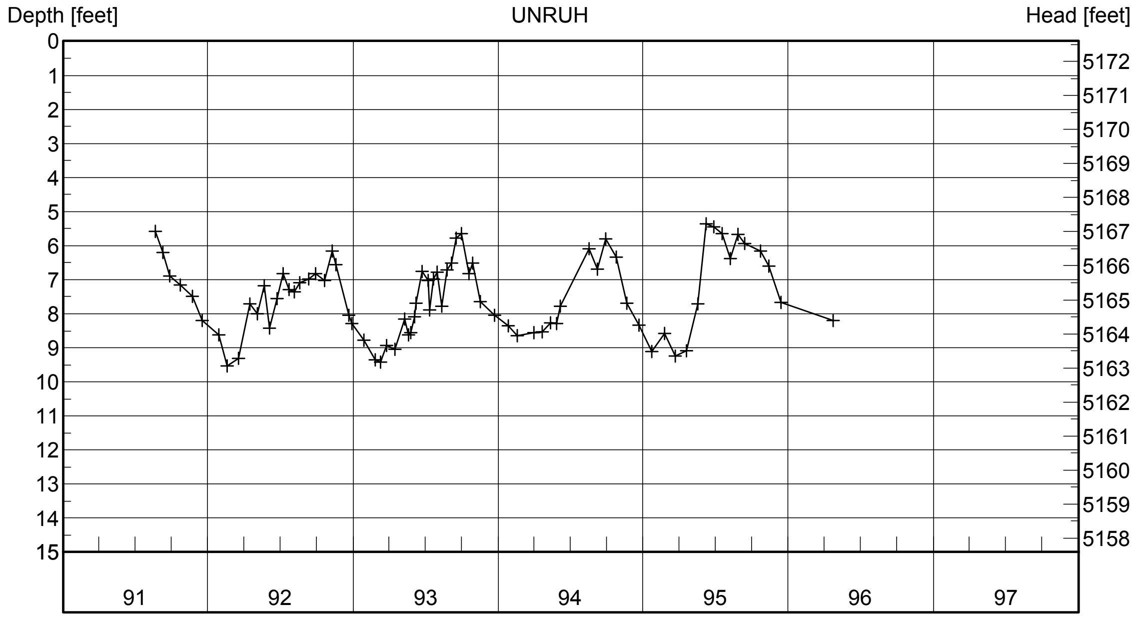
Well Name or Well Owner
Mark Unruh

Location
07S 09W 33 ADDD

Ground Surface Elev. (ft)
5170.56

Measuring Point Elev. (ft)
5172.09

Well Depth below m.p. (ft)
103.63



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
08/22/1991	5.58	5166.51
09/09/1991	6.20	5165.89
09/27/1991	6.88	5165.21
10/23/1991	7.16	5164.93
11/22/1991	7.48	5164.61
12/18/1991	8.21	5163.88
01/29/1992	8.63	5163.46
02/19/1992	9.52	5162.57
03/18/1992	9.31	5162.78
04/16/1992	7.70	5164.39
05/05/1992	7.99	5164.10
05/21/1992	7.17	5164.92
06/04/1992	8.41	5163.68
06/23/1992	7.56	5164.53
07/09/1992	6.82	5165.27
07/23/1992	7.29	5164.80
08/06/1992	7.36	5164.73
08/19/1992	7.10	5164.99
09/10/1992	6.97	5165.12
09/28/1992	6.83	5165.26
10/21/1992	7.02	5165.07
11/09/1992	6.15	5165.94
11/18/1992	6.56	5165.53
12/20/1992	8.05	5164.04
12/29/1992	8.28	5163.81
01/27/1993	8.77	5163.32
02/25/1993	9.35	5162.74
03/11/1993	9.43	5162.66
03/26/1993	8.93	5163.16
04/15/1993	9.04	5163.05
05/10/1993	8.15	5163.94
05/19/1993	8.63	5163.46
05/25/1993	8.55	5163.54
06/04/1993	8.08	5164.01
06/08/1993	7.68	5164.41
06/24/1993	6.76	5165.33
07/08/1993	7.02	5165.07
07/12/1993	7.89	5164.20
07/21/1993	6.98	5165.11
08/01/1993	6.78	5165.31
08/12/1993	7.78	5164.31
08/25/1993	6.71	5165.38
09/06/1993	6.52	5165.57
09/16/1993	5.79	5166.30
09/30/1993	5.65	5166.44
10/19/1993	6.82	5165.27
10/29/1993	6.52	5165.57
11/17/1993	7.65	5164.44
12/22/1993	8.04	5164.05
01/26/1994	8.35	5163.74
02/17/1994	8.64	5163.45
03/31/1994	8.56	5163.53
04/21/1994	8.54	5163.55
05/12/1994	8.27	5163.82
05/27/1994	8.29	5163.80
06/06/1994	7.77	5164.32
08/18/1994	6.10	5165.99
09/07/1994	6.68	5165.41
09/29/1994	5.80	5166.29
10/26/1994	6.34	5165.75
11/21/1994	7.69	5164.40
12/22/1994	8.34	5163.75
01/23/1995	9.11	5162.98
02/24/1995	8.57	5163.52
03/22/1995	9.25	5162.84
04/20/1995	9.09	5163.00
05/18/1995	7.70	5164.39
06/08/1995	5.35	5166.74
06/27/1995	5.44	5166.65
07/19/1995	5.65	5166.44
08/08/1995	6.38	5165.71
08/28/1995	5.68	5166.41
09/14/1995	5.94	5166.15
10/23/1995	6.15	5165.94
11/14/1995	6.60	5165.49
12/14/1995	7.66	5164.43
04/24/1996	8.20	5163.89

Groundwater Hydrograph

Well Identification
YUHAS

MBMG Site #
M:109858

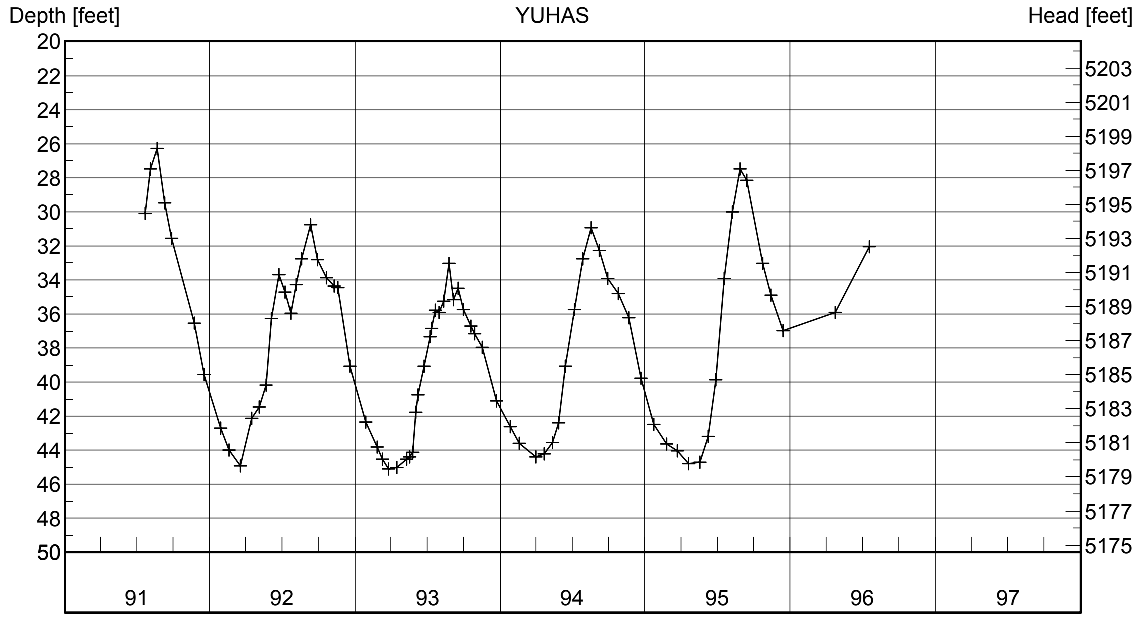
Well Name or Well Owner
Larry Yuhas

Location
08S 09W 08 ABCA

Ground Surface Elev. (ft)
5222.20

Measuring Point Elev. (ft)
5224.56

Well Depth below m.p. (ft)
54.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
07/22/1991	30.10	5194.46	10/21/1992	33.85	5190.71	09/06/1993	35.15	5189.41	12/22/1994	39.76	5184.80
08/05/1991	27.46	5197.10	11/09/1992	34.37	5190.19	09/16/1993	34.49	5190.07	01/23/1995	42.47	5182.09
08/21/1991	26.26	5198.30	11/18/1992	34.44	5190.12	09/30/1993	35.73	5188.83	02/24/1995	43.65	5180.91
09/09/1991	29.49	5195.07	12/19/1992	39.05	5185.51	10/19/1993	36.71	5187.85	03/22/1995	44.05	5180.51
09/27/1991	31.54	5193.02	01/27/1993	42.35	5182.21	10/29/1993	37.16	5187.40	04/20/1995	44.80	5179.76
11/22/1991	36.54	5188.02	02/25/1993	43.80	5180.76	11/17/1993	37.97	5186.59	05/18/1995	44.68	5179.88
12/18/1991	39.55	5185.01	03/11/1993	44.53	5180.03	12/22/1993	41.11	5183.45	06/08/1995	43.19	5181.37
01/29/1992	42.70	5181.86	03/26/1993	45.09	5179.47	01/26/1994	42.59	5181.97	06/27/1995	39.85	5184.71
02/19/1992	43.99	5180.57	04/15/1993	45.00	5179.56	02/17/1994	43.58	5180.98	07/19/1995	33.90	5190.66
03/18/1992	44.94	5179.62	05/10/1993	44.53	5180.03	03/31/1994	44.37	5180.19	08/08/1995	30.00	5194.56
04/16/1992	42.13	5182.43	05/18/1993	44.39	5180.17	04/21/1994	44.21	5180.35	08/28/1995	27.46	5197.10
05/05/1992	41.46	5183.10	05/25/1993	44.12	5180.44	05/12/1994	43.54	5181.02	09/14/1995	28.13	5196.43
05/21/1992	40.18	5184.38	06/03/1993	41.77	5182.79	05/27/1994	42.41	5182.15	10/23/1995	33.03	5191.53
06/04/1992	36.25	5188.31	06/08/1993	40.73	5183.83	06/14/1994	39.07	5185.49	11/14/1995	34.89	5189.67
06/23/1992	33.68	5190.88	06/24/1993	39.06	5185.50	07/07/1994	35.74	5188.82	12/14/1995	36.97	5187.59
07/09/1992	34.71	5189.85	07/08/1993	37.33	5187.23	07/28/1994	32.78	5191.78	04/24/1996	35.89	5188.67
07/23/1992	35.94	5188.62	07/12/1993	36.86	5187.70	08/17/1994	30.96	5193.60	07/18/1996	32.03	5192.53
08/06/1992	34.28	5190.28	07/21/1993	35.78	5188.78	09/07/1994	32.27	5192.29			
08/19/1992	32.76	5191.80	08/01/1993	35.90	5188.66	09/29/1994	33.92	5190.64			
09/10/1992	30.77	5193.79	08/12/1993	35.23	5189.33	10/26/1994	34.81	5189.75			
09/28/1992	32.79	5191.77	08/25/1993	33.03	5191.53	11/21/1994	36.22	5188.34			

Beaverhead River Floodplain near Dillon

Groundwater Hydrograph

Well Identification
92-16

MBMG Site #
M:133382

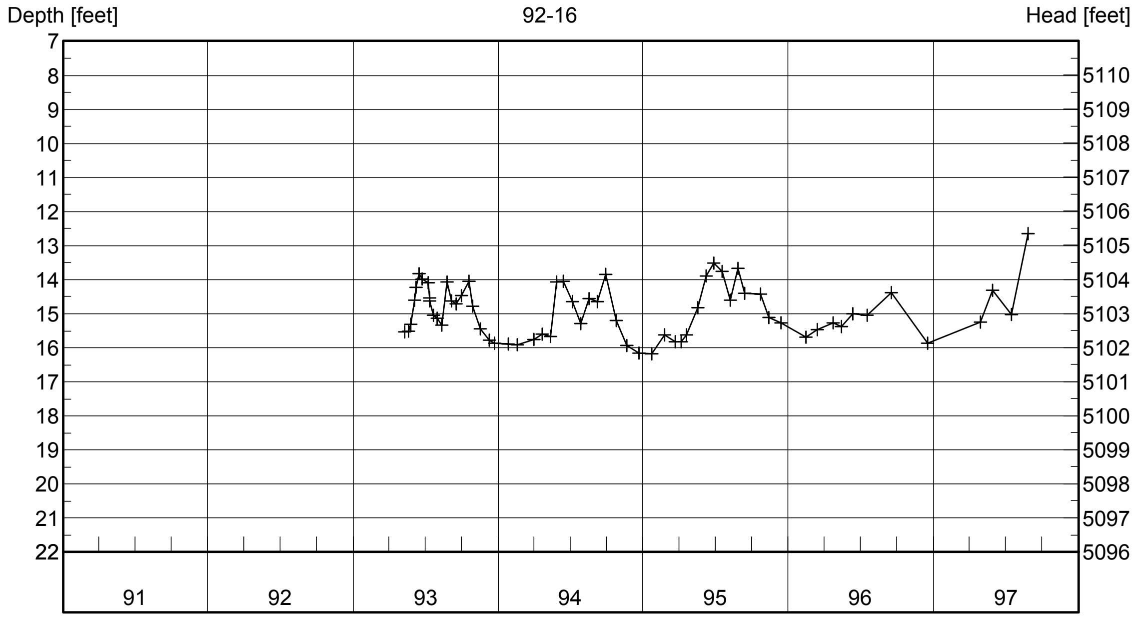
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-16

Location
07S 09W 24 CBDB

Ground Surface Elev. (ft)
5115.33

Measuring Point Elev. (ft)
5117.49

Well Depth below m.p. (ft)
204.67



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
05/10/1993	15.53	5101.96
05/19/1993	15.51	5101.98
05/25/1993	15.31	5102.18
06/04/1993	14.61	5102.88
06/08/1993	14.22	5103.27
06/15/1993	13.82	5103.67
06/24/1993	13.97	5103.52
07/08/1993	14.09	5103.40
07/12/1993	14.53	5102.96
07/13/1993	14.62	5102.87
07/21/1993	15.05	5102.44
08/01/1993	15.13	5102.36
08/12/1993	15.33	5102.16
08/25/1993	14.06	5103.43
09/06/1993	14.63	5102.86
09/16/1993	14.71	5102.78
09/30/1993	14.46	5103.03
10/19/1993	14.04	5103.45
10/29/1993	14.78	5102.71
11/17/1993	15.45	5102.04
12/09/1993	15.78	5101.71
12/22/1993	15.87	5101.62
01/26/1994	15.88	5101.61
02/17/1994	15.90	5101.59
03/31/1994	15.75	5101.74
04/21/1994	15.60	5101.89
05/12/1994	15.67	5101.82
05/27/1994	14.06	5103.43
06/14/1994	14.04	5103.45
07/07/1994	14.64	5102.85
07/28/1994	15.29	5102.20
08/17/1994	14.55	5102.94
09/07/1994	14.64	5102.85
09/29/1994	13.85	5103.64
10/26/1994	15.21	5102.28
11/21/1994	15.94	5101.55
12/22/1994	16.16	5101.33
01/23/1995	16.18	5101.31
02/24/1995	15.61	5101.88
03/22/1995	15.81	5101.68
04/06/1995	15.83	5101.66
04/20/1995	15.62	5101.87
05/18/1995	14.82	5102.67
06/08/1995	13.90	5103.59
06/27/1995	13.51	5103.98
07/19/1995	13.76	5103.73
08/08/1995	14.61	5102.88
08/28/1995	13.66	5103.83
09/14/1995	14.40	5103.09
10/23/1995	14.43	5103.06
11/14/1995	15.11	5102.38
12/14/1995	15.27	5102.22
02/15/1996	15.68	5101.81
03/14/1996	15.47	5102.02
04/24/1996	15.26	5102.23
05/15/1996	15.37	5102.12
06/11/1996	14.99	5102.50
07/18/1996	15.04	5102.45
09/17/1996	14.38	5103.11
12/17/1996	15.87	5101.62
04/29/1997	15.24	5102.25
05/29/1997	14.32	5103.17
07/17/1997	15.02	5102.47
08/27/1997	12.64	5104.85

Groundwater Hydrograph

Well Identification
92-17

MBMG Site #
M:133384

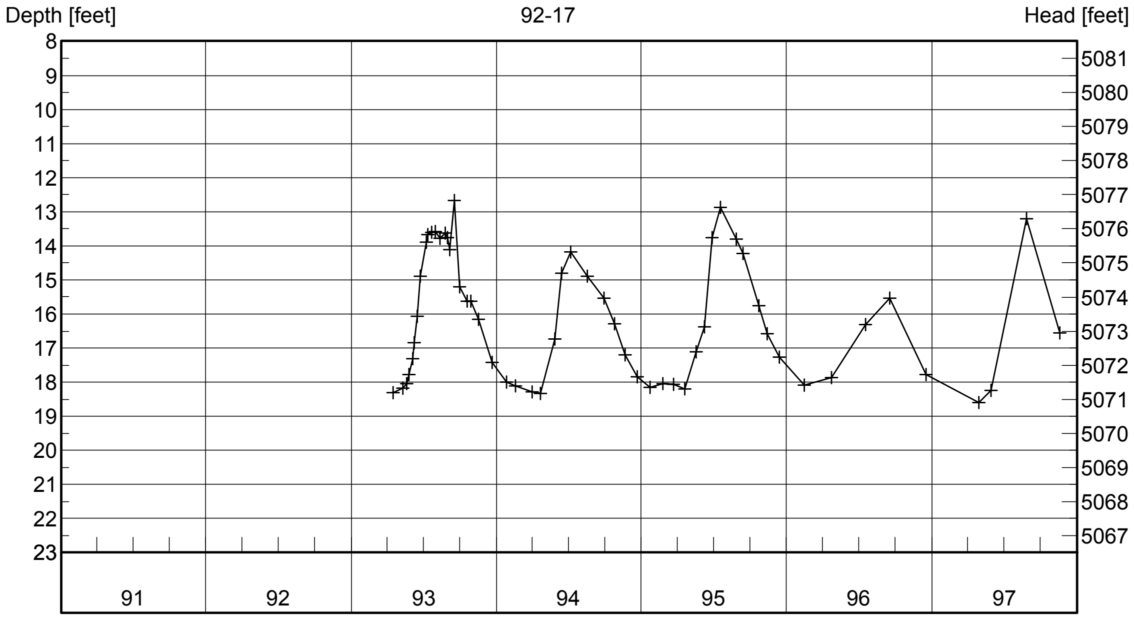
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-17

Location
07S 08W 19 BADD

Ground Surface Elev. (ft)
5087.39

Measuring Point Elev. (ft)
5089.00

Well Depth below m.p. (ft)
327.16



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
04/15/1993	18.31	5070.69
05/10/1993	18.17	5070.83
05/19/1993	18.04	5070.96
05/25/1993	17.78	5071.22
06/04/1993	17.31	5071.69
06/08/1993	16.85	5072.15
06/15/1993	16.07	5072.93
06/24/1993	14.88	5074.12
07/08/1993	13.90	5075.10
07/12/1993	13.67	5075.33
07/21/1993	13.61	5075.39
08/01/1993	13.58	5075.42
08/12/1993	13.79	5075.21
08/25/1993	13.62	5075.38
08/31/1993	13.75	5075.25
09/06/1993	14.11	5074.89
09/16/1993	12.68	5076.32
09/30/1993	15.19	5073.81
10/19/1993	15.62	5073.38
10/29/1993	15.63	5073.37
11/17/1993	16.16	5072.84
12/21/1993	17.43	5071.57
01/26/1994	17.99	5071.01
02/17/1994	18.11	5070.89
03/31/1994	18.28	5070.72
04/21/1994	18.32	5070.68
05/27/1994	16.74	5072.26
06/14/1994	14.79	5074.21
07/07/1994	14.18	5074.82
08/18/1994	14.88	5074.12
09/29/1994	15.53	5073.47
10/26/1994	16.29	5072.71
11/21/1994	17.19	5071.81
12/22/1994	17.84	5071.16
01/23/1995	18.15	5070.85
02/23/1995	18.03	5070.97
03/22/1995	18.07	5070.93
04/20/1995	18.20	5070.80
05/18/1995	17.10	5071.90
06/08/1995	16.38	5072.62
06/28/1995	13.76	5075.24
07/19/1995	12.87	5076.13
08/28/1995	13.81	5075.19
09/14/1995	14.23	5074.77
10/23/1995	15.75	5073.25
11/14/1995	16.58	5072.42
12/14/1995	17.26	5071.74
02/15/1996	18.09	5070.91
04/24/1996	17.86	5071.14
07/18/1996	16.32	5072.68
09/17/1996	15.53	5073.47
12/17/1996	17.77	5071.23
04/29/1997	18.59	5070.41
05/29/1997	18.23	5070.77
08/27/1997	13.20	5075.80
11/19/1997	16.55	5072.45

Groundwater Hydrograph

Well Identification
92-18

MBMG Site #
M:133386

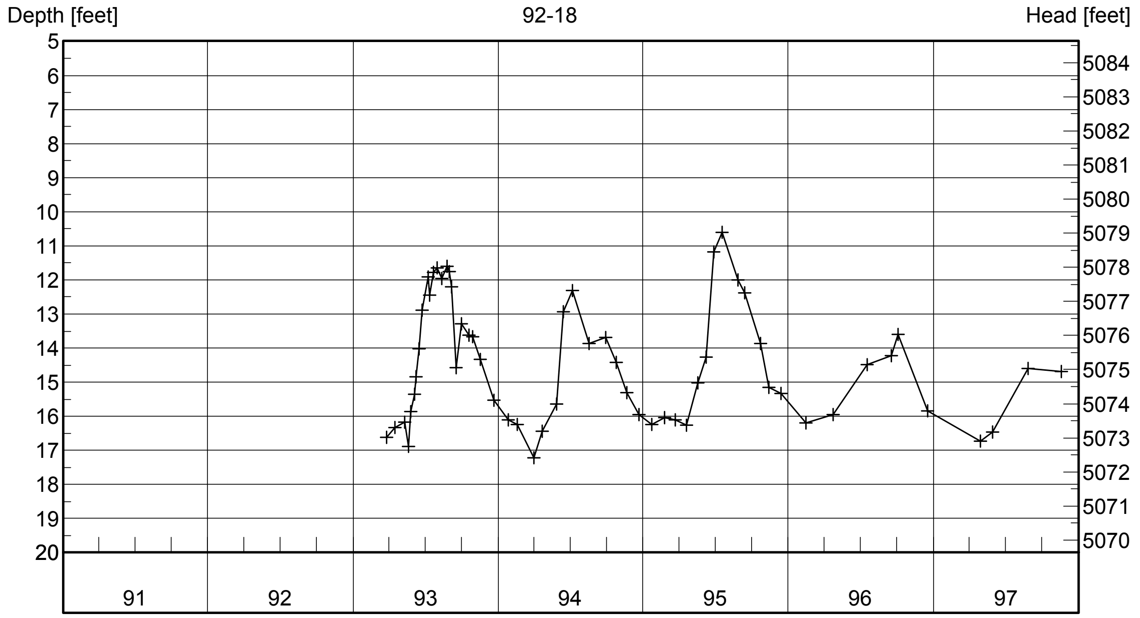
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-18

Location
07S 08W 19 BADD

Ground Surface Elev. (ft)
5087.76

Measuring Point Elev. (ft)
5089.13

Well Depth below m.p. (ft)
80.66



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
03/26/1993	16.61	5072.52	11/17/1993	14.34	5074.79	07/19/1995	10.60	5078.53			
04/15/1993	16.32	5072.81	12/21/1993	15.53	5073.60	08/28/1995	11.99	5077.14			
05/10/1993	16.17	5072.96	01/26/1994	16.11	5073.02	09/14/1995	12.37	5076.76			
05/19/1993	16.89	5072.24	02/17/1994	16.25	5072.88	10/23/1995	13.87	5075.26			
05/25/1993	15.87	5073.26	03/31/1994	17.21	5071.92	11/14/1995	15.15	5073.98			
06/04/1993	15.36	5073.77	04/21/1994	16.43	5072.70	12/14/1995	15.32	5073.81			
06/08/1993	14.85	5074.28	05/27/1994	15.64	5073.49	02/15/1996	16.19	5072.94			
06/15/1993	14.01	5075.12	06/14/1994	12.94	5076.19	04/24/1996	15.96	5073.17			
06/24/1993	12.89	5076.24	07/07/1994	12.31	5076.82	07/18/1996	14.49	5074.64			
07/08/1993	11.91	5077.22	08/18/1994	13.86	5075.27	09/17/1996	14.22	5074.91			
07/12/1993	12.44	5076.69	09/29/1994	13.68	5075.45	10/03/1996	13.60	5075.53			
07/21/1993	11.77	5077.36	10/26/1994	14.41	5074.72	12/17/1996	15.83	5073.30			
08/01/1993	11.65	5077.48	11/21/1994	15.30	5073.83	04/29/1997	16.72	5072.41			
08/12/1993	11.95	5077.18	12/22/1994	15.94	5073.19	05/29/1997	16.45	5072.68			
08/25/1993	11.61	5077.52	01/23/1995	16.24	5072.89	08/27/1997	14.59	5074.54			
08/31/1993	11.75	5077.38	02/23/1995	16.04	5073.09	11/19/1997	14.69	5074.44			
09/06/1993	12.20	5076.93	03/22/1995	16.11	5073.02						
09/16/1993	14.58	5074.55	04/20/1995	16.27	5072.86						
09/30/1993	13.29	5075.84	05/18/1995	15.01	5074.12						
10/19/1993	13.63	5075.50	06/08/1995	14.27	5074.86						
10/29/1993	13.67	5075.46	06/28/1995	11.18	5077.95						

Groundwater Hydrograph

Well Identification
92-19

MBMG Site #
M:133387

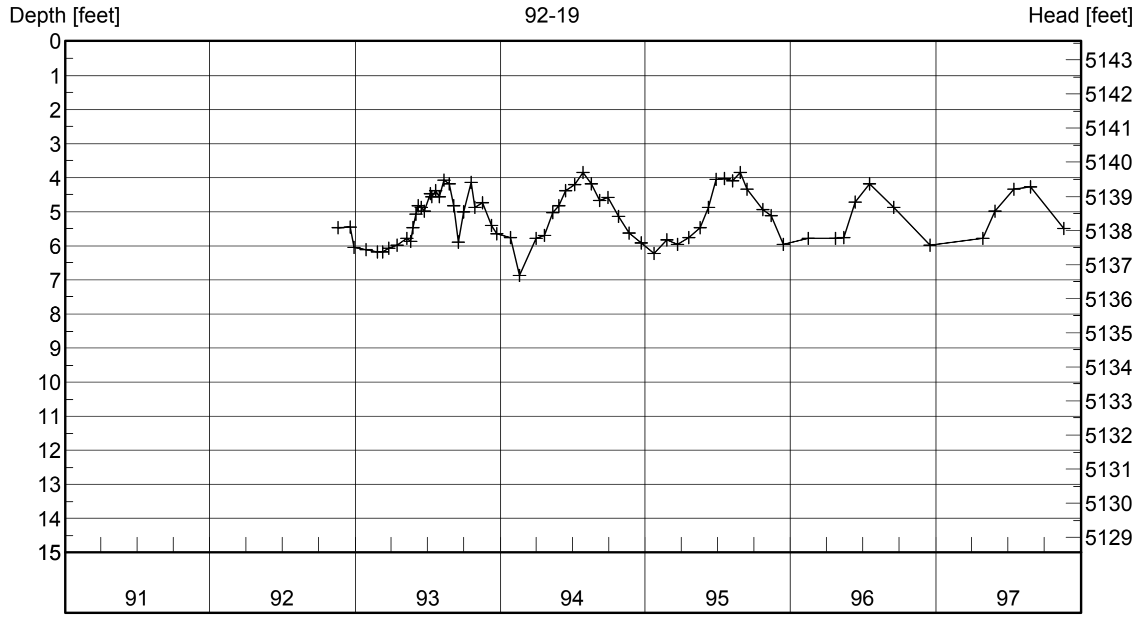
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-19

Location
07S 09W 26 CDAD

Ground Surface Elev. (ft)
5141.31

Measuring Point Elev. (ft)
5143.55

Well Depth below m.p. (ft)
149.53



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
11/18/1992	5.47	5138.08
12/19/1992	5.45	5138.10
12/29/1992	6.04	5137.51
01/27/1993	6.11	5137.44
02/25/1993	6.19	5137.36
03/11/1993	6.17	5137.38
03/26/1993	6.07	5137.48
04/15/1993	5.99	5137.56
05/10/1993	5.79	5137.76
05/19/1993	5.87	5137.68
05/25/1993	5.46	5138.09
06/03/1993	5.08	5138.47
06/08/1993	4.83	5138.72
06/15/1993	4.86	5138.69
06/24/1993	4.98	5138.57
07/08/1993	4.47	5139.08
07/12/1993	4.56	5138.99
07/21/1993	4.38	5139.17
08/01/1993	4.55	5139.00
08/12/1993	4.08	5139.47
08/25/1993	4.19	5139.36
09/05/1993	4.82	5138.73
09/16/1993	5.89	5137.66
09/30/1993	5.01	5138.54
10/19/1993	4.14	5139.41
10/29/1993	4.87	5138.68
11/17/1993	4.73	5138.82
12/10/1993	5.41	5138.14
12/22/1993	5.65	5137.90
01/26/1994	5.75	5137.80
02/17/1994	6.87	5136.68
03/31/1994	5.79	5137.76
04/21/1994	5.69	5137.86
05/12/1994	5.02	5138.53
05/27/1994	4.82	5138.73
06/14/1994	4.38	5139.17
07/07/1994	4.21	5139.34
07/28/1994	3.84	5139.71
08/17/1994	4.18	5139.37
09/07/1994	4.66	5138.89
09/29/1994	4.59	5138.96
10/26/1994	5.13	5138.42
11/21/1994	5.63	5137.92
12/22/1994	5.92	5137.63
01/23/1995	6.23	5137.32
02/24/1995	5.82	5137.73
03/22/1995	5.96	5137.59
04/20/1995	5.76	5137.79
05/18/1995	5.47	5138.08
06/08/1995	4.88	5138.67
06/27/1995	4.05	5139.50
07/19/1995	4.02	5139.53
08/08/1995	4.10	5139.45
08/28/1995	3.85	5139.70
09/14/1995	4.34	5139.21
10/23/1995	4.93	5138.62
11/14/1995	5.12	5138.43
12/14/1995	5.95	5137.60
02/15/1996	5.79	5137.76
04/24/1996	5.77	5137.78
05/15/1996	5.76	5137.79
06/11/1996	4.71	5138.84
07/18/1996	4.19	5139.36
09/17/1996	4.88	5138.67
12/17/1996	5.97	5137.58
04/29/1997	5.79	5137.76
05/29/1997	4.98	5138.57
07/17/1997	4.33	5139.22
08/27/1997	4.27	5139.28
11/19/1997	5.49	5138.06

Groundwater Hydrograph

Well Identification 92-20

MBMG Site # M:133390

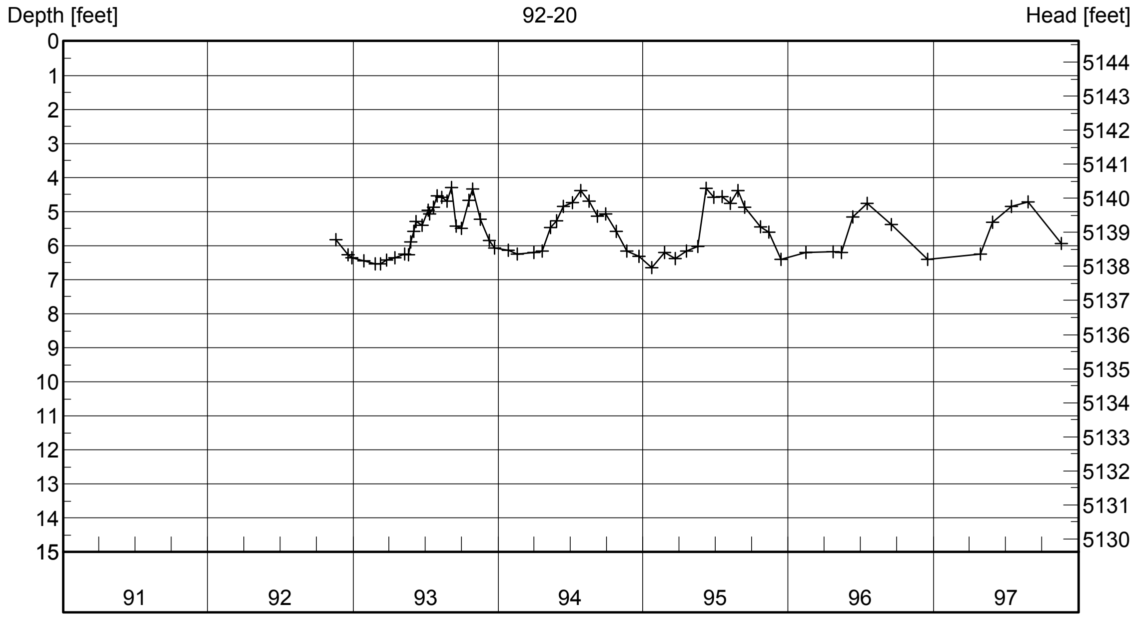
Well Name or Well Owner MT DNRC Beaverhead Groundwater Project well 92-20

Location 07S 09W 26 CDAD

Ground Surface Elev. (ft) 5141.72

Measuring Point Elev. (ft) 5144.11

Well Depth below m.p. (ft) 20.28



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
11/18/1992	5.82	5138.29
12/19/1992	6.27	5137.84
12/29/1992	6.36	5137.75
01/27/1993	6.45	5137.66
02/25/1993	6.54	5137.57
03/11/1993	6.54	5137.57
03/26/1993	6.43	5137.68
04/15/1993	6.36	5137.75
05/10/1993	6.24	5137.87
05/19/1993	6.27	5137.84
05/25/1993	5.89	5138.22
06/03/1993	5.57	5138.54
06/08/1993	5.30	5138.81
06/24/1993	5.41	5138.70
07/08/1993	4.96	5139.15
07/12/1993	5.06	5139.05
07/21/1993	4.87	5139.24
08/01/1993	4.54	5139.57
08/12/1993	4.59	5139.52
08/25/1993	4.69	5139.42
09/05/1993	4.30	5139.81
09/16/1993	5.42	5138.69
09/30/1993	5.49	5138.62
10/19/1993	4.66	5139.45
10/29/1993	4.34	5139.77
11/17/1993	5.22	5138.89
12/10/1993	5.84	5138.27
12/22/1993	6.06	5138.05
01/26/1994	6.14	5137.97
02/17/1994	6.25	5137.86
03/31/1994	6.21	5137.90
04/21/1994	6.15	5137.96
05/12/1994	5.46	5138.65
05/27/1994	5.27	5138.84
06/14/1994	4.85	5139.26
07/07/1994	4.73	5139.38
07/28/1994	4.38	5139.73
08/17/1994	4.70	5139.41
09/07/1994	5.14	5138.97
09/29/1994	5.08	5139.03
10/26/1994	5.58	5138.53
11/21/1994	6.16	5137.95
12/22/1994	6.31	5137.80
01/23/1995	6.65	5137.46
02/24/1995	6.21	5137.90
03/22/1995	6.37	5137.74
04/20/1995	6.16	5137.95
05/18/1995	6.03	5138.08
06/08/1995	4.32	5139.79
06/27/1995	4.58	5139.53
07/19/1995	4.55	5139.56
08/08/1995	4.76	5139.35
08/28/1995	4.38	5139.73
09/14/1995	4.87	5139.24
10/23/1995	5.45	5138.66
11/14/1995	5.61	5138.50
12/14/1995	6.40	5137.71
02/15/1996	6.21	5137.90
04/24/1996	6.19	5137.92
05/15/1996	6.21	5137.90
06/11/1996	5.17	5138.94
07/18/1996	4.75	5139.36
09/17/1996	5.37	5138.74
12/17/1996	6.40	5137.71
04/29/1997	6.25	5137.86
05/29/1997	5.31	5138.80
07/17/1997	4.85	5139.26
08/27/1997	4.72	5139.39
11/19/1997	5.94	5138.17

Groundwater Hydrograph

Well Identification
92-28

MBMG Site #
M:133400

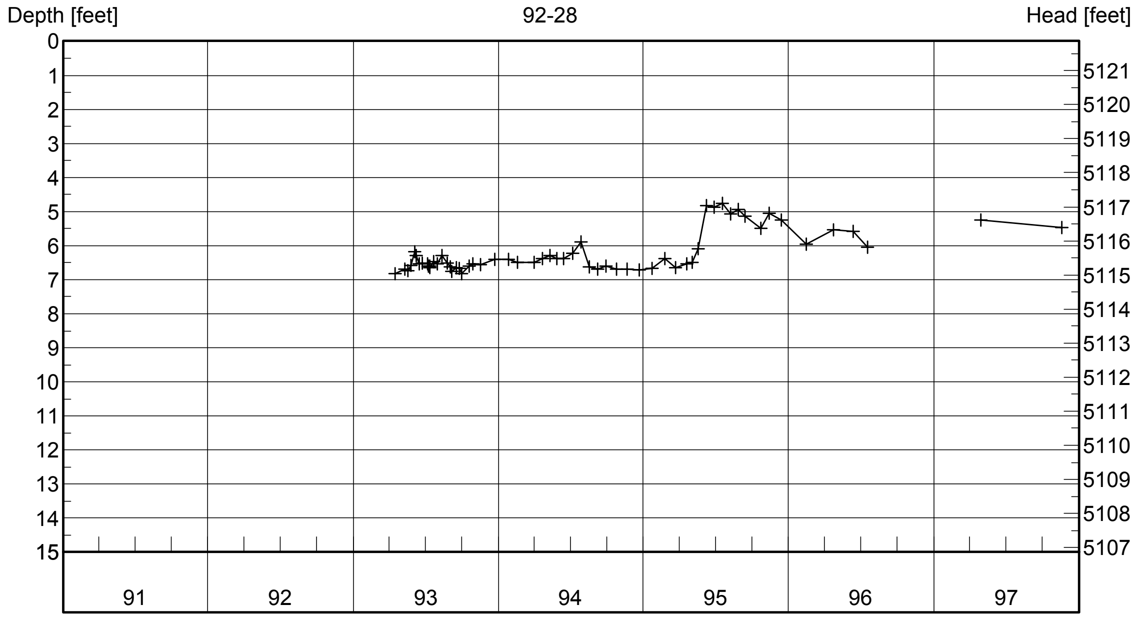
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-28

Location
07S 09W 23 CACD

Ground Surface Elev. (ft)
5119.51

Measuring Point Elev. (ft)
5121.86

Well Depth below m.p. (ft)
87.12



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
04/15/1993	6.82	5115.04
05/10/1993	6.68	5115.18
05/18/1993	6.73	5115.13
05/25/1993	6.58	5115.28
06/04/1993	6.18	5115.68
06/08/1993	6.29	5115.57
06/15/1993	6.53	5115.33
06/24/1993	6.51	5115.35
07/07/1993	6.54	5115.32
07/08/1993	6.61	5115.25
07/12/1993	6.61	5115.25
07/13/1993	6.64	5115.22
07/21/1993	6.47	5115.39
08/01/1993	6.54	5115.32
08/12/1993	6.28	5115.58
08/25/1993	6.52	5115.34
09/01/1993	6.62	5115.24
09/05/1993	6.76	5115.10
09/16/1993	6.64	5115.22
09/24/1993	6.67	5115.19
09/30/1993	6.82	5115.04
10/19/1993	6.60	5115.26
10/29/1993	6.54	5115.32
11/17/1993	6.56	5115.30
12/22/1993	6.40	5115.46
01/26/1994	6.40	5115.46
02/17/1994	6.50	5115.36
03/31/1994	6.50	5115.36
04/21/1994	6.39	5115.47
05/11/1994	6.28	5115.58
05/27/1994	6.39	5115.47
06/14/1994	6.38	5115.48
07/07/1994	6.22	5115.64
07/27/1994	5.89	5115.97
08/18/1994	6.62	5115.24
09/07/1994	6.68	5115.18
09/29/1994	6.61	5115.25
10/26/1994	6.68	5115.18
11/21/1994	6.70	5115.16
12/22/1994	6.72	5115.14
01/23/1995	6.67	5115.19
02/24/1995	6.37	5115.49
03/22/1995	6.65	5115.21
04/20/1995	6.53	5115.33
05/04/1995	6.48	5115.38
05/18/1995	6.10	5115.76
06/08/1995	4.83	5117.03
06/28/1995	4.88	5116.98
07/19/1995	4.76	5117.10
08/08/1995	5.08	5116.78
08/28/1995	4.93	5116.93
09/14/1995	5.13	5116.73
10/23/1995	5.50	5116.36
11/14/1995	5.04	5116.82
12/14/1995	5.24	5116.62
02/15/1996	5.96	5115.90
04/24/1996	5.54	5116.32
06/11/1996	5.59	5116.27
07/18/1996	6.04	5115.82
04/29/1997	5.24	5116.62
11/19/1997	5.47	5116.39

Groundwater Hydrograph

Well Identification
92-29

MBMG Site #
M:133402

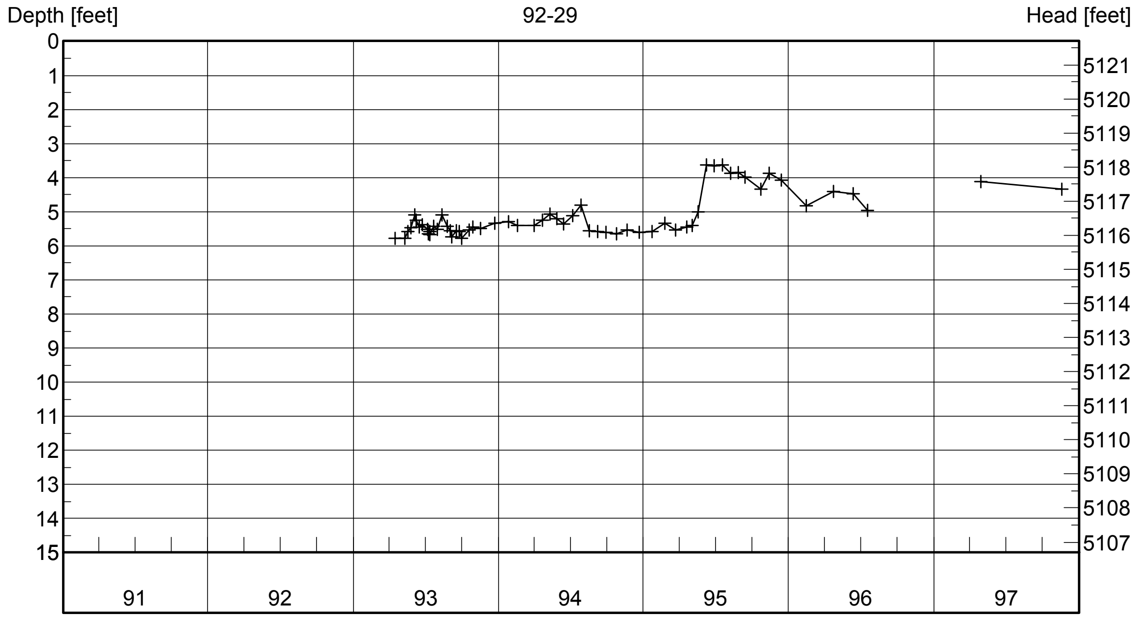
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-29

Location
07S 09W 23 CACD

Ground Surface Elev. (ft)
5119.35

Measuring Point Elev. (ft)
5121.69

Well Depth below m.p. (ft)
22.09



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
04/15/1993	5.77	5115.92
05/10/1993	5.77	5115.92
05/18/1993	5.57	5116.12
05/25/1993	5.46	5116.23
06/04/1993	5.10	5116.59
06/08/1993	5.25	5116.44
06/15/1993	5.45	5116.24
06/24/1993	5.39	5116.30
07/07/1993	5.51	5116.18
07/08/1993	5.65	5116.04
07/12/1993	5.59	5116.10
07/13/1993	5.66	5116.03
07/21/1993	5.42	5116.27
08/01/1993	5.52	5116.17
08/12/1993	5.10	5116.59
08/25/1993	5.42	5116.27
09/01/1993	5.56	5116.13
09/05/1993	5.74	5115.95
09/16/1993	5.55	5116.14
09/24/1993	5.57	5116.12
09/30/1993	5.79	5115.90
10/19/1993	5.53	5116.16
10/29/1993	5.45	5116.24
11/17/1993	5.50	5116.19
12/22/1993	5.34	5116.35
01/26/1994	5.30	5116.39
02/17/1994	5.41	5116.28
03/31/1994	5.40	5116.29
04/21/1994	5.25	5116.44
05/11/1994	5.08	5116.61
05/27/1994	5.21	5116.48
06/14/1994	5.36	5116.33
07/07/1994	5.12	5116.57
07/27/1994	4.80	5116.89
08/18/1994	5.55	5116.14
09/07/1994	5.58	5116.11
09/29/1994	5.60	5116.09
10/26/1994	5.64	5116.05
11/21/1994	5.54	5116.15
12/22/1994	5.60	5116.09
01/23/1995	5.57	5116.12
02/24/1995	5.33	5116.36
03/22/1995	5.54	5116.15
04/20/1995	5.45	5116.24
05/04/1995	5.40	5116.29
05/18/1995	5.00	5116.69
06/08/1995	3.63	5118.06
06/28/1995	3.65	5118.04
07/19/1995	3.63	5118.06
08/08/1995	3.88	5117.81
08/28/1995	3.85	5117.84
09/14/1995	3.98	5117.71
10/23/1995	4.34	5117.35
11/14/1995	3.88	5117.81
12/14/1995	4.08	5117.61
02/15/1996	4.83	5116.86
04/24/1996	4.41	5117.28
06/11/1996	4.48	5117.21
07/18/1996	4.95	5116.74
04/29/1997	4.11	5117.58
11/19/1997	4.34	5117.35

Groundwater Hydrograph

Well Identification
92-30

MBMG Site #
M:133403

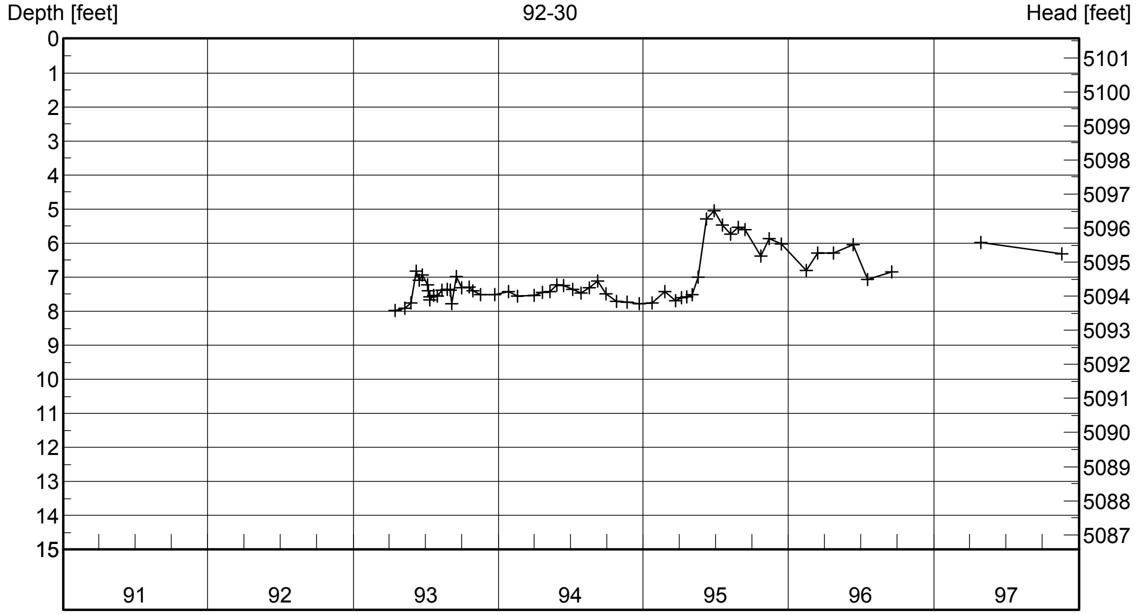
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 92-30

Location
07S 09W 24 BABA

Ground Surface Elev. (ft)
5099.84

Measuring Point Elev. (ft)
5101.06

Well Depth below m.p. (ft)
32.37



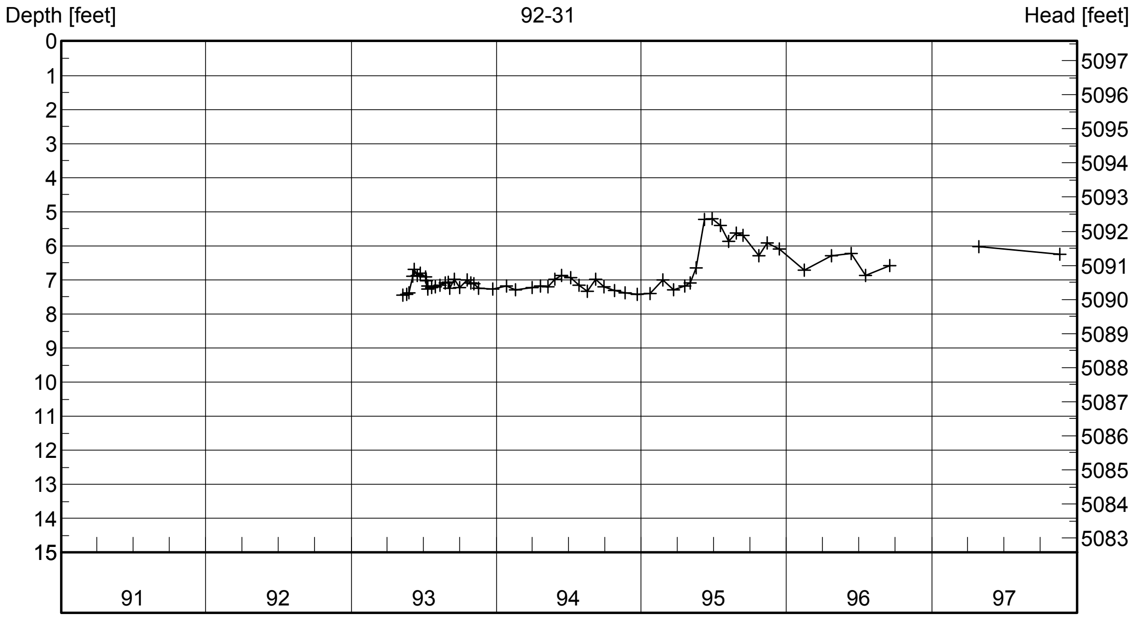
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
04/15/1993	7.97	5093.09
05/10/1993	7.90	5093.16
05/25/1993	7.76	5093.30
06/08/1993	6.83	5094.23
06/15/1993	7.08	5093.98
06/24/1993	6.93	5094.13
07/07/1993	7.23	5093.83
07/08/1993	7.40	5093.66
07/12/1993	7.58	5093.48
07/13/1993	7.67	5093.39
07/21/1993	7.53	5093.53
08/01/1993	7.56	5093.50
08/12/1993	7.38	5093.68
08/25/1993	7.35	5093.71
09/01/1993	7.38	5093.68
09/05/1993	7.78	5093.28
09/16/1993	6.98	5094.08
09/30/1993	7.32	5093.74
10/19/1993	7.30	5093.76
10/29/1993	7.39	5093.67
11/17/1993	7.52	5093.54
12/22/1993	7.50	5093.56
01/26/1994	7.43	5093.63
02/17/1994	7.55	5093.51
03/31/1994	7.54	5093.52
04/21/1994	7.45	5093.61
05/11/1994	7.43	5093.63
05/27/1994	7.22	5093.84
06/14/1994	7.24	5093.82
07/07/1994	7.36	5093.70
07/27/1994	7.47	5093.59
08/18/1994	7.32	5093.74
09/07/1994	7.11	5093.95
09/29/1994	7.49	5093.57
10/26/1994	7.71	5093.35
11/21/1994	7.73	5093.33
12/22/1994	7.77	5093.29
01/23/1995	7.76	5093.30
02/24/1995	7.42	5093.64
03/22/1995	7.69	5093.37
04/06/1995	7.59	5093.47
04/20/1995	7.57	5093.49
05/04/1995	7.50	5093.56
05/18/1995	7.00	5094.06
06/08/1995	5.29	5095.77
06/28/1995	5.05	5096.01
07/19/1995	5.46	5095.60
08/08/1995	5.74	5095.32
08/28/1995	5.53	5095.53
09/14/1995	5.61	5095.45
10/23/1995	6.37	5094.69
11/14/1995	5.86	5095.20
12/14/1995	6.03	5095.03
02/15/1996	6.79	5094.27
03/14/1996	6.29	5094.77
04/24/1996	6.30	5094.76
06/11/1996	6.04	5095.02
07/18/1996	7.06	5094.00
09/17/1996	6.85	5094.21
04/29/1997	5.99	5095.07
11/19/1997	6.32	5094.74

Groundwater Hydrograph

Well Identification 92-31	**MBMG Site #** M:140584	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 92-31

Location 07S 09W 13 CDDD	**Ground Surface Elev. (ft)** 5094.80	**Measuring Point Elev. (ft)** 5097.07	**Well Depth below m.p. (ft)** 34.26

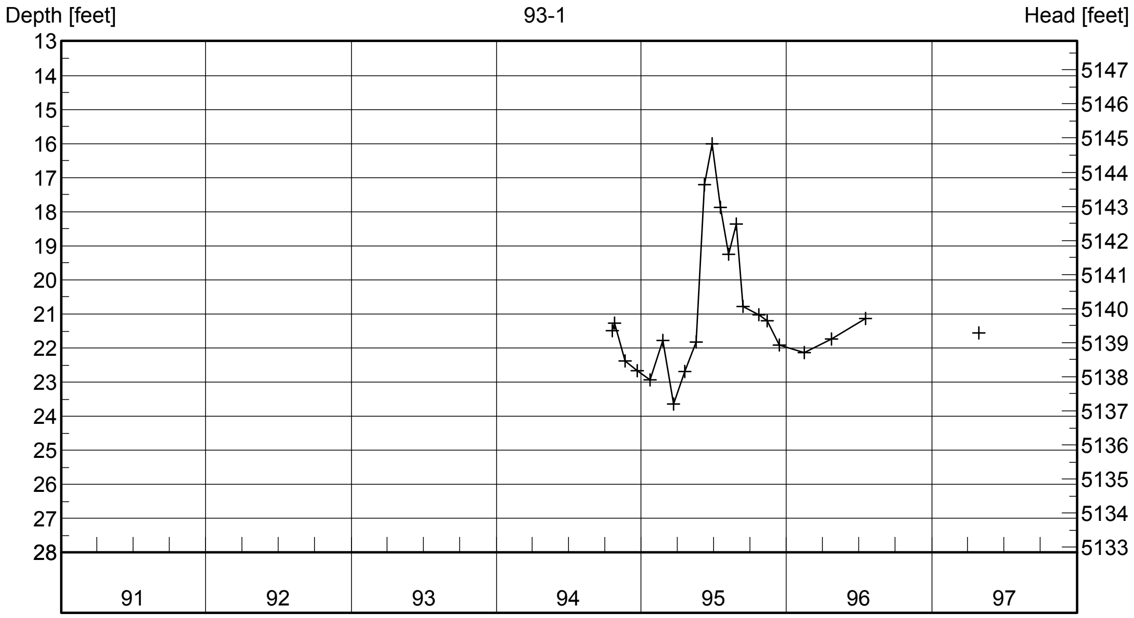


Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
05/10/1993	7.45	5089.62	11/05/1993	7.12	5089.95	04/20/1995	7.17	5089.90			
05/19/1993	7.42	5089.65	11/17/1993	7.25	5089.82	05/04/1995	7.09	5089.98			
05/25/1993	7.37	5089.70	12/22/1993	7.27	5089.80	05/18/1995	6.65	5090.42			
06/04/1993	6.90	5090.17	01/26/1994	7.18	5089.89	06/08/1995	5.22	5091.85			
06/08/1993	6.70	5090.37	02/17/1994	7.29	5089.78	06/28/1995	5.20	5091.87			
06/15/1993	6.87	5090.20	03/31/1994	7.23	5089.84	07/19/1995	5.40	5091.67			
06/24/1993	6.79	5090.28	04/21/1994	7.17	5089.90	08/08/1995	5.87	5091.20			
07/07/1993	6.91	5090.16	05/11/1994	7.20	5089.87	08/28/1995	5.63	5091.44			
07/08/1993	7.03	5090.04	05/27/1994	6.98	5090.09	09/14/1995	5.70	5091.37			
07/12/1993	7.18	5089.89	06/14/1994	6.86	5090.21	10/23/1995	6.30	5090.77			
07/13/1993	7.26	5089.81	07/07/1994	6.94	5090.13	11/14/1995	5.92	5091.15			
07/21/1993	7.22	5089.85	07/27/1994	7.15	5089.92	12/14/1995	6.10	5090.97			
08/01/1993	7.20	5089.87	08/18/1994	7.33	5089.74	02/15/1996	6.71	5090.36			
08/12/1993	7.16	5089.91	09/07/1994	6.97	5090.10	04/24/1996	6.30	5090.77			
08/25/1993	7.10	5089.97	09/29/1994	7.21	5089.86	06/11/1996	6.22	5090.85			
09/01/1993	7.07	5090.00	10/26/1994	7.31	5089.76	07/18/1996	6.87	5090.20			
09/06/1993	7.24	5089.83	11/21/1994	7.37	5089.70	09/17/1996	6.57	5090.50			
09/16/1993	6.98	5090.09	12/22/1994	7.42	5089.65	04/29/1997	6.02	5091.05			
09/30/1993	7.23	5089.84	01/23/1995	7.39	5089.68	11/19/1997	6.24	5090.83			
10/19/1993	7.01	5090.06	02/24/1995	7.00	5090.07						
10/29/1993	7.09	5089.98	03/22/1995	7.28	5089.79						

Groundwater Hydrograph

Well Identification 93-1	**MBMG Site #** M:144014	**Well Name or Well Owner** MT DNRC Beaverhead Groundwater Project well 93-1	
Location 07S 09W 27 BDDB	**Ground Surface Elev. (ft)** 5159.33	**Measuring Point Elev. (ft)** 5160.84	**Well Depth below m.p. (ft)** 81.00



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
10/19/1994	21.48	5139.36
10/26/1994	21.26	5139.58
11/21/1994	22.37	5138.47
12/22/1994	22.67	5138.17
01/23/1995	22.92	5137.92
02/24/1995	21.78	5139.06
03/22/1995	23.65	5137.19
04/20/1995	22.68	5138.16
05/18/1995	21.81	5139.03
06/08/1995	17.21	5143.63
06/27/1995	16.00	5144.84
07/19/1995	17.87	5142.97
08/08/1995	19.25	5141.59
08/28/1995	18.36	5142.48
09/14/1995	20.77	5140.07
10/23/1995	21.02	5139.82
11/14/1995	21.20	5139.64
12/14/1995	21.92	5138.92
02/15/1996	22.12	5138.72
04/24/1996	21.74	5139.10
07/18/1996	21.14	5139.70
04/29/1997	21.55	5139.29

Groundwater Hydrograph

Well Identification
93-2

MBMG Site #
M:144016

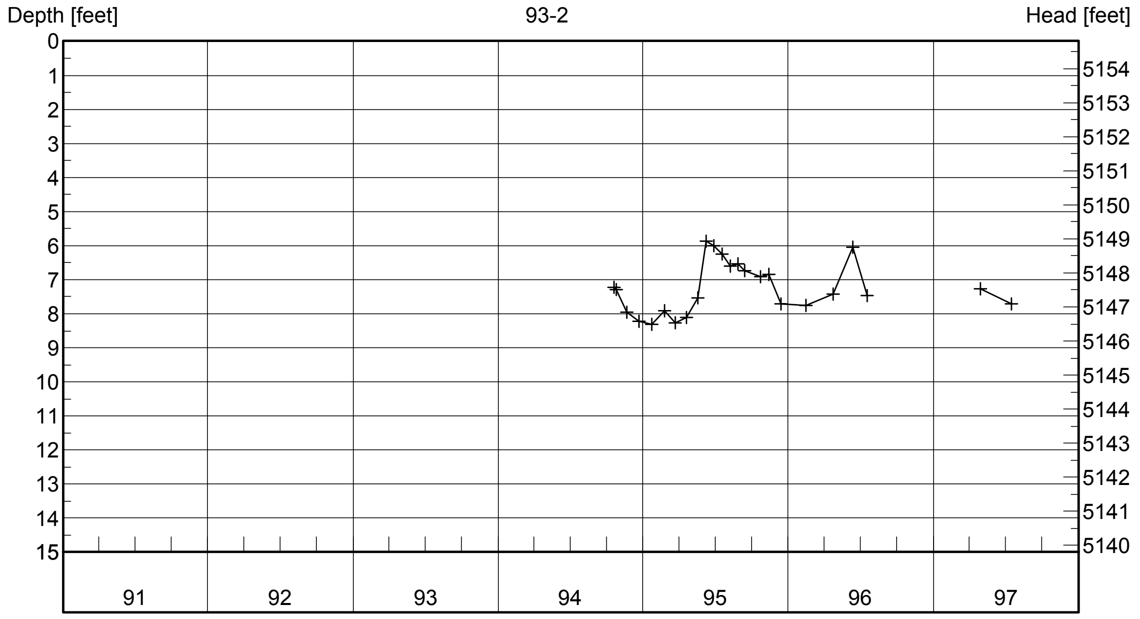
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project well 93-2

Location
07S 09W 34 ABBA

Ground Surface Elev. (ft)
5152.78

Measuring Point Elev. (ft)
5154.30

Well Depth below m.p. (ft)
41.43



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
10/19/1994	7.23	5147.07	07/18/1996	7.46	5146.84						
10/26/1994	7.29	5147.01	04/29/1997	7.27	5147.03						
11/21/1994	7.96	5146.34	07/17/1997	7.71	5146.59						
12/22/1994	8.22	5146.08									
01/23/1995	8.30	5146.00									
02/24/1995	7.92	5146.38									
03/22/1995	8.27	5146.03									
04/20/1995	8.11	5146.19									
05/18/1995	7.54	5146.76									
06/08/1995	5.86	5148.44									
06/27/1995	6.01	5148.29									
07/19/1995	6.25	5148.05									
08/08/1995	6.60	5147.70									
08/28/1995	6.54	5147.76									
09/14/1995	6.73	5147.57									
10/23/1995	6.91	5147.39									
11/14/1995	6.84	5147.46									
12/14/1995	7.72	5146.58									
02/15/1996	7.75	5146.55									
04/24/1996	7.43	5146.87									
06/11/1996	6.05	5148.25									

Groundwater Hydrograph

Well Identification ERB

MBMG Site # M:145387

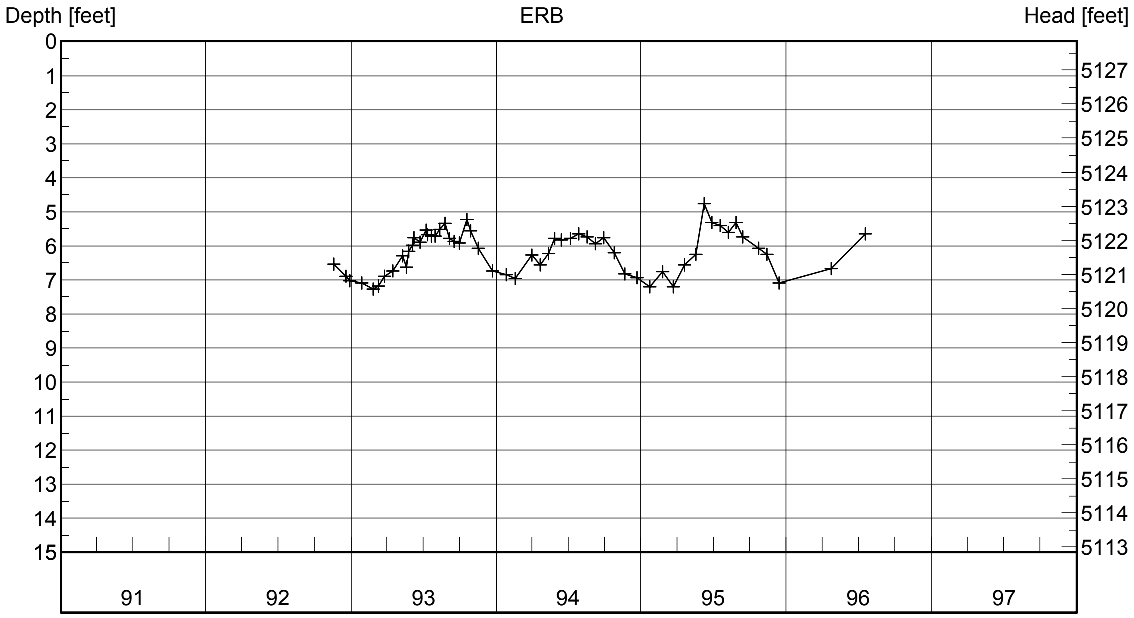
Well Name or Well Owner John Erb

Location 07S 09W 25 BBAD

Ground Surface Elev. (ft) 5126.07

Measuring Point Elev. (ft) 5127.84

Well Depth below m.p. (ft) 29.72



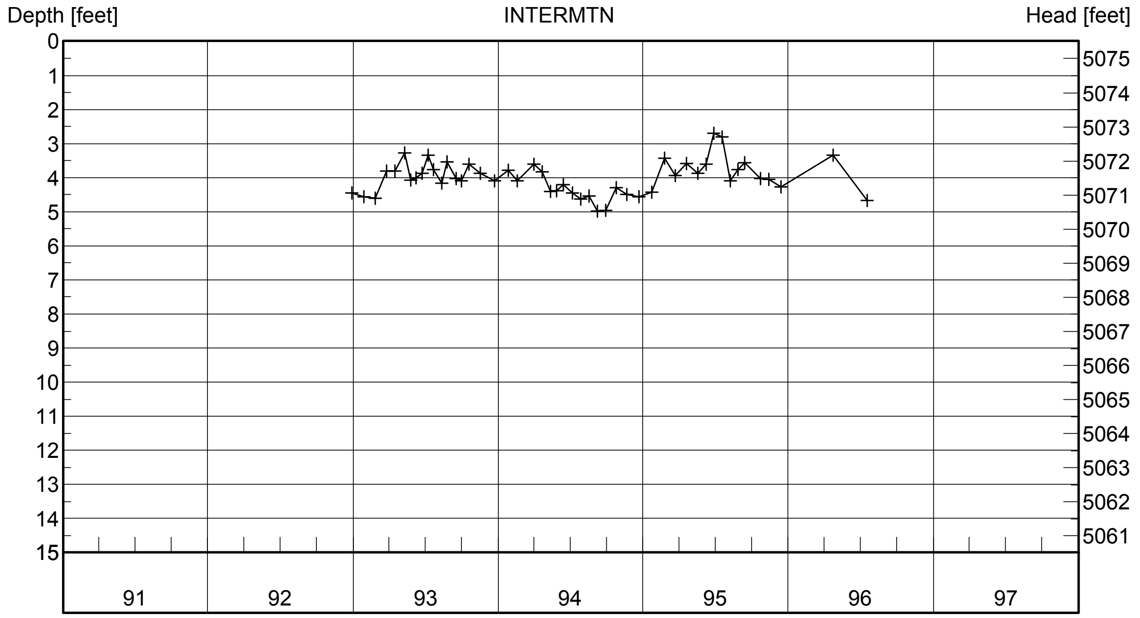
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/18/1992	6.53	5121.31	09/16/1993	5.88	5121.96	01/23/1995	7.19	5120.65			
12/19/1992	6.89	5120.95	09/30/1993	5.91	5121.93	02/24/1995	6.75	5121.09			
12/29/1992	7.02	5120.82	10/19/1993	5.22	5122.62	03/22/1995	7.20	5120.64			
01/27/1993	7.09	5120.75	10/29/1993	5.55	5122.29	04/20/1995	6.55	5121.29			
02/25/1993	7.26	5120.58	11/17/1993	6.06	5121.78	05/18/1995	6.25	5121.59			
03/11/1993	7.17	5120.67	12/22/1993	6.73	5121.11	06/08/1995	4.75	5123.09			
03/26/1993	6.90	5120.94	01/26/1994	6.84	5121.00	06/27/1995	5.31	5122.53			
04/15/1993	6.73	5121.11	02/17/1994	6.96	5120.88	07/19/1995	5.40	5122.44			
05/10/1993	6.28	5121.56	03/31/1994	6.27	5121.57	08/08/1995	5.61	5122.23			
05/19/1993	6.62	5121.22	04/21/1994	6.55	5121.29	08/28/1995	5.31	5122.53			
05/25/1993	6.15	5121.69	05/12/1994	6.22	5121.62	09/14/1995	5.73	5122.11			
06/04/1993	5.97	5121.87	05/27/1994	5.79	5122.05	10/23/1995	6.06	5121.78			
06/08/1993	5.75	5122.09	06/14/1994	5.82	5122.02	11/14/1995	6.25	5121.59			
06/24/1993	5.90	5121.94	07/07/1994	5.78	5122.06	12/14/1995	7.09	5120.75			
07/08/1993	5.53	5122.31	07/28/1994	5.64	5122.20	04/24/1996	6.66	5121.18			
07/12/1993	5.67	5122.17	08/17/1994	5.73	5122.11	07/18/1996	5.65	5122.19			
07/21/1993	5.72	5122.12	09/07/1994	5.94	5121.90						
08/01/1993	5.71	5122.13	09/29/1994	5.76	5122.08						
08/12/1993	5.52	5122.32	10/26/1994	6.21	5121.63						
08/25/1993	5.33	5122.51	11/21/1994	6.82	5121.02						
09/06/1993	5.78	5122.06	12/22/1994	6.94	5120.90						

Groundwater Hydrograph

Well Identification	MBMG Site #	Well Name or Well Owner
INTERMTN	M:145389	Intermountain Irrigation Co.

Location	Ground Surface Elev. (ft)	Measuring Point Elev. (ft)
07S 08W 18 BDCB	5074.38	5075.51



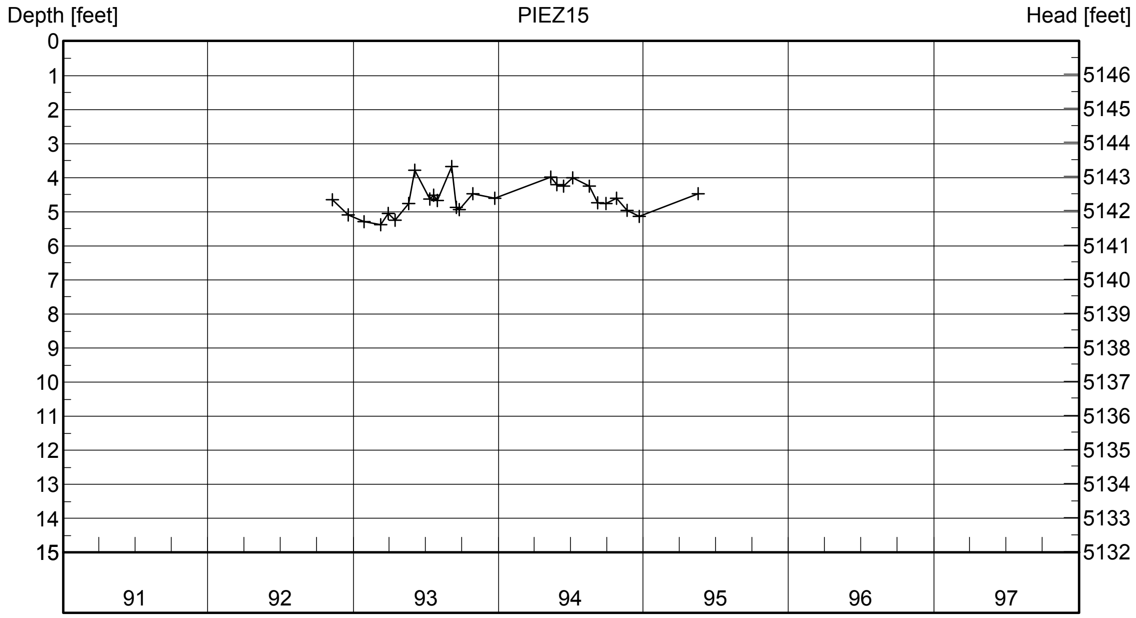
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
12/29/1992	4.45	5071.06	04/21/1994	3.83	5071.68	08/28/1995	3.75	5071.76			
01/27/1993	4.55	5070.96	05/12/1994	4.41	5071.10	09/14/1995	3.56	5071.95			
02/25/1993	4.60	5070.91	05/27/1994	4.38	5071.13	10/23/1995	4.03	5071.48			
03/26/1993	3.80	5071.71	06/14/1994	4.21	5071.30	11/14/1995	4.05	5071.46			
04/15/1993	3.81	5071.70	07/07/1994	4.44	5071.07	12/14/1995	4.27	5071.24			
05/10/1993	3.28	5072.23	07/28/1994	4.62	5070.89	04/24/1996	3.35	5072.16			
05/25/1993	4.07	5071.44	08/17/1994	4.53	5070.98	07/18/1996	4.66	5070.85			
06/08/1993	4.01	5071.50	09/07/1994	4.98	5070.53						
06/24/1993	3.88	5071.63	09/29/1994	4.95	5070.56						
07/08/1993	3.33	5072.18	10/26/1994	4.29	5071.22						
07/21/1993	3.75	5071.76	11/21/1994	4.49	5071.02						
08/12/1993	4.16	5071.35	12/22/1994	4.56	5070.95						
08/25/1993	3.53	5071.98	01/23/1995	4.43	5071.08						
09/16/1993	4.02	5071.49	02/24/1995	3.42	5072.09						
09/30/1993	4.09	5071.42	03/22/1995	3.93	5071.58						
10/19/1993	3.60	5071.91	04/20/1995	3.58	5071.93						
11/17/1993	3.88	5071.63	05/18/1995	3.87	5071.64						
12/22/1993	4.10	5071.41	06/08/1995	3.60	5071.91						
01/26/1994	3.78	5071.73	06/27/1995	2.70	5072.81						
02/17/1994	4.09	5071.42	07/19/1995	2.81	5072.70						
03/31/1994	3.60	5071.91	08/08/1995	4.09	5071.42						

Groundwater Hydrograph

Well Identification **PIEZ15**		**Well Name or Well Owner** **Piezometer #15 (Tash yellow piezometer)**

Location **07S 09W 27 DDBC**	**Ground Surface Elev. (ft)** **5145.92**	**Measuring Point Elev. (ft)** **5146.97**	**Well Depth below m.p. (ft)** **7.43**

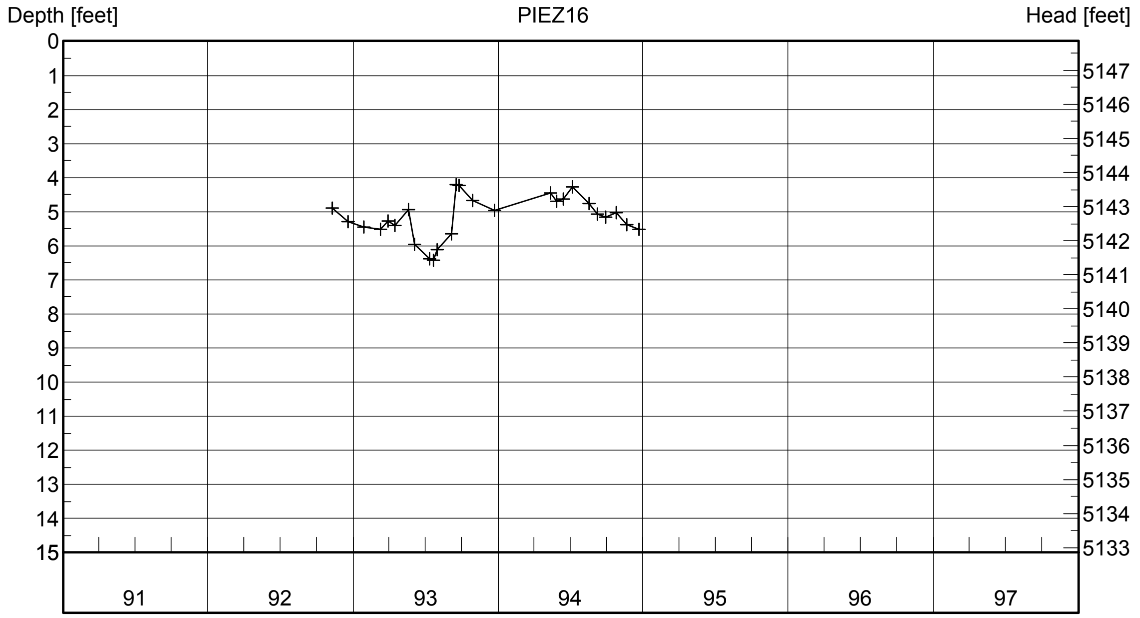


Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
11/08/1992	4.64	5142.33
12/19/1992	5.10	5141.87
01/27/1993	5.29	5141.68
03/11/1993	5.37	5141.60
03/29/1993	5.04	5141.93
04/15/1993	5.24	5141.73
05/19/1993	4.75	5142.22
06/04/1993	3.78	5143.19
07/12/1993	4.62	5142.35
07/21/1993	4.51	5142.46
08/01/1993	4.66	5142.31
09/06/1993	3.68	5143.29
09/17/1993	4.86	5142.11
09/24/1993	4.93	5142.04
10/29/1993	4.48	5142.49
12/22/1993	4.61	5142.36
05/12/1994	3.99	5142.98
05/27/1994	4.21	5142.76
06/14/1994	4.26	5142.71
07/07/1994	4.00	5142.97
08/18/1994	4.26	5142.71
09/07/1994	4.74	5142.23
09/29/1994	4.76	5142.21
10/26/1994	4.60	5142.37
11/21/1994	4.95	5142.02
12/22/1994	5.14	5141.83
05/18/1995	4.47	5142.50

Groundwater Hydrograph

Well Identification	**PIEZ16**
Well Name or Well Owner	**Piezometer #16 (Tash white piezometer)**
Location	**07S 09W 27 DDBC**
Ground Surface Elev. (ft)	**5146.02**
Measuring Point Elev. (ft)	**5147.35**
Well Depth below m.p. (ft)	**15.89**



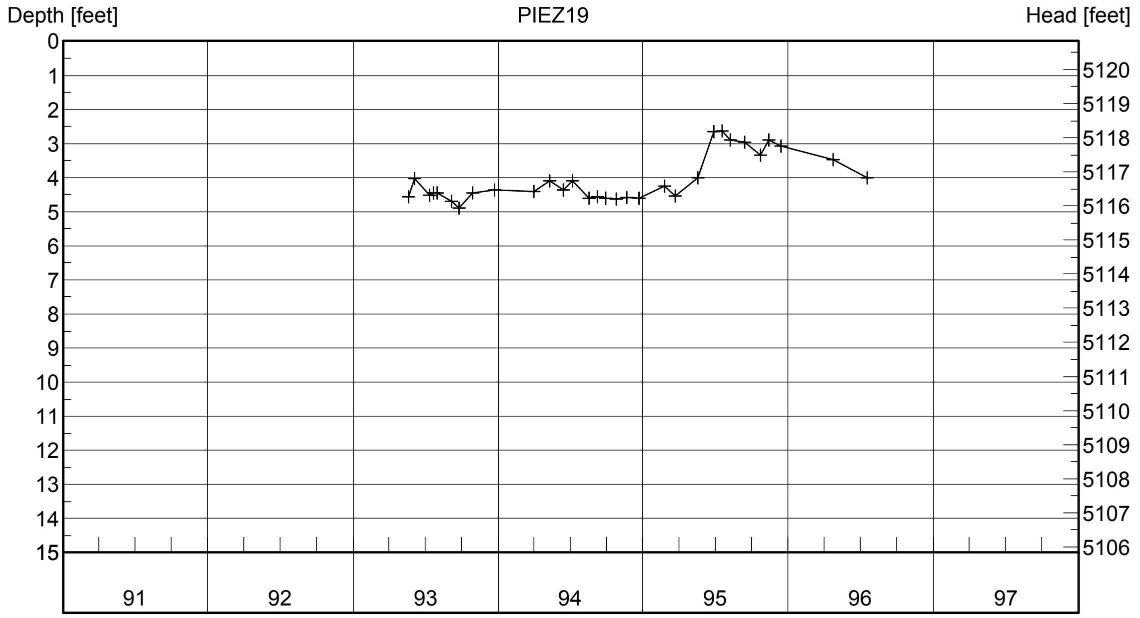
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
11/08/1992	4.89	5142.46	09/07/1994	5.07	5142.28						
12/19/1992	5.30	5142.05	09/29/1994	5.15	5142.20						
01/27/1993	5.45	5141.90	10/26/1994	5.02	5142.33						
03/11/1993	5.51	5141.84	11/21/1994	5.39	5141.96						
03/29/1993	5.26	5142.09	12/22/1994	5.51	5141.84						
04/15/1993	5.41	5141.94									
05/19/1993	4.94	5142.41									
06/04/1993	5.95	5141.40									
07/12/1993	6.37	5140.98									
07/21/1993	6.42	5140.93									
08/01/1993	6.11	5141.24									
09/06/1993	5.65	5141.70									
09/17/1993	4.20	5143.15									
09/24/1993	4.22	5143.13									
10/29/1993	4.66	5142.69									
12/22/1993	4.96	5142.39									
05/12/1994	4.45	5142.90									
05/27/1994	4.70	5142.65									
06/14/1994	4.62	5142.73									
07/07/1994	4.28	5143.07									
08/18/1994	4.77	5142.58									

Groundwater Hydrograph

Well Identification **PIEZ19**	**Well Name or Well Owner** **Piezometer #19 (Wheat North blackpipe piezometer)**

Location **07S 09W 23 CACD**	**Ground Surface Elev. (ft)** **5118.99**	**Measuring Point Elev. (ft)** **5120.83**	**Well Depth below m.p. (ft)** **12.42**



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)	Date	Depth (ft)	Head (ft)
05/19/1993	4.56	5116.27	05/18/1995	4.00	5116.83						
06/04/1993	4.03	5116.80	06/28/1995	2.65	5118.18						
07/12/1993	4.51	5116.32	07/19/1995	2.63	5118.20						
07/21/1993	4.44	5116.39	08/08/1995	2.90	5117.93						
08/01/1993	4.46	5116.37	09/14/1995	2.97	5117.86						
09/06/1993	4.70	5116.13	10/23/1995	3.33	5117.50						
09/24/1993	4.89	5115.94	11/14/1995	2.89	5117.94						
10/29/1993	4.45	5116.38	12/14/1995	3.08	5117.75						
12/22/1993	4.37	5116.46	04/24/1996	3.47	5117.36						
03/31/1994	4.40	5116.43	07/18/1996	4.00	5116.83						
05/11/1994	4.10	5116.73									
06/14/1994	4.35	5116.48									
07/07/1994	4.10	5116.73									
08/18/1994	4.60	5116.23									
09/07/1994	4.56	5116.27									
09/29/1994	4.60	5116.23									
10/26/1994	4.62	5116.21									
11/21/1994	4.59	5116.24									
12/22/1994	4.60	5116.23									
02/24/1995	4.24	5116.59									
03/22/1995	4.53	5116.30									

Groundwater Hydrograph

Well Identification
PIEZ20

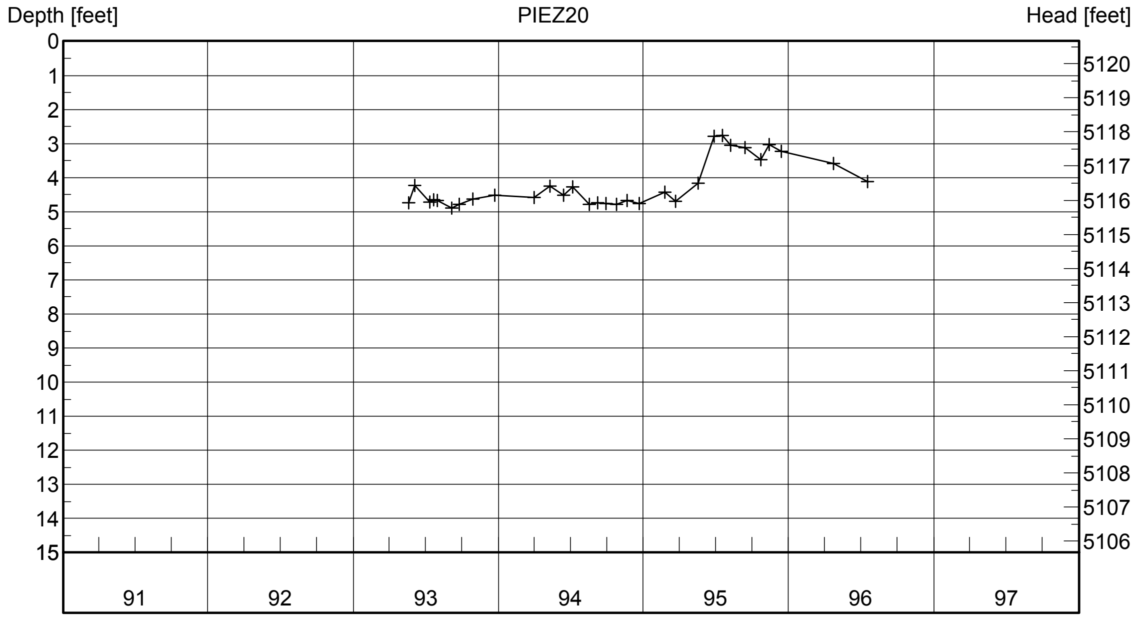
Well Name or Well Owner
Piezometer #20 (Wheat North white piezometer)

Location
07S 09W 23 CACD

Ground Surface Elev. (ft)
5118.69

Measuring Point Elev. (ft)
5120.66

Well Depth below m.p. (ft)
6.96



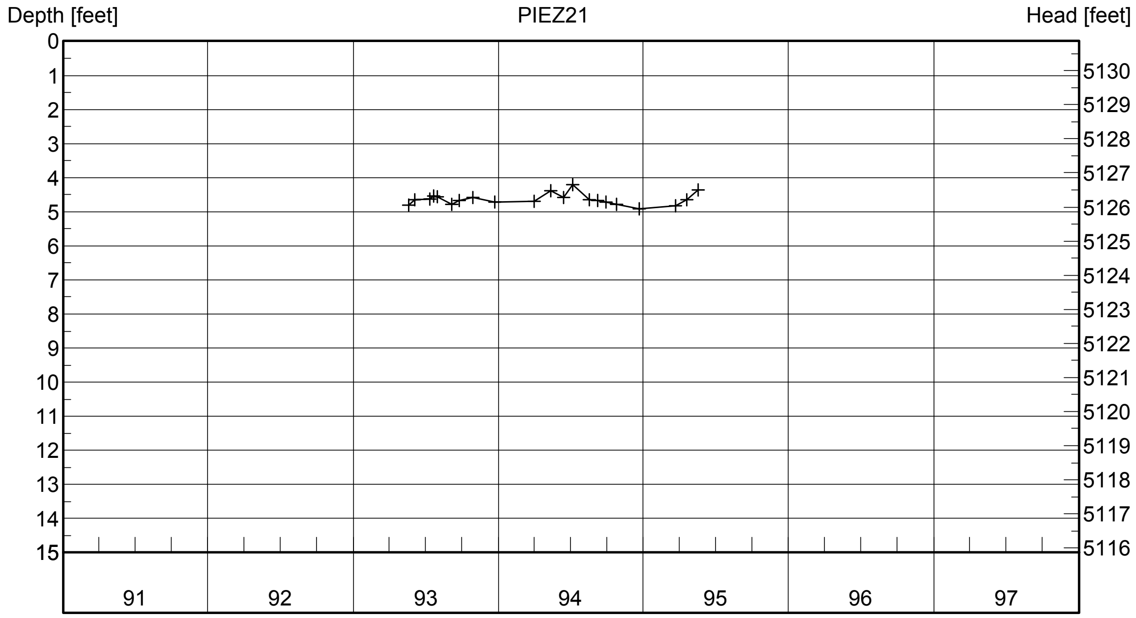
Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
05/19/1993	4.73	5115.93
06/04/1993	4.22	5116.44
07/12/1993	4.72	5115.94
07/21/1993	4.64	5116.02
08/01/1993	4.67	5115.99
09/06/1993	4.89	5115.77
09/24/1993	4.78	5115.88
10/29/1993	4.62	5116.04
12/22/1993	4.52	5116.14
03/31/1994	4.58	5116.08
05/11/1994	4.25	5116.41
06/14/1994	4.51	5116.15
07/07/1994	4.28	5116.38
08/18/1994	4.79	5115.87
09/07/1994	4.73	5115.93
09/29/1994	4.77	5115.89
10/26/1994	4.79	5115.87
11/21/1994	4.68	5115.98
12/22/1994	4.77	5115.89
02/24/1995	4.42	5116.24
03/22/1995	4.69	5115.97
05/18/1995	4.16	5116.50
06/28/1995	2.79	5117.87
07/19/1995	2.77	5117.89
08/08/1995	3.04	5117.62
09/14/1995	3.11	5117.55
10/23/1995	3.48	5117.18
11/14/1995	3.02	5117.64
12/14/1995	3.23	5117.43
04/24/1996	3.58	5117.08
07/18/1996	4.12	5116.54

Groundwater Hydrograph

Well Identification **PIEZ21**	**Well Name or Well Owner** **Piezometer #21 (Wheat South piezometer)**

Location **07S 09W 26 BACC**	**Ground Surface Elev. (ft)** **5129.04**	**Measuring Point Elev. (ft)** **5130.86**	**Well Depth below m.p. (ft)** **7.17**

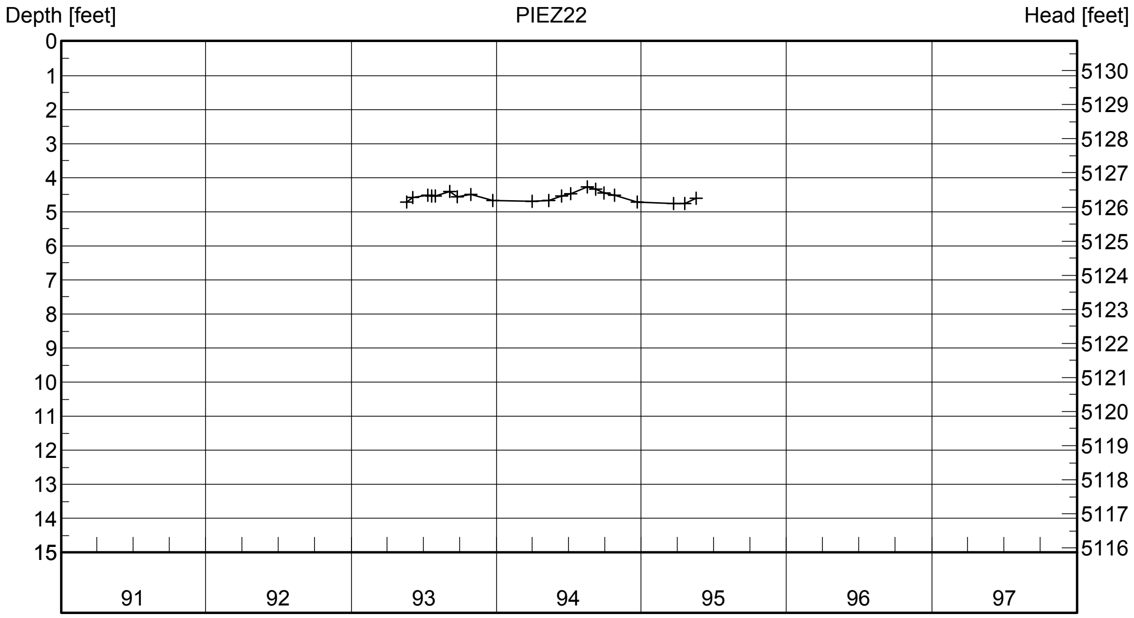


Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
05/19/1993	4.81	5126.05
06/04/1993	4.65	5126.21
07/12/1993	4.62	5126.24
07/21/1993	4.53	5126.33
08/01/1993	4.56	5126.30
09/06/1993	4.78	5126.08
09/24/1993	4.68	5126.18
10/29/1993	4.58	5126.28
12/22/1993	4.71	5126.15
03/31/1994	4.70	5126.16
05/12/1994	4.39	5126.47
06/14/1994	4.58	5126.28
07/07/1994	4.20	5126.66
08/18/1994	4.65	5126.21
09/07/1994	4.66	5126.20
09/29/1994	4.72	5126.14
10/26/1994	4.79	5126.07
12/22/1994	4.92	5125.94
03/22/1995	4.83	5126.03
04/20/1995	4.64	5126.22
05/18/1995	4.36	5126.50

Groundwater Hydrograph

Well Identification	PIEZ22
Well Name or Well Owner	Piezometer #22 (Wheat South piezometer)
Location	07S 09W 26 BACC
Ground Surface Elev. (ft)	5129.08
Measuring Point Elev. (ft)	5130.86
Well Depth below m.p. (ft)	14.02



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
05/19/1993	4.72	5126.14
06/04/1993	4.58	5126.28
07/12/1993	4.52	5126.34
07/21/1993	4.54	5126.32
08/01/1993	4.54	5126.32
09/06/1993	4.41	5126.45
09/24/1993	4.57	5126.29
10/29/1993	4.49	5126.37
12/22/1993	4.66	5126.20
03/31/1994	4.70	5126.16
05/12/1994	4.66	5126.20
06/14/1994	4.54	5126.32
07/07/1994	4.48	5126.38
08/17/1994	4.28	5126.58
09/07/1994	4.33	5126.53
09/29/1994	4.46	5126.40
10/26/1994	4.52	5126.34
12/22/1994	4.71	5126.15
03/22/1995	4.75	5126.11
04/20/1995	4.75	5126.11
05/18/1995	4.61	5126.25

Groundwater Hydrograph

Well Identification
SANDPT

MBMG Site #
M:145392

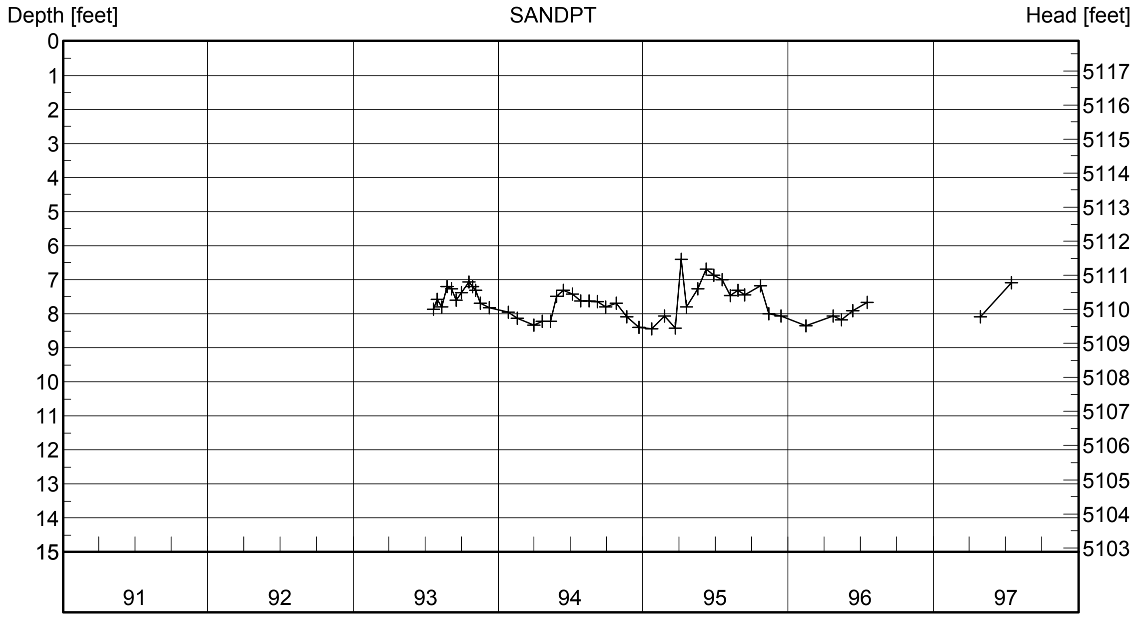
Well Name or Well Owner
MT DNRC Beaverhead Groundwater Project sandpoint

Location
07S 09W 24 CBCA

Ground Surface Elev. (ft)
5115.34

Measuring Point Elev. (ft)
5117.37

Well Depth below m.p. (ft)
13.11

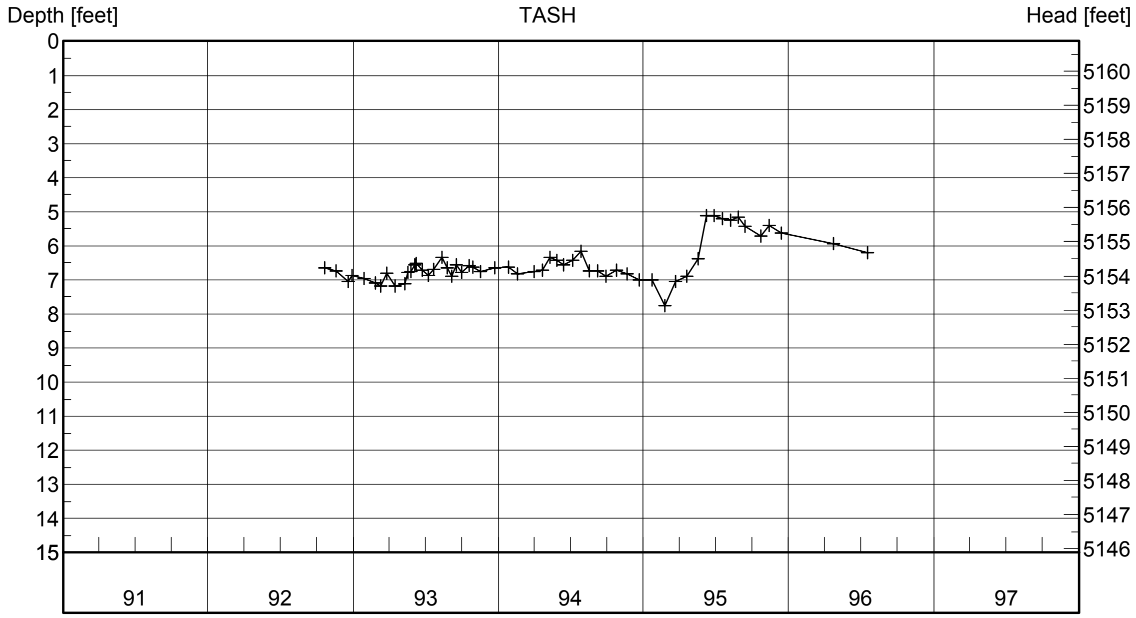


Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
07/21/1993	7.87	5109.50
08/01/1993	7.57	5109.80
08/12/1993	7.80	5109.57
08/25/1993	7.19	5110.18
09/06/1993	7.27	5110.10
09/16/1993	7.59	5109.78
09/30/1993	7.37	5110.00
10/19/1993	7.07	5110.30
10/29/1993	7.20	5110.17
11/05/1993	7.32	5110.05
11/17/1993	7.68	5109.69
12/09/1993	7.82	5109.55
01/26/1994	7.96	5109.41
02/17/1994	8.14	5109.23
03/31/1994	8.34	5109.03
04/21/1994	8.22	5109.15
05/12/1994	8.22	5109.15
05/27/1994	7.49	5109.88
06/14/1994	7.31	5110.06
07/07/1994	7.42	5109.95
07/28/1994	7.63	5109.74
08/17/1994	7.63	5109.74
09/07/1994	7.65	5109.72
09/29/1994	7.81	5109.56
10/26/1994	7.69	5109.68
11/21/1994	8.08	5109.29
12/22/1994	8.39	5108.98
01/23/1995	8.45	5108.92
02/24/1995	8.06	5109.31
03/22/1995	8.42	5108.95
04/06/1995	6.40	5110.97
04/20/1995	7.80	5109.57
05/18/1995	7.27	5110.10
06/08/1995	6.69	5110.68
06/27/1995	6.86	5110.51
07/19/1995	7.00	5110.37
08/08/1995	7.46	5109.91
08/28/1995	7.32	5110.05
09/14/1995	7.45	5109.92
10/23/1995	7.18	5110.19
11/14/1995	8.01	5109.36
12/14/1995	8.07	5109.30
02/15/1996	8.35	5109.02
04/24/1996	8.07	5109.30
05/15/1996	8.17	5109.20
06/11/1996	7.90	5109.47
07/18/1996	7.67	5109.70
04/29/1997	8.08	5109.29
07/17/1997	7.10	5110.27

Groundwater Hydrograph

Well Identification TASH	**MBMG Site #** M:109703	**Well Name or Well Owner** Bill Tash
Location 07S 09W 34 ACDC	**Ground Surface Elev. (ft)** 5159.49	**Measuring Point Elev. (ft)** 5160.88
Well Depth below m.p. (ft) 47.00		



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
10/21/1992	6.65	5154.23
11/18/1992	6.74	5154.14
12/19/1992	7.04	5153.84
12/29/1992	6.86	5154.02
01/27/1993	6.96	5153.92
02/25/1993	7.08	5153.80
03/11/1993	7.17	5153.71
03/26/1993	6.79	5154.09
04/15/1993	7.17	5153.71
05/10/1993	7.11	5153.77
05/18/1993	6.77	5154.11
05/25/1993	6.75	5154.13
06/04/1993	6.55	5154.33
06/08/1993	6.52	5154.36
06/24/1993	6.71	5154.17
07/08/1993	6.87	5154.01
07/21/1993	6.68	5154.20
08/12/1993	6.33	5154.55
08/25/1993	6.65	5154.23
09/06/1993	6.90	5153.98
09/16/1993	6.56	5154.32
09/30/1993	6.77	5154.11
10/19/1993	6.57	5154.31
10/29/1993	6.63	5154.25
11/17/1993	6.75	5154.13
12/22/1993	6.64	5154.24
01/26/1994	6.63	5154.25
02/17/1994	6.82	5154.06
03/31/1994	6.75	5154.13
04/21/1994	6.72	5154.16
05/11/1994	6.34	5154.54
05/27/1994	6.42	5154.46
06/14/1994	6.55	5154.33
07/07/1994	6.42	5154.46
07/27/1994	6.15	5154.73
08/18/1994	6.74	5154.14
09/07/1994	6.73	5154.15
09/29/1994	6.88	5154.00
10/26/1994	6.71	5154.17
11/21/1994	6.82	5154.06
12/22/1994	7.00	5153.88
01/23/1995	7.01	5153.87
02/24/1995	7.75	5153.13
03/22/1995	7.05	5153.83
04/20/1995	6.89	5153.99
05/18/1995	6.37	5154.51
06/08/1995	5.11	5155.77
06/28/1995	5.12	5155.76
07/19/1995	5.21	5155.67
08/08/1995	5.24	5155.64
08/28/1995	5.15	5155.73
09/14/1995	5.43	5155.45
10/23/1995	5.72	5155.16
11/14/1995	5.40	5155.48
12/14/1995	5.63	5155.25
04/24/1996	5.94	5154.94
07/18/1996	6.21	5154.67

Groundwater Hydrograph

Well Identification
TASHSTK

MBMG Site #
M:109668

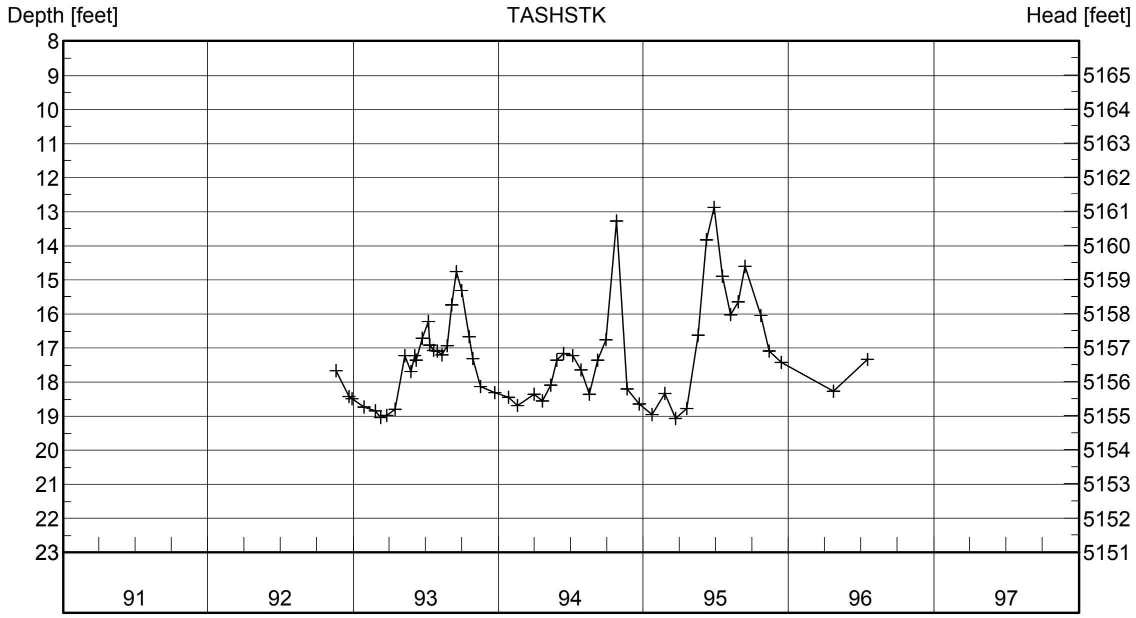
Well Name or Well Owner
Tash T Diamond Ranch stock well @ corral

Location
07S 09W 34 BBAB

Ground Surface Elev. (ft)
5171.77

Measuring Point Elev. (ft)
5173.48

Well Depth below m.p. (ft)
36.95



Depth to groundwater and head are reported from measuring point

Date	Depth (ft)	Head (ft)
11/18/1992	17.67	5155.81
12/20/1992	18.42	5155.06
12/29/1992	18.49	5154.99
01/27/1993	18.72	5154.76
02/25/1993	18.84	5154.64
03/11/1993	19.04	5154.44
03/26/1993	18.97	5154.51
04/15/1993	18.80	5154.68
05/10/1993	17.21	5156.27
05/25/1993	17.68	5155.80
06/04/1993	17.23	5156.25
06/08/1993	17.36	5156.12
06/24/1993	16.71	5156.77
07/08/1993	16.23	5157.25
07/12/1993	16.90	5156.58
07/21/1993	17.06	5156.42
08/01/1993	17.08	5156.40
08/12/1993	17.19	5156.29
08/25/1993	16.93	5156.55
09/06/1993	15.73	5157.75
09/16/1993	14.75	5158.73
09/30/1993	15.31	5158.17
10/19/1993	16.67	5156.81
10/29/1993	17.30	5156.18
11/17/1993	18.12	5155.36
12/22/1993	18.30	5155.18
01/26/1994	18.43	5155.05
02/17/1994	18.69	5154.79
03/31/1994	18.36	5155.12
04/21/1994	18.56	5154.92
05/12/1994	18.09	5155.39
05/27/1994	17.36	5156.12
06/14/1994	17.16	5156.32
07/07/1994	17.22	5156.26
07/28/1994	17.64	5155.84
08/17/1994	18.36	5155.12
09/07/1994	17.36	5156.12
09/29/1994	16.75	5156.73
10/26/1994	13.26	5160.22
11/21/1994	18.19	5155.29
12/22/1994	18.64	5154.84
01/23/1995	18.96	5154.52
02/24/1995	18.34	5155.14
03/22/1995	19.06	5154.42
04/20/1995	18.77	5154.71
05/18/1995	16.61	5156.87
06/08/1995	13.83	5159.65
06/27/1995	12.87	5160.61
07/19/1995	14.90	5158.58
08/08/1995	16.02	5157.46
08/28/1995	15.64	5157.84
09/14/1995	14.60	5158.88
10/23/1995	16.05	5157.43
11/14/1995	17.09	5156.39
12/14/1995	17.43	5156.05
04/24/1996	18.26	5155.22
07/18/1996	17.34	5156.14

Appendix C

Aquifer Testing and Drawdown Impacts

Appendix C1. Aquifer Test Data
Johnson Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 6/6 - 6/8, 1994
Test Site: Big Sky Pallets property **Site Location:** 07S 09W 33 DAAA
Address: Highway 278, Dillon **County:** Beaverhead **State:** Montana
Test Well: Johnson irrigation well **Pumping Rate:** 1,800 - 1,860 gpm
Observation Well: well 92-26 **Distance to Observation Well:** 190.75 ft
Type of Test: variable rate discharge **Test Conducted by:** W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 6/6/94 Time 1:11 pm Pump off: Date____ Time____ Duration of aquifer test: Pumping 2549 mins Recovery____	Static Water Level 9.82 ft Measuring Point top of casing Elevation of Measuring Point 5174.76 ft	How Q measured pressure gage Depth of pump/air line____ Previous pumping? Yes___ No T Duration____ End____	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	Pressure gage readings calibrated with accumulating meter: 115psi = 1800 gpm, 110psi = 1900 gpm, 105psi = 2100 gpm, 95-100psi = 2150-2200 gpm.
6/6/94	12:17 pm		9.82				
	12:27		9.82				
	1:11	-- start	aquifer test				
	1:11:30	½	9.91	0.09			
	1:12	1	9.96	0.14			
	1:12:30	1½	9.96	0.14			
	1:13	2	9.98	0.16			
	1:14	3	9.99	0.17			
	1:14:30	3½	9.99	0.17			
	1:15	4	10.00	0.18			
	1:16	5	10.00	0.18			
	1:16:30	5½	10.01	0.19			
	1:17:30	6½	10.01	0.19			
	1:18	7	10.00	0.18			
	1:18:30	7½	10.00	0.18			
	1:19	8	9.99	0.17			
	1:19:30	8½	9.98	0.16			
	1:20:30	9½	9.98	0.16			
	1:21	10	9.97	0.15			
	1:21:30	10½	9.98	0.16			
	1:23	12	9.98	0.16			
	1:24	13	9.98	0.16			
	1:25	14	10.00	0.18			
	1:26	15	10.00	0.18			
	1:30	19	10.00	0.18			
	1:35	24	10.00	0.18		1,800	115psi @ 1:32 pm
	1:39	28	10.00	0.18			
	1:51	40	10.02	0.20			115psi @ 1:52 pm
	1:56	45	10.03	0.21			
	2:12	61	10.05	0.23			
	2:33	82	10.08	0.26			

Page 2 of 2

Johnson Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project
Test Date: 6/6 - 6/8, 1994
Test Site: Big Sky Pallets property
Site Location: 07S 09W 33 DAAA
Address: Highway 278, Dillon
County: Beaverhead **State:** Montana
Test Well: Johnson irrigation well
Pumping Rate: 1,800 - 1,860 gpm
Observation Well: well 92-26
Distance to Observation Well: 190.75 ft
Type of Test: variable rate discharge
Test Conducted by: W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 6/6/94 Time 1:11 pm Pump off: Date_______ Time_______ Duration of aquifer test: Pumping 2549 mins Recovery______	Static Water Level 9.82 ft Measuring Point top of casing Elevation of Measuring Point 5174.76 ft	How Q measured pressure gage Depth of pump/air line________ Previous pumping? Yes__ No T Duration_______ End______	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
6/6/94	2:53 pm	102	10.10	0.28			115psi @ 2:35 pm
	3:19	128	10.12	0.30			
	3:48	157	10.13	0.31			
	4:13	182	10.16	0.34			
	4:37	206	10.17	0.35			
	5:09	238	10.19	0.37			115psi @ 4:42 pm
	5:41	270	10.21	0.39			
	6:16	305	10.22	0.40			
	6:51	340	10.24	0.42			115psi @ 6:22 pm
	7:28	377	10.26	0.44			115psi @ 6:56 pm
	8:01	410	10.27	0.45			
	8:39	448	10.29	0.47		1,840	
	9:09	478	10.30	0.48			113psi @ 8:45 pm
	9:41	510	10.31	0.49			
	10:59	588	10.33	0.51			113psi @ 9:43 pm
6/7/94	1:08 am	717	10.37	0.55			113psi @ 11:08 pm
	3:43	872	10.40	0.58			113psi @ 1:15 am
	5:24	973	10.41	0.59			
	7:28	1097	10.43	0.61		1,860	
	8:58	1187	10.44	0.62			112 psi @ 7:35 am
	10:31	1280	10.44	0.62			
	11:24	1333	10.45	0.63			112psi @ 10:40 am
	12:20 pm	1389	10.45	0.63		1,880	
	1:11	1440	10.46	0.64			111psi @ 12:26 pm
	5:30	1699	10.48	0.66			111psi @ 1:17 pm
	9:08	1917	10.49	0.67		1,860	111psi @ 5:22 pm
6/8/94	2:56 am	2265	10.51	0.69			112psi @ 9:13 pm
	7:40	2549	10.53	0.71			112psi @ 2:41 am
							112psi @ 7:43 am

Page 1 of 2

Johnson Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project
Test Date: 6/6 - 6/8, 1994
Test Site: Big Sky Pallets property
Site Location: 07S 09W 33 DAAA
Address: Highway 278, Dillon
County: Beaverhead **State:** Montana
Test Well: Johnson irrigation well
Pumping Rate: 1,800 - 1,860 gpm
Observation Well: Unruh well
Distance to Observation Well: 348.50 ft
Type of Test: variable rate discharge
Test Conducted by: W. Uthman

Time Data	Water Level Data	Discharge Data	Comments on factors affecting test data
Pump on: Date 6/6/94 Time 1:11 pm Pump off: Date ____ Time ____ Duration of aquifer test: Pumping 2557 mins Recovery ____	Static Water Level 7.77 ft Measuring Point top of casing Elevation of Measuring Point 5172.09ft	How Q measured pressure gage Depth of pump/air line ____ Previous pumping? Yes ___ No T Duration ____ End ____	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	pressure gage readings calibrated with accumulating meter: 115psi = 1800 gpm, 110psi = 1900 gpm, 105psi = 2100 gpm, 95-100psi = 2150-2200 gpm.
6/6/94	12:32 pm		7.77				
	1:11	-- start	aquifer test				
	1:12	1	7.82	0.05			
	1:13	2	7.86	0.09			
	1:14	3	7.86	0.09			
	1:15	4	7.88	0.11			
	1:16	5	7.88	0.11			
	1:17	6	7.89	0.12			
	1:18	7	7.90	0.13			
	1:19	8	7.90	0.13			
	1:20	9	7.90	0.13			
	1:21	10	7.90	0.13			
	1:22	11	7.90	0.13			
	1:23	12	7.91	0.14			
	1:24	13	7.91	0.14			
	1:25	14	7.91	0.14			
	1:26	15	7.91	0.14			
	1:27	16	7.91	0.14			
	1:30	19	7.92	0.15		1,800	115psi @ 1:32 pm
	1:33	22	7.92	0.15			
	1:36	25	7.92	0.15			
	1:39	28	7.93	0.16			
	1:42	31	7.93	0.16			
	1:59	48	7.93	0.16			115psi @ 1:52 pm
	2:15	64	7.96	0.19			
	2:37	86	7.99	0.22			115psi @ 2:35 pm
	2:56	105	7.99	0.22			
	3:22	131	8.01	0.24			
	3:51	160	8.04	0.27			
	4:16	185	8.05	0.28			
	4:40	209	8.06	0.29			115psi @ 4:42 pm

Johnson Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 6/6 - 6/8, 1994
Test Site: Big Sky Pallets property **Site Location:** 07S 09W 33 DAAA
Address: Highway 278, Dillon **County:** Beaverhead **State:** Montana
Test Well: Johnson irrigation well **Pumping Rate:** 1,800 - 1,860 gpm
Observation Well: Unruh well **Distance to Observation Well:** 348.50 ft
Type of Test: variable rate discharge **Test Conducted by:** W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 6/6/94 Time 1:11 pm Pump off: Date____ Time____ Duration of aquifer test: Pumping 2557 mins Recovery____	Static Water Level 7.77 ft Measuring Point top of casing Elevation of Measuring Point 5172.09 ft	How Q measured pressure gage Depth of pump/air line____ Previous pumping? Yes__ No T Duration____ End____	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
6/6/94	5:12 pm	241	8.09	0.32			
	5:43	272	8.09	0.32			
	6:19	308	8.12	0.35			115psi @ 6:22 pm
	6:53	342	8.15	0.38			115psi @ 6:56 pm
	7:32	381	8.16	0.39			
	8:04	413	8.18	0.41			
	8:42	451	8.18	0.41		1,840	113psi @ 8:45 pm
	9:12	481	8.20	0.43			
	9:47	516	8.20	0.43			113psi @ 9:43 pm
	11:03	592	8.24	0.47			113psi @ 11:08 pm
6/7/94	1:12 am	721	8.28	0.51			113psi @ 1:15 am
	3:47	876	8.30	0.53			
	5:28	977	8.32	0.55			
	7:32	1101	8.32	0.55		1,860	112 psi @ 7:35 am
	9:02	1191	8.34	0.57			
	10:34	1283	8.35	0.58			112psi @ 10:40 am
	11:28	1337	8.35	0.58			
	12:23 pm	1392	8.36	0.59		1,880	111psi @ 12:26 pm
	1:13	1442	8.36	0.59			111psi @ 1:17 pm
	5:26	1695	8.39	0.62			111psi @ 5:22 pm
	9:03	1912	8.41	0.64		1,860	112psi @ 9:13 pm
6/8/94	2:50 am	2259	8.42	0.65			112psi @ 2:41 am
	7:48	2557	8.43	0.66			112psi @ 7:43 am

Laden Rattlesnake Creek Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project
Test Date: 9/8 - 9/9, 1993
Test Site: Laden property in Rattlesnake Creek valley
Site Location: 07S 09W 33 CBDD
Address: 1125 Laden Lane, Dillon
County: Beaverhead **State:** Montana
Test Well: Laden irrigation well
Pumping Rate: 1,130 gpm
Observation Well: well 92-27
Distance to Observation Well: 146.5 ft
Type of Test: constant rate discharge
Test Conducted by: W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 9/8/93 Time 8:42 am	Static Water Level 11.45 ft	How Q measured pressure gage	
Pump off: Date 9/9/93 Time 8:42 am	Measuring Point top of casing	Depth of pump/air line	
Duration of aquifer test:		Previous pumping? Yes___ No T	
Pumping 1440 mins Recovery	Elevation of Measuring Point 5190.24 ft	Duration End	

Date	**Clock time**	**Time since pump started (min)**	**Depth to water from m.p. (ft)**	**Water level change (ft)**	**Discharge measurement**	**Rate (gpm)**	
9/7/93	2:30 pm		11.47				
	7:22		11.44				
9/8/93	7:56 am		11.46				
	8:39		11.45				
	8:41		11.45				
	8:41:30		11.45				
	8:42	-- start	aquifer test				
	8:42:30	½	11.56	0.11			
	8:43	1	12.20	0.75			
	8:44	2	13.30	1.85			
	8:44:30	2½	13.90	2.45			
	8:45	3	14.45	3.00			
	8:45:30	3½	14.90	3.45			
	8:46	4	15.14	3.69			
	8:46:30	4½	15.36	3.91			
	8:47	5	15.53	4.08			
	8:47:30	5½	15.67	4.22			
	8:48	6	15.76	4.31			
	8:48:30	6½	15.75	4.30			
	8:49	7	15.74	4.29			
	8:49:30	7½	15.63	4.18			
	8:50	8	15.44	3.99			
	8:50:30	8½	15.43	3.98			
	8:51	9	15.35	3.90			
	8:51:30	9½	15.29	3.84			
	8:52	10	15.21	3.76			
	8:52:30	10½	15.18	3.73			
	8:53	11	15.14	3.69			
	8:54	12	15.11	3.66			
	8:54:30	12½	15.09	3.64			
	8:55	13	15.08	3.63			

Laden Rattlesnake Creek Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project
Test Date: 9/8 - 9/9, 1993
Test Site: Laden property in Rattlesnake Creek valley
Site Location: 07S 09W 33 CBDD
Address: 1125 Laden Lane, Dillon
County: Beaverhead **State:** Montana
Test Well: Laden irrigation well
Pumping Rate: 1,130 gpm
Observation Well: well 92-27
Distance to Observation Well: 146.5 ft
Type of Test: constant rate discharge
Test Conducted by: W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 9/8/93 Time 8:42 am Pump off: Date 9/9/93 Time 8:42 am Duration of aquifer test: Pumping 1440 mins Recovery ______	Static Water Level 11.45 ft Measuring Point top of casing Elevation of Measuring Point 5190.24 ft	How Q measured pressure gage Depth of pump/air line ______ Previous pumping? Yes ___ No T Duration ______ End ______	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
9/8/93	8:55:30am	13½	15.07	3.62			
	8:56	14	15.08	3.63			
	8:56:30	14½	15.09	3.64			
	8:57	15	15.09	3.64			
	8:57:30	15½	15.09	3.64			
	8:58	16	15.09	3.64			
	8:58:30	16½	15.10	3.65			
	8:59	17	15.10	3.65			
	8:59:30	17½	15.11	3.66			
	9:00	18	15.11	3.66			
	9:01	19	15.13	3.68			
	9:02	20	15.15	3.70			
	9:03	21	15.18	3.73			
	9:07:30	25½	15.27	3.82			
	9:08	26	15.28	3.83			
	9:09	27	15.31	3.86			
	9:10:30	28½	15.33	3.88			
	9:12	30	15.37	3.92			
	9:14	32	15.40	3.95			
	9:18:30	36½	15.48	4.03			
	9:24:30	42½	15.59	4.14			
	9:26	44	15.61	4.16			
	9:30:30	48½	15.68	4.23			
	9:34	52	15.73	4.28			
	9:44	62	15.85	4.40			
	9:48:30	66½	15.91	4.46			
	10:01	79	16.04	4.59			
	10:15	93	16.16	4.71			
	10:26	104	16.25	4.80			
	10:41	119	16.32	4.87			
	11:08	146	16.47	5.02			

Laden Rattlesnake Creek Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project
Test Date: 9/8 - 9/9, 1993
Test Site: Laden property in Rattlesnake Creek valley
Site Location: 07S 09W 33 CBDD
Address: 1125 Laden Lane, Dillon
County: Beaverhead **State:** Montana
Test Well: Laden irrigation well
Pumping Rate: 1,130 gpm
Observation Well: well 92-27
Distance to Observation Well: 146.5 ft
Type of Test: constant rate discharge
Test Conducted by: W. Uthman

Time Data	Water Level Data	Discharge Data	Comments on factors affecting test data
Pump on: Date 9/8/93 Time 8:42 am Pump off: Date 9/9/93 Time 8:42 am Duration of aquifer test: Pumping 1440 mins Recovery ______	Static Water Level 11.45 ft Measuring Point top of casing Elevation of Measuring Point 5190.24 ft	How Q measured pressure gage Depth of pump/air line ______ Previous pumping? Yes___No_T_ Duration ______ End ______	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
9/8/93	11:28 am	166	16.56	5.11			
	11:48	186	16.63	5.18			
	12:10 pm	208	16.69	5.24			
	12:35	233	16.76	5.31			
	1:02	260	16.81	5.36		79 psi	
	1:26	284	16.86	5.41			
	1:49	307	16.90	5.45			
	2:20	338	16.94	5.49		79 psi	
	3:29	407	17.03	5.58			
	4:03	441	17.06	5.61			
	5:16	514	17.11	5.66		79 psi	
	6:03	561	17.15	5.70			
	6:49	607	17.19	5.74		79 psi	
	7:41	659	17.23	5.78			
	8:21	682	17.21	5.76			
	8:53	731	17.16	5.71			
	10:18	816	17.17	5.72			
	11:55	913	17.22	5.77		79 psi	
9/9/93	2:04 am	1042	17.25	5.80			
	4:37	1195	17.31	5.86			
	6:44	1322	17.42	5.97		79 psi	
	7:08	1346	17.35	5.90			
	8:18	1416	17.38	5.93			
	8:42	1440	17.38	5.93		79 psi	pumping water level in irrig. well = 26.40 ft

City of Dillon Municipal Well #3 Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 8/9 - 8/10, 1994
Test Site: City of Dillon at municipal building **Site Location:** 07S 08W 18 CDCC
Address: 125 N. Idaho Street, Dillon **County:** Beaverhead **State:** Montana
Test Well: City of Dillon municipal well #3 **Pumping Rate:** 615 - 625 gpm
Observation Well: 2-inch PVC well **Distance to Observation Well:** 55.75 ft
Type of Test: constant rate discharge **Test Conducted by:** W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 8/9/94 Time 8:02 am Pump off: Date___ Time___ Duration of aquifer test: Pumping 1926 mins Recovery___	Static Water Level 14.54 ft Measuring Point top of casing Elevation of Measuring Point ___	How Q measured flow meter Depth of pump/air line___ Previous pumping? Yes___ No T Duration___ End___	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
8/9/94	7:08 am		14.54				
	7:33		14.54				
	7:59		14.54				
	8:02	-- start	aquifer test				
	8:02:30	½	14.57	0.03			
	8:03	1	14.59	0.05			
	8:03:30	1½	14.60	0.06			
	8:04	2	14.61	0.07			
	8:04:30	2½	14.62	0.08			
	8:05	3	14.62	0.08			
	8:05:30	3½	14.63	0.09		615	
	8:06	4	14.64	0.10			
	8:06:30	4½	14.64	0.10			
	8:07	5	14.65	0.11			
	8:07:30	5½	14.65	0.11			
	8:08	6	14.65	0.11			
	8:08:30	6½	14.66	0.12			
	8:09	7	14.67	0.13			
	8:09:30	7½	14.67	0.13			
	8:10	8	14.67	0.13			
	8:10:30	8½	14.69	0.15			
	8:11	9	14.69	0.15			
	8:11:30	9½	14.69	0.15			
	8:12	10	14.70	0.16			
	8:13	11	14.70	0.16			
	8:14	12	14.71	0.17			
	8:15	13	14.71	0.17			
	8:16	14	14.72	0.18		625	
	8:17	15	14.73	0.19			
	8:18	16	14.73	0.19			
	8:19	17	14.74	0.20			

City of Dillon Municipal Well #3 Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 8/9 - 8/10, 1994
Test Site: City of Dillon at municipal building **Site Location:** 07S 08W 18 CDCC
Address: 125 N. Idaho Street, Dillon **County:** Beaverhead **State:** Montana
Test Well: City of Dillon municipal well #3 **Pumping Rate:** 615 - 625 gpm
Observation Well: 2-inch PVC well **Distance to Observation Well:** 55.75 ft
Type of Test: constant rate discharge **Test Conducted by:** W. Uthman

Time Data	Water Level Data	Discharge Data	Comments on factors affecting test data
Pump on: Date 8/9/94 Time 8:02 am Pump off: Date______ Time________ Duration of aquifer test: Pumping 1926 mins Recovery______	Static Water Level 14.54 ft Measuring Point top of casing Elevation of Measuring Point ________	How Q measured flow meter Depth of pump/air line__________ Previous pumping? Yes___No T Duration_______ End______	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
8/9/94	8:20 am	18	14.74	0.20			
	8:22	20	14.75	0.21			
	8:25	23	14.77	0.23			
	8:27	25	14.78	0.24			
	8:29	27	14.78	0.24			
	8:31	29	14.79	0.25			
	8:32	30	14.80	0.26			
	8:37	35	14.81	0.27			
	8:42	40	14.82	0.28		625	8:43 am
	8:47	45	14.84	0.30			
	8:52	50	14.85	0.31			
	8:57	55	14.86	0.32			
	9:02	60	14.87	0.33			
	9:12	70	14.89	0.35		625	9:20 am
	9:22	80	14.90	0.36			
	9:32	90	14.92	0.38			
	9:47	105	14.94	0.40		625	9:48 am
	10:02	120	14.96	0.42		625	10:03 am
	10:28	146	14.99	0.45		615	10:29 am
	10:51	169	15.00	0.46		625	10:52 am
	11:10	188	15.01	0.47			
	11:30	208	15.02	0.48		625	11:29 am
	12:12 pm	250	15.06	0.52		625	12:13 pm
	12:43	281	15.07	0.53		625	12:44 pm
	1:26	324	15.09	0.55		635	1:28 pm
	2:24	382	15.11	0.57		625	2:25 pm
	3:16	434	15.12	0.58			
	4:16	494	15.15	0.61		625	4:15 pm
	5:13	551	15.16	0.62			
	5:50	588	15.17	0.63		635	5:49 pm
	7:02	660	15.18	0.64			

City of Dillon Municipal Well #3 Aquifer Test Data

Project: Beaverhead Groundwater Project
Test Date: 8/9 - 8/10, 1994
Test Site: City of Dillon at municipal building
Site Location: 07S 08W 18 CDCC
Address: 125 N. Idaho Street, Dillon
County: Beaverhead **State:** Montana
Test Well: City of Dillon municipal well #3
Pumping Rate: 615 - 625 gpm
Observation Well: 2-inch PVC well
Distance to Observation Well: 55.75 ft
Type of Test: constant rate discharge
Test Conducted by: W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 8/9/94 Time 8:02 am Pump off: Date ____ Time ____ Duration of aquifer test: Pumping 1926 mins Recovery ____	Static Water Level 14.54 ft Measuring Point top of casing Elevation of Measuring Point ____	How Q measured flow meter Depth of pump/air line ____ Previous pumping? Yes ___ No T Duration ____ End ____	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
8/9/94	7:45 pm	703	15.19	0.65		625	7:44 pm
	8:37	755	15.20	0.66		625	8:36 pm
	10:13	851	15.20	0.66			
8/10/94	12:16 am	974	15.22	0.68		625	12:15 am
	1:58	1076	15.24	0.70		625	1:57 am
	4:39	1237	15.28	0.74		625	4:37 am
	6:12	1330	15.29	0.75			
	8:07	1445	15.29	0.75			
	11:08	1626	15.31	0.77		630	11:07 am
	4:08 pm	1926	15.32	0.78		625	4:07 pm

City of Dillon Municipal Well #4 Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 8/2 - 8/3, 1994
Test Site: City of Dillon at Vigilante Park **Site Location:** 07S 08W 19 BADD
Address: South California & Central, Dillon **County:** Beaverhead **State:** Montana
Test Well: City of Dillon municipal well #4 **Pumping Rate:** 550 - 600 gpm
Observation Well: well 92-18 **Distance to Observation Well:** 46.5 ft
Type of Test: variable rate discharge **Test Conducted by:** W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 8/2/94 Time 9:12 am Pump off: Date 8/3/94 Time 9:15 am Duration of aquifer test: Pumping 1440 mins Recovery ______	Static Water Level 12.64 ft Measuring Point top of casing Elevation of Measuring Point 5089.13ft	How Q measured flow meter Depth of pump/air line ______ Previous pumping? Yes ___ No T Duration ______ End ______	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
8/2/94	8:56 am		12.64				
	9:07		12.64				
	9:12	-- start	aquifer test				
	9:12:30	½	12.65	0.01			
	9:13	1	12.72	0.08			
	9:13:30	1½	12.77	0.13			
	9:14	2	12.84	0.20			
	9:14:30	2½	12.87	0.23			
	9:15	3	12.91	0.27			
	9:15:30	3½	12.93	0.29			
	9:16	4	12.96	0.32			
	9:16:30	4½	12.99	0.35			
	9:17	5	13.03	0.39			
	9:18	6	13.05	0.41			
	9:18:30	6½	13.05	0.41			
	9:19	7	13.07	0.43			
	9:19:30	7½	13.07	0.43			
	9:20	8	13.07	0.43			
	9:21	9	13.10	0.46			
	9:22	10	13.11	0.47			
	9:24:30	12½	13.13	0.49			
	9:25:30	13½	13.13	0.49			
	9:26	14	13.14	0.50			
	9:27	15	13.14	0.50			
	9:28	16	13.15	0.51		550	9:27 am
	9:30	18	13.16	0.52			
	9:31	19	13.16	0.52			
	9:32	20	13.17	0.53			
	9:34	22	13.18	0.54			
	9:36	24	13.19	0.55			
	9:38	26	13.20	0.56		550	9:39 am
	9:40	28	13.20	0.56			
	9:42	30	13.21	0.57			

City of Dillon Municipal Well #4 Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 8/2 - 8/3, 1994
Test Site: City of Dillon at Vigilante Park **Site Location:** 07S 08W 19 BADD
Address: South California & Central, Dillon **County:** Beaverhead **State:** Montana
Test Well: City of Dillon municipal well #4 **Pumping Rate:** 550 - 600 gpm
Observation Well: well 92-18 **Distance to Observation Well:** 46.5 ft
Type of Test: variable rate discharge **Test Conducted by:** W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 8/2/94 Time 9:12 am Pump off: Date 8/3/94 Time 9:15 am Duration of aquifer test: Pumping 1440 mins Recovery ______	Static Water Level 12.64 ft Measuring Point top of casing Elevation of Measuring Point 5089.13ft	How Q measured flow meter Depth of pump/air line ______ Previous pumping? Yes ___ No T Duration ______ End ______	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
8/2/94	9:47am	35	13.22	0.58			
	9:52	40	13.23	0.59			
	9:57	45	13.24	0.60			
	10:03	51	13.26	0.62			
	10:12	60	13.29	0.65		550	10:13 am
	10:29	77	13.31	0.67			
	10:41	89	13.32	0.68			
	10:57	105	13.34	0.70			
	11:21	129	13.37	0.73			
	11:55	163	13.41	0.77		550	11:25 am
	12:21pm	189	13.43	0.79			
	12:38	206	13.45	0.81		550	12:37 pm
	1:11	239	13.46	0.82			
	1:51	279	13.49	0.85		550	1:50 pm
	2:25	313	13.51	0.87			
	2:57	345	13.52	0.88			
	3:41	389	13.54	0.90			
	4:27	435	13.59	0.95		575	4:25 pm
	5:35	503	13.62	0.98		600	5:38 pm
	6:18	546	13.65	1.01			
	7:00	588	13.69	1.05		600	7:01 pm
	7:50	638	13.71	1.07		600	7:54 pm
	8:49	697	13.72	1.08		600	8:50 pm
	9:52	760	13.69	1.05		575	9:53 pm
	11:03	831	13.66	1.02		550	11:04 pm
8/3/94	12:28 am	916	13.64	1.00		550	12:27 am
	1:57	1005	13.66	1.02		575	1:58 am
	3:51	1119	13.70	1.06		575	3:50 am
	5:31	1219	13.71	1.07			
	6:33	1281	13.74	1.10		575	6:32 am
	8:01	1369	13.79	1.15			
	9:12	1440	13.78	1.14		575	9:11 am

Laden Blacktail Deer Creek Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 7/13 - 7/14, 1994
Test Site: Laden property in Blacktail Deer Creek Valley **Site Location:** 08S 09W 14 ABDD
Address: 1125 Laden Lane, Dillon **County:** Beaverhead **State:** Montana
Test Well: Laden Blacktail Deer Creek irrigation well **Pumping Rate:** 925 gpm
Observation Well: well 92-13 **Distance to Observation Well:** 98.75 ft
Type of Test: constant rate discharge **Test Conducted by:** J.Beck / W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 7/13/94 Time 10:44 am	Static Water Level 31.38 ft	How Q measured pressure gage	
Pump off: Date ______ Time ______	Measuring Point top of casing	Depth of pump/air line ______	
Duration of aquifer test:		Previous pumping? Yes ___ No T	
Pumping 1524 mins Recovery ______	Elevation of Measuring Point 5270.41 ft	Duration ______ End ______	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
7/13/94	10:05 am		31.37				
	10:30		31.37				
	10:41		31.38				
	10:44	-- start	aquifer test				
	10:44:30	½	32.56	1.18			
	10:45	1	32.67	1.29			
	10:45:30	1½	32.68	1.30			
	10:46	2	32.68	1.30			
	10:46:30	2½	32.42	1.04			
	10:47	3	32.35	0.97			
	10:47:30	3½	32.34	0.96			
	10:48	4	32.34	0.96			
	10:48:30	4½	32.34	0.96			
	10:49	5	32.34	0.96			
	10:49:30	5½	32.34	0.96			
	10:50	6	32.33	0.95			
	10:50:30	6½	32.33	0.95			
	10:51	7	32.33	0.95			
	10:51:30	7½	32.34	0.96			
	10:52	8	32.34	0.96			
	10:52:30	8½	32.34	0.96			
	10:53	9	32.34	0.96			
	10:53:30	9½	32.34	0.96			
	10:54	10	32.34	0.96			
	10:55	11	32.34	0.96			
	10:56	12	32.34	0.96			
	10:57	13	32.35	0.97			
	10:58	14	32.35	0.97			
	11:00	16	32.35	0.97			
	11:01	17	32.35	0.97			
	11:02	18	32.35	0.97			

Laden Blacktail Deer Creek Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 7/13 - 7/14, 1994
Test Site: Laden property in Blacktail Deer Creek Valley **Site Location:** 08S 09W 14 ABDD
Address: 1125 Laden Lane, Dillon **County:** Beaverhead **State:** Montana
Test Well: Laden Blacktail Deer Creek irrigation well **Pumping Rate:** 925 gpm
Observation Well: well 92-13 **Distance to Observation Well:** 98.75 ft
Type of Test: constant rate discharge **Test Conducted by:** J.Beck / W. Uthman

Time Data	Water Level Data	Discharge Data	Comments on factors affecting test data
Pump on: Date 7/13/94 Time 10:44 am	Static Water Level 31.38 ft	How Q measured pressure gage	
Pump off: Date_______ Time_______	Measuring Point top of casing	Depth of pump/air line_______	
Duration of aquifer test:		Previous pumping? Yes___No T	
Pumping 1524 mins Recovery______	Elevation of Measuring Point 5270.41 ft	Duration_______ End_______	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
7/13/94	11:03 am	19	32.36	0.98			
	11:04	20	32.36	0.98			
	11:06	22	32.36	0.98			
	11:08	24	32.36	0.98			
	11:10	26	32.36	0.98			
	11:12	28	32.36	0.98			
	11:14	30	32.36	0.98			
	11:16	32	32.36	0.98			
	11:19	35	32.37	0.99			
	11:24	40	32.37	0.99			
	11:34	50	32.38	1.00			
	11:44	60	32.39	1.01			
	11:54	70	32.39	1.01			
	12:04 pm	80	32.40	1.02			
	12:14	90	32.41	1.03			
	12:24	100	32.41	1.03			
	12:44	120	32.43	1.05			
	1:04	140	32.43	1.05			
	1:24	160	32.45	1.07			
	1:44	180	32.45	1.07			
	2:04	200	32.46	1.08			
	2:24	220	32.47	1.09			
	2:44	240	32.48	1.10			
	3:04	260	32.48	1.10			
	3:24	280	32.49	1.11			
	3:44	300	32.50	1.12			
	4:04	320	32.50	1.12			
	4:24	340	32.51	1.13			
	4:44	360	32.51	1.13		925	pump press - 60 psi
	5:14	390	32.52	1.14			
	5:44	420	32.53	1.15			

Laden Blacktail Deer Creek Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project
Test Date: 7/13 - 7/14, 1994
Test Site: Laden property in Blacktail Deer Creek Valley
Site Location: 08S 09W 14 ABDD
Address: 1125 Laden Lane, Dillon
County: Beaverhead **State:** Montana
Test Well: Laden Blacktail Deer Creek irrigation well
Pumping Rate: 925 gpm
Observation Well: well 92-13
Distance to Observation Well: 98.75 ft
Type of Test: constant rate discharge
Test Conducted by: J.Beck / W. Uthman

Time Data
Pump on: Date 7/13/94 Time 10:44 am
Pump off: Date ____ Time ____
Duration of aquifer test:
Pumping 1524 mins Recovery ____

Water Level Data
Static Water Level 31.38 ft
Measuring Point top of casing
Elevation of Measuring Point 5270.41 ft

Discharge Data
How Q measured pressure gage
Depth of pump/air line ____
Previous pumping? Yes ___ No T
Duration ____ End ____

Comments on factors affecting test data

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
7/13/94	6:14 pm	450	32.54	1.16			
	6:44	480	32.55	1.17			
	7:44	540	32.56	1.18			
	8:44	600	32.58	1.20			
	9:44	660	32.59	1.21		925	pump press = 60 psi
	10:44	720	32.60	1.22			
7/14/94	12:14 am	810	32.63	1.25			
	1:44	900	32.65	1.27		925	pump press = 60 psi
	3:14	990	32.66	1.28			
	4:44	1080	32.67	1.29			
	6:14	1170	32.68	1.30			
	7:44	1260	32.70	1.32			
	9:14	1350	32.71	1.33			
	12:08 pm	1524	32.73	1.35		925	pump press = 60 psi

Anderson Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project
Test Date: 9/15 - 9/16, 1994
Test Site: J. B. Anderson property
Site Location: 08S 08W 06 CBDD
Address: 112 S. Washington St., Dillon
County: Beaverhead **State:** Montana
Test Well: Anderson irrigation well
Pumping Rate: 1,465 gpm
Observation Well: well 92-14
Distance to Observation Well: 67.5 ft
Type of Test: constant rate discharge
Test Conducted by: W. Uthman

Time Data

Pump on: Date 9/15/94 Time 9:05 am
Pump off: Date 9/16/94 Time 9:05 am
Duration of aquifer test:
Pumping 1440 mins Recovery______

Water Level Data

Static Water Level 19.65 ft
Measuring Point top of casing
Elevation of Measuring Point 5248.30 ft

Discharge Data

How Q measured flume
Depth of pump/air line__________
Previous pumping? Yes___No T
Duration________End________

Comments on factors affecting test data

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
9/15/94	8:36 am		19.65				
	8:45		19.65				
	9:03		19.65				
	9:05	-- start	aquifer test				
	9:05:30	½	26.14	6.49			
	9:06	1	28.29	8.64			
	9:06:30	1½	28.83	9.18			
	9:07	2	29.25	9.60			
	9:07:30	2½	29.53	9.88			
	9:08	3	29.64	9.99			19 psi
	9:08:30	3½	29.71	10.06			24 psi
	9:09	4	29.81	10.16			29 psi
	9:09:30	4½	29.79	10.14			36 psi
	9:10	5	29.86	10.21			37 psi
	9:10:30	5½	29.95	10.30			38 psi
	9:11	6	30.06	10.41		1,465	38 psi
	9:11:30	6½	30.17	10.52			
	9:12	7	30.27	10.62			38 psi
	9:12:30	7½	30.38	10.73			
	9:13	8	30.45	10.80			38 psi
	9:13:30	8½	30.52	10.87			
	9:14	9	30.61	10.96			
	9:14:30	9½	30.67	11.02			
	9:15	10	30.75	11.10			
	9:16	11	30.87	11.22			
	9:17	12	30.99	11.34			
	9:18	13	31.11	11.46			
	9:19	14	31.20	11.55			
	9:20	15	31.29	11.64			
	9:21	16	31.37	11.72		1,465	38 psi
	9:22	17	31.47	11.82			

Anderson Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 9/15 - 9/16, 1994
Test Site: J. B. Anderson property **Site Location:** 08S 08W 06 CBDD
Address: 112 S. Washington St., Dillon **County:** Beaverhead **State:** Montana
Test Well: Anderson irrigation well **Pumping Rate:** 1,465 gpm
Observation Well: well 92-14 **Distance to Observation Well:** 67.5 ft
Type of Test: constant rate discharge **Test Conducted by:** W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 9/15/94 Time 9:05 am	Static Water Level 19.65 ft	How Q measured flume	
Pump off: Date 9/16/94 Time 9:05 am	Measuring Point top of casing	Depth of pump/air line	
Duration of aquifer test:		Previous pumping? Yes ___ No T	
Pumping 1440 mins Recovery	Elevation of Measuring Point 5248.30 ft	Duration ___ End ___	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
9/15/94	9:23 am	18	31.52	11.87			
	9:24	19	31.60	11.95			
	9:25	20	31.65	12.00			
	9:28	23	31.83	12.18		1,465	38 psi
	9:31	26	31.97	12.32			
	9:35	30	32.13	12.48			
	9:39	34	32.27	12.62			38 psi
	9:43	38	32.39	12.74			
	9:51	46	32.51	12.86			
	9:56	51	32.67	13.02			38 psi
	10:03	58	32.77	13.12			
	10:10	65	32.88	13.23			
	10:16	71	32.96	13.31			
	10:22	77	33.02	13.37			38 psi
	10:27	82	33.08	13.43			
	10:34	89	33.13	13.48			
	10:43	98	33.20	13.55			38 psi
	10:52	107	33.35	13.70			
	11:02	117	33.31	13.66			38 psi
	11:09	124	33.35	13.70			
	11:18	133	33.40	13.75			
	11:28	143	33.44	13.79			
	11:37	152	33.49	13.84			38 psi
	12:05 pm	180	33.64	13.99			38 psi
	12:25	200	33.70	14.05			39.48 ft pumping water level @ 12:18
	12:47	222	33.76	14.11			
	1:09	244	33.85	14.20			38 psi
	1:33	268	33.92	14.27			
	2:02	297	34.01	14.36		1,465	38 psi
	2:31	326	34.10	14.45			
	3:16	371	34.21	14.56			

Anderson Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 9/15 - 9/16, 1994
Test Site: J. B. Anderson property **Site Location:** 08S 08W 06 CBDD
Address: 112 S. Washington St., Dillon **County:** Beaverhead **State:** Montana
Test Well: Anderson irrigation well **Pumping Rate:** 1,465 gpm
Observation Well: well 92-14 **Distance to Observation Well:** 67.5 ft
Type of Test: constant rate discharge **Test Conducted by:** W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 9/15/94 Time 9:05 am	Static Water Level 19.65 ft	How Q measured flume	
Pump off: Date 9/16/94 Time 9:05 am	Measuring Point top of casing	Depth of pump/air line	
Duration of aquifer test:		Previous pumping? Yes No T	
Pumping 1440 mins Recovery	Elevation of Measuring Point 5248.30 ft	Duration End	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
9/15/94	3:53 pm	408	34.29	14.64			
	4:24	439	34.36	14.71			
	5:35	510	34.48	14.83		1,465	38 psi
	6:32	567	34.59	14.94			
	7:27	622	34.69	15.04			
	8:26	681	34.77	15.12			
	9:38	753	34.88	15.23			39 psi
	11:13	848	35.02	15.37			39 psi
9/16/94	1:12 am	967	35.15	15.50			
	2:59	1074	35.26	15.61			39 psi
	5:26	1221	35.40	15.75			
	7:15	1330	35.49	15.84			
	9:05	1440	35.56	15.91			39 psi
							39 psi; final pumping water level in irrigation well is 40.91 ft

Forrester Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project
Test Date: 9/28 - 9/29, 1993
Test Site: Roy Forrester property
Site Location: 08S 08W 20 ACCA
Address: 7125 Blacktail Road, Dillon
County: Beaverhead **State:** Montana
Test Well: Forrester irrigation well
Pumping Rate: 835 - 996 gpm
Observation Well: well 92-5
Distance to Observation Well: 103 ft
Type of Test: variable rate discharge
Test Conducted by: W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 9/28/93 Time 8:32 am	Static Water Level 49.99 ft	How Q measured 9" Parshall flume	
Pump off: Date 9/29/93 Time 9:28 am	Measuring Point top of casing	Depth of pump/air line	
Duration of aquifer test:		Previous pumping? Yes___ No T	
Pumping 1495 mins Recovery	Elevation of Measuring Point 5400.45 ft	Duration ___ End ___	

Date	**Clock time**	**Time since pump started (min)**	**Depth to water from m.p. (ft)**	**Water level change (ft)**	**Discharge measurement**	**Rate (gpm)**	Water Measurement Manual, table 15, p.273 for stage in flume conversions from feet to gpm
9/28/93	8:21 am		49.99				swl in irrigation well = 48.95 ft @ 8:21
	8:32	-- start	aquifer test				
	8:32:30	½	51.22	1.23			
	8:33	1	52.13	2.14			
	8:33:30	1½	52.62	2.63			
	8:34	2	53.20	3.21			
	8:34:30	2½	53.68	3.69			
	8:35	3	54.02	4.03			
	8:36	4	54.59	4.60			
	8:37	5	54.93	4.94			
	8:37:30	5½	55.15	5.16			
	8:38	6	55.36	5.37	0.81 ft @ 8:37 am	996	
	8:38:30	6½	55.55	5.56			
	8:39	7	55.83	5.84			
	8:40	8	56.27	6.28			
	8:40:30	8½	56.45	6.46			
	8:41	9	56.62	6.63			
	8:41:30	9½	56.79	6.80			
	8:42	10	56.95	6.96			
	8:42:30	10½	57.14	7.15			
	8:43	11	57.25	7.26			
	8:43:30	11½	57.42	7.43			
	8:44	12	57.53	7.54			
	8:44:30	12½	57.63	7.64			
	8:45	13	57.73	7.74			
	8:45:30	13½	57.84	7.85			
	8:46	14	57.97	7.98			
	8:47	15	58.10	8.11			
	8:47:30	15½	58.22	8.23			
	8:48	16	58.32	8.33			
	8:49	17	58.45	8.46			

Forrester Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 9/28 - 9/29, 1993
Test Site: Roy Forrester property **Site Location:** 08S 08W 20 ACCA
Address: 7125 Blacktail Road, Dillon **County:** Beaverhead **State:** Montana
Test Well: Forrester irrigation well **Pumping Rate:** 835 - 996 gpm
Observation Well: well 92-5 **Distance to Observation Well:** 103 ft
Type of Test: variable rate discharge **Test Conducted by:** W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 9/28/93 Time 8:32 am	Static Water Level 49.99 ft	How Q measured 9" Parshall flume	
Pump off: Date 9/29/93 Time 9:28 am	Measuring Point top of casing	Depth of pump/air line	
Duration of aquifer test:		Previous pumping? Yes No T	
Pumping 1495 mins Recovery	Elevation of Measuring Point 5400.45ft	Duration End	

Date	**Clock time**	**Time since pump started (min)**	**Depth to water from m.p. (ft)**	**Water level change (ft)**	**Discharge measurement**	**Rate (gpm)**	Water Measurement Manual, table 15, p.273 for stage in flume conversions from feet to gpm
9/28/93	8:49:30 am	17½	58.56	8.57			
	8:50	18	58.62	8.63			
	8:50:30	18½	58.71	8.72			
	8:51	19	58.76	8.77			
	8:51:30	19½	58.84	8.85			
	8:52	20	58.90	8.91			
	8:55	23	59.27	9.28			
	8:58	26	59.58	9.59	0.76 ft @ 8:58 am	907	
	9:00	28	59.86	9.87			
	9:07	35	60.29	10.30			
	9:12	40	60.60	10.61			
	9:19	47	60.96	10.97			
	9:23	51	61.13	11.14	0.75 ft @ 9:23 am	889	
	9:32	60	61.44	11.45			
	9:39	67	61.70	11.71			
	9:47	75	61.90	11.91			
	9:55	83	62.09	12.10			
	10:05	93	62.29	12.30			
	10:11	99	62.40	12.41	0.74 ft @ 10:12 am	871	
	10:23	111	62.55	12.56			
	10:32	120	62.68	12.69			
	10:40	128	62.77	12.78			
	10:50	138	62.88	12.89	0.74 ft @ 10:48 am	871	
	11:03	151	63.01	13.02			
	11:14	162	63.15	13.16			
	11:29	177	63.24	13.25			
	11:48	196	63.39	13.40	0.74 ft @ 11:50 am	871	
	12:16 pm	224	63.58	13.59			
	12:36	244	63.70	13.71			
	12:54	262	63.78	13.79	0.74 ft @12:51 pm	871	
	1:11	279	63.87	13.88			

Forrester Irrigation Well Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 9/28 - 9/29, 1993
Test Site: Roy Forrester property **Site Location:** 08S 08W 20 ACCA
Address: 7125 Blacktail Road, Dillon **County:** Beaverhead **State:** Montana
Test Well: Forrester irrigation well **Pumping Rate:** 835 - 996 gpm
Observation Well: well 92-5 **Distance to Observation Well:** 103 ft
Type of Test: variable rate discharge **Test Conducted by:** W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 9/28/93 Time 8:32 am Pump off: Date 9/29/93 Time 9:28 am Duration of aquifer test: Pumping 1495 mins Recovery ______	Static Water Level 49.99 ft Measuring Point top of casing Elevation of Measuring Point 5400.45 ft	How Q measured 9" Parshall flume Depth of pump/air line ______ Previous pumping? Yes___No_T_ Duration ______ End ______	

Date	**Clock time**	**Time since pump started (min)**	**Depth to water from m.p. (ft)**	**Water level change (ft)**	**Discharge measurement**	**Rate (gpm)**	Water Measurement Manual, table 15, p.273 for stage in flume conversions from feet to gpm
9/28/93	1:38 pm	306	64.00	14.01			
	1:58	326	64.09	14.10	0.73 ft @ 1:54 pm	853	
	2:21	349	64.18	14.19			
	2:44	372	64.28	14.29			
	3:04	392	64.35	14.36	0.73 ft @ 3:02 pm	853	
	3:30	418	64.44	14.45			
	4:04	452	64.55	14.56	0.73 ft @ 4:02 pm	853	
	4:34	482	64.63	14.64			
	4:58	506	64.71	14.72	0.73 ft @ 5:00 pm	853	
	5:33	541	64.81	14.82			
	5:59	567	64.89	14.90	0.72 ft @ 6:01 pm	835	
	6:28	596	64.90	14.91			
	7:00	628	64.99	15.00	0.72 ft @ 6:57 pm	835	
	7:29	657	65.07	15.08			
	7:59	687	65.14	15.15	0.72 ft @ 7:56 pm	835	
	8:30	718	65.23	15.24			
	9:00	748	65.30	15.31	0.72 ft @ 9:03 pm	835	
	10:05	813	65.44	15.45	0.72 ft @ 10:07 pm	835	
	11:06	874	65.57	15.58			
	11:55	923	65.68	15.69	0.72 ft @ 11:52 pm	835	
9/29/93	1:04 am	992	65.82	15.83			
	2:20	1068	65.96	15.97	0.72 ft @ 2:23 am	835	
	3:27	1135	66.10	16.11			
	4:35	1203	66.22	16.23			
	5:40	1268	66.35	16.36			
	6:43	1331	66.45	16.46	0.72 ft @ 6:46 am	835	
	7:50	1398	66.55	16.56			
	8:32	1440	66.62	16.66	0.72 ft @ 8:27 am	835	
	9:27	1495	66.70	16.71			

Matador Ranch Irrigation Well #1 Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 9/30 - 10/1, 1993
Test Site: Matador Ranch at Blacktail Road **Site Location:** 08S 08W 32 DABD
Address: 9500 Blacktail Road, Dillon **County:** Beaverhead **State:** Montana
Test Well: Matador Ranch irrigation well #1 **Pumping Rate:** 1,867 - 1,961 gpm
Observation Well: well 92-4 **Distance to Observation Well:** 100.5 ft
Type of Test: variable rate discharge **Test Conducted by:** W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 9/30/93 Time 9:12 am Pump off: Date 10/1/93 Time 9:12 am Duration of aquifer test: Pumping 1440 mins Recovery ______	Static Water Level 45.17 ft Measuring Point top of casing Elevation of Measuring Point 5484.03 ft	How Q measured 9" Parshall flume Depth of pump/air line ______ Previous pumping? Yes ___ No T Duration ______ End ______	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Flume discharge measurement (ft)	Rate (gpm)	Water Measurement Manual, table 15, p. 273 for stage in flume conversions from feet to gpm
9/29/93	3:10 pm		45.08				
9/30/93	8:15 am		45.17				8:19 - 44.09 ft - Matador #1
	9:11		45.17				9:09 - 44.09 ft - Matador #1
	9:12	-- start	aquifer test				
	9:12:30	½	47.33	2.16			
	9:14	2	49.98	4.81			
	9:15	3	50.35	5.18			
	9:15:30	3½	50.78	5.61			
	9:16	4	51.07	5.90			
	9:16:30	4½	51.27	6.10			
	9:17	5	51.46	6.29			
	9:17:30	5½	51.58	6.41			
	9:18	6	51.68	6.51			
	9:18:30	6½	51.76	6.59			
	9:19	7	51.85	6.68			
	9:19:30	7½	51.92	6.75			
	9:20	8	52.00	6.83			
	9:20:30	8½	52.04	6.87			
	9:21	9	52.10	6.93			
	9:21:30	9½	52.14	6.97			
	9:22	10	52.18	7.01			
	9:22:30	10½	52.22	7.05			
	9:23	11	52.28	7.11			
	9:23:30	11½	52.33	7.16			
	9:24	12	52.35	7.18			
	9:24:30	12½	52.37	7.20			
	9:25	13	52.43	7.26	1.26	1,961	
	9:25:30	13½	52.45	7.28			
	9:26	14	52.49	7.32			
	9:26:30	14½	52.51	7.34			
	9:27	15	52.54	7.37			
	9:27:30	15½	52.59	7.42			
	9:28	16	52.60	7.43			
	9:28:30	16½	52.62	7.45			

Matador Ranch Irrigation Well #1 Aquifer Test Data

Project: Beaverhead Groundwater Project
Test Date: 9/30 - 10/1, 1993
Test Site: Matador Ranch at Blacktail Road
Site Location: 08S 08W 32 DABD
Address: 9500 Blacktail Road, Dillon
County: Beaverhead **State:** Montana
Test Well: Matador Ranch irrigation well #1
Pumping Rate: 1,867 - 1,961 gpm
Observation Well: well 92-4
Distance to Observation Well: 100.5 ft
Type of Test: variable rate discharge
Test Conducted by: W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 9/30/93 Time 9:12 am Pump off: Date 10/1/93 Time 9:12 am Duration of aquifer test: Pumping 1440 mins Recovery ______	Static Water Level 45.17 ft Measuring Point top of casing Elevation of Measuring Point 5484.03 ft	How Q measured 9" Parshall flume Depth of pump/air line ______ Previous pumping? Yes___No_T_ Duration ______ End ______	

Date	**Clock time**	**Time since pump started (min)**	**Depth to water from m.p. (ft)**	**Water level change (ft)**	**Flume discharge measurement (ft)**	**Rate (gpm)**	Water Measurement Manual, table 15, p. 273 for stage in flume conversions from feet to gpm
9/30/93	9:29 am	17	52.65	7.48			
	9:29:30	17½	52.68	7.51			
	9:30	18	52.71	7.54			
	9:30:30	18½	52.73	7.56			
	9:31	19	52.75	7.58			
	9:31:30	19½	52.78	7.61			
	9:32	20	52.80	7.63			
	9:33	21	52.83	7.66			
	9:34	22	52.88	7.71			
	9:35	23	52.92	7.75			
	9:36	24	52.95	7.78			
	9:37	25	53.00	7.83			
	9:38	26	53.06	7.89			
	9:39	27	53.09	7.92			
	9:40	28	53.12	7.95			
	9:41	29	53.16	7.99			
	9:42	30	53.19	8.02			
	9:47	35	53.34	8.17			
	9:50	38	53.41	8.24			
	9:57	45	53.56	8.39			
	10:00	48	53.62	8.45	1.26	1,961	
	10:04	52	53.69	8.52			
	10:09	57	53.78	8.61			
	10:14	62	53.86	8.69	1.26	1,961	
	10:25	73	54.00	8.83			
	10:35	83	54.12	8.95			
	10:45	93	54.24	9.07	1.26	1,961	
	11:00	108	54.40	9.23			
	11:15	123	54.54	9.37			
	11:30	138	54.66	9.49			
	11:45	153	54.78	9.61	1.26	1,961	
	12:00 pm	168	54.88	9.71			
	12:21	189	55.03	9.86			
	12:30	198	55.09	9.92			

Matador Ranch Irrigation Well #1 Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 9/30 - 10/1, 1993
Test Site: Matador Ranch at Blacktail Road **Site Location:** 08S 08W 32 DABD
Address: 9500 Blacktail Road, Dillon **County:** Beaverhead **State:** Montana
Test Well: Matador Ranch irrigation well #1 **Pumping Rate:** 1,867 - 1,961 gpm
Observation Well: well 92-4 **Distance to Observation Well:** 100.5 ft
Type of Test: variable rate discharge **Test Conducted by:** W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 9/30/93 Time 9:12 am Pump off: Date 10/1/93 Time 9:12 am Duration of aquifer test: Pumping 1440 mins Recovery	Static Water Level 45.17 ft Measuring Point top of casing Elevation of Measuring Point 5484.03 ft	How Q measured 9" Parshall flume Depth of pump/air line Previous pumping? Yes No T Duration End	

Date	**Clock time**	**Time since pump started (min)**	**Depth to water from m.p. (ft)**	**Water level change (ft)**	**Flume discharge measurement (ft)**	**Rate (gpm)**	Water Measurement Manual, table 15, p. 273 for stage in flume conversions from feet to gpm
9/30/93	12:47 pm	215	55.19	10.02	1.26	1,961	
	1:00	228	55.28	10.11			
	1:20	248	55.38	10.21			
	1:40	268	55.48	10.31	1.26	1,961	
	2:05	293	55.61	10.44			
	2:23	311	55.69	10.52			
	2:47	335	55.79	10.62	1.25	1,939	
	3:02	350	55.86	10.69			
	3:21	369	55.93	10.76	1.24	1,916	
	3:40	388	56.01	10.84			
	4:00	408	56.09	10.92	1.24	1,916	
	4:20	428	56.17	11.00			
	4:40	448	56.24	11.07			
	5:00	468	56.30	11.13			
	5:21	489	56.37	11.20	1.24	1,916	
	5:40	508	56.44	11.27			
	6:00	528	56.50	11.33	1.24	1,916	
	6:30	558	56.60	11.43			
	7:00	588	56.69	11.52	1.24	1,916	
	7:30	618	56.77	11.60	1.24	1,916	
	8:00	648	56.85	11.68			
	8:30	678	56.93	11.76			
	9:00	708	57.02	11.85	1.24	1,916	
	10:00	768	57.14	11.97			
	10:55	823	57.26	12.09	1.24	1,916	
10/1/93	12:24 am	912	57.45	12.28	1.24	1,916	
	1:30	978	57.57	12.40			
	2:54	1062	57.72	12.55	1.23	1,894	
	4:24	1152	57.85	12.68			
	5:54	1242	57.97	12.80	1.22	1,867	
	7:48	1356	58.10	12.93	1.22	1,867	
	9:12	1440	58.19	13.02	1.22	1,867	

Matador Ranch Irrigation Well #15 Aquifer Test Data

Project: Beaverhead Groundwater Project
Test Date: 7/14 - 7/15, 1994
Test Site: Matador Ranch near Sheep Creek Canyon
Site Location: 09S 08W 07 DBDC
Address: 9500 Blacktail Road, Dillon
County: Beaverhead **State:** Montana
Test Well: Matador Ranch irrigation well #15
Pumping Rate: 1,500 gpm
Observation Well: well 92-7
Distance to Observation Well: 125.5 ft
Type of Test: constant rate discharge
Test Conducted by: W. Uthman

Time Data	**Water Level Data**	**Discharge Data**	Comments on factors affecting test data
Pump on: Date 7/14/94 Time 10:06 am Pump off: Date 7/15/94 Time 10:13 am Duration of aquifer test: Pumping 1440 mins Recovery ______	Static Water Level 160.04 ft Measuring Point top of casing Elevation of Measuring Point 5679.63 ft	How Q measured pressure gauge Depth of pump/air line ______ Previous pumping? Yes ___ No T Duration ______ End ______	

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	
7/14/94	9:58 am		160.04				
	10:03		160.04				
	10:06	-- start	aquifer test				
	10:06:30	½	162.99	2.95			
	10:07	1	163.92	3.88			
	10:07:30	1½	164.62	4.58			
	10:08	2	165.04	5.00			
	10:08:30	2½	165.35	5.31			
	10:09	3	165.66	5.62			
	10:09:30	3½	165.91	5.87			
	10:10	4	166.12	6.08			
	10:10:30	4½	166.30	6.26			
	10:11	5	166.43	6.39			
	10:12	6	166.63	6.59			
	10:12:30	6½	166.80	6.76			
	10:13	7	166.91	6.87			
	10:16	10	167.22	7.18			
	10:17	11	167.33	7.29			
	10:18	12	167.44	7.40			
	10:19	13	167.51	7.47			
	10:20	14	167.60	7.56			
	10:21	15	167.67	7.63			4 psi @ 10:21 am
	10:22	16	167.75	7.71			
	10:23	17	167.80	7.76			
	10:24	18	167.86	7.82			
	10:25	19	167.91	7.87			
	10:26	20	167.97	7.93			
	10:28	22	168.05	8.01			
	10:30	24	168.17	8.13			
	10:33	27	168.30	8.26			
	10:36	30	168.39	8.35			
	10:39	33	168.49	8.45			
	10:47	41	168.76	8.72			

Matador Ranch Irrigation Well #15 Aquifer Test Data

Project: Beaverhead Groundwater Project **Test Date:** 7/14 - 7/15, 1994
Test Site: Matador Ranch near Sheep Creek Canyon **Site Location:** 09S 08W 07 DBDC
Address: 9500 Blacktail Road, Dillon **County:** Beaverhead **State:** Montana
Test Well: Matador Ranch irrigation well #15 **Pumping Rate:** 1,500 gpm
Observation Well: well 92-7 **Distance to Observation Well:** 125.5 ft
Type of Test: constant rate discharge **Test Conducted by:** W. Uthman

Time Data

Pump on: Date 7/14/94 Time 10:06 am
Pump off: Date 7/15/94 Time 10:13 am
Duration of aquifer test:
Pumping 1440 mins Recovery______

Water Level Data

Static Water Level 160.04 ft
Measuring Point top of casing
Elevation of Measuring Point 5679.63 ft

Discharge Data

How Q measured pressure gauge
Depth of pump/air line________
Previous pumping? Yes___No T
Duration________End________

Date	Clock time	Time since pump started (min)	Depth to water from m.p. (ft)	Water level change (ft)	Discharge measurement	Rate (gpm)	Comments on factors affecting test data
7/14/94	10:53 am	47	168.93	8.89			
	10:56	50	169.00	8.96			
	11:01	55	169.12	9.08			
	11:06	60	169.25	9.21			
	11:12	66	169.40	9.36			
	11:18	72	169.55	9.51			
	11:23	77	169.66	9.62			
	11:36	90	169.89	9.85			
	11:46	100	170.07	10.03			
	11:55	109	170.22	10.18			
	12:01 pm	115	170.43	10.39			
	12:27	141	170.64	10.60			
	12:47	161	170.88	10.84			
	1:11	185	171.11	11.07			
	1:39	213	171.35	11.31			4½ psi @ 1:37 pm
	2:11	245	171.60	11.56			
	2:39	273	171.81	11.77			
	3:24	318	172.13	12.09			
	3:40	334	172.21	12.17			4½ psi @ 3:43 pm
	4:44	398	172.54	12.50			4½ psi @ 4:46 pm
	5:44	458	172.83	12.79			4½ psi @ 5:57 pm
	6:32	506	173.02	12.98			
	7:24	558	173.23	13.19			
	8:10	604	173.39	13.35			
	9:22	676	173.65	13.61			4½ psi @ 9:19 pm
	10:26	740	173.90	13.86			
7/15/94	12:40 am	874	174.27	14.23			
	2:05	959	174.48	14.44			
	3:46	1060	174.69	14.65			
	5:33	1167	174.99	14.95			4½ psi @ 5:41 am
	7:51	1305	175.16	15.12			
	9:00	1374	175.28	15.24			
	10:06	1440	175.39	15.35			4½ psi @ 10:08 am

Appendix D

Streamflow and Surface Water-Groundwater Interactions

Appendix D1. Mean Daily Streamflow Data

Barretts Gaging Station (06016000) on Beaverhead River
1991 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1		132	120	460	651	778	298	111
2		139	114	471	565	782	291	109
3		142	104	539	545	782	271	108
4		142	108	732	561	771	240	108
5		142	113	793	550	747	232	109
6	115	149	115	704	544	724	231	110
7	112	143	114	746	582	688	231	110
8	111	129	112	628	626	646	234	110
9	115	121	122	572	638	668	239	110
10	115	119	123	571	674	623	239	111
11	120	115	133	606	717	595	222	112
12	116	107	142	653	766	579	196	113
13	118	120	138	751	762	561	179	120
14	118	113	139	821	795	548	189	117
15	118	115	169	911	818	566	192	117
16	120	117	196	944	859	527	189	116
17	121	117	202	935	894	508	167	115
18	119	121	209	951	957	502	145	118
19	121	121	229	987	985	455	132	119
20	128	121	246	1010	976	427	126	120
21	128	127	241	1030	964	409	111	122
22	127	128	242	1080	942	419	109	123
23	126	122	284	1040	945	418	109	124
24	124	124	324	1020	954	409	103	123
25	122	132	344	923	929	402	103	124
26	120	131	369	871	924	390	104	127
27	123	126	447	883	888	374	104	134
28	122	120	446	798	876	351	108	120
29	119	118	424	701	871	331	123	115
30	121	121	418	666	790	323	120	110
31	125		459		781	304		123
Total:	3124.0	3774.0	6946.0	23797.0	24329.0	16607.0	5337.0	3608.0
Mean:	120.2	125.8	224.1	793.2	784.8	535.7	177.9	116.4
Max:	128.0	149.0	459.0	1080.0	985.0	782.0	298.0	134.0
Min:	111.0	107.0	104.0	460.0	544.0	304.0	103.0	108.0

Barretts Gaging Station (06016000) on Beaverhead River
1992 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1	174	142	319	627	406	820	218	189
2	172	143	319	669	329	838	207	179
3	177	155	318	740	303	832	186	154
4	195	158	359	751	283	832	186	160
5	210	162	490	800	243	861	169	161
6	213	158	523	788	226	865	171	129
7	188	148	528	783	223	871	171	113
8	177	148	579	784	270	867	171	101
9	159	154	630	800	290	862	173	103
10	153	156	615	803	310	844	190	102
11	154	166	601	816	316	777	200	99
12	161	162	587	816	338	689	226	97
13	166	157	599	805	349	587	227	98
14	170	155	625	793	345	628	226	99
15	170	152	624	717	381	616	228	99
16	170	157	622	550	434	580	225	99
17	171	180	625	394	506	557	223	100
18	167	200	657	366	525	554	223	97
19	158	200	722	344	547	529	224	99
20	157	193	796	336	627	461	225	100
21	156	219	786	328	729	400	228	101
22	152	265	739	363	714	369	226	99
23	149	244	701	461	692	358	215	98
24	149	221	716	505	678	327	216	98
25	151	215	754	529	642	310	209	98
26	150	216	817	515	633	312	197	99
27	152	215	720	517	625	298	197	100
28	154	221	668	528	646	258	198	101
29	151	260	614	495	696	239	193	104
30	151	301	591	425	757	218	188	108
31	151		629		792	219		109
Total:	5128.0	5623.0	18873.0	18148.0	14855.0	17778.0	6136.0	3493.0
Mean:	165.4	187.4	608.8	604.9	479.2	573.5	204.5	112.7
Max:	213.0	301.0	817.0	816.0	792.0	871.0	228.0	189.0
Min:	149.0	142.0	318.0	328.0	223.0	218.0	169.0	97.0

Barretts Gaging Station (06016000) on Beaverhead River
1993 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1		164	134	776	565	365	316	248
2		164	130	813	569	412	302	248
3		152	130	847	594	463	282	248
4		149	145	839	506	539	280	251
5		176	168	813	427	587	280	262
6	101	159	192	813	373	627	281	277
7	101	140	213	788	343	640	283	288
8	102	135	171	672	325	666	284	300
9	104	136	149	539	336	679	280	274
10	104	139	140	609	385	695	280	269
11	104	135	166	659	423	760	277	273
12	104	137	262	628	477	745	279	263
13	104	134	257	582	510	708	277	254
14	105	143	265	485	518	657	277	248
15	108	140	281	474	573	576	278	229
16	108	139	306	452	578	502	277	216
17	107	137	331	502	588	444	278	213
18	111	138	416	463	588	424	277	212
19	113	137	465	432	585	394	277	201
20	131	132	537	509	562	426	283	177
21	141	129	625	508	537	456	283	165
22	150	134	623	551	481	416	284	166
23	166	139	563	589	449	408	277	166
24	206	137	536	609	444	386	265	165
25	210	131	565	550	430	369	264	164
26	239	130	649	564	415	372	262	163
27	233	129	709	556	413	369	262	162
28	203	127	741	554	432	343	260	166
29	187	130	777	563	328	331	258	162
30	182	135	750	559	301	319	251	153
31	175		751		302	314		159
Total:	3699.0	4207.0	12147.0	18298.0	14357.0	15392.0	8314.0	6742.0
Mean:	142.3	140.2	391.8	609.9	463.1	496.5	277.1	217.5
Max:	239.0	176.0	777.0	847.0	594.0	760.0	316.0	300.0
Min:	101.0	127.0	130.0	432.0	301.0	314.0	251.0	153.0

Barretts Gaging Station (06016000) on Beaverhead River
1994 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1	184	211	219	762	760	738	298	187
2	187	213	235	765	761	705	278	167
3	193	220	271	767	758	653	277	145
4	216	224	273	764	757	633	276	127
5	223	211	274	755	755	621	276	110
6	208	211	310	750	763	603	279	111
7	202	212	395	773	761	569	285	109
8	201	207	432	794	756	554	284	109
9	199	206	490	791	730	531	283	108
10	199	207	578	769	701	516	283	107
11	202	209	697	770	684	509	281	108
12	199	213	756	786	710	490	281	107
13	202	213	805	789	723	463	283	107
14	207	211	795	732	745	444	276	108
15	218	209	793	752	759	419	266	118
16	229	211	765	776	791	381	259	117
17	229	223	689	786	819	352	259	119
18	212	231	700	757	820	328	262	122
19	210	238	716	758	832	321	260	121
20	195	243	747	771	872	320	249	119
21	201	252	695	797	932	316	241	118
22	202	266	640	817	940	303	231	119
23	197	261	619	813	951	289	220	119
24	188	255	661	807	956	287	218	118
25	198	241	672	799	942	281	217	116
26	197	226	700	770	918	280	214	116
27	198	217	783	769	902	280	206	116
28	200	222	821	766	890	280	203	124
29	195	216	825	762	854	287	198	126
30	197	216	791	761	832	303	198	118
31	202		762		786	304		122
Total:	6290.0	6695.0	18909.0	23228.0	25160.0	13360.0	7641.0	3738.0
Mean:	202.9	223.2	610.0	774.3	811.6	431.0	254.7	120.6
Max:	229.0	266.0	825.0	817.0	956.0	738.0	298.0	187.0
Min:	184.0	206.0	219.0	732.0	684.0	280.0	198.0	107.0

Barretts Gaging Station (06016000) on Beaverhead River
1995 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1		147	239	925	1410	1510	1040	445
2		151	236	950	1390	1450	1040	456
3		149	255	1010	1410	1430	1040	506
4		157	266	1170	1440	1430	1080	606
5		161	272	1230	1440	1420	1070	681
6		167	355	1320	1420	1410	1040	708
7		167	468	1320	1410	1410	983	711
8		178	417	1170	1400	1400	961	701
9		170	369	1080	1440	1390	965	695
10		158	354	1140	1490	1390	958	690
11		160	378	1180	1510	1370	937	682
12		167	425	1230	1580	1370	905	683
13		173	432	1260	1600	1360	899	687
14		186	411	1260	1520	1360	898	685
15	189	182	414	1290	1490	1350	895	675
16	186	173	430	1310	1470	1350	898	648
17	175	171	447	1310	1450	1350	904	551
18	166	171	466	1320	1440	1340	876	409
19	162	174	477	1350	1430	1340	822	350
20	156	180	486	1420	1450	1330	803	373
21	161	180	483	1420	1490	1330	797	443
22	154	176	493	1380	1490	1290	786	488
23	146	177	508	1390	1490	1230	785	533
24	144	178	537	1340	1480	1200	778	674
25	128	186	555	1310	1550	1200	774	720
26	140	201	607	1370	1640	1200	774	
27	137	216	613	1370	1560	1190	727	
28	135	220	606	1420	1540	1180	577	
29	130	231	675	1450	1520	1180	465	
30	135	232	790	1440	1540	1150	441	
31	141		856		1540	1080		
Total:	2585.0	5339.0	14320.0	38135.0	46030.0	40990.0	25918.0	14800.0
Mean:	152.1	178.0	461.9	1271.2	1484.8	1322.3	863.9	592.0
Max:	189.0	232.0	856.0	1450.0	1640.0	1510.0	1080.0	720.0
Min:	128.0	147.0	236.0	925.0	1390.0	1080.0	441.0	350.0

Barretts Gaging Station (06016000) on Beaverhead River
1996 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1		707	635	963	885	1000	357	262
2		730	639	946	868	990	357	255
3		771	644	952	877	934	356	234
4		756	640	973	897	915	353	234
5		752	632	996	899	854	353	234
6		744	632	1020	891	792	353	234
7		774	631	1040	897	787	353	234
8		826	644	1020	915	779	353	234
9		839	670	1020	918	776	336	237
10		786	717	1020	915	759	314	239
11		777	736	1010	915	721	314	239
12		764	764	953	936	674	314	239
13	660	708	823	948	964	670	314	239
14	614	671	910	953	964	675	315	239
15	599	652	925	978	978	747	310	240
16	734	645	946	930	1030	734	318	239
17	713	649	987	886	1020	684	312	175
18	674	654	1030	834	1030	643	310	173
19	666	649	1050	810	1030	562	310	173
20	669	639	1040	861	1030	488	310	184
21	721	641	977	899	1030	488	310	173
22	731	644	945	978	1020	488	309	182
23	730	652	968	993	1010	442	305	186
24	687	664	999	953	1020	415	305	186
25	654	682	969	898	1010	415	302	190
26	645	664	943	909	1020	415	289	192
27	674	659	944	877	1030	411	270	180
28	667	647	967	849	1030	387	270	183
29	686	639	1000	886	1030	357	270	191
30	700	639	1010	904	1050	346	268	190
31	697		986		1030	360		190
Total:	12921.0	21024.0	26403.0	28259.0	30139.0	19708.0	9510.0	6580.0
Mean:	680.1	700.8	851.7	942.0	972.2	635.7	317.0	212.3
Max:	734.0	839.0	1050.0	1040.0	1050.0	1000.0	357.0	262.0
Min:	599.0	639.0	631.0	810.0	868.0	346.0	268.0	173.0

Dillon Gaging Station (06017000) on Beaverhead River
1992 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Apr	May	Jun	Jul	Aug	Sep
1	95.5	78.7	141.6	135.9		114.3
2	94.8	85.7	123.4	146.4		126.4
3	92.4	78.6	133.0	105.2		116.5
4	87.2	95.1	112.3	109.9		123.3
5	90.5	150.7	120.1		221.3	111.2
6	87.3	166.0	127.6		221.2	107.2
7	80.2	136.0	135.1		237.5	101.7
8	73.5	142.1	138.6		263.7	65.9
9	77.5	173.1	138.3		272.0	60.0
10	81.1	182.7	158.3		294.9	46.4
11	85.3	155.2	149.3		270.3	32.9
12	85.3	114.0	133.2		239.8	38.9
13	83.0	118.9	142.8		147.4	43.3
14	78.1	121.9	129.5	63.8	140.8	42.8
15	72.5	107.4	153.7	52.8	160.4	49.0
16	68.2	115.1	101.9	61.6	164.5	74.6
17	67.7	110.1	43.0	57.0	155.0	75.7
18	73.7	110.6	36.6	60.6	162.7	76.4
19	76.6	97.7	32.2	42.0	159.9	79.2
20	58.7	130.9	32.2	54.1	144.8	79.6
21	51.8	128.7	33.2	117.9	85.5	79.3
22	96.1	147.8	35.1	106.7	67.5	82.1
23	105.4	100.1	52.0	94.0	68.0	83.2
24	98.8	106.1	69.8	111.1	80.3	84.5
25	91.0	117.8	97.8	101.8	100.5	90.6
26	80.4	200.9	99.5	91.8	107.1	88.3
27	79.8	179.7	83.1		119.4	88.5
28	71.1	141.9	84.8		136.4	88.8
29	66.1	126.9	115.0		124.8	95.7
30	81.3	116.3	140.9		120.3	98.7
31		137.0			113.3	
Total:	2430.9	3973.7	3093.9	1512.6	4379.3	2445.0
Mean:	81.0	128.2	103.1	89.0	162.2	81.5
Max:	105.4	200.9	158.3	146.4	294.9	126.4
Min:	51.8	78.6	32.2	42.0	67.5	32.9

Dillon Gaging Station (06017000) on Beaverhead River
1993 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Apr	May	Jun	Jul	Aug	Sep	Oct
1		73.4	209.1	72.4	147.7	125.8	129.7
2		68.6	196.5	80.7	153.5	132.8	131.1
3		61.9	195.6	152.9	111.9	118.7	130.3
4		67.3	203.6	175.9	107.8	105.6	136.0
5		90.5	188.6	152.6	96.3	103.1	141.5
6	186.1	101.7	216.5	130.3	90.3	107.5	135.1
7	161.2	169.5	233.8	136.5	79.3	116.4	81.8
8	124.1	111.0	200.6	117.8	75.3	127.1	114.0
9	118.4	98.0	89.5	108.8	88.6	132.9	108.5
10	122.2	88.5	72.4	106.0	89.9	153.7	107.0
11	121.7	79.6	139.8	110.2	129.6	155.6	119.3
12	124.0	103.3	191.2	92.1	163.5	149.4	117.1
13	126.4	86.8	187.5	92.1	159.6	164.5	105.6
14	117.3	93.0	123.7		187.4	186.1	123.6
15	98.0	86.1	106.4		161.0	197.9	123.4
16	80.1	95.8	99.1	94.7	127.5	200.1	149.8
17		100.6	110.5	108.3	90.3	185.8	145.7
18		109.4	143.6	134.3	81.4	165.1	162.0
19		141.8	97.1	129.8	66.0	159.1	203.1
20		127.1	115.2	128.3	72.7	155.8	207.4
21		128.6	100.3	133.0	104.0	153.6	220.5
22		155.9	106.7	132.7	147.3	139.4	214.5
23		131.8	121.6		128.1	135.7	215.6
24		101.0	144.4		118.3	116.0	215.3
25		82.9	114.5		115.3	119.6	209.6
26	54.6	109.2	107.0		134.4	111.1	206.7
27	71.8	154.1	105.6	275.8	199.4	102.0	204.8
28	69.5	167.8	84.7	269.9	181.5	100.4	
29	66.4	209.6	81.1	225.5	176.2	87.4	
30	72.6	210.2	70.5	171.7	153.4	89.1	
31		200.0		147.2			
Total:	1714.4	3605.0	4156.7	3479.5	3737.5	4097.3	4159.0
Mean:	107.2	116.3	138.6	139.2	124.6	136.6	154.0
Max:	186.1	210.2	233.8	275.8	199.4	200.1	220.5
Min:	54.6	61.9	70.5	72.4	66.0	87.4	81.8

Dillon Gaging Station (06017000) on Beaverhead River
1994 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Apr	May	Jun	Jul	Aug	Sep
1	240.0	112.1	152.8		194.7	111.1
2	243.0	120.4	147.9		158.6	102.1
3	253.9	155.8	156.7		119.9	96.0
4	272.6	145.4	154.7			93.0
5	260.2	129.7	159.6			95.1
6	257.5	125.1	144.5			87.5
7	258.4	157.8	139.2			89.4
8	249.5	179.4	165.5	132.8		
9		183.5	187.1	109.7	137.9	
10		178.6	173.3	99.1	132.6	83.6
11		192.5	167.1	70.0	119.6	86.1
12	142.5	198.3	158.1	84.2	105.7	81.0
13	217.2	213.9	151.3	84.2	95.1	80.4
14	225.7	222.8	100.5	84.3	88.7	81.0
15	221.6	215.9	102.3	88.9	94.5	90.8
16	212.2	196.4	137.3	100.6	87.8	93.3
17	219.2	134.8	168.9	127.1	78.4	98.0
18	232.7		166.7	142.4	72.9	98.8
19	238.0	202.0	161.9	122.3	92.2	97.1
20	229.4		155.0	161.3	106.6	90.6
21			126.5	163.2	113.8	96.9
22			118.5	198.7	116.2	109.7
23			114.5	221.0	108.2	109.7
24		162.3	116.4	222.0	113.2	103.3
25		126.4	127.5	225.5	103.0	102.6
26		89.1	136.7	199.4	102.8	
27		148.6	164.1		89.5	
28		200.3	162.5		91.3	
29	124.4	218.8	162.4		92.7	
30	118.8	205.0		214.3	102.3	
31		170.2		227.9	98.5	
Total:	4216.8	4385.1	4279.5	3078.9	2816.7	2177.1
Mean:	221.9	168.7	147.6	146.6	108.3	94.7
Max:	272.6	222.8	187.1	227.9	194.7	111.1
Min:	118.8	89.1	100.5	70.0	72.9	80.4

Dillon Gaging Station (06017000) on Beaverhead River
1995 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1		43.4	198.4	335.7	1166.4	842.8	802.2		504.4	777.4
2			179.2	342.3	1127.8	754.2	786.6	333.8	528.1	778.0
3			181.6	383.2	1151.4	700.2	798.5	472.3	552.5	761.2
4		109.0	198.3	537.0	1188.4	692.2	858.0	537.1	577.5	674.9
5		185.5	200.6	652.5	1204.3	787.6	850.7	604.6	603.1	738.8
6		192.6	298.5	925.3	1159.1	767.3	764.8	649.0	630.8	733.0
7		193.1	412.2	1091.9	1130.3	761.7	729.5	657.7	659.7	735.4
8		202.6	398.6	964.8	1100.6	773.3	756.3	638.9	687.3	743.3
9		200.8	329.4	868.1	1123.3	780.4	773.3	631.4	715.5	743.0
10		190.3	312.8	890.3	1189.0	785.5	777.9	629.8	744.4	743.0
11		187.2	327.0	930.2	1229.6	799.4	782.4	628.9	774.0	719.0
12		194.4	359.2	954.3	1290.5	811.4	778.5	634.2	804.2	746.2
13		197.0	368.1	963.7	1290.5	804.1	735.2	644.8	827.8	773.5
14		217.9	347.9	990.1	1385.3	791.3	701.1	652.5	829.6	769.3
15		212.5	329.9	1024.3	1359.2	784.6	685.7	652.3	833.5	764.7
16		207.7	324.3	1005.6	1241.7	759.8	659.7	643.8	772.5	761.3
17		207.3	341.2	983.7	1190.0	757.3	656.5	614.4	730.8	755.5
18		205.2	370.8	1002.2	1151.4	790.1	674.7	612.0	667.1	
19		204.3	373.8	1000.8	1066.0	811.9	675.6	612.0	658.3	
20		210.6	355.2	1043.6	983.7	845.1	649.0	612.0	650.1	
21		205.0	351.8	1095.6	1003.1	898.8	651.3	612.0	645.1	
22		201.3	337.1	1072.9	1010.6	920.9	645.9	612.0	656.6	
23		198.5	325.4	1082.2	977.8	856.4	647.6	623.1	661.1	
24	107.2	156.7	346.8	1081.9	947.0	828.9	648.5	641.5	658.0	
25	168.3	176.9	325.6	1020.5	951.6	863.0	633.8	454.5	660.3	
26	172.9	173.7	334.4	1081.8	1044.5	898.0	604.5	462.6	669.9	
27	176.4	164.1	339.1	1077.8	994.7	896.8	560.0	477.3	665.1	
28	170.5	171.4	309.5	1105.2	949.9	885.6	430.6	478.7	668.3	
29	167.0	204.7	300.9	1200.7	932.4	903.7	327.4	482.5	702.7	
30	174.0	209.6	333.1	1193.2	922.0	939.4	284.7	483.7	728.3	
31	176.0		319.7		877.8	866.0		484.6		
Total:	1312.3	5223.3	9830.4	27901.4	34339.9	25357.7	20330.5	17274.0	20466.6	12717.5
Mean:	164.0	186.5	317.1	930.0	1107.7	818.0	677.7	575.8	682.2	748.1
Max:	176.4	217.9	412.2	1200.7	1385.3	939.4	858.0	657.7	833.5	778.0
Min:	107.2	43.4	179.2	335.7	877.8	692.2	284.7	333.8	504.4	674.9

Dillon Gaging Station (06017000) on Beaverhead River
1996 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Apr	May	Jun	Jul	Aug	Sep
1		682.0	817.4	430.3	421.3	321.5
2		692.2	791.4	397.1	419.2	321.7
3		684.6	762.9	391.5	404.1	318.3
4		673.4	752.8	435.1	422.0	315.9
5		667.6	730.1	444.5	423.0	320.0
6		659.7	718.1	453.0	361.7	321.1
7		649.8	703.1	452.4	359.1	317.6
8		641.1	660.0	450.6	355.9	317.0
9		649.3	642.0	433.9	363.5	306.9
10		676.3	648.5	396.3	381.8	274.1
11	880.3	669.8	610.0	379.5	389.8	260.2
12	841.1	655.8	527.9	379.5	362.2	256.4
13	800.9	679.8	473.5	384.1	324.4	252.8
14	772.1	734.3	430.9	380.0	307.6	240.7
15	766.2	770.2	523.5	397.6	358.2	245.2
16	725.7	792.1	510.2	424.7	380.7	258.1
17	755.5	811.7	486.6	407.1	376.2	268.0
18	752.7	848.9	441.4	432.7	383.1	267.0
19	740.5	889.2	394.0	427.9	363.0	269.5
20	743.6	878.0	426.3	436.4	323.6	265.1
21	744.8	795.2	422.9	433.7	327.3	270.0
22	747.5	732.4	459.6	421.8	343.2	275.7
23	746.0	747.6	483.9	395.4	335.6	281.6
24	750.0	800.7	461.0	386.5	328.4	282.8
25	765.6	796.2	396.9	376.7	331.2	282.1
26	758.2	783.0	416.9	353.1	342.4	278.4
27	755.9	783.9	390.2	374.9	350.4	253.8
28	744.2	795.3	326.8	373.1	352.4	242.2
29	718.5	835.2	403.5	370.8	311.7	236.0
30	706.0	855.7	443.6	378.3	302.1	229.4
31		835.2		399.5	321.5	
Total:	15215.3	23166.2	16255.9	12598.0	11126.6	8349.1
Mean:	760.8	747.3	541.9	406.4	358.9	278.3
Max:	880.3	889.2	817.4	453.0	423.0	321.7
Min:	706.0	641.1	326.8	353.1	302.1	229.4

East Bench Irrigation District Canal Diversions
1991 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	May	Jun	Jul	Aug	Sep
1		235	308	393	160
2		245	296	377	143
3		260	305	370	133
4		275	310	370	130
5		280	310	363	135
6	40	275	310	360	122
7	40	284	315	353	115
8	47	290	325	340	125
9	55	290	330	325	112
10	55	290	350	320	110
11	55	295	355	313	98
12	55	306	355	306	90
13	55	326	355	305	86
14	55	360	377	292	85
15	71	390	399	280	85
16	92	410	410	268	74
17	95	416	441	261	60
18	95	425	465	256	46
19	95	426	490	255	33
20	95	424	490	255	30
21	103	420	490	260	30
22	126	420	472	258	30
23	140	423	465	245	28
24	160	408	447	233	25
25	172	372	440	219	25
26	185	355	422	209	25
27	222	368	412	210	25
28	226	353	394	210	25
29	230	338	395	200	25
30	235	325	400	188	25
31	235		400	174	
Total:	3034.0	10284.0	12033.0	8768.0	2235.0
Mean:	116.7	342.8	388.2	282.8	74.5
Max:	235.0	426.0	490.0	393.0	160.0
Min:	40.0	235.0	296.0	174.0	25.0

East Bench Irrigation District Canal Diversions
1992 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	May	Jun	Jul	Aug	Sep
1	170	285	218	348	116
2	170	300	206	355	97
3	161	320	191	360	90
4	167	336	171	347	90
5	202	348	160	343	90
6	240	337	162	339	90
7	236	330	176	321	90
8	255	330	176	310	94
9	260	330	193	310	100
10	260	344	218	300	102
11	260	366	230	289	110
12	260	380	237	280	110
13	260	380	245	278	110
14	271	372	248	285	110
15	274	331	262	276	110
16	275	257	300	257	110
17	279	225	319	239	110
18	305	225	338	214	110
19	322	225	348	201	110
20	347	208	360	182	110
21	334	208	349	176	110
22	330	228	337	180	100
23	333	277	319	185	91
24	355	285	330	174	90
25	370	287	293	152	82
26	363	296	290	150	75
27	331	307	275	143	75
28	319	315	280	127	75
29	294	293	304	125	69
30	285	237	236	125	65
31	285		324	125	
Total:	8573.0	8962.0	8095.0	7496.0	2891.0
Mean:	276.5	298.7	261.1	241.8	96.4
Max:	370.0	380.0	360.0	360.0	116.0
Min:	161.0	208.0	160.0	125.0	65.0

East Bench Irrigation District Canal Diversions
1993 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	May	Jun	Jul	Aug	Sep	Oct
1		349	321	204	192	140
2		358	329	240	177	140
3		376	279	275	176	140
4		380	235	309	180	140
5		380	230	334	180	145
6		360	214	362	180	155
7		344	186	376	172	155
8		334	175	380	165	141
9		330	191	380	165	130
10	45	330	215	380	165	130
11	73	320	230	380	165	130
12	124	296	276	371	165	130
13	135	296	293	351	161	115
14	121	285	285	345	143	105
15	135	265	309	320	125	85
16	135	260	320	298	128	70
17	152	248	320	290	130	70
18	179	251	326	283	130	54
19	191	263	326	271	130	45
20	240	300	310	265	130	
21	263	325	300	248	130	
22	255	322	276	245	130	
23	255	308	260	239	130	
24	255	289	260	230	124	
25	268	291	240	225	120	
26	280	297	200	225	120	
27	280	310	169	225	120	
28	287	315	185	225	130	
29	300	315	185	231	140	
30	320	315	185	235	140	
31	338		185	215		
Total:	4631.0	9412.0	7815.0	8957.0	4443.0	2220.0
Mean:	210.5	313.7	252.1	288.9	148.1	116.8
Max:	338.0	380.0	329.0	380.0	192.0	155.0
Min:	45.0	248.0	169.0	204.0	120.0	45.0

East Bench Irrigation District Canal Diversions
1994 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	May	Jun	Jul	Aug	Sep
1	37	340	415	370	188
2	52	340	420	367	185
3	82	346	431	360	185
4	103	350	444	360	185
5	110	366	450	357	189
6	133	363	450	345	193
7	145	370	450	340	193
8	145	362	450	328	193
9	193	343	450	306	193
10	241	335	450	287	193
11	265	341	450	277	193
12	279	346	450	275	193
13	300	350	450	275	186
14	300	345	450	269	172
15	313	345	461	249	160
16	314	354	460	230	155
17	229	355	460	225	155
18	280	355	460	220	175
19	259	366	465	215	160
20	250	384	490	206	148
21	255	385	490	205	128
22	255	389	490	198	111
23	255	410	490	184	100
24	270	416	482	180	95
25	309	420	467	180	95
26	322	410	458	185	95
27	334	415	467	190	95
28	340	415	419	190	95
29	340	415	401	193	95
30	340	415	383	201	95
31	340		373	199	
Total:	7390.0	11146.0	13926.0	7966.0	4598.0
Mean:	238.4	371.5	449.2	257.0	153.3
Max:	340.0	420.0	490.0	370.0	193.0
Min:	37.0	335.0	373.0	180.0	95.0

East Bench Irrigation District Canal Diversions
1995 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	May	Jun	Jul	Aug	Sep	Oct
1		300	320	440	215	160
2		314	320	440	220	160
3		324	306	440	220	153
4		283	300	425	213	139
5		262	300	425	203	128
6		218	300	425	200	125
7		213	300	397	200	125
8		222	300	405	184	125
9		205	310	405	167	122
10		215	305	396	165	125
11		233	297	379	154	125
12		248	301	370	150	118
13		268	310	370	150	115
14		275	315	370	150	115
15		293	315	369	150	115
16		318	324	365	150	115
17		330	330	363	150	43
18		358	349	344	150	
19		360	389	335	143	
20	100	355	412	324	140	
21	100	348	429	313	130	
22	100	345	438	303	119	
23	100	335	440	283	115	
24	100	330	440	276	115	
25	100	337	446	256	126	
26	100	345	450	239	143	
27	100	345	450	235	150	
28	139	351	452	235	155	
29	200	349	455	235	160	
30	267	330	429	218	160	
31	277		440	205		
Total:	1683.0	9009.0	11272.0	10585.0	4847.0	2108.0
Mean:	140.3	300.3	363.6	341.5	161.6	124.0
Max:	277.0	360.0	455.0	440.0	220.0	160.0
Min:	100.0	205.0	297.0	205.0	115.0	43.0

East Bench Irrigation District Canal Diversions
1996 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	May	Jun	Jul	Aug	Sep	Oct
1	55	175	414	445	160	150
2	50	190	415	432	163	150
3	60	209	420	425	165	150
4	60	232	425	425	165	150
5	60	246	425	410	165	150
6	60	259	425	401	165	150
7	60	285	438	393	165	150
8	83	295	445	387	165	136
9	95	315	451	368	170	133
10	95	345	461	351	188	140
11	115	369	467	345	192	133
12	135	396	473	335	195	130
13	135	419	475	316	195	130
14	149	448	475	306	195	120
15	166	455	482	280	195	59
16	173	462	485	270	185	
17	185	465	496	256	180	
18	158	465	495	250	175	
19	172	465	490	236	164	
20	201	465	485	230	157	
21	216	454	485	215	155	
22	214	439	485	205	155	
23	202	435	485	194	155	
24	195	430	485	185	155	
25	195	418	485	190	148	
26	195	408	482	186	145	
27	195	405	475	175	148	
28	190	405	475	180	150	
29	185	405	475	185	150	
30	178	405	473	176	150	
31	175		447	165		
Total:	4407.0	11164.0	14394.0	8917.0	5015.0	2031.0
Mean:	142.2	372.1	464.3	287.6	167.2	135.4
Max:	216.0	465.0	496.0	445.0	195.0	150.0
Min:	50.0	175.0	414.0	165.0	145.0	59.0

Canyon Ditch Diversions
1991 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	May	Jun	Jul	Aug	Sep
1		60	113	74	52
2		60	91	84	52
3		60	83	87	42
4		63	83	87	25
5		63	83	86	25
6		58	91	87	22
7		49	103	88	20
8		44	115	87	18
9		44	115	88	18
10		50	130	101	18
11		58	154	106	14
12		58	178	97	9
13		58	200	79	13
14		58	218	68	18
15		58	220	63	18
16		58	247	56	18
17		60	257	52	18
18		66	265	52	9
19		66	273	52	5
20		68	269	52	5
21		77	281	52	5
22	12.5	77	285	52	5
23	15	77	285	52	2
24	20	77	263	55	
25	20	77	255	60	
26	26	77	233	63	
27	35	77	226	64	
28	35	66	200	63	
29	35	60	156	63	
30	38	60	126	55	
31	51		128	52	
Total:	287.5	1884.0	5726.0	2177.0	431.0
Mean:	28.8	62.8	184.7	70.2	18.7
Max:	51.0	77.0	285.0	106.0	52.0
Min:	12.5	44.0	83.0	52.0	2.0

Canyon Ditch Diversions
1992 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	May	Jun	Jul	Aug
1	20	69	32	108
2	20	76	26	108
3	24	83	17	108
4	32	95	12	108
5	36	101	12	108
6	40	101	5	108
7	45	101	4	99
8	45	100	4	95
9	50	100	4	95
10	56	100	18	83
11	71	100	26	82
12	82	100	26	82
13	82	100	27	83
14	82	96	34	83
15	87	90	44	76
16	92	66	50	76
17	83	51	67	75
18	75	44	78	75
19	86	33	83	69
20	86	28	89	61
21	60	28	98	58
22	75	32	97	58
23	75	45	92	34
24	75	53	90	22
25	75	53	90	28
26	75	53	90	34
27	75	53	90	34
28	74	60	90	15
29	69	57	95	5
30	63	41	104	5
31	63		108	5
Total:	1973.0	2109.0	1702.0	2080.0
Mean:	63.6	70.3	54.9	67.1
Max:	92.0	101.0	108.0	108.0
Min:	20.0	28.0	4.0	5.0

Canyon Ditch Diversions
1993 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	May	Jun	Jul	Aug	Sep	Oct
1		56	70	23	17	27
2		70	60	30	17	27
3		84	55	36	17	27
4		87	44	44	17	27
5		87	40	58	17	27
6		81	34	63	17	27
7		70	22	68	17	27
8		66	32	68	17	27
9		67	44	68	17	27
10		67	48	70	21	27
11		58	51	81	30	24
12		38	58	81	30	24
13		31	70	75	30	24
14		31	76	65	30	24
15		19	76	65	30	24
16		19	76	58	30	24
17	15	19	76	51	30	24
18	26	19	76	43	30	24
19	35	8	76	41	30	
20	45	0	70	41	30	
21	48	0	64	41	28	
22	45	0	57	41	28	
23	45	16	57	41	28	
24	45	46	48	32	28	
25	45	52	44	29	28	
26	45	58	26	20	28	
27	45	61	8	17	27	
28	45	61	8	17	27	
29	45	65	8	17	27	
30	45	70	0	17	27	
31	45		0	17		
Total:	619.0	1406.0	1474.0	1418.0	750.0	462.0
Mean:	41.3	46.9	47.5	45.7	25.0	25.7
Max:	48.0	87.0	76.0	81.0	30.0	27.0
Min:	15.0	0.0	0.0	17.0	17.0	24.0

Canyon Ditch Diversions
1994 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	May	Jun	Jul	Aug
1	13	80	60	96
2	13	80	60	101
3	13	80	60	96
4	13	80	60	93
5	13	80	60	93
6	17	85	71	93
7	34	94	85	85
8	37	94	85	80
9	42	94	85	82
10	45	94	85	87
11	51	94	85	87
12	65	94	84	81
13	73	102	93	77
14	73	107	104	69
15	77	107	107	60
16	86	107	99	58
17	93	107	97	49
18	88	107	97	38
19	80	107	97	35
20	67	100	97	35
21	60	92	97	35
22	60	92	97	35
23	60	84	92	35
24	60	79	87	35
25	66	79	87	35
26	72	79	95	35
27	80	79	100	35
28	80	79	100	35
29	80	69	93	35
30	80	62	87	35
31	80		87	35
Total:	1771.0	2687.0	2693.0	1880.0
Mean:	57.1	89.6	86.9	60.6
Max:	93.0	107.0	107.0	101.0
Min:	13.0	62.0	60.0	35.0

Canyon Ditch Diversions
1995 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Jun	Jul	Aug	Sep	Oct
1	60	46	84	48	22
2	60	46	84	48	22
3	80	38	84	48	22
4	84	26	84	48	22
5	84	22	78	48	8
6	46	22	70	48	
7	0	22	70	39	
8	0	22	70	34	
9	0	29	70	34	
10	0	33	78	34	
11	0	33	83	25	
12	0	33	83	22	
13	0	11	83	22	
14	0	0	83	26	
15	0	0	91	34	
16	14	0	104	34	
17	22	8	110	34	
18	22	15	110	34	
19	25	36	110	34	
20	28	52	110	25	
21	40	52	110	22	
22	46	52	110	22	
23	38	52	106	22	
24	34	52	91	22	
25	42	59	73	22	
26	50	70	60	22	
27	50	73	60	22	
28	50	73	60	22	
29	50	73	53	22	
30	50	78	48	22	
31		84	48		
Total:	975.0	1212.0	2558.0	939.0	96.0
Mean:	32.5	39.1	82.5	31.3	19.2
Max:	84.0	84.0	110.0	48.0	22.0
Min:	0.0	0.0	48.0	22.0	8.0

Canyon Ditch Diversions
1996 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	May	Jun	Jul	Aug	Sep	Oct
1		36	80	104	58	47
2		36	80	104	58	7
3		42	80	104	58	8
4		46	80	104	58	7
5		44	80	104	58	7
6		60	80	104	58	7
7		60	80	104	58	8
8		66	80	100	58	8
9		70	87	92	58	19
10		70	87	92	58	20
11		70	87	92	51	20
12		76	87	96	46	20
13		82	97	104	46	20
14		84	97	112	46	20
15	20	84	90	112	46	
16	25	84	96	112	46	
17	34	84	96	112	46	
18	34	84	72	112	46	
19	34	84	97	104	46	
20	34	84	109	92	46	
21	40	84	117	84	46	
22	57	84	126	71	46	
23	60	84	126	66	46	
24	52	84	126	66	46	
25	48	83	126	61	46	
26	48	80	126	58	46	
27	48	80	126	58	46	
28	48	80	124	58	46	
29	48	80		58	46	
30	48	80		58	46	
31	40			58		
Total:	718.0	2165.0	2739.0	2756.0	1505.0	218.0
Mean:	42.2	72.2	97.8	88.9	50.2	15.6
Max:	60.0	84.0	126.0	112.0	58.0	47.0
Min:	20.0	36.0	72.0	58.0	46.0	7.0

Lower Blacktail Deer Creek Gaging Station at I-15
1993 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Jun	Jul	Aug	Sep
1		98.4	91.4	91.9
2		84.5	71.2	88.7
3		126.4	52.9	81.6
4		161.0	39.7	75.0
5		142.7	45.5	78.4
6		133.6	48.8	85.7
7		121.7	38.2	81.8
8		114.4	38.4	68.9
9		109.5	43.2	62.6
10		107.3	36.7	64.5
11		107.2	51.1	64.6
12		105.6	66.0	68.2
13		94.6	74.0	91.1
14		91.3	78.7	91.4
15		83.7	82.1	89.2
16		77.2	79.3	91.0
17		79.7	91.9	96.0
18		84.5	93.4	90.2
19		71.6	83.9	79.8
20		67.8	82.9	83.8
21		71.1	122.8	82.0
22		72.8	172.9	84.5
23		81.5	131.1	89.5
24	82.8	114.0	111.1	90.8
25	84.4	146.5	96.2	88.8
26	73.7	181.7	97.3	89.1
27	73.9	148.5	91.9	86.1
28	80.7	118.6	90.7	67.8
29	88.4	101.3	85.1	62.0
30	96.0	104.0	101.4	57.4
31		99.5	99.4	
Total:	579.9	3302.2	2489.2	2422.4
Mean:	82.8	106.5	80.3	80.7
Max:	96.0	181.7	172.9	96.0
Min:	73.7	67.8	36.7	57.4

Lower Blacktail Deer Creek Gaging Station at I-15
1994 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	May	Jun	Jul	Aug	Sep
1		81.7	54.3	40.0	29.7
2		78.1	53.6	47.8	26.5
3		72.7	56.2	46.9	26.6
4		62.4	51.7	47.4	24.0
5		62.4	49.1	52.5	22.2
6		75.2	57.9	60.7	23.0
7		71.6	48.8	50.4	22.0
8		65.0	46.0	43.1	20.7
9		65.2	44.3	38.6	20.8
10		63.6	41.6	49.9	21.2
11		57.5	37.0	56.4	21.7
12		60.8	36.6	56.5	22.2
13	49.3	62.8	36.6	55.9	23.3
14	53.4	65.8	39.4	52.7	23.6
15	54.2	57.4	43.6	48.5	20.5
16	63.0	60.0	49.4	41.7	19.2
17	72.2	51.8	48.3	31.2	20.5
18	83.6	53.9	47.4	27.9	21.5
19	95.8	62.7	51.4	31.5	21.5
20	91.0	65.7	57.6	42.7	21.7
21	78.1	67.6	45.5	40.5	21.1
22	66.1	78.4	51.3	30.1	21.8
23	57.0	74.8	59.0	28.3	21.1
24	59.4	78.2	59.6	27.4	20.5
25	64.1	74.7	51.4	26.9	20.0
26	73.4	79.0	47.9	27.0	20.9
27	87.6	77.7	49.0	26.6	21.6
28	92.3	67.9	58.3	26.2	22.8
29	88.2	53.2	53.3	29.8	23.6
30	74.6	50.4	38.0	29.4	
31	71.8		40.1	30.2	
Total:	1375.1	1998.2	1504.2	1244.7	645.8
Mean:	72.4	66.6	48.5	40.2	22.3
Max:	95.8	81.7	59.6	60.7	29.7
Min:	49.3	50.4	36.6	26.2	19.2

Lower Blacktail Deer Creek Gaging Station at I-15
1995 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
1		46.4	51.2	57.4	227.5	84.1	97.3	77.9	80.3
2		45.0	46.6	64.2	237.2	71.9	101.4	77.4	64.1
3		43.3	43.6	74.3	263.8	66.4	98.7	92.7	65.0
4		41.7	42.4	107.0	267.9	76.7	133.6	101.7	62.1
5		41.8	44.1	148.1	266.5	97.4	128.6	97.6	68.1
6		42.6	62.8	244.2	262.0	91.9	121.4	80.0	70.3
7		44.0	68.1	238.6	251.8	75.6	121.8	80.7	76.1
8		46.0	51.4	224.3	244.8	70.9	121.7	86.6	83.1
9		46.4	54.0	220.3	246.1	67.0	121.2	87.4	85.3
10		44.7	50.2	205.3	288.8	64.2	119.9	108.2	78.9
11		44.5	56.7	170.2	307.2	68.0	111.8	102.3	76.8
12		43.9	76.3	148.1	305.9	64.2	89.8	97.1	77.2
13		41.7	85.6	150.9	305.9	61.8	82.3	94.5	85.8
14		46.1	81.3	181.3	298.0	53.7	77.9	95.1	
15		47.1	76.5	222.9	267.7	49.5	81.7	96.4	
16		45.9	71.6	250.2	229.0	52.5	82.9	95.2	
17		45.9	77.5	271.3	203.7	55.0	81.9	95.3	
18		45.1	80.4	291.1	169.3	53.8	83.5	102.7	
19		43.6	84.6	294.6	146.9	49.1	98.0	100.8	
20		43.7	93.0	293.1	139.1	49.9	111.3	99.3	
21		40.9	97.9	287.2	150.4	55.6	105.6	100.7	
22		38.6	102.9	277.8	150.2	68.5	107.7	104.3	
23		34.5	104.2	244.2	127.0	81.4	104.6	101.4	
24		33.6	105.3	209.1	101.4	101.8	102.2	93.3	
25	41.3	37.6	106.4	178.8	87.1	113.9	99.8	100.9	
26	44.0	44.7	103.6	166.8	83.1	132.1	100.9	101.4	
27	43.8	41.5	90.5	166.4	74.1	137.1	89.9	98.6	
28	44.1	47.4	82.6	183.6	58.4	139.0	77.5	97.4	
29	42.6	53.6	62.0	204.2	59.2	129.5	77.0	96.3	
30	42.3	57.4	50.9	227.5	92.8	117.9	66.9	99.0	
31	44.3		50.7		88.5	111.9		95.8	
Total:	302.4	1319.2	2254.9	6003.0	6001.3	2512.3	2998.8	2958.0	973.1
Mean:	43.2	44.0	72.7	200.1	193.6	81.0	100.0	95.4	74.9
Max:	44.3	57.4	106.4	294.6	307.2	139.0	133.6	108.2	85.8
Min:	41.3	33.6	42.4	57.4	58.4	49.1	66.9	77.4	62.1

Lower Blacktail Deer Creek Gaging Station at I-15
1996 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Apr	May	Jun	Jul	Aug	Sep
1		68.4	138.9	132.2	71.0	85.4
2		74.7	112.9	130.2	57.1	90.0
3		76.9	82.1	132.5	40.7	89.5
4		72.4	78.1	132.6	45.6	89.8
5		74.7	86.2	127.9	51.4	94.9
6		77.2	80.0	114.9	56.0	99.1
7		75.6	86.6	97.9	58.1	100.1
8		77.5	86.8	89.8	49.2	93.3
9		74.7	94.7	73.8	51.5	85.2
10		72.4	105.8	58.0	53.8	73.5
11		82.5	118.8	58.5	49.6	55.2
12		98.4	129.1	58.5	34.0	59.6
13		118.1	126.0	59.0	44.3	59.9
14		120.2	136.5	66.8	48.2	63.4
15		115.4	141.9	62.0	50.4	68.2
16		142.5	148.1	61.5	56.3	74.4
17		134.9	123.9	58.9	57.5	75.4
18		131.3	118.1	57.5	62.1	72.2
19		120.4	116.9	60.9	59.6	72.7
20		103.6	116.5	58.7	55.6	78.2
21		87.8	120.2	56.1	58.4	93.3
22		132.6	135.6	57.4	52.8	94.8
23		157.7	134.6	54.0	54.3	112.7
24	94.9	137.9	127.2	54.0	53.6	116.2
25	81.8	119.9	126.5	55.9	52.9	108.4
26	78.1	140.9	127.0	55.9	59.7	113.0
27	77.0	165.5	136.2	55.5	73.6	100.6
28	74.5	163.1	142.8	55.8	70.0	100.6
29	72.4	161.8	134.5	64.4	70.7	94.8
30	70.3	168.2	138.2	61.7	71.6	
31		147.5		60.8	73.4	
Total:	549.0	3494.7	3550.7	2323.6	1743.0	2514.4
Mean:	78.4	112.7	118.4	75.0	56.2	86.7
Max:	94.9	168.2	148.1	132.6	73.6	116.2
Min:	70.3	68.4	78.1	54.0	34.0	55.2

Middle Blacktail Deer Creek Gaging Station at EBID Canal
1993 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Apr	May	Jun	Jul	Aug	Sep
1	26.3	13.7	48.8	55.9	50.7	48.5
2	28.1	12.4	57.1	80.4	50.5	46.4
3	25.4	14.3	60.9	92.4	47.4	42.1
4	24.8	14.8	60.5	83.8	43.4	39.6
5	24.9	19.9	58.0	79.2	47.4	40.3
6	23.4	29.0	66.0	74.7	49.8	43.5
7	22.3	42.7	73.1	67.2	37.6	40.4
8	21.7	34.5	68.3	67.4	35.8	34.9
9	22.1	28.3	62.9	67.1	33.1	34.1
10	22.0	23.9	57.2	63.6	26.8	34.3
11	21.4	19.3	72.1	60.8	34.2	34.7
12	21.6	17.8	85.6	50.4	38.7	37.7
13	20.0	16.2	85.7	43.6	35.9	43.9
14	18.5	15.1	73.3	37.6	40.9	47.2
15	18.5	14.6	73.4	35.2	36.4	47.4
16	20.0	15.5	83.9	36.8	35.3	48.6
17	23.0	17.6	86.8	45.7	42.3	50.7
18	21.6	17.0	82.4	48.8	46.8	50.5
19	20.9	17.0	76.2	36.1	44.4	49.2
20	20.1	18.6	70.0	32.3	44.1	48.6
21	19.1	26.3	70.9	35.0	51.8	49.1
22	19.0	46.9	68.3	40.8	78.2	49.7
23	21.0	58.8	73.0	44.5	60.1	54.8
24	21.9	55.7	71.1	56.7	51.8	55.5
25	1.7	44.7	62.9	74.1	46.9	54.2
26	1.4	43.7	55.7	84.8	46.9	52.3
27	1.3	46.7	54.1	85.7	48.3	51.9
28	15.3	51.3	58.7	68.2	45.8	51.4
29	15.5	48.7	58.4	55.2	41.6	50.9
30	15.3	50.8	59.0	48.1	54.9	49.9
31		49.7		51.8	54.4	
Total:	578.1	925.5	2034.3	1803.9	1402.2	1382.3
Mean:	19.3	29.9	67.8	58.2	45.2	46.1
Max:	28.1	58.8	86.8	92.4	78.2	55.5
Min:	1.3	12.4	48.8	32.3	26.8	34.1

Middle Blacktail Deer Creek Gaging Station at EBID Canal
1994 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Apr	May	Jun	Jul	Aug	Sep	Oct
1		38.3	11.5	5.3	0.4	0.7	
2	32.5	37.8	24.4	6.2	0.7	0.7	
3	35.1	36.3	17.5	7.7	0.3	0.7	
4	33.7	35.4	12.7	7.0	0.9	0.5	
5	33.4	37.1	6.2	2.2	0.9	1.1	
6	34.7	32.8	3.4	11.4	0.4	1.0	
7	38.6	31.4	5.0	7.8	0.1	0.2	
8	36.3	24.5	13.3	2.4	0.0	0.3	
9	37.3	22.6	9.1	1.4	0.0	0.0	
10	39.2	14.1	3.7	0.8	0.0	0.3	
11	38.1	6.5	0.8	1.4	0.1	0.2	
12	35.8	6.0	2.0	1.0	0.2	0.2	
13	34.9	7.6	10.4	1.2	0.4	0.2	2.9
14	34.7	9.6	16.8	2.5	0.4	0.4	3.1
15	33.8	3.0	15.4	5.4	0.3	0.1	4.7
16	33.6	4.1	9.2	2.4	0.4	0.0	9.2
17	34.3	19.1	12.2	1.9	0.3	0.0	8.1
18	35.2	19.8	10.2	1.8	0.3	0.0	9.8
19	36.2	23.4	8.2	1.5	0.3	0.0	10.0
20	38.5	21.7	6.6	0.9	0.5	0.0	8.6
21	41.4	20.9	3.3	0.5	1.2	0.0	7.5
22	48.7	15.7	1.9	0.4	0.7	0.1	7.4
23	48.9	7.9	5.9	0.4	0.7	0.0	7.2
24	42.9	5.7	2.0	1.0	0.2	0.0	7.1
25	40.8	3.8	0.7	1.0	0.3	0.0	6.3
26	40.1	4.1	1.1	1.3	0.3	0.0	6.4
27	39.1	11.0	2.5	0.7	0.4	0.0	7.7
28	38.5	23.1	1.6	0.6	0.6	0.0	
29	38.6	22.8	4.1	0.4	0.5	3.0	
30	37.9	17.5	3.1	0.2	0.5		
31		9.6		0.2	0.7		
Total:	1092.8	573.2	224.8	78.9	13.0	9.7	106.0
Mean:	37.7	18.5	7.5	2.5	0.4	0.3	7.1
Max:	48.9	38.3	24.4	11.4	1.2	3.0	10.0
Min:	32.5	3.0	0.7	0.2	0.0	0.0	2.9

Middle Blacktail Deer Creek Gaging Station at EBID Canal
1995 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Apr	May	Jun	Jul	Aug	Sep	Oct
1		32.4	78.1	153.9	59.5	44.0	51.6
2		25.1	96.7	150.3	52.6	42.2	52.4
3		23.8	109.4	160.0	51.3	43.1	57.4
4		25.2	154.0	159.8	52.7	54.2	62.3
5		28.0	166.5	171.3	52.7	50.8	59.4
6		30.7	211.5	168.3	49.1	50.0	57.2
7	31.9	31.5	229.4	175.0	45.8	52.5	58.0
8	33.2	35.5	192.3	173.0	45.8	53.2	61.3
9	33.3	35.8	169.5	184.2	46.1	55.0	55.7
10	31.3	34.3	157.1	211.2	42.9	52.7	54.6
11	31.4	39.5	131.1	221.1	43.1	51.9	52.5
12	30.6	59.1	122.5	215.8	40.3	49.1	51.5
13	29.3	61.6	138.3	215.8	37.3	47.6	52.9
14	31.0	58.6	167.1	209.1	33.8	46.6	51.3
15	32.4	57.8	199.7	196.6	31.3	44.9	51.7
16	32.0	54.8	208.5	157.8	31.1	44.2	51.5
17	32.2	61.5	228.7	135.2	32.0	45.5	50.5
18	31.5	65.6	240.2	116.8	31.9	47.1	51.8
19	30.0	73.2	245.9	137.9	31.4	47.2	51.4
20	28.9	80.3	272.3	119.1	31.6	53.4	
21	27.2	83.7	270.4	113.7	32.0	56.0	
22	24.6	85.4	257.9	111.8	32.4	58.4	
23	22.1	86.8	220.2	101.9	32.6	57.2	
24	21.7	83.5	178.1	91.9	35.6	56.2	
25	23.8	86.7	147.7	84.0	41.2	55.4	
26	28.1	89.4	137.7	80.0	46.1	54.0	
27	25.6	77.7	141.1	74.0	47.2	53.0	
28	24.7	71.4	158.6	67.4	46.2	54.5	
29	31.6	64.6	179.5	67.4	42.7	52.5	
30	33.1	66.1	175.6	70.8	42.6	51.9	
31		72.6		66.7	43.1		
Total:	701.5	1782.2	5385.6	4361.8	1284.0	1524.3	1035.0
Mean:	29.2	57.5	179.5	140.7	41.4	50.8	54.5
Max:	33.3	89.4	272.3	221.1	59.5	58.4	62.3
Min:	21.7	23.8	78.1	66.7	31.1	42.2	50.5

Middle Blacktail Deer Creek Gaging Station at EBID Canal
1996 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Apr	May	Jun	Jul	Aug	Sep
1		67.3	96.9	63.4	2.2	2.0
2		66.9	86.4	55.3	1.2	6.2
3		72.6	82.7	55.5	0.3	9.5
4		70.8	82.6	53.3	0.2	7.8
5		67.3	88.1	56.2	0.1	9.6
6		66.7	98.5	52.4	0.1	5.7
7		65.0	97.3	41.6	0.0	9.3
8		64.6	93.7	35.8	0.0	9.6
9		64.6	97.0	32.8	0.0	4.2
10		63.7	99.0	29.9	0.0	6.0
11		60.1	103.5	27.2	0.0	4.3
12	95.3	55.5	105.8	27.2	0.0	4.8
13	80.6	61.5	106.4	24.6	0.0	12.0
14	72.8	72.1	105.2	22.2	0.0	10.1
15	69.4	86.9	105.5	15.3	0.0	12.5
16	68.8	94.8	104.7	11.1	0.0	14.7
17	73.6	109.2	108.7	7.9	0.6	22.3
18	72.7	108.0	109.2	6.6	0.8	17.3
19	68.1	104.9	108.1	5.5	1.5	12.7
20	69.9	96.8	94.4	3.4	0.0	17.4
21	75.2	86.5	87.4	5.6	1.1	20.0
22	78.0	72.6	83.6	1.4	1.7	19.7
23	73.1	106.0	101.7	4.1	0.9	20.9
24	77.3	113.5	88.2	3.3	1.0	23.1
25	88.9	101.7	80.7	3.0	0.7	23.0
26	78.4	87.4	81.8	2.8	1.9	24.2
27	74.9	96.9	72.8	2.5	1.1	25.3
28	78.7	104.1	72.5	2.3	3.1	24.2
29	72.2	103.9	75.9	2.1	4.6	23.1
30	70.5	105.7	69.9	1.9	3.8	20.8
31		106.9		1.7	2.1	
Total:	1438.4	2604.5	2788.2	657.9	29.0	422.3
Mean:	75.7	84.0	92.9	21.2	0.9	14.1
Max:	95.3	113.5	109.2	63.4	4.6	25.3
Min:	68.1	55.5	69.9	1.4	0.0	2.0

Upper Blacktail Deer Creek Gaging Station (06017500)
1992 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Mar	Apr	May	Jun	Jul	Aug	Sep
1		33.4	47.5	72.3	112.0	56.7	37.6
2		30.1	47.4	71.9	101.0	57.3	36.0
3		30.7	51.0	68.7	98.1	56.6	34.4
4		30.0	53.8	73.4	100.1	55.1	37.1
5		32.7	55.3	71.3	96.6	52.8	41.9
6		34.1	57.2	69.9	89.6	51.5	42.5
7		35.8	63.0	64.8	84.7	50.6	41.5
8		37.7	77.2	64.2	80.8	48.8	38.9
9		38.1	77.7	64.6	80.9	49.1	37.8
10		38.7	69.0	63.5	80.1	47.7	36.6
11		38.6	64.4	61.9	83.2	47.1	35.3
12		38.9	62.4	59.0	101.7	46.9	36.9
13		38.9	61.0	60.3	101.7	46.3	39.8
14		38.2	62.1	68.1	89.4	45.6	39.2
15		37.8	66.3	80.5	79.7	45.7	37.0
16		39.4	66.1	113.7	71.2	49.0	36.5
17		40.9	67.7	101.4	68.3	44.3	35.3
18		35.8	71.8	85.6	66.3	38.3	35.3
19		37.5	73.1	78.4	65.0	37.0	35.6
20		38.6	78.1	75.0	69.2	36.6	35.8
21		57.4	79.8	72.2	76.0	38.6	36.2
22		65.1	75.7	70.1	76.8	38.8	35.3
23		62.0	75.3	73.3	70.4	40.1	35.1
24		62.5	75.0	79.8	61.9	42.0	36.2
25		52.6	77.0	81.1	60.6	42.6	37.0
26		46.3	87.2	80.8	59.2	41.2	37.0
27		43.7	85.6	85.4	56.1	39.8	37.0
28		43.3	79.9	96.3	54.2	37.2	37.0
29		44.7	77.7	104.7	56.9	36.3	37.0
30		48.4	75.7	110.3	60.7	35.9	36.8
31	33.8		74.3		58.8	36.8	
Total:	33.8	1251.9	2135.3	2322.5	2411.2	1392.3	1115.6
Mean:	33.8	41.7	68.9	77.4	77.8	44.9	37.2
Max:	33.8	65.1	87.2	113.7	112.0	57.3	42.5
Min:	33.8	30.0	47.4	59.0	54.2	35.9	34.4

Upper Blacktail Deer Creek Gaging Station (06017500)
1993 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Apr	May	Jun	Jul	Aug	Sep	Oct
1	51.0	36.4	192.2	111.0	83.6	77.2	61.0
2	51.5	35.0	231.0	108.2	84.1	77.6	61.0
3	46.7	39.7	237.9	232.4	80.8	74.6	61.0
4	45.5	45.7	215.3	218.3	75.8	72.3	61.0
5	46.1	55.2	193.3	154.4	83.5	71.4	60.7
6	44.2	60.6	249.5	142.5	96.3	73.4	60.5
7	42.1	113.4	269.2	132.2	85.1	71.9	62.5
8	41.8	71.4	241.6	117.3	95.2	69.2	70.1
9	43.1	57.6	215.4	109.9	84.6	69.2	70.8
10	42.1	50.6	188.6	101.4	78.0	73.9	73.2
11	41.3	48.7	255.1	96.5	88.5	71.4	80.3
12	42.2	54.1	298.8	90.7	94.2	71.5	72.2
13	42.5	59.7	240.1	90.7	98.9	76.4	68.9
14	40.7	67.1	191.2	88.4	118.7	76.5	68.1
15	40.1	74.0	185.0	88.2	102.6	74.0	72.1
16	44.5	81.0	237.1	110.4	96.8	72.9	73.5
17	48.3	92.8	236.3	118.0	101.6	72.9	71.4
18	44.2	99.1	201.9	116.1	94.3	72.5	69.1
19	42.2	106.9	174.9	93.0	90.0	71.5	67.5
20	40.6	118.6	158.7	86.1	89.9	69.9	64.8
21	39.5	144.6	159.7	80.4	132.6	68.8	67.5
22	40.3	199.0	163.9	86.6	187.1	68.8	
23	45.0	217.4	165.3	89.8	115.0	68.4	
24	45.6	167.3	154.6	112.5	95.3	67.4	
25	43.8	137.7	140.4	138.6	90.6	66.8	
26	42.7	141.1	128.3	191.2	91.7	63.8	
27	41.5	156.2	123.4	152.6	88.9	63.2	
28	40.2	171.4	125.1	108.3	84.8	61.9	
29	40.0	179.7	119.5	92.4	82.1	61.1	
30	39.0	204.6	115.7	86.1	81.7	61.7	
31		194.9		85.9	80.1		
Total:	1298.3	3281.5	5809.0	3630.1	2952.4	2112.1	1417.2
Mean:	43.3	105.9	193.6	117.1	95.2	70.4	67.5
Max:	51.5	217.4	298.8	232.4	187.1	77.6	80.3
Min:	39.0	35.0	115.7	80.4	75.8	61.1	60.5

Upper Blacktail Deer Creek Gaging Station (06017500)
1994 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Apr	May	Jun	Jul	Aug	Sep	Oct
1	59.3	58.0	84.5	50.6	36.4	26.3	27.8
2	57.9	56.9	100.4	50.1	35.6	25.7	28.5
3	56.8	55.8	90.2	49.9	35.7	24.3	29.7
4	54.1	55.3	85.6	49.2	34.1	24.5	31.2
5	53.1	56.9	75.9	51.6	35.2	24.9	31.8
6	59.5	52.7	71.0	59.8	33.3	24.7	31.0
7	63.0	53.5	73.7	59.3	31.9	24.4	30.9
8	59.8	50.9	82.4	53.8	31.9	25.6	29.7
9	62.8	55.2	78.4	50.1	31.2	24.4	29.1
10	66.7	56.3	74.7	49.5	30.0	25.1	28.5
11	62.6	57.6	69.1	47.5	32.4	26.2	28.8
12	59.4	60.1	69.4	47.5	33.8	26.8	30.3
13	57.0	70.0	71.5	47.5	33.8	26.7	31.3
14	54.1	68.6	74.8	47.5	32.1	25.7	31.8
15	51.9	62.3	72.1	47.9	30.3	25.8	34.5
16	52.9	67.7	72.6	46.2	28.9	26.2	32.8
17	55.3	83.0	74.9	44.6	28.9	25.9	32.7
18	56.7	77.5	67.0	43.5	29.2	25.3	37.0
19	58.5	89.2	60.9	42.8	28.5	25.6	36.4
20	64.6	79.0	62.5	42.6	28.7	25.8	35.1
21	72.1	75.0	58.7	40.8	29.3	25.9	34.5
22	85.0	69.7	60.6	39.8	27.6	26.5	33.9
23	80.4	66.0	60.8	39.6	29.1	26.3	33.9
24	70.1	65.7	57.1	41.1	27.9	26.0	33.4
25	67.3	67.1	54.9	41.7	26.4	25.8	33.3
26	65.7	71.7	53.3	38.9	25.4	25.9	
27	61.0	77.7	51.9	37.1	25.2	25.8	
28	58.0	84.2	49.7	35.1	25.8	26.0	
29	54.8	80.2	50.9	37.3	26.5	25.9	
30	57.0	76.0	50.7	37.8	25.8	27.3	
31		75.5		37.3	25.9		
Total:	1837.4	2075.3	2060.2	1408.0	936.8	771.3	797.9
Mean:	61.2	66.9	68.7	45.4	30.2	25.7	31.9
Max:	85.0	89.2	100.4	59.8	36.4	27.3	37.0
Min:	51.9	50.9	49.7	35.1	25.2	24.3	27.8

Upper Blacktail Deer Creek Gaging Station (06017500)
1995 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1		49.5	59.9	187.0	297.3	119.3	69.9	55.2
2		47.3	55.7	217.7	289.1	110.8	69.6	54.3
3		43.8	54.0	257.0	286.5	106.9	71.6	58.7
4		43.2	56.5	339.0	293.1	107.4	90.9	65.2
5		44.5	59.3	360.1	277.9	105.5	82.6	61.1
6		44.6	84.6	454.9	261.9	98.0	89.0	58.7
7		47.9	86.6	424.4	256.1	92.4	85.9	59.9
8		48.9	77.2	385.9	251.7	94.6	78.3	63.1
9		46.9	74.7	370.9	273.0	102.9	82.3	57.9
10		44.7	71.4	322.5	312.6	92.6	79.9	56.0
11		44.8	84.7	279.4	310.7	92.4	80.3	53.1
12		43.7	120.5	277.7	272.5	86.1	74.6	52.4
13		43.5	114.2	331.1	272.5	82.7	70.3	53.4
14		51.4	105.4	378.1	270.3	82.7	68.9	51.8
15		51.3	106.3	395.2	256.3	79.3	67.4	50.7
16		50.9	102.4	399.3	213.1	78.3	65.6	49.6
17		52.4	114.1	418.3	200.3	84.5	67.7	48.9
18		50.4	119.5	424.7	192.1	83.3	68.0	50.6
19		47.0	129.6	414.5	186.5	78.7	68.4	49.2
20		48.2	140.7	415.4	196.0	77.3	80.7	
21		49.2	151.2	397.2	189.2	74.4	73.2	
22		47.8	158.9	386.2	183.3	75.4	67.6	
23		47.3	161.8	353.3	169.3	75.1	65.6	
24	45.4	45.8	158.0	319.0	157.9	82.1	63.3	
25	44.7	53.5	159.9	294.3	152.4	92.9	61.9	
26	45.3	61.9	161.2	290.5	148.9	88.7	59.8	
27	45.6	57.3	144.8	311.5	145.3	77.1	57.3	
28	44.0	57.1	141.6	333.3	136.2	71.2	56.9	
29	41.7	70.5	143.8	338.7	134.0	66.5	55.7	
30	41.6	66.7	152.9	316.6	139.2	66.5	56.1	
31	48.4		167.7		130.8	70.1		
Total:	356.7	1502.0	3519.1	10393.7	6856.0	2695.7	2129.3	1049.8
Mean:	44.6	50.1	113.5	346.5	221.2	87.0	71.0	55.3
Max:	48.4	70.5	167.7	454.9	312.6	119.3	90.9	65.2
Min:	41.6	43.2	54.0	187.0	130.8	66.5	55.7	48.9

Upper Blacktail Deer Creek Gaging Station (06017500)
1996 Mean Daily Streamflow
Discharge (cubic feet per second)

Day	Apr	May	Jun	Jul	Aug	Sep
1		68.3	173.6	127.3	53.0	34.1
2		68.5	166.1	114.1	47.3	34.6
3		75.9	172.2	113.1	46.0	35.3
4		74.2	188.3	103.5	47.9	35.1
5		69.5	213.9	103.3	46.7	36.2
6		69.3	225.4	95.8	44.2	37.0
7		66.9	218.7	86.3	44.2	36.6
8		67.3	222.2	82.5	41.8	35.9
9		69.3	238.0	78.7	39.9	36.0
10		69.0	247.2	71.9	38.6	36.6
11	130.3	69.3	257.3	64.0	37.7	36.8
12	98.2	73.2	254.5	64.0	37.2	38.1
13	74.7	83.4	246.5	63.3	36.5	37.5
14	73.3	100.0	239.0	60.2	39.5	38.3
15	70.9	121.0	243.8	59.1	43.5	39.1
16	70.4	136.5	232.8	72.2	39.2	41.6
17	74.9	158.6	220.0	78.7	37.9	47.0
18	74.2	153.7	207.1	76.3	38.2	43.1
19	68.6	147.9	194.7	72.6	38.3	42.9
20	70.8	131.4	182.1	71.7	36.9	42.5
21	77.4	113.5	174.0	68.5	35.6	41.8
22	80.7	127.5	177.4	66.4	36.2	41.3
23	75.1	171.9	193.9	64.5	35.5	43.6
24	80.5	168.9	173.3	65.1	34.4	46.7
25	96.0	150.6	162.2	61.1	34.0	46.8
26	81.4	135.3	153.9	60.0	34.1	47.4
27	77.3	166.7	148.6	59.9	33.6	47.4
28	75.7	179.9	149.2	57.6	37.0	46.6
29	74.4	184.6	148.9	57.0	38.9	44.8
30	72.5	197.4	136.2	60.5	37.4	43.1
31		193.0		58.3	35.5	
Total:	1597.3	3662.5	5961.0	2337.5	1226.7	1213.8
Mean:	79.9	118.1	198.7	75.4	39.6	40.5
Max:	130.3	197.4	257.3	127.3	53.0	47.4
Min:	68.6	66.9	136.2	57.0	33.6	34.1

Appendix D2. Streamflow Rating Curves

Beaverhead River at Barretts Gaging Station

Discharge (cfs) for a Given Gage Height (feet)

Gage Hgt (ft)	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
.30										74.50
.40	75.84	77.19	78.55	79.93	81.33	82.74	84.16	85.60	87.05	88.52
.50	90.00	91.66	93.33	95.03	96.75	98.48	100.2	102.0	103.8	105.6
.60	107.5	109.3	111.2	113.1	115.0	117.1	119.3	121.5	123.7	126.0
.70	128.3	130.6	132.9	135.3	137.7	140.1	142.6	145.0	147.6	150.1
.80	152.7	155.2	157.9	160.5	163.2	165.9	168.7	171.4	174.2	177.1
.90	179.9	182.8	185.8	188.7	191.7	194.7	197.8	200.9	204.0	207.2
1.00	210.3	213.6	216.8	220.1	223.4	226.8	230.1	233.6	237.0	240.5
1.10	244.0	247.6	251.1	254.8	258.4	262.1	265.8	269.6	273.4	277.2
1.20	281.1	285.0	289.0	292.9	296.9	301.0	305.3	309.6	313.9	318.3
1.30	322.8	327.2	331.8	336.3	340.9	345.6	350.3	355.0	359.8	364.6
1.40	369.5	374.4	379.3	384.3	389.4	394.5	399.6	404.8	410.0	415.3
1.50	420.6	425.9	431.4	436.8	442.3	447.9	453.5	459.1	464.8	470.6
1.60	476.4	482.2	488.1	494.0	500.0	506.1	512.1	518.3	524.5	530.7
1.70	537.0	544.0	551.1	558.2	565.4	572.7	580.0	587.4	594.9	602.4
1.80	610.0	617.0	624.0	631.1	638.2	645.4	652.6	659.9	667.3	674.7
1.90	682.2	689.7	697.3	704.9	712.6	720.4	728.2	736.0	744.0	752.0
2.00	760.0	766.2	772.5	778.7	785.0	791.4	797.7	804.1	810.5	817.0
2.10	823.5	830.0	836.5	843.1	849.7	856.4	863.0	869.7	876.5	883.2
2.20	890.0	896.3	902.6	908.9	915.2	921.6	928.0	934.4	940.8	947.3
2.30	953.8	960.3	966.8	973.4	980.0	986.6	993.2	999.9	1007	1013
2.40	1020	1026	1033	1039	1045	1052	1058	1065	1071	1077
2.50	1084	1090	1097	1104	1110	1117	1123	1130	1137	1143
2.60	1150	1156	1162	1168	1174	1180	1186	1192	1198	1205
2.70	1211	1217	1223	1229	1235	1242	1248	1254	1260	1267
2.80	1273	1279	1285	1292	1298	1304	1311	1317	1324	1330
2.90	1336	1343	1349	1356	1362	1369	1375	1382	1388	1395
3.00	1401	1408	1415	1421	1428	1435	1441	1448	1455	1461
3.10	1468	1475	1481	1488	1495	1502	1509	1515	1522	1529
3.20	1536	1543	1550	1557	1563	1570	1577	1584	1591	1598
3.30	1605	1612	1619	1626	1633	1640	1648	1655	1662	1669
3.40	1676	1683	1690	1698	1705	1712	1719	1726	1734	1741
3.50	1748	1756	1763	1770	1778	1785	1792	1800	1807	1814
3.60	1822	1829	1837	1844	1852	1859	1867	1874	1882	1889
3.70	1897	1905	1912	1920	1927	1935	1943	1950	1958	1966
3.80	1973	1981	1989	1997	2004	2012	2020	2028	2036	2043
3.90	2051	2059	2067	2075	2083	2091	2099	2107	2115	2123
4.00	2131	2139	2147	2155	2163	2171	2179	2187	2195	2203
4.10	2211	2219	2228	2236	2244	2252	2260	2269	2277	2285
4.20	2293	2302	2310	2318	2327	2335	2343	2352	2360	2368
4.30	2377	2385	2394	2402	2411	2419	2428	2436	2445	2453
4.40	2462	2470	2479	2487	2496	2505	2513	2522	2531	2539
4.50	2548	2557	2565	2574	2583	2592	2600	2609	2618	2627
4.60	2636	2644	2653	2662	2671	2680	2689	2698	2707	2716
4.70	2725	2734	2743	2752	2761	2770	2779	2788	2797	2806
4.80	2815	2824	2833	2842	2852	2861	2870	2879	2888	2898
4.90	2907	2916	2925	2935	2944	2953	2963	2972	2981	2991

Beaverhead River at Dillon Gaging Station

Relationship Based on 1964 USGS Rating and 1992 and 1993 Measurements

Discharge (cfs) for a Given Gage Height (feet)

Gage Hgt (ft)	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
2.0	10.4	10.7	11.0	11.3	11.6	11.9	12.2	12.5	12.9	13.2
2.1	13.6	13.9	14.3	14.6	15.0	15.4	15.8	16.2	16.6	17.0
2.2	17.4	17.9	18.3	18.8	19.2	19.7	20.2	20.7	21.2	21.7
2.3	22.2	22.7	23.3	23.8	24.4	24.9	25.5	26.1	26.7	27.3
2.4	27.9	28.6	29.2	29.9	30.6	31.3	32.0	32.7	33.4	34.1
2.5	34.9	35.6	36.4	37.2	38.0	38.8	39.7	40.5	41.4	42.2
2.6	43.1	44.0	45.0	45.9	46.9	47.9	48.9	49.9	50.9	52.0
2.7	53.0	54.1	55.2	56.4	57.5	58.7	59.9	61.1	62.3	63.5
2.8	64.8	66.1	67.4	68.7	70.1	71.4	72.8	74.2	75.7	77.1
2.9	78.6	80.1	81.6	83.2	84.7	86.3	88.0	89.6	91.3	93.0
3.0	94.7	96.4	98.2	100	102	104	106	108	109	111
3.1	113	115	117	120	122	124	126	128	130	133
3.2	135	137	140	142	145	147	150	152	155	157
3.3	160	163	165	168	171	174	177	180	182	185
3.4	189	192	195	198	200	202	204	207	209	211
3.5	214	216	218	221	223	226	228	231	233	236
3.6	238	241	243	246	248	251	254	256	259	262
3.7	265	267	270	273	276	279	281	284	287	290
3.8	293	296	299	302	305	308	311	314	317	321
3.9	324	327	330	333	337	340	343	347	350	353
4.0	357	360	364	367	371	374	378	381	385	389
4.1	392	396	400	403	407	411	415	419	423	426
4.2	430	434	438	442	446	450	454	459	463	467
4.3	471	475	480	484	488	492	497	501	506	510
4.4	515	519	524	528	533	537	542	547	551	556
4.5	561	566	571	575	580	585	590	595	600	605
4.6	610	615	621	626	631	636	641	647	652	657
4.7	663	668	674	679	685	690	696	702	707	713
4.8	719	724	730	736	742	748	754	760	766	772
4.9	778	784	790	796	803	809	815	821	828	834

Lower Blacktail Deer Creek Gaging Station at I-15 exit 62

Relationship Based on 1994 and 1995 Measurements

Discharge (cfs) for a Given Gage Height (feet)

Gage Hgt (ft)	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
1.0	18.5	18.9	19.2	19.6	19.9	20.3	20.7	21.1	21.4	21.8
1.1	22.2	22.6	23.0	23.4	23.8	24.2	24.6	25.0	25.4	25.8
1.2	26.2	26.7	27.1	27.5	27.9	28.4	28.8	29.3	29.7	30.1
1.3	30.6	31.0	31.5	32.0	32.4	32.9	33.4	33.8	34.3	34.8
1.4	35.3	35.7	36.2	36.7	37.2	37.7	38.2	38.7	39.2	39.7
1.5	40.2	40.8	41.3	41.8	42.3	42.9	43.4	43.9	44.5	45.0
1.6	45.5	46.1	46.6	47.2	47.8	48.3	48.9	49.4	50.0	50.6
1.7	51.2	51.7	52.3	52.9	53.5	54.1	54.7	55.3	55.9	56.5
1.8	57.1	57.7	58.3	58.9	59.5	60.2	60.8	61.4	62.0	62.7
1.9	63.3	64.0	64.6	65.3	65.9	66.6	67.2	67.9	68.5	69.2
2.0	69.9	70.5	71.2	71.9	72.6	73.2	73.9	74.6	75.3	76.0
2.1	76.7	77.4	78.1	78.8	79.5	80.3	81.0	81.7	82.4	83.1
2.2	83.9	84.6	85.3	86.1	86.8	87.6	88.3	89.1	89.8	90.6
2.3	91.3	92.1	92.9	93.6	94.4	95.2	95.9	96.7	97.5	98.3
2.4	99.1	99.9	101	101	102	103	103	104	105	105
2.5	106	107	107	108	109	109	110	111	111	112
2.6	113	113	114	115	115	116	117	117	118	119
2.7	119	120	121	121	122	123	124	124	125	126
2.8	126	127	128	128	129	130	131	131	132	133
2.9	133	134	135	135	136	137	138	138	139	140
3.0	141	141	142	143	143	144	145	146	146	147
3.1	148	149	149	150	151	152	152	153	154	155
3.2	155	156	157	158	158	159	160	161	161	162
3.3	163	164	164	165	166	167	168	168	169	170
3.4	171	171	172	173	174	175	175	176	177	178
3.5	178	179	180	181	182	182	183	184	185	186
3.6	186	187	188	189	190	190	191	192	193	194
3.7	195	195	196	197	198	199	199	200	201	202
3.8	203	204	204	205	206	207	208	209	209	210
3.9	211	212	213	214	214	215	216	217	218	219
4.0	219	220	221	222	223	224	225	225	226	227
4.1	228	229	230	231	231	232	233	234	235	236
4.2	237	238	238	239	240	241	242	243	244	245
4.3	246	246	247	248	249	250	251	252	253	254
4.4	254	255	256	257	258	259	260	261	262	263

Middle Blacktail Deer Creek Gaging Station at East Bench Irrigation District Canal

Relationship Based on 1993 through 1995 Measurements

Discharge (cfs) for a Given Gage Height (feet)

Gage Hgt (ft)	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.118
0.4	0.175	0.233	0.290	0.347	0.405	0.462	0.519	0.577	0.634	0.692
0.5	0.749	0.827	0.915	1.01	1.11	1.23	1.35	1.48	1.62	1.77
0.6	1.93	2.10	2.29	2.48	2.70	2.92	3.16	3.42	3.70	3.99
0.7	4.30	4.63	4.98	5.35	5.74	6.15	6.59	7.06	7.55	8.06
0.8	8.61	9.19	9.79	10.4	11.1	11.8	12.5	13.3	14.1	15.0
0.9	15.9	16.8	17.8	18.9	19.7	20.1	20.5	21.0	21.4	21.8
1.0	22.3	22.8	23.2	23.7	24.2	24.6	25.1	25.6	26.1	26.6
1.1	27.1	27.6	28.1	28.6	29.1	29.6	30.2	30.7	31.2	31.8
1.2	32.3	32.9	33.4	34.0	34.5	35.1	35.7	36.3	36.8	37.4
1.3	38.0	38.4	39.1	39.8	40.5	41.2	41.9	42.6	43.3	44.1
1.4	44.8	45.5	46.3	47.0	47.8	48.6	49.4	50.1	50.9	51.7
1.5	52.5	53.3	54.2	55.0	55.8	56.7	57.5	58.4	59.2	60.1
1.6	61.0	61.9	62.8	63.7	64.6	65.5	66.4	67.3	68.3	69.2
1.7	70.2	71.1	72.1	73.0	74.0	75.0	76.0	77.0	78.0	79.0
1.8	80.1	81.1	82.1	83.2	84.2	85.3	86.4	87.4	88.5	89.6
1.9	90.7	91.8	92.9	94.1	95.2	96.3	97.5	98.6	99.8	101
2.0	102	103	105	106	107	108	109	111	112	113
2.1	114	116	117	118	119	121	122	123	125	126
2.2	127	129	130	131	133	134	135	137	138	140
2.3	141	142	144	145	147	148	150	151	153	154
2.4	156	157	159	160	162	163	165	166	168	169
2.5	171	173	174	176	177	179	181	182	184	186
2.6	187	189	191	192	194	196	197	199	201	203
2.7	204	206	208	210	211	213	215	217	219	220

Upper Blacktail Deer Creek Gaging Station (Gage No. 06017500)

Relationship Based on 1992 through 1995 Measurements
Discharge (cfs) for a Given Gage Height (feet)

Gage Hgt (ft)	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.5	0.60	0.64	0.69	0.74	0.79	0.85	0.90	0.96	1.03	1.09
0.6	1.16	1.23	1.31	1.38	1.47	1.55	1.64	1.73	1.83	1.92
0.7	2.03	2.13	2.24	2.36	2.48	2.60	2.73	2.86	3.00	3.14
0.8	3.29	3.44	3.59	3.76	3.92	4.09	4.27	4.45	4.64	4.83
0.9	5.03	5.24	5.45	5.67	5.89	6.12	6.36	6.60	6.85	7.11
1.0	7.37	7.64	7.92	8.20	8.49	8.79	9.10	9.41	9.74	10.1
1.1	10.4	10.8	11.1	11.5	11.8	12.2	12.6	13.0	13.4	13.8
1.2	14.3	14.7	15.2	15.6	16.1	16.6	17.1	17.5	18.1	18.6
1.3	19.1	19.6	20.2	20.8	21.3	21.9	22.5	23.1	23.7	24.4
1.4	25.0	25.7	26.3	27.0	27.7	28.4	29.1	29.8	30.6	31.3
1.5	32.1	32.9	33.7	34.5	35.3	36.2	37.0	37.9	38.8	39.7
1.6	40.6	41.5	42.5	43.4	44.4	45.4	46.4	47.4	48.5	49.5
1.7	50.6	51.7	52.8	53.9	55.0	56.2	57.4	58.6	59.8	61.0
1.8	62.2	63.5	64.8	66.1	67.4	68.8	70.1	71.5	72.9	74.3
1.9	75.7	77.2	78.7	80.2	81.7	83.2	84.8	86.4	88.0	89.6
2.0	91.2	92.9	94.6	96.3	98.0	99.8	102	103	105	107
2.1	109	111	113	115	117	119	121	123	125	127
2.2	129	131	133	135	138	140	142	144	147	149
2.3	150	152	154	155	157	159	161	162	164	166
2.4	168	170	171	173	175	177	179	181	183	185
2.5	186	188	190	192	194	196	198	200	202	204
2.6	206	208	210	213	215	217	219	221	223	225
2.7	227	230	232	234	236	238	241	243	245	248
2.8	250	252	254	257	259	261	264	266	269	271
2.9	273	276	278	281	283	286	288	291	293	296
3.0	299	301	304	306	309	312	314	317	320	322
3.1	325	328	330	333	336	339	341	344	347	350
3.2	353	355	358	361	364	367	370	373	376	379
3.3	382	385	388	391	394	397	400	403	406	409
3.4	412	416	419	422	425	428	431	435	438	441

Appendix D3. Beaverhead River Stages at Well and Piezometer Sites

Beaverhead River Stage
at Staff Gage at Piezometers
#2, #3, #5 & #6, Sec 17, T8S, R9W

date	stage (ft)
May 12, 1994	5,240.70
Jun 14, 1994	5,240.27
Jul 07, 1994	5,240.25
Jul 28, 1994	5,240.77
Aug 18, 1994	5,239.56
Sep 07, 1994	5,239.27
Sep 30, 1994	5,239.48
Oct 26, 1994	5,239.52
Nov 21, 1994	5,239.57
Dec 22, 1994	5,239.37
Jan 23, 1995	5,239.97
Feb 24, 1995	5,239.79
Mar 22, 1995	5,239.63
May 18, 1995	5,240.69
Jun 28, 1995	5,242.36
Jul 19, 1995	5,242.07
Aug 08, 1995	5,242.05
Aug 28, 1995	5,242.09
Sep 14, 1995	5,241.51
Oct 23, 1995	5,242.05
Nov 14, 1995	5,241.81
Dec 14, 1995	5,241.62
Apr 24, 1996	5,241.23
Jul 18, 1996	5,241.57

Beaverhead River Stage
at Staff Gage at Wells #92-32
and #92-33, Sec 16, T8S, R9W

date	stage (ft)
May 11, 1994	5220.73
May 27, 1994	5220.51
Jun 14, 1994	5219.98
Jul 07, 1994	5220.08
Jul 28, 1994	5220.55
Aug 18, 1994	5218.77
Sep 07, 1994	5219.23
Sep 30, 1994	5219.24
Oct 27, 1994	5219.44
Nov 21, 1994	5219.67
Dec 22, 1994	5219.38
Jan 23, 1995	5219.87

Beaverhead River Stage
at Staff Gage at Piezometers
#9 and #10, Sec 9, T8S, R9W

date	stage (ft)
May 12, 1994	5199.63
Jun 14, 1994	5198.81
Jul 07, 1994	5198.92
Jul 28, 1994	5199.27
Aug 18, 1994	5197.36
Sep 07, 1994	5197.82
Sep 30, 1994	5197.86
Oct 26, 1994	5198.12
Nov 21, 1994	5197.90
Dec 22, 1994	5198.18

Poindexter Slough Stage at Staff Gage at Piezometers #11 and #12, Sec 3, T8S, R9W

date	stage (ft)
May 12, 1994	5173.55
Jun 14, 1994	5173.51
Sep 07, 1994	5173.60
Sep 29, 1994	5173.55
Oct 27, 1994	5173.47
Nov 21, 1994	5173.43
Dec 22, 1994	5173.32
Jan 23, 1995	5172.70
Feb 24, 1995	5172.97
Mar 22, 1995	5173.36
Apr 20, 1995	5173.36
May 18, 1995	5173.42
Jun 28, 1995	5174.17
Jul 19, 1995	5174.02
Aug 08, 1995	5173.98
Nov 14, 1995	5173.90
Dec 14, 1995	5174.19

Beaverhead River Stage at Staff Gage at Piezometers #13 and #14, Sec 3, T8S, R9W

date	stage (ft)
May 11, 1994	5174.73
Jun 14, 1994	5176.32
Jul 07, 1994	5176.63
Jul 28, 1994	5177.01
Aug 18, 1994	5175.64
Sep 07, 1994	5175.80
Sep 30, 1994	5175.81
Oct 26, 1994	5175.83
Nov 21, 1994	5176.11
Jun 28, 1995	5179.11

Beaverhead River Stage at Staff Gage near the Tash Well, Sec 34, T7S, R9W

date	stage (ft)
May 11, 1994	5154.40
May 27, 1994	5154.04
Jun 14, 1994	5153.62
Jul 07, 1994	5153.90
Aug 18, 1994	5152.93
Sep 07, 1994	5153.14
Sep 29, 1994	5152.99
Oct 26, 1994	5153.07
Nov 21, 1994	5153.35
Dec 22, 1994	5152.84
Feb 24, 1995	5152.73
May 18, 1995	5153.30
Jun 28, 1995	5155.24
Jul 19, 1995	5155.14
Aug 08, 1995	5154.99
Aug 28, 1995	5155.08
Sep 14, 1995	5154.58
Oct 23, 1995	5154.12
Nov 14, 1995	5155.06
Dec 14, 1995	5154.66
Apr 24, 1996	5154.28
Jul 18, 1996	5154.56

Beaverhead River Stage at Staff Gage at Piezometers #15 and #16, Sec 27, T7S, R9W

date	stage (ft)
Aug 18, 1994	5141.75
Sep 29, 1994	5141.49
Oct 26, 1994	5141.41
Nov 21, 1994	5141.50
Dec 22, 1994	5141.40
May 18, 1995	5142.11

Beaverhead River Stage at Staff Gage at Piezometers #19 and #20, Sec 23, T7S, R9W

date	stage (ft)
May 11, 1994	5116.58
Jun 14, 1994	5116.16
Jul 07, 1994	5116.47
Aug 18, 1994	5115.90
Sep 07, 1994	5115.91
Sep 29, 1994	5115.80
Oct 26, 1994	5115.85
Nov 21, 1994	5116.01
Dec 22, 1994	5115.89
Feb 24, 1995	5116.16
Mar 22, 1995	5115.97
May 18, 1995	5116.60
Apr 24, 1996	5117.20
Jul 18, 1996	5116.57

Beaverhead River Stage at Staff Gage at Well #92-30 Sec 24, T7S, R9W

date	stage (ft)
Apr 01, 1992	5092.87
May 15, 1992	5092.97
Jun 09, 1992	5093.31
Jul 09, 1992	5093.31
Aug 19, 1992	5093.65
Oct 15, 1992	5093.35
Nov 13, 1992	5093.40
Apr 28, 1993	5092.80
Jun 25, 1993	5093.55
Jul 21, 1993	5093.46
Aug 05, 1993	5093.25
Aug 26, 1993	5093.49
Sep 08, 1993	5093.43
Sep 22, 1993	5093.67
Oct 06, 1993	5092.98
Apr 22, 1994	5093.35
May 11, 1994	5093.37
Jun 22, 1994	5093.35
Jul 11, 1994	5092.80
Jul 20, 1994	5093.51
Aug 18, 1994	5092.97
Sep 01, 1994	5093.27
Sep 14, 1994	5093.12
Sep 29, 1994	5093.05
Oct 13, 1994	5093.11
Oct 26, 1994	5093.25
Nov 21, 1994	5093.19
Dec 22, 1994	5093.20
Mar 22, 1995	5093.09
Apr 06, 1995	5093.27
Apr 20, 1995	5093.14
May 04, 1995	5093.33
May 18, 1995	5093.65
Jun 01, 1995	5093.77
Jun 15, 1995	5095.49
Jul 12, 1995	5095.88
Jul 27, 1995	5095.37
Aug 23, 1995	5095.33
Sep 07, 1995	5095.26
Sep 21, 1995	5095.07
May 23, 1996	5094.86
Jun 17, 1996	5094.12
Jul 19, 1996	5093.84
Aug 16, 1996	5093.91
Sep 13, 1996	5093.41
Oct 03, 1996	5093.35

Appendix D4. Beaverhead River and EBID Canal Synoptic Seepage Measurements

Beaverhead River Synoptic Seepage Measurements

Measuring Location	Miles Downstream	Streamflow (cfs) on 10/28/93	Streamflow (cfs) on 3/10/94
near Barretts gaging station	0.05	148	198
near Barretts Minerals, Inc.	1.08		191
near wells 92-23 & 92-24	3.76	143	190
near railroad bridge	5.99	121	145
above Poindexter Slough	8.62	124	138
near Dillon gaging station	11.93	213	245

East Bench Irrrigation District Canal Synoptic Seepage Measurements

Measuring Location	Miles Downstream	Streamflow (cfs) on 7/22/93	Streamflow (cfs) on 8/26/93	Streamflow (cfs) on 10/1/93	Streamflow (cfs) on 10/4/95
near EBID Canal flume	0.05	250	225	135	132
near EBID Canal bridge #1	0.70		223		
near EBID Canal bridge #2	1.49	232	211	135	126
near EBID Canal bridge #3	2.23				139
boat (NE Sec.22, T8S,R9W)	2.97			130	
near Carrigan Lane bridge	3.52	209	187	130	136
near EBID Canal bridge #5	4.73				132
near EBID Canal bridge #6	7.38	210	191		

Appendix E

Water Quality

Appendix E1. Inventory of Water Quality

Field Parameters

Site Name	Site Id#	Location	Sample Date	Water TmpEC	Cond @ 25EC (µmhos/cm)	Field pH	Hardness (mg/l)	TDS (mg/l)
Groundwater Quality of Beaverhead River valley								
92-16	M:133382	07S 09W 24 CBDB	Aug 27,1993	11.0	530	7.48	173.59	338.79
92-17	M:133384	07S 08W 19 BADD	Aug 23,1993	12.5	504	7.78	116.28	364.69
92-18	M:133386	07S 08W 19 BADD	Aug 23,1993	11.5	694	7.36	325.11	440.15
92-19	M:133387	07S 09W 26 CDAD	Aug 26,1993	10.0	583	7.63	272.75	354.48
92-20	M:133390	07S 09W 26 CDAD	Aug 26,1993				337.60	445.03
92-21	M:133392	08S 09W 03 DACC	Sep 02,1993	14.4	478	7.65	149.88	357.23
92-22	M:133394	08S 09W 03 DACC	Sep 02,1993	10.9	629	7.50	296.03	382.89
92-23	M:133395	08S 09W 09 ADDB	Aug 28,1993	9.4	688	7.38	308.17	429.52
92-24	M:133396	08S 09W 09 ADDB	Aug 28,1993	9.5	770	7.32	350.86	482.88
92-25	M:133397	08S 09W 17 DCBA	Sep 14,1993	9.2	645	7.75	296.86	407.80
92-28	M:133400	07S 09W 23 CACD	Aug 27,1993	10.0	505	7.75	227.34	326.55
92-29	M:133402	07S 09W 23 CACD	Aug 27,1993	10.0	673	7.38	310.86	415.35
92-30	M:133403	07S 09W 24 BABA	Sep 15,1993	11.8	719	7.20	329.99	445.40
92-32	M:133406	08S 09W 16 BDAC	Sep 01,1993	10.3	523	7.66	279.03	364.22
92-33	M:133409	08S 09W 16 BDAC	Sep 01,1993	14.0	542	7.51	271.89	384.96
Dawson	M:109840	08S 09W 03 BDDD	Dec 04,1993	9.8		7.07	401.77	496.69
Dillon #1	M:149185	07S 09W 23 BDAA	Aug 22,1991	9.6	700	7.30	329.25	448.94
Dillon #3	M:109444	07S 08W 18 CDCC	Aug 21,1991	9.0	719	7.23	340.86	440.57
Intermtn Irrig.Co	M:145389	07S 08W 18 BDCB	Nov 14,1993	7.1		7.44	512.46	602.56
Mooney	M:126665	08S 09W 10 CDBB	Nov 14,1993	6.4		7.82	362.10	480.90
Rebich	M:125143	08S 09W 15 CBAB	Nov 14,1993	6.0		8.05	474.79	623.75
Tash	M:109703	07S 09W 34 ACDC	Dec 04,1993	9.6		7.14	343.35	451.76
Tash stock	M:109668	07S 09W 34 BBAB	Dec 03,1993	10.0		7.27	324.11	379.68
Groundwater Quality of Blacktail Deer Creek valley								
91-1	M:126669	09S 08W 10 BCDC	Aug 24,1993	8.4	547	7.43	248.06	312.04
91-2	M:126666	08S 08W 33 CDBB	Aug 25,1993	10.6	534	7.31	245.35	307.50
91-3	M:126662	08S 08W 28 CBDA	Aug 25,1993	9.8	680	7.30	323.02	418.00
91-4	M:126664	08S 08W 32 CCAB	Sep 03,1993	10.8	547	7.49	261.84	326.96
91-5	M:126663	08S 08W 30 AAAA	Sep 03,1993	9.2	650	7.41	326.56	392.28
91-6	M:126661	08S 08W 18 DCCD	Sep 03,1993	8.1	547	7.56	262.53	330.52
91-7	M:133329	08S 09W 01 DDAA	Aug 26,1993	9.4	564	7.59	267.22	341.20
92-1	M:131129	09S 08W 14 CDAD	Aug 24,1993	11.8	641	7.46	288.57	409.68
92-2	M:131130	09S 08W 14 CDAD	Aug 24,1993	9.6	566	7.37	273.71	346.01
92-4	M:131122	08S 08W 32 DABD	Aug 25,1993	9.9	562	7.38	270.33	339.75
92-5	M:133332	08S 08W 20 ACCA	Sep 15,1993	10.2	537	7.47	250.77	344.45
92-6	M:133371	08S 08W 31 CCAA	Sep 01,1993	15.0	632	7.41	280.26	410.31
92-7	M:133372	09S 08W 07 DBDC	Aug 31,1993	21.7	647	7.41	312.57	432.40
92-8	M:133373	08S 08W 30 CCCC	Aug 31,1993	14.7	632	7.63	248.98	415.56
92-9	M:133374	08S 08W 30 CCCC	Sep 01,1993	13.7	635	7.42	286.96	413.59
92-10	M:133375	08S 09W 23 DADD	Sep 02,1993	10.8	582	7.54	266.19	357.68
92-11	M:133376	08S 09W 23 DADD	Sep 02,1993	10.8	677	7.51	310.83	428.34
92-12	M:133377	08S 09W 14 ABDD	Apr 13,1994	14.0	390	7.81	115.07	307.16

Field Parameters

Groundwater Quality of Blacktail Deer Creek valley (cont.)

Site Name	Site Id#	Location	Sample Date	Water TmpEC	Cond @ 25EC (µmhos/cm)	Field pH	Hardness (mg/l)	TDS (mg/l)
92-13	M:133378	08S 09W 14 ABDD	Apr 13,1994				321.48	386.76
92-14	M:140582	08S 08W 06 CBDD	Apr 14,1994	8.2	561	7.24	278.71	347.66
92-15	M:133380	07S 08W 31 BCAD	Apr 14,1994	14.0	384	7.43	155.80	279.89
Casey	M:109904	08S 09W 14 CBBB	Sep 15,1993	11.3	649	7.48	296.34	407.85
Cornell	M:109658	07S 09W 25 AADD	Nov 14,1993	7.8		7.63	355.00	432.92
Downey	M:109659	07S 09W 25 ACAB	Nov 14,1993	5.9		7.78	393.75	471.77
Eberline	M:145386	07S 09W 35 ACBD	Nov 14,1993	6.3		7.75	331.13	400.51
Forrester	M:109803	08S 08W 20 ACCA	Aug 20,1991	9.6	519	7.45	242.87	326.30
Hemsley	M:109940	08S 09W 24 BBBC	Dec 09,1993	7.9		7.23	321.06	385.83
High Mtn stock	M:109794	08S 08W 07 DCCC	Dec 10,1993	8.8		7.39	297.35	341.47
High Mtn #1	M:109796	08S 08W 07 DDDD	Aug 21,1991	8.4	517	7.52	247.12	315.59
Humphrey	M:109789	08S 08W 06 ADDD	Dec 10,1993	8.9		7.23	479.32	576.41
Laden Irrig	M:109901	08S 09W 14 ABDD	Apr 03,1987				309.36	380.44
Matador #16	M:110037	09S 08W 07 DBDB	Aug 20,1991	22.1	640	7.40	288.69	420.96
Meine	M:131128	08S 09W 24 DCDC	Dec 10,1993	9.3		7.14	314.38	220.54
Ripley	M:109795	08S 08W 07 DAAC	Dec 09,1993	8.4		7.18	284.08	333.00
Svendsen	M:121424	07S 08W 30 CADC	Dec 03,1993	9.4		7.54	347.27	434.30
Zenchiku #4	M:109941	08S 09W 24 CCCC	Aug 21,1991	12.5	614	7.40	266.22	386.62
Zenchiku #5	M:149188	08S 09W 14 CDDD	Aug 21,1991	10.1	670	7.90	294.43	412.78

Groundwater Quality of Rattlesnake Creek valley

Site Name	Site Id#	Location	Sample Date	Water TmpEC	Cond @ 25EC (µmhos/cm)	Field pH	Hardness (mg/l)	TDS (mg/l)
92-26	M:133398	07S 09W 33 DAAA	Sep 14,1993	10.4	765	7.57	346.89	482.95
92-27	M:133399	07S 09W 33 CBDD	Sep 14,1993	9.1	294	7.55	142.59	170.44
Boka	M:109869	08S 09W 08 DDCB	Dec 04,1993	10.7		7.07	348.11	449.99
Holland	M:145396	07S 10W 25 AAAB	Dec 10,1993	10.2		7.65	321.06	251.74
Holland stock	M:109683	07S 09W 31 DAAA	Dec 10,1993	8.3		7.33	207.26	254.15
Rawson	M:123858	07S 10W 15 ADDC	Dec 10,1993	9.3		7.21	217.08	276.08
Rice	M:109872	08S 09W 09 BCDD	Dec 04,1993	10.4		7.22	368.77	469.47
Stewart	M:109675	07S 09W 28 CDAC	Dec 10,1993	16.4		7.31	362.77	417.06
Yuhas	M:109858	08S 09W 08 ABCA	Dec 04,1993	14.1		7.48	339.59	440.26

Surface Water Quality

Site Name	Site Id#	Location	Sample Date	Water TmpEC	Cond @ 25EC (µmhos/cm)	Field pH	Hardness (mg/l)	TDS (mg/l)
Bvhd-Barr. gage	M:141429	08S O9W 19 DCD	May 04,1994	11.0	545	8.50	250.93	347.63
Bvhd-Barr.diver	M:147979	08S 09W 17 CCDC	Dec 06,1993	1.0			285.11	365.92
Bvhd slough	M:136770	07S 09W 26 DBCCD	Aug 26,1993	13.0	900	7.90	437.75	566.03
Bvhd-Dillon gage	M:147977	07S 09W 24 BABA	Dec 06,1993				298.48	380.84
BT-EBID Canal	M:136464	08S 08W 06 CADAA	Aug 25,1993	14.6	503	8.76	241.16	293.62
BT- upper gage	M:135835	09S 08W 14 CDAD	Aug 24,1993	13.0	517	8.45	253.36	314.38
Connover spgs	M:149187	09S 08W 18 ABBD	Aug 20,1991	20.5	660	7.40	292.07	434.91

Major Chemical Constituents

Site Name	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Bicarbonate mg/l	Carbonate mg/l	Silica mg/l	Sulfate mg/l	Chloride mg/l
Groundwater Quality of Beaverhead River valley									
92-16	50.4	11.6	40.4	8.2	220	0	30.4	79.4	8.8
92-17	37.5	5.5	55.0	13.2	230	0	73.5	59.1	6.7
92-18	88.0	25.6	19.2	6.6	307	0	35.7	98.6	13.9
92-19	72.8	22.1	14.5	5.1	272	0	24.4	71.0	9.4
92-20	90.2	27.3	21.2	5.8	308	0	22.9	111.0	13.3
92-21	44.2	9.6	36.9	12.0	174		72.1	85.7	10.0
92-22	78.5	24.3	17.1	4.3	276		21.0	89.3	10.6
92-23	82.7	24.7	25.5	4.2	267	0	19.5	125.0	15.0
92-24	93.7	28.4	30.0	4.9	286	0	19.9	143.0	18.6
92-25	78.5	24.5	25.1	3.8	266	0	19.4	113.0	11.8
92-28	65	15.8	13.3	4.3	210	0	38.7	72	11.8
92-29	87.9	22.2	22.1	4.3	290	0	24.8	90.8	17.2
92-30	86	28	23.4	5.5	321		28.2	102	13.4
92-32	74	22.9	16.1	3.2	238		21.7	94.9	13.2
92-33	68.5	24.5	25.7	4.5	256		22.7	100.0	12.1
Dawson	107.0	32.7	29.4	7.87	270.7		11.1	158.17	15.54
Dillon #1	89	26	21	5.2	268.23		28	130	17
Dillon #3	92	27	23	5.7	315.78	0	26	95	16
Intermtn Irrig. Co	136.0	42.0	58.4	7.71	414.53		15.8	112.51	15.83
Mooney	98.2	28.4	28.6	7.22	319.4		12.6	133.9	13.6
Rebich	128.0	37.7	38.0	7.87	295.1	0	12.4	239.2	14.5
Tash	93.0	27.0	26.1	7.2	312.1		10.7	114.34	18.55
Tash stock	87.6	25.6	15.2	6.32	229.2		11.1	109.4	10.15
Groundwater Quality of Blacktail Deer Creek valley									
91-1	67.2	19.5	10.7	4.5	245	0	20.7	59.6	8.5
91-2	67.6	18.6	9.3	4.4	243	0	25.6	55.0	6.7
91-3	87	25.7	20.1	4.9	314	0	24.9	79.7	16.2
91-4	71.4	20.3	14.6	3.4	273		16.6	55.9	8.9
91-5	89.9	24.8	10.9	4.5	291	0	25.3	75.2	10.6
91-6	69.7	21.5	10.9	4.0	261		26.1	60.2	8.7
91-7	72.4	21.0	12.1	5.0	271	0	29.2	56.9	9.7
92-1	76.5	23.7	18.0	9.1	318	0	50.6	57.8	16.9
92-2	75	21.0	11.5	4.3	277	0	24.9	64.0	8.3
92-4	74.8	20.3	10.6	4.2	280	0	22.6	61.8	6.8
92-5	64.0	22.1	15.1	6.1	259		40.5	57.1	11.2
92-6	76.8	21.5	26.3	5.0	231		20.7	135.0	9.9
92-7	87.1	23.1	22.7	4.4	236	0	15.5	152.0	10.2
92-8	64.6	21.3	37.1	5.7	207	0	26.8	145.0	11.7
92-9	78.0	22.4	25.6	5.9	234	0	20.4	134.0	10.4
92-10	71.0	21.6	20.6	4.3	262		18.9	81.5	9.1
92-11	83.6	24.8	25.9	4.5	256		18.7	124.0	18.6
92-12	32.4	8.3	34.2	10.2	174	0	80.7	47.2	6.9
92-13	84.9	26.6	13.9	4.2	304	0	22.8	71.8	9.3
92-14	74.2	22.7	12.5	5.0	278	0	29.7	56.7	8.1

Major Chemical Constituents

Site Name	Calcium mg/l	Magnesium mg/l	Sodium mg/l	Potassium mg/l	Bicarbonate mg/l	Carbonate mg/l	Silica mg/l	Sulfate mg/l	Chloride mg/l
Groundwater Quality of Blacktail Deer Creek valley (cont.)									
92-15	46.9	9.4	14.6	10.2	195	0	67.2	29.7	4.9
Casey	77.8	24.8	23.2	4.7	254	0	20.9	117.0	13.1
Cornell	91.4	30.8	19.6	9.78	300.0	0	18.3	98.93	13.2
Downey	99.5	35.3	22.4	9.26	307.2		20.1	113.11	15.83
Eberline	91.4	25.0	22.3	6.72	253.6		12.2	103.41	13.04
Forrester	61	22	14	5	258	0	36	47	14
Hemsley	87.7	24.8	14.7	7.52	304.8	0	9.94	77.94	10.86
High Mtn stock	81.5	22.8	11.3	7.21	278.0	0	12.3	58.7	10.11
High Mtn #1	66	20	12	5.2	246	0	33	47	11
Humphrey	128.0	38.8	27.1	10.63	329.2		19.8	102.18	82.17
Laden Irrig	81.2	25.9	13.5	3.5	300	0	23.9	72.9	8.4
Matador #16	81	21	24	4.4	212	0	14	160	11
Meine	84.2	25.3	14.4	6.7			10.5	69.03	8.88
Ripley	78.0	21.7	11.5	8.42	275.5		15.9	53.52	7.96
Svendsen	94.9	26.8	15.6	11.84	302.4	0	25.4	82.47	26.1
Zenchiku #4	72	21	25	4.7	229.3		18	120	12
Zenchiku #5	80	23	22	5.4	249	0	18	120	21
Groundwater Quality of Rattlesnake Creek valley									
92-26	102.0	22.4	29.2	4.2	304	0	35.6	112.0	22.3
92-27	42.6	8.8	4.1	1.3	154		18.0	8.8	9.3
Boka	95.4	26.7	24.7	7.13	321.8	0	11.5	110.44	15.19
Holland	87.7	24.8	14.7	7.52	190.2		9.94	8.07	4.52
Holland stock	65.2	10.8	12.7	4.74	251.2		14.3	12.72	8.99
Rawson	63.2	14.4	16.1	3.32	153.6		11.6	17.95	64.69
Rice	98.4	29.9	26.5	7.95	312.1		11.6	122.79	17.33
Stewart	92.7	31.9	12.2	7.01	192.6		9.39	161.55	5.98
Yuhas	93.8	25.6	25.1	7.36	297.5	0	12.3	113.5	15.74
Surface Water Quality									
Bvhd-Barr. gage	63.9	22.2	23.1	4.2	239	0	18.3	86.8	10.8
Bvhd-Barr.divers	73.3	24.8	23.2	7.26	248.72		9.23	90.95	14.36
Bvhd slough	113	37.8	29.0	7.9	440	0	30.6	112.0	18.1
Bvhd-Dillon gage	77.5	25.5	23.4	7.58	268.23		9.91	93.11	11.81
BT-EBID Canal	64.6	19.4	9.2	4.0	220	6.72	17.6	57.1	6.2
BT-upper gage	68.5	20.0	9.4	3.7	263	0	18.6	57.9	6.3
Connover spgs	84	20	25	4.5	230	0	14	160	13

Minor and Trace Chemical Constituents

Groundwater Quality of Beaverhead River valley

Site Name	Aluminum mg/l	Arsenic mg/l	Barium mg/l	Boron mg/l	Cadium mg/l	Chromium mg/l	Copper mg/l	Flouride mg/l	Iron mg/l	Lead mg/l
92-16	<0.030	0.016	0.0292	0.068	<0.002	<0.002	<0.002	0.66	0.152	<0.002
92-17	<0.030	0.0134	0.0396	0.085	<0.002	<0.002	<0.002	0.65	0.027	<0.002
92-18	<0.030	0.0017	0.0465	0.047	<0.002	<0.002	0.002	0.36	0.042	<0.002
92-19	<0.030	0.0026	0.0409	<0.030	<0.002	<0.002	<0.002	0.40	0.058	<0.002
92-20	<0.030	0.0026	0.0569	0.0347	<0.002	<0.002	<0.002	0.43	0.057	<0.002
92-21	<0.030	0.0068	0.0315	0.080	<0.002	<0.002	<0.002	0.62	0.05	<0.002
92-22	<0.030	0.0028	0.0317	0.042	<0.002	<0.002	<0.002	0.51	0.009	<0.002
92-23	<0.030	0.0024	0.0737	0.042	<0.002	<0.002	<0.002	0.04	0.116	<0.002
92-24	<0.030	0.0022	0.0902	0.039	<0.002	<0.002	<0.002	0.58	0.041	<0.002
92-25	<0.030	0.002	0.0723	0.0374	<0.002	<0.002	<0.002	0.43	0.068	<0.002
92-28	<0.03	0.0041	0.0294	<0.03	<0.002	<0.002	<0.002	0.28	0.129	<0.002
92-29	<0.03	0.0024	0.0591	0.037	<0.002	<0.002	<0.002	0.45	0.151	<0.002
92-30	<0.03	0.0028	0.054	0.0493	<0.002	<0.002	<0.002	0.43	0.126	<0.002
92-32	<0.026	0.0019	0.0262	0.027	<0.002	<0.002	<0.002	0.51	0.151	<0.002
92-33	<0.030	0.0032	0.0696	0.0461	<0.002	<0.002	<0.002	0.67	0.055	<0.002
Dawson	<0.2	<0.094		0.053	<0.0066	<0.012	<0.033		0.024	<0.0576
Dillon #1			0.044	0.12	<0.001	<0.005	<0.01	0.6	0.01	<0.01
Dillon #3			0.06	0.06	<0.001	<0.005	<0.01	0.3	0.007	<0.01
Intermtn Irrig. Co.	<0.200	<0.094		0.069	<0.0066	<0.012	<0.033		2	<0.0576
Mooney	<0.2	<0.094		0.079	<0.0066	<0.012	<0.033		<0.012	<0.0576
Rebich	<0.2	<0.094		0.119	<0.0066	<0.012	<0.033		<0.012	<0.0576
Tash	<0.2	<0.094		0.039	<0.0066	<0.012	<0.033		<0.012	<0.0576
Tash stock	<0.2	<0.094		0.03	<0.0066	<0.012	<0.033		0.032	<0.0576

Groundwater Quality of Blacktail Deer Creek valley

Site Name	Aluminum mg/l	Arsenic mg/l	Barium mg/l	Boron mg/l	Cadium mg/l	Chromium mg/l	Copper mg/l	Flouride mg/l	Iron mg/l	Lead mg/l
91-1	<0.030	0.0032	0.0534	<0.030	<0.002	<0.002	<0.002	0.47	<0.003	<0.002
91-2	<0.03	0.0015	0.07	<0.030	<0.002	<0.002	<0.002	0.28	<0.003	<0.002
91-3	<0.030	0.002	0.0862	0.033	<0.002	<0.002	<0.002	0.34	<0.003	<0.002
91-4	<0.030	0.0043	0.035	0.0425	<0.002	<0.002	<0.002	1.01	0.004	<0.002
91-5	<0.030	0.0015	0.0731	<0.030	<0.002	<0.002	<0.002	0.35	<0.003	<0.002
91-6	<0.030	0.0021	0.0666	<0.030	<0.002	<0.002	<0.002	0.40	<0.003	<0.002
91-7	<0.030	0.0024	0.076	<0.030	<0.002	<0.002	<0.002	0.34	<0.003	<0.002
92-1	<0.030	0.0036	0.0505	0.031	<0.002	<0.002	<0.002	0.23	0.016	<0.002
92-2	<0.030	0.0047	0.0551	<0.030	<0.002	<0.002	<0.002	0.51	0.044	<0.002
92-4	<0.030	0.0021	0.0568	<0.030	<0.002	<0.002	<0.002	0.32	0.062	<0.002
92-5	<0.030	0.0025	0.0632	<0.030	<0.002	<0.002	<0.002	0.24	0.017	<0.002
92-6	<0.030	0.0036	0.0187	0.110	<0.002	<0.002	<0.002	1.04	0.056	<0.002
92-7	<0.030	0.0079	0.025	0.097	<0.002	<0.002	<0.002	1.0	0.004	<0.002
92-8	<0.030	0.0057	0.0164	0.136	<0.002	<0.002	<0.002	1.00	0.075	<0.002
92-9	<0.030	0.0033	0.0254	0.102	<0.002	<0.002	<0.002	1.06	0.053	<0.002
92-10	<0.030	0.0043	0.0248	0.0592	<0.002	<0.002	<0.002	0.86	0.019	<0.002
92-11	<0.030	0.0022	0.0326	0.074	<0.002	<0.002	<0.002	1.07	0.036	<0.002
92-12	<0.030	0.022	0.037	0.052	<0.002	0.0142	<0.002	0.60	0.52	<0.002
92-13	<0.030	0.0026	0.0445	0.032	<0.002	<0.002	<0.002	0.34	0.04	<0.002
92-14	<0.030	0.0029	0.0831	<0.030	<0.002	<0.002	<0.002	0.33	0.017	<0.002

Minor and Trace Chemical Constituents

Site Name	Aluminum mg/l	Arsenic mg/l	Barium mg/l	Boron mg/l	Cadium mg/l	Chromium mg/l	Copper mg/l	Flouride mg/l	Iron mg/l	Lead mg/l
Groundwater Quality of Blacktail Deer Creek valley (cont.)										
92-15	<0.030	0.0117	0.0815	0.030	<0.002	<0.002	<0.002	0.36	0.144	<0.002
Casey	<0.030	0.0037	0.0443	0.0463	<0.002	<0.002	<0.002	0.67	0.004	<0.002
Cornell	<0.2	<0.094		0.038	<0.0066	<0.012	<0.033		<0.012	<0.0576
Downey	<0.2	<0.094		0.041	<0.0066	<0.012	<0.033		<0.012	<0.0576
Eberline	<0.2	<0.094		0.045	<0.0066	<0.012	<0.033		<0.012	<0.0576
Forrester			0.069	0.040	0.001	<0.005	<0.010	0.2	0.008	0.010
Hemsley	<0.2	<0.094		0.038	<0.0066	<0.012	<0.033		<0.012	<0.0576
High Mtn stock	<0.2	<0.094		0.026	<0.0066	<0.012	<0.033		0.045	<0.0576
High Mtn #1			0.085	0.040	<0.001	<0.005	<0.01	0.2	0.006	0.010
Humphrey	<0.02	<0.094		0.061	<0.0066	<0.012	<0.033		<0.012	<0.0576
Laden Irrig	<0.03			0.03	0.006	<0.002	0.003	0.3	0.66	
Matador #16			0.027	0.100	<0.001	<0.005	<0.010	1.1	0.012	<0.010
Meine	<0.2	<0.094		0.040	<0.0066	<0.012	<0.033		<0.012	<0.0576
Ripley	<0.2	<0.094		0.027	<0.0066	<0.012	<0.033		<0.012	<0.0576
Svendsen	<0.2	<0.094		0.024	<0.0066	<0.012	<0.033		<0.012	<0.0576
Zenchiku #4			0.03	0.09	<0.001	<0.005	<0.01	1	0.014	<0.01
Zenchiku #5			0.05	0.07	<0.001	<0.005	<0.01	0.7	0.012	<0.01
Groundwater Quality of Rattlesnake Creek valley										
92-26	<0.030	0.0032	0.0919	0.060	<0.002	<0.002	<0.002	0.42	0.007	<0.002
92-27	<0.030	<0.001	0.0615	<0.030	<0.002	<0.002	<0.002	0.05	0.021	<0.002
Boka	<0.2	<0.094		0.046	<0.0066	<0.012	<0.033		<0.012	<0.0576
Holland	<0.2	<0.094		0.038	<0.0066	<0.012	0.033		<0.012	<0.0576
Holland stock	<0.2	<0.094		0.022	<0.0066	<0.012	<0.033		<0.012	<0.0576
Rawson	<0.2	<0.094		0.032	<0.0066	<0.012	<0.033		<0.012	<0.0576
Rice	<0.2	<0.094		0.052	<0.0066	<0.012	<0.033		<0.012	<0.0576
Stewart	<0.2	<0.094		0.048	<0.0066	<0.012	<0.033		<0.012	<0.0576
Yuhas	<0.2	<0.094		0.048	<0.0066	<0.012	<0.033		<0.012	<0.0576
Surface Water Quality										
Bvhd-Barr. gage	<.03	0.0052	0.0561	0.037	<0.002	<0.002	<0.002	0.54	0.021	<0.002
Bvhd-Barr.diver	<0.2	<0.094		0.034	<0.0066	<0.012	<0.033		<0.012	<0.0576
Bvhd slough	<0.03	0.0045	0.0585	0.05	<0.002	<0.002	<0.002	0.63	0.03	<0.002
Bvhd-Dillon gage	<0.2	<0.094		0.038	<0.0066	<0.012	<0.033		<0.012	<0.0576
BT-EBIDCanal	<0.03	0.0034	0.0677	<0.03	<0.002	<0.002	<0.002	0.42	0.005	<0.002
BT-upper gage	<0.03	0.0035	0.0734	<0.03	<0.002	<0.002	<0.002	0.41	0.008	<0.002
Connover spgs			0.032	0.12	<0.001	<0.005	<0.01	1.1	0.006	<0.01

Minor and Trace Chemical Constituents

Site Name	Manganese mg/l	Molybdenum mg/l	Nickel mg/l	Nitrate mg/l	Phosphorus mg/l	Selenium mg/l	Silver mg/l	Strontium mg/l	Zinc mg/l
Groundwater Quality of Beaverhead River valley									
92-16	0.091	<0.010	<0.002	0.31	<0.0002	0.0012	<0.001	0.700	<0.002
92-17	0.034	<0.020	<0.002	0.17	<0.0002	0.0019	<0.001	0.382	<0.002
92-18	0.003	<0.020	<0.002	0.91	<0.0002	0.0018	<0.001	0.532	<0.008
92-19	0.006	<0.010	0.0017	0.72	<0.0002	0.001	<0.001	0.484	<0.002
92-20	0.002	<0.010	0.0021	1.12	<0.0002	0.002	<0.001	0.583	<0.002
92-21	0.131	<0.010	0.0034	0.21	<0.0002	<0.001	<0.001	0.482	<0.002
92-22	0.003	<0.010	0.0021	1.31	<0.0002	<0.001	<0.001	0.946	<0.002
92-23	0.002	<0.010	0.0019	1.23	<0.0002	0.0016	<0.001	0.655	<0.002
92-24	<0.002	<0.010	0.0024	2.87	<0.0002	0.0012	<0.001	0.705	<0.002
92-25	0.005	<0.010	<0.002	0.15	<0.0002	<0.001	<0.001	0.643	<0.002
92-28	0.023	<0.01	<0.002	1.77	<0.0002	0.0012	<0.001	0.548	<0.002
92-29	0.011	<0.01	0.0021	2.58	<0.0002	0.0012	<0.001	0.590	<0.002
92-30	0.06	<0.010	0.0043	0.15	<0.0002	0.0012	<0.001	0.781	<0.002
92-32	0.017	<0.010	<0.002	0.30	<0.0002	<0.001	<0.001	0.700	<0.002
92-33	0.003	<0.010	<0.002	0.12	<0.0002	0.0013	<0.001	0.655	<0.002
Dawson	<0.005	<0.005	<0.036	1.88	0.31			0.819	0.06
Dillon #1	<0.001	<0.01	<0.01				<0.001	0.91	0.009
Dillon #3	<0.001	<0.01	<0.01				<0.001	0.62	0.01
Intermtn Irrig. Co.	2.283	<0.005	<0.036	5.59	0.24			0.840	0.089
Mooney	<0.005	<0.005	<0.036	1.19	0.4			0.881	0.033
Rebich	<0.005	<0.005	<0.036	0.76	0.25			1.096	0.033
Tash	<0.005	<0.005	<0.036	1.2	0.32			0.593	0.093
Tash stock	<0.005	<0.005	<0.036	1.47	0.27			0.641	0.043
Groundwater Quality of Blacktail Deer Creek valley									
91-1	<0.002	<0.020	0.0018	0.18	<0.0002	0.0016	<0.001	0.402	0.0034
91-2	<0.002	<0.010	0.0019	0.31	<0.0002	<0.001	<0.001	0.420	0.0027
91-3	<0.002	<0.010	0.0023	4.48	<0.0002	0.0025	<0.001	0.347	<0.002
91-4	<0.002	<0.010	<0.002	0.36	<0.0002	0.0012	<0.001	0.870	<0.002
91-5	<0.002	<0.010	0.002	7.38	<0.0002	0.0014	<0.001	0.552	<0.002
91-6	<0.002	<0.010	<0.002	0.45	<0.0002	<0.001	<0.001	0.389	0.0153
91-7	<0.002	<0.010	0.0018	1.06	<0.0002	0.0016	<0.001	0.422	<0.002
92-1	0.076	<0.020	0.0023	0.10	<0.0002	0.0013	<0.001	0.420	<0.002
92-2	<0.002	<0.020	0.0018	<0.05	<0.0002	0.0019	<0.001	0.423	<0.002
92-4	0.005	<0.010	0.0019	0.33	<0.0002	0.0016	<0.001	0.433	<0.002
92-5	0.002	<0.010	<0.002	0.5	<0.0002	0.001	<0.001	0.222	<0.002
92-6	0.017	<0.010	<0.002	0.20	<0.0002	<0.001	<0.001	1.076	<0.008
92-7	<0.002	<0.010	0.0023	0.13	<0.0002	<0.001	<0.001	0.983	0.002
92-8	0.013	<0.010	<0.002	0.29	<0.0002	<0.001	<0.001	1.092	<0.002
92-9	0.046	<0.010	<0.002	0.46	<0.0002	<0.001	<0.001	1.077	<0.002
92-10	0.003	<0.010	<0.002	0.73	<0.0002	<0.001	<0.001	0.926	<0.002
92-11	0.004	<0.010	<0.002	1.02	<0.0002	0.0012	<0.001	1.037	<0.002
92-12	0.006	<0.010	<0.002	0.42	<0.0002	<0.001	<0.001	0.511	<0.002
92-13	0.002	<0.010	<0.002	3.12	<0.0002	<0.001	<0.001	0.586	<0.002
92-14	0.002	<0.010	<0.002	1.47	<0.0002	0.0014	<0.001	0.461	<0.002

Minor and Trace Chemical Constituents

Site Name	Manganese mg/l	Molybdenum mg/l	Nickel mg/l	Nitrate mg/l	Phosphorus mg/l	Selenium mg/l	Silver mg/l	Strontium mg/l	Zinc mg/l
Groundwater Quality of Blacktail Deer Creek valley (cont.)									
92-15	0.046	<0.010	<0.002	0.38	<0.0002	<0.001	<0.001	0.532	<0.002
Casey	<0.002	<0.010	<0.002	0.54	<0.0002	<0.001	<0.001	0.915	<0.002
Cornell	<0.005	<0.005	<0.036	3.62	0.26			0.528	0.044
Downey	<0.005	<0.005	<0.036	5.04	0.13			0.617	0.078
Eberline	<0.005	<0.005	<0.036	1.81	0.41			0.487	0.063
Forrester	<0.001	<0.010	<0.010				<0.001	0.200	<0.003
Hemsley	<0.005	<0.005	<0.036	2.58	0.42			0.5	0.037
High Mtn stock	<0.005	<0.005	<0.036	1.01	0.47			0.366	0.04
High Mtn #1	<0.001	<0.01	<0.01				<0.001	0.280	0.005
Humphrey	<0.005	<0.005	<0.036	5.66	0.44			0.505	0.043
Laden Irrig	0.004	0.03	<0.01	2.40	<0.0001		<0.002	0.56	<0.003
Matador #16	0.004	<0.010	<0.010				<0.001	0.960	0.012
Meine	<0.005	<0.005	<0.036	1.53	0.32			0.543	0.027
Ripley	<0.005	<0.005	<0.036	0.5	0.44			0.32	0.035
Svendsen	<0.005	<0.005	<0.036	2.39	0.27			0.045	0.034
Zenchiku #4	0.001	<0.01	<0.01				<0.001	0.98	<0.003
Zenchiku #5	<0.001	<0.01	<0.01				<0.001	0.87	0.006
Groundwater Quality of Rattlesnake Creek valley									
92-26	<0.002	<0.010	0.0023	5.07	<0.0002	0.0013	<0.001	0.679	0.0267
92-27	0.002	<0.010	<0.002	1.6	<0.0002	<0.001	<0.001	0.115	<0.002
Boka	<0.005	<0.005	<0.036	0.31	0.33			0.601	0.02
Holland	<0.005	<0.005	<0.036	0.89	0.42			0.5	0.037
Holland stock	<0.005	<0.005	<0.036	1.05	0.36			0.178	0.118
Rawson	0.0052	<0.005	<0.036	8.95	0.08			0.317	0.03
Rice	<0.005	<0.005	<0.036	1.24	0.38			0.615	0.069
Stewart	<0.005	0.006	<0.036	1.26	0.54			0.775	0.031
Yuhas	<0.005	<0.005	<0.036	0.55	0.37			0.537	0.019
Surface Water Quality									
Bvhd-Barr. gage	0.031	<0.001	<0.002	<0.1	<0.0002	<0.001	<0.001	0.586	<0.002
Bvhd-Barr. diversion	<0.005	<0.005	<0.036	0.16				0.546	0
Bvhd slough	0.042	<0.01	0.0028	0.18	<0.0002	0.0011	<0.001	0.796	<0.002
Bvhd-Dillon gage	0.006	<0.005	<0.036	<0.15				0.572	0
BT-EBID Canal	<0.002	<0.01	0.002	<0.05	<0.0002	<0.001	<0.001	0.408	<0.002
BT-upper gage	0.007	<0.02	0.0018	<0.05	<0.0002	0.0015	<0.001	0.425	<0.002
Connover spgs	0.003	<0.01	<0.01				<0.001	0.98	0.003

Summary of Milliequivalents Per Liter for Selected Chemical Constituents

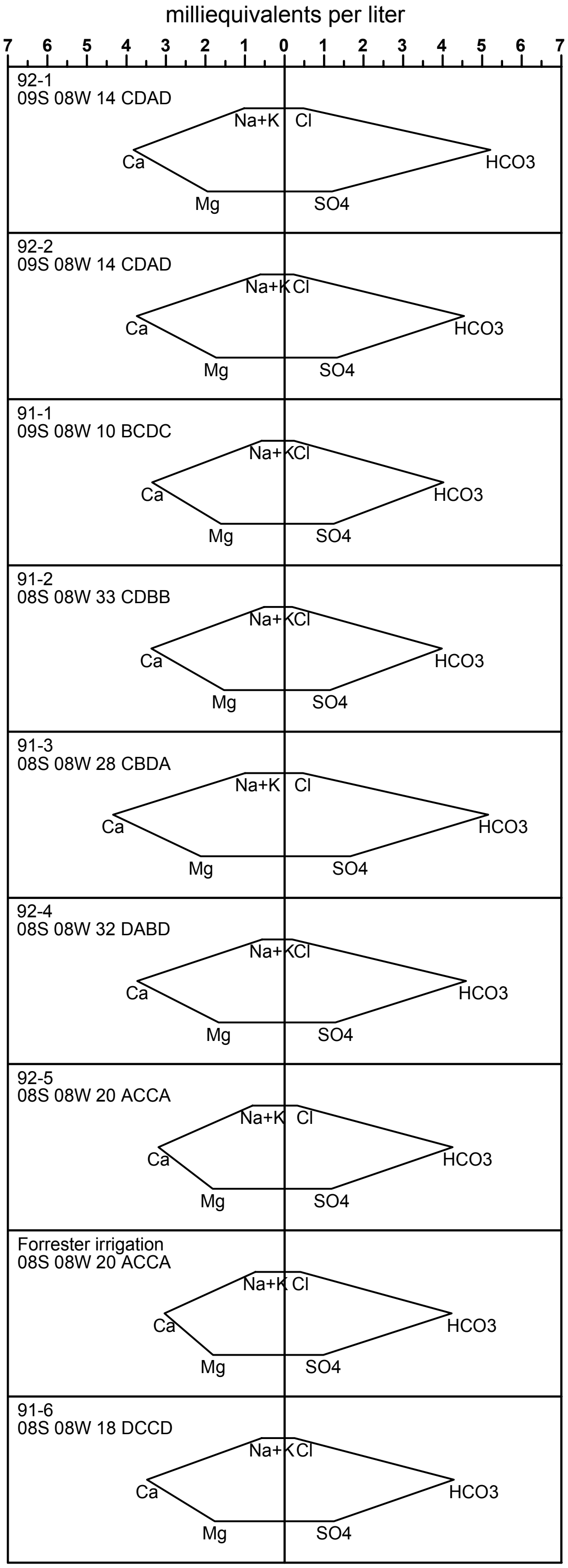
Site Name	Na meq/l	K meq/l	Ca meq/l	Mg meq/l	Cl meq/l	HCO_3 meq/l	SO_4 meq/l	Na %meq/l	K %meq/l	Ca %me/l	Mg %meq/l	Cl %meq/l	HCO_3 %meq/l	SO_4 %mq/l
Groundwater Quality of Beaverhead River valley														
92-16	1.757	0.210	2.515	0.955	0.248	3.606	1.653	32.32	3.86	46.26	17.56	4.51	65.47	30.02
92-17	2.392	0.338	1.871	0.453	0.189	3.770	1.230	47.34	6.68	37.03	8.96	3.64	72.65	23.71
92-18	0.835	0.169	4.391	2.107	0.392	5.032	2.053	11.13	2.25	58.53	28.08	5.24	67.30	27.46
92-19	0.631	0.130	3.633	1.819	0.265	4.458	1.478	10.15	2.10	58.47	29.27	4.28	71.89	23.84
92-20	0.922	0.148	4.501	2.247	0.375	5.048	2.311	11.80	1.90	57.57	28.73	4.85	65.27	29.88
92-21	1.605	0.307	2.206	0.790	0.282	2.852	1.784	32.71	6.25	44.94	16.10	5.74	57.99	36.28
92-22	0.744	0.110	3.917	2.000	0.299	4.524	1.859	10.99	1.62	57.85	29.53	4.48	67.70	27.82
92-23	1.109	0.107	4.127	2.033	0.423	4.376	2.602	15.04	1.46	55.95	27.56	5.72	59.12	35.16
92-24	1.305	0.125	4.676	2.337	0.525	4.688	2.977	15.46	1.48	55.38	27.68	6.41	57.24	36.35
92-25	1.092	0.097	3.917	2.016	0.333	4.360	2.353	15.33	1.36	55.00	28.31	4.72	61.88	33.39
92-28	0.579	0.110	3.243	1.300	0.333	3.442	1.499	11.06	2.10	61.99	24.85	6.31	65.26	28.42
92-29	0.961	0.110	4.386	1.827	0.485	4.753	1.890	13.20	1.51	60.21	25.08	6.81	66.67	26.52
92-30	1.018	0.141	4.291	2.304	0.378	5.261	2.124	13.13	1.81	55.34	29.71	4.87	67.77	27.36
92-32	0.700	0.082	3.693	1.884	0.372	3.901	1.976	11.01	1.29	58.07	29.63	5.96	62.42	31.62
92-33	1.118	0.115	3.418	2.016	0.341	4.196	2.082	16.77	1.73	51.27	30.24	5.16	63.39	31.45
Dawson	1.279	0.201	5.339	2.691	0.438	4.437	3.293	13.45	2.12	56.14	28.29	5.37	54.32	40.32
Dillon #1	0.913	0.133	4.441	2.140	0.480	4.396	2.707	11.98	1.74	58.23	28.05	6.32	57.98	35.70
Dillon #3	1.000	0.146	4.591	2.222	0.451	5.176	1.978	12.57	1.83	57.68	27.92	5.94	68.06	26.01
Intermtn Irrig.	2.540	0.197	6.786	3.456	0.447	6.794	2.342	19.57	1.52	52.28	26.63	4.66	70.90	24.44
Mooney	1.244	0.185	4.900	2.337	0.384	5.235	2.788	14.36	2.13	56.54	26.97	4.56	62.27	33.16
Rebich	1.653	0.201	6.387	3.102	0.409	4.837	4.980	14.57	1.77	56.31	27.35	4.00	47.30	48.70
Tash	1.135	0.184	4.641	2.222	0.523	5.115	2.381	13.88	2.25	56.72	27.15	6.53	63.79	29.69
Tash stock	0.661	0.162	4.371	2.107	0.286	3.757	2.278	9.06	2.21	59.87	28.85	4.53	59.43	36.04
Groundwater Quality of Blacktail Deer Creek valley														
91-1	0.465	0.115	3.353	1.605	0.240	4.016	1.241	8.40	2.08	60.54	28.97	4.36	73.06	22.58
91-2	0.405	0.113	3.373	1.531	0.189	3.983	1.145	7.46	2.08	62.23	28.23	3.55	74.91	21.54
91-3	0.874	0.125	4.341	2.115	0.457	5.146	1.659	11.73	1.68	58.23	28.37	6.29	70.86	22.85
91-4	0.635	0.087	3.563	1.670	0.251	4.474	1.164	10.66	1.46	59.83	28.05	4.26	75.98	19.76
91-5	0.474	0.115	4.486	2.041	0.299	4.769	1.566	6.66	1.62	63.04	28.68	4.51	71.89	23.60
91-6	0.474	0.102	3.478	1.769	0.245	4.278	1.253	8.14	1.76	59.72	30.38	4.25	74.05	21.70
91-7	0.526	0.128	3.613	1.728	0.274	4.442	1.185	8.78	2.13	60.26	28.83	4.64	75.28	20.08
92-1	0.783	0.233	3.817	1.950	0.477	5.212	1.203	11.54	3.43	56.27	28.75	6.92	75.62	17.46
92-2	0.500	0.110	3.742	1.728	0.234	4.540	1.332	8.23	1.81	61.55	28.42	3.83	74.35	21.82
92-4	0.461	0.107	3.733	1.670	0.192	4.589	1.287	7.72	1.80	62.51	27.97	3.16	75.63	21.21
92-5	0.657	0.156	3.194	1.819	0.316	4.245	1.189	11.28	2.68	54.82	31.22	5.50	73.83	20.68
92-6	1.144	0.128	3.832	1.769	0.279	3.786	2.811	16.64	1.86	55.75	25.74	4.06	55.06	40.88
92-7	0.987	0.113	4.346	1.901	0.288	3.868	3.165	13.44	1.53	59.16	25.87	3.93	52.84	43.23
92-8	1.614	0.146	3.224	1.753	0.330	3.393	3.019	23.96	2.16	47.86	26.02	4.90	50.32	44.78
92-9	1.114	0.151	3.892	1.843	0.293	3.835	2.790	15.91	2.16	55.60	26.33	4.24	55.43	40.32
92-10	0.896	0.110	3.543	1.777	0.257	4.294	1.697	14.16	1.74	56.00	28.10	4.11	68.73	27.16
92-11	1.127	0.115	4.172	2.041	0.525	4.196	2.582	15.11	1.54	55.96	27.38	7.19	57.46	35.35
92-12	1.488	0.261	1.617	0.683	0.195	2.852	0.983	36.75	6.44	39.94	16.87	4.83	70.78	24.39
92-13	0.605	0.107	4.237	2.189	0.262	4.983	1.495	8.47	1.51	59.36	30.67	3.89	73.93	22.18
92-14	0.544	0.128	3.703	1.868	0.229	4.556	1.180	8.71	2.05	59.32	29.93	3.83	76.38	19.79

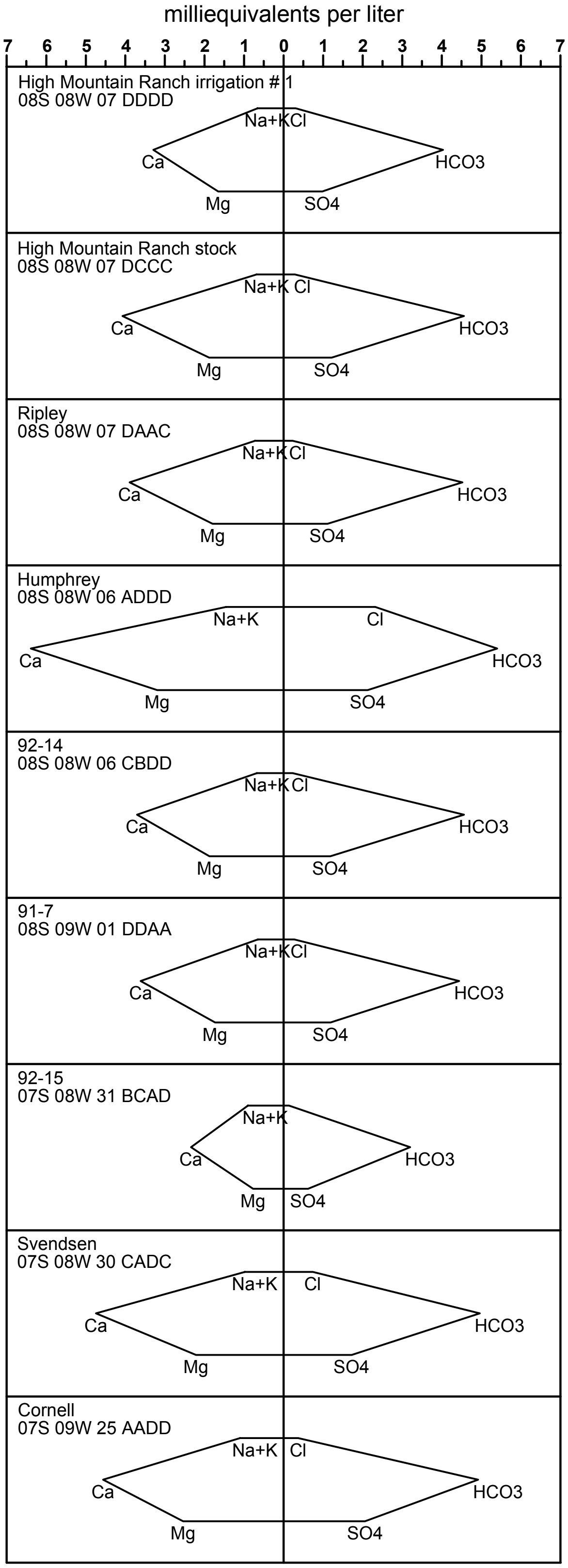
Summary of Milliequivalents Per Liter for Selected Chemical Constituents

Site Name	Na meq/l	K meq/l	Ca meq/l	Mg meq/l	Cl meq/l	HCO_3 meq/l	SO_4 meq/l	Na %meq/l	K %meq/l	Ca %meq/l	Mg %meq/l	Cl %meq/l	HCO_3 %meq/l	SO_4 %mq/l
Groundwater Quality of Blacktail Deer Creek valley (cont.)														
92-15	0.635	0.261	2.340	0.774	0.138	3.196	0.618	15.84	6.51	58.36	19.29	3.50	80.86	15.64
Casey	1.009	0.120	3.882	2.041	0.370	4.163	2.436	14.31	1.70	55.05	28.94	5.30	59.74	34.96
Cornell	0.853	0.250	4.561	2.535	0.372	4.917	2.060	10.40	3.05	55.63	30.92	5.07	66.91	28.03
Downey	0.974	0.237	4.965	2.905	0.447	5.035	2.355	10.73	2.61	54.67	31.99	5.70	64.25	30.05
Eberline	0.970	0.172	4.561	2.057	0.368	4.157	2.153	12.50	2.22	58.77	26.51	5.51	62.25	32.24
Forrester	0.609	0.128	3.044	1.810	0.395	4.229	0.979	10.89	2.29	54.44	32.38	7.05	75.48	17.47
Hemsley	0.639	0.192	4.376	2.041	0.306	4.996	1.623	8.82	2.65	60.37	28.15	4.42	72.14	23.43
High Mtn stock	0.492	0.184	4.067	1.876	0.285	4.556	1.222	7.43	2.79	61.44	28.35	4.70	75.14	20.15
High Mtn #1	0.522	0.133	3.293	1.646	0.310	4.032	0.979	9.33	2.38	58.87	29.42	5.83	75.78	18.39
Humphrey	1.179	0.272	6.387	3.193	2.318	5.396	2.127	10.69	2.47	57.90	28.94	23.55	54.83	21.62
Laden Irrig	0.587	0.090	4.052	2.131	0.237	4.917	1.518	8.56	1.31	59.07	31.07	3.55	73.70	22.75
Matador #16	1.044	0.113	4.042	1.728	0.310	3.475	3.331	15.07	1.62	58.35	24.95	4.36	48.83	46.81
Meine	0.626	0.171	4.202	2.082	0.251		1.437	8.85	2.42	59.33	29.40			
Ripley	0.500	0.215	3.892	1.786	0.225	4.515	1.114	7.82	3.37	60.88	27.93	3.84	77.13	19.03
Svendsen	0.679	0.303	4.736	2.205	0.736	4.960	1.717	8.57	3.82	59.77	27.84	9.93	66.90	23.16
Zenchiku #4	1.087	0.120	3.593	1.728	0.339	3.757	2.498	16.66	1.84	55.03	26.47	5.14	56.98	37.88
Zenchiku #5	0.957	0.138	3.992	1.893	0.592	4.081	2.498	13.71	1.98	57.19	27.12	8.26	56.90	34.84
Groundwater Quality of Rattlesnake Creek valley														
92-26	1.270	0.107	5.090	1.843	0.629	4.983	2.332	15.28	1.29	61.24	22.18	7.92	62.73	29.36
92-27	0.178	0.033	2.126	0.724	0.262	2.524	0.183	5.83	1.09	69.43	23.65	8.83	85.00	6.17
Boka	1.074	0.182	4.760	2.197	0.429	5.274	2.299	13.08	2.22	57.95	26.75	5.35	65.91	28.73
Holland	0.639	0.192	4.376	2.041	0.128	3.117	0.168	8.82	2.65	60.37	28.15	3.74	91.34	4.92
Holland stock	0.552	0.121	3.253	0.889	0.254	4.117	0.265	11.47	2.52	67.56	18.45	5.47	88.82	5.71
Rawson	0.700	0.085	3.154	1.185	1.825	2.518	0.374	13.67	1.66	61.55	23.13	38.69	53.38	7.92
Rice	1.153	0.203	4.910	2.460	0.489	5.115	2.556	13.21	2.33	56.27	28.19	5.99	62.68	31.33
Stewart	0.531	0.179	4.626	2.625	0.169	3.157	3.363	6.67	2.25	58.11	32.97	2.52	47.19	50.28
Yuhas	1.092	0.188	4.681	2.107	0.444	4.876	2.363	13.53	2.33	58.02	26.11	5.78	63.46	30.76
Surface Water Quality														
Bvhd-Barr.gage	1.005	0.107	3.189	1.827	0.305	3.917	1.807	16.40	1.75	52.04	29.81	5.05	64.97	29.97
Bvhd-Barr.diver	1.009	0.186	3.658	2.041	0.405	4.077	1.894	14.64	2.69	53.06	29.61	6.35	63.94	29.70
Bvhd slough	1.262	0.202	5.639	3.111	0.511	7.212	2.332	12.35	1.98	55.21	30.46	5.08	71.73	23.19
Bvhd-Dill gage	1.018	0.194	3.867	2.098	0.333	4.396	1.939	14.18	2.70	53.88	29.24	5.00	65.93	29.07
BT-EBID Canal	0.400	0.102	3.224	1.596	0.175	3.606	1.189	7.52	1.92	60.56	29.99	3.52	72.56	23.92
BT-upper gage	0.409	0.095	3.418	1.646	0.178	4.311	1.205	7.34	1.70	61.39	29.56	3.12	75.71	21.17
Connover spgs	1.087	0.115	4.192	1.646	0.367	3.770	3.331	15.45	1.64	59.54	23.38	4.91	50.48	44.61

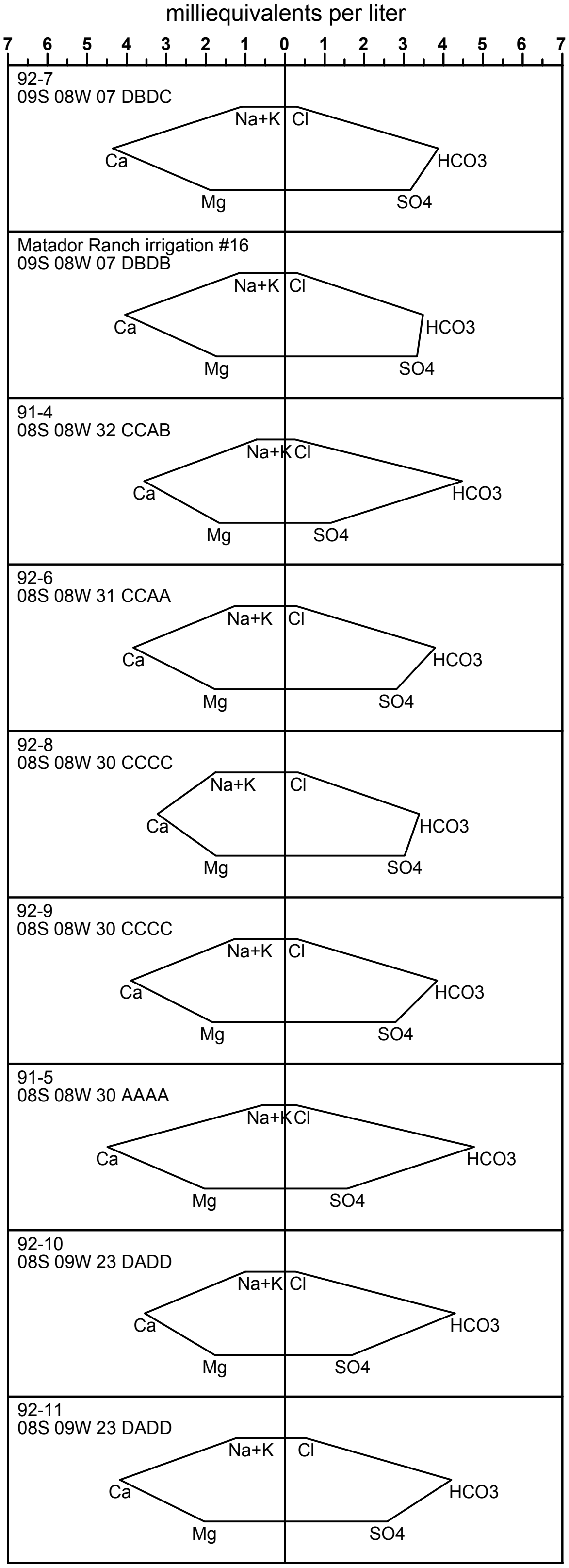
Appendix E2. Water Quality Stiff Diagrams

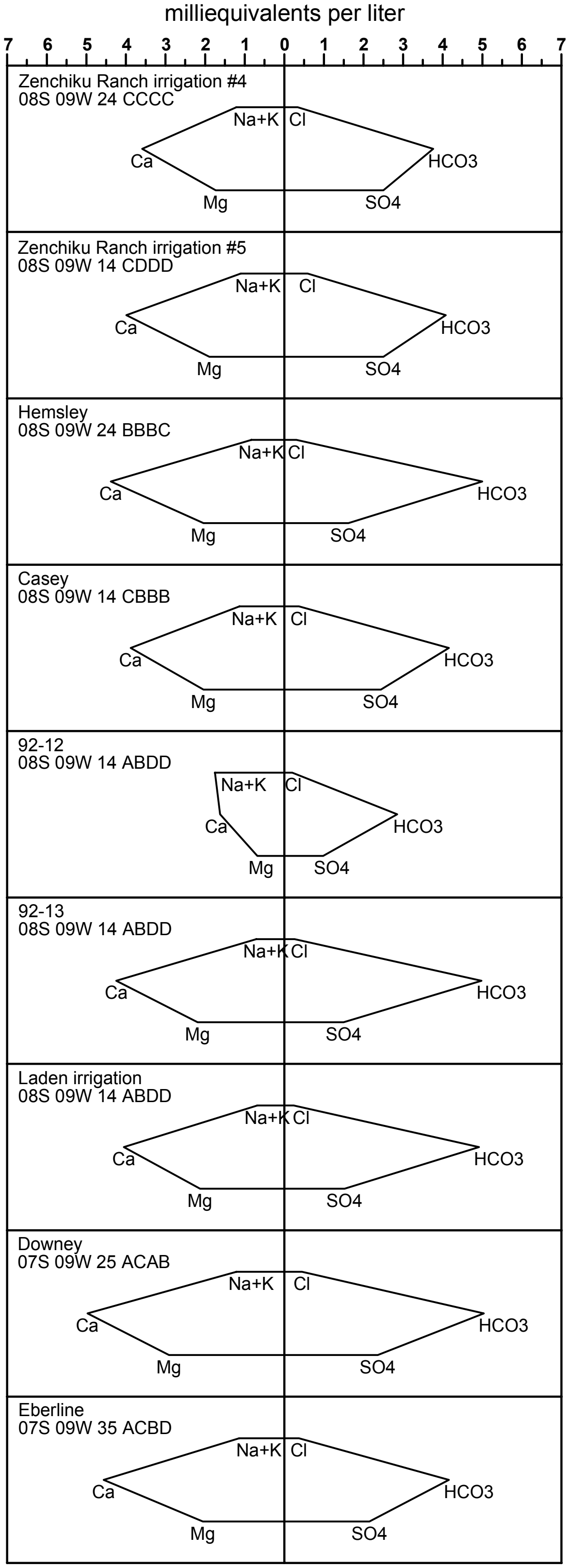
Groundwater Quality of the Blacktail Deer Creek Valley



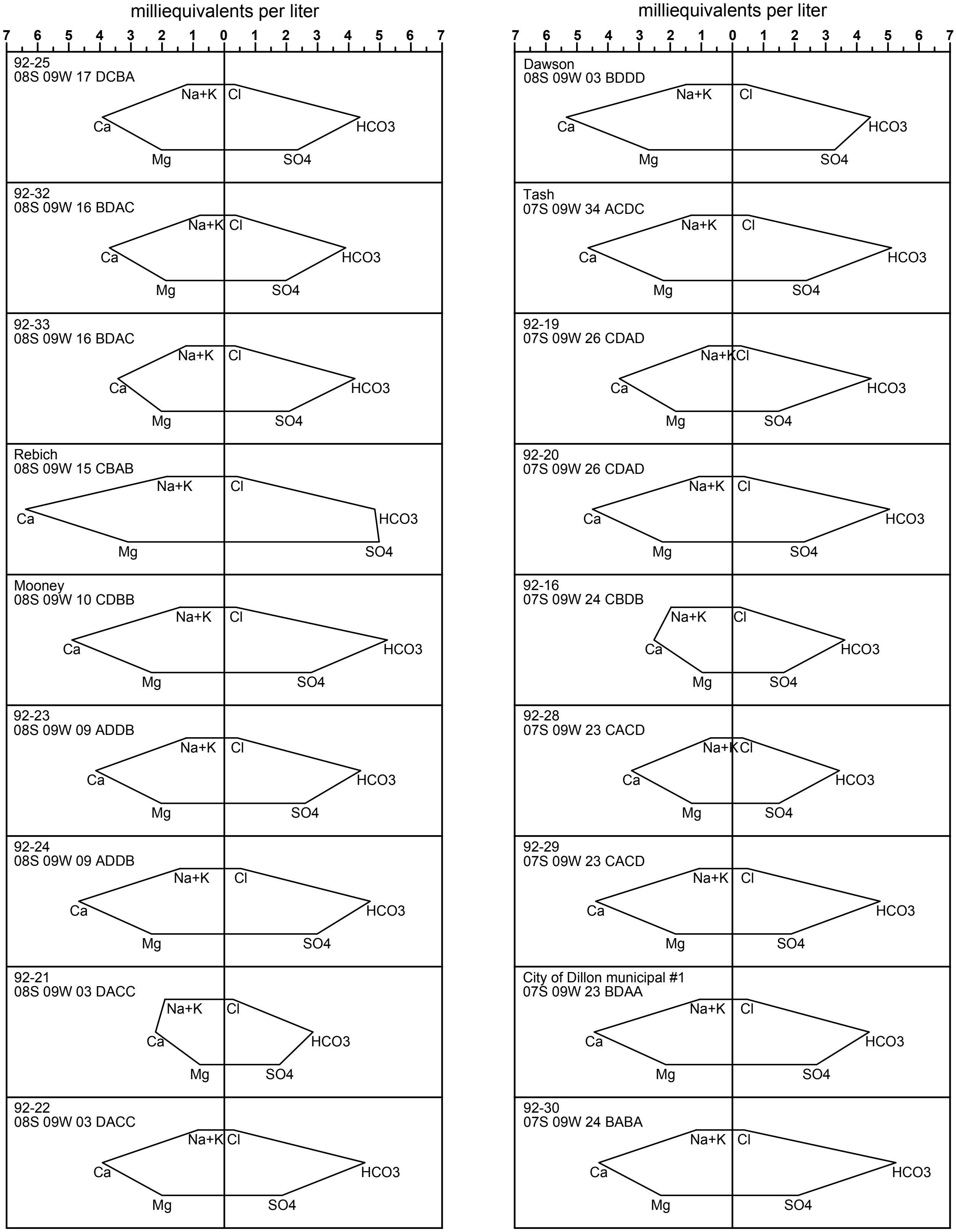


Groundwater Quality of the Blacktail Deer Creek Valley (cont.)

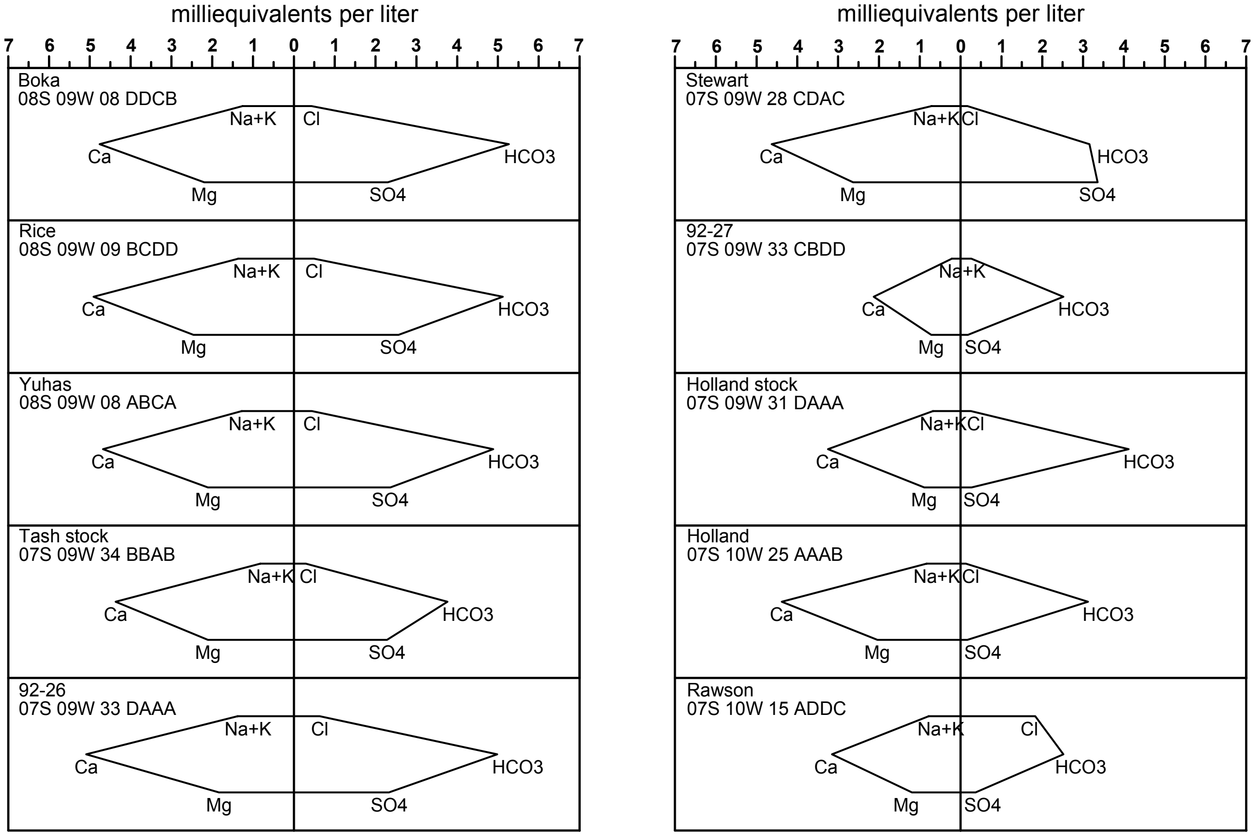




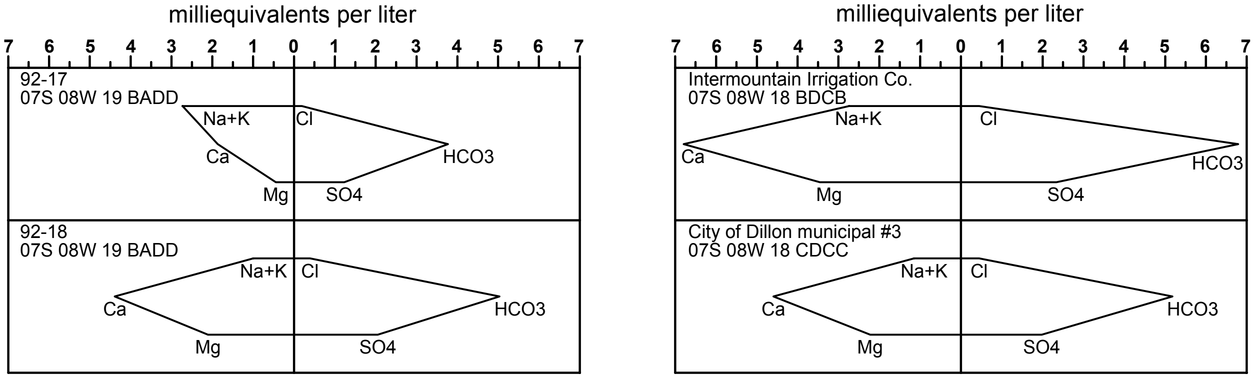
Groundwater Quality along the Beaverhead River Floodplain



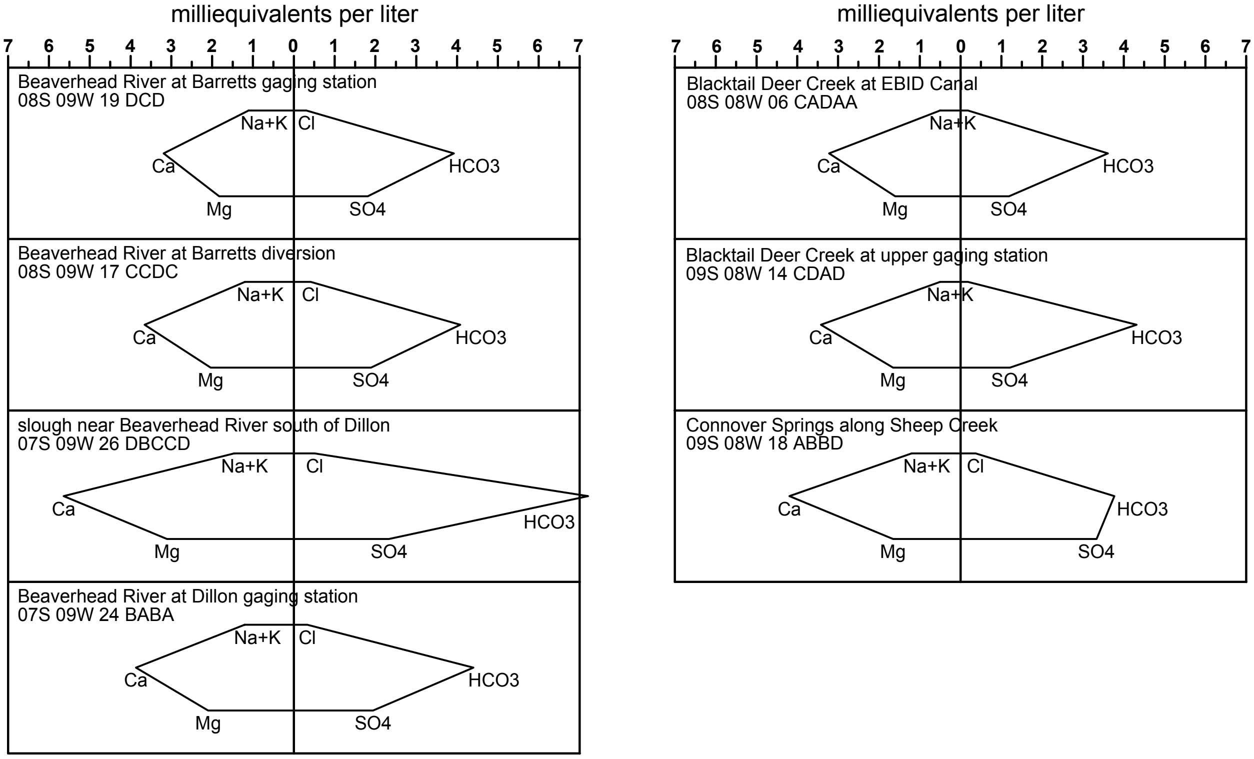
Groundwater Quality of the Rattlesnake Creek valley



Groundwater Quality in Dillon



Surface Water Quality



Appendix E3. Water Quality Analysis Reports
Upper Blacktail Deer Creek Valley

MONTANA BUREAU OF MINES AND GEOLOGY	WATER QUALITY ANALYSIS
BUTTE, MONTANA 59701 (406) 496-4156	Lab No.: 94Q0252

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D03'55'N 112D35'29'W	Site Location:	09S 08W 10 BCDC
Topographic Map:	Ashbough Canyon 7 1/2'	MBMG Site:	M:126669
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	91-01	Land Surface Altitude:	5584.41 ft
Date Sampled:	Aug 24, 1993	Sustained Yield:	
Time Sampled:	15:40	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	57.02 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	2.0 in.
Method Sampled:	Pumped	Casing Type:	PVC
Procedure Type:	Dissolved	Completion Type:	0.020 slot 2-in. PVC screen
Water Use:	Monitoring	Perforation Interval:	45.5 - 55.5 ft

Sampling Site: **Beaverhead Groundwater Project 91-1**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	67.2	3.35	Bicarbonate	(HCO_3)	245.	4.02
Magnesium	(Mg)	19.5	1.60	Carbonate	(CO_3)		0.00
Sodium	(Na)	10.7	0.47	Chloride	(Cl)	8.5	0.24
Potassium	(K)	4.5	0.12	Sulfate	(SO_4)	59.6	1.24
Iron	(Fe)	<0.003	0.00	Nitrate	(as N)	0.18	0.01
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	0.47	0.02
Silica	(SiO_2)	20.7		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			5.55	Total Anions:			5.53

Standard Deviation of Anion-Cation Balance (Sigma) -0.07

Calculated Dissolved Solid:	312.04	Total Hardness as $CaCO_3$:	248.06
Sum of Diss, Constituent:	436.35	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	547.	Total Alkalinity as $CaCO_3$:	200.94
Lab cnductvy, micromhos:	510.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.43	Ryznar Stability Index:	7.14
Laboratory PH:	7.60	Langlier Saturation Index:	0.23
		Sodium Adsorption Ratio:	0.30

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	8.4 C

ALUMINUM, DISS (μg/l as AL)	<30.	LITHIUM, DISS (μg/l as LI)	<8.
ANTIMONY, DISS (μg/l as SB)	<2.	MOLYBDENUM, DISS (μg/l as MO)	<20.
ARSENIC, DISS (μg/l as AS)	3.2	NICKEL, DISS (μg/l as NI)	1.8
BARIUM, DISS (μg/l as BA)	53.4	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BERYLL, DISS (μg/l as BE)	<2.	SELENIUM, DISS (μg/l as SE)	1.6
BORON, DISS (μg/l as B)	<30.	SILVER, DISS (μg/l as AG)	<1.
BROMIDE, DISS (μg/l as BR)	<100.	STRONTIUM, DISS (μg/l as SR)	402.
CADMIUM, DISS (μg/l as CD)	<2.	TITANIUM, DISS (μg/l as TI)	<10.
CHROMIUM, DISS (μg/l as CR)	<2.	VANADIUM, DISS (μg/l as V)	<5.
COBALT, DISS (μg/l as CO)	<2.	ZINC, DISS (μg/l as ZN)	3.4
COPPER, DISS (μg/l as CU)	<2.	ZIRCONIUM, DISS (μg/l as ZR)	<20.
LEAD, DISS (μg/l as PB)	<2.		

Explanation: mg/l = milligrams per liter; μg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
60.6	29.0	8.4	2.1	4.4	22.6	73.1	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0354

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D05'25'N 112D35'35'W	Site Location:	08S 08W 33 CDBBA
Topographic Map:	Ashbough Canyon 7 1/2'	MBMG Site:	M:126666
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	91-02	Land Surface Altitude:	5499.49 ft
Date Sampled:	Aug 25, 1993	Sustained Yield:	
Time Sampled:	10:30	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	96.25 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	2.0 in.
Method Sampled:	Pumped	Casing Type:	PVC
Procedure Type:	Dissolved	Completion Type:	0.020 slot 2-in. PVC screen
Water Use:	Monitoring	Perforation Interval:	84 - 94 ft

Sampling Site: **Beaverhead Groundwater Project 91-2**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	67.6	3.37	Bicarbonate	(HCO_3)	243.	3.98
Magnesium	(Mg)	18.6	1.53	Carbonate	(CO_3)		0.00
Sodium	(Na)	9.3	0.40	Chloride	(Cl)	6.7	0.19
Potassium	(K)	4.4	0.11	Sulfate	(SO_4)	55.	1.15
Iron	(Fe)	<0.003	0.00	Nitrate	(as N)	0.31	0.02
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	0.28	0.01
Silica	(SiO_2)	25.6		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			5.43	Total Anions:			5.35

Standard Deviation of Anion-Cation Balance (Sigma) -0.41

Calculated Dissolved Solid:	307.50	Total Hardness as $CaCO_3$:	245.35
Sum of Diss, Constituent:	430.80	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	534.	Total Alkalinity as $CaCO_3$:	199.30
Lab cnductvy, micromhos:	522.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.31	Ryznar Stability Index:	7.28
Laboratory PH:	7.46	Langlier Saturation Index:	0.09
		Sodium Adsorption Ratio:	0.26

Parameter	Value	Parameter	Value
Field Temp, Air	9.0 C	Field Temp, Water	10.6 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	<9.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	1.5	NICKEL, DISS (µg/l as NI)	1.9
BARIUM, DISS (µg/l as BA)	70.	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	<30.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	420.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	2.7
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
62.2	28.2	7.5	2.1	3.6	21.5	74.9	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0351

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D06'23'N 112D35'42'W	Site Location:	08S 08W 28 CBDA
Topographic Map:	Ashbough Canyon 7 1/2'	MBMG Site:	M:126662
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	91-03	Land Surface Altitude:	5446.96 ft
Date Sampled:	Aug 25, 1993	Sustained Yield:	
Time Sampled:	13:00	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	66.79 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	2.0 in.
Method Sampled:	Pumped	Casing Type:	PVC
Procedure Type:	Dissolved	Completion Type:	0.020 slot 2-in. PVC screen
Water Use:	Monitoring	Perforation Interval:	55.5 - 65.5 ft

Sampling Site: **Beaverhead Groundwater Project 91-3**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	87.	4.34	Bicarbonate	(HCO_3)	314.	5.15
Magnesium	(Mg)	25.7	2.11	Carbonate	(CO_3)		0.00
Sodium	(Na)	20.1	0.87	Chloride	(Cl)	16.2	0.46
Potassium	(K)	4.9	0.13	Sulfate	(SO_4)	79.7	1.66
Iron	(Fe)	<0.003	0.00	Nitrate	(as N)	4.48	0.32
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	0.34	0.02
Silica	(SiO_2)	24.9		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			7.46	Total Anions:			7.60

Standard Deviation of Anion-Cation Balance (Sigma) 0.64

Calculated Dissolved Solid:	418.	Total Hardness as $CaCO_3$:	323.02
Sum of Diss, Constituent:	577.32	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	680.	Total Alkalinity as $CaCO_3$:	257.53
Lab cnductvy, micromhos:	680.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.30	Ryznar Stability Index:	6.98
Laboratory PH:	7.32	Langlier Saturation Index:	0.17
		Sodium Adsorption Ratio:	0.49

Parameter	Value	Parameter	Value
Field Temp, Air	15.0 C	Field Temp, Water	9.8 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	18.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.	NICKEL, DISS (µg/l as NI)	2.3
BARIUM, DISS (µg/l as BA)	86.2	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	33.	SELENIUM, DISS (µg/l as SE)	2.5
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	347.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
58.2	28.4	11.7	1.7	6.3	22.8	70.9	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0255

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D02'45'N 112D32'53'W	Site Location:	09S 08W 14 CDAD
Topographic Map:	Ashbough Canyon 7 1/2'	MBMG Site:	M:131129
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-01	Land Surface Altitude:	5675.01 ft
Date Sampled:	Aug 24, 1993	Sustained Yield:	
Time Sampled:	12:30	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	120.90 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	2.0 in.
Method Sampled:	Pumped	Casing Type:	PVC
Procedure Type:	Dissolved	Completion Type:	0.010 slot 2-in. PVC screen
Water Use:	Monitoring	Perforation Interval:	109.5 - 119.5 ft

Sampling Site: **Beaverhead Groundwater Project 92-1**
Geologic Source: Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	76.5	3.82	Bicarbonate	(HCO_3)	318.	5.21
Magnesium	(Mg)	23.7	1.95	Carbonate	(CO_3)		0.00
Sodium	(Na)	18.	0.78	Chloride	(Cl)	16.9	0.48
Potassium	(K)	9.1	0.23	Sulfate	(SO_4)	57.8	1.20
Iron	(Fe)	0.016	0.00	Nitrate	(as N)	0.10	0.01
Manganese	(Mn)	0.076	0.00	Fluoride	(F)	0.23	0.01
Silica	(SiO_2)	50.6		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			6.80	Total Anions:			6.91

Standard Deviation of Anion-Cation Balance (Sigma) 0.56

Calculated Dissolved Solid:	409.68	Total Hardness as $CaCO_3$:	288.57
Sum of Diss, Constituent:	571.03	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	641.	Total Alkalinity as $CaCO_3$:	260.81
Lab cnductvy, micromhos:	622.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.46	Ryznar Stability Index:	6.80
Laboratory PH:	7.60	Langlier Saturation Index:	0.40
		Sodium Adsorption Ratio:	0.46

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	11.8 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	10.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<20.
ARSENIC, DISS (µg/l as AS)	3.6	NICKEL, DISS (µg/l as NI)	2.3
BARIUM, DISS (µg/l as BA)	50.5	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BERYLL, DISS (µg/l as BE)	<2.	SELENIUM, DISS (µg/l as SE)	1.3
BORON, DISS (µg/l as B)	31.	SILVER, DISS (µg/l as AG)	<1.
BROMIDE, DISS (µg/l as BR)	<100.	STRONTIUM, DISS (µg/l as SR)	420.
CADMIUM, DISS (µg/l as CD)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
CHROMIUM, DISS (µg/l as CR)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COBALT, DISS (µg/l as CO)	<2.	ZINC, DISS (µg/l as ZN)	<2.
COPPER, DISS (µg/l as CU)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.
LEAD, DISS (µg/l as PB)	<2.		

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
56.3	28.8	11.5	3.4	6.9	17.5	75.6	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0253

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D02'45'N 112D32'53'W	Site Location:	09S 08W 14 CDAD
Topographic Map:	Ashbough Canyon 7 1/2'	MBMG Site:	M:131130
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-02	Land Surface Altitude:	5674.93 ft
Date Sampled:	Aug 24, 1993	Sustained Yield:	
Time Sampled:	10:30	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	27.13 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	15.5 - 19.5 ft

Sampling Site: **Beaverhead Groundwater Project 92-2**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	75.	3.74	Bicarbonate	(HCO_3)	277.	4.54
Magnesium	(Mg)	21.	1.73	Carbonate	(CO_3)		0.00
Sodium	(Na)	11.5	0.50	Chloride	(Cl)	8.3	0.23
Potassium	(K)	4.3	0.11	Sulfate	(SO_4)	64.	1.33
Iron	(Fe)	0.044	0.00	Nitrate	(as N)	<0.05	0.00
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	0.51	0.03
Silica	(SiO_2)	24.9		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			6.09	Total Anions:			6.13

Standard Deviation of Anion-Cation Balance (Sigma) 0.21

Calculated Dissolved Solid:	346.01	Total Hardness as $CaCO_3$:	273.71
Sum of Diss, Constituent:	486.55	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	566.	Total Alkalinity as $CaCO_3$:	227.19
Lab cnductvy, micromhos:	543.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.37	Ryznar Stability Index:	7.05
Laboratory PH:	7.49	Langlier Saturation Index:	0.22
		Sodium Adsorption Ratio:	0.30

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	9.6 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	7.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<20.
ARSENIC, DISS (µg/l as AS)	4.7	NICKEL, DISS (µg/l as NI)	1.8
BARIUM, DISS (µg/l as BA)	55.1	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BERYLL, DISS (µg/l as BE)	<2.	SELENIUM, DISS (µg/l as SE)	1.9
BORON, DISS (µg/l as B)	<30.	SILVER, DISS (µg/l as AG)	<1.
BROMIDE, DISS (µg/l as BR)	<100.	STRONTIUM, DISS (µg/l as SR)	423.
CADMIUM, DISS (µg/l as CD)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
CHROMIUM, DISS (µg/l as CR)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COBALT, DISS (µg/l as CO)	<2.	ZINC, DISS (µg/l as ZN)	<2.
COPPER, DISS (µg/l as CU)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.
LEAD, DISS (µg/l as PB)	<2.		

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
61.6	28.4	8.2	1.8	3.8	21.8	74.4	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0350

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D05'34'N 112D06'09'W	Site Location:	08S 08W 32 DABD
Topographic Map:	Ashbough Canyon 7 1/2'	MBMG Site:	M:131122
Geologic Source:		Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-04	Land Surface Altitude:	5482.09 ft
Date Sampled:	Aug 25, 1993	Sustained Yield:	
Time Sampled:	17:00	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	160.42 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	130-135, 145-150 ft

Sampling Site:	**Beaverhead Groundwater Project 92-4**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	74.8	3.73	Bicarbonate	(HCO_3)	280.	4.59
Magnesium	(Mg)	20.3	1.67	Carbonate	(CO_3)		0.00
Sodium	(Na)	10.6	0.46	Chloride	(Cl)	6.8	0.19
Potassium	(K)	4.2	0.11	Sulfate	(SO_4)	61.8	1.29
Iron	(Fe)	0.062	0.00	Nitrate	(as N)	0.33	0.02
Manganese	(Mn)	0.005	0.00	Fluoride	(F)	0.32	0.02
Silica	(SiO_2)	22.6		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			5.98	Total Anions:			6.11

Standard Deviation of Anion-Cation Balance (Sigma) 0.64

Calculated Dissolved Solid:	339.75	Total Hardness as $CaCO_3$:	270.33
Sum of Diss, Constituent:	481.82	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	562.	Total Alkalinity as $CaCO_3$:	229.65
Lab cnductvy, micromhos:	549.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.38	Ryznar Stability Index:	6.91
Laboratory PH:	7.62	Langlier Saturation Index:	0.35
		Sodium Adsorption Ratio:	0.28

Parameter	Value	Parameter	Value
Field Temp, Air	18.0 C	Field Temp, Water	9.9 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	10.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.1	NICKEL, DISS (µg/l as NI)	1.9
BARIUM, DISS (µg/l as BA)	56.8	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	<30.	SELENIUM, DISS (µg/l as SE)	1.6
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	433.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
62.5	28.0	7.7	1.8	3.2	21.2	75.6	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0254

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D02'46'N 112D32'53'W	Site Location:	09S 08W 14 CDAD
Topographic Map:	Ashbough Canyon 7 1/2'	MBMG Site:	M:135835
Geologic Source:		Project Id:	
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Stream
Bottle number:	Blacktail	Land Surface Altitude:	
Date Sampled:	Aug 24, 1993	Water Flow Rate:	96.3 cfs
Time Sampled:	13:00	Flow Meas. Method:	
Lab + Analyst:	MBMG*SFM	Staff Gage:	2.03
Date Complete:	Jan 05, 1994	Stream Stage:	
Sample Handling:	312	Depth to Sample:	
Method Sampled:		Total Depth of Water:	
Procedure Type:	Dissolved	Stream Width:	
Water Use:			

Sampling Site:	**Blacktail Deer Creek at Upper Blacktail Gaging Station**
Drainage Basin:	Beaverhead River

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	68.5	3.42	Bicarbonate	(HCO_3)	263.	4.31
Magnesium	(Mg)	20.	1.65	Carbonate	(CO_3)		0.00
Sodium	(Na)	9.4	0.41	Chloride	(Cl)	6.3	0.18
Potassium	(K)	3.7	0.09	Sulfate	(SO_4)	57.9	1.21
Iron	(Fe)	0.008	0.00	Nitrate	(as N)	<0.05	0.00
Manganese	(Mn)	0.007	0.00	Fluoride	(F)	0.41	0.02
Silica	(SiO_2)	18.6		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			5.58	Total Anions:			5.72

Standard Deviation of Anion-Cation Balance (Sigma) 0.73

Calculated Dissolved Solid:	314.38	Total Hardness as $CaCO_3$:	253.36
Sum of Diss, Constituent:	447.83	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	517.	Total Alkalinity as $CaCO_3$:	215.70
Lab cnductvy, micromhos:	503.	Field Alkalinity as $CaCO_3$:	
Field PH:	8.45	Ryznar Stability Index:	6.38
Laboratory PH:	8.28	Langlier Saturation Index:	0.95
		Sodium Adsorption Ratio:	0.26

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	13.0 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	7.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<20.
ARSENIC, DISS (µg/l as AS)	3.5	NICKEL, DISS (µg/l as Ni)	1.8
BARIUM, DISS (µg/l as BA)	73.4	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BERYLL, DISS (µg/l as BE)	<2.	SELENIUM, DISS (µg/l as SE)	1.5
BORON, DISS (µg/l as B)	<30.	SILVER, DISS (µg/l as AG)	<1.
BROMIDE, DISS (µg/l as BR)	<100.	STRONTIUM, DISS (µg/l as SR)	425.
CADMIUM, DISS (µg/l as CD)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
CHROMIUM, DISS (µg/l as CR)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COBALT, DISS (µg/l as CO)	<2.	ZINC, DISS (µg/l as ZN)	<2.
COPPER, DISS (µg/l as CU)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.
LEAD, DISS (µg/l as PB)	<2.		

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
61.4	29.6	7.3	1.7	3.1	21.2	75.7	0.0

Blacktail Range Alluvial Fan

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0519

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D05'21'N 112D37'01'W	Site Location:	08S 08W 32 CCAB
Topographic Map:	Ashbough Canyon 7 1/2'	MBMG Site:	M:126664
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450521112370101
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	91-04	Land Surface Altitude:	5499.21 ft
Date Sampled:	Sep 03, 1993	Sustained Yield:	
Time Sampled:	13:00	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	150.26 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	2.0 in.
Method Sampled:	Pumped	Casing Type:	PVC
Procedure Type:	Dissolved	Completion Type:	0.020 slot 2-in PVC screen
Water Use:	Monitoring	Perforation Interval:	142 - 152 ft

Sampling Site:	**Beaverhead Groundwater Project 91-4**
Geologic Source:	Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	71.4	3.56	Bicarbonate	(HCO_3)	273.	4.47
Magnesium	(Mg)	20.3	1.67	Carbonate	(CO_3)		0.00
Sodium	(Na)	14.6	0.64	Chloride	(Cl)	8.9	0.25
Potassium	(K)	3.4	0.09	Sulfate	(SO_4)	55.9	1.16
Iron	(Fe)	0.004	0.00	Nitrate	(as N)	0.36	0.03
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	1.01	0.05
Silica	(SiO_2)	16.6		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			5.97	Total Anions:			5.97

Standard Deviation of Anion-Cation Balance (Sigma) -0.03

Calculated Dissolved Solid:	326.96	Total Hardness as $CaCO_3$:	261.84
Sum of Diss, Constituent:	465.47	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	547.	Total Alkalinity as $CaCO_3$:	233.91
Lab cnductvy, micromhos:	534.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.49	Ryznar Stability Index:	7.04
Laboratory PH:	7.55	Langlier Saturation Index:	0.25
		Sodium Adsorption Ratio:	0.39

Parameter	Value	Parameter	Value
Field Temp, Air	21.0 C	Field Temp, Water	10.8 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	39.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	4.3	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	35.	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	42.5	SELENIUM, DISS (µg/l as SE)	1.2
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	870.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
59.8	28.0	10.7	1.5	4.3	19.8	76.0	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0521

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D05'24'N 112D38'07'W	Site Location:	08S 08W 31 CCAA
Topographic Map:	Gallagher Mountain 7 1/2'	MBMG Site:	M:133371
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450518112380401
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-6	Land Surface Altitude:	5520.70 ft
Date Sampled:	Sep 01, 1993	Sustained Yield:	
Time Sampled:	13:45	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	217.30 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	0.020 slot 4-in. PVC screen
Water Use:	Monitoring	Perforation Interval:	207 - 217 ft

Sampling Site:	**Beaverhead Groundwater Project 92-6**
Geologic Source:	Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	76.8	3.83	Bicarbonate	(HCO_3)	231.	3.79
Magnesium	(Mg)	21.5	1.77	Carbonate	(CO_3)		0.00
Sodium	(Na)	26.3	1.14	Chloride	(Cl)	9.9	0.28
Potassium	(K)	5.	0.13	Sulfate	(SO_4)	135.	2.81
Iron	(Fe)	0.056	0.00	Nitrate	(as N)	0.20	0.01
Manganese	(Mn)	0.017	0.00	Fluoride	(F)	1.04	0.05
Silica	(SiO_2)	20.7		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			6.90	Total Anions:			6.95

Standard Deviation of Anion-Cation Balance (Sigma) 0.22

Calculated Dissolved Solid:	410.31	Total Hardness as $CaCO_3$:	280.26
Sum of Diss, Constituent:	527.52	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	632.	Total Alkalinity as $CaCO_3$:	189.46
Lab cnductvy, micromhos:	507.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.41	Ryznar Stability Index:	7.29
Laboratory PH:	7.38	Langlier Saturation Index:	0.04
		Sodium Adsorption Ratio:	0.68

Parameter	Value	Parameter	Value
Field Temp, Air	19.0 C	Field Temp, Water	15.0 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	41.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	3.6	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	18.7	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	110.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	1076.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<8.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<2.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
55.8	25.7	16.6	1.9	4.1	40.9	55.1	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0516

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D03'43'N 112D37'37'W	Site Location:	09S 08W 07 DBDC
Topographic Map:	Gallagher Mountain 7 1/2'	MBMG Site:	M:133372
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450341112373501
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-7	Land Surface Altitude:	5678.08 ft
Date Sampled:	Aug 31, 1993	Sustained Yield:	
Time Sampled:	15:00	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	226.36 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	0.020 slot 4-in PVC screen
Water Use:	Monitoring	Perforation Interval:	205 - 225 ft

Sampling Site:	**Beaverhead Groundwater Project 92-7**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	87.1	4.35	Bicarbonate	(HCO_3)	236.	3.87
Magnesium	(Mg)	23.1	1.90	Carbonate	(CO_3)		0.00
Sodium	(Na)	22.7	0.99	Chloride	(Cl)	10.2	0.29
Potassium	(K)	4.4	0.11	Sulfate	(SO_4)	152.	3.16
Iron	(Fe)	0.004	0.00	Nitrate	(as N)	0.13	0.01
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	1.00	0.05
Silica	(SiO_2)	15.5		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			7.37	Total Anions:			7.38

Standard Deviation of Anion-Cation Balance (Sigma) 0.06

Calculated Dissolved Solid:	432.40	Total Hardness as $CaCO_3$:	312.57
Sum of Diss, Constituent:	552.14	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	647.	Total Alkalinity as $CaCO_3$:	193.56
Lab cnductvy, micromhos:	629.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.41	Ryznar Stability Index:	7.10
Laboratory PH:	7.45	Langlier Saturation Index:	0.18
		Sodium Adsorption Ratio:	0.56

Parameter	Value	Parameter	Value
Field Temp, Air	22.0 C	Field Temp, Water	21.7 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	48.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	7.9	NICKEL, DISS (µg/l as NI)	2.3
BARIUM, DISS (µg/l as BA)	25.	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	97.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	983.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
59.2	25.9	13.4	1.5	3.9	43.2	52.8	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0520

State: Montana
Latitude-Longitude: 45D06'06'N 112D38'21'W
Topographic Map: Gallagher Mountain 7 1/2'
Geologic Source: 120SDMS
Drainage Basin: AB
Agency + Sampler: USGS*DWC
Bottle number: 92-8
Date Sampled: Aug 31, 1993
Time Sampled: 19:00
Lab + Analyst: MBMG*SFM
Date Complete: Jan 05, 1994
Sample Handling: 312
Method Sampled: Pumped
Procedure Type: Dissolved
Water Use: Monitoring

County: Beaverhead
Site Location: 08S 08W 30 CCCC
MBMG Site: M:133373
Project Id: Gwaamon
Station Id: 450606112382101
Sample Source: Well
Land Surface Altitude: 5440.15 ft
Sustained Yield:
Yield Meas Method:
Total Depth of Well: 341.41 ft below toc
SWL from g.s.:
Casing Diameter: 6.0 in.
Casing Type: Steel
Completion Type: 3/8 x 1 air perf.
Perforation Interval: 323 - 330 ft

Sampling Site: **Beaverhead Groundwater Project 92-8**
Geologic Source: Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	64.6	3.22	Bicarbonate	(HCO$_3$)	207.	3.39
Magnesium	(Mg)	21.3	1.75	Carbonate	(CO$_3$)		0.00
Sodium	(Na)	37.1	1.61	Chloride	(Cl)	11.7	0.33
Potassium	(K)	5.7	0.15	Sulfate	(SO$_4$)	145.	3.02
Iron	(Fe)	0.075	0.00	Nitrate	(as N)	0.29	0.02
Manganese	(Mn)	0.013	0.00	Fluoride	(F)	1.00	0.05
Silica	(SiO$_2$)	26.8		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			6.76	Total Anions:			6.82

Standard Deviation of Anion-Cation Balance (Sigma) 0.25

Calculated Dissolved Solid:	415.56	Total Hardness as CaCO$_3$:	248.98
Sum of Diss, Constituent:	520.59	Field Hardness as CaCO$_3$:	
Field cnductvy, micromhos:	632.	Total Alkalinity as CaCO$_3$:	169.78
Lab cnductvy, micromhos:	615.	Field Alkalinity as CaCO$_3$:	
Field PH:	7.63	Ryznar Stability Index:	7.27
Laboratory PH:	7.65	Langlier Saturation Index:	0.19
		Sodium Adsorption Ratio:	1.02

Parameter	Value	Parameter	Value
Field Temp, Air	22.0 C	Field Temp, Water	14.7 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	54.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	5.7	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	16.4	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	136.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	1092.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO$_4$	HCO$_3$	CO$_3$
47.9	26.0	24.0	2.2	4.9	44.8	50.3	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0509

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D06'08'N 112D38'21'W	Site Location:	08S 08W 30 CCCC
Topographic Map:	Gallagher Mountain 7 1/2'	MBMG Site:	M:133374
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450608112382102
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-9	Land Surface Altitude:	5439.76 ft
Date Sampled:	Sep 01, 1993	Sustained Yield:	
Time Sampled:	11:00	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	229.10 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	219 - 226 ft

Sampling Site: **Beaverhead Groundwater Project 92-9**
Geologic Source: Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	78.	3.89	Bicarbonate	(HCO_3)	234.	3.84
Magnesium	(Mg)	22.4	1.84	Carbonate	(CO_3)		0.00
Sodium	(Na)	25.6	1.11	Chloride	(Cl)	10.4	0.29
Potassium	(K)	5.9	0.15	Sulfate	(SO_4)	134.	2.79
Iron	(Fe)	0.053	0.00	Nitrate	(as N)	0.46	0.03
Manganese	(Mn)	0.046	0.00	Fluoride	(F)	1.06	0.06
Silica	(SiO_2)	20.4		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			7.03	Total Anions:			7.01

Standard Deviation of Anion-Cation Balance (Sigma) - 0.10

Calculated Dissolved Solid:	413.59	Total Hardness as $CaCO_3$:	286.96
Sum of Diss, Constituent:	532.32	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	635.	Total Alkalinity as $CaCO_3$:	191.92
Lab cnductvy, micromhos:	611.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.42	Ryznar Stability Index:	7.32
Laboratory PH:	7.33	Langlier Saturation Index:	0.01
		Sodium Adsorption Ratio:	0.66

Parameter	Value	Parameter	Value
Field Temp, Air	17.0 C	Field Temp, Water	13.7 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	45.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	3.3	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	25.4	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	102.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	1077.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
55.6	26.3	15.9	2.2	4.2	40.3	55.4	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 91Q5003

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D03'24'N 112D37'41'W	Site Location:	09S 08W 18 ABBD
Topographic Map:	Gallagher Mountain 7 1/2'	MBMG Site:	M:149187
Geologic Source:		Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450324112374101
Agency + Sampler:	USGS*DC	Sample Source:	Spring
Bottle number:		Land Surface Altitude:	
Date Sampled:	Aug 20, 1991	Sustained Yield:	1000 gpm
Time Sampled:	15:00	Yield Meas Method:	Measured
Lab + Analyst:	USGS	Total Depth of Well:	
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	
Method Sampled:		Casing Type:	
Procedure Type:	Dissolved	Completion Type:	
Water Use:		Perforation Interval:	

Sampling Site: **Connover Springs**
Drainage Basin: Beaverhead River

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	84.	4.19	Bicarbonate	(HCO_3)	230.	3.77
Magnesium	(Mg)	20.	1.65	Carbonate	(CO_3)		0.00
Sodium	(Na)	25.	1.09	Chloride	(Cl)	13.	0.37
Potassium	(K)	4.5	0.12	Sulfate	(SO_4)	160.	3.33
Iron	(Fe)	0.006	0.00	Nitrate	(as N)		0.00
Manganese	(Mn)	0.003	0.00	Fluoride	(F)	1.1	0.06
Silica	(SiO_2)	14.		OrthoPhosphate	(as P)		0.00
Total Cations:			7.06	Total Anions:			7.53

Calculated Dissolved Solid:	434.91	Total Hardness as $CaCO_3$:	292.07
Sum of Diss, Constituent:	551.61	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	660.	Total Alkalinity as $CaCO_3$:	188.64
Lab cnductvy, micromhos:	659.	Field Alkalinity as $CaCO_3$:	189.
Field PH:	7.4	Ryznar Stability Index:	6.80
Laboratory PH:	7.8	Langlier Saturation Index:	0.50
		Sodium Adsorption Ratio:	0.64

Parameter	Value	Parameter	Value
Field Temp, Air	28.0 C	Field Temp, Water	20.5 C
Oxygen, DISS, Field (mg/l as O)	3.85		

BARIUM, DISS (µg/l as BA)	32.	LITHIUM, DISS (µg/l as LI)	56.
BERYLL, DISS (µg/l as BE)	<0.5	MOLYBDENUM, DISS (µg/l as MO)	<10.
BORON, DISS (µg/l as B)	120.	NICKEL, DISS (µg/l as NI)	<10.
CADMIUM, DISS (µg/l as CD)	<1.	OXYGEN, 18/16 RATIO (per M)	-18.95
CHROMIUM, DISS (µg/l as CR)	<5.	SILVER, DISS (µg/l as AG)	<1.
COBALT, DISS (µg/l as CO)	<3.	STRONTIUM, DISS (µg/l as SR)	980.
COPPER, DISS (µg/l as CU)	<10.	TRITIUM, DISS (PCI/L)	110.
HYDROGEN, 2/1 RATIO (per M)	-143.	VANADIUM, DISS (µg/l as V)	<6.
LEAD, DISS (µg/l as PB)	<10.	ZINC, DISS (µg/l as ZN)	3.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
59.5	23.4	15.4	1.6	4.9	44.6	50.5	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 91Q5002

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D03'44'N 112D37'47'W	Site Location:	09S 08W 07 DBDB
Topographic Map:	Gallagher Mountain 7 1/2'	MBMG Site:	M:110037
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450344112374701
Agency + Sampler:	USGS*DC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5666.26 ft
Date Sampled:	Aug 20, 1991	Sustained Yield:	
Time Sampled:	13:00	Yield Meas Method:	
Lab + Analyst:	USGS	Total Depth of Well:	405.0 ft
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	20.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	torch perf.
Water Use:	Irrigation	Perforation Interval:	140 - 360 ft

Sampling Site: **Matador Ranch Irrigation Well #16**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	81.	4.04	Bicarbonate	(HCO_3)	212.	3.47
Magnesium	(Mg)	21.	1.73	Carbonate	(CO_3)		0.00
Sodium	(Na)	24.	1.04	Chloride	(Cl)	11.	0.31
Potassium	(K)	4.4	0.11	Sulfate	(SO_4)	160.	3.33
Iron	(Fe)	0.012	0.00	Nitrate	(as N)		0.00
Manganese	(Mn)	0.004	0.00	Fluoride	(F)	1.1	0.06
Silica	(SiO_2)	14.		OrthoPhosphate	(as P)		0.00
Total Cations:			6.95	Total Anions:			7.17

Calculated Dissolved Solid:	420.96	Total Hardness as $CaCO_3$:	288.69
Sum of Diss, Constituent:	528.53	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	644.	Total Alkalinity as $CaCO_3$:	173.88
Lab cnductvy, micromhos:	640.	Field Alkalinity as $CaCO_3$:	186.
Field PH:	7.4	Ryznar Stability Index:	7.00
Laboratory PH:	7.7	Langlier Saturation Index:	0.35
		Sodium Adsorption Ratio:	0.61

Parameter	Value	Parameter	Value
Field Temp, Air	26.0 C	Field Temp, Water	22.1 C
Oxygen, DISS, Field (mg/l as O)	4.8		

BARIUM, DISS (µg/l as BA)	27.	LITHIUM, DISS (µg/l as LI)	56.
BERYLL, DISS (µg/l as BE)	<0.5	MOLYBDENUM, DISS (µg/l as MO)	<10.
BORON, DISS (µg/l as B)	100.	NICKEL, DISS (µg/l as NI)	<10.
CADMIUM, DISS (µg/l as CD)	<1.	OXYGEN, 18/16 RATIO (per M)	-19.
CHROMIUM, DISS (µg/l as CR)	<5.	SILVER, DISS (µg/l as AG)	<1.
COBALT, DISS (µg/l as CO)	<3.	STRONTIUM, DISS (µg/l as SR)	960.
COPPER, DISS (µg/l as CU)	<10.	TRITIUM, DISS (PCI/L)	100.
HYDROGEN, 2/1 RATIO (per M)	-145.	VANADIUM, DISS (µg/l as V)	<6.
LEAD, DISS (µg/l as PB)	<10.	ZINC, DISS (µg/l as ZN)	12.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
58.4	24.9	15.1	1.6	4.4	46.8	48.8	0.0

Flynn Lane Well Field Area

MONTANA BUREAU OF MINES AND GEOLOGY	WATER QUALITY ANALYSIS
BUTTE, MONTANA 59701 (406) 496-4156	Lab No.: 94Q0510

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D07'13'N 112D39'41'W	Site Location:	08S 09W 23 DADD
Topographic Map:	Gallagher Mountain 7 1/2'	MBMG Site:	M:133375
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450715112393901
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	91-10	Land Surface Altitude:	5316.00 ft
Date Sampled:	Sep 02 1993	Sustained Yield:	
Time Sampled:	10:00	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	281.46 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	0.020 slot 4-in. PVC screen
Water Use:	Monitoring	Perforation Interval:	269.5 - 279.5 ft

Sampling Site:	**Beaverhead Groundwater Project 92-10**
Geologic Source:	Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	71.	3.54	Bicarbonate	(HCO$_3$)	262.	4.29
Magnesium	(Mg)	21.6	1.78	Carbonate	(CO$_3$)		0.00
Sodium	(Na)	20.6	0.90	Chloride	(Cl)	9.1	0.26
Potassium	(K)	4.3	0.11	Sulfate	(SO$_4$)	81.5	1.70
Iron	(Fe)	0.019	0.00	Nitrate	(as N)	0.73	0.05
Manganese	(Mn)	0.003	0.00	Fluoride	(F)	0.86	0.05
Silica	(SiO$_2$)	18.9		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			6.35	Total Anions:			6.35

Standard Deviation of Anion-Cation Balance (Sigma) -0.01

Calculated Dissolved Solid:	357.68	Total Hardness as CaCO$_3$:	266.19
Sum of Diss, Constituent:	490.61	Field Hardness as CaCO$_3$:	
Field cnductvy, micromhos:	582.	Total Alkalinity as CaCO$_3$:	214.88
Lab cnductvy, micromhos:	560.	Field Alkalinity as CaCO$_3$:	
Field PH:	7.54	Ryznar Stability Index:	7.23
Laboratory PH:	7.40	Langlier Saturation Index:	0.08
		Sodium Adsorption Ratio:	0.55

Parameter	Value	Parameter	Value
Field Temp, Air	14.0 C	Field Temp, Water	10.8 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	42.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	4.3	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	24.8	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	59.2	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	926.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO$_4$	HCO$_3$	CO$_3$
56.0	28.1	14.2	1.7	4.1	27.2	68.7	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0513

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D07'14'N 112D39'41'W	Site Location:	08S 09W 23 DADD
Topographic Map:	Gallagher Mountain 7 1/2'	MBMG Site:	M:133376
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450714112394102
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-11	Land Surface Altitude:	5316.01 ft
Date Sampled:	Sep 02, 1993	Sustained Yield:	
Time Sampled:	10:45	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	100.04 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	93 - 98 ft

Sampling Site:	**Beaverhead Groundwater Project 92-11**
Geologic Source:	Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	83.6	4.17	Bicarbonate	(HCO_3)	256.	4.20
Magnesium	(Mg)	24.8	2.04	Carbonate	(CO_3)		0.00
Sodium	(Na)	25.9	1.13	Chloride	(Cl)	18.6	0.52
Potassium	(K)	4.5	0.12	Sulfate	(SO_4)	124.	2.58
Iron	(Fe)	0.036	0.00	Nitrate	(as N)	1.02	0.07
Manganese	(Mn)	0.004	0.00	Fluoride	(F)	1.07	0.06
Silica	(SiO_2)	18.7		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			7.48	Total Anions:			7.43

Standard Deviation of Anion-Cation Balance (Sigma) -0.22

Calculated Dissolved Solid:	428.34	Total Hardness as $CaCO_3$:	310.83
Sum of Diss, Constituent:	558.23	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	677.	Total Alkalinity as $CaCO_3$:	209.96
Lab cnductvy, micromhos:	642.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.51	Ryznar Stability Index:	6.89
Laboratory PH:	7.62	Langlier Saturation Index:	0.36
		Sodium Adsorption Ratio:	0.64

Parameter	Value	Parameter	Value
Field Temp, Air	18.0 C	Field Temp, Water	10.8 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	41.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.2	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	32.6	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	74.	SELENIUM, DISS (µg/l as SE)	1.2
BROMIDE, DISS (µg/l as BR)	55.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	1037.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
56.0	27.4	15.1	1.5	7.2	35.4	57.5	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0978

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D08'28'N 112D40'05'W	Site Location:	08S 09W 14 ABDD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133377
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450828112400501
Agency + Sampler:	USGS*DAP	Sample Source:	Well
Bottle number:	92-12	Land Surface Altitude:	5268.92 ft
Date Sampled:	Apr 13, 1994	Sustained Yield:	
Time Sampled:	12:50	Yield Meas Method:	
Lab + Analyst:	MBMG*GAL	Total Depth of Well:	401.78 ft below toc
Date Complete:	Jul 19, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	390 - 396 ft

Sampling Site:	**Beaverhead Groundwater Project 92-12**
Geologic Source:	Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	32.4	1.62	Bicarbonate	(HCO_3)	174.	2.85
Magnesium	(Mg)	8.3	0.68	Carbonate	(CO_3)		0.00
Sodium	(Na)	34.2	1.49	Chloride	(Cl)	6.9	0.19
Potassium	(K)	10.2	0.26	Sulfate	(SO_4)	47.2	0.98
Iron	(Fe)	0.52	0.03	Nitrate	(as N)	0.42	0.03
Manganese	(Mn)	0.006	0.00	Fluoride	(F)	0.60	0.03
Silica	(SiO_2)	80.7		OrthoPhosphate	(as P)	<0.02	0.00
Total Cations:			4.09	Total Anions:			4.09

Calculated Dissolved Solid:	307.16	Total Hardness as $CaCO_3$:	115.07
Sum of Diss, Constituent:	395.45	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	390.	Total Alkalinity as $CaCO_3$:	142.71
Lab cnductvy, micromhos:	390.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.81	Ryznar Stability Index:	7.81
Laboratory PH:	7.86	Langlier Saturation Index:	0.02
		Sodium Adsorption Ratio:	1.39

Parameter	Value	Parameter	Value
Field Temp, Air	13.5 C	Field Temp, Water	14.0 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	18.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	22.0	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	37.	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	52.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	39.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	511.
CHROMIUM, DISS (µg/l as CR)	14.2	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	18.0
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
39.9	16.9	36.8	6.4	4.8	24.4	70.8	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0979

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D08'28'N 112D40'02'W	Site Location:	08S 09W 14 ABDD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133378
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450828112400202
Agency + Sampler:	USGS*DAP	Sample Source:	Well
Bottle number:	92-13	Land Surface Altitude:	5268.88 ft
Date Sampled:	Apr 13, 1994	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	MBMG*GAL	Total Depth of Well:	175.30 ft below toc
Date Complete:	Jul 19, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	100-105,135-140,165-170 ft

Sampling Site: **Beaverhead Groundwater Project 92-13**
Geologic Source: Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	84.9	4.24	Bicarbonate	(HCO_3)	304.	4.98
Magnesium	(Mg)	26.6	2.19	Carbonate	(CO_3)		0.00
Sodium	(Na)	13.9	0.60	Chloride	(Cl)	9.3	0.26
Potassium	(K)	4.2	0.11	Sulfate	(SO_4)	71.8	1.49
Iron	(Fe)	0.04	0.00	Nitrate	(as N)	3.12	0.22
Manganese	(Mn)	0.002	0.00	Fluoride	(F)	0.34	0.02
Silica	(SiO_2)	22.8		OrthoPhosphate	(as P)	<0.02	0.00
Total Cations:			7.15	Total Anions:			6.98

Calculated Dissolved Solid:	386.76	Total Hardness as $CaCO_3$:	321.48
Sum of Diss, Constituent:	541.00	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	249.33
Lab cnductvy, micromhos:	623.	Field Alkalinity as $CaCO_3$:	
Field PH:		Ryznar Stability Index:	6.73
Laboratory PH:	7.62	Langlier Saturation Index:	0.45
		Sodium Adsorption Ratio:	0.34

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	15.2
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.6	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	44.5	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	32.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	37.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	586.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
59.4	30.7	8.5	1.5	3.9	22.2	73.9	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0501

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D08'17'N 112D40'52'W	Site Location:	08S 09W 14 CBBB
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:109904
Geologic Source:	111ALVM	Project Id:	USGS
Drainage Basin:	AB	Station Id:	450817112405201
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	Casey	Land Surface Altitude:	5246.12 ft
Date Sampled:	Sep 15, 1993	Sustained Yield:	
Time Sampled:	10:00	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	80 ft below toc
Date Complete:	Feb 10, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Domestic	Perforation Interval:	

Sampling Site: **Casey, Joe**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	77.8	3.88	Bicarbonate	(HCO_3)	254.	4.16
Magnesium	(Mg)	24.8	2.04	Carbonate	(CO_3)		0.00
Sodium	(Na)	23.2	1.01	Chloride	(Cl)	13.1	0.37
Potassium	(K)	4.7	0.12	Sulfate	(SO_4)	117.	2.44
Iron	(Fe)	0.004	0.00	Nitrate	(as N)	0.54	0.04
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	0.67	0.04
Silica	(SiO_2)	20.9		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			7.07	Total Anions:			7.04

Standard Deviation of Anion-Cation Balance (Sigma) -0.14

Calculated Dissolved Solid:	407.85	Total Hardness as $CaCO_3$:	296.34
Sum of Diss, Constituent:	536.73	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	649.	Total Alkalinity as $CaCO_3$:	208.32
Lab cnductvy, micromhos:	639.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.48	Ryznar Stability Index:	6.76
Laboratory PH:	7.82	Langlier Saturation Index:	0.53
		Sodium Adsorption Ratio:	0.59

Parameter	Value	Parameter	Value
Field Temp, Air	15.0 C	Field Temp, Water	11.3 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	38.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	3.7	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	44.3	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	46.3	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	55.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	915.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
55.1	28.9	14.3	1.7	5.3	35.0	59.7	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q5013

State: Montana
Latitude-Longitude: 45D07'41'N 112D39'34'W
Topographic Map: Dillon West 7 1/2'
Geologic Source: 110ALVM
Drainage Basin: AB
Agency + Sampler: DNRC*BU
Bottle number:
Date Sampled: Dec 09, 1993
Time Sampled:
Lab + Analyst: UM*LB
Date Complete:
Sample Handling:
Method Sampled: Pumped
Procedure Type: Dissolved
Water Use: Domestic

County: Beaverhead
Site Location: 08S 09W 24 BBBC
MBMG Site: M:109940
Project Id: Bvrhead
Station Id: 450741112393401
Sample Source: Well
Land Surface Altitude: 5308.39 ft
Sustained Yield:
Yield Meas Method:
Total Depth of Well: 82 ft below toc
SWL from g.s.:
Casing Diameter: 6.0 in.
Casing Type: Steel
Completion Type:
Perforation Interval:

Sampling Site: **Hemsley, Kelley**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l
Calcium	(Ca)	87.7	4.38
Magnesium	(Mg)	24.8	2.04
Sodium	(Na)	14.7	0.64
Potassium	(K)	7.52	0.19
Iron	(Fe)	<0.012	0.00
Manganese	(Mn)	<0.005	0.00
Silica	(SiO_2)	9.94	
Total Cations:			7.26

		mg/l	meq/l
Bicarbonate	(HCO_3)	304.	4.98
Carbonate	(CO_3)		0.00
Chloride	(Cl)	10.86	0.31
Sulfate	(SO_4)	77.94	1.62
Nitrate	(as N)	2.58	0.18
Fluoride	(F)		0.00
OrthoPhosphate	(as P)	<0.5	0.00
Total Anions:			7.10

Calculated Dissolved Solid: 385.83
Sum of Diss, Constituent: 540.08
Field cnductvy, micromhos:
Lab cnductvy, micromhos:
Field PH: 7.23
Laboratory PH:

Total Hardness as $CaCO_3$: 321.06
Field Hardness as $CaCO_3$:
Total Alkalinity as $CaCO_3$: 249.33
Field Alkalinity as $CaCO_3$: 250.
Ryznar Stability Index: 14.22
Langlier Saturation Index: -7.11
Sodium Adsorption Ratio: 0.36

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	7.9 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	38.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	500.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	24.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	37.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
60.4	28.1	8.8	2.7	4.4	23.4	72.1	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 87Q0027

State:	Montana	County:	Beaverhead
Latitude-Longitude:	D ' 'N D ' 'W	Site Location:	08S 09W 14 ABDD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:109901
Geologic Source:	120SDMS	Project Id:	
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	PRIV*TL	Sample Source:	Well
Bottle number:	Prvwell	Land Surface Altitude:	5269 ft
Date Sampled:		Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	MBMG*WO	Total Depth of Well:	200 ft below toc
Date Analyzed	Apr 03, 1987	SWL from g.s.:	
Sample Handling:		Casing Diameter:	16 in.
Method Sampled:		Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	Screen
Water Use:	Irrigation	Screened Interval:	100 - 170 ft

Sampling Site: **Laden, Tim (Blacktail Deer Creek valley)**
Geologic Source: Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	81.2	4.05	Bicarbonate	(HCO_3)	300.	4.92
Magnesium	(Mg)	25.9	2.13	Carbonate	(CO_3)		0.00
Sodium	(Na)	13.5	0.59	Chloride	(Cl)	8.4	0.24
Potassium	(K)	3.5	0.09	Sulfate	(SO_4)	72.9	1.52
Iron	(Fe)	0.66	0.04	Nitrate	(as N)	2.4	0.17
Manganese	(Mn)	0.004	0.00	Fluoride	(F)	0.3	0.02
Silica	(SiO_2)	23.9		OrthoPhosphate	(as P)		
Total Cations:			6.90	Total Anions:			6.85

Standard Deviation of Anion-Cation Balance (Sigma) -0.241

Calculated Dissolved Solid:	380.44	Total Hardness as $CaCO_3$:	309.36
Sum of Diss, Constituent:	532.66	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	246.05
Lab cnductvy, micromhos:	635.3	Field Alkalinity as $CaCO_3$:	
Field PH:		Ryznar Stability Index:	6.92
Laboratory PH:	7.47	Langlier Saturation Index:	0.27
		Sodium Adsorption Ratio:	0.33

Parameter	Value	Parameter	Value
ALUMINUM, DISS (µg/l as AL)	<30.	NICKEL, DISS (µg/l as NI)	<10.
BORON, DISS (µg/l as B)	30.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.1
BROMIDE, DISS (mg/l as BR)	<0.1	SILVER, DISS (µg/l as AG)	<2.
CADMIUM, DISS (µg/l as CD)	6.	STRONTIUM, DISS (µg/l as SR)	560.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<1.
COPPER, DISS (µg/l as CU)	3.	VANADIUM, DISS (µg/l as V)	<1.
LITHIUM, DISS (µg/l as LI)	16.	ZINC, DISS (µg/l as ZN)	<3.
MOLYBDENUM, DISS (µg/l as MO)	30.	ZIRCONIUM, DISS (µg/l as ZR)	<4.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
59.1	31.1	8.6	1.3	3.5	22.8	73.7	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q5012

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D07'02'N 112D38'51'W	Site Location:	08S 09W 24 DCDC
Topographic Map:	Gallagher Mountain 7 1/2'	MBMG Site:	M:131128
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450702112385101
Agency + Sampler:	DNRC*BU	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5351.94 ft
Date Sampled:	Dec 10, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	117 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	torch perf.
Water Use:	Domestic	Perforation Interval:	

Sampling Site:	**Meine, Bob**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	84.2	4.20	Bicarbonate	(HCO_3)		
Magnesium	(Mg)	25.3	2.08	Carbonate	(CO_3)		0.00
Sodium	(Na)	14.4	0.63	Chloride	(Cl)	8.88	0.25
Potassium	(K)	6.7	0.17	Sulfate	(SO_4)	69.03	1.44
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	1.53	0.11
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	10.5		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			7.09	Total Anions:			1.80

Calculated Dissolved Solid:	220.54	Total Hardness as $CaCO_3$:	314.38
Sum of Diss, Constituent:	220.54	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	
Field PH:	7.14	Ryznar Stability Index:	
Laboratory PH:		Langlier Saturation Index:	
		Sodium Adsorption Ratio:	0.35

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	9.3 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	40.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	543.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	20.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	27.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
59.3	29.4	8.9	2.4				

MONTANA BUREAU OF MINES AND GEOLOGY	WATER QUALITY ANALYSIS
BUTTE, MONTANA 59701 (406) 496-4156	Lab No.: 91Q5006

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D07'00'N 112D39'36'W	Site Location:	08S 09W 24 CCCC
Topographic Map:	Gallagher Mountain 7 1/2'	MBMG Site:	M:109941
Geologic Source:	120SDMS	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450700112393601
Agency + Sampler:	USGS*DC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5329.60 ft
Date Sampled:	Aug 21, 1991	Sustained Yield:	
Time Sampled:	10:30	Yield Meas Method:	
Lab + Analyst:	USGS	Total Depth of Well:	435 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	16 in.
Method Sampled:		Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	torch perf.
Water Use:	Irrigation	Perforation Interval:	160 - 365 ft

Sampling Site:	**Zenchiku Ranch Land and Livestock Irrigation Well #4**
Geologic Source:	Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	72.	3.59	Bicarbonate	(HCO_3)	229.2	3.76
Magnesium	(Mg)	21.	1.73	Carbonate	(CO_3)		0.00
Sodium	(Na)	25.	1.09	Chloride	(Cl)	12.	0.34
Potassium	(K)	4.7	0.12	Sulfate	(SO_4)	120.	2.50
Iron	(Fe)	0.014	0.00	Nitrate	(as N)		0.00
Manganese	(Mn)	0.001	0.00	Fluoride	(F)	1.	0.05
Silica	(SiO_2)	18.		OrthoPhosphate	(as P)		0.00
Total Cations:			6.55	Total Anions:			6.65

Calculated Dissolved Solid:	386.62	Total Hardness as $CaCO_3$:	266.22
Sum of Diss, Constituent:	502.92	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	614.	Total Alkalinity as $CaCO_3$:	187.98
Lab cnductvy, micromhos:	609.	Field Alkalinity as $CaCO_3$:	188.
Field PH:	7.4	Ryznar Stability Index:	7.04
Laboratory PH:	7.7	Langlier Saturation Index:	0.33
		Sodium Adsorption Ratio:	0.67

Parameter	Value	Parameter	Value
Field Temp, Air	20.0 C	Field Temp, Water	12.5 C
Oxygen, DISS, Field (mg/l as O)	7.3		

BARIUM, DISS (µg/l as BA)	30.	LITHIUM, DISS (µg/l as LI)	50.
BERYLL, DISS (µg/l as BE)	<0.5	MOLYBDENUM, DISS (µg/l as MO)	<10.
BORON, DISS (µg/l as B)	90.	NICKEL, DISS (µg/l as NI)	<10.
CADMIUM, DISS (µg/l as CD)	<1.	OXYGEN, 18/16 RATIO (per M)	-18.8
CHROMIUM, DISS (µg/l as CR)	<5.	SILVER, DISS (µg/l as AG)	<1.
COBALT, DISS (µg/l as CO)	<3.	STRONTIUM, DISS (µg/l as SR)	980.
COPPER, DISS (µg/l as CU)	<10.	TRITIUM, DISS (PCI/L)	83.
HYDROGEN, 2/1 RATIO (per M)	-143.	VANADIUM, DISS (µg/l as V)	<6.
LEAD, DISS (µg/l as PB)	<10.	ZINC, DISS (µg/l as ZN)	3.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
55.0	26.5	16.7	1.8	5.1	37.9	57.0	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 91Q5007

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D07'52'N 112D40'19'W	Site Location:	08S 09W 14 CDDD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:149188
Geologic Source:	120SDMS	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450752112401901
Agency + Sampler:	USGS*DC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5274.70 ft
Date Sampled:	Aug 21, 1991	Sustained Yield:	
Time Sampled:	12:45	Yield Meas Method:	
Lab + Analyst:	USGS	Total Depth of Well:	405.30 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	20 in.
Method Sampled:		Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	torch perf.
Water Use:	Irrigation	Perforation Interval:	104 - 404 ft

Sampling Site: **Zenchiku Ranch Land and Livestock Irrigation Well #5**
Geologic Source: Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	80.	3.99	Bicarbonate	(HCO_3)	249.	4.08
Magnesium	(Mg)	23.	1.89	Carbonate	(CO_3)		0.00
Sodium	(Na)	22.	0.96	Chloride	(Cl)	21.	0.59
Potassium	(K)	5.4	0.14	Sulfate	(SO_4)	120.	2.50
Iron	(Fe)	0.012	0.00	Nitrate	(as N)		0.00
Manganese	(Mn)	<0.001	0.00	Fluoride	(F)	0.7	0.04
Silica	(SiO_2)	18.		OrthoPhosphate	(as P)		0.00
Total Cations:			7.00	Total Anions:			7.21

Calculated Dissolved Solid:	412.78	Total Hardness as $CaCO_3$:	294.43
Sum of Diss, Constituent:	539.12	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	670.	Total Alkalinity as $CaCO_3$:	204.22
Lab cnductvy, micromhos:	664.	Field Alkalinity as $CaCO_3$:	204.
Field PH:	7.9	Ryznar Stability Index:	6.57
Laboratory PH:	8.0	Langlier Saturation Index:	0.71
		Sodium Adsorption Ratio:	0.56

Parameter	Value	Parameter	Value
Field Temp, Air	25.0 C	Field Temp, Water	10.1 C
BARIUM, DISS (µg/l as BA)	50.	LITHIUM, DISS (µg/l as LI)	41.
BERYLL, DISS (µg/l as BE)	<0.5	MOLYBDENUM, DISS (µg/l as MO)	<10.
BORON, DISS (µg/l as B)	70.	NICKEL, DISS (µg/l as NI)	<10.
CADMIUM, DISS (µg/l as CD)	<1.	SILVER, DISS (µg/l as AG)	<1.
CHROMIUM, DISS (µg/l as CR)	<5.	STRONTIUM, DISS (µg/l as SR)	870.
COBALT, DISS (µg/l as CO)	<3.	VANADIUM, DISS (µg/l as V)	<6.
COPPER, DISS (µg/l as CU)	<10.	ZINC, DISS (µg/l as ZN)	6
LEAD, DISS (µg/l as PB)	<10.		

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
57.2	27.1	13.7	2.0	8.3	34.8	56.9	0.0

Middle Blacktail Deer Creek Valley

MONTANA BUREAU OF MINES AND GEOLOGY	WATER QUALITY ANALYSIS
BUTTE, MONTANA 59701 (406) 496-4156	Lab No.: 94Q0518

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D06'57'N 112D37'16'W	Site Location:	08S 08W 30 AAAA
Topographic Map:	Ashbough Canyon 7 1/2'	MBMG Site:	M:126663
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450657112371601
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	91-05	Land Surface Altitude:	5397.92 ft
Date Sampled:	Sep 03, 1993	Sustained Yield:	
Time Sampled:	11:00	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	106.91 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	2.0 in.
Method Sampled:	Pumped	Casing Type:	PVC
Procedure Type:	Dissolved	Completion Type:	0.020 slot 2-in PVC screen
Water Use:	Monitoring	Perforation Interval:	95.5 - 105.5 ft

Sampling Site:	**Beaverhead Groundwater Project 91-5**
Geologic Source:	Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	89.9	4.49	Bicarbonate	(HCO_3)	291.	4.77
Magnesium	(Mg)	24.8	2.04	Carbonate	(CO_3)		0.00
Sodium	(Na)	10.9	0.47	Chloride	(Cl)	10.6	0.30
Potassium	(K)	4.5	0.12	Sulfate	(SO_4)	75.2	1.57
Iron	(Fe)	<0.003	0.00	Nitrate	(as N)	7.38	0.53
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	0.35	0.02
Silica	(SiO_2)	25.3		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			7.13	Total Anions:			7.18

Standard Deviation of Anion-Cation Balance (Sigma) 0.25

Calculated Dissolved Solid:	392.28	Total Hardness as $CaCO_3$:	326.56
Sum of Diss, Constituent:	539.93	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	650.	Total Alkalinity as $CaCO_3$:	238.67
Lab cnductvy, micromhos:	618.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.41	Ryznar Stability Index:	6.70
Laboratory PH:	7.64	Langlier Saturation Index:	0.47
		Sodium Adsorption Ratio:	0.26

Parameter	Value	Parameter	Value
Field Temp, Air	17.0 C	Field Temp, Water	9.2 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	10.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	1.5	NICKEL, DISS (µg/l as NI)	2.
BARIUM, DISS (µg/l as BA)	73.1	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	<30.	SELENIUM, DISS (µg/l as SE)	1.4
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	552.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
63.0	28.7	6.7	1.6	4.5	23.6	71.9	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0514

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D07'52'N 112D37'42'W	Site Location:	08S 08W 18 DCCD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:126661
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450748112374001
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	91-6	Land Surface Altitude:	5351.09 ft
Date Sampled:	Sep 03, 1993	Sustained Yield:	
Time Sampled:	08:45	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	122.48 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	2.0 in.
Method Sampled:	Pumped	Casing Type:	PVC
Procedure Type:	Dissolved	Completion Type:	0.020 slot 2-in. PVC screen
Water Use:	Monitoring	Perforation Interval:	110.5 - 120.5 ft

Sampling Site: **Beaverhead Groundwater Project 91-6**
Geologic Source: Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	69.7	3.48	Bicarbonate	(HCO$_3$)	261.	4.28
Magnesium	(Mg)	21.5	1.77	Carbonate	(CO$_3$)		0.00
Sodium	(Na)	10.9	0.47	Chloride	(Cl)	8.7	0.25
Potassium	(K)	4.	0.10	Sulfate	(SO$_4$)	60.2	1.25
Iron	(Fe)	<0.003	0.00	Nitrate	(as N)	0.45	0.03
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	0.40	0.02
Silica	(SiO$_2$)	26.1		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			5.83	Total Anions:			5.83

Standard Deviation of Anion-Cation Balance (Sigma) - 0.01

Calculated Dissolved Solid:	330.52	Total Hardness as CaCO$_3$:	262.53
Sum of Diss, Constituent:	462.95	Field Hardness as CaCO$_3$:	
Field cnductvy, micromhos:	547.	Total Alkalinity as CaCO$_3$:	214.06
Lab cnductvy, micromhos:	526.	Field Alkalinity as CaCO$_3$:	
Field PH:	7.56	Ryznar Stability Index:	6.95
Laboratory PH:	7.7	Langlier Saturation Index:	0.37
		Sodium Adsorption Ratio:	0.29

Parameter	Value	Parameter	Value
Field Temp, Air	13.0 C	Field Temp, Water	8.1 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	10.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.1	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	66.6	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	<30.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	389.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	15.3
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO$_4$	HCO$_3$	CO$_3$
59.7	30.4	8.1	1.8	4.2	21.7	74.1	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0348

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D09'46'N 112D38'27'W	Site Location:	08S 09W 01 DDAA
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133329
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	91-07	Land Surface Altitude:	5248.66 ft
Date Sampled:	Aug 26, 1993	Sustained Yield:	
Time Sampled:	16:00	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	62.29 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	2.0 in.
Method Sampled:	Pumped	Casing Type:	PVC
Procedure Type:	Dissolved	Completion Type:	0.020 slot 2-in. PVC screen
Water Use:	Monitoring	Perforation Interval:	50.5 - 60.5 ft

Sampling Site: **Beaverhead Groundwater Project 91-7**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	72.4	3.61	Bicarbonate	(HCO_3)	271.	4.44
Magnesium	(Mg)	21.	1.73	Carbonate	(CO_3)		0.00
Sodium	(Na)	12.1	0.53	Chloride	(Cl)	9.7	0.27
Potassium	(K)	5.	0.13	Sulfate	(SO_4)	56.9	1.18
Iron	(Fe)	<0.003	0.00	Nitrate	(as N)	1.06	0.08
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	0.34	0.02
Silica	(SiO_2)	29.2		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			6.00	Total Anions:			5.99

Standard Deviation of Anion-Cation Balance (Sigma) - 0.05

Calculated Dissolved Solid:	341.20	Total Hardness as $CaCO_3$:	267.22
Sum of Diss, Constituent:	478.70	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	564.	Total Alkalinity as $CaCO_3$:	222.27
Lab cnductvy, micromhos:	551.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.59	Ryznar Stability Index:	7.11
Laboratory PH:	7.48	Langlier Saturation Index:	0.19
		Sodium Adsorption Ratio:	0.32

Parameter	Value	Parameter	Value
Field Temp, Air	17.0 C	Field Temp, Water	9.4 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	7.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.4	NICKEL, DISS (µg/l as NI)	1.8
BARIUM, DISS (µg/l as BA)	76.	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	<30.	SELENIUM, DISS (µg/l as SE)	1.6
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	422.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
60.3	28.8	8.8	2.1	4.6	20.1	75.3	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0498

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D07'30'N 112D36'35'W	Site Location:	08S 08W 20 ACCA
Topographic Map:	Dillon East 7 1/2'	MBMG Site:	M:133332
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450730112363501
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-05	Land Surface Altitude:	5399.03 ft
Date Sampled:	Sep 15, 1993	Sustained Yield:	
Time Sampled:	11:15	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	177.89 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	air perf.
Water Use:	Monitoring	Perforation Interval:	86-91, 124-127, 147-152 164-169 ft

Sampling Site: **Beaverhead Groundwater Project 92-5**
Geologic Source: Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	64.	3.19	Bicarbonate	(HCO_3)	259.	4.25
Magnesium	(Mg)	22.1	1.82	Carbonate	(CO_3)		0.00
Sodium	(Na)	15.1	0.66	Chloride	(Cl)	11.2	0.32
Potassium	(K)	6.1	0.16	Sulfate	(SO_4)	57.1	1.19
Iron	(Fe)	0.017	0.00	Nitrate	(as N)	0.5	0.04
Manganese	(Mn)	0.002	0.00	Fluoride	(F)	0.24	0.01
Silica	(SiO_2)	40.5		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			5.83	Total Anions:			5.80

Standard Deviation of Anion-Cation Balance (Sigma) - 0.17

Calculated Dissolved Solid:	344.45	Total Hardness as $CaCO_3$:	250.77
Sum of Diss, Constituent:	475.86	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	537.	Total Alkalinity as $CaCO_3$:	212.42
Lab cnductvy, micromhos:	536.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.47	Ryznar Stability Index:	7.11
Laboratory PH:	7.62	Langlier Saturation Index:	0.25
		Sodium Adsorption Ratio:	0.41

Parameter	Value	Parameter	Value
Field Temp, Air	19.0 C	Field Temp, Water	10.2 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	11.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.5	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	63.2	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	<30.	SELENIUM, DISS (µg/l as SE)	1.
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	222.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
54.8	31.2	11.3	2.7	5.5	20.7	73.8	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0980

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D09'53'N 112D38'07'W	Site Location:	08S 08W 06 CBDD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:140582
Geologic Source:	120SDMS	Project Id:	USGS
Drainage Basin:	AB	Station Id:	450953112380701
Agency + Sampler:	USGS*DAP	Sample Source:	Well
Bottle number:	92-14	Land Surface Altitude:	5246.69 ft
Date Sampled:	Apr 14, 1994	Sustained Yield:	
Time Sampled:	13:40	Yield Meas Method:	
Lab + Analyst:	MBMG*GAL	Total Depth of Well:	320.02 ft below toc
Date Complete:	Jul 19, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	52-57, 70-76, 140-150, 239-245, 253-258 ft

Sampling Site:	**Beaverhead Groundwater Project 92-14**
Geologic Source:	Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	74.2	3.70	Bicarbonate	(HCO_3)	278.	4.56
Magnesium	(Mg)	22.7	1.87	Carbonate	(CO_3)		0.00
Sodium	(Na)	12.5	0.54	Chloride	(Cl)	8.1	0.23
Potassium	(K)	5.	0.13	Sulfate	(SO_4)	56.7	1.18
Iron	(Fe)	0.017	0.00	Nitrate	(as N)	1.47	0.10
Manganese	(Mn)	0.002	0.00	Fluoride	(F)	0.33	0.02
Silica	(SiO_2)	29.7		OrthoPhosphate	(as P)	<0.02	0.00
Total Cations:			6.25	Total Anions:			6.09

Standard Deviation of Anion-Cation Balance (Sigma) - 0.84

Calculated Dissolved Solid:	347.66	Total Hardness as $CaCO_3$:	278.71
Sum of Diss, Constituent:	488.72	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	561.	Total Alkalinity as $CaCO_3$:	228.01
Lab cnductvy, micromhos:	553.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.24	Ryznar Stability Index:	6.91
Laboratory PH:	7.63	Langlier Saturation Index:	0.36
		Sodium Adsorption Ratio:	0.33

Parameter	Value	Parameter	Value
Field Temp, Air	6.5 C	Field Temp, Water	8.2 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	12.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.9	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	83.1	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	<30.	SELENIUM, DISS (µg/l as SE)	1.4
BROMIDE, DISS (µg/l as BR)	47.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	461.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
59.3	29.9	8.7	2.1	3.8	19.8	76.4	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0352

State:	Montana	County:	Beaverhead
Latitude-Longitude:	D ' 'N D ' 'W	Site Location:	08S 08W 06 CADA
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:136464
Geologic Source:		Project Id:	USGS
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Stream
Bottle number:	Blackta	Land Surface Altitude:	5250 ft
Date Sampled:	Aug 25, 1993	Water Flow Rate:	45.0 cfs
Time Sampled:	18:30	Flow Meas. Method:	
Lab + Analyst:	MBMG*SFM	Staff Gage:	
Date Complete:	Jan 05, 1994	Stream Stage:	
Sample Handling:	312	Depth to Sample:	
Method Sampled:	Grab	Total Depth of Water:	
Procedure Type:	Dissolved	Stream Width:	
Water Use:			

Sampling Site:	**Blacktail Deer Creek Gaging Station near EBID Canal**
Drainage Basin:	Beaverhead River

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	64.6	3.22	Bicarbonate	(HCO_3)	220.	3.61
Magnesium	(Mg)	19.4	1.60	Carbonate	(CO_3)	6.72	0.22
Sodium	(Na)	9.2	0.40	Chloride	(Cl)	6.2	0.17
Potassium	(K)	4.0	0.10	Sulfate	(SO_4)	57.1	1.19
Iron	(Fe)	0.005	0.00	Nitrate	(as N)	<0.05	0.00
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	0.42	0.02
Silica	(SiO_2)	17.6		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			5.33	Total Anions:			5.22

Standard Deviation of Anion-Cation Balance (Sigma) -0.63

Calculated Dissolved Solid:	293.62	Total Hardness as $CaCO_3$:	241.16
Sum of Diss, Constituent:	405.25	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	503.	Total Alkalinity as $CaCO_3$:	180.55
Lab cnductvy, micromhos:	494.	Field Alkalinity as $CaCO_3$:	
Field PH:	8.76	Ryznar Stability Index:	6.37
Laboratory PH:	8.44	Langlier Saturation Index:	1.03
		Sodium Adsorption Ratio:	0.26

Parameter	Value	Parameter	Value
Field Temp, Air	14.5C	Field Temp, Water	14.6 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	7.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	3.4	NICKEL, DISS (µg/l as Ni)	2.0
BARIUM, DISS (µg/l as BA)	67.7	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	<30.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	408.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
60.6	30.0	7.5	1.9	3.4	22.9	69.4	4.3

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 91Q5004

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D07'31'N 112D36'30'W	Site Location:	08S 08W 20 ACCA
Topographic Map:	Dillon East 7 1/2'	MBMG Site:	M:109803
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450731112363001
Agency + Sampler:	USGS*DC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5400.11 ft
Date Sampled:	Aug 20, 1991	Sustained Yield:	
Time Sampled:	17:30	Yield Meas Method:	
Lab + Analyst:	USGS	Total Depth of Well:	183.73 ft
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	20 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	torch perfs
Water Use:	Irrigation	Perforation Interval:	45 - 185 ft

Sampling Site: **Forrester, Roy (irrigation well #1)**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	61.	3.04	Bicarbonate	(HCO_3)	258.	4.23
Magnesium	(Mg)	22.	1.81	Carbonate	(CO_3)		0.00
Sodium	(Na)	14.	0.61	Chloride	(Cl)	14.	0.39
Potassium	(K)	5.	0.13	Sulfate	(SO_4)	47.	0.98
Iron	(Fe)	0.008	0.00	Nitrate	(as N)		0.00
Manganese	(Mn)	<0.001	0.00	Fluoride	(F)	0.2	0.01
Silica	(SiO_2)	36.		OrthoPhosphate (as P)			0.00
Total Cations:			5.60	Total Anions:			5.61

Calculated Dissolved Solid:	326.30	Total Hardness as $CaCO_3$:	242.87
Sum of Diss, Constituent:	457.21	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	519.	Total Alkalinity as $CaCO_3$:	211.60
Lab cnductvy, micromhos:	519.	Field Alkalinity as $CaCO_3$:	211.
Field PH:	7.45	Ryznar Stability Index:	6.98
Laboratory PH:	7.8	Langlier Saturation Index:	0.41
		Sodium Adsorption Ratio:	0.39

Parameter	Value	Parameter	Value
Field Temp, Air	30.0 C	Field Temp, Water	9.6 C
Oxygen, DISS, Field (mg/l as O)	9.5		

BARIUM, DISS (µg/l as BA)	69.	LITHIUM, DISS (µg/l as LI)	16.
BERYLL, DISS (µg/l as BE)	<0.5	MOLYBDENUM, DISS (µg/l as MO)	<10.
BORON, DISS (µg/l as B)	40.	NICKEL, DISS (µg/l as NI)	<10.
CADMIUM, DISS (µg/l as CD)	1.	OXYGEN, 18/16 RATIO (per M)	-17.95
CHROMIUM, DISS (µg/l as CR)	<5.	SILVER, DISS (µg/l as AG)	<1.
COBALT, DISS (µg/l as CO)	<3.	STRONTIUM, DISS (µg/l as SR)	200.
COPPER, DISS (µg/l as CU)	<10.	TRITIUM, DISS (PCI/L)	54.
HYDROGEN, 2/1 RATIO (per M)	-140.	VANADIUM, DISS (µg/l as V)	<6.
LEAD, DISS (µg/l as PB)	10.	ZINC, DISS (µg/l as ZN)	<3.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
54.4	32.4	10.9	2.3	7.0	17.5	75.5	0.0

MONTANA BUREAU OF MINES AND GEOLOGY	WATER QUALITY ANALYSIS
BUTTE, MONTANA 59701 (406) 496-4156	Lab No.: 91Q5005

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D08'43'N 112D37'14'W	Site Location:	08S 08W 07 DDDD
Topographic Map:	Dillon East 7 1/2'	MBMG Site:	M:109796
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450843112371401
Agency + Sampler:	USGS*DC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5313.90 ft
Date Sampled:	Aug 21, 1991	Sustained Yield:	
Time Sampled:	18:00	Yield Meas Method:	
Lab + Analyst:	USGS	Total Depth of Well:	186 ft
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	20 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	torch perfs
Water Use:	Irrigation	Perforation Interval:	60 - 170 ft

Sampling Site:	**High Mountain irrigation well #1**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	66.	3.29	Bicarbonate	(HCO_3)	246.	4.03
Magnesium	(Mg)	20.	1.65	Carbonate	(CO_3)		0.00
Sodium	(Na)	12.	0.52	Chloride	(Cl)	11.	0.31
Potassium	(K)	5.2	0.13	Sulfate	(SO_4)	47.	0.98
Iron	(Fe)	0.006	0.00	Nitrate	(as N)		0.00
Manganese	(Mn)	<0.001	0.00	Fluoride	(F)	0.2	0.01
Silica	(SiO_2)	33.		OrthoPhosphate	(as P)		0.00
Total Cations:			5.60	Total Anions:			5.33

Calculated Dissolved Solid:	315.59	Total Hardness as $CaCO_3$:	247.12
Sum of Diss, Constituent:	440.41	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	517.	Total Alkalinity as $CaCO_3$:	201.76
Lab cnductvy, micromhos:	514.	Field Alkalinity as $CaCO_3$:	202.
Field PH:	7.52	Ryznar Stability Index:	6.95
Laboratory PH:	7.8	Langlier Saturation Index:	0.42
		Sodium Adsorption Ratio:	0.33

Parameter	Value	Parameter	Value
Field Temp, Air	27.0 C	Field Temp, Water	8.4 C

BARIUM, DISS (µg/l as BA)	85.	LITHIUM, DISS (µg/l as LI)	13.
BERYLL, DISS (µg/l as BE)	<0.5	MOLYBDENUM, DISS (µg/l as MO)	<10.
BORON, DISS (µg/l as B)	40.	NICKEL, DISS (µg/l as NI)	<10.
CADMIUM, DISS (µg/l as CD)	<1.	OXYGEN, 18/16 RATIO (per M)	-18.05
CHROMIUM, DISS (µg/l as CR)	<5.	SILVER, DISS (µg/l as AG)	<1.
COBALT, DISS (µg/l as CO)	<3.	STRONTIUM, DISS (µg/l as SR)	280.
COPPER, DISS (µg/l as CU)	<10.	TRITIUM, DISS (PCI/L)	64.
HYDROGEN, 2/1 RATIO (per M)	-140.	VANADIUM, DISS (µg/l as V)	7.
LEAD, DISS (µg/l as PB)	10.	ZINC, DISS (µg/l as ZN)	5.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
58.9	29.4	9.3	2.4	5.8	18.4	75.8	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q5005

State: Montana
Latitude-Longitude: 45D08'47'N 112D37'47'W
Topographic Map: Dillon West 7 1/2'
Geologic Source: 110ALVM
Drainage Basin: AB
Agency + Sampler: DNRC*BU
Bottle number:
Date Sampled: Dec 10, 1993
Time Sampled:
Lab + Analyst: UM*LB
Date Complete:
Sample Handling:
Method Sampled: Pumped
Procedure Type: Dissolved
Water Use: Domestic/Stock

County: Beaverhead
Site Location: 08S 08W 07 DCCC
MBMG Site: M:109794
Project Id: Bvrhead
Station Id: 450847112374701
Sample Source: Well
Land Surface Altitude: 5302.43 ft
Sustained Yield:
Yield Meas Method:
Total Depth of Well: 82 ft below toc
SWL from g.s.:
Casing Diameter: 6.0 in.
Casing Type: Steel
Completion Type:
Perforation Interval:

Sampling Site: **High Mountain Ranch**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	81.5	4.07	Bicarbonate	(HCO_3)	277.	4.54
Magnesium	(Mg)	22.8	1.88	Carbonate	(CO_3)		0.00
Sodium	(Na)	11.3	0.49	Chloride	(Cl)	10.11	0.29
Potassium	(K)	7.21	0.18	Sulfate	(SO_4)	58.7	1.22
Iron	(Fe)	0.045	0.00	Nitrate	(as N)	1.01	0.07
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	12.3		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			6.63	Total Anions:			6.12

Calculated Dissolved Solid:	341.47	Total Hardness as $CaCO_3$:	297.35
Sum of Diss, Constituent:	482.02	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	227.19
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	228.
Field PH:	7.39	Ryznar Stability Index:	14.36
Laboratory PH:		Langlier Saturation Index:	-7.18
		Sodium Adsorption Ratio:	0.29

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	8.8 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	26.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	366.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	27.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	40.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
61.4	28.4	7.4	2.8	4.7	20.2	75.1	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q5010

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D10'00'N 112D37'09'W	Site Location:	08S 08W 06 ADDD
Topographic Map:	Dillon East 7 1/2'	MBMG Site:	M:109789
Geologic Source:	120SDMS	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	451000112370901
Agency + Sampler:	DNRC*BU	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5293.08 ft
Date Sampled:	Dec 10, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	94 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Domestic	Perforation Interval:	

Sampling Site: **Humphrey, Niles**
Geologic Source: Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	128.	6.39	Bicarbonate	(HCO$_3$)	329.	5.39
Magnesium	(Mg)	38.8	3.19	Carbonate	(CO$_3$)		0.00
Sodium	(Na)	27.1	1.18	Chloride	(Cl)	82.17	2.32
Potassium	(K)	10.63	0.27	Sulfate	(SO$_4$)	102.18	2.13
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	5.66	0.40
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO$_2$)	19.8		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			11.04	Total Anions:			10.24

Calculated Dissolved Solid:	576.41	Total Hardness as CaCO$_3$:	479.32
Sum of Diss, Constituent:	743.34	Field Hardness as CaCO$_3$:	
Field cnductvy, micromhos:		Total Alkalinity as CaCO$_3$:	269.84
Lab cnductvy, micromhos:		Field Alkalinity as CaCO$_3$:	270.
Field PH:	7.23	Ryznar Stability Index:	13.82
Laboratory PH:		Langlier Saturation Index:	-6.91
		Sodium Adsorption Ratio:	0.54

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	8.9 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	61.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	505.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	25.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	43.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO$_4$	HCO$_3$	CO$_3$
57.9	28.9	10.7	2.5	23.6	21.6	54.8	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q5011

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D09'11'N 112D37'18'W	Site Location:	08S 08W 07 DAAC
Topographic Map:	Dillon East 7 1/2'	MBMG Site:	M:109795
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450911112371801
Agency + Sampler:	DNRC*BU	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5285.72 ft
Date Sampled:	Dec 09, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	75 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	8.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Domestic	Perforation Interval:	

Sampling Site: **Ripley, Jack**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	78.	3.89	Bicarbonate	(HCO_3)	275.	4.51
Magnesium	(Mg)	21.7	1.79	Carbonate	(CO_3)		0.00
Sodium	(Na)	11.5	0.50	Chloride	(Cl)	7.96	0.22
Potassium	(K)	8.42	0.22	Sulfate	(SO_4)	53.52	1.11
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	0.5	0.04
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	15.9		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			6.40	Total Anions:			5.88

Calculated Dissolved Solid:	333.00	Total Hardness as $CaCO_3$:	284.08
Sum of Diss, Constituent:	472.54	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	225.55
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	226.
Field PH:	7.18	Ryznar Stability Index:	14.41
Laboratory PH:		Langlier Saturation Index:	-7.20
		Sodium Adsorption Ratio:	0.30

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	8.4 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	27.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	320.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	23.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	35.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
60.9	27.9	7.8	3.4	3.8	19.0	77.1	0.0

Lower Blacktail Deer Creek Valley

MONTANA BUREAU OF MINES AND GEOLOGY	WATER QUALITY ANALYSIS
BUTTE, MONTANA 59701 (406) 496-4156	Lab No.: 94Q0981

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D11'04'N 112D38'05'W	Site Location:	07S 08W 31 BCAD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133380
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	451104112380501
Agency + Sampler:	USGS*DAP	Sample Source:	Well
Bottle number:	92-15	Land Surface Altitude:	5216.77 ft
Date Sampled:	Apr 14, 1994	Sustained Yield:	
Time Sampled:	10:50	Yield Meas Method:	
Lab + Analyst:	MBMG*GAL	Total Depth of Well:	510.68 ft below toc
Date Complete:	Jul 19, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Monitoring	Perforation Interval:	

Sampling Site:	**Beaverhead Groundwater Project 92-15**
Geologic Source:	Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	46.9	2.34	Bicarbonate	(HCO_3)	195.	3.20
Magnesium	(Mg)	9.4	0.77	Carbonate	(CO_3)		0.00
Sodium	(Na)	14.6	0.64	Chloride	(Cl)	4.9	0.14
Potassium	(K)	10.2	0.26	Sulfate	(SO_4)	29.7	0.62
Iron	(Fe)	0.144	0.01	Nitrate	(as N)	0.38	0.03
Manganese	(Mn)	0.046	0.00	Fluoride	(F)	0.36	0.02
Silica	(SiO_2)	67.2		OrthoPhosphate	(as P)	<0.02	0.00
Total Cations:			4.03	Total Anions:			4.00

Calculated Dissolved Solid:	279.89	Total Hardness as $CaCO_3$:	155.80
Sum of Diss, Constituent:	378.83	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	384.	Total Alkalinity as $CaCO_3$:	159.93
Lab cnductvy, micromhos:	384.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.43	Ryznar Stability Index:	7.59
Laboratory PH:	7.66	Langlier Saturation Index:	0.04
		Sodium Adsorption Ratio:	0.51

Parameter	Value	Parameter	Value
Field Temp, Air	4.0 C	Field Temp, Water	14.0 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	18.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	11.7	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	81.5	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	30.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	34.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	532.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	13.5
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
58.4	19.3	15.8	6.5	3.5	15.6	80.9	0.0

MONTANA BUREAU OF MINES AND GEOLOGY BUTTE, MONTANA 59701 (406) 496-4156	WATER QUALITY ANALYSIS Lab No.: 94Q5015

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D12'01'N 112D38'38'W	Site Location:	07S 09W 25 AADD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:109658
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	451201112383801
Agency + Sampler:	DNRC*BC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5178.86 ft
Date Sampled:	Nov 14, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	69 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Domestic	Perforation Interval:	

Sampling Site: **Cornell, Roy**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	91.4	4.56	Bicarbonate	(HCO_3)	299.	4.90
Magnesium	(Mg)	30.8	2.53	Carbonate	(CO_3)		0.00
Sodium	(Na)	19.6	0.85	Chloride	(Cl)	13.2	0.37
Potassium	(K)	9.78	0.25	Sulfate	(SO_4)	98.93	2.06
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	3.62	0.26
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	18.3		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			8.21	Total Anions:			7.59

Calculated Dissolved Solid:	432.92	Total Hardness as $CaCO_3$:	355.0
Sum of Diss, Constituent:	584.63	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	245.23
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	246.
Field PH:	7.63	Ryznar Stability Index:	14.2
Laboratory PH:		Langlier Saturation Index:	-7.10
		Sodium Adsorption Ratio:	0.45

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	7.8 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	38.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	528.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	15.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	44.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
55.6	30.9	10.4	3.1	5.1	28.0	66.9	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q5016

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D11'59'N 112D38'50'W	Site Location:	07S 09W 25 ACAB
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:109659
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	451159112385001
Agency + Sampler:	DNRC*BC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5143.29 ft
Date Sampled:	Nov 14, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	40 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Domestic	Perforation Interval:	

Sampling Site: **Downey, Dan**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l
Calcium	(Ca)	99.5	4.97
Magnesium	(Mg)	35.3	2.90
Sodium	(Na)	22.4	0.97
Potassium	(K)	9.26	0.24
Iron	(Fe)	<0.012	0.00
Manganese	(Mn)	<0.005	0.00
Silica	(SiO_2)	20.1	
Total Cations:			9.10

		mg/l	meq/l
Bicarbonate	(HCO_3)	307.	5.03
Carbonate	(CO_3)		0.00
Chloride	(Cl)	15.83	0.45
Sulfate	(SO_4)	113.11	2.35
Nitrate	(as N)	5.04	0.36
Fluoride	(F)		0.00
OrthoPhosphate	(as P)	<0.5	0.00
Total Anions:			8.19

Calculated Dissolved Solid:	471.77
Sum of Diss, Constituent:	627.54
Field cnductvy, micromhos:	
Lab cnductvy, micromhos:	
Field PH:	7.78
Laboratory PH:	

Total Hardness as $CaCO_3$:	393.75
Field Hardness as $CaCO_3$:	
Total Alkalinity as $CaCO_3$:	251.79
Field Alkalinity as $CaCO_3$:	252.
Ryznar Stability Index:	14.10
Langlier Saturation Index:	-7.05
Sodium Adsorption Ratio:	0.49

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	5.9 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	41.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	617.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	8.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	78.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
54.7	32.0	10.7	2.6	5.7	30.1	64.2	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q5007

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D11'04'N 112D40'09'W	Site Location:	07S 09W 35 ACBD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:145386
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	451104112400901
Agency + Sampler:	DNRC*BC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5160.40 ft
Date Sampled:	Nov 14, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	40 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Domestic	Perforation Interval:	

Sampling Site:	**Eberline, Rich**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	91.4	4.56	Bicarbonate	(HCO_3)	253.	4.15
Magnesium	(Mg)	25.0	2.06	Carbonate	(CO_3)		0.00
Sodium	(Na)	22.3	0.97	Chloride	(Cl)	13.04	0.37
Potassium	(K)	6.72	0.17	Sulfate	(SO_4)	103.41	2.15
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	1.81	0.13
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	12.2		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			7.77	Total Anions:			6.80

Calculated Dissolved Solid:	400.51	Total Hardness as $CaCO_3$:	331.13
Sum of Diss, Constituent:	528.88	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	207.50
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	208.
Field PH:	7.75	Ryznar Stability Index:	14.34
Laboratory PH:		Langlier Saturation Index:	-7.17
		Sodium Adsorption Ratio:	0.53

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	6.3 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	45.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	487.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	23.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	63.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
58.8	26.5	12.5	2.2	5.5	32.2	62.3	0.0

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WATER QUALITY ANALYSIS
Lab No.: 94Q5014

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D11'31'N 112D37'51'W	Site Location:	07S 08W 30 CADC
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:121424
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	451131112375101
Agency + Sampler:	DNRC*BU	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5205.77 ft
Date Sampled:	Dec 03, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	130 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Domestic	Perforation Interval:	

Sampling Site:	**Svendsen, Ed**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	94.9	4.74	Bicarbonate	(HCO_3)	302.	4.95
Magnesium	(Mg)	26.8	2.20	Carbonate	(CO_3)		0.00
Sodium	(Na)	15.6	0.68	Chloride	(Cl)	26.1	0.74
Potassium	(K)	11.84	0.30	Sulfate	(SO_4)	82.47	1.72
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	2.39	0.17
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	25.4		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			7.92	Total Anions:			7.57

Calculated Dissolved Solid:	434.30	Total Hardness as $CaCO_3$:	347.27
Sum of Diss, Constituent:	587.53	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	247.69
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	248.
Field PH:	7.54	Ryznar Stability Index:	14.16
Laboratory PH:		Langlier Saturation Index:	-7.08
		Sodium Adsorption Ratio:	0.36

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	9.4 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	24.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	45.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	17.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	34.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
59.8	27.8	8.6	3.8	9.9	23.2	66.9	0.0

Beaverhead River Floodplain near Barretts

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0517

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D09'50'N 112D41'09'W	Site Location:	08S 09W 03 DACC
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133392
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450952112410501
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-21	Land Surface Altitude:	5182.36 ft
Date Sampled:	Sep 02, 1993	Sustained Yield:	
Time Sampled:	15:30	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	487.30 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	2.0 in.
Method Sampled:	Pumped	Casing Type:	PVC
Procedure Type:	Dissolved	Completion Type:	0.020 slot 4-in. PVC screen
Water Use:	Monitoring	Perforation Interval:	475 - 485 ft

Sampling Site:	**Beaverhead Groundwater Project 92-21**
Geologic Source:	Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	44.2	2.21	Bicarbonate	(HCO_3)	174.	2.85
Magnesium	(Mg)	9.6	0.79	Carbonate	(CO_3)		0.00
Sodium	(Na)	36.9	1.61	Chloride	(Cl)	10.	0.28
Potassium	(K)	12.	0.31	Sulfate	(SO_4)	85.7	1.78
Iron	(Fe)	0.05	0.00	Nitrate	(as N)	0.21	0.02
Manganese	(Mn)	0.131	0.00	Fluoride	(F)	0.62	0.03
Silica	(SiO_2)	72.1		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			4.93	Total Anions:			4.97

Standard Deviation of Anion-Cation Balance (Sigma) 0.23

Calculated Dissolved Solid:	357.23	Total Hardness as $CaCO_3$:	149.88
Sum of Diss, Constituent:	445.52	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	478.	Total Alkalinity as $CaCO_3$:	142.71
Lab cnductvy, micromhos:	479.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.65	Ryznar Stability Index:	7.78
Laboratory PH:	7.62	Langlier Saturation Index:	-0.08
		Sodium Adsorption Ratio:	1.31

Parameter	Value	Parameter	Value
Field Temp, Air	24.0 C	Field Temp, Water	14.4 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	33.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	6.8	NICKEL, DISS (µg/l as NI)	3.4
BARIUM, DISS (µg/l as BA)	31.5	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	80.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	482.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	11.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
44.9	16.1	32.7	6.3	5.7	36.3	58.0	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q0522

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D09'52'N 112D41'07'W	Site Location:	08S 09W 03 DACC
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133394
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450952112410702
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-22	Land Surface Altitude:	5182.35 ft
Date Sampled:	Sep 02, 1993	Sustained Yield:	
Time Sampled:	14:50	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	50.81 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	43 - 48 ft

Sampling Site: **Beaverhead Groundwater Project 92-22**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	78.5	3.92	Bicarbonate	(HCO_3)	276.	4.52
Magnesium	(Mg)	24.3	2.00	Carbonate	(CO_3)		0.00
Sodium	(Na)	17.1	0.74	Chloride	(Cl)	10.6	0.30
Potassium	(K)	4.3	0.11	Sulfate	(SO_4)	89.3	1.86
Iron	(Fe)	0.009	0.00	Nitrate	(as N)	1.31	0.09
Manganese	(Mn)	0.003	0.00	Fluoride	(F)	0.51	0.03
Silica	(SiO_2)	21.		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			6.79	Total Anions:			6.80

Standard Deviation of Anion-Cation Balance (Sigma) 0.05

Calculated Dissolved Solid:	382.89	Total Hardness as $CaCO_3$:	296.03
Sum of Diss, Constituent:	522.93	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	629.	Total Alkalinity as $CaCO_3$:	226.37
Lab cnductvy, micromhos:	604.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.50	Ryznar Stability Index:	6.76
Laboratory PH:	7.74	Langlier Saturation Index:	0.49
		Sodium Adsorption Ratio:	0.43

Parameter	Value	Parameter	Value
Field Temp, Air	22.0 C	Field Temp, Water	10.9 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	30.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.8	NICKEL, DISS (µg/l as NI)	2.1
BARIUM, DISS (µg/l as BA)	31.7	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	42.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	946.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
57.9	29.5	11.0	1.6	4.5	27.8	67.7	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0349

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D09'12'N 112D42'14'W	Site Location:	08S 09W 09 ADDB
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133395
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-23	Land Surface Altitude:	5200.58 ft
Date Sampled:	Aug 28, 1993	Sustained Yield:	
Time Sampled:	11:30	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	210.36 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	191 - 196 ft

Sampling Site: **Beaverhead Groundwater Project 92-23**
Geologic Source: Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	82.7	4.13	Bicarbonate	(HCO_3)	267.	4.38
Magnesium	(Mg)	24.7	2.03	Carbonate	(CO_3)		0.00
Sodium	(Na)	25.5	1.11	Chloride	(Cl)	15.	0.42
Potassium	(K)	4.2	0.11	Sulfate	(SO_4)	125.	2.60
Iron	(Fe)	0.116	0.01	Nitrate	(as N)	1.23	0.09
Manganese	(Mn)	0.002	0.00	Fluoride	(F)	0.04	0.00
Silica	(SiO_2)	19.5		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			7.40	Total Anions:			7.49

Standard Deviation of Anion-Cation Balance (Sigma) 0.44

Calculated Dissolved Solid:	429.52	Total Hardness as $CaCO_3$:	308.17
Sum of Diss, Constituent:	564.99	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	688.	Total Alkalinity as $CaCO_3$:	218.99
Lab cnductvy, micromhos:	660.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.38	Ryznar Stability Index:	7.06
Laboratory PH:	7.42	Langlier Saturation Index:	0.18
		Sodium Adsorption Ratio:	0.63

Parameter	Value	Parameter	Value
Field Temp, Air	15.0 C	Field Temp, Water	9.4 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	18.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.4	NICKEL, DISS (µg/l as NI)	1.9
BARIUM, DISS (µg/l as BA)	73.7	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	42.	SELENIUM, DISS (µg/l as SE)	1.6
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	655.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
56.0	27.5	15.0	1.5	5.7	35.2	59.1	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0355

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D09'10'N 112D42'14'W	Site Location:	08S 09W 09 ADDB
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133396
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-24	Land Surface Altitude:	5200.53 ft
Date Sampled:	Aug 28, 1993	Sustained Yield:	
Time Sampled:	12:45	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	52.47 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	43 - 48 ft

Sampling Site: **Beaverhead Groundwater Project 92-24**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	93.7	4.68	Bicarbonate	(HCO_3)	286.	4.69
Magnesium	(Mg)	28.4	2.34	Carbonate	(CO_3)		0.00
Sodium	(Na)	30.	1.31	Chloride	(Cl)	18.6	0.52
Potassium	(K)	4.9	0.13	Sulfate	(SO_4)	143.	2.98
Iron	(Fe)	0.041	0.00	Nitrate	(as N)	2.87	0.20
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	0.58	0.03
Silica	(SiO_2)	19.9		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			8.46	Total Anions:			8.42

Standard Deviation of Anion-Cation Balance (Sigma) -0.15

Calculated Dissolved Solid:	482.88	Total Hardness as $CaCO_3$:	350.86
Sum of Diss, Constituent:	627.99	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	770.	Total Alkalinity as $CaCO_3$:	234.57
Lab cnductvy, micromhos:	731.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.32	Ryznar Stability Index:	6.90
Laboratory PH:	7.42	Langlier Saturation Index:	0.26
		Sodium Adsorption Ratio:	0.70

Parameter	Value	Parameter	Value
Field Temp, Air	21.0 C	Field Temp, Water	9.5 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	20.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.2	NICKEL, DISS (µg/l as NI)	2.4
BARIUM, DISS (µg/l as BA)	90.2	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	39.	SELENIUM, DISS (µg/l as SE)	1.2
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	705.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
55.4	27.7	15.5	1.5	6.4	36.4	57.2	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0502

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D07'59'N 112D43'40'W	Site Location:	08S 09W 17 DCBA
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133397
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-25	Land Surface Altitude:	5245.01 ft
Date Sampled:	Sep 14, 1993	Sustained Yield:	
Time Sampled:	19:45	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	52.98 ft below toc
Date Complete:	Feb 10, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	43.5 - 47.5 ft

Sampling Site: **Beaverhead Groundwater Project 92-25**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	78.5	3.92	Bicarbonate	(HCO_3)	266.	4.36
Magnesium	(Mg)	24.5	2.02	Carbonate	(CO_3)		0.00
Sodium	(Na)	25.1	1.09	Chloride	(Cl)	11.8	0.33
Potassium	(K)	3.8	0.10	Sulfate	(SO_4)	113.	2.35
Iron	(Fe)	0.068	0.00	Nitrate	(as N)	0.15	0.01
Manganese	(Mn)	0.005	0.00	Fluoride	(F)	0.43	0.02
Silica	(SiO_2)	19.4		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			7.14	Total Anions:			7.08

Standard Deviation of Anion-Cation Balance (Sigma) -0.29

Calculated Dissolved Solid:	407.80	Total Hardness as $CaCO_3$:	296.86
Sum of Diss, Constituent:	542.77	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	645.	Total Alkalinity as $CaCO_3$:	218.17
Lab cnductvy, micromhos:	633.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.75	Ryznar Stability Index:	6.85
Laboratory PH:	7.68	Langlier Saturation Index:	0.41
		Sodium Adsorption Ratio:	0.63

Parameter	Value	Parameter	Value
Field Temp, Air	16.0 C	Field Temp, Water	9.2 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	21.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	72.3	NITRITE, TOTAL DISS (mg/l as N)	<0.2
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	37.4	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	46.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	643.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
55.0	28.3	15.3	1.4	4.7	33.4	61.9	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q0512

State: Montana
Latitude-Longitude: 45D08'24'N 112D42'49'W
Topographic Map: Dillon West 7 1/2'
Geologic Source: 120SDMS
Drainage Basin: AB
Agency + Sampler: USGS*DWC
Bottle number: 92-32
Date Sampled: Sep 01, 1993
Time Sampled: 18:00
Lab + Analyst: MBMG*SFM
Date Complete: Jan 05, 1994
Sample Handling: 312
Method Sampled: Pumped
Procedure Type: Dissolved
Water Use: Monitoring

County: Beaverhead
Site Location: 08S 09W 16 BDAC
MBMG Site: M:133406
Project Id: Gwaamon
Station Id: 450824112424901
Sample Source: Well
Land Surface Altitude: 5224.61 ft
Sustained Yield:
Yield Meas Method:
Total Depth of Well: 368.85 ft below toc
SWL from g.s.:
Casing Diameter: 6.0 in.
Casing Type: Steel
Completion Type:
Perforation Interval:

Sampling Site: **Beaverhead Groundwater Project 92-32**
Geologic Source: Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	74.	3.69	Bicarbonate	(HCO_3)	238.	3.90
Magnesium	(Mg)	22.9	1.88	Carbonate	(CO_3)		0.00
Sodium	(Na)	16.1	0.70	Chloride	(Cl)	13.2	0.37
Potassium	(K)	3.2	0.08	Sulfate	(SO_4)	94.9	1.98
Iron	(Fe)	0.151	0.01	Nitrate	(as N)	0.30	0.02
Manganese	(Mn)	0.017	0.00	Fluoride	(F)	0.51	0.03
Silica	(SiO_2)	21.7		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			6.39	Total Anions:			6.30

Standard Deviation of Anion-Cation Balance (Sigma) -0.45

Calculated Dissolved Solid:	364.22	Total Hardness as $CaCO_3$:	279.03
Sum of Diss, Constituent:	484.98	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	523.	Total Alkalinity as $CaCO_3$:	195.20
Lab cnductvy, micromhos:	565.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.66	Ryznar Stability Index:	6.99
Laboratory PH:	7.69	Langlier Saturation Index:	0.35
		Sodium Adsorption Ratio:	0.42

Parameter	Value	Parameter	Value
Field Temp, Air	14.0 C	Field Temp, Water	10.3 C

ALUMINUM, DISS (µg/l as AL)	26.	LITHIUM, DISS (µg/l as LI)	21.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	1.9	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	26.2	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	27.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	700.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
58.1	29.6	11.0	1.3	6.0	31.6	62.4	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q0515

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D08'23'N 112D42'51'W	Site Location:	08S 09W 16 BDAC
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133409
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	450823112425102
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-33	Land Surface Altitude:	5224.85 ft
Date Sampled:	Sep 01, 1993	Sustained Yield:	
Time Sampled:	16:45	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	55.56 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	46 -51 ft

Sampling Site:	**Beaverhead Groundwater Project 92-33**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	68.5	3.42	Bicarbonate	(HCO_3)	256.	4.20
Magnesium	(Mg)	24.5	2.02	Carbonate	(CO_3)		0.00
Sodium	(Na)	25.7	1.12	Chloride	(Cl)	12.1	0.34
Potassium	(K)	4.5	0.12	Sulfate	(SO_4)	100.	2.08
Iron	(Fe)	0.055	0.00	Nitrate	(as N)	0.12	0.01
Manganese	(Mn)	0.003	0.00	Fluoride	(F)	0.67	0.04
Silica	(SiO_2)	22.7		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			6.68	Total Anions:			6.66

Standard Deviation of Anion-Cation Balance (Sigma) -0.11

Calculated Dissolved Solid:	384.96	Total Hardness as $CaCO_3$:	271.89
Sum of Diss, Constituent:	514.85	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	542.	Total Alkalinity as $CaCO_3$:	209.96
Lab cnductvy, micromhos:	592.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.51	Ryznar Stability Index:	7.17
Laboratory PH:	7.51	Langlier Saturation Index:	0.17
		Sodium Adsorption Ratio:	0.68

Parameter	Value	Parameter	Value
Field Temp, Air	17.0 C	Field Temp, Water	14.0 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	28.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	3.2	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	69.6	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	46.1	SELENIUM, DISS (µg/l as SE)	1.3
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	655.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
51.3	30.2	16.8	1.7	5.2	31.4	63.4	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q5023

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D07'51'N 112D44'19'W	Site Location:	08S 09W 17 CCDC
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:147979
Geologic Source:		Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450751112441901
Agency + Sampler:	DNRC*BC	Sample Source:	Stream
Bottle number:		Land Surface Altitude:	
Date Sampled:	Dec 06, 1993	Water Flow Rate:	
Time Sampled:		Flow Meas Method:	
Lab + Analyst:	UM*LB	Staff Gage:	
Date Complete:		Stream Stage:	
Sample Handling:		Depth of Sample:	
Method Sampled:	Grab	Total Depth of Water:	
Procedure Type:	Dissolved	Stream Width:	
Water Use:			

Sampling Site:	**Beaverhead River @ Barretts diversion**
Drainage Basin:	Beaverhead River

		mg/l	meq/l
Calcium	(Ca)	73.3	3.66
Magnesium	(Mg)	24.8	2.04
Sodium	(Na)	23.2	1.01
Potassium	(K)	7.26	0.19
Iron	(Fe)	<0.012	0.00
Manganese	(Mn)	<0.005	0.00
Silica	(SiO_2)	9.23	
Total Cations:			6.91

		mg/l	meq/l
Bicarbonate	(HCO_3)	249.	4.08
Carbonate	(CO_3)		0.00
Chloride	(Cl)	14.36	0.41
Sulfate	(SO_4)	90.95	1.89
Nitrate	(as N)	0.16	0.01
Fluoride	(F)		0.00
OrthoPhosphate	(as P)	<0.5	0.00
Total Anions:			6.39

Calculated Dissolved Solid:	365.92	Total Hardness as $CaCO_3$:	285.11
Sum of Diss, Constituent:	492.26	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	204.22
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	204.
Field PH:		Ryznar Stability Index:	14.55
Laboratory PH:		Langlier Saturation Index:	-7.27
		Sodium Adsorption Ratio:	0.60

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	1.0 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	34.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	546.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS ((µg/l as TI)	15.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	0.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
53.1	29.6	14.6	2.7	6.3	29.7	64.0	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q0983

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D06'59'N 112D44'59'W	Site Location:	08S 09W 19 DCD
Topographic Map:	Gallagher Mountain 7 1/2'	MBMG Site:	M:141429
Geologic Source:		Project Id:	USGS
Drainage Basin:	AB	Station Id:	450659112445901
Agency + Sampler:	USGS*PLK	Sample Source:	Stream
Bottle number:	Barretts	Land Surface Altitude:	5270 ft
Date Sampled:	May 04, 1994	Water Flow Rate:	281.0 cfs
Time Sampled:	19:50	Flow Meas. Method:	Gaging station
Lab + Analyst:	MBMG*GAL	Staff Gage:	
Date Complete:	Jul 19, 1994	Stream Stage:	
Sample Handling:	312	Depth to Sample:	
Method Sampled:		Total Depth of Water:	
Procedure Type:	Dissolved	Stream Width:	84 ft
Water Use:			

Sampling Site:	**Beaverhead River @ USGS Gaging Station at Barretts**
Drainage Basin:	Beaverhead River

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	63.9	3.19	Bicarbonate	(HCO_3)	239.	3.92
Magnesium	(Mg)	22.2	1.83	Carbonate	(CO_3)		0.00
Sodium	(Na)	23.1	1.00	Chloride	(Cl)	10.8	0.30
Potassium	(K)	4.2	0.11	Sulfate	(SO_4)	86.8	1.81
Iron	(Fe)	0.021	0.00	Nitrate	(as N)	<0.1	0.00
Manganese	(Mn)	0.031	0.00	Fluoride	(F)	0.54	0.03
Silica	(SiO_2)	18.3		OrthoPhosphate	(as P)	<0.1	0.00
Total Cations:			6.14	Total Anions:			6.06

Standard Deviation of Anion-Cation Balance (Sigma) -0.44

Calculated Dissolved Solid:	347.63	Total Hardness as $CaCO_3$:	250.93
Sum of Diss, Constituent:	468.89	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	545.	Total Alkalinity as $CaCO_3$:	196.02
Lab cnductvy, micromhos:	499.	Field Alkalinity as $CaCO_3$:	
Field PH:	8.5	Ryznar Stability Index:	6.52
Laboratory PH:	8.28	Langlier Saturation Index:	0.88
		Sodium Adsorption Ratio:	0.63

Parameter	Value	Parameter	Value
Field Temp, Air	12.0 C	Field Temp, Water	11.0 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	18.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	5.2	NICKEL, DISS (µg/l as Ni)	<2.
BARIUM, DISS (µg/l as BA)	56.1	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	37.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	37.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	586.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
52.0	29.8	16.4	1.8	5.0	30.0	65.0	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q5008

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D10'07'N 112D41'39'W	Site Location:	08S 09W 03 BDDD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:109840
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	451007112413901
Agency + Sampler:	DNRC*BC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5179.89 ft
Date Sampled:	Dec 04, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	40 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Domestic	Perforation Interval:	

Sampling Site:	**Dawson, Steve**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	107.	5.34	Bicarbonate	(HCO_3)	270.	4.43
Magnesium	(Mg)	32.7	2.69	Carbonate	(CO_3)		0.00
Sodium	(Na)	29.4	1.28	Chloride	(Cl)	15.54	0.44
Potassium	(K)	7.87	0.20	Sulfate	(SO_4)	158.17	3.29
Iron	(Fe)	0.024	0.00	Nitrate	(as N)	1.88	0.13
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	11.1		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			9.53	Total Anions:			8.29

Calculated Dissolved Solid:	496.69	Total Hardness as $CaCO_3$:	401.77
Sum of Diss, Constituent:	633.68	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	221.45
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	222.
Field PH:	7.07	Ryznar Stability Index:	14.15
Laboratory PH:		Langlier Saturation Index:	-7.08
		Sodium Adsorption Ratio:	0.64

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	9.8 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	53.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	819.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	17.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	60.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
56.1	28.3	13.5	2.1	5.4	40.3	54.3	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q5004

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D08'51'N 112D41'44'W	Site Location:	08S 09W 10 CDBB
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:126665
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450851112414401
Agency + Sampler:	DNRC*BC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5206.25 ft
Date Sampled:	Nov 14, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	38 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Stock	Perforation Interval:	

Sampling Site:	**Mooney, Francis**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	98.2	4.90	Bicarbonate	(HCO_3)	319.	5.23
Magnesium	(Mg)	28.4	2.34	Carbonate	(CO_3)		0.00
Sodium	(Na)	28.6	1.24	Chloride	(Cl)	13.6	0.38
Potassium	(K)	7.22	0.18	Sulfate	(SO_4)	133.9	2.79
Iron	(Fe)	0.012	0.00	Nitrate	(as N)	1.19	0.08
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	12.6		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			8.69	Total Anions:			8.48

Calculated Dissolved Solid:	480.90	Total Hardness as $CaCO_3$:	362.10
Sum of Diss, Constituent:	642.76	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	261.63
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	262.
Field PH:	7.82	Ryznar Stability Index:	14.08
Laboratory PH:		Langlier Saturation Index:	-7.04
		Sodium Adsorption Ratio:	0.65

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	6.4 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	79.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	881.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	21.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	33.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
56.6	27.0	14.4	2.1	4.6	33.2	62.2	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q5003

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D08'11'N 112D41'57'W	Site Location:	08S 09W 15 CBAB
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:125143
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450811112415701
Agency + Sampler:	DNRC*BC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5224.73 ft
Date Sampled:	Nov 14, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	41 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Domestic	Perforation Interval:	

Sampling Site: **Rebich, Phil**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	128.0	6.39	Bicarbonate	(HCO_3)	295.	4.84
Magnesium	(Mg)	37.7	3.10	Carbonate	(CO_3)		0.00
Sodium	(Na)	38.0	1.65	Chloride	(Cl)	14.5	0.41
Potassium	(K)	7.87	0.20	Sulfate	(SO_4)	239.2	4.98
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	0.76	0.05
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	12.4		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			11.37	Total Anions:			10.28

Calculated Dissolved Solid:	623.75	Total Hardness as $CaCO_3$:	474.79
Sum of Diss, Constituent:	773.43	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	241.95
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	242.
Field PH:	8.06	Ryznar Stability Index:	13.92
Laboratory PH:		Langlier Saturation Index:	-6.96
		Sodium Adsorption Ratio:	0.76

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	6.0 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	119.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	1096.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	13.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	33.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
56.3	27.3	14.6	1.8	4.0	48.7	47.3	0.0

Lower Rattlesnake Creek Valley

MONTANA BUREAU OF MINES AND GEOLOGY	WATER QUALITY ANALYSIS
BUTTE, MONTANA 59701 (406) 496-4156	Lab No.: 94Q0505

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D10'52'N 112D42'08'W	Site Location:	07S 09W 33 DAAA
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133398
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	451054112421101
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-26	Land Surface Altitude:	5172.61 ft
Date Sampled:	Sep 14, 1993	Sustained Yield:	
Time Sampled:	15:30	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	94.52 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	81 - 86 ft

Sampling Site:	**Beaverhead Groundwater Project 92-26**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	102.	5.09	Bicarbonate	(HCO_3)	304.	4.98
Magnesium	(Mg)	22.4	1.84	Carbonate	(CO_3)		0.00
Sodium	(Na)	29.2	1.27	Chloride	(Cl)	22.3	0.63
Potassium	(K)	4.2	0.11	Sulfate	(SO_4)	112.	2.33
Iron	(Fe)	0.007	0.00	Nitrate	(as N)	5.07	0.36
Manganese	(Mn)	<0.002	0.00	Fluoride	(F)	0.42	0.02
Silica	(SiO_2)	35.6		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			8.33	Total Anions:			8.33

Standard Deviation of Anion-Cation Balance (Sigma) 0.00

Calculated Dissolved Solid:	482.95	Total Hardness as $CaCO_3$:	346.89
Sum of Diss, Constituent:	637.2	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	765.	Total Alkalinity as $CaCO_3$:	249.33
Lab cnductvy, micromhos:	739.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.57	Ryznar Stability Index:	6.72
Laboratory PH:	7.47	Langlier Saturation Index:	0.38
		Sodium Adsorption Ratio:	0.68

Parameter	Value	Parameter	Value
Field Temp, Air	16.0 C	Field Temp, Water	10.4 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	16.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	3.2	NICKEL, DISS (µg/l as NI)	2.3
BARIUM, DISS (µg/l as BA)	91.9	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	60.	SELENIUM, DISS (µg/l as SE)	1.3
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	679.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	26.7
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
61.2	22.2	15.3	1.3	7.9	29.4	62.7	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0504

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D10'41'N 112D43'03'W	Site Location:	07S 09W 33 CBDD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133399
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	451042112430101
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-27	Land Surface Altitude:	5188.77 ft
Date Sampled:	Sep 14, 1993	Sustained Yield:	
Time Sampled:	16:45	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	182.97 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	65-70, 160-165, 168-175 ft

Sampling Site:	**Beaverhead Groundwater Project 92-27**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	42.6	2.13	Bicarbonate	(HCO_3)	154.	2.52
Magnesium	(Mg)	8.8	0.72	Carbonate	(CO_3)		0.00
Sodium	(Na)	4.1	0.18	Chloride	(Cl)	9.3	0.26
Potassium	(K)	1.3	0.03	Sulfate	(SO_4)	8.8	0.18
Iron	(Fe)	0.021	0.00	Nitrate	(as N)	1.6	0.11
Manganese	(Mn)	0.002	0.00	Fluoride	(F)	0.05	0.00
Silica	(SiO_2)	18.		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			3.07	Total Anions:			3.09

Standard Deviation of Anion-Cation Balance (Sigma) 0.14

Calculated Dissolved Solid:	170.44	Total Hardness as $CaCO_3$:	142.59
Sum of Diss, Constituent:	248.58	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	294.	Total Alkalinity as $CaCO_3$:	126.31
Lab cnductvy, micromhos:	304.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.55	Ryznar Stability Index:	7.90
Laboratory PH:	7.64	Langlier Saturation Index:	-0.13
		Sodium Adsorption Ratio:	0.15

Parameter	Value	Parameter	Value
Field Temp, Air	17.0 C	Field Temp, Water	9.1 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	<6.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	1.	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	61.5	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	<30.	SELENIUM, DISS (µg/l as SE)	<1.
BROMIDE, DISS (µg/l as BR)	<50.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	115.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
69.4	23.7	5.8	1.1	8.8	6.2	85.0	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q5000

State: Montana
Latitude-Longitude: 45D08'45'N 112D43'32'W
Topographic Map: Dillon West 7 1/2'
Geologic Source: 110ALVM
Drainage Basin: AB
Agency + Sampler: DNRC*BC
Bottle number:
Date Sampled: Dec 04, 1993
Time Sampled:
Lab + Analyst: UM*LB
Date Complete: Dec 06, 1993
Sample Handling:
Method Sampled: Pumped
Procedure Type: Dissolved
Water Use: Domestic

County: Beaverhead
Site Location: 08S 09W 08 DDCB
MBMG Site: M:109869
Project Id: Bvrhead
Station Id: 450845112433201
Sample Source: Well
Land Surface Altitude: 5233.90 ft
Sustained Yield:
Yield Meas Method:
Total Depth of Well: 60 ft below toc
SWL from g.s.:
Casing Diameter: 6.0 in.
Casing Type: Steel
Completion Type:
Perforation Interval:

Sampling Site: **Boka, Mike**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l
Calcium	(Ca)	95.4	4.76
Magnesium	(Mg)	26.7	2.20
Sodium	(Na)	24.7	1.07
Potassium	(K)	7.13	0.18
Iron	(Fe)	<0.012	0.00
Manganese	(Mn)	<0.005	0.00
Silica	(SiO_2)	11.5	
Total Cations:			8.23

		mg/l	meq/l
Bicarbonate	(HCO_3)	322.	5.28
Carbonate	(CO_3)		0.00
Chloride	(Cl)	15.19	0.43
Sulfate	(SO_4)	110.44	2.30
Nitrate	(as N)	0.31	0.02
Fluoride	(F)		0.00
OrthoPhosphate	(as P)	<0.5	0.00
Total Anions:			8.03

Calculated Dissolved Solid: 449.99
Sum of Diss, Constituent: 613.37
Field cnductvy, micromhos:
Lab cnductvy, micromhos:
Field PH: 7.07
Laboratory PH:

Total Hardness as $CaCO_3$: 348.11
Field Hardness as $CaCO_3$:
Total Alkalinity as $CaCO_3$: 264.10
Field Alkalinity as $CaCO_3$: 264.
Ryznar Stability Index: 14.10
Langlier Saturation Index: -7.05
Sodium Adsorption Ratio: 0.58

Parameter	Value
Field Temp, Air	
ALUMINUM, DISS (µg/l as AL)	<200.
ARSENIC, DISS (µg/l as AS)	<94.
BORON, DISS (µg/l as B)	46.
CADMIUM, DISS (µg/l as CD)	<6.6
CHROMIUM, DISS (µg/l as CR)	<12.
COBALT, DISS (µg/l as CO)	<5.
COPPER, DISS (µg/l as CU)	<33.

Parameter	Value
Field Temp, Water	10.7 C
LEAD, DISS (µg/l as PB)	<57.6
MOLYBDENUM, DISS (µg/l as MO)	<5.
NICKEL, DISS (µg/l as NI)	<36.
STRONTIUM, DISS (µg/l as SR)	601.
TITANIUM, DISS (µg/l as TI)	19.
ZINC, DISS (µg/l as ZN)	20.

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
58.0	26.7	13.1	2.2	5.4	28.7	65.9	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q5022

State: Montana
Latitude-Longitude: D ' 'N D ' 'W
Topographic Map: Burns Mountain 7 1/2'
Geologic Source: 110ALVM
Drainage Basin: AB
Agency + Sampler: DNRC*BU
Bottle number:
Date Sampled: Dec 10, 1993
Time Sampled:
Lab + Analyst: UM*LB
Date Complete:
Sample Handling:
Method Sampled: Pumped
Procedure Type: Dissolved
Water Use: Domestic

County: Beaverhead
Site Location: 07S 10W 25 AAAB
MBMG Site: M:145396
Project Id: Bvrhead
Station Id:
Sample Source: Well
Land Surface Altitude: 5391.75 ft
Sustained Yield:
Yield Meas Method:
Total Depth of Well:
SWL from g.s.:
Casing Diameter: 6.0 in.
Casing Type: Steel
Completion Type:
Perforation Interval:

Sampling Site: **Holland, Ben**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l
Calcium	(Ca)	87.7	4.38
Magnesium	(Mg)	24.8	2.04
Sodium	(Na)	14.7	0.64
Potassium	(K)	7.52	0.19
Iron	(Fe)	<0.012	0.00
Manganese	(Mn)	<0.005	0.00
Silica	(SiO_2)	9.94	
Total Cations:			7.26

		mg/l	meq/l
Bicarbonate	(HCO_3)	190.	3.11
Carbonate	(CO_3)		0.00
Chloride	(Cl)	4.52	0.13
Sulfate	(SO_4)	8.07	0.17
Nitrate	(as N)	0.89	0.06
Fluoride	(F)		0.00
OrthoPhosphate	(as P)	<0.5	0.00
Total Anions:			3.47

Calculated Dissolved Solid: 251.74
Sum of Diss, Constituent: 348.14
Field cnductvy, micromhos:
Lab cnductvy, micromhos:
Field PH: 7.66
Laboratory PH:

Total Hardness as $CaCO_3$: 321.06
Field Hardness as $CaCO_3$:
Total Alkalinity as $CaCO_3$: 155.83
Field Alkalinity as $CaCO_3$: 156.
Ryznar Stability Index: 14.63
Langlier Saturation Index: -7.31
Sodium Adsorption Ratio: 0.36

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	10.2 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	38.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	500.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	24.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	37.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
60.4	28.1	8.8	2.7	3.7	4.9	91.3	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q5018

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D10'49'N 112D44'36'W	Site Location:	07S 09W 31 DAAA
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:109683
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	451049112443601
Agency + Sampler:	DNRC*BU	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5280.77 ft
Date Sampled:	Dec 10, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	80 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Stock	Perforation Interval:	

Sampling Site: **Holland, Ben**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	65.2	3.25	Bicarbonate	(HCO_3)	251.	4.11
Magnesium	(Mg)	10.8	0.89	Carbonate	(CO_3)		0.00
Sodium	(Na)	12.7	0.55	Chloride	(Cl)	8.99	0.25
Potassium	(K)	4.74	0.12	Sulfate	(SO_4)	12.72	0.26
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	1.05	0.07
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	14.3		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			4.82	Total Anions:			4.71

Calculated Dissolved Solid:	254.15	Total Hardness as $CaCO_3$:	207.26
Sum of Diss, Constituent:	381.50	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	205.86
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	206.
Field PH:	7.33	Ryznar Stability Index:	14.64
Laboratory PH:		Langlier Saturation Index:	-7.32
		Sodium Adsorption Ratio:	0.38

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	8.3 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	22.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	178.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	19.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	118.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
67.6	18.4	11.5	2.5	5.5	5.7	88.8	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q5020

State:	Montana	County:	Beaverhead
Latitude-Longitude:	D ' 'N D ' 'W	Site Location:	07S 10W 15 ADDC
Topographic Map:	Burns Mountain 7 1/2'	MBMG Site:	M:123858
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	DNRC*BU	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5621 ft
Date Sampled:	Dec 10, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	155 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Domestic	Perforation Interval:	

Sampling Site:	**Rawson, Gayle**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	63.2	3.15	Bicarbonate	(HCO_3)	154.	2.52
Magnesium	(Mg)	14.4	1.18	Carbonate	(CO_3)		0.00
Sodium	(Na)	16.1	0.70	Chloride	(Cl)	64.69	1.82
Potassium	(K)	3.32	0.08	Sulfate	(SO_4)	17.95	0.37
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	8.95	0.64
Manganese	(Mn)	<0.0052	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	11.6		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			5.13	Total Anions:			5.36

Calculated Dissolved Solid:	276.08	Total Hardness as $CaCO_3$:	217.08
Sum of Diss, Constituent:	354.22	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	126.31
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	126.
Field PH:	7.21	Ryznar Stability Index:	15.10
Laboratory PH:		Langlier Saturation Index:	-7.55
		Sodium Adsorption Ratio:	0.48

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	9.3 C
ALUMINUM, DISS (µg/l as AL)	<200.	COPPER, DISS (µg/l as CU)	<33.
ARSENIC, DISS (µg/l as AS)	<94.	LEAD, DISS (µg/l as PB)	<57.6
BORON, DISS (µg/l as B)	32.	MOLYBDENUM, DISS (µg/l as MO)	<5.
CADMIUM, DISS (µg/l as CD)	<6.6	NICKEL, DISS (µg/l as NI)	<36.
CHROMIUM, DISS (µg/l as CR)	<12.	STRONTIUM, DISS (µg/l as SR)	317.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	30.

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
61.5	23.1	13.7	1.7	38.7	7.9	53.4	0.0

MONTANA BUREAU OF MINES AND GEOLOGY		WATER QUALITY ANALYSIS	
BUTTE, MONTANA 59701 (406) 496-4156		Lab No.: 94Q5002	

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D09'11'N 112D43'03'W	Site Location:	08S 09W 09 BCDD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:109872
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450911112430301
Agency + Sampler:	DNRC*BC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5217.91 ft
Date Sampled:	Dec 04, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	52 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Domestic	Perforation Interval:	

Sampling Site:	**Rice, Tom**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	98.4	4.91	Bicarbonate	(HCO_3)	312.	5.11
Magnesium	(Mg)	29.9	2.46	Carbonate	(CO_3)		0.00
Sodium	(Na)	26.5	1.15	Chloride	(Cl)	17.33	0.49
Potassium	(K)	7.95	0.20	Sulfate	(SO_4)	122.79	2.56
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	1.24	0.09
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	11.6		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			8.74	Total Anions:			8.25

Calculated Dissolved Solid:	469.47	Total Hardness as $CaCO_3$:	368.77
Sum of Diss, Constituent:	627.78	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	255.89
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	256.
Field PH:	7.22	Ryznar Stability Index:	14.10
Laboratory PH:		Langlier Saturation Index:	-7.05
		Sodium Adsorption Ratio:	0.60

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	10.4 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	52.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	615.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	22.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	69.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
56.3	28.2	13.2	2.3	6.0	31.3	62.7	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q5019

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D11'22'N 112D42'46'W	Site Location:	07S 09W 28 CDAC
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:109675
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	451122112424601
Agency + Sampler:	DNRC*BU	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5224.29 ft
Date Sampled:	Dec 10, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	38 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Domestic	Perforation Interval:	

Sampling Site:	**Stewart, Marvin**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	92.7	4.63	Bicarbonate	(HCO_3)	193.	3.16
Magnesium	(Mg)	31.9	2.62	Carbonate	(CO_3)		0.00
Sodium	(Na)	12.2	0.53	Chloride	(Cl)	5.98	0.17
Potassium	(K)	7.01	0.18	Sulfate	(SO_4)	161.55	3.36
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	1.26	0.09
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	9.39		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			7.98	Total Anions:			6.79

Calculated Dissolved Solid:	417.06	Total Hardness as $CaCO_3$:	362.77
Sum of Diss, Constituent:	514.99	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	158.29
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	158.
Field PH:	7.31	Ryznar Stability Index:	14.57
Laboratory PH:		Langlier Saturation Index:	-7.28
		Sodium Adsorption Ratio:	0.28

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	16.4 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	6.
BORON, DISS (µg/l as B)	48.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	775.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	29.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	31.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
58.1	33.0	6.7	2.2	2.5	50.3	47.2	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q5001

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D09'27'N 112D43'48'W	Site Location:	08S 09W 08 ABCA
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:109858
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	450927112434801
Agency + Sampler:	DNRC*BC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5222.20 ft
Date Sampled:	Dec 04, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	54 ft below toc
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Stock	Perforation Interval:	

Sampling Site:	**Yuhas, Larry**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	93.8	4.68	Bicarbonate	(HCO_3)	297.	4.87
Magnesium	(Mg)	25.6	2.11	Carbonate	(CO_3)		0.00
Sodium	(Na)	25.1	1.09	Chloride	(Cl)	15.74	0.44
Potassium	(K)	7.36	0.19	Sulfate	(SO_4)	113.50	2.36
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	0.55	0.04
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	12.3		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			8.08	Total Anions:			7.71

Calculated Dissolved Solid:	440.26	Total Hardness as $CaCO_3$:	339.59
Sum of Diss, Constituent:	590.95	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	243.59
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	244.
Field PH:	7.48	Ryznar Stability Index:	14.18
Laboratory PH:		Langlier Saturation Index:	-7.09
		Sodium Adsorption Ratio:	0.59

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	14.1 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	48.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	537.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	22.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	19.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
58.0	26.1	13.5	2.3	5.8	30.8	63.4	0.0

Beaverhead River Floodplain near Dillon

MONTANA BUREAU OF MINES AND GEOLOGY BUTTE, MONTANA 59701 (406) 496-4156	WATER QUALITY ANALYSIS Lab No.: 94Q0356

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D12'30'N 112D39'28'W	Site Location:	07S 09W 24 CBDB
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133382
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	451229112393001
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-16	Land Surface Altitude:	5115.33 ft
Date Sampled:	Aug 27, 1993	Sustained Yield:	
Time Sampled:	16:45	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	204.67 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	190 - 197 ft

Sampling Site:	**Beaverhead Groundwater Project 92-16**
Geologic Source:	Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	50.4	2.51	Bicarbonate	(HCO_3)	220.	3.61
Magnesium	(Mg)	11.6	0.95	Carbonate	(CO_3)		0.00
Sodium	(Na)	40.4	1.76	Chloride	(Cl)	8.8	0.25
Potassium	(K)	8.2	0.21	Sulfate	(SO_4)	79.4	1.65
Iron	(Fe)	0.152	0.01	Nitrate	(as N)	0.31	0.02
Manganese	(Mn)	0.091	0.00	Fluoride	(F)	0.66	0.03
Silica	(SiO_2)	30.4		OrthoPhosphate (as P)		<0.15	0.00
Total Cations:			5.46	Total Anions:			5.56

Standard Deviation of Anion-Cation Balance (Sigma) 0.54

Calculated Dissolved Solid:	338.79	Total Hardness as $CaCO_3$:	173.59
Sum of Diss, Constituent:	450.41	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	530.	Total Alkalinity as $CaCO_3$:	180.44
Lab cnductvy, micromhos:	524.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.48	Ryznar Stability Index:	7.63
Laboratory PH:	7.45	Langlier Saturation Index:	-0.09
		Sodium Adsorption Ratio:	1.33

Parameter	Value	Parameter	Value
Field Temp, Air	20.0 C	Field Temp, Water	11.0 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	39.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	16.	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	29.2	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	68.	SELENIUM, DISS (µg/l as SE)	1.2
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	700.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	4.9
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
46.3	17.6	32.3	3.9	4.5	30.0	65.5	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0251

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D12'54'N 112D37'51'W	Site Location:	07S 08W 19 BADD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133384
Geologic Source:	120SDMS	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-17	Land Surface Altitude:	5087.39 ft
Date Sampled:	Aug 23, 1993	Sustained Yield:	
Time Sampled:	19:30	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	327.16 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	0.020 Slot 4-in. PVC screen
Water Use:	Monitoring	Perforation Interval:	315.5 - 325.5 ft

Sampling Site:	**Beaverhead Groundwater Project 92-17**
Geologic Source:	Sediments (Tertiary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	37.5	1.87	Bicarbonate	(HCO_3)	230.	3.77
Magnesium	(Mg)	5.5	0.45	Carbonate	(CO_3)		0.00
Sodium	(Na)	55.	2.39	Chloride	(Cl)	6.7	0.19
Potassium	(K)	13.2	0.34	Sulfate	(SO_4)	59.1	1.23
Iron	(Fe)	0.027	0.00	Nitrate	(as N)	0.17	0.01
Manganese	(Mn)	0.034	0.00	Fluoride	(F)	0.65	0.03
Silica	(SiO_2)	73.5		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			5.07	Total Anions:			5.24

Standard Deviation of Anion-Cation Balance (Sigma) 0.94

Calculated Dissolved Solid:	364.69	Total Hardness as $CaCO_3$:	116.28
Sum of Diss, Constituent:	481.39	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	504.	Total Alkalinity as $CaCO_3$:	188.64
Lab cnductvy, micromhos:	499.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.78	Ryznar Stability Index:	7.63
Laboratory PH:	7.67	Langlier Saturation Index:	0.02
		Sodium Adsorption Ratio:	2.22

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	12.5 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	50.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<20.
ARSENIC, DISS (µg/l as AS)	13.4	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	39.6	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BERYLL, DISS (µg/l as BE)	<2.	SELENIUM, DISS (µg/l as SE)	1.9
BORON, DISS (µg/l as B)	85.	SILVER, DISS (µg/l as AG)	<1.
BROMIDE, DISS (µg/l as BR)	<100.	STRONTIUM, DISS (µg/l as SR)	382.
CADMIUM, DISS (µg/l as CD)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
CHROMIUM, DISS (µg/l as CR)	<2.	VANADIUM, DISS (µg/l as V)	20.
COBALT, DISS (µg/l as CO)	<2.	ZINC, DISS (µg/l as ZN)	<2.
COPPER, DISS (µg/l as CU)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.
LEAD, DISS (µg/l as PB)	<2.		

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
37.0	9.0	47.3	6.7	3.6	23.7	72.7	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0250

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D12'54'N 112D37'51'W	Site Location:	07S 08W 19 BADD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133386
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-18	Land Surface Altitude:	5087.76 ft
Date Sampled:	Aug 23, 1993	Sustained Yield:	
Time Sampled:	17:00	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	80.66 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 X 1 air perf.
Water Use:	Monitoring	Perforation Interval:	74 - 77.5 ft

Sampling Site: **Beaverhead Groundwater Project 92-18**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	88.	4.39	Bicarbonate	(HCO_3)	307.	5.03
Magnesium	(Mg)	25.6	2.11	Carbonate	(CO_3)		0.00
Sodium	(Na)	19.2	0.84	Chloride	(Cl)	13.9	0.39
Potassium	(K)	6.6	0.17	Sulfate	(SO_4)	98.6	2.05
Iron	(Fe)	0.042	0.00	Nitrate	(as N)	0.91	0.07
Manganese	(Mn)	0.003	0.00	Fluoride	(F)	0.36	0.02
Silica	(SiO_2)	35.7		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			7.52	Total Anions:			7.56

Standard Deviation of Anion-Cation Balance (Sigma) 0.21

Calculated Dissolved Solid:	440.15	Total Hardness as $CaCO_3$:	325.11
Sum of Diss, Constituent:	595.92	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	694.	Total Alkalinity as $CaCO_3$:	251.79
Lab cnductvy, micromhos:	653.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.36	Ryznar Stability Index:	7.92
Laboratory PH:	6.29	Langlier Saturation Index:	-0.81
		Sodium Adsorption Ratio:	0.46

Parameter	Value	Parameter	Value
Field Temp, Air	25.0 C	Field Temp, Water	11.5 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	12.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<20.
ARSENIC, DISS (µg/l as AS)	1.7	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	46.5	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BERYLL, DISS (µg/l as BE)	<2.	SELENIUM, DISS (µg/l as SE)	1.8
BORON, DISS (µg/l as B)	47.	SILVER, DISS (µg/l as AG)	<1.
BROMIDE, DISS (µg/l as BR)	<100.	STRONTIUM, DISS (µg/l as SR)	532.
CADMIUM, DISS (µg/l as CD)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
CHROMIUM, DISS (µg/l as CR)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COBALT, DISS (µg/l as CO)	<2.	ZINC, DISS (µg/l as ZN)	<8.
COPPER, DISS (µg/l as CU)	2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.
LEAD, DISS (µg/l as PB)	<2.		

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
58.5	28.1	11.1	2.3	5.2	27.5	67.3	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0359

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D11'28'N 112D40'18'W	Site Location:	07S 09W 26 CDAD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133387
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	451130112401801
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-19	Land Surface Altitude:	5141.31 ft
Date Sampled:	Aug 26, 1993	Sustained Yield:	
Time Sampled:	11:00	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	149.53 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	96 - 100 ft

Sampling Site: **Beaverhead Groundwater Project 92-19**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	72.8	3.63	Bicarbonate	(HCO_3)	272.	4.46
Magnesium	(Mg)	22.1	1.82	Carbonate	(CO_3)		0.00
Sodium	(Na)	14.5	0.63	Chloride	(Cl)	9.4	0.27
Potassium	(K)	5.1	0.13	Sulfate	(SO_4)	71.	1.48
Iron	(Fe)	0.058	0.00	Nitrate	(as N)	0.72	0.05
Manganese	(Mn)	0.006	0.00	Fluoride	(F)	0.40	0.02
Silica	(SiO_2)	24.4		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			6.23	Total Anions:			6.27

Standard Deviation of Anion-Cation Balance (Sigma) 0.24

Calculated Dissolved Solid:	354.48	Total Hardness as $CaCO_3$:	272.75
Sum of Diss, Constituent:	492.49	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	583.	Total Alkalinity as $CaCO_3$:	233.09
Lab cnductvy, micromhos:	570.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.63	Ryznar Stability Index:	7.02
Laboratory PH:	7.56	Langlier Saturation Index:	0.27
		Sodium Adsorption Ratio:	0.38

Parameter	Value	Parameter	Value
Field Temp, Air	13.0 C	Field Temp, Water	10.0 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	10.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.6	NICKEL, DISS (µg/l as NI)	1.7
BARIUM, DISS (µg/l as BA)	40.9	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	<30.	SELENIUM, DISS (µg/l as SE)	1.
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	484.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
58.5	29.3	10.1	2.1	4.3	23.8	71.9	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0358

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D11'28'N 112D40'18'W	Site Location:	07S 09W 26 CDAD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133390
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	451132112401202
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-20	Land Surface Altitude:	5141.72 ft
Date Sampled:	Aug 26, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	20.28 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Monitoring	Perforation Interval:	

Sampling Site:	**Beaverhead Groundwater Project 92-20**
Geologic Source:	Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	90.2	4.50	Bicarbonate	(HCO_3)	308.	5.05
Magnesium	(Mg)	27.3	2.25	Carbonate	(CO_3)		0.00
Sodium	(Na)	21.2	0.92	Chloride	(Cl)	13.3	0.38
Potassium	(K)	5.8	0.15	Sulfate	(SO_4)	111.	2.31
Iron	(Fe)	0.057	0.00	Nitrate	(as N)	1.12	0.08
Manganese	(Mn)	0.002	0.00	Fluoride	(F)	0.43	0.02
Silica	(SiO_2)	22.9		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			7.83	Total Anions:			7.84

Standard Deviation of Anion-Cation Balance (Sigma) 0.01

Calculated Dissolved Solid:	445.03	Total Hardness as $CaCO_3$:	337.60
Sum of Diss, Constituent:	601.31	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	252.61
Lab cnductvy, micromhos:	691.	Field Alkalinity as $CaCO_3$:	
Field PH:		Ryznar Stability Index:	6.54
Laboratory PH:	7.74	Langlier Saturation Index:	0.60
		Sodium Adsorption Ratio:	0.50

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	18.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.6	NICKEL, DISS (µg/l as NI)	2.1
BARIUM, DISS (µg/l as BA)	56.9	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	34.7	SELENIUM, DISS (µg/l as SE)	2.
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	583.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
57.6	28.7	11.8	1.9	4.8	29.9	65.3	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0353

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D12'28'N 112D40'28'W	Site Location:	07S 09W 23 CACD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133400
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	451228112403001
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-28	Land Surface Altitude:	5119.51 ft
Date Sampled:	Aug 27, 1993	Sustained Yield:	
Time Sampled:	11:15	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	87.12 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	76 - 80 ft

Sampling Site: **Beaverhead Groundwater Project 92-28**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	65.	3.24	Bicarbonate	(HCO_3)	210.	3.44
Magnesium	(Mg)	15.8	1.30	Carbonate	(CO_3)		0.00
Sodium	(Na)	13.3	0.58	Chloride	(Cl)	11.8	0.33
Potassium	(K)	4.3	0.11	Sulfate	(SO_4)	72.	1.50
Iron	(Fe)	0.129	0.01	Nitrate	(as N)	1.77	0.13
Manganese	(Mn)	0.023	0.00	Fluoride	(F)	0.28	0.01
Silica	(SiO_2)	38.7		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			5.25	Total Anions:			5.41

Standard Deviation of Anion-Cation Balance (Sigma) 0.89

Calculated Dissolved Solid:	326.55	Total Hardness as $CaCO_3$:	227.34
Sum of Diss, Constituent:	433.10	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	505.	Total Alkalinity as $CaCO_3$:	172.24
Lab cnductvy, micromhos:	503.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.75	Ryznar Stability Index:	7.18
Laboratory PH:	7.72	Langlier Saturation Index:	0.27
		Sodium Adsorption Ratio:	0.38

Parameter	Value	Parameter	Value
Field Temp, Air	15.0 C	Field Temp, Water	10.0 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	16.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	4.1	NICKEL, DISS (µg/l as NI)	<2.
BARIUM, DISS (µg/l as BA)	29.4	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	<30.	SELENIUM, DISS (µg/l as SE)	1.2
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	548.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
62.0	24.8	11.1	2.1	6.3	28.4	65.3	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0357

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D12'28'N 112D40'28'W	Site Location:	07S 09W 23 CACD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133402
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	451228112403002
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-29	Land Surface Altitude:	5119.35 ft
Date Sampled:	Aug 27, 1993	Sustained Yield:	
Time Sampled:	12:30	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	22.09 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	1/8 x 2 torch perf.
Water Use:	Monitoring	Perforation Interval:	17.5 - 19 ft

Sampling Site: **Beaverhead Groundwater Project 92-29**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	87.9	4.39	Bicarbonate	(HCO_3)	290.	4.75
Magnesium	(Mg)	22.2	1.83	Carbonate	(CO_3)		0.00
Sodium	(Na)	22.1	0.96	Chloride	(Cl)	17.2	0.49
Potassium	(K)	4.3	0.11	Sulfate	(SO_4)	90.8	1.89
Iron	(Fe)	0.151	0.01	Nitrate	(as N)	2.58	0.18
Manganese	(Mn)	0.011	0.00	Fluoride	(F)	0.45	0.02
Silica	(SiO_2)	24.8		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			7.31	Total Anions:			7.34

Standard Deviation of Anion-Cation Balance (Sigma) 0.15

Calculated Dissolved Solid:	415.35	Total Hardness as $CaCO_3$:	310.86
Sum of Diss, Constituent:	562.49	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	673.	Total Alkalinity as $CaCO_3$:	237.85
Lab cnductvy, micromhos:	648.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.38	Ryznar Stability Index:	6.90
Laboratory PH:	7.46	Langlier Saturation Index:	0.28
		Sodium Adsorption Ratio:	0.55

Parameter	Value	Parameter	Value
Field Temp, Air	17.0 C	Field Temp, Water	10.0 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	14.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.4	NICKEL, DISS (µg/l as NI)	2.1
BARIUM, DISS (µg/l as BA)	59.1	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	37.	SELENIUM, DISS (µg/l as SE)	1.2
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	590.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
60.2	25.1	13.2	1.5	6.8	26.5	66.7	0.0

MONTANA BUREAU OF MINES AND GEOLOGY	WATER QUALITY ANALYSIS
BUTTE, MONTANA 59701 (406) 496-4156	Lab No.: 94Q0503

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D13'03'N 112D39'15'W	Site Location:	07S 09W 24 BABA
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:133403
Geologic Source:	110ALVM	Project Id:	Gwaamon
Drainage Basin:	AB	Station Id:	451302112392501
Agency + Sampler:	USGS*DWC	Sample Source:	Well
Bottle number:	92-30	Land Surface Altitude:	5099.84 ft
Date Sampled:	Sep 15, 1993	Sustained Yield:	
Time Sampled:	13:15	Yield Meas Method:	
Lab + Analyst:	MBMG*SFM	Total Depth of Well:	32.37 ft below toc
Date Complete:	Jan 05, 1994	SWL from g.s.:	
Sample Handling:	312	Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	3/8 x 1 air perf.
Water Use:	Monitoring	Perforation Interval:	22 - 24 ft

Sampling Site: **Beaverhead Groundwater Project 92-30**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	86.	4.29	Bicarbonate	(HCO$_3$)	321.	5.26
Magnesium	(Mg)	28.	2.30	Carbonate	(CO$_3$)		0.00
Sodium	(Na)	23.4	1.02	Chloride	(Cl)	13.4	0.38
Potassium	(K)	5.5	0.14	Sulfate	(SO$_4$)	102.	2.12
Iron	(Fe)	0.126	0.01	Nitrate	(as N)	0.15	0.01
Manganese	(Mn)	0.060	0.00	Fluoride	(F)	0.43	0.02
Silica	(SiO$_2$)	28.2		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			7.78	Total Anions:			7.80

Standard Deviation of Anion-Cation Balance (Sigma) 0.08

Calculated Dissolved Solid:	445.40	Total Hardness as CaCO$_3$:	329.99
Sum of Diss, Constituent:	608.27	Field Hardness as CaCO$_3$:	
Field cnductvy, micromhos:	719.	Total Alkalinity as CaCO$_3$:	263.27
Lab cnductvy, micromhos:	702.	Field Alkalinity as CaCO$_3$:	
Field PH:	7.20	Ryznar Stability Index:	6.67
Laboratory PH:	7.62	Langlier Saturation Index:	0.47
		Sodium Adsorption Ratio:	0.56

Parameter	Value	Parameter	Value
Field Temp, Air	20.0 C	Field Temp, Water	11.8 C
ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	25.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	2.8	NICKEL, DISS (µg/l as NI)	4.3
BARIUM, DISS (µg/l as BA)	54.	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	49.3	SELENIUM, DISS (µg/l as SE)	1.2
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	781.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO$_4$	HCO$_3$	CO$_3$
55.3	29.7	13.1	1.8	4.9	27.4	67.8	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q0360

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D11'35'N 112D40'13'W	Site Location:	07S 09W 26 DBCCD
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:136770
Geologic Source:		Project Id:	USGS
Drainage Basin:	AB	Station Id:	
Agency + Sampler:	USGS*DWC	Sample Source:	Ditch
Bottle number:	Shough3	Land Surface Altitude:	5140 ft
Date Sampled:	Aug 26, 1993	Water Rate Flow:	1.5 cfs
Time Sampled:	13:45	Flow Meas Method:	
Lab + Analyst:	MBMG*SFM	Staff Gage:	
Date Complete:	Jan 05, 1994	Stream Stage:	
Sample Handling:	312	Depth of Sample:	
Method Sampled:	Grab	Total Depth of Water:	
Procedure Type:	Dissolved	Stream Width:	
Water Use:			

Sampling Site:	**Beaverhead River Slough**
Drainage Basin:	Beaverhead River

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	113.	5.64	Bicarbonate	(HCO_3)	440.	7.21
Magnesium	(Mg)	37.8	3.11	Carbonate	(CO_3)		0.00
Sodium	(Na)	29.	1.26	Chloride	(Cl)	18.1	0.51
Potassium	(K)	7.9	0.20	Sulfate	(SO_4)	112.	2.33
Iron	(Fe)	0.03	0.00	Nitrate	(as N)	0.18	0.01
Manganese	(Mn)	0.042	0.00	Fluoride	(F)	0.63	0.03
Silica	(SiO_2)	30.6		OrthoPhosphate	(as P)	<0.15	0.00
Total Cations:			10.23	Total Anions:			10.10

Standard Deviation of Anion-Cation Balance (Sigma) -0.52

Calculated Dissolved Solid:	566.03	Total Hardness as $CaCO_3$:	437.75
Sum of Diss, Constituent:	789.28	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:	900.	Total Alkalinity as $CaCO_3$:	360.88
Lab cnductvy, micromhos:	853.	Field Alkalinity as $CaCO_3$:	
Field PH:	7.9	Ryznar Stability Index:	5.91
Laboratory PH:	7.87	Langlier Saturation Index:	0.98
		Sodium Adsorption Ratio:	0.60

Parameter	Value	Parameter	Value
Field Temp, Air	16.0 C	Field Temp, Water	13.0 C

ALUMINUM, DISS (µg/l as AL)	<30.	LITHIUM, DISS (µg/l as LI)	26.
ANTIMONY, DISS (µg/l as SB)	<2.	MOLYBDENUM, DISS (µg/l as MO)	<10.
ARSENIC, DISS (µg/l as AS)	4.5	NICKEL, DISS (µg/l as NI)	2.8
BARIUM, DISS (µg/l as BA)	58.5	NITRITE, TOTAL DISS (mg/l as N)	<0.1
BERYLL, DISS (µg/l as BE)	<2.	PHOSPHATE, TOTAL DISS (mg/l as P)	<0.2
BORON, DISS (µg/l as B)	50.	SELENIUM, DISS (µg/l as SE)	1.1
BROMIDE, DISS (µg/l as BR)	<100.	SILVER, DISS (µg/l as AG)	<1.
CADMIUM, DISS (µg/l as CD)	<2.	STRONTIUM, DISS (µg/l as SR)	796.
CHROMIUM, DISS (µg/l as CR)	<2.	TITANIUM, DISS (µg/l as TI)	<10.
COBALT, DISS (µg/l as CO)	<2.	VANADIUM, DISS (µg/l as V)	<5.
COPPER, DISS (µg/l as CU)	<2.	ZINC, DISS (µg/l as ZN)	<2.
LEAD, DISS (µg/l as PB)	<2.	ZIRCONIUM, DISS (µg/l as ZR)	<20.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
55.2	30.5	12.3	2.0	5.1	23.2	71.7	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q5024

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D13'03'N 112D39'15'W	Site Location:	07S 09W 24 BABA
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:147977
Geologic Source:		Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	451303112391501
Agency + Sampler:	DNRC*BC	Sample Source:	Stream
Bottle number:		Land Surface Altitude:	5088 ft
Date Sampled:	Dec 06, 1993	Water Rate Flow:	
Time Sampled:		Flow Meas Method:	
Lab + Analyst:	UM*LB	Staff Gage:	
Date Complete:		Stream Stage:	
Sample Handling:		Depth of Sample:	
Method Sampled:	Grab	Total Depth of Water:	
Procedure Type:	Dissolved	Stream Width:	
Water Use:			

Sampling Site:	**Beaverhead River @ USGS Gaging Station at Dillon**
Drainage Basin:	Beaverhead River

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	77.5	3.87	Bicarbonate	(HCO_3)	268.	4.39
Magnesium	(Mg)	25.5	2.10	Carbonate	(CO_3)		0.00
Sodium	(Na)	23.4	1.02	Chloride	(Cl)	11.81	0.33
Potassium	(K)	7.58	0.19	Sulfate	(SO_4)	93.11	1.94
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	<0.15	0.00
Manganese	(Mn)	0.006	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	9.91		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			7.19	Total Anions:			6.66

Calculated Dissolved Solid:	380.84	Total Hardness as $CaCO_3$:	298.48
Sum of Diss, Constituent:	516.82	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	219.81
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	220.
Field PH:		Ryznar Stability Index:	14.44
Laboratory PH:		Langlier Saturation Index:	-7.22
		Sodium Adsorption Ratio:	0.59

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	1.2 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	38.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	572.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	16.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	0.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
53.9	29.2	14.2	2.7	5.0	29.1	65.9	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 91Q5001

State: Montana
Latitude-Longitude: 45D12'49'N 112D40'20'W
Topographic Map: Dillon West 7 1/2'
Geologic Source: 110ALVM
Drainage Basin: AB
Agency + Sampler: USGS*DC
Bottle number:
Date Sampled: Aug 22, 1991
Time Sampled: 11:00
Lab + Analyst: USGS
Date Complete:
Sample Handling:
Method Sampled:
Procedure Type: Dissolved
Water Use: Municipal

County: Beaverhead
Site Location: 07S 09W 23 BDAA
MBMG Site: M:149185
Project Id: Bvrhead
Station Id: 451249112402001
Sample Source: Well
Land Surface Altitude: 5135 ft
Sustained Yield:
Yield Meas Method:
Total Depth of Well: 124 ft
SWL from g.s.:
Casing Diameter: 10 in.
Casing Type:
Completion Type:
Perforation Interval:

Sampling Site: **Dillon Municipal Well #1**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l
Calcium	(Ca)	89.	4.44
Magnesium	(Mg)	26.	2.14
Sodium	(Na)	21.	0.91
Potassium	(K)	5.2	0.13
Iron	(Fe)	0.01	0.00
Manganese	(Mn)	<0.001	0.00
Silica	(SiO_2)	28.	
Total Cations:			7.65

		mg/l	meq/l
Bicarbonate	(HCO_3)	268.2	4.40
Carbonate	(CO_3)		0.00
Chloride	(Cl)	17.	0.48
Sulfate	(SO_4)	130.	2.71
Nitrate	(as N)		0.00
Fluoride	(F)	0.6	0.03
OrthoPhosphate	(as P)		0.00
Total Anions:			7.61

Calculated Dissolved Solid: 448.94
Sum of Diss, Constituent: 585.02
Field cnductvy, micromhos: 700.
Lab cnductvy, micromhos: 688.
Field PH: 7.3
Laboratory PH: 7.7

Total Hardness as $CaCO_3$: 329.25
Field Hardness as $CaCO_3$:
Total Alkalinity as $CaCO_3$: 219.97
Field Alkalinity as $CaCO_3$: 220.
Ryznar Stability Index: 6.72
Langlier Saturation Index: 0.49
Sodium Adsorption Ratio: 0.50

Parameter	Value
Field Temp, Air	21.0 C
Oxygen, DISS, Field (mg/l as O)	2.8

Parameter	Value
Field Temp, Water	9.5 C

BARIUM, DISS (µg/l as BA)	44.
BERYLL, DISS (µg/l as BE)	<0.5
BORON, DISS (µg/l as B)	120.
CADMIUM, DISS (µg/l as CD)	<1.
CHROMIUM, DISS (µg/l as CR)	<5.
COBALT, DISS (µg/l as CO)	<3.
COPPER, DISS (µg/l as CU)	<10.
HYDROGEN, 2/1 RATIO (per M)	136.
LEAD, DISS (µg/l as PB)	<10.
LITHIUM, DISS (µg/l as LI)	23.
MOLYBDENUM, DISS (µg/l as MO)	<10.
NICKEL, DISS (µg/l as NI)	<10.
OXYGEN, 18/16 RATIO (per M)	17.6
SILVER, DISS (µg/l as AG)	<1.
STRONTIUM, DISS (µg/l as SR)	910.
TRITIUM, DISS (PCI/L)	70.
VANADIUM, DISS (µg/l as V)	6.
ZINC, DISS (µg/l as ZN)	9.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
58.2	28.1	12.0	1.7	6.3	35.7	58.0	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 91Q5000

State: Montana
Latitude-Longitude: 45D13'07'N 112D38'05'W
Topographic Map: Dillon West 7 1/2'
Geologic Source: 110ALVM
Drainage Basin: AB
Agency + Sampler: USGS*DC
Bottle number:
Date Sampled: Aug 21, 1991
Time Sampled: 14:30
Lab + Analyst: USGS
Date Complete:
Sample Handling:
Method Sampled:
Procedure Type: Dissolved
Water Use: Municipal

County: Beaverhead
Site Location: 07S 08W 18 CDCC
MBMG Site: M:109444
Project Id: Bvrhead
Station Id: 451307112380501
Sample Source: Well
Land Surface Altitude: 5091.46 ft
Sustained Yield:
Yield Meas Method:
Total Depth of Well: 61 ft
SWL from g.s.:
Casing Diameter: 14 in.
Casing Type: Steel
Completion Type: 1/4 x 2 perf.
Perforation Interval: 20 - 46 ft

Sampling Site: **Dillon Municipal Well #3**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l
Calcium	(Ca)	92.	4.59
Magnesium	(Mg)	27.	2.22
Sodium	(Na)	23.	1.00
Potassium	(K)	5.7	0.15
Iron	(Fe)	0.007	0.00
Manganese	(Mn)	<0.001	0.00
Silica	(SiO_2)	26.	
Total Cations:			7.97

		mg/l	meq/l
Bicarbonate	(HCO_3)	315.78	5.18
Carbonate	(CO_3)		0.00
Chloride	(Cl)	16.	0.45
Sulfate	(SO_4)	95.	1.98
Nitrate	(as N)		0.00
Fluoride	(F)	0.3	0.02
OrthoPhosphate	(as P)		0.00
Total Anions:			7.62

Calculated Dissolved Solid:	440.57
Sum of Diss, Constituent:	600.80
Field cnductvy, micromhos:	719.
Lab cnductvy, micromhos:	711.
Field PH:	7.23
Laboratory PH:	7.6

Total Hardness as $CaCO_3$:	340.86
Field Hardness as $CaCO_3$:	
Total Alkalinity as $CaCO_3$:	258.99
Field Alkalinity as $CaCO_3$:	259.
Ryznar Stability Index:	6.65
Langlier Saturation Index:	0.48
Sodium Adsorption Ratio:	0.54

Parameter	Value	Parameter	Value
Field Temp, Air	28.0 C	Field Temp, Water	9.0 C

BARIUM, DISS (µg/l as BA)	60.	LITHIUM, DISS (µg/l as LI)	23.
BERYLL, DISS (µg/l as BE)	<0.5	MOLYBDENUM, DISS (µg/l as MO)	<10.
BORON, DISS (µg/l as B)	60.	NICKEL, DISS (µg/l as NI)	<10.
CADMIUM, DISS (µg/l as CD)	<1.	OXYGEN, 18/16 RATIO (per M)	17.1
CHROMIUM, DISS (µg/l as CR)	<5.	SILVER, DISS (µg/l as AG)	<1.
COBALT, DISS (µg/l as CO)	<3.	STRONTIUM, DISS (µg/l as SR)	620.
COPPER, DISS (µg/l as CU)	<10.	TRITIUM, DISS (PCI/L)	100.
HYDROGEN, 2/1 RATIO (per M)	133.	VANADIUM, DISS (µg/l as V)	<6.
LEAD, DISS (µg/l as PB)	<10.	ZINC, DISS (µg/l as ZN)	10.

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
57.7	27.9	12.6	1.8	5.9	26.0	68.1	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406) 496-4156

WATER QUALITY ANALYSIS
Lab No.: 94Q5009

State: Montana
Latitude-Longitude: 45D13'40'N 112D38'02'W
Topographic Map: Dillon West 7 1/2'
Geologic Source: 110ALVM
Drainage Basin: AB
Agency + Sampler: DNRC*BC
Bottle number:
Date Sampled: Nov 14, 1993
Time Sampled:
Lab + Analyst: UM*LB
Date Complete:
Sample Handling:
Method Sampled: Pumped
Procedure Type: Dissolved
Water Use: Domestic

County: Beaverhead
Site Location: 07S 08W 18 BDCB
MBMG Site: M:145389
Project Id: Bvrhead
Station Id: 451340112380201
Sample Source: Well
Land Surface Altitude: 5074.38 ft
Sustained Yield:
Yield Meas Method:
Total Depth of Well:
SWL from g.s.:
Casing Diameter: 6.0 in.
Casing Type: Steel
Completion Type:
Perforation Interval:

Sampling Site: **Intermountain Irrigation Co.**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l
Calcium	(Ca)	136.	6.79
Magnesium	(Mg)	42.	3.45
Sodium	(Na)	58.4	2.54
Potassium	(K)	7.71	0.20
Iron	(Fe)	2.	0.11
Manganese	(Mn)	2.283	0.08
Silica	(SiO_2)	15.8	
Total Cations:			13.19

		mg/l	meq/l
Bicarbonate	(HCO_3)	415.	6.80
Carbonate	(CO_3)		0.00
Chloride	(Cl)	15.83	0.45
Sulfate	(SO_4)	112.51	2.34
Nitrate	(as N)	5.59	0.40
Fluoride	(F)		0.00
OrthoPhosphate	(as P)	<0.5	0.00
Total Anions:			9.99

Calculated Dissolved Solid: 602.56
Sum of Diss, Constituent: 813.12
Field cnductvy, micromhos:
Lab cnductvy, micromhos:
Field PH: 7.44
Laboratory PH:

Total Hardness as $CaCO_3$: 512.46
Field Hardness as $CaCO_3$:
Total Alkalinity as $CaCO_3$: 340.37
Field Alkalinity as $CaCO_3$: 340.
Ryznar Stability Index: 13.57
Langlier Saturation Index: -6.78
Sodium Adsorption Ratio: 1.12

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	7.1 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	69.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	840.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	15.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	89.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
52.3	26.6	19.6	1.5	4.7	24.4	70.9	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q5017

State: Montana
Latitude-Longitude: 45D10'56'N 112D40'21'W
Topographic Map: Dillon West 7 1/2'
Geologic Source: 110ALVM
Drainage Basin: AB
Agency + Sampler: DNRC*BC
Bottle number:
Date Sampled: Dec 04, 1993
Time Sampled:
Lab + Analyst: UM*LB
Date Complete:
Sample Handling:
Method Sampled: Pumped
Procedure Type: Dissolved
Water Use: Domestic

County: Beaverhead
Site Location: 07S 09W 34 ACDC
MBMG Site: M:109703
Project Id: Bvrhead
Station Id: 451056112402101
Sample Source: Well
Land Surface Altitude: 5159.49 ft
Sustained Yield:
Yield Meas Method:
Total Depth of Well: 47 ft
SWL from g.s.:
Casing Diameter: 6.0 in.
Casing Type: Steel
Completion Type:
Perforation Interval:

Sampling Site: **Tash, Bill**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	93.	4.64	Bicarbonate	(HCO_3)	312.	5.11
Magnesium	(Mg)	27.	2.22	Carbonate	(CO_3)		0.00
Sodium	(Na)	26.1	1.14	Chloride	(Cl)	18.53	0.52
Potassium	(K)	7.2	0.18	Sulfate	(SO_4)	114.34	2.38
Iron	(Fe)	<0.012	0.00	Nitrate	(as N)	1.20	0.09
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	10.7		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			8.20	Total Anions:			8.10

Calculated Dissolved Solid: 451.76
Sum of Diss, Constituent: 610.07
Field cnductvy, micromhos:
Lab cnductvy, micromhos:
Field PH: 7.14
Laboratory PH:

Total Hardness as $CaCO_3$: 343.35
Field Hardness as $CaCO_3$:
Total Alkalinity as $CaCO_3$: 255.89
Field Alkalinity as $CaCO_3$: 256.
Ryznar Stability Index: 14.15
Langlier Saturation Index: -7.07
Sodium Adsorption Ratio: 0.61

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	9.6 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	39.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	593.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	19.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	93.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
56.7	27.2	13.9	2.2	6.5	29.7	63.8	0.0

MONTANA BUREAU OF MINES AND GEOLOGY
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WATER QUALITY ANALYSIS
Lab No.: 94Q5006

State:	Montana	County:	Beaverhead
Latitude-Longitude:	45D11'28'N 112D41'54'W	Site Location:	07S 09W 34 BBAB
Topographic Map:	Dillon West 7 1/2'	MBMG Site:	M:109668
Geologic Source:	110ALVM	Project Id:	Bvrhead
Drainage Basin:	AB	Station Id:	451128112415401
Agency + Sampler:	DNRC*BC	Sample Source:	Well
Bottle number:		Land Surface Altitude:	5171.77 ft
Date Sampled:	Dec 03, 1993	Sustained Yield:	
Time Sampled:		Yield Meas Method:	
Lab + Analyst:	UM*LB	Total Depth of Well:	37 ft
Date Complete:		SWL from g.s.:	
Sample Handling:		Casing Diameter:	6.0 in.
Method Sampled:	Pumped	Casing Type:	Steel
Procedure Type:	Dissolved	Completion Type:	
Water Use:	Stock	Perforation Interval:	

Sampling Site: **Tash T Diamond Livestock Co.**
Geologic Source: Alluvium (Quaternary)

		mg/l	meq/l			mg/l	meq/l
Calcium	(Ca)	87.6	4.37	Bicarbonate	(HCO_3)	229.	3.75
Magnesium	(Mg)	25.6	2.11	Carbonate	(CO_3)		0.00
Sodium	(Na)	15.2	0.66	Chloride	(Cl)	10.15	0.29
Potassium	(K)	6.32	0.16	Sulfate	(SO_4)	109.40	2.28
Iron	(Fe)	0.032	0.00	Nitrate	(as N)	1.47	0.10
Manganese	(Mn)	<0.005	0.00	Fluoride	(F)		0.00
Silica	(SiO_2)	11.1		OrthoPhosphate	(as P)	<0.5	0.00
Total Cations:			7.32	Total Anions:			6.42

Calculated Dissolved Solid:	379.68	Total Hardness as $CaCO_3$:	324.11
Sum of Diss, Constituent:	495.87	Field Hardness as $CaCO_3$:	
Field cnductvy, micromhos:		Total Alkalinity as $CaCO_3$:	187.82
Lab cnductvy, micromhos:		Field Alkalinity as $CaCO_3$:	188.
Field PH:	7.27	Ryznar Stability Index:	14.47
Laboratory PH:		Langlier Saturation Index:	-7.23
		Sodium Adsorption Ratio:	0.37

Parameter	Value	Parameter	Value
Field Temp, Air		Field Temp, Water	10.0 C
ALUMINUM, DISS (µg/l as AL)	<200.	LEAD, DISS (µg/l as PB)	<57.6
ARSENIC, DISS (µg/l as AS)	<94.	MOLYBDENUM, DISS (µg/l as MO)	<5.
BORON, DISS (µg/l as B)	30.	NICKEL, DISS (µg/l as NI)	<36.
CADMIUM, DISS (µg/l as CD)	<6.6	STRONTIUM, DISS (µg/l as SR)	641.
CHROMIUM, DISS (µg/l as CR)	<12.	TITANIUM, DISS (µg/l as TI)	17.
COBALT, DISS (µg/l as CO)	<5.	ZINC, DISS (µg/l as ZN)	43.
COPPER, DISS (µg/l as CU)	<33.		

Remarks: Sampled by Bill Uthman and Bill Craig for Beaverhead Groundwater Project
Analysis by Geochemistry Lab, Geology Dept., University of Montana, Missoula

Explanation: mg/l = milligrams per liter; µg/l = micrograms per liter; meq/l = milliequivalents per liter; ft = feet.

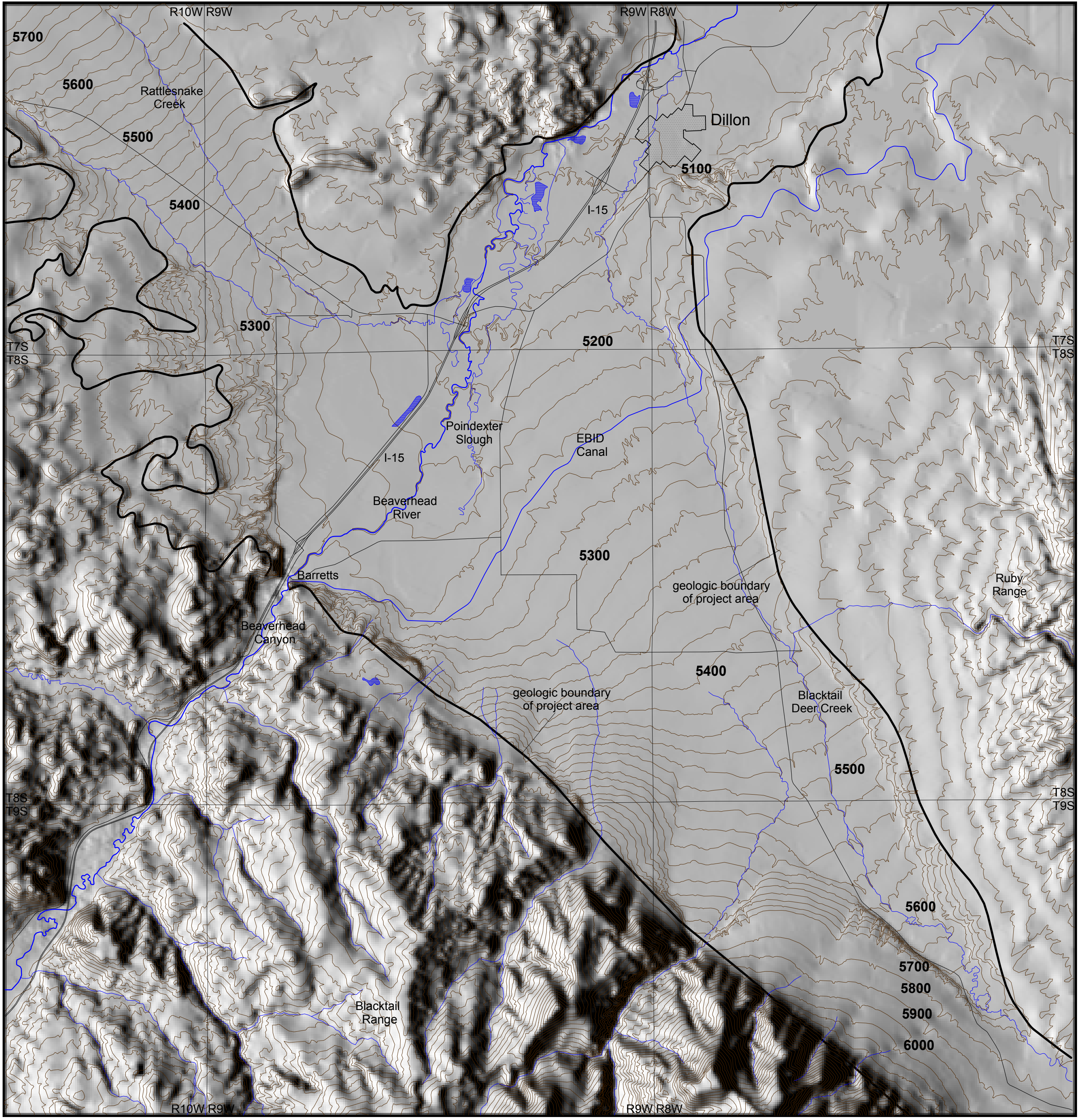
Percent Meq/L (For Piper Plot)

Ca	Mg	Na	K	Cl	SO_4	HCO_3	CO_3
59.9	28.8	9.1	2.2	4.5	36.0	59.4	0.0

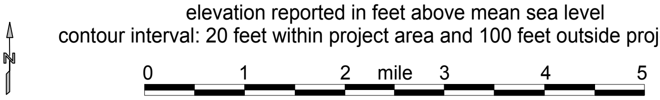
Appendix F

Groundwater Modeling

Appendix F1. Topographic Map of a Portion of the Upper Beaverhead Basin



elevation reported in feet above mean sea level
contour interval: 20 feet within project area and 100 feet outside project area



Appendix F2. 1993 - 1996 Surface Water - Groundwater Budget Evaluations

Surface Water-Groundwater Budget Evaluations
1993 irrigation season

IN

	Beaverhead River at Barretts gage (cfs)	EBID Canal (cfs)	Canyon Ditch (cfs)	Beaverhead River at Barretts diversions (cfs)	upper Blacktail Deer Creek (cfs)	Rattlesnake Creek (est. cfs)	Irrig (cfs) from EBID Canal @ 13% of mixed zone	Precipitation from model (cfs)	General Heads from *.BDI (ft^3/d)	General Heads (cfs)	TOTAL IN (cfs)
							7,280 acres * 43560ft^2/ac =				**426.9**
Jun	609.9	313.7	46.9	249.3	193.6	7.0	317,116,800 ft^2 * 36"/12"/ft =	22.7	6,272,400+5,697,800	138.5	TOTAL IN (ac-ft)
Jul	463.1	252.1	47.5	163.5	117.1	6.0	951,350,400	42.5	5,379,700+5,191,800	122.4	**103,313.5**
Aug	496.5	288.9	45.7	161.9	95.2	4.0	ft^3 applied to mixed zone	23.4	5,125,700+5,101,200	118.4	
Sep	277.1	148.1	25.0	104.0	70.4	3.0	x 0.13 from EBID Canal =	0.5	1,507,800	17.5	
122 days ave.				**169.7**	**119.1**	**5.0**	**11.7**	**22.3**		**99.2**	

OUT

	Beaverhead River at Dillon gage (cfs)	lower Blacktail Creek (cfs)	Evt from model (cfs)	GW to storage from model (IN-OUT) (cfs)	General Heads from *.BDO (ft^3/d)	General Heads (cfs)	TOTAL OUT (cfs)	Diff (IN-OUT as cfs)	Alflafa Consumptive Use (in)	Effective Ppt from model (in)	Plant Consump. (in)
							323.1	**103.9**			**10.9**
Jun	138.6	82.8	2.8	162.6	686,580+467,440	13.4	TOTAL OUT (ac-ft)	Diff (IN-OUT as ac-ft)	4.79	2.1	Model Water (in)
Jul	139.2	106.5	2.8	120.4	1,038,200+730,330	20.5	**78,176.9**	**25,136.5**	6.43	4.0	available for plants
Aug	124.6	80.3	2.8	94.0	625,020+1,151,800	20.6			5.31	2.2	**12.4**
Sep	136.6	80.7	0.0	-65.4	2,476,500	28.7			2.78	0.1	
122 days ave.	**134.8**	**87.6**	**2.1**	**77.9**		**20.8**			**19.3**	**8.4**	

Diff (IN-OUT) x 86,400 sec/day x 1 acre/43,560 ft^2 x 122 days / 24,354 irrig. acres x 12 in/ft = water available for plants

Surface Water-Groundwater Budget Evaluations
1994 irrigation season

IN

	Beaverhead River at Barretts gage (cfs)	EBID Canal (cfs)	Canyon Ditch (cfs)	Beaverhead River at Barretts diversions (cfs)	upper Blacktail Deer Creek (cfs)	Rattlesnake Creek (est. cfs)	Irrig (cfs) from EBID Canal @ 13% of mixed zone	Precipitation from model (cfs)	General Heads from *.BDI (ft^3/d)	General Heads (cfs)	TOTAL IN (cfs)
							7,280 acres * 43560ft^2/ac =				**338.3**
Jun	774.3	371.5	89.6	313.2	68.7	5.0	317,116,800 ft^2 * 48"/12"/ft =	12.7	4,613,100+4,368,800	104.0	TOTAL IN (ac-ft)
Jul	811.6	449.2	86.9	275.5	45.4	4.0	1,268,467,200	12.9	4,249,800+4,152,500	97.3	**81,873.7**
Aug	431.0	257.0	60.6	113.4	30.2	3.0	ft^3 applied to mixed zone	9.9	1,400,300+2,046,200	39.9	
Sep	254.7	153.3	0.0	101.4	25.7	2.0	x 0.13 from EBID Canal =	0.5	2,266,600	26.2	
122 days ave.				**200.9**	**42.5**	**3.5**	**15.6**	**9.0**		**66.8**	

OUT

	Beaverhead River at Dillon gage (cfs)	lower Blacktail Creek (cfs)	Evt from model (cfs)	GW to storage from model (IN-OUT) (cfs)	General Heads from *.BDO (ft^3/d)	General Heads (cfs)	TOTAL OUT (cfs)	Diff (IN-OUT as cfs)	Alflafa Consumptive Use (in)	Effective Ppt from model (in)	Plant Consump. (in)
							227.3	**111.0**			**15.9**
Jun	147.6	66.6	2.9	114.5	1,107,200+746,500	21.5	TOTAL OUT (ac-ft)	Diff (IN-OUT as ac-ft)	4.79	1.16	Model Water (in)
Jul	146.6	48.5	2.9	66.8	1,535,200+1,084,400	30.3	**55,015.1**	**26,858.5**	6.43	1.22	available for plants
Aug	108.3	40.2	2.8	-34.9	3,088,400+2,404,100	63.6			5.31	0.93	**13.2**
Sep	94.7	22.3	0.0	-51.0	1,321,200	15.3			2.78	0.09	
122 days ave.	**124.3**	**44.4**	**2.1**	**23.8**		**32.7**			**19.3**	**3.4**	

Diff (IN-OUT) x 86,400 sec/day x 1 acre/43,560 ft^2 x 122 days / 24,354 irrig. acres x 12 in/ft = water available for plants

Surface Water-Groundwater Budget Evaluations
1995 irrigation season

IN

	Beaverhead River at Barretts gage (cfs)	EBID Canal (cfs)	Canyon Ditch (cfs)	Beaverhead River at Barretts diversions (cfs)	upper Blacktail Deer Creek (cfs)	Rattlesnake Creek (est. cfs)	Irrig (cfs) from EBID Canal @ 13% of mixed zone	Precipitation from model (cfs)	General Heads from *.BDI (ft^3/d)	General Heads (cfs)	TOTAL IN (cfs)
							7,280 acres * 43560ft^2/ac =				**1238.5**
Jun	1271.2	300.3	32.5	938.4	346.5	8.0	317,116,800 ft^2 * 17"/12"/ft =	43.4	9,361,300+7,452,800	194.6	TOTAL IN (ac-ft)
Jul	1484.8	363.6	39.1	1082.1	221.2	7.0	449,248,800	17.8	6,729,300+6,383,800	151.8	**299,710.1**
Aug	1322.3	341.5	82.5	898.3	87.0	5.0	ft^3 applied to mixed zone	10.7	6,214,000+6,089,200	142.4	
Sep	863.9	161.6	31.3	671.0	71.0	4.0	x 0.13 from EBID Canal =	11.2	1,779,600	20.6	
122 days ave.				**897.5**	**181.4**	**6.0**	**5.5**	**20.8**		**127.3**	

OUT

	Beaverhead River at Dillon gage (cfs)	lower Blacktail Creek (cfs)	Evt from model (cfs)	GW to storage from model (IN-OUT) (cfs)	General Heads from *.BDO (ft^3/d)	General Heads (cfs)	TOTAL OUT (cfs)	Diff (IN-OUT as cfs)	Alflafa Consumptive Use (in)	Effective Ppt from model (in)	Plant Consump. (in)
							1154.5	**84.1**			**10.6**
Jun	930.0	200.1	3.8	122.1	330,530+395,120	8.4	TOTAL OUT (ac-ft)	Diff (IN-OUT as ac-ft)	4.79	3.96	Model Water (in)
Jul	1107.7	193.6	4.4	199.0	1,072,600+639,430	19.8	**279,367.3**	**20,342.8**	6.43	1.68	available for plants
Aug	818.0	81.0	4.2	144.1	492,440+1,146,400	19.0			5.31	1.01	**10.0**
Sep	677.7	100.0	0.0	-42.7	2,401,900	27.8			2.78	2.05	
122 days ave.	**883.4**	**143.7**	**3.1**	**105.6**		**18.7**			**19.3**	**8.7**	

Diff (IN-OUT) x 86,400 sec/day x 1 acre/43,560 ft^2 x 122 days / 24,354 irrig. acres x 12 in/ft = water available for plants

Surface Water-Groundwater Budget Evaluations
1996 irrigation season

IN

	Beaverhead River at Barretts gage (cfs)	EBID Canal (cfs)	Canyon Ditch (cfs)	Beaverhead River at Barretts diversions (cfs)	upper Blacktail Deer Creek (cfs)	Rattlesnake Creek (est. cfs)	Irrig (cfs) from EBID Canal @ 13% of mixed zone	Precipitation from model (cfs)	General Heads from *.BDI (ft^3/d)	General Heads (cfs)	TOTAL IN (cfs)
							7,280 acres * 43560ft^2/ac =				**499.1**
Jun	942.0	372.1	72.2	497.7	198.7	8.0	317,116,800 ft^2 * 25"/12"/ft =	5.9	4,619,700+4,336,500	103.7	TOTAL IN (ac-ft)
Jul	972.2	464.3	97.8	410.1	75.4	7.0	660,660,000	0.0	4,335,800+3,910,100	95.4	**120,771.6**
Aug	635.7	287.6	88.9	259.2	39.6	5.0	ft^3 applied to mixed zone	1.8	2,624,200+3,414,700	69.9	
Sep	317.0	167.2	50.2	99.6	40.5	4.0	x 0.13 from EBID Canal =	2.0	3,471,200	40.2	
122 days ave.				**316.7**	**88.6**	**6.0**	**8.1**	**2.4**		**77.3**	

OUT

	Beaverhead River at Dillon gage (cfs)	lower Blacktail Creek (cfs)	Evt from model (cfs)	GW to storage from model (IN-OUT) (cfs)	General Heads from *.BDO (ft^3/d)	General Heads (cfs)	TOTAL OUT (cfs)	Diff (IN-OUT as cfs)	Alflafa Consumptive Use (in)	Effective Ppt from model (in)	Plant Consump. (in)
							541.3	**-42.3**			**18.2**
Jun	541.9	118.4	3.5	61.5	881,060+576,480	16.9	TOTAL OUT (ac-ft)	Diff (IN-OUT as ac-ft)	4.79	0.5	Model Water (in)
Jul	406.4	75.0	3.3	136.5	1,136,000+1,346,300	28.7	**130,999.1**	**-10227.5**	6.43	0.0	available for plants
Aug	358.9	56.2	3.3	-28.3	1,058,800+1,429,200	28.8			5.31	0.2	**-5.0**
Sep	278.3	86.7	0.0	-20.4	844,680	9.8			2.78	0.4	
122 days ave.	**396.4**	**84.1**	**2.5**	**37.3**		**21.0**			**19.3**	**1.1**	

Diff (IN-OUT) x 86,400 sec/day x 1 acre/43,560 ft^2 x 122 days / 24,354 irrig. acres x 12 in/ft = water available for plants

Appendix F3. Groundwater Model Water Budgets

CURRENT WELLS Model Water Budget (cfs)

Stress Period	Date Range	Elapsed Days	Storage	Recharge	Baseflow	Wells	General Heads	Evt
1	04/01 - 04/30, 1993	30	-0.01	10.23	-38.70	-2.23	30.72	0.00
2	05/01 - 05/20, 1993	50	-75.16	12.50	-31.75	-2.23	96.64	0.00
3	05/21 - 05/31, 1993	61	21.33	31.66	-32.56	-97.23	78.17	-1.37
4	06/01 - 06/10, 1993	71	-129.76	199.95	-32.42	-101.03	64.65	-1.38
5	06/11 - 06/30, 1993	91	-32.85	11.34	-31.61	-6.03	60.54	-1.37
6	07/01 - 07/18, 1993	109	-105.38	209.28	-51.73	-101.03	50.25	-1.39
7	07/19 - 07/31, 1993	122	-15.05	17.94	-47.10	-6.03	51.64	-1.40
8	08/01 - 08/15, 1993	137	-10.58	14.36	-48.46	-6.03	52.09	-1.38
9	08/16 - 08/31, 1993	153	-83.37	199.75	-59.67	-101.03	45.71	-1.39
10	09/01 - 09/30, 1993	183	65.40	0.50	-52.45	-2.23	-11.21	0.00
11	10/01 - 10/31, 1993	214	28.52	7.79	-47.37	-2.23	13.29	0.00
12	11/01 - 11/30, 1993	244	21.60	0.22	-39.47	-2.23	19.87	0.00
13	12/01 - 12/31, 1993	275	17.29	0.42	-38.23	-2.23	22.74	0.00
14	01/01 - 01/31, 1994	306	14.36	0.63	-37.11	-2.23	24.33	0.00
15	02/01 - 02/28, 1994	334	11.29	2.29	-36.48	-2.23	25.13	0.00
16	03/01 - 03/31, 1994	365	9.58	2.86	-35.96	-2.23	25.74	0.00
17	04/01 - 04/30, 1994	395	6.39	5.81	-35.88	-2.23	25.90	0.00
18	05/01 - 05/15, 1994	410	-33.81	5.19	-32.01	-2.23	62.85	0.00
19	05/16 - 05/31, 1994	426	51.49	25.58	-33.39	-97.23	55.00	-1.45
20	06/01 - 06/15, 1994	441	-117.55	227.56	-48.11	-101.03	40.58	-1.44
21	06/16 - 06/30, 1994	456	3.08	6.35	-43.88	-6.03	41.92	-1.44
22	07/01 - 07/20, 1994	476	-91.28	227.88	-65.53	-101.03	31.42	-1.46
23	07/21 - 07/31, 1994	487	24.48	5.91	-58.40	-6.03	35.51	-1.46
24	08/01 - 08/15, 1994	502	82.96	5.33	-61.32	-6.03	-19.54	-1.40
25	08/16 - 08/31, 1994	518	-48.07	226.34	-71.69	-101.03	-4.14	-1.41
26	09/01 - 09/30, 1994	548	51.00	0.50	-60.20	-2.23	10.94	0.00
27	10/01 - 10/31, 1994	579	31.72	9.86	-54.76	-2.23	15.41	0.00
28	11/01 - 11/30, 1994	609	24.23	1.81	-42.13	-2.23	18.32	0.00
29	12/01 - 12/31, 1994	640	21.15	1.85	-40.85	-2.23	20.07	0.00
30	01/01 - 01/31, 1995	671	15.76	5.46	-39.90	-2.23	20.90	0.00
31	02/01 - 02/28, 1995	699	18.07	0.59	-38.52	-2.23	22.09	0.00
32	03/01 - 03/31, 1995	730	12.93	4.77	-37.97	-2.23	22.49	0.00
33	04/01 - 04/30, 1995	760	-0.26	16.92	-35.90	-2.23	21.46	0.00
34	05/01 - 05/31, 1995	791	-126.51	22.89	-26.50	-2.23	132.35	0.00
35	06/01 - 06/08, 1995	799	-34.04	28.32	0.32	-97.23	104.52	-1.89
36	06/09 - 06/30, 1995	821	-88.02	21.69	-11.20	-2.23	81.69	-1.92
37	07/01 - 07/15, 1995	836	-156.69	216.39	-22.00	-101.03	65.47	-2.15
38	07/16 - 07/31, 1995	852	-42.28	7.67	-23.63	-6.03	66.49	-2.21
39	08/01 - 08/20, 1995	872	-25.79	6.34	-38.62	-6.03	66.22	-2.11
40	08/21 - 08/31, 1995	883	-118.26	212.70	-48.50	-101.03	57.21	-2.12
41	09/01 - 09/30, 1995	913	42.67	11.23	-44.45	-2.23	-7.20	0.00
42	10/01 - 10/31, 1995	944	18.25	2.97	-39.47	-2.23	20.49	0.00
43	11/01 - 11/30, 1995	974	10.94	0.55	-36.36	-2.23	27.10	0.00
44	12/01 - 12/31, 1995	1005	6.81	1.91	-36.09	-2.23	29.62	0.00
45	01/01 - 01/31, 1996	1036	4.62	1.01	-34.37	-2.23	30.97	0.00
46	02/01 - 02/29, 1996	1065	0.93	3.75	-33.84	-2.23	31.40	0.00
47	03/01 - 03/31, 1996	1096	-1.40	5.85	-33.71	-2.23	31.51	0.00
48	04/01 - 04/30, 1996	1126	-0.48	4.34	-33.40	-2.23	31.77	0.00
49	05/01 - 05/15, 1996	1141	-40.63	15.25	-32.10	-2.23	59.72	0.00
50	05/16 - 05/31, 1996	1157	54.50	21.65	-30.61	-97.23	53.56	-1.87
51	06/01 - 06/15, 1996	1172	-54.84	151.05	-36.70	-101.03	43.27	-1.75
52	06/16 - 06/30, 1996	1187	-6.67	2.97	-32.07	-6.03	43.52	-1.72
53	07/01 - 07/20, 1996	1207	-30.39	145.91	-49.86	-101.03	37.03	-1.67
54	07/21 - 07/31, 1996	1218	-106.10	137.65	-53.52	-6.03	29.67	-1.67
55	08/01 - 08/15, 1996	1233	38.90	0.77	-50.09	-6.03	18.12	-1.66
56	08/16 - 08/31, 1996	1249	-10.58	146.82	-56.51	-101.03	22.98	-1.67
57	09/01 - 09/30, 1996	1279	20.41	2.03	-50.61	-2.23	30.40	0.00

NO WELLS Model Water Budget (cfs)

Stress Period	Date Range	Elapsed Days	Storage	Recharge	Baseflow	Wells	General Heads	Evt
1	04/01 - 04/30, 1993	30	-0.01	9.67	-38.39	-2.23	30.97	0.00
2	05/01 - 05/20, 1993	50	-76.54	13.34	-31.43	-2.23	96.85	0.00
3	05/21 - 05/31, 1993	61	-56.03	19.42	-33.17	-2.23	73.38	-1.37
4	06/01 - 06/10, 1993	71	-202.62	186.96	-33.92	-6.03	57.00	-1.38
5	06/11 - 06/30, 1993	91	-27.36	11.34	-33.24	-6.03	56.68	-1.38
6	07/01 - 07/18, 1993	109	-175.61	196.68	-54.98	-6.03	41.34	-1.40
7	07/19 - 07/31, 1993	122	-7.19	19.14	-50.37	-6.03	45.88	-1.40
8	08/01 - 08/15, 1993	137	-2.62	13.32	-51.55	-6.03	48.27	-1.38
9	08/16 - 08/31, 1993	153	-152.04	187.15	-64.28	-6.03	36.62	-1.40
10	09/01 - 09/30, 1993	183	74.28	0.50	-56.58	-2.23	-15.97	0.00
11	10/01 - 10/31, 1993	214	35.31	7.79	-50.99	-2.23	10.12	0.00
12	11/01 - 11/30, 1993	244	27.46	0.22	-42.81	-2.23	17.33	0.00
13	12/01 - 12/31, 1993	275	22.54	0.42	-41.27	-2.23	20.52	0.00
14	01/01 - 01/31, 1994	306	19.16	0.63	-39.90	-2.23	22.32	0.00
15	02/01 - 02/28, 1994	334	15.78	2.29	-39.09	-2.23	23.25	0.00
16	03/01 - 03/31, 1994	365	13.76	2.86	-38.39	-2.23	23.98	0.00
17	04/01 - 04/30, 1994	395	10.31	5.81	-38.15	-2.23	24.25	0.00
18	05/01 - 05/15, 1994	410	-29.94	5.19	-34.28	-2.23	61.26	0.00
19	05/16 - 05/31, 1994	426	-18.38	11.66	-36.93	-2.23	47.33	-1.45
20	06/01 - 06/15, 1994	441	-182.95	213.91	-53.22	-6.03	29.75	-1.45
21	06/16 - 06/30, 1994	456	15.18	6.35	-48.89	-6.03	34.85	-1.45
22	07/01 - 07/20, 1994	476	-153.90	214.09	-72.47	-6.03	19.79	-1.47
23	07/21 - 07/31, 1994	487	39.55	6.12	-65.10	-6.03	26.94	-1.47
24	08/01 - 08/15, 1994	502	95.44	5.18	-67.34	-6.03	-25.82	-1.41
25	08/16 - 08/31, 1994	518	-110.52	212.56	-79.29	-6.03	-15.28	-1.42
26	09/01 - 09/30, 1994	548	64.29	0.50	-66.74	-2.23	4.18	0.00
27	10/01 - 10/31, 1994	579	42.56	9.86	-60.59	-2.23	10.39	0.00
28	11/01 - 11/30, 1994	609	33.93	1.81	-47.58	-2.23	14.05	0.00
29	12/01 - 12/31, 1994	640	29.94	1.85	-45.83	-2.23	16.23	0.00
30	01/01 - 01/31, 1995	671	23.85	5.46	-44.47	-2.23	17.35	0.00
31	02/01 - 02/28, 1995	699	25.64	0.59	-42.78	-2.23	18.75	0.00
32	03/01 - 03/31, 1995	730	20.00	4.77	-41.93	-2.23	19.36	0.00
33	04/01 - 04/30, 1995	760	6.44	16.92	-39.64	-2.23	18.50	0.00
34	05/01 - 05/31, 1995	791	-119.61	22.89	-30.59	-2.23	129.54	0.00
35	06/01 - 06/08, 1995	799	-112.34	23.79	-4.76	-2.23	97.44	-1.90
36	06/09 - 06/30, 1995	821	-78.50	21.69	-16.05	-2.23	77.03	-1.92
37	07/01 - 07/15, 1995	836	-229.99	211.85	-28.94	-6.03	55.28	-2.16
38	07/16 - 07/31, 1995	852	-29.16	8.13	-30.36	-6.03	59.66	-2.22
39	08/01 - 08/20, 1995	872	-14.37	5.97	-44.64	-6.03	61.23	-2.13
40	08/21 - 08/31, 1995	883	-191.37	208.17	-56.03	-6.03	47.41	-2.13
41	09/01 - 09/30, 1995	913	55.01	11.23	-50.93	-2.23	-13.08	0.00
42	10/01 - 10/31, 1995	944	28.49	2.97	-45.27	-2.23	16.05	0.00
43	11/01 - 11/30, 1995	974	20.05	0.55	-41.65	-2.23	23.26	0.00
44	12/01 - 12/31, 1995	1005	15.15	1.91	-40.97	-2.23	26.14	0.00
45	01/01 - 01/31, 1996	1036	12.38	1.01	-38.93	-2.23	27.75	0.00
46	02/01 - 02/29, 1996	1065	8.22	3.75	-38.13	-2.23	28.38	0.00
47	03/01 - 03/31, 1996	1096	5.43	5.85	-37.72	-2.23	28.67	0.00
48	04/01 - 04/30, 1996	1126	5.91	4.34	-37.13	-2.23	29.10	0.00
49	05/01 - 05/15, 1996	1141	-34.39	15.25	-35.75	-2.23	57.12	0.00
50	05/16 - 05/31, 1996	1157	-21.96	17.28	-35.66	-2.23	44.44	-1.88
51	06/01 - 06/15, 1996	1172	-123.60	143.81	-43.26	-6.03	30.86	-1.76
52	06/16 - 06/30, 1996	1187	8.10	2.97	-38.57	-6.03	35.26	-1.73
53	07/01 - 07/20, 1996	1207	-97.78	140.15	-58.45	-6.03	23.80	-1.69
54	07/21 - 07/31, 1996	1218	-87.20	137.53	-62.42	-6.03	19.82	-1.69
55	08/01 - 08/15, 1996	1233	54.34	0.86	-58.18	-6.03	10.68	-1.68
56	08/16 - 08/31, 1996	1249	-77.32	141.05	-66.27	-6.03	10.27	-1.68
57	09/01 - 09/30, 1996	1279	37.04	2.03	-59.34	-2.23	22.50	0.00

MORE WELLS Model Water Budget (cfs)

Stress Period	Date Range	Elapsed Days	Storage	Recharge	Baseflow	Wells	General Heads	Evt
1	04/01 - 04/30, 1993	30	-0.01	10.24	-38.71	-2.23	30.72	0.00
2	05/01 - 05/20, 1993	50	-75.15	12.49	-31.75	-2.23	96.64	0.00
3	05/21 - 05/31, 1993	61	105.94	41.92	-32.45	-192.23	78.18	-1.37
4	06/01 - 06/10, 1993	71	-45.55	210.22	-32.06	-196.03	64.82	-1.38
5	06/11 - 06/30, 1993	91	-34.38	11.34	-30.66	-6.03	61.11	-1.37
6	07/01 - 07/18, 1993	109	-23.42	219.55	-49.92	-196.03	51.20	-1.39
7	07/19 - 07/31, 1993	122	-18.67	17.94	-44.77	-6.03	52.93	-1.39
8	08/01 - 08/15, 1993	137	-14.99	14.36	-45.60	-6.03	53.63	-1.37
9	08/16 - 08/31, 1993	153	-4.09	210.01	-56.01	-196.03	47.51	-1.39
10	09/01 - 09/30, 1993	183	58.88	0.50	-48.16	-2.23	-8.97	0.00
11	10/01 - 10/31, 1993	214	21.50	7.79	-42.76	-2.23	15.69	0.00
12	11/01 - 11/30, 1993	244	14.37	0.22	-34.67	-2.23	22.30	0.00
13	12/01 - 12/31, 1993	275	10.25	0.42	-33.57	-2.23	25.12	0.00
14	01/01 - 01/31, 1994	306	7.62	0.63	-32.67	-2.23	26.64	0.00
15	02/01 - 02/28, 1994	334	4.87	2.29	-32.28	-2.23	27.36	0.00
16	03/01 - 03/31, 1994	365	3.52	2.86	-32.02	-2.23	27.87	0.00
17	04/01 - 04/30, 1994	395	0.66	5.81	-32.18	-2.23	27.94	0.00
18	05/01 - 05/15, 1994	410	-39.66	5.19	-28.13	-2.23	64.82	0.00
19	05/16 - 05/31, 1994	426	129.36	36.81	-29.50	-192.23	56.99	-1.44
20	06/01 - 06/15, 1994	441	-40.55	238.80	-43.64	-196.03	42.86	-1.44
21	06/16 - 06/30, 1994	456	-4.46	6.35	-38.98	-6.03	44.56	-1.43
22	07/01 - 07/20, 1994	476	-16.85	239.12	-59.28	-196.03	34.49	-1.45
23	07/21 - 07/31, 1994	487	14.69	5.91	-51.98	-6.03	38.87	-1.45
24	08/01 - 08/15, 1994	502	72.83	5.33	-54.78	-6.03	-15.95	-1.39
25	08/16 - 08/31, 1994	518	24.42	237.56	-64.24	-196.03	-0.32	-1.40
26	09/01 - 09/30, 1994	548	39.45	0.50	-52.83	-2.23	15.13	0.00
27	10/01 - 10/31, 1994	579	20.00	9.86	-47.32	-2.23	19.70	0.00
28	11/01 - 11/30, 1994	609	12.54	1.81	-34.68	-2.23	22.56	0.00
29	12/01 - 12/31, 1994	640	9.79	1.85	-33.61	-2.23	24.19	0.00
30	01/01 - 01/31, 1995	671	4.88	5.46	-32.99	-2.23	24.87	0.00
31	02/01 - 02/28, 1995	699	7.67	0.59	-31.95	-2.23	25.92	0.00
32	03/01 - 03/31, 1995	730	3.07	4.77	-31.77	-2.23	26.15	0.00
33	04/01 - 04/30, 1995	760	-9.62	16.92	-30.03	-2.23	24.95	0.00
34	05/01 - 05/31, 1995	791	-136.23	22.89	-20.08	-2.23	135.66	0.00
35	06/01 - 06/08, 1995	799	47.17	32.01	7.14	-192.23	107.81	-1.88
36	06/09 - 06/30, 1995	821	-98.07	21.69	-4.51	-2.23	85.04	-1.91
37	07/01 - 07/15, 1995	836	-76.24	220.08	-14.69	-196.03	69.01	-2.14
38	07/16 - 07/31, 1995	852	-53.59	7.67	-16.06	-6.03	70.21	-2.20
39	08/01 - 08/20, 1995	872	-37.05	6.34	-31.17	-6.03	70.02	-2.10
40	08/21 - 08/31, 1995	883	-38.85	216.39	-40.50	-196.03	61.11	-2.10
41	09/01 - 09/30, 1995	913	30.96	11.23	-36.80	-2.23	-3.15	0.00
42	10/01 - 10/31, 1995	944	6.67	2.97	-31.91	-2.23	24.51	0.00
43	11/01 - 11/30, 1995	974	-0.32	0.55	-29.00	-2.23	31.00	0.00
44	12/01 - 12/31, 1995	1005	-3.95	1.91	-29.09	-2.23	33.36	0.00
45	01/01 - 01/31, 1996	1036	-5.57	1.01	-27.76	-2.23	34.54	0.00
46	02/01 - 02/29, 1996	1065	-8.73	3.75	-27.60	-2.23	34.80	0.00
47	03/01 - 03/31, 1996	1096	-10.47	5.85	-27.88	-2.23	34.73	0.00
48	04/01 - 04/30, 1996	1126	-8.98	4.34	-27.96	-2.23	34.83	0.00
49	05/01 - 05/15, 1996	1141	-48.89	15.25	-26.82	-2.23	62.69	0.00
50	05/16 - 05/31, 1996	1157	136.40	26.34	-25.29	-192.23	56.64	-1.86
51	06/01 - 06/15, 1996	1172	26.16	155.75	-30.84	-196.03	46.70	-1.74
52	06/16 - 06/30, 1996	1187	-16.70	2.97	-25.79	-6.03	47.28	-1.71
53	07/01 - 07/20, 1996	1207	48.14	150.60	-42.36	-196.03	41.30	-1.66
54	07/21 - 07/31, 1996	1218	-118.81	137.66	-45.38	-6.03	34.23	-1.66
55	08/01 - 08/15, 1996	1233	25.71	0.77	-41.67	-6.03	22.88	-1.65
56	08/16 - 08/31, 1996	1249	65.41	151.52	-47.24	-196.03	28.00	-1.66
57	09/01 - 09/30, 1996	1279	5.52	2.03	-41.03	-2.23	35.71	0.00

DRY YEARS Model Water Budget (cfs)

Stress Period	Date Range	Elapsed Days	Storage	Recharge	Baseflow	Wells	General Heads	Evt
1	04/01 - 04/30, 1993	30	-0.01	10.23	-37.71	-3.34	30.83	0.00
2	05/01 - 05/20, 1993	50	-74.89	12.49	-30.74	-3.34	96.48	0.00
3	05/21 - 05/31, 1993	61	21.52	31.65	-31.57	-98.34	78.08	-1.35
4	06/01 - 06/10, 1993	71	-129.62	199.94	-31.41	-102.15	64.60	-1.35
5	06/11 - 06/30, 1993	91	-32.76	11.33	-30.59	-7.15	60.51	-1.35
6	07/01 - 07/18, 1993	109	-105.28	209.27	-50.72	-102.15	50.23	-1.37
7	07/19 - 07/31, 1993	122	-14.95	17.93	-46.08	-7.15	51.63	-1.37
8	08/01 - 08/15, 1993	137	-10.51	14.36	-47.43	-7.15	52.08	-1.35
9	08/16 - 08/31, 1993	153	-83.30	199.75	-58.64	-102.15	45.71	-1.37
10	09/01 - 09/30, 1993	183	65.18	0.49	-51.42	-3.34	-10.89	0.00
11	10/01 - 10/31, 1993	214	28.41	7.79	-46.35	-3.34	13.50	0.00
12	11/01 - 11/30, 1993	244	21.54	0.22	-38.48	-3.34	20.05	0.00
13	12/01 - 12/31, 1993	275	17.25	0.42	-37.25	-3.34	22.91	0.00
14	01/01 - 01/31, 1994	306	14.32	0.63	-36.12	-3.34	24.50	0.00
15	02/01 - 02/28, 1994	334	11.25	2.29	-35.49	-3.34	25.29	0.00
16	03/01 - 03/31, 1994	365	9.55	2.86	-34.97	-3.34	25.90	0.00
17	04/01 - 04/30, 1994	395	6.36	5.80	-34.89	-3.34	26.06	0.00
18	05/01 - 05/15, 1994	410	-33.74	5.19	-31.01	-3.34	62.90	0.00
19	05/16 - 05/31, 1994	426	51.52	25.57	-32.42	-98.34	55.08	-1.42
20	06/01 - 06/15, 1994	441	-117.57	227.56	-47.10	-102.15	40.68	-1.42
21	06/16 - 06/30, 1994	456	3.08	6.35	-42.89	-7.15	42.03	-1.41
22	07/01 - 07/20, 1994	476	-91.29	227.88	-64.54	-102.15	31.52	-1.43
23	07/21 - 07/31, 1994	487	24.47	5.91	-57.41	-7.15	35.62	-1.43
24	08/01 - 08/15, 1994	502	87.33	5.33	-59.39	-7.15	-24.76	-1.37
25	08/16 - 08/31, 1994	518	-46.30	226.34	-69.26	-102.15	-7.26	-1.38
26	09/01 - 09/30, 1994	548	51.68	0.49	-57.41	-3.34	8.59	0.00
27	10/01 - 10/31, 1994	579	32.07	9.85	-51.85	-3.34	13.27	0.00
28	11/01 - 11/30, 1994	609	24.42	1.81	-39.14	-3.34	16.25	0.00
29	12/01 - 12/31, 1994	640	21.27	1.85	-37.81	-3.34	18.03	0.00
30	01/01 - 01/31, 1995	671	19.94	0.16	-36.20	-3.34	19.44	0.00
31	02/01 - 02/28, 1995	699	17.55	0.58	-35.12	-3.34	20.31	0.00
32	03/01 - 03/31, 1995	730	14.48	2.33	-34.38	-3.34	20.89	0.00
33	04/01 - 04/30, 1995	760	11.20	4.16	-33.21	-3.34	21.18	0.00
34	05/01 - 05/15, 1995	775	-41.31	3.87	-39.71	-3.34	80.50	0.00
35	05/16 - 05/31, 1995	791	-79.62	177.31	-48.52	-98.34	49.17	0.00
36	06/01 - 06/15, 1995	806	-62.73	177.43	-50.88	-102.15	39.78	-1.45
37	06/16 - 06/30, 1995	821	8.55	4.16	-44.67	-7.15	40.50	-1.38
38	07/01 - 07/20, 1995	841	-56.06	178.23	-52.29	-102.15	33.77	-1.51
39	07/21 - 07/31, 1995	852	16.43	4.51	-48.52	-7.15	36.26	-1.53
40	08/01 - 08/15, 1995	867	23.17	4.13	-56.22	-7.15	37.53	-1.47
41	08/16 - 08/31, 1995	883	-43.32	177.23	-63.10	-102.15	32.81	-1.47
42	09/01 - 09/30, 1995	913	70.70	0.22	-55.68	-3.34	-11.90	0.00
43	10/01 - 10/31, 1995	944	31.47	4.03	-41.57	-3.34	9.43	0.00
44	11/01 - 11/30, 1995	974	26.17	1.26	-39.20	-3.34	15.10	0.00
45	12/01 - 12/31, 1995	1005	21.84	1.32	-37.59	-3.34	17.76	0.00
46	01/01 - 01/31, 1996	1036	19.11	0.53	-35.76	-3.34	19.45	0.00
47	02/01 - 02/29, 1996	1065	15.64	1.99	-34.69	-3.34	20.39	0.00
48	03/01 - 03/31, 1996	1096	13.80	2.12	-33.78	-3.34	21.18	0.00
49	04/01 - 04/30, 1996	1126	11.55	3.29	-33.17	-3.34	21.67	0.00
50	05/01 - 05/15, 1996	1141	-29.88	4.49	-36.59	-3.34	65.31	0.00
51	05/16 - 05/31, 1996	1157	-74.64	176.90	-43.72	-98.34	40.97	-1.18
52	06/01 - 06/15, 1996	1172	-64.74	177.05	-42.16	-102.15	33.17	-1.18
53	06/16 - 06/30, 1996	1187	8.05	3.84	-38.01	-7.15	34.45	-1.17
54	07/01 - 07/20, 1996	1207	-46.53	179.05	-57.52	-102.15	28.32	-1.19
55	07/21 - 07/31, 1996	1218	25.92	2.98	-51.70	-7.15	31.14	-1.19
56	08/01 - 08/15, 1996	1233	35.93	1.94	-52.91	-7.15	23.34	-1.15
57	08/16 - 08/31, 1996	1249	-35.57	175.59	-59.82	-102.15	23.11	-1.16
58	09/01 - 09/30, 1996	1279	27.82	0.82	-53.63	-3.34	28.35	0.00

FLOOD IRRIGATION Model Water Budget (cfs)

Stress Period	Date Range	Elapsed Days	Storage	Recharge	Baseflow	Wells	General Heads	Evt
1	04/01 - 04/30, 1993	30	-0.01	9.68	-38.38	-2.23	30.95	0.00
2	05/01 - 05/20, 1993	50	-76.62	13.47	-31.45	-2.23	96.82	0.00
3	05/21 - 05/31, 1993	61	-50.65	13.47	-32.90	-2.23	73.67	-1.37
4	06/01 - 06/10, 1993	71	-419.81	427.85	-51.63	-6.03	51.04	-1.42
5	06/11 - 06/30, 1993	91	-14.88	11.34	-43.10	-6.03	54.09	-1.41
6	07/01 - 07/18, 1993	109	-370.29	437.77	-91.02	-6.03	31.08	-1.51
7	07/19 - 07/31, 1993	122	24.49	18.89	-75.55	-6.03	39.72	-1.51
8	08/01 - 08/15, 1993	137	21.86	12.89	-70.96	-6.03	43.71	-1.47
9	08/16 - 08/31, 1993	153	-336.84	428.23	-108.60	-6.03	24.80	-1.54
10	09/01 - 09/30, 1993	183	106.89	0.50	-82.84	-2.23	-22.33	0.00
11	10/01 - 10/31, 1993	214	59.22	7.79	-70.12	-2.23	5.33	0.00
12	11/01 - 11/30, 1993	244	46.75	0.22	-58.07	-2.23	13.31	0.00
13	12/01 - 12/31, 1993	275	38.38	0.42	-53.57	-2.23	16.99	0.00
14	01/01 - 01/31, 1994	306	32.56	0.63	-50.08	-2.23	19.11	0.00
15	02/01 - 02/28, 1994	334	27.47	2.29	-47.82	-2.23	20.27	0.00
16	03/01 - 03/31, 1994	365	23.97	2.86	-45.86	-2.23	21.22	0.00
17	04/01 - 04/30, 1994	395	19.38	5.81	-44.65	-2.23	21.67	0.00
18	05/01 - 05/15, 1994	410	-21.19	5.19	-40.59	-2.23	58.81	0.00
19	05/16 - 05/31, 1994	426	-4.54	5.19	-42.35	-2.23	45.39	-1.47
20	06/01 - 06/15, 1994	441	-429.80	509.43	-90.45	-6.03	18.41	-1.55
21	06/16 - 06/30, 1994	456	47.18	6.35	-73.94	-6.03	27.98	-1.54
22	07/01 - 07/20, 1994	476	-372.40	509.55	-133.04	-6.03	3.59	-1.66
23	07/21 - 07/31, 1994	487	95.91	6.13	-110.14	-6.03	15.78	-1.65
24	08/01 - 08/15, 1994	502	138.63	5.17	-101.68	-6.03	-34.52	-1.57
25	08/16 - 08/31, 1994	518	-320.89	508.01	-146.92	-6.03	-32.52	-1.64
26	09/01 - 09/30, 1994	548	114.79	0.50	-106.89	-2.23	-6.17	0.00
27	10/01 - 10/31, 1994	579	79.80	9.86	-89.65	-2.23	2.22	0.00
28	11/01 - 11/30, 1994	609	64.71	1.81	-71.27	-2.23	6.97	0.00
29	12/01 - 12/31, 1994	640	55.71	1.85	-65.22	-2.23	9.89	0.00
30	01/01 - 01/31, 1995	671	45.82	5.46	-60.62	-2.23	11.56	0.00
31	02/01 - 02/28, 1995	699	44.94	0.59	-56.67	-2.23	13.36	0.00
32	03/01 - 03/31, 1995	730	37.07	4.77	-53.95	-2.23	14.33	0.00
33	04/01 - 04/30, 1995	760	21.75	16.92	-50.25	-2.23	13.77	0.00
34	05/01 - 05/31, 1995	791	-104.68	22.89	-41.14	-2.23	125.16	0.00
35	06/01 - 06/08, 1995	799	-95.20	21.69	-15.54	-2.23	93.22	-1.93
36	06/09 - 06/30, 1995	821	-64.50	21.69	-25.95	-2.23	72.95	-1.95
37	07/01 - 07/15, 1995	836	-541.84	596.30	-85.67	-6.03	39.57	-2.32
38	07/16 - 07/31, 1995	852	19.26	8.17	-68.90	-6.03	49.87	-2.37
39	08/01 - 08/20, 1995	872	22.07	5.94	-73.41	-6.03	53.69	-2.25
40	08/21 - 08/31, 1995	883	-490.89	592.57	-123.81	-6.03	30.51	-2.34
41	09/01 - 09/30, 1995	913	104.26	11.23	-90.63	-2.23	-22.64	0.00
42	10/01 - 10/31, 1995	944	64.57	2.97	-73.99	-2.23	8.68	0.00
43	11/01 - 11/30, 1995	974	48.84	0.55	-64.13	-2.23	16.95	0.00
44	12/01 - 12/31, 1995	1005	38.92	1.91	-59.11	-2.23	20.51	0.00
45	01/01 - 01/31, 1996	1036	32.60	1.01	-54.01	-2.23	22.61	0.00
46	02/01 - 02/29, 1996	1065	25.92	3.75	-51.06	-2.23	23.59	0.00
47	03/01 - 03/31, 1996	1096	21.10	5.85	-48.95	-2.23	24.20	0.00
48	04/01 - 04/30, 1996	1126	19.99	4.34	-47.03	-2.23	24.90	0.00
49	05/01 - 05/15, 1996	1141	-20.93	15.25	-45.14	-2.23	53.04	0.00
50	05/16 - 05/31, 1996	1157	-7.42	15.25	-44.34	-2.23	40.63	-1.90
51	06/01 - 06/15, 1996	1172	-343.63	417.93	-85.33	-6.03	18.95	-1.87
52	06/16 - 06/30, 1996	1187	45.68	2.97	-68.10	-6.03	27.30	-1.83
53	07/01 - 07/20, 1996	1207	-289.68	414.95	-125.18	-6.03	7.81	-1.88
54	07/21 - 07/31, 1996	1218	-261.45	414.95	-146.55	-6.03	1.00	-1.93
55	08/01 - 08/15, 1996	1233	126.01	0.90	-116.85	-6.03	-2.13	-1.90
56	08/16 - 08/31, 1996	1249	-244.13	415.87	-155.08	-6.03	-8.65	-1.97
57	09/01 - 09/30, 1996	1279	103.45	2.03	-114.10	-2.23	10.85	0.00

Comparison of Baseflow among Models (cfs)

Stress Period	Date Range	Elapsed Days	CURRENT WELLS	NO WELLS	MORE WELLS	FLOOD IRRIGATION	DRY YEARS	DRY YEARS Elapsed Days	Date Range for DRY YEARS model
1	04/01 - 04/30, 1993	30	38.70	38.39	38.71	38.38	37.71	30	04/01 - 04/30, 1993
2	05/01 - 05/20, 1993	50	31.75	31.43	31.75	31.45	30.74	50	05/01 - 05/20, 1993
3	05/21 - 05/31, 1993	61	32.56	33.17	32.45	32.90	31.57	61	05/21 - 05/31, 1993
4	06/01 - 06/10, 1993	71	32.42	33.92	32.06	51.63	31.41	71	06/01 - 06/10, 1993
5	06/11 - 06/30, 1993	91	31.61	33.24	30.66	43.10	30.59	91	06/11 - 06/30, 1993
6	07/01 - 07/18, 1993	109	51.73	54.98	49.92	91.02	50.72	109	07/01 - 07/18, 1993
7	07/19 - 07/31, 1993	122	47.10	50.37	44.77	75.55	46.08	122	07/19 - 07/31, 1993
8	08/01 - 08/15, 1993	137	48.46	51.55	45.60	70.96	47.43	137	08/01 - 08/15, 1993
9	08/16 - 08/31, 1993	153	59.67	64.28	56.01	108.60	58.64	153	08/16 - 08/31, 1993
10	09/01 - 09/30, 1993	183	52.45	56.58	48.16	82.84	51.42	183	09/01 - 09/30, 1993
11	10/01 - 10/31, 1993	214	47.37	50.99	42.76	70.12	46.35	214	10/01 - 10/31, 1993
12	11/01 - 11/30, 1993	244	39.47	42.81	34.67	58.07	38.48	244	11/01 - 11/30, 1993
13	12/01 - 12/31, 1993	275	38.23	41.27	33.57	53.57	37.25	275	12/01 - 12/31, 1993
14	01/01 - 01/31, 1994	306	37.11	39.90	32.67	50.08	36.12	306	01/01 - 01/31, 1994
15	02/01 - 02/28, 1994	334	36.48	39.09	32.28	47.82	35.49	334	02/01 - 02/28, 1994
16	03/01 - 03/31, 1994	365	35.96	38.39	32.02	45.86	34.97	365	03/01 - 03/31, 1994
17	04/01 - 04/30, 1994	395	35.88	38.15	32.18	44.65	34.89	395	04/01 - 04/30, 1994
18	05/01 - 05/15, 1994	410	32.01	34.28	28.13	40.59	31.01	410	05/01 - 05/15, 1994
19	05/16 - 05/31, 1994	426	33.39	36.93	29.50	42.35	32.42	426	05/16 - 05/31, 1994
20	06/01 - 06/15, 1994	441	48.11	53.22	43.64	90.45	47.10	441	06/01 - 06/15, 1994
21	06/16 - 06/30, 1994	456	43.88	48.89	38.98	73.94	42.89	456	06/16 - 06/30, 1994
22	07/01 - 07/20, 1994	476	65.53	72.47	59.28	133.04	64.54	476	07/01 - 07/20, 1994
23	07/21 - 07/31, 1994	487	58.40	65.10	51.98	110.14	57.41	487	07/21 - 07/31, 1994
24	08/01 - 08/15, 1994	502	61.32	67.34	54.78	101.68	59.39	502	08/01 - 08/15, 1994
25	08/16 - 08/31, 1994	518	71.69	79.29	64.24	146.92	69.26	518	08/16 - 08/31, 1994
26	09/01 - 09/30, 1994	548	60.20	66.74	52.83	106.89	57.41	548	09/01 - 09/30, 1994
27	10/01 - 10/31, 1994	579	54.76	60.59	47.32	89.65	51.85	579	10/01 - 10/31, 1994
28	11/01 - 11/30, 1994	609	42.13	47.58	34.68	71.27	39.14	609	11/01 - 11/30, 1994
29	12/01 - 12/31, 1994	640	40.85	45.83	33.61	65.22	37.81	640	12/01 - 12/31, 1994
30	01/01 - 01/31, 1995	671	39.90	44.47	32.99	60.62	36.20	671	01/01 - 01/31, 1995
31	02/01 - 02/28, 1995	699	38.52	42.78	31.95	56.67	35.12	699	02/01 - 02/28, 1995
32	03/01 - 03/31, 1995	730	37.97	41.93	31.77	53.95	34.38	730	03/01 - 03/31, 1995
33	04/01 - 04/30, 1995	760	35.90	39.64	30.03	50.25	33.21	760	04/01 - 04/30, 1995
34	05/01 - 05/31, 1995	791	26.50	30.59	20.08	41.14	39.71	775	05/01 - 05/15, 1995
35	06/01 - 06/08, 1995	799	-0.32	4.76	-7.14	15.54	48.52	791	05/16 - 05/31, 1995
36	06/09 - 06/30, 1995	821	11.20	16.05	4.51	25.95	50.88	806	06/01 - 06/15, 1995
37	07/01 - 07/15, 1995	836	22.00	28.94	14.69	85.67	44.67	821	06/16 - 06/30, 1995
38	07/16 - 07/31, 1995	852	23.63	30.36	16.06	68.90	52.29	841	07/01 - 07/20, 1995
39	08/01 - 08/20, 1995	872	38.62	44.64	31.17	73.41	48.52	852	07/21 - 07/31, 1995
40	08/21 - 08/31, 1995	883	48.50	56.03	40.50	123.81	56.22	867	08/01 - 08/15, 1995
41	09/01 - 09/30, 1995	913	44.45	50.93	36.80	90.63	63.10	883	08/16 - 08/31, 1995
42	10/01 - 10/31, 1995	944	39.47	45.27	31.91	73.99	55.68	913	09/01 - 09/30, 1995
43	11/01 - 11/30, 1995	974	36.36	41.65	29.00	64.13	41.57	944	10/01 - 10/31, 1995
44	12/01 - 12/31, 1995	1005	36.09	40.97	29.09	59.11	39.20	974	11/01 - 11/30, 1995
45	01/01 - 01/31, 1996	1036	34.37	38.93	27.76	54.01	37.59	1005	12/01 - 12/31, 1995
46	02/01 - 02/29, 1996	1065	33.84	38.13	27.60	51.06	35.76	1036	01/01 - 01/31, 1996
47	03/01 - 03/31, 1996	1096	33.71	37.72	27.88	48.95	34.69	1065	02/01 - 02/29, 1996
48	04/01 - 04/30, 1996	1126	33.40	37.13	27.96	47.03	33.78	1096	03/01 - 03/31, 1996
49	05/01 - 05/15, 1996	1141	32.10	35.75	26.82	45.14	33.17	1126	04/01 - 04/30, 1996
50	05/16 - 05/31, 1996	1157	30.61	35.66	25.29	44.34	36.59	1141	05/01 - 05/15, 1996
51	06/01 - 06/15, 1996	1172	36.70	43.26	30.84	85.33	43.72	1157	05/16 - 05/31, 1996
52	06/16 - 06/30, 1996	1187	32.07	38.57	25.79	68.10	42.16	1172	06/01 - 06/15, 1996
53	07/01 - 07/20, 1996	1207	49.86	58.45	42.36	125.18	38.01	1187	06/16 - 06/30, 1996
54	07/21 - 07/31, 1996	1218	53.52	62.42	45.38	146.55	57.52	1207	07/01 - 07/20, 1996
55	08/01 - 08/15, 1996	1233	50.09	58.18	41.67	116.85	51.70	1218	07/21 - 07/31, 1996
56	08/16 - 08/31, 1996	1249	56.51	66.27	47.24	155.08	52.91	1233	08/01 - 08/15, 1996
57	09/01 - 09/30, 1996	1279	50.61	59.34	41.03	114.1	59.82	1249	08/16 - 08/31, 1996
58							53.63	1279	09/01 - 09/30, 1996

Original Map Figures

Figure 1. Project Location in the Upper Beaverhead Basin, Beaverhead County, Montana

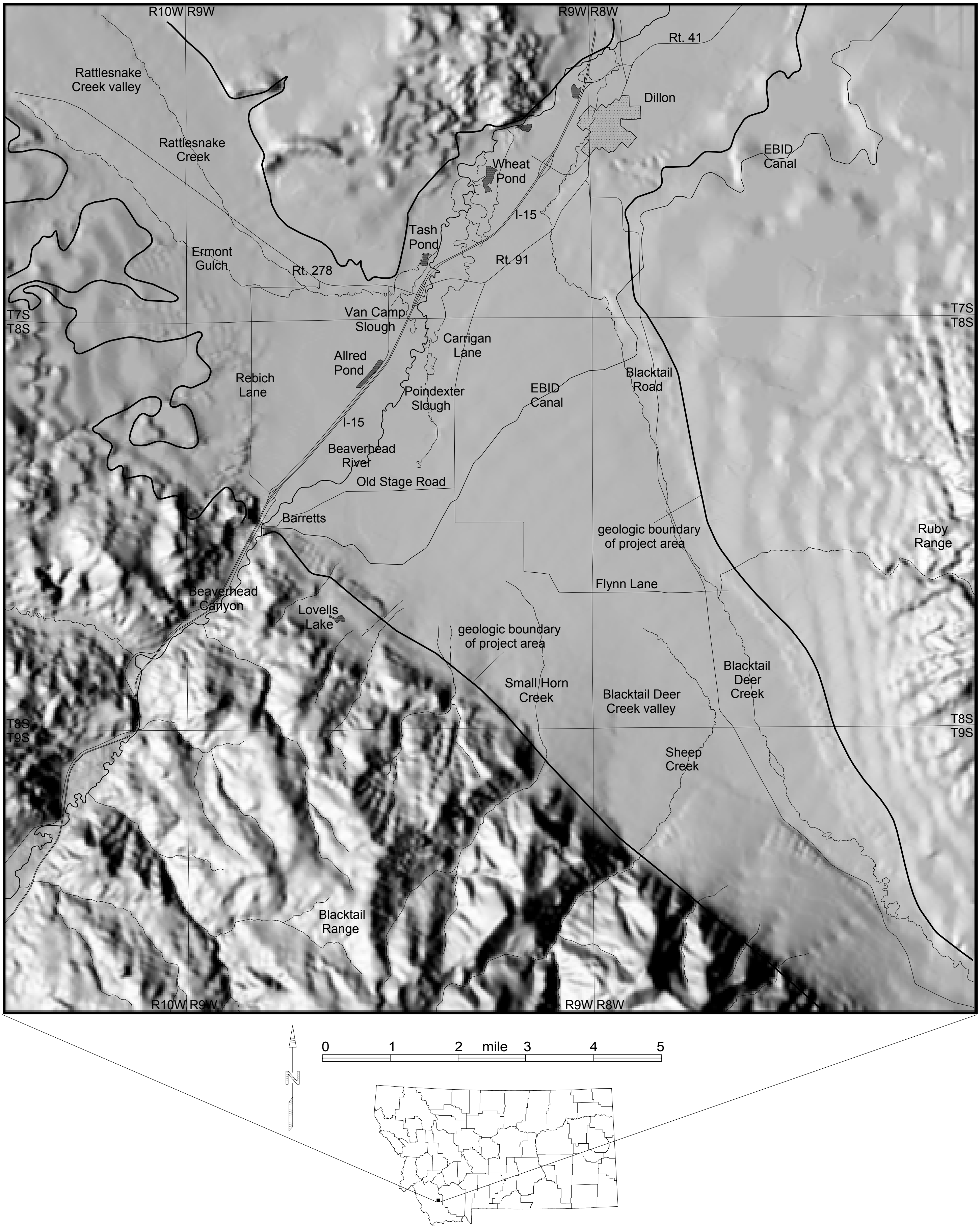


Figure 4. Generalized Geology of the Upper Beaverhead Basin

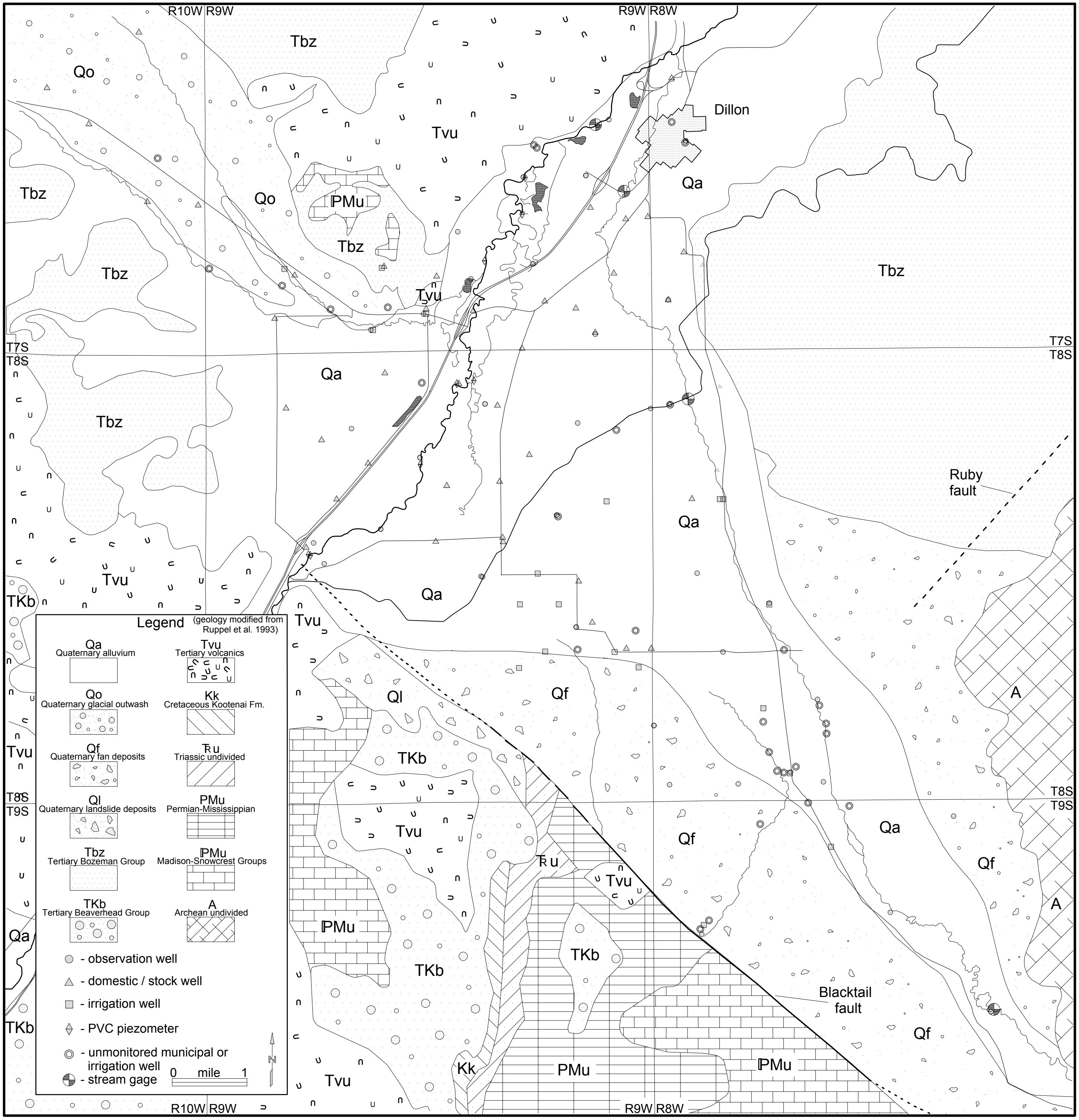


Figure 5. Locations of Observation, Irrigation, and Municipal Wells, and Seismic Refraction Profiles

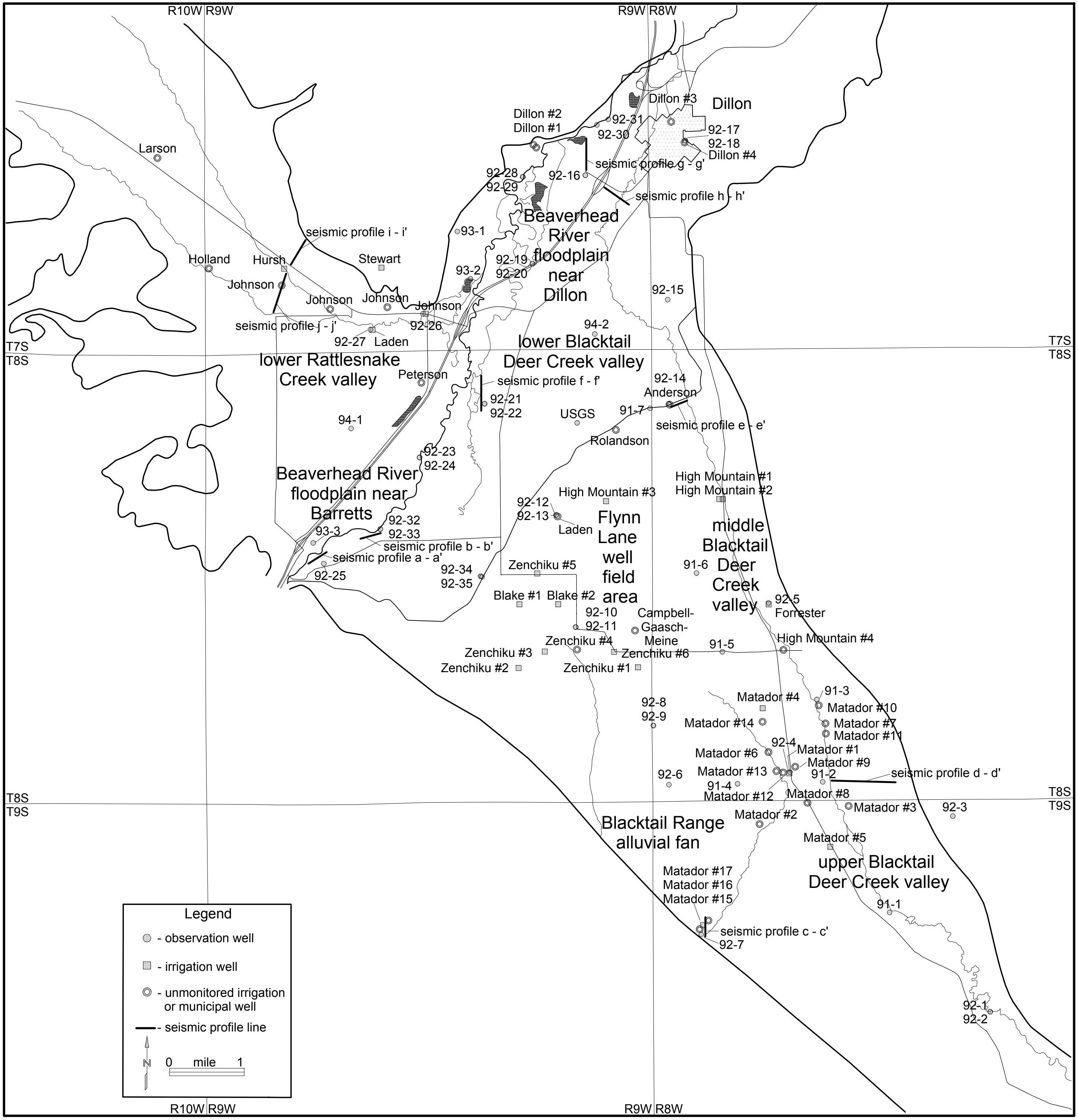
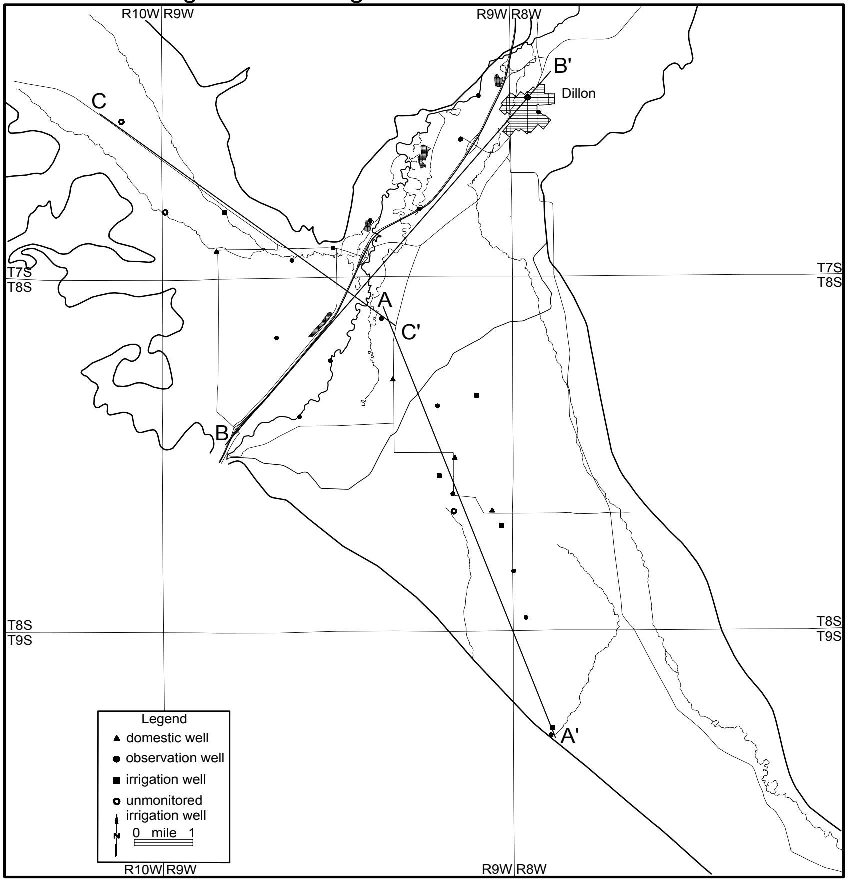


Figure 6. Geologic Cross-Section Locations



<u>Upper Blacktail Deer Creek Valley</u>. Seven observation wells, 91-1, 91-2, 91-3, 92-1, 92-2, 92-3, and 92-4, were drilled in the upper Blacktail Deer Creek valley. Existing wells include several irrigation wells owned by the Matador Cattle Company and a few shallow, stock wells. Lithologic logs for wells in this area are presented in Appendix A3.

Wells 91-1, 91-2, and 91-3, ranging in depth from 55 to 95 feet, were drilled near Blacktail Deer Creek to observe surface water-groundwater interactions. Sediments encountered during drilling were interlayered sand and gravel. Wells 92-1 and 92-2 were drilled near the upper Blacktail Deer Creek gaging station in Section 14, T9S, R8W. Well 92-1 penetrated sandy gravel at a depth of 22 feet and was drilled to 148 feet. The material between 22 and 148 feet was sandy silt and clay with thin clayey gravel seams. The borehole was backfilled with natural material to 119 feet, and a 2-inch PVC casing with a 20-foot slotted screen was installed. Well 92-2 was drilled, adjacent to well 92-1, through the sandy gravel to a depth of 25 feet and perforated between 15 and 19 feet. Well 92-3 was drilled in Section 2, T9S, R8W in the foothills east of Blacktail Deer Creek. Borehole cuttings were silt and fine sand, with a white bentonitic clay between depths of 30 to 40 feet. No water was found at a depth of 200 feet when drilling was delayed in autumn 1992. In spring 1993 when drilling resumed, the groundwater level was near the top of the well casing. However, deepening the well to 260 feet failed to produce water in usable quantities. Well 92-4 was drilled to 158 feet near Matador Ranch irrigation well #1 as an aquifer test observation well. Cuttings were interlayered sand, gravel, and silt.

Figure 10. Groundwater and Surface Water Monitoring Sites

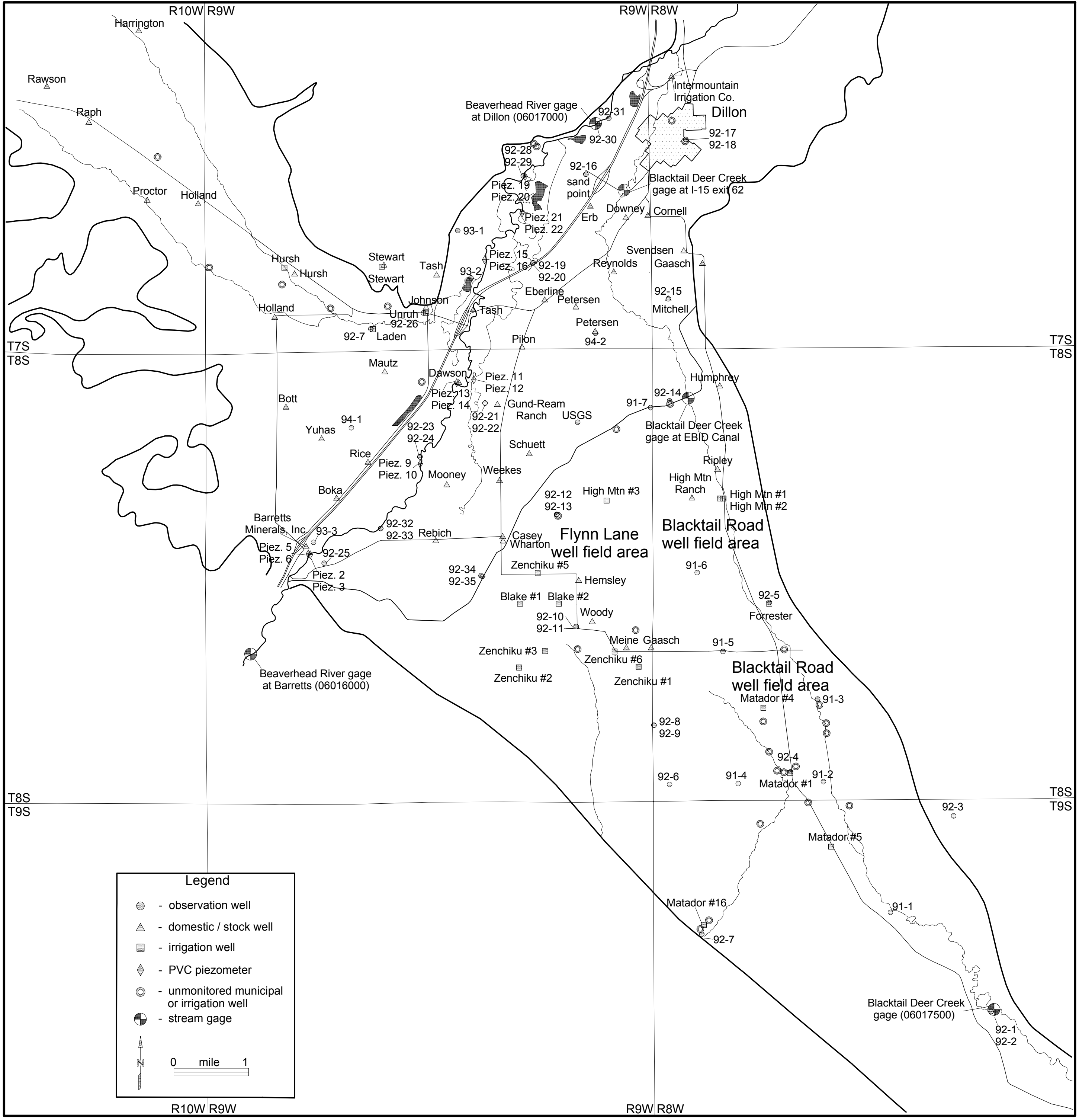


Figure 11. General Groundwater Flow Direction

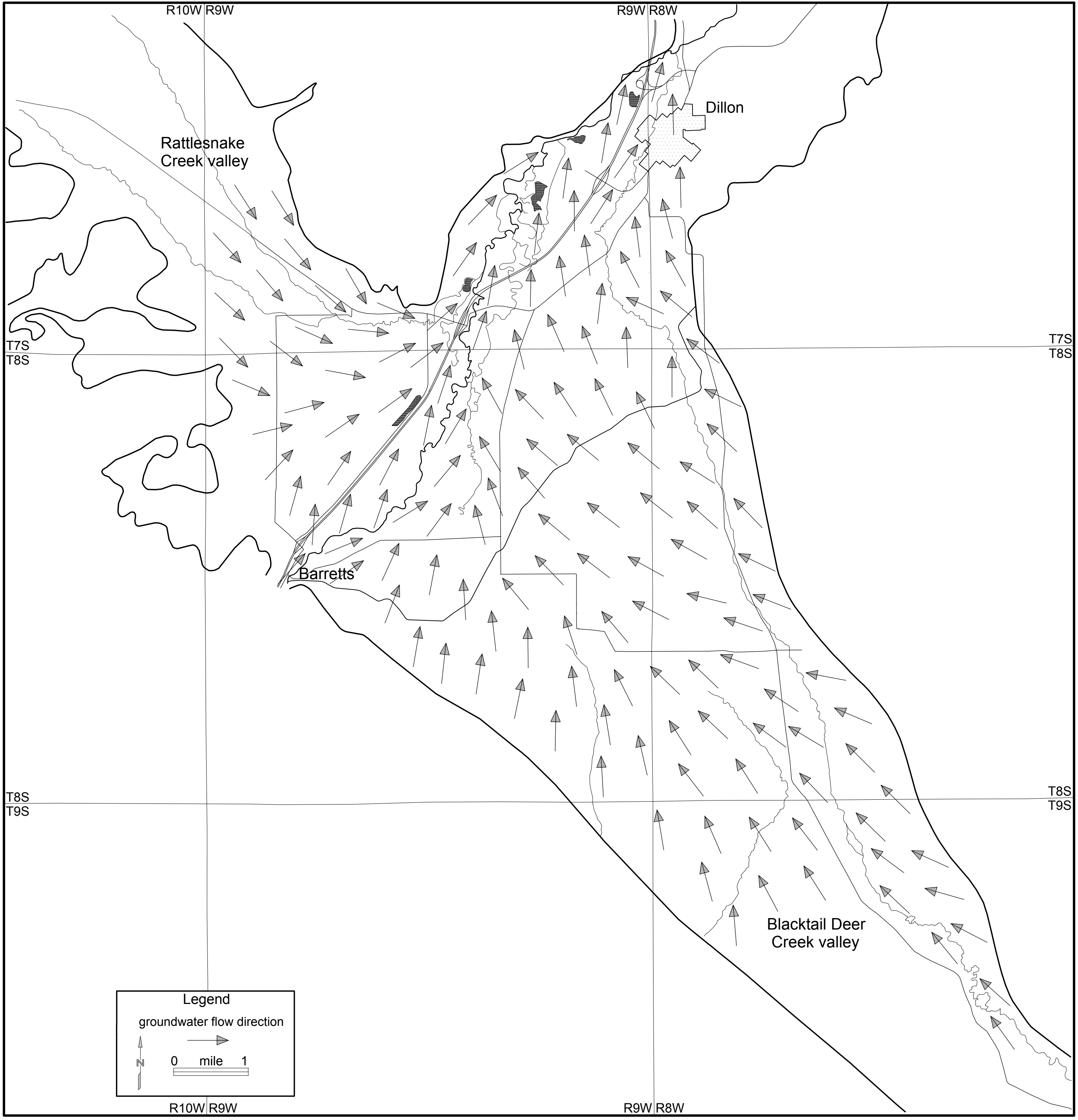


Figure 12. Groundwater Hydrograph Localities

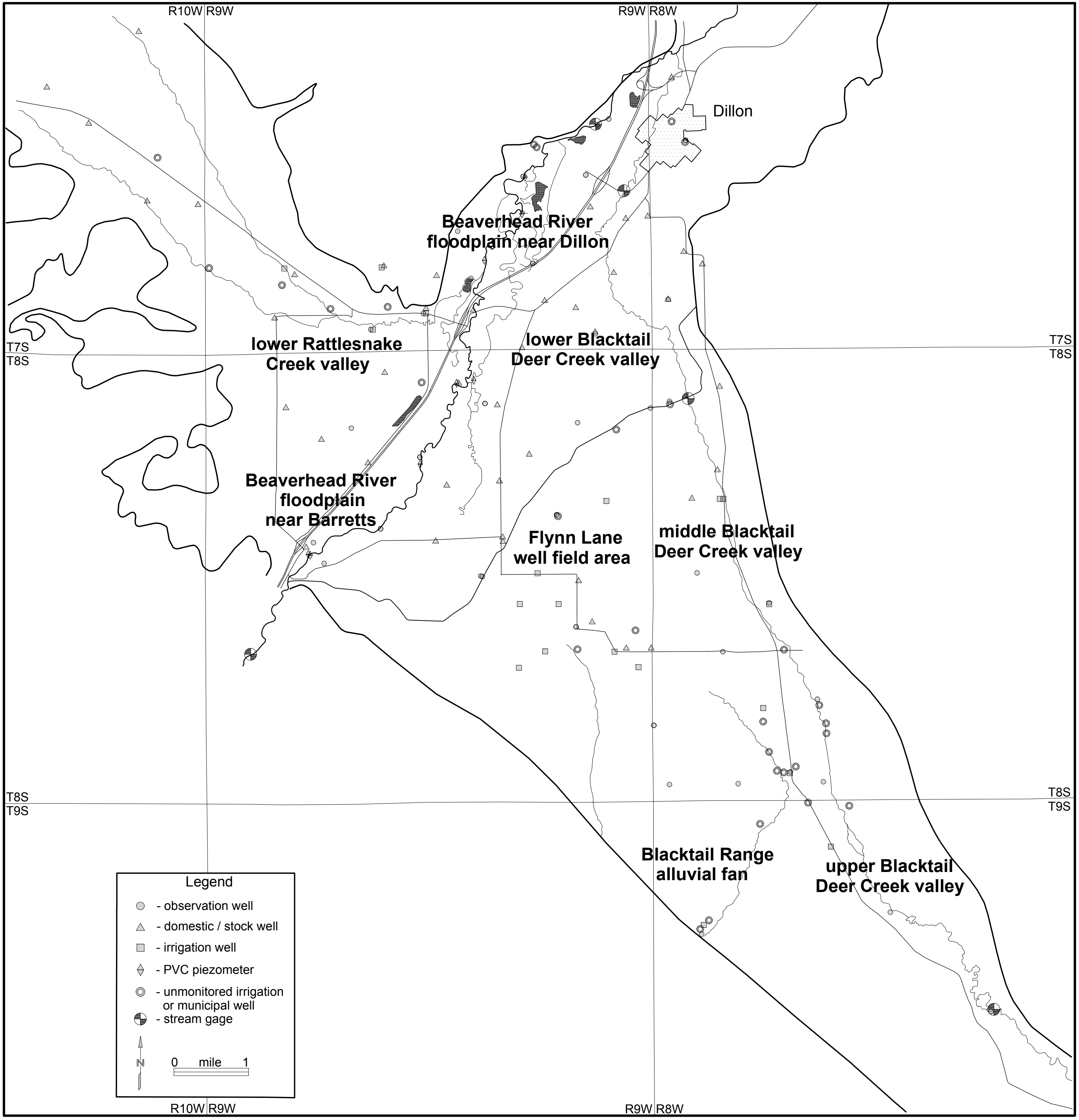


Figure 25. Groundwater-Level Changes between July 22, 1991 and April 16, 1992

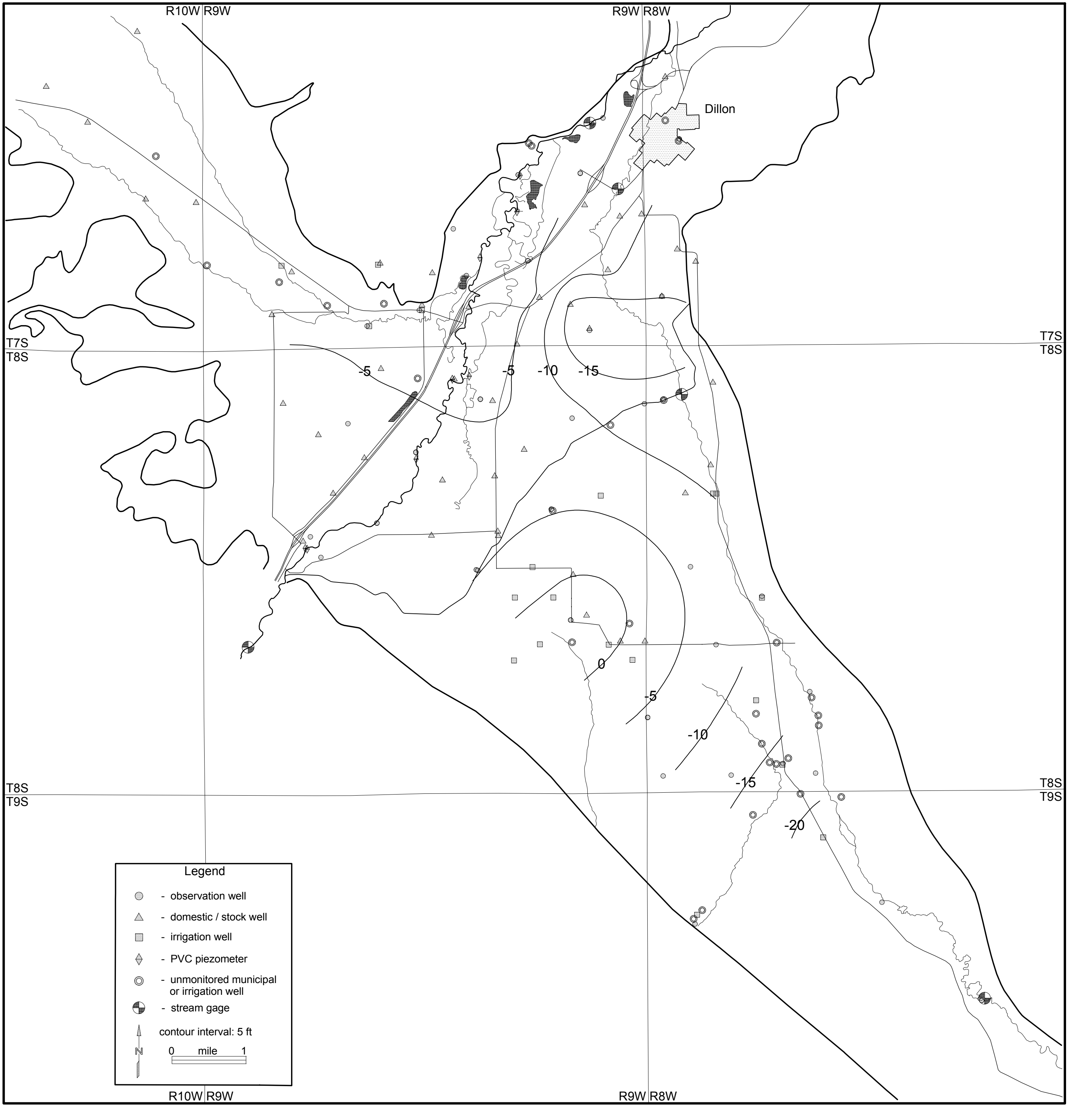


Figure 26. Groundwater-Level Changes between April 16, 1992 and July 23, 1992

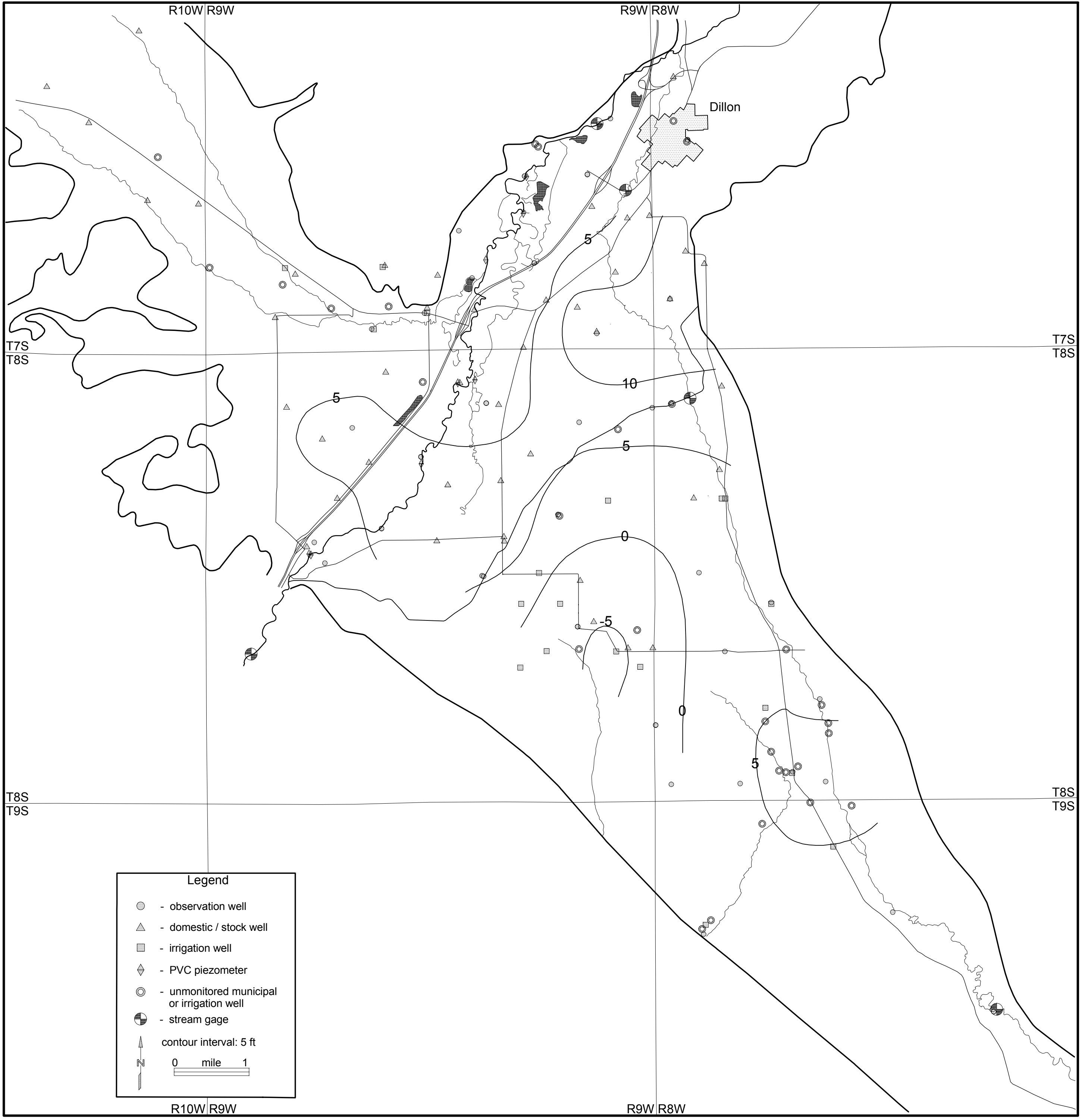


Figure 27. Groundwater-Level Changes between July 23, 1992 and April 15, 1993

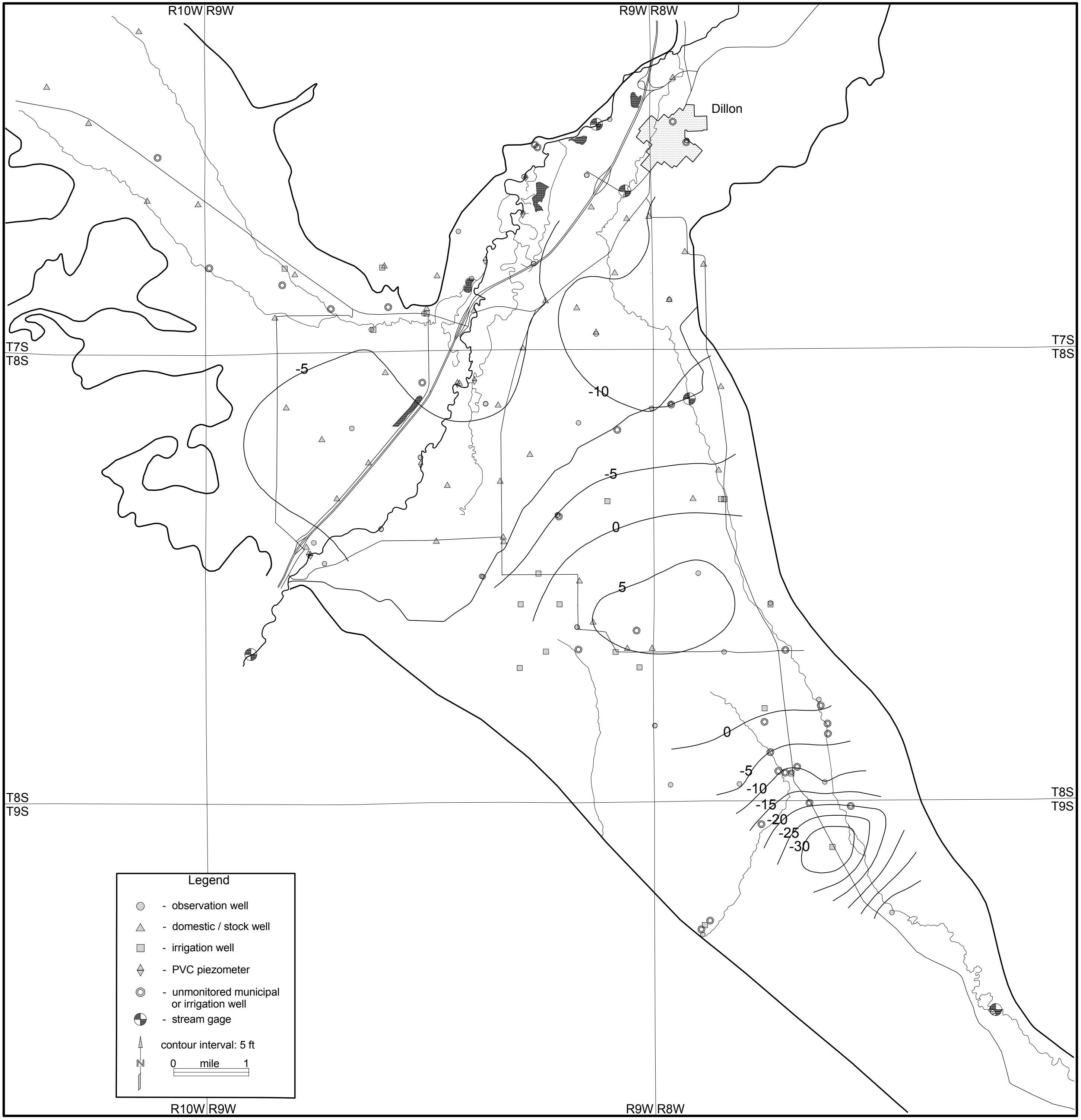


Figure 28. Groundwater-Level Changes between April 15, 1993 and August 25, 1993

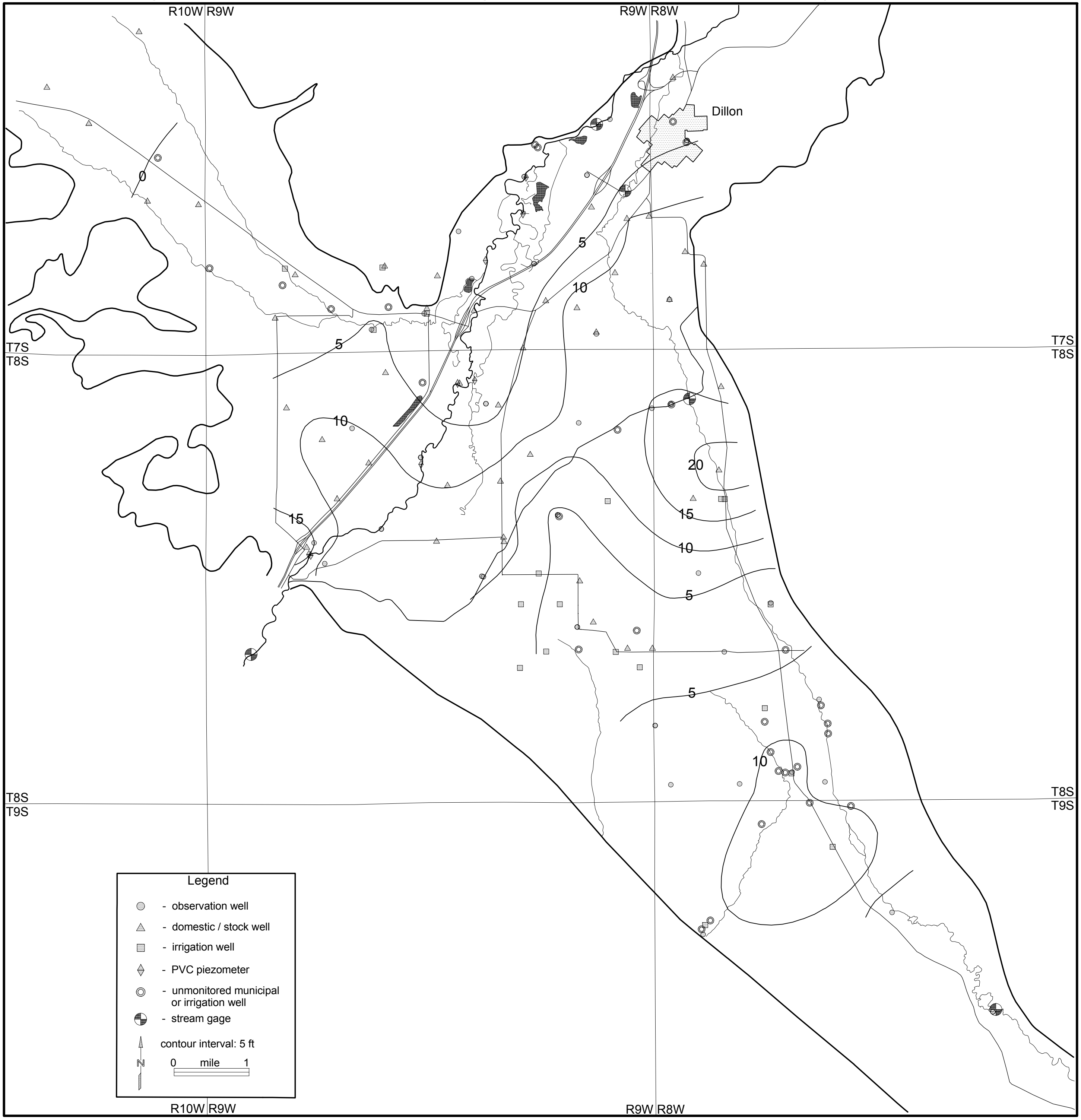


Figure 29. Groundwater-Level Changes between August 25, 1993 and April 21, 1994

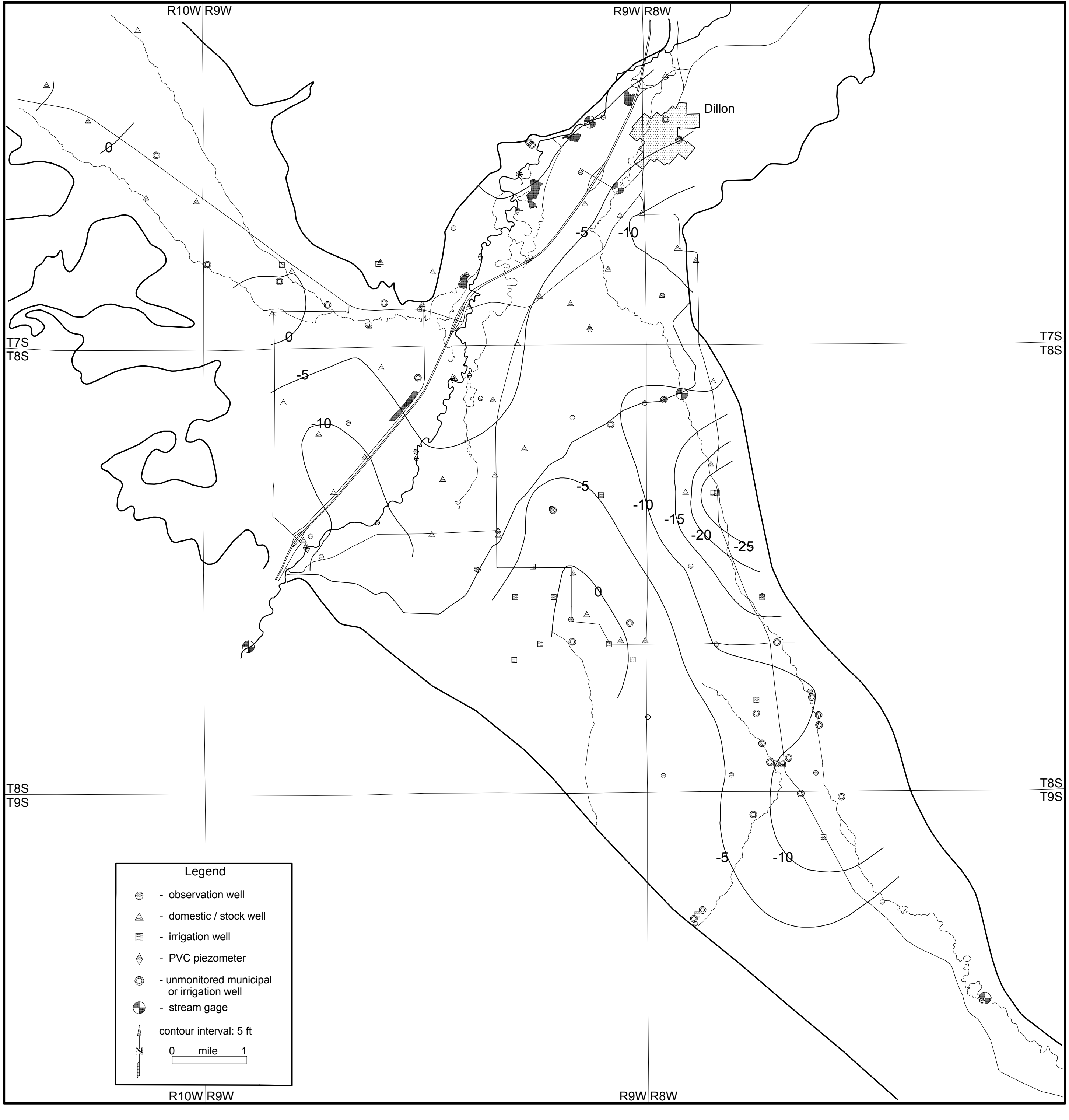


Figure 30. Groundwater-Level Changes between April 21, 1994 and July 28, 1994

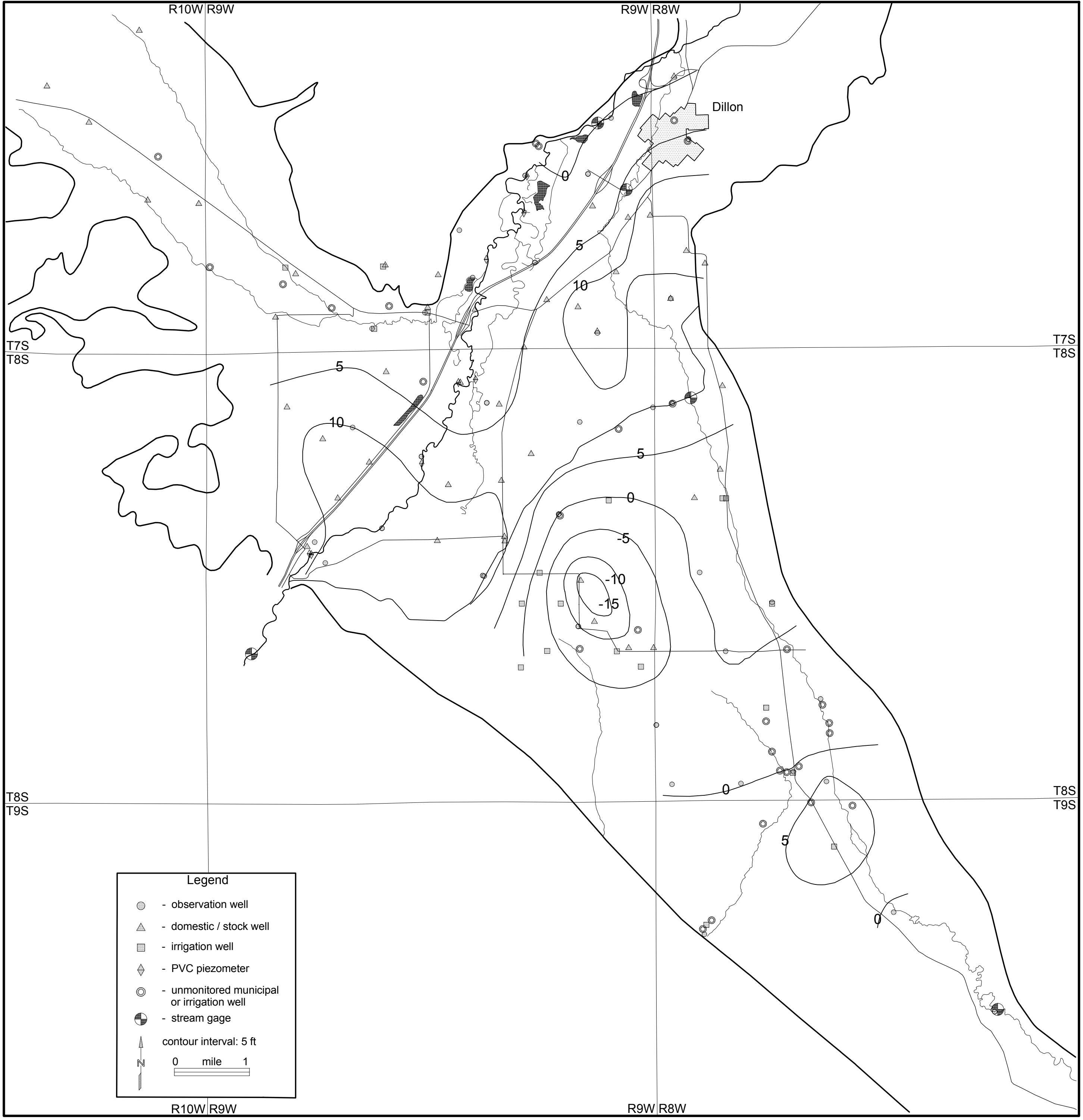


Figure 31. Groundwater-Level Changes between July 28, 1994 and April 20, 1995

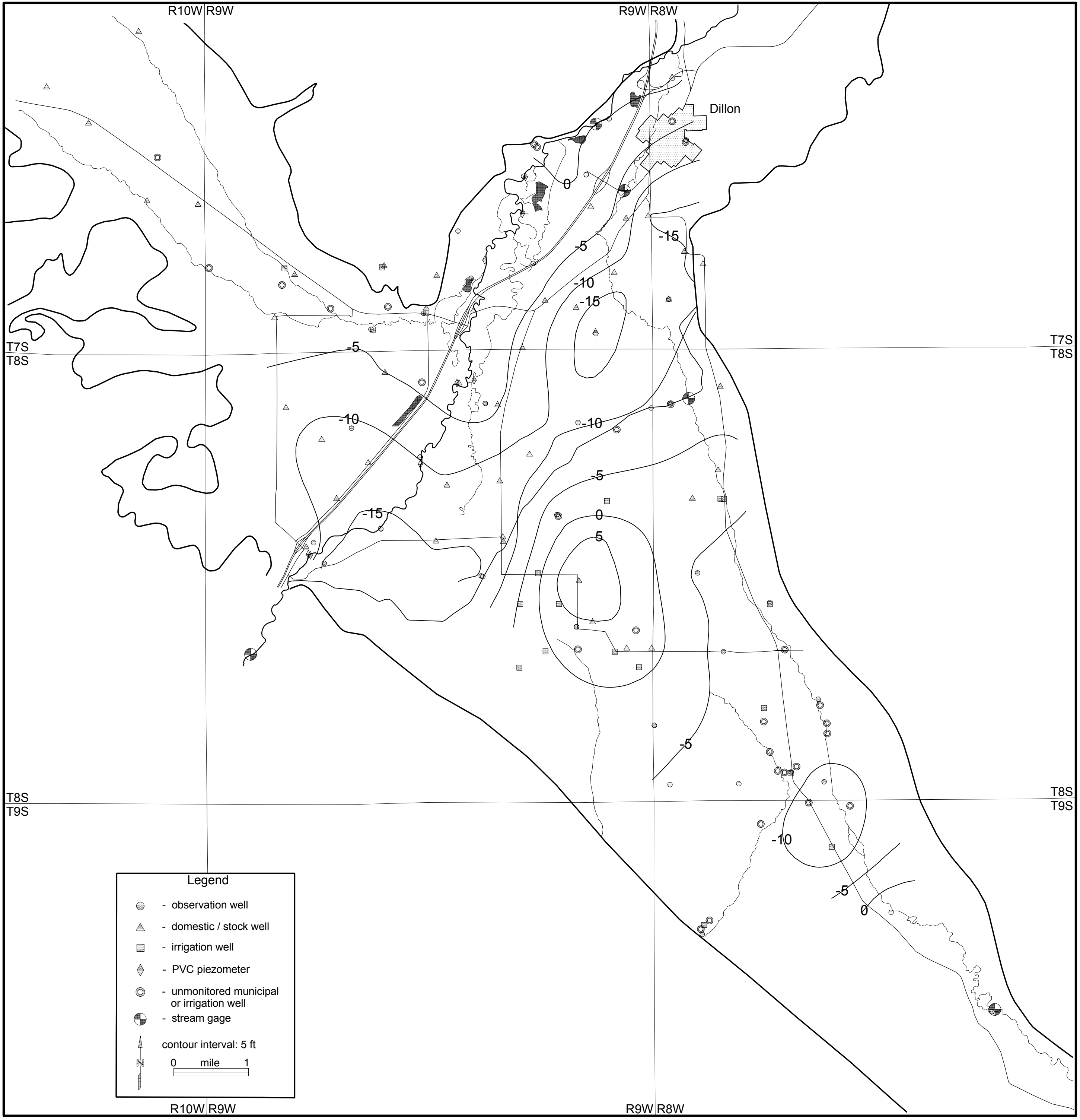


Figure 32. Groundwater-Level Changes between April 20, 1995 and August 28, 1995

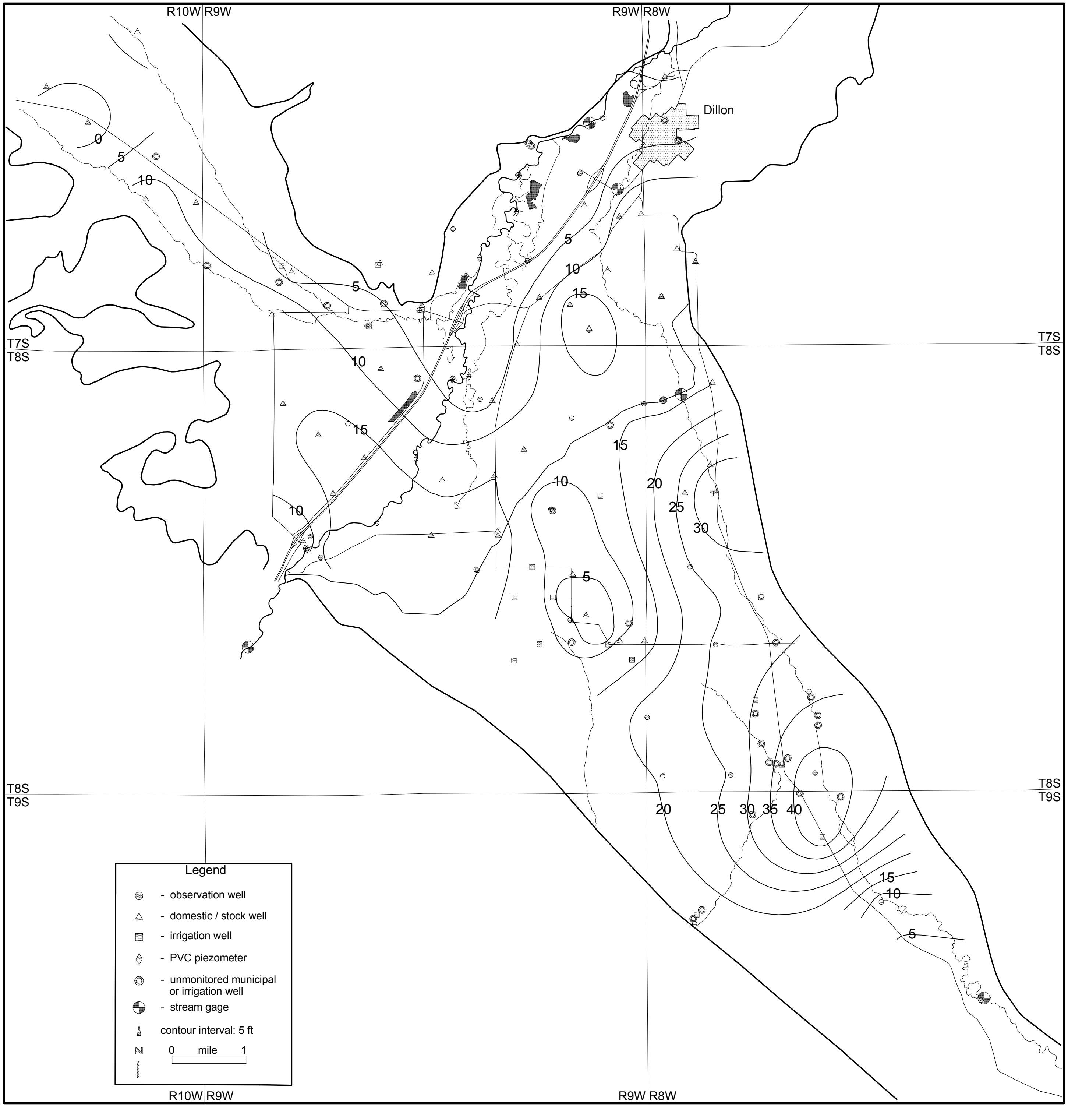


Figure 33. Groundwater-Level Changes between August 28, 1995 and April 24, 1996

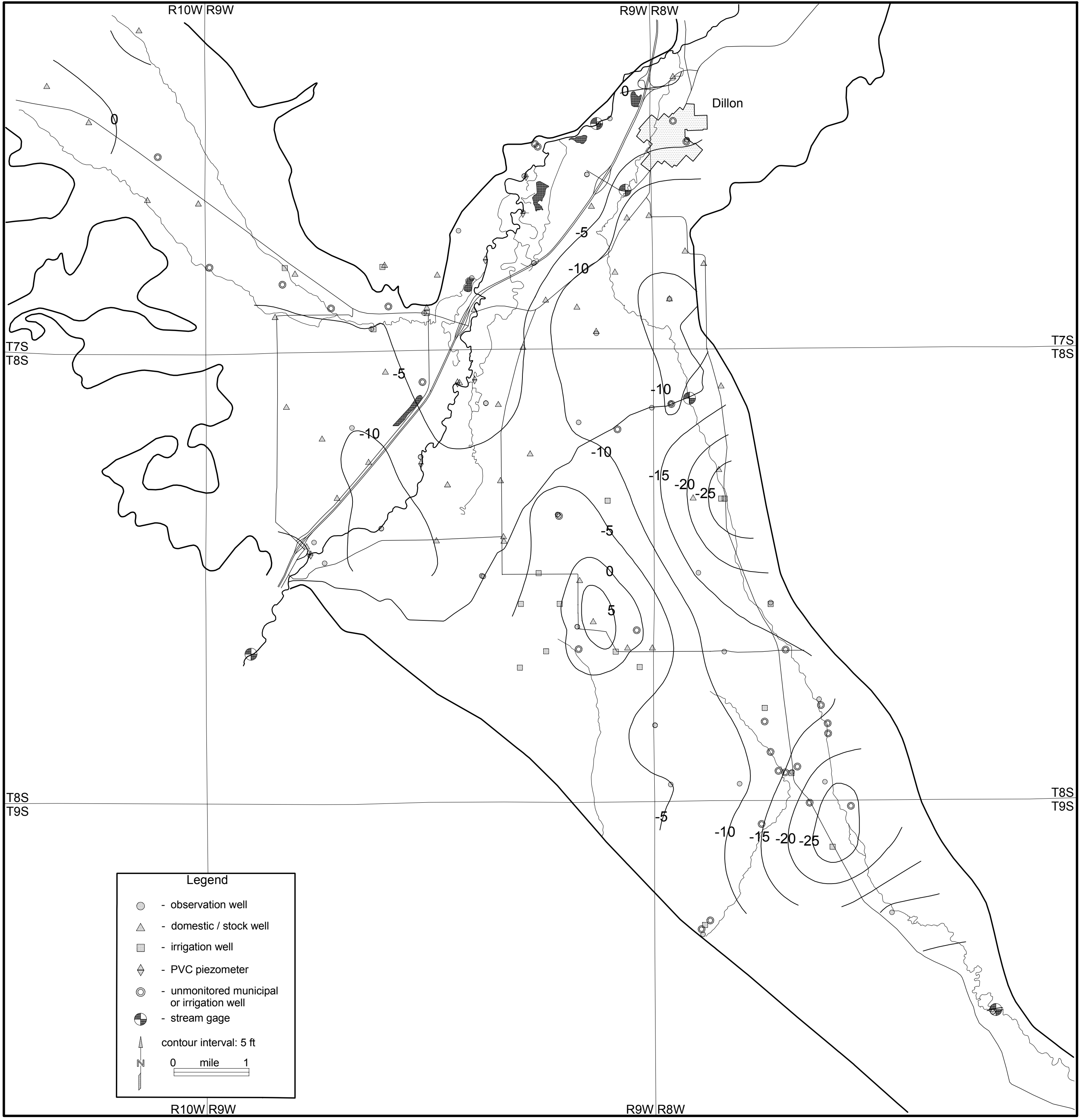


Figure 34. Groundwater-Level Changes between April 24, 1996 and July 18, 1996

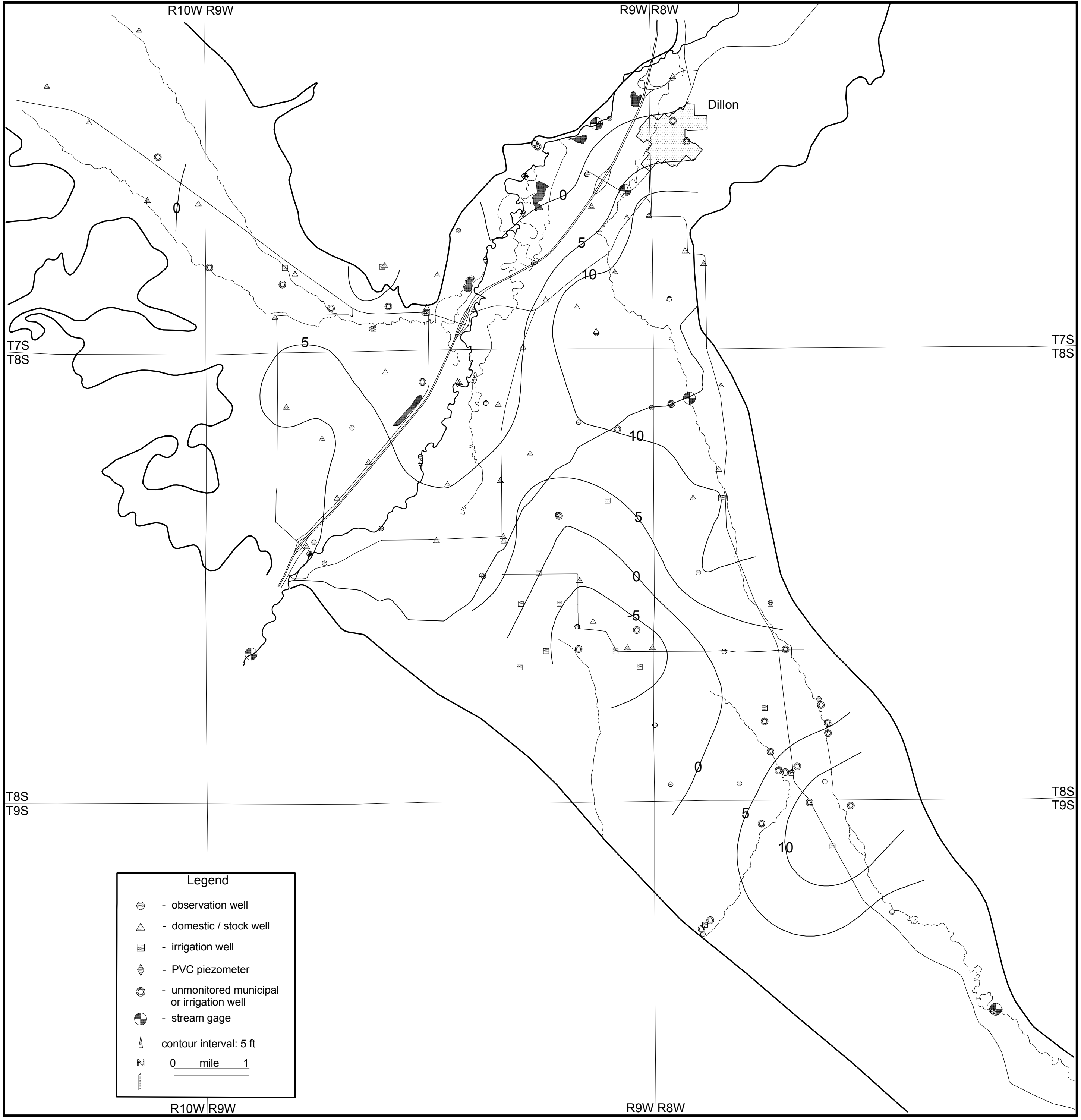


Figure 35. Maximum Observed Groundwater-Level Changes between July 1991 and July 1996

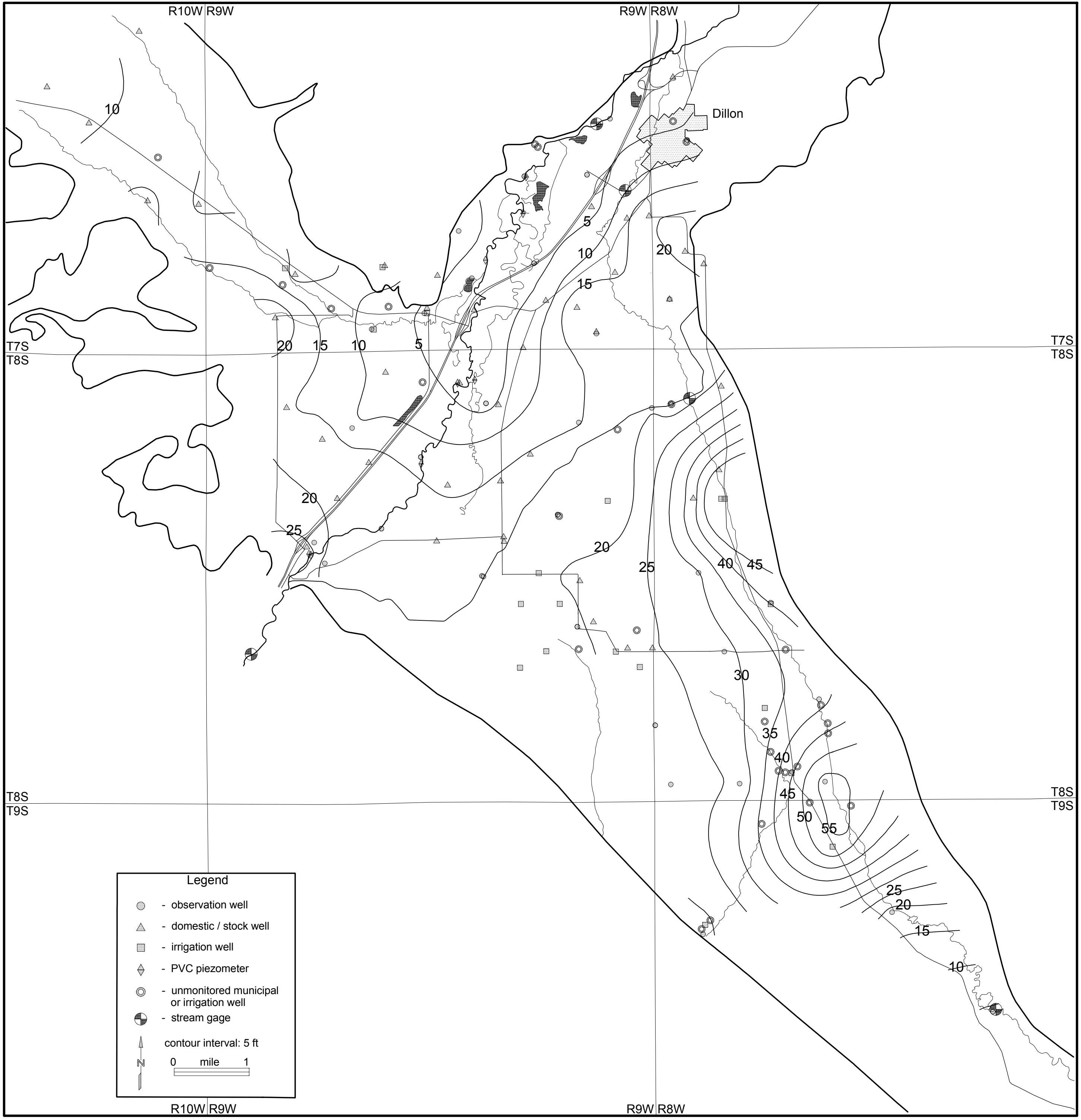


Figure 36. Average Depth to Groundwater from Land Surface between July 1991 and July 1996

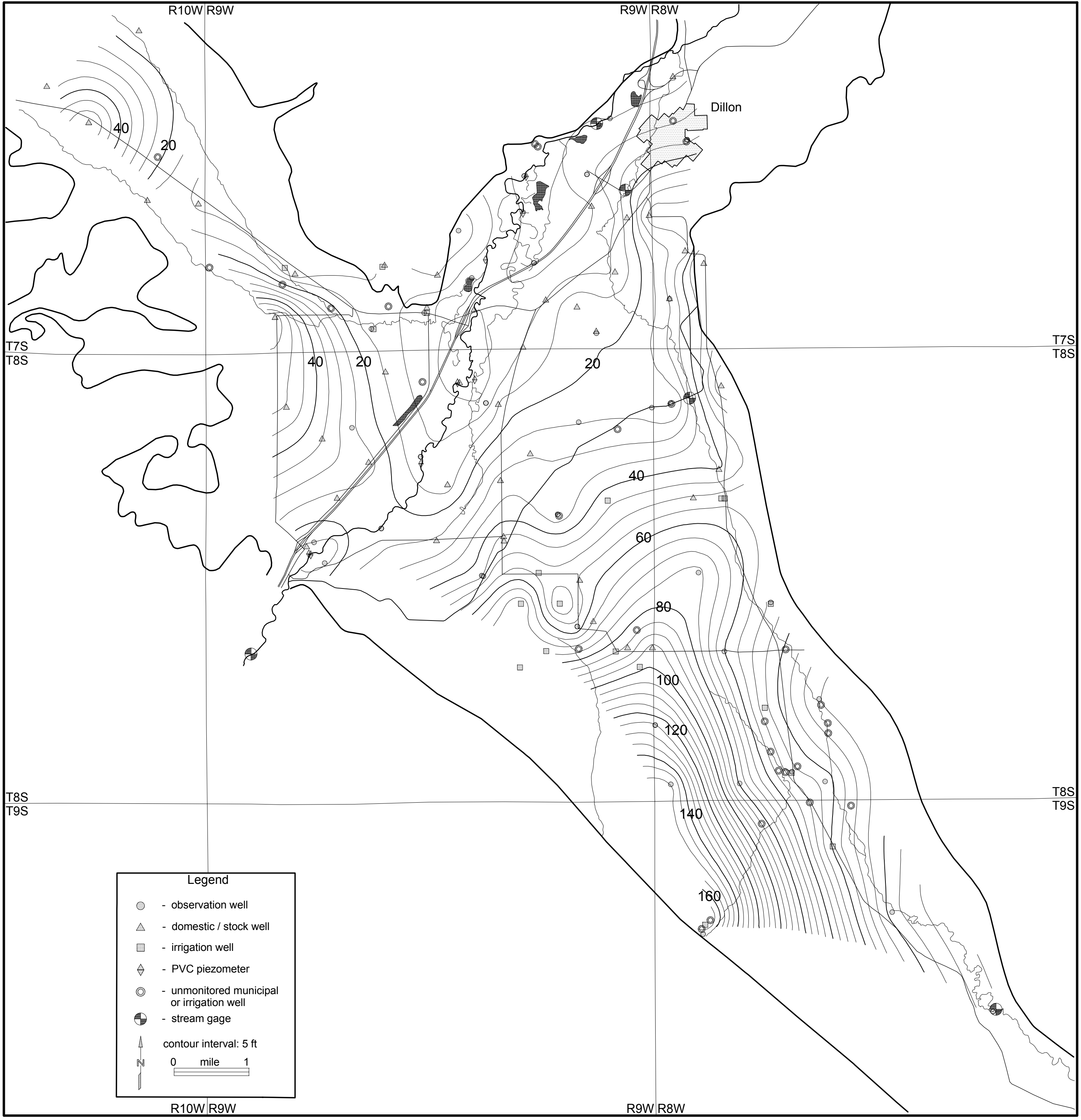


Figure 37. 1991 Composite Potentiometric Surface

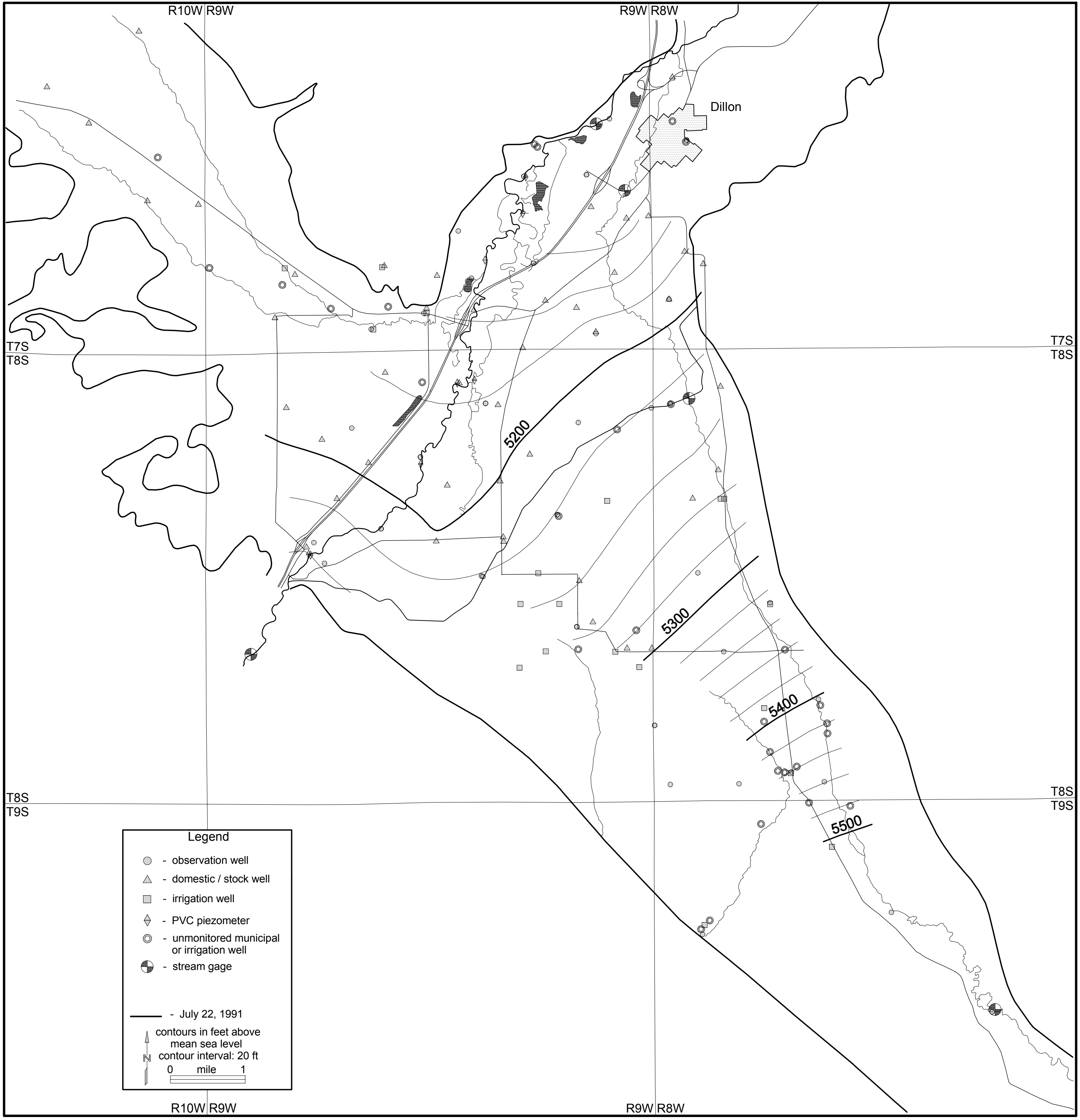


Figure 38. 1992 Composite Potentiometric Surfaces

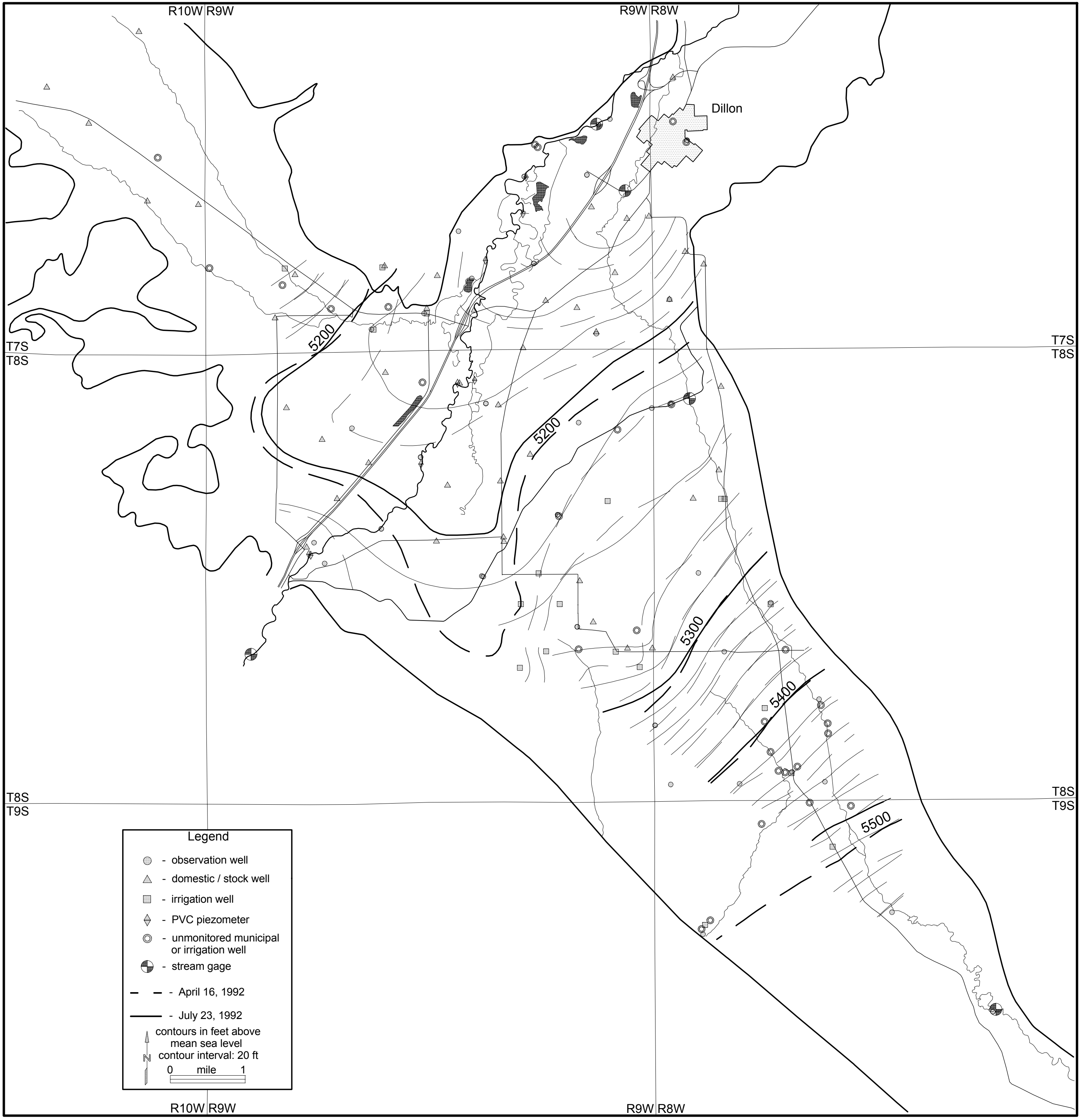


Figure 39. 1993 Composite Potentiometric Surfaces

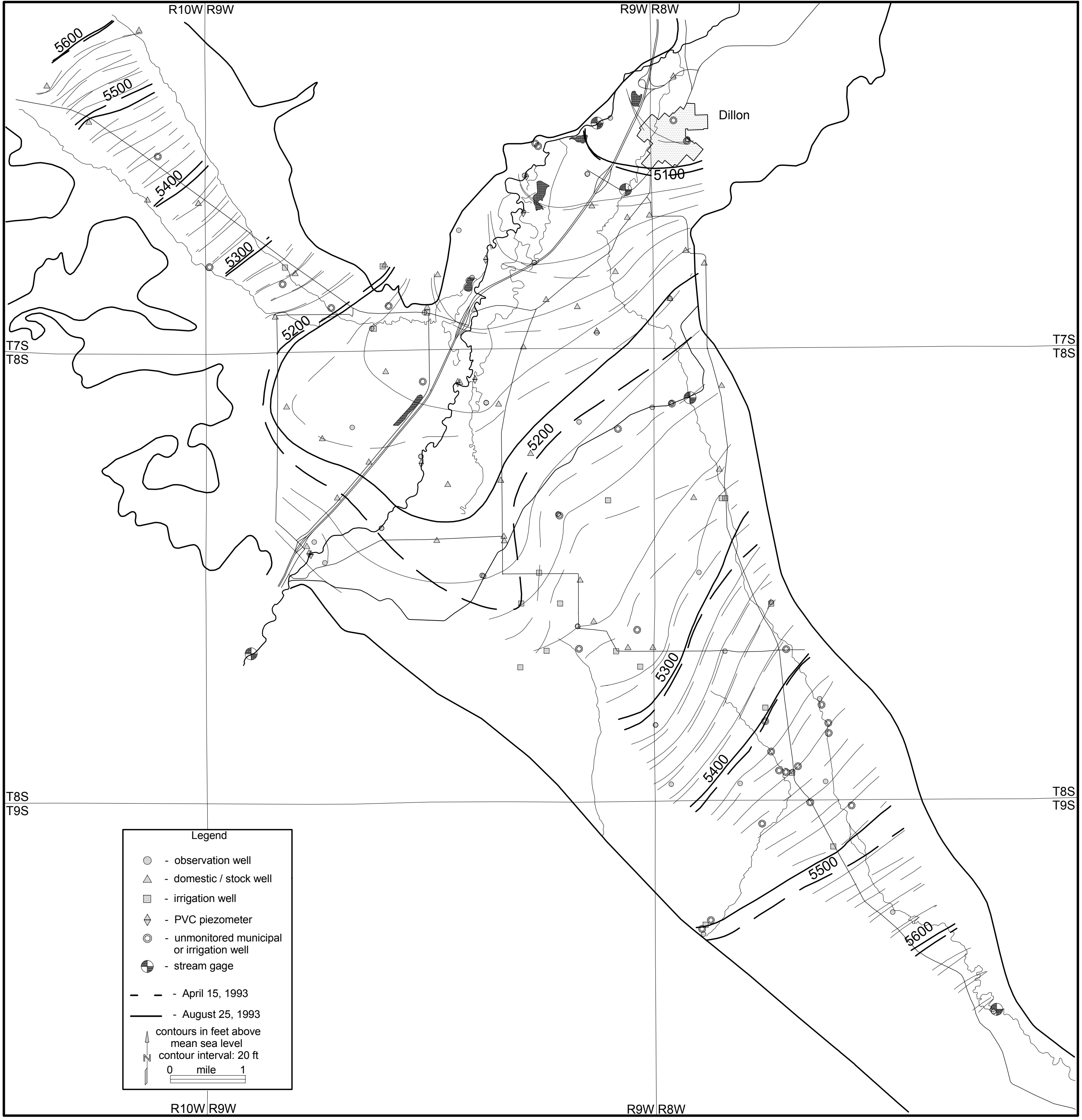


Figure 40. 1994 Composite Potentiometric Surfaces

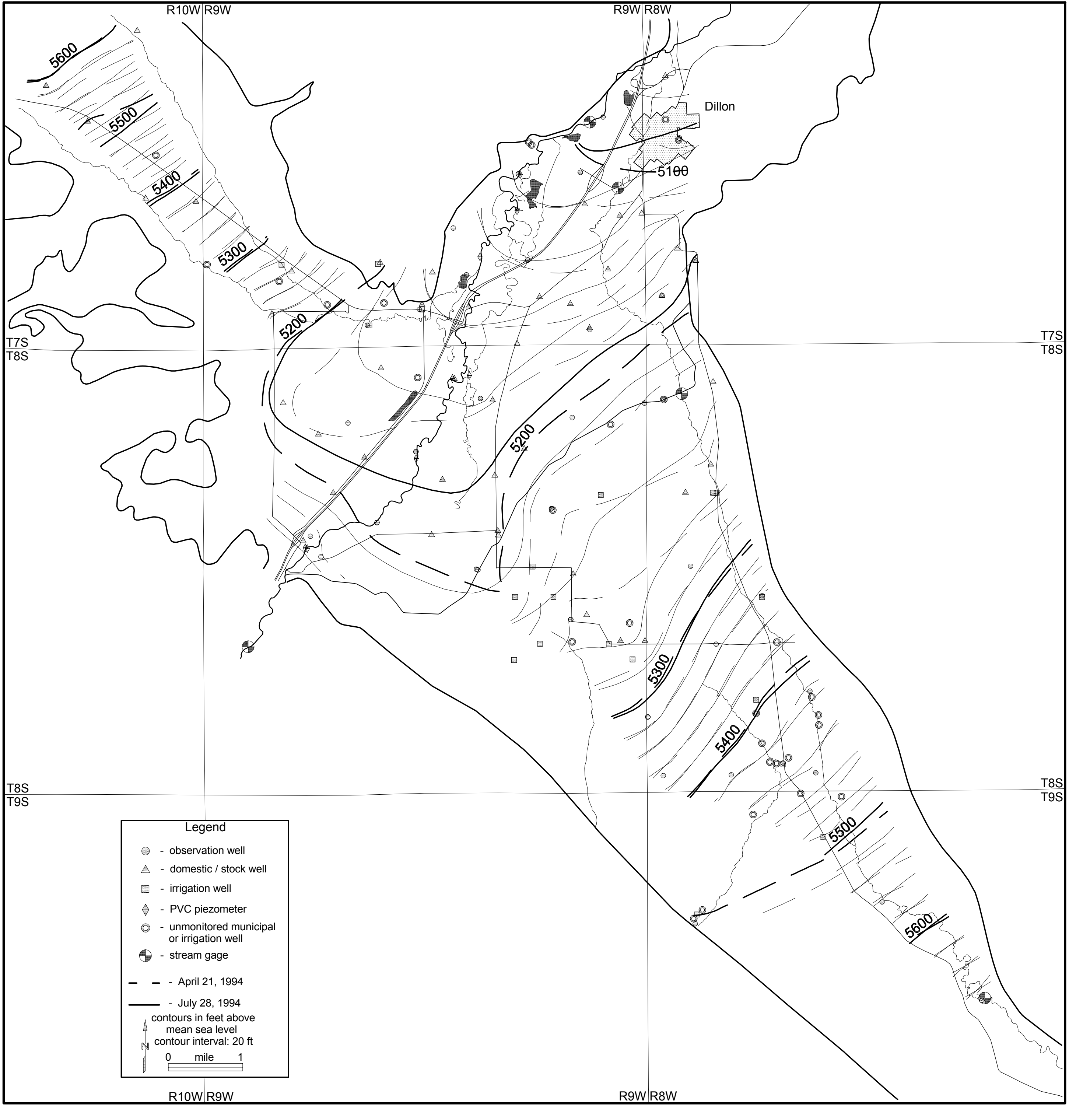


Figure 41. 1995 Composite Potentiometric Surfaces

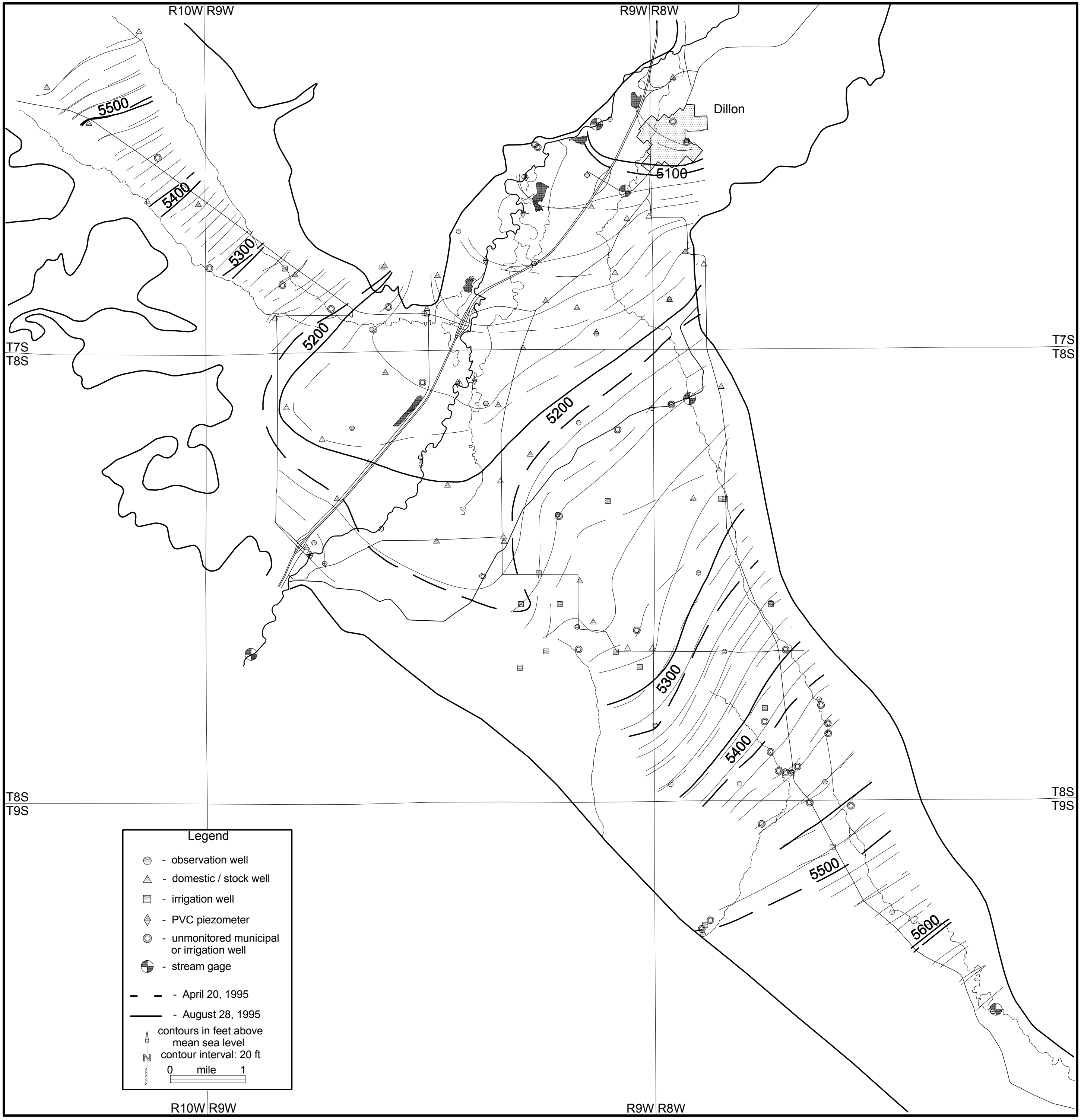
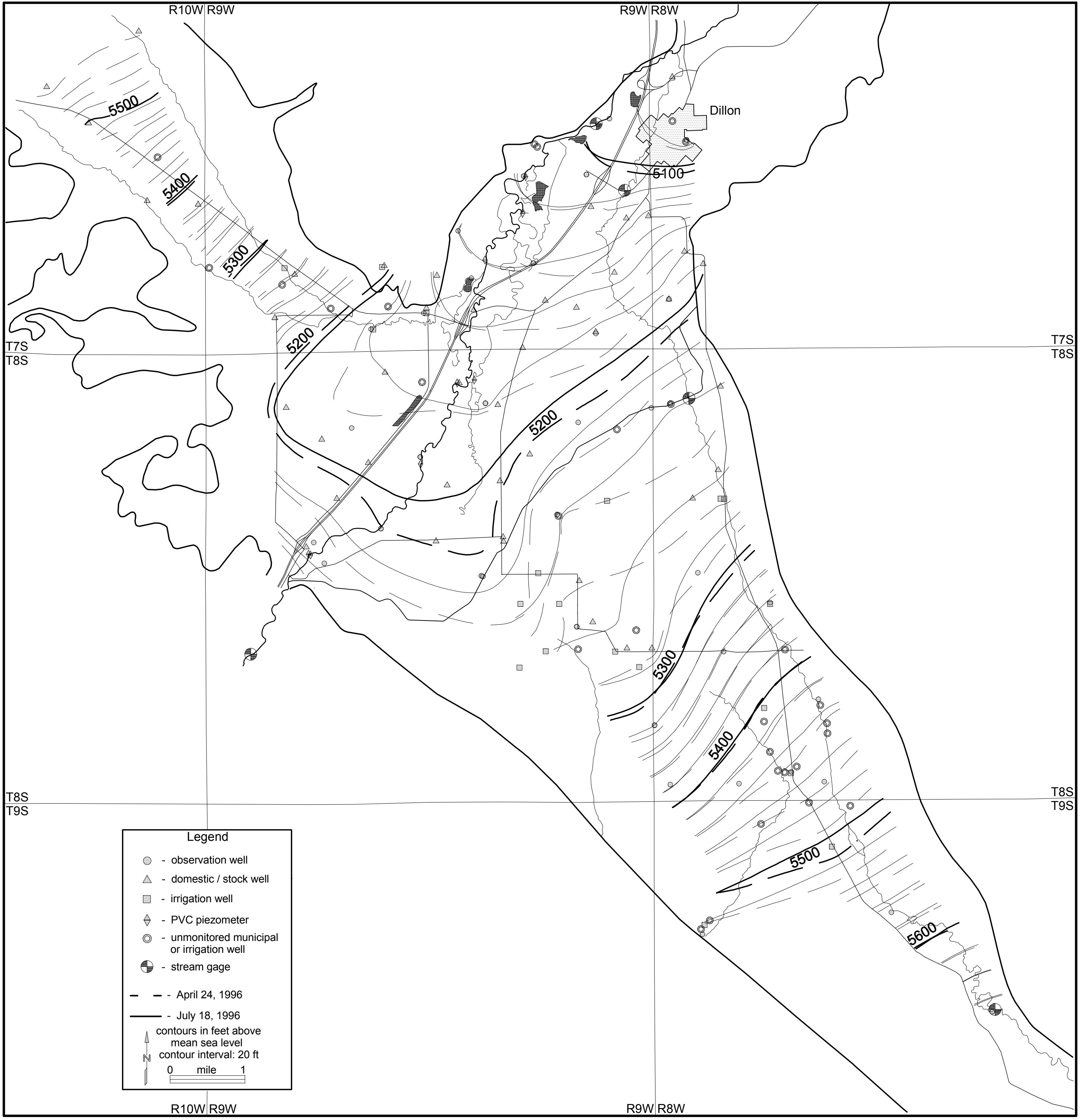


Figure 42. 1996 Composite Potentiometric Surfaces



Results and Interpretations

Aquifer Test Analyses. Aquifer test locations and aquifer test analyses are presented in Figure 43, and Figures 44 through 52, respectively. Aquifer test time-drawdown data are presented in Appendix C1.

Figure 43. Aquifer Test Locations

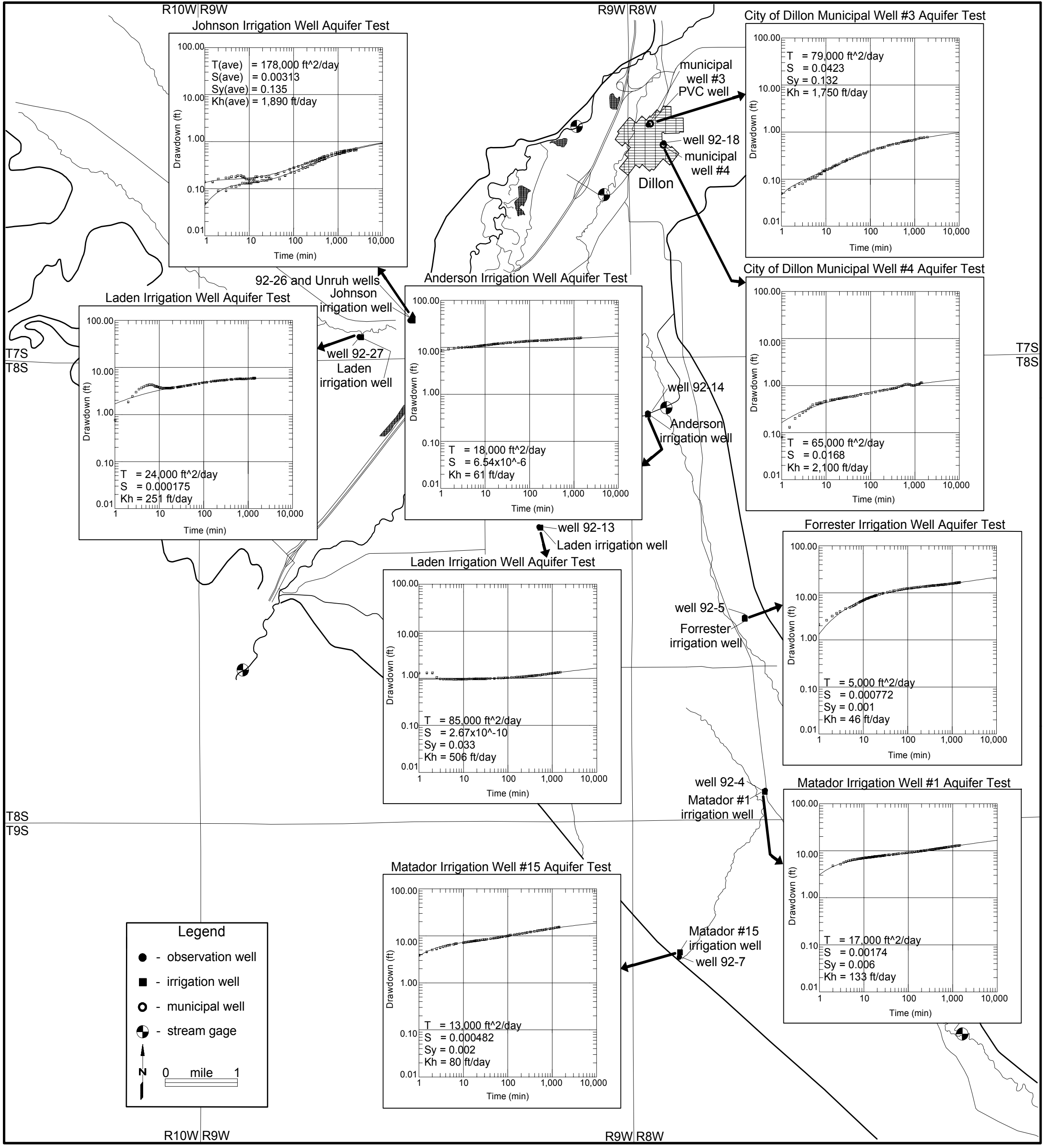


Figure 75. Water Quality Stiff Diagrams

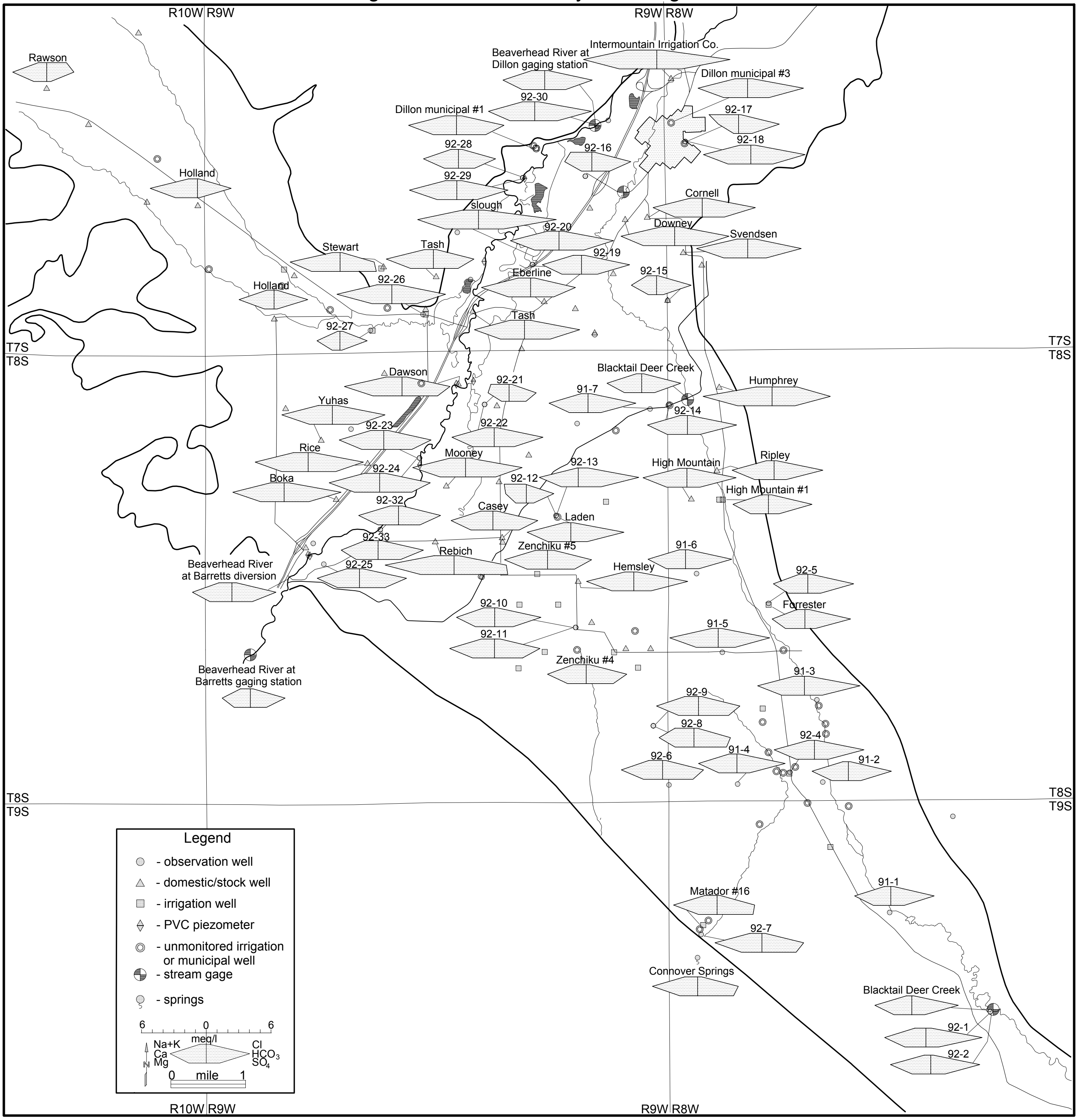
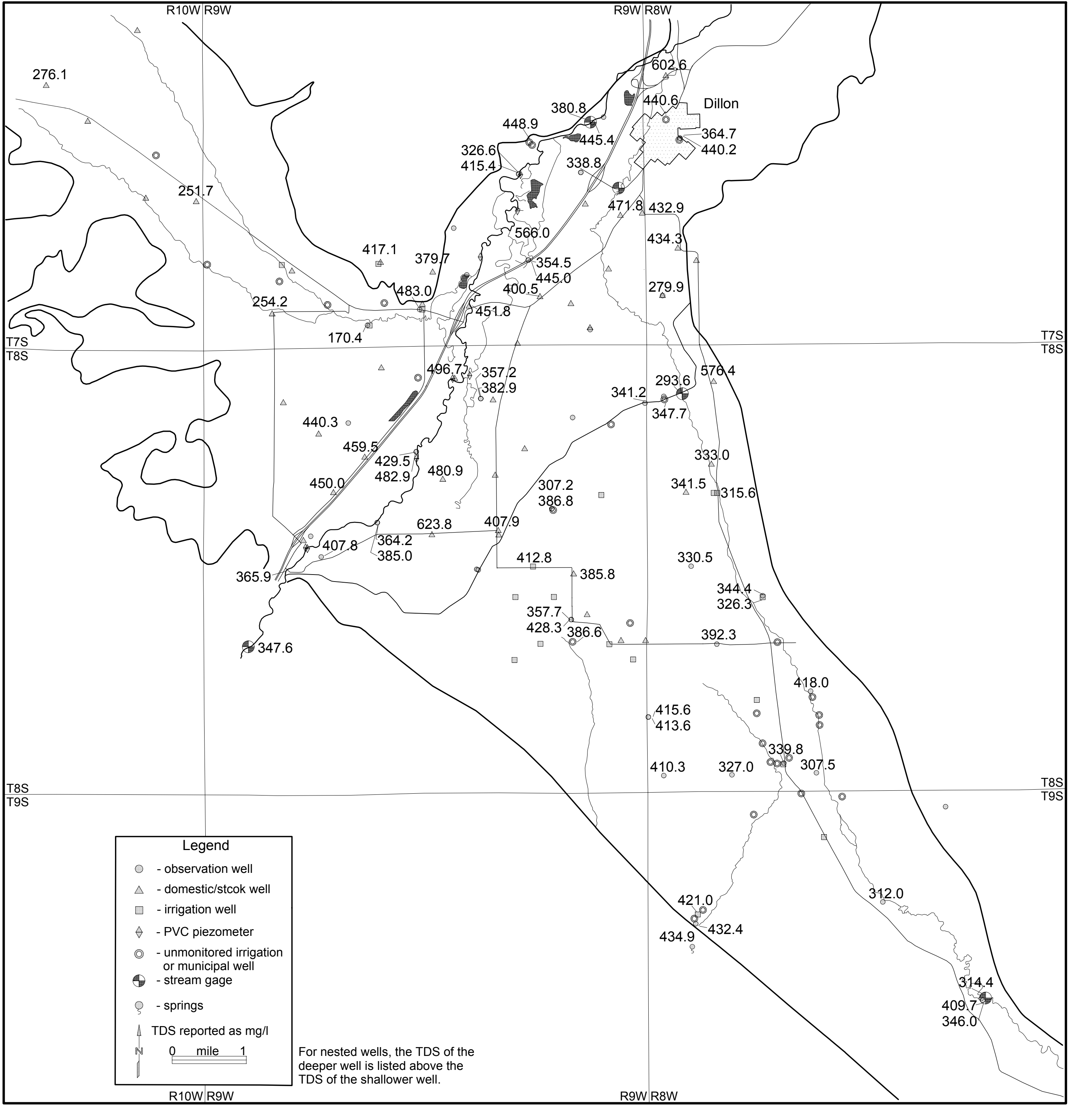
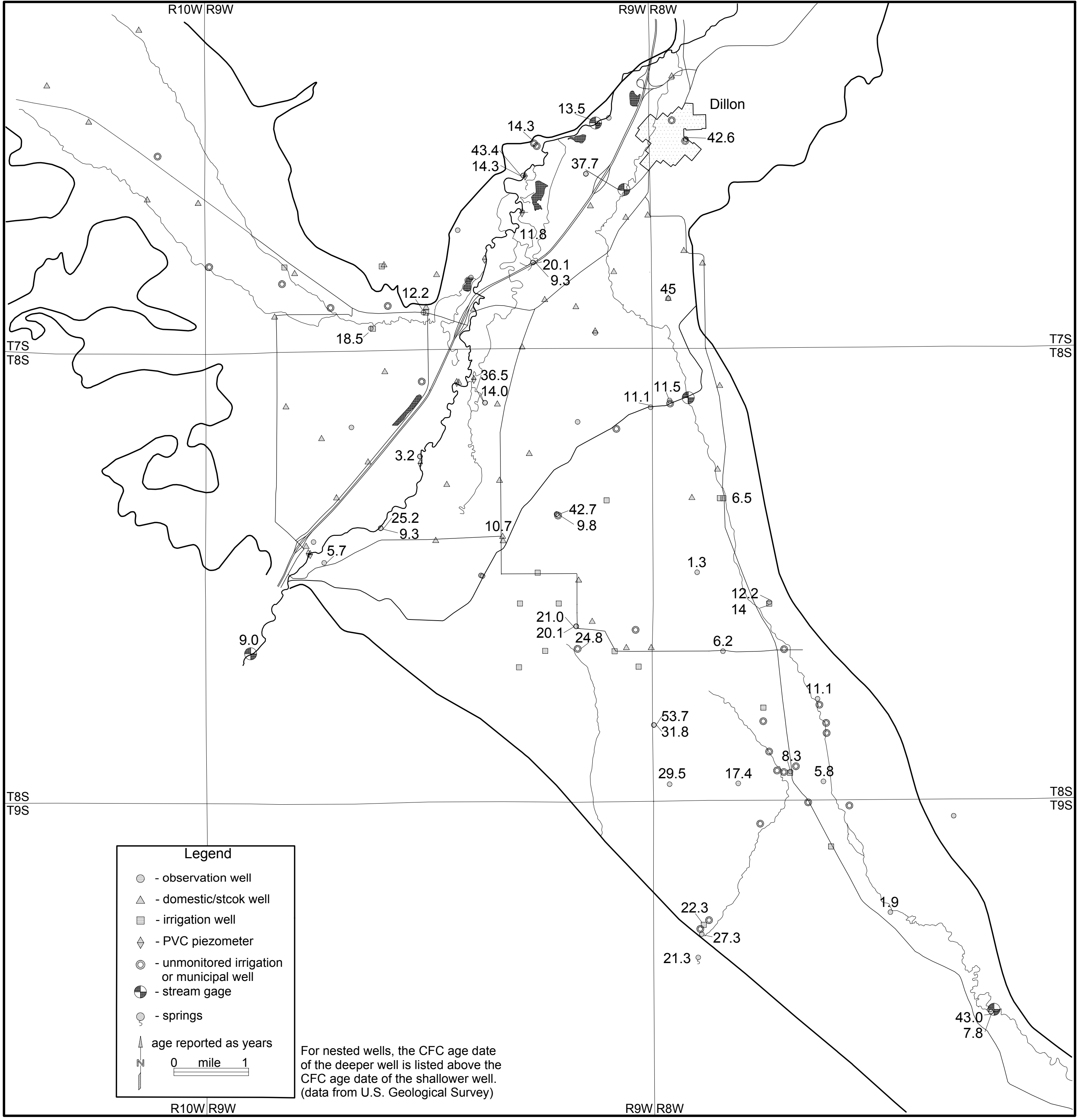


Figure 76. Distribution of Total Dissolved Solids



Chlorofluorocarbon Age-Dating Analyses. The USGS collected water samples for chlorofluorocarbon and tritium/helium isotope age-dating analysis. The distribution of the CFC age dates is illustrated in Figure 77.

Figure 77. Distribution of Chlorofluorocarbon Age Dates



For nested wells, the CFC age date of the deeper well is listed above the CFC age date of the shallower well. (data from U.S. Geological Survey)

Figure 78. Groundwater Model Grid

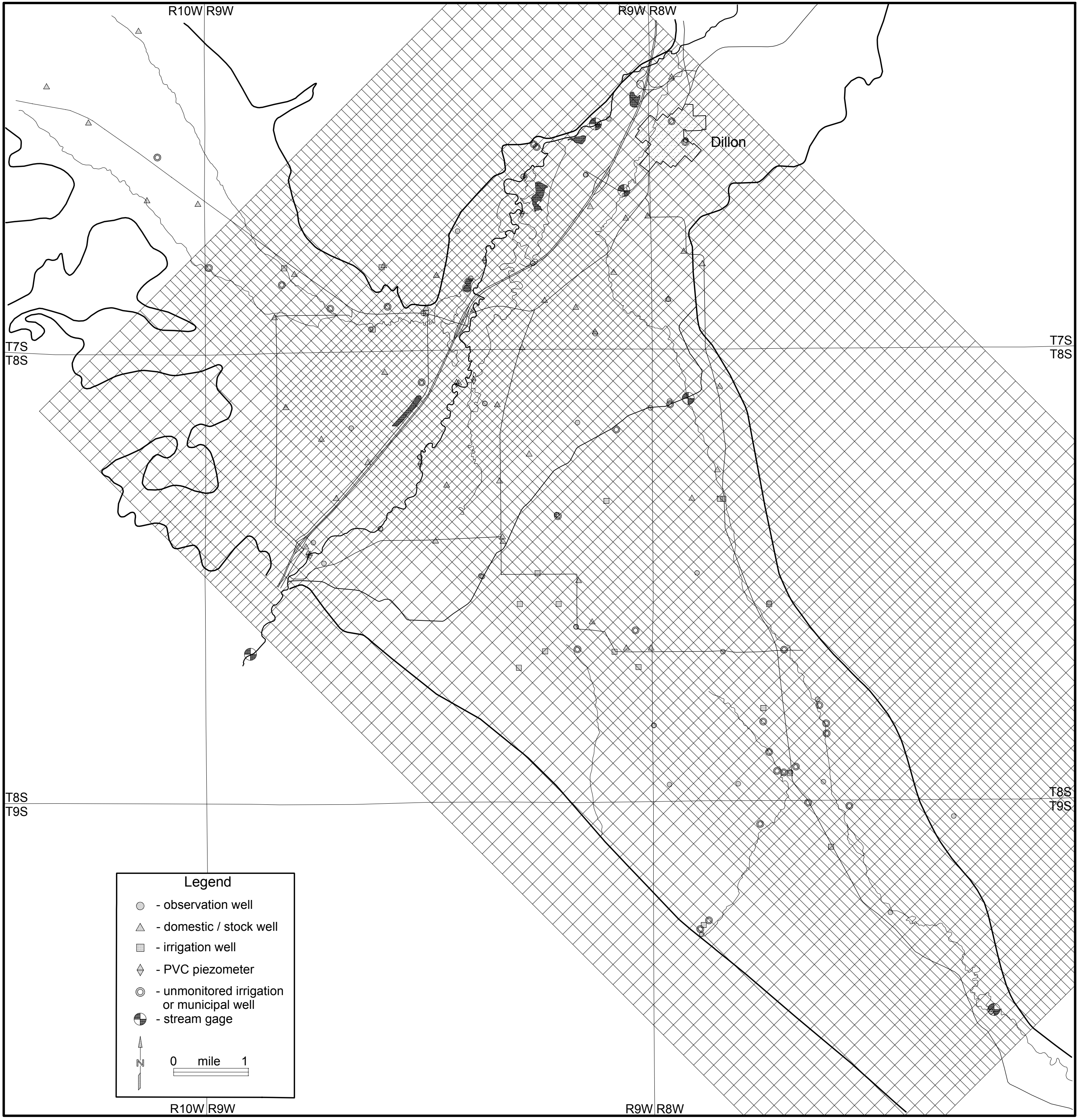


Figure 79. Hydraulic Conductivity Distribution of Model Layer 1

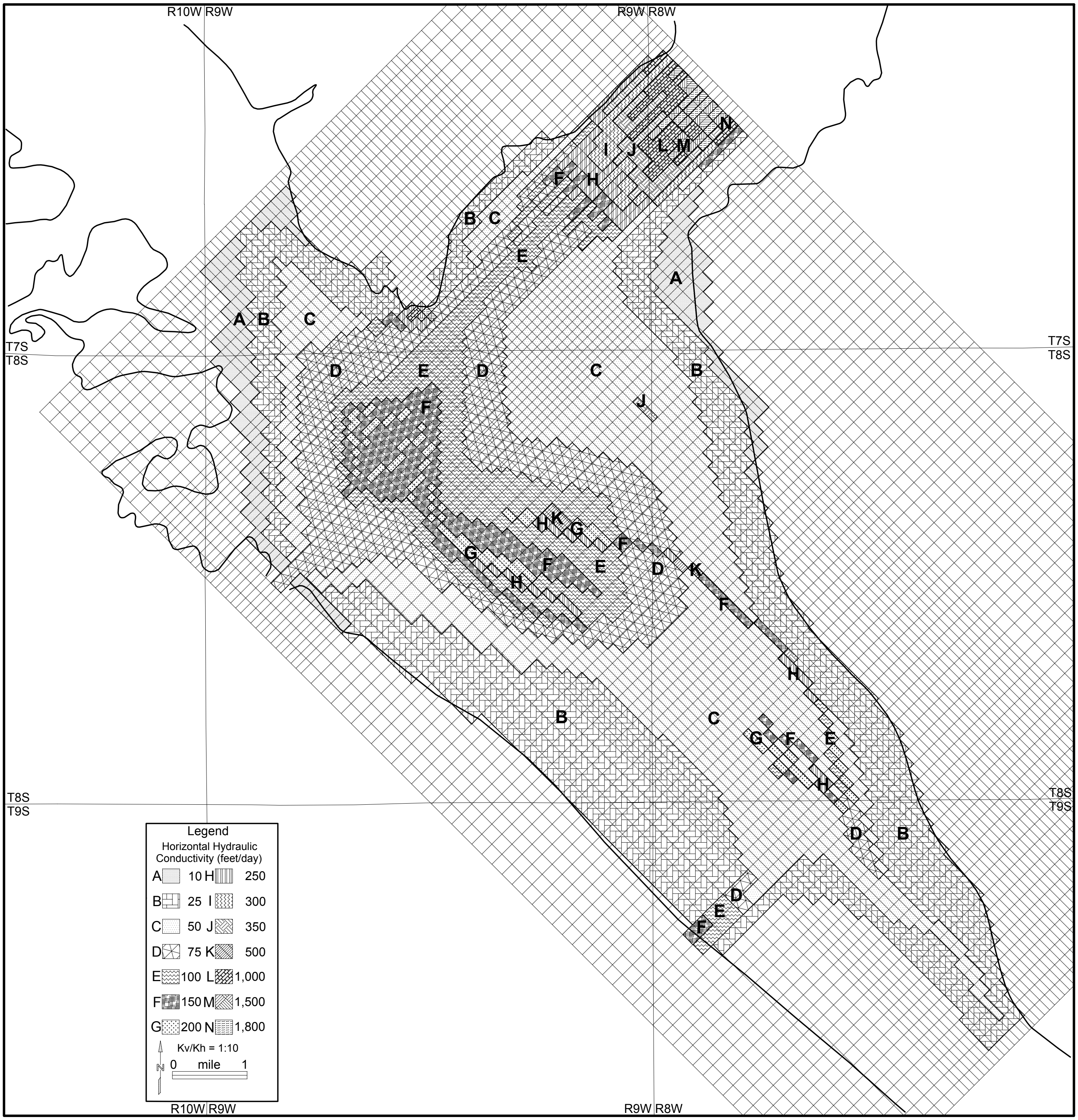


Figure 80. Hydraulic Conductivity Distribution of Model Layer 2

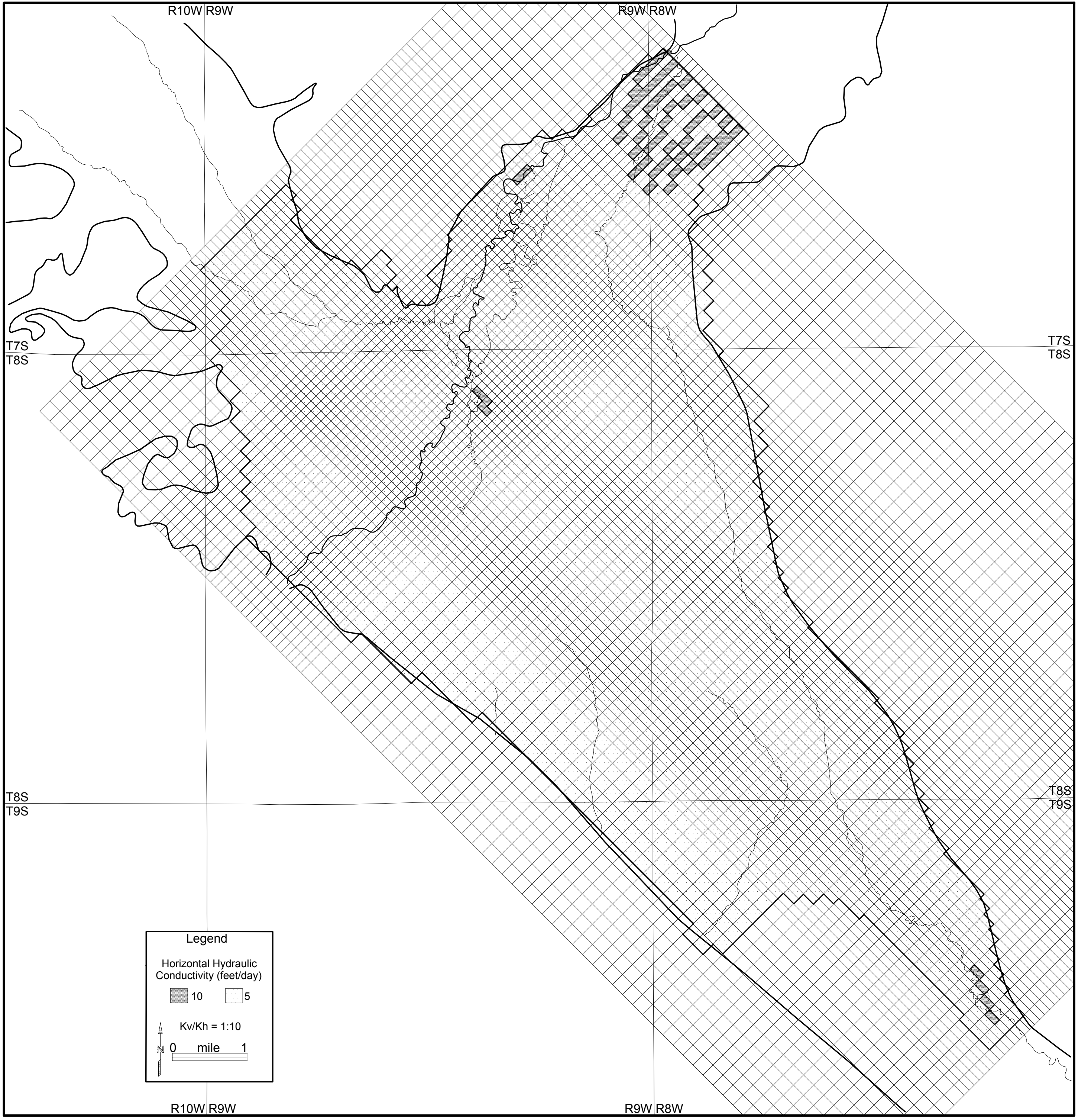


Figure 81. Specific Yield Distribution of Model Layer 1

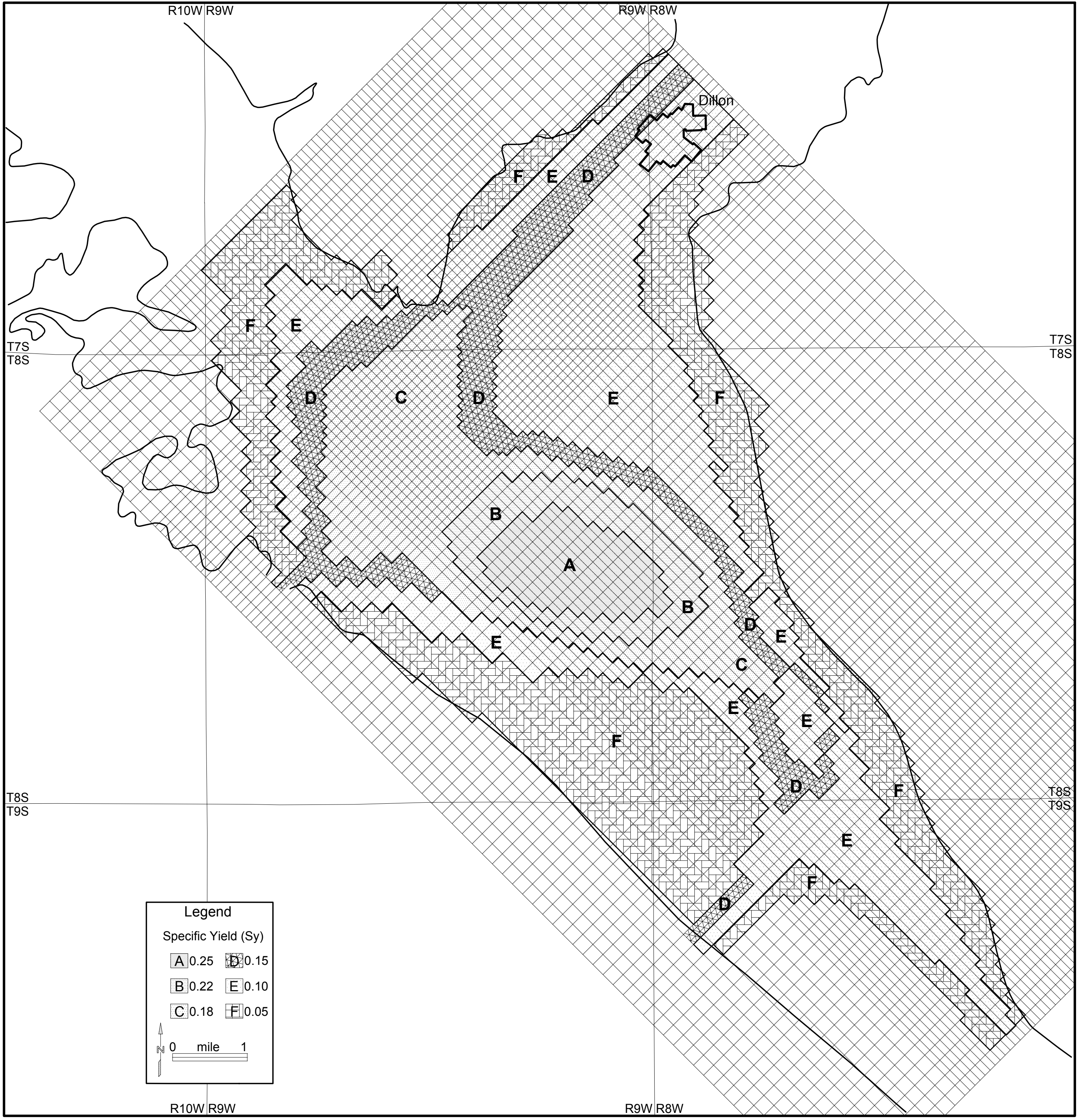


Figure 82. Groundwater Model Cell Types

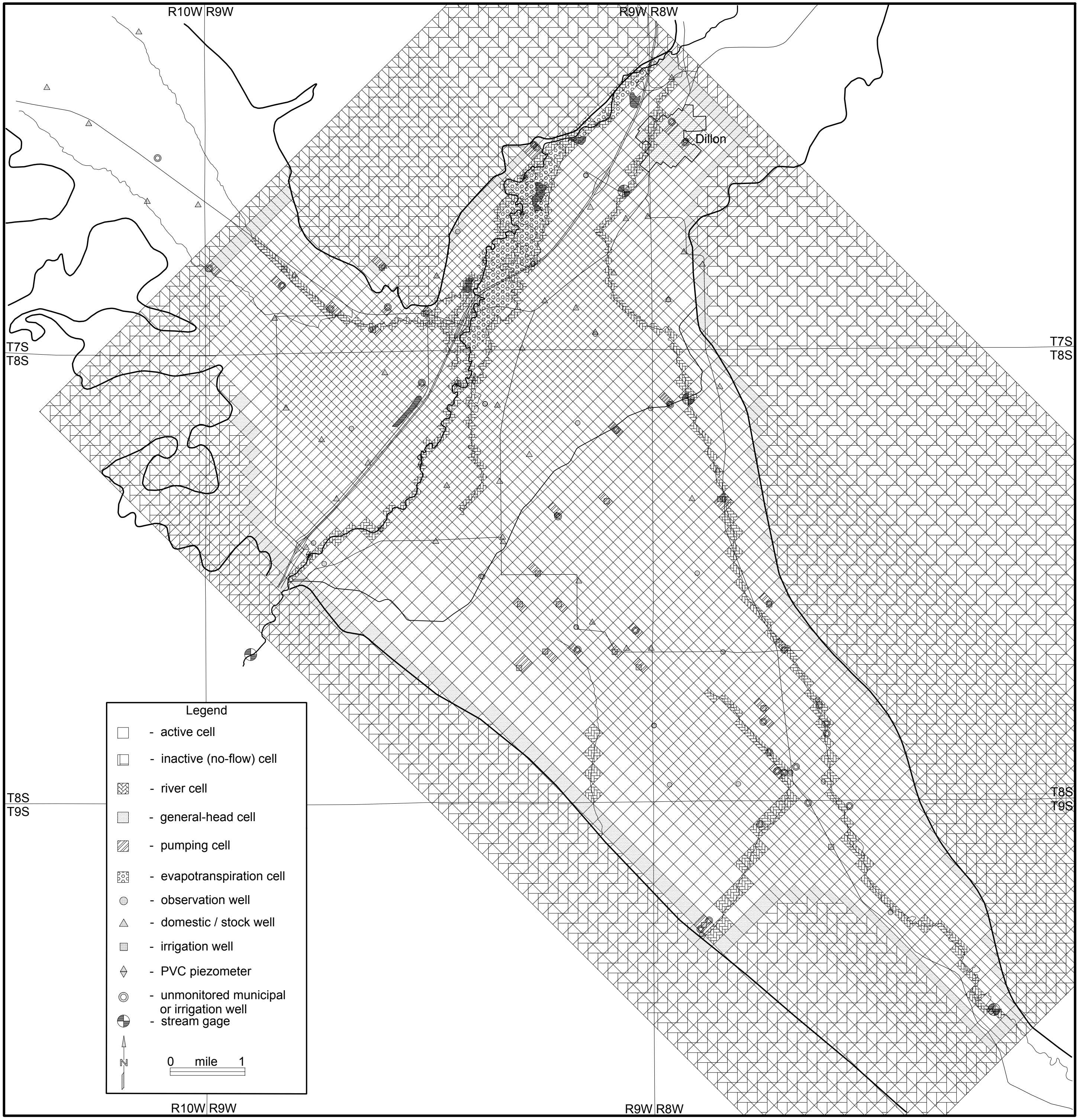


Figure 83. Groundwater Model Irrigation Zones

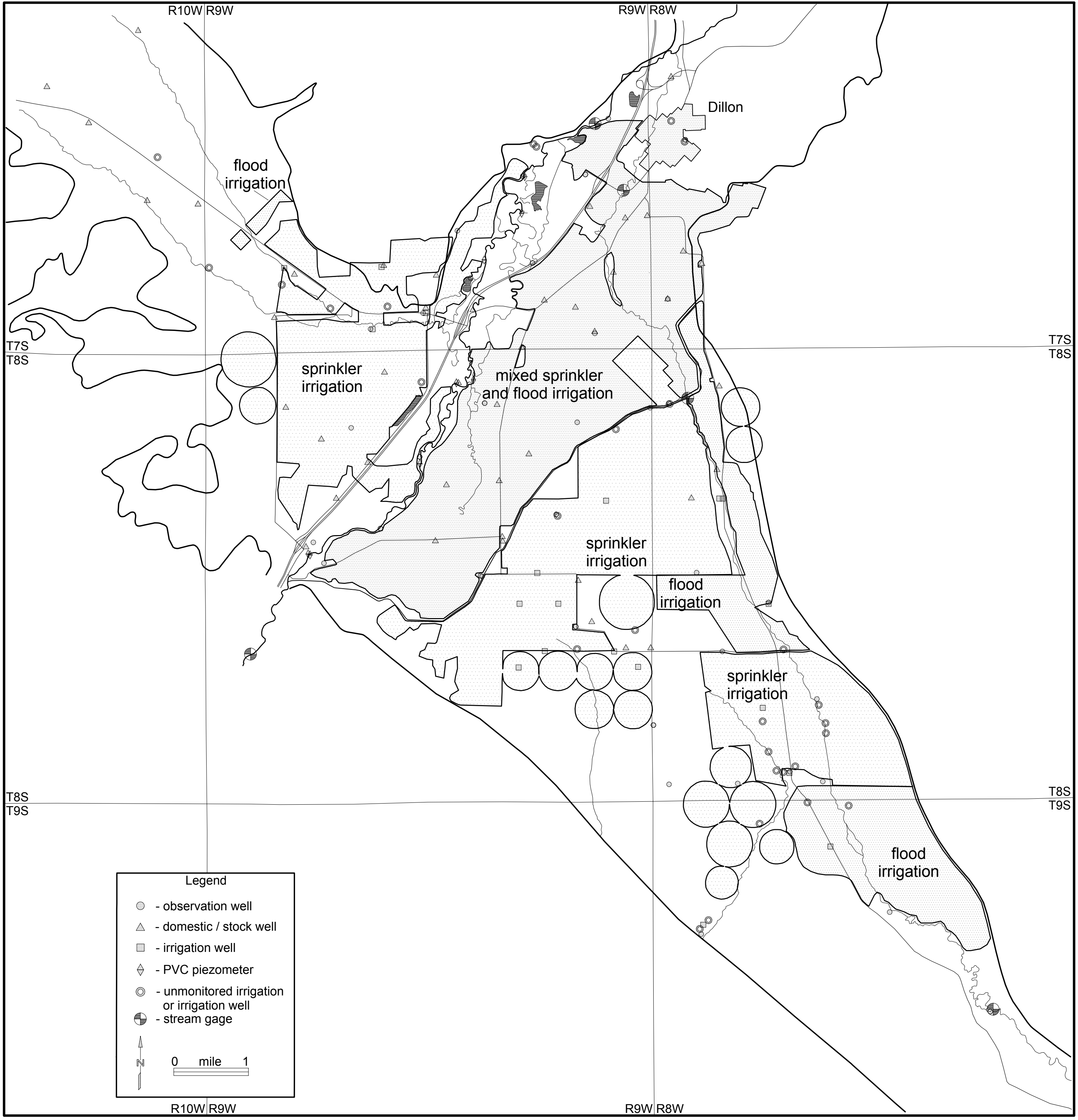


Figure 102. Modeled Potentiometric Surfaces for August 31, 1993

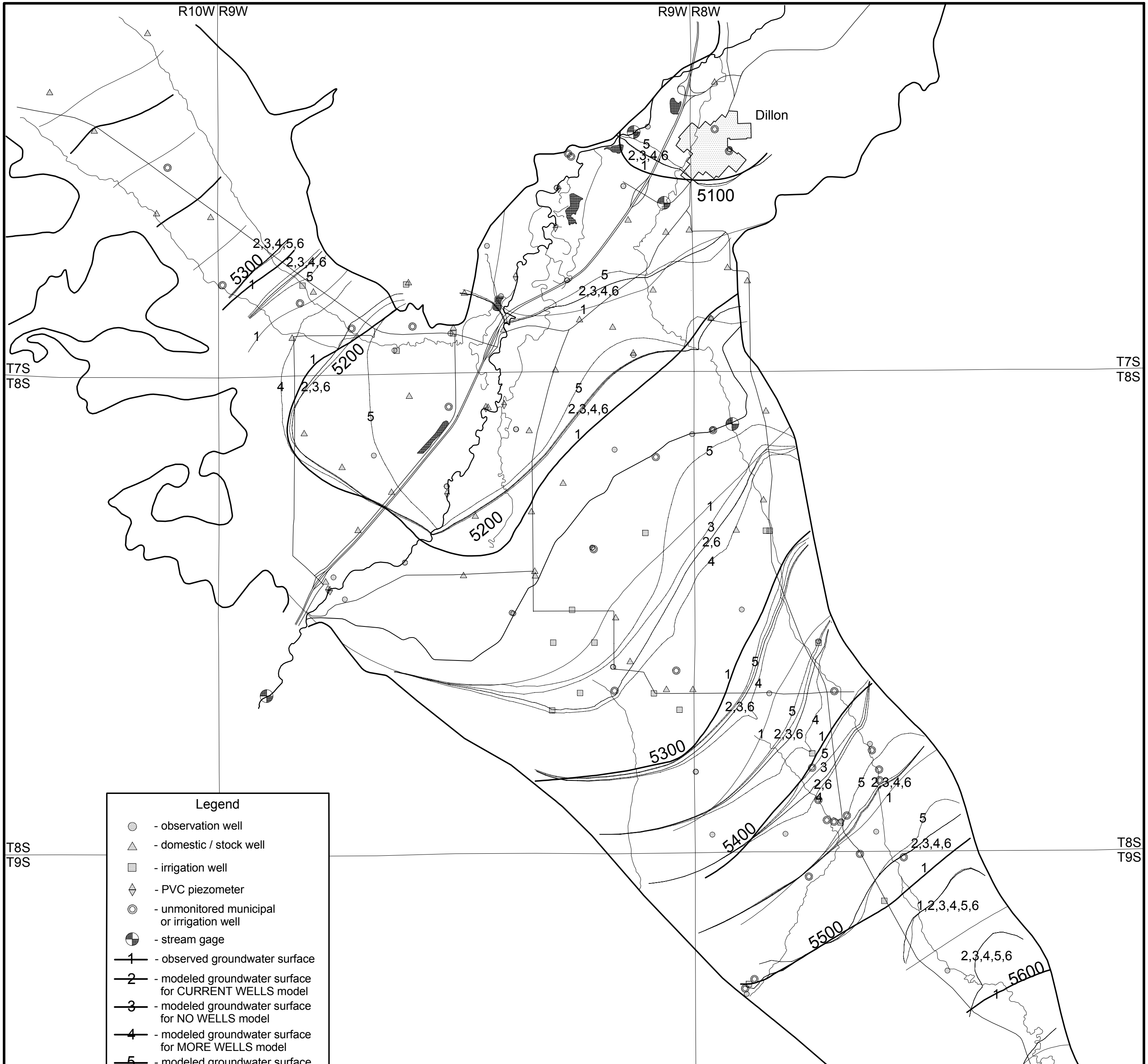


Figure 103. Modeled Potentiometric Surfaces for July 31, 1994

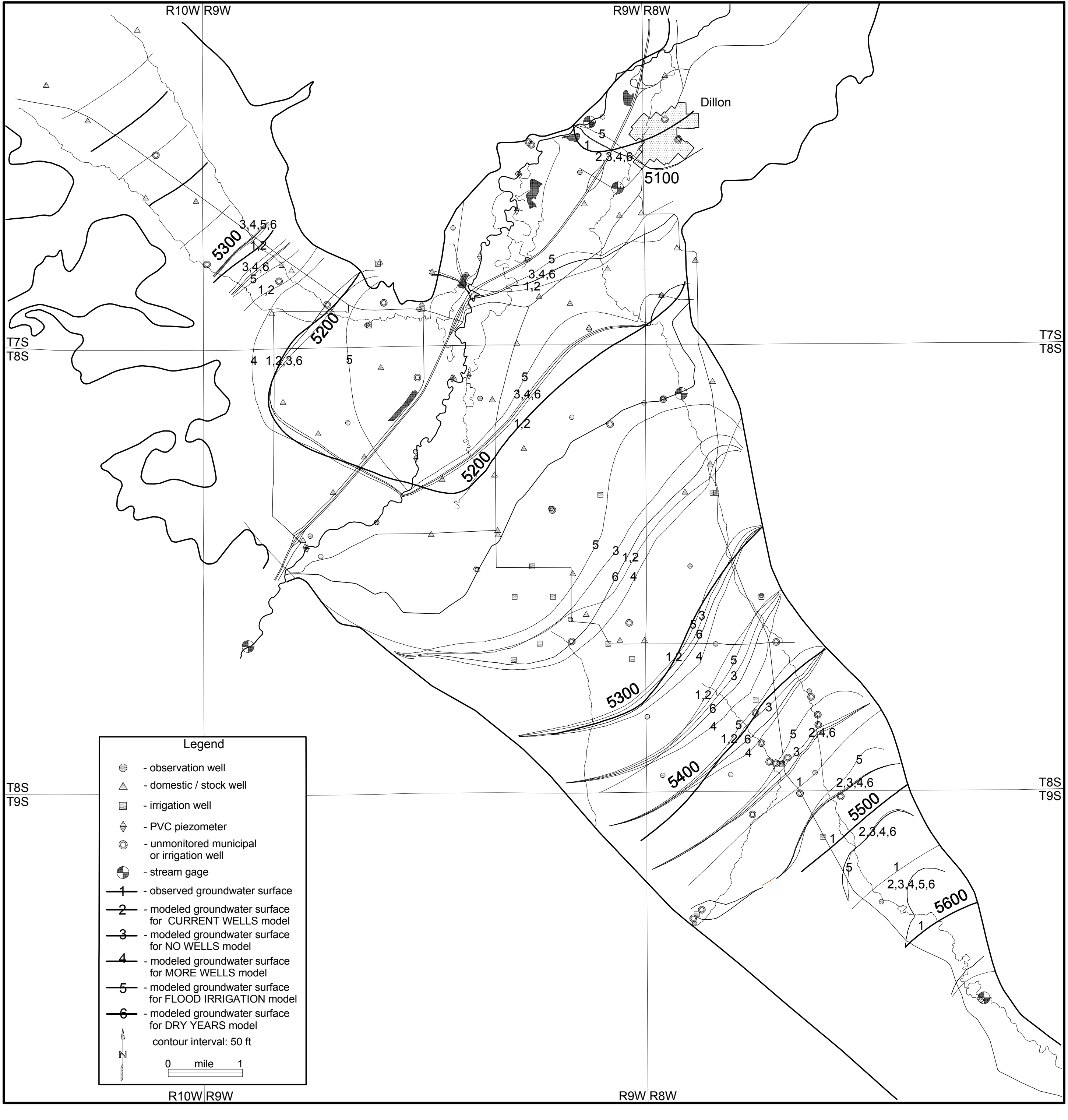


Figure 104. Modeled Potentiometric Surfaces for August 31, 1995

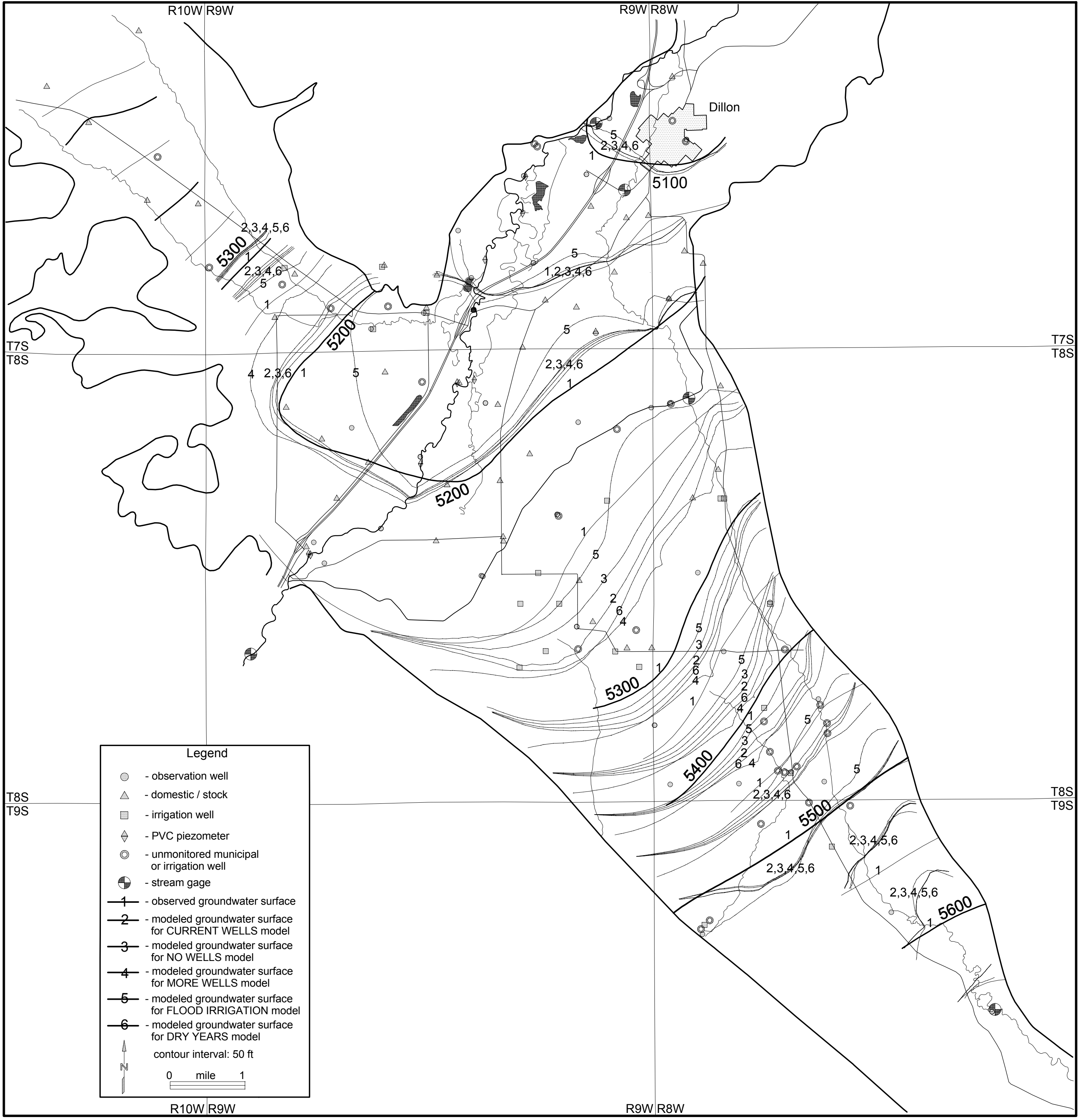
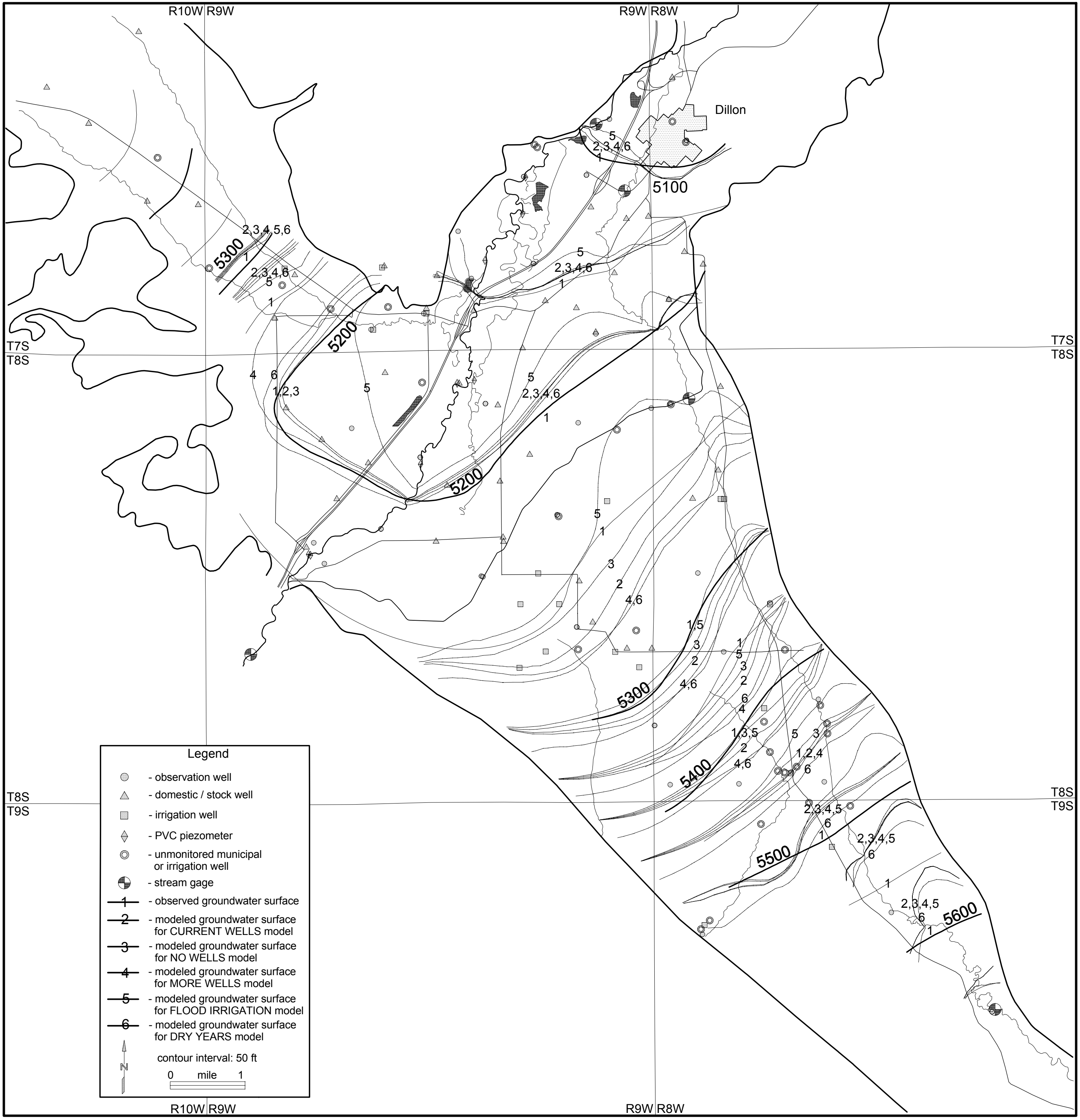
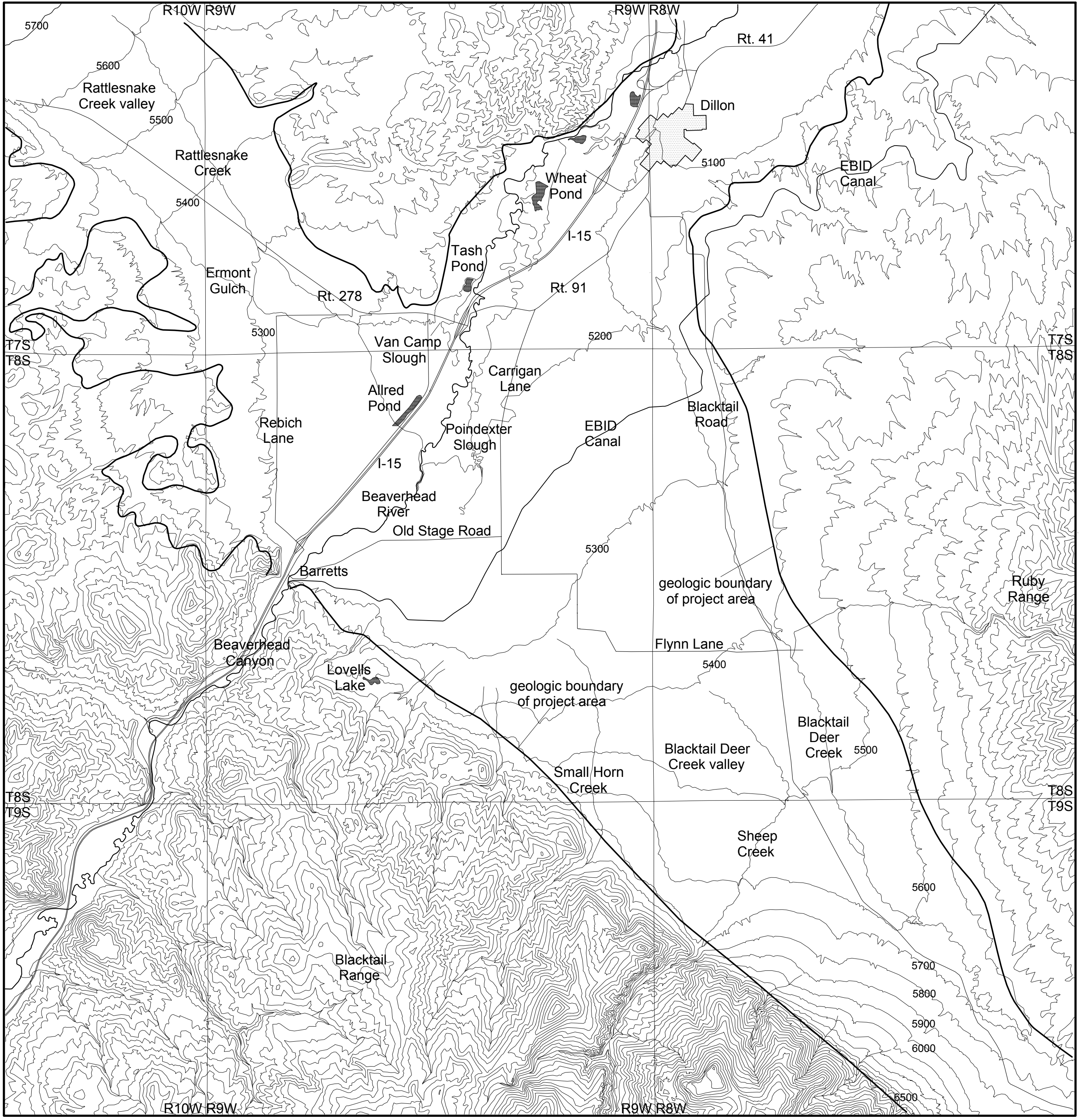


Figure 105. Modeled Potentiometric Surfaces for July 31, 1996



Appendix F1. Topographic Map of a Portion of the Upper Beaverhead Basin



elevation reported in feet above mean sea level
contour interval: 100 feet