HYDROGEOLOGIC ASSESSMENT OF THE TOWN OF LIMA WATER SUPPLY, ALDER SPRING, FOR GROUND WATER UNDER THE DIRECT INFLUENCE OF SURFACE WATER

Open-File Report
MBMG 401-N

Town of Lima
Lima Water Department
PWSID #00276
P. O. Box 184
Lima, Montana 59739

Prepared
for
Montana Department of Environmental Quality
Water Quality Division

by
James Rose
Montana Bureau of Mines and Geology

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Montana Bureau of Mines and Geology
Since 1919
Earth Science Information

INTRODUCTION AND PURPOSE

This report summarizes the results of a hydrogeologic assessment for the Town of Lima Public Water Supply (PWSID #00276). Lima is located in southwest Montana in southern Beaverhead County. The Montana Bureau of Mines and Geology (MBMG) is under contract with the Montana Department of Environmental Quality (DEQ) to conduct preliminary assessments and hydrogeologic assessments for selected community water supplies. The project was funded under DEQ contract number 400022, task order number 7.

The purpose of this hydrogeologic assessment was to determine if the spring source used by the Town of Lima is under the direct influence of surface water as defined in 40 CFR part 141. A field inspection of the water supply system was completed on February 4, 1997 by Alan English, hydrogeologist for the MBMG, and John Wendt (certified system operator). **The results of the assessment indicate that the spring used by the Town of Lima water supply system may be under the direct influence of surface water as defined in 40 CFR part 141.**

This report summarizes information obtained during the field inspection and the follow-up research investigation that were used to make the above determination. Information on system location, construction, geology, hydrology, and water quality are summarized. Conclusions and recommendations are presented at the end of the report. A preliminary assessment form, photographs of the site, and water-quality reports have been included in the appendices.

BACKGROUND

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

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

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

The evaluation begins with a preliminary assessment (PA). If the PA indicates that the ground-water supply may be under the direct influence of surface water, further study is required. Further study may include conducting a hydrogeologic assessment (HA) and / or a water quality assessment, that may include conducting microscopic particulate analysis (MPA).

PRELIMINARY ASSESSMENT

A completed PA form for the Town of Lima water supply is included as appendix A-1. The sole water source for the town is Alder Spring, and it was assigned a total score of 50 points. The site was assigned 40 point because the water source is a spring. The 40 points automatically requires that the site receive further evaluation. Ten points were added for two acute maximum contaminant level (MCL) violations of the Total Coliform Rule over the last three years. **The total score of 50 points, out of a possible total of 180, indicates the system is at moderate risk of being under the direct influence of surface water. Because the score is above 40 points, additional evaluation is required under DEQ guidelines.**

SYSTEM DESCRIPTION

Location

Lima, Montana is located in the southwest corner of the state in southern Beaverhead County. The town is situated 49 miles south of Dillon along interstate I-15 and 15 miles north of the Montana-Idaho border (Figure 1). The location of Lima is shown on the Lima 7.5-minute U.S. Geological Survey (USGS) topographic quadrangle map in sections 4, 5, 8 and 9, T. 14 S., R. 8 W. (Figure 2). The water-supply spring (Alder Spring) and a storage reservoir are located south of town at NW¼, NW¼, SE¼, NW¼ (BDBB) sec 16, T. 14 S., R 8 W. on the Lima Peaks 7.5-minute U.S. Geological Survey (USGS) topographic quadrangle map. The latitude of the spring site is 44° 37' 04" N; the longitude is 112° 35' 11" W. Alder Spring is located along the east fork of Alder Creek where the creek emerges from the hills along the north side of the Tendoy Mountains (Figure 2).

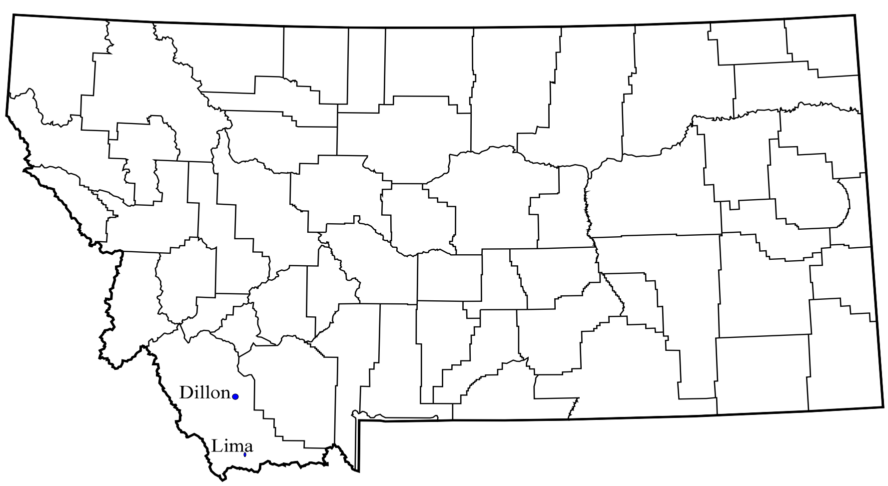

Figure 1. Map of the state of Montana showing the location of the towns of Dillon and Lima in Beaverhead County.

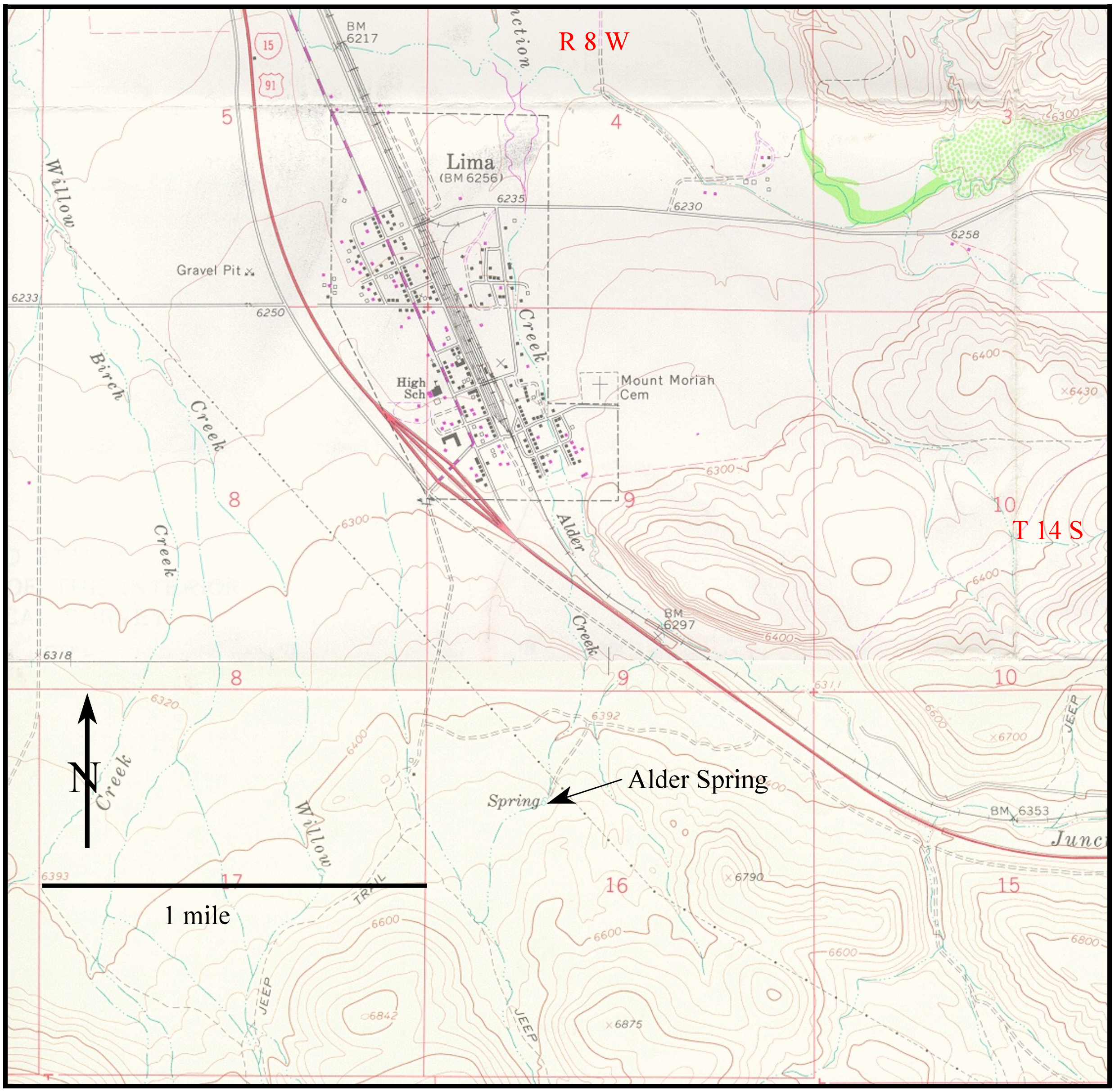

Figure 2. Topographic map of the Lima area showing the location of Alder Spring. The Tendoy Mountains are located south of the spring (Lima Peaks topographic quadrangle map, USGS, 1965).

Lima is located in the Red Rock River valley, a northwest-southeast trending intermontane valley surrounded by the Blacktail Mountains to the north, Tendoy Mountains to the west and south, the Centennial Mountains to the southeast, and the Snowcrest Range to the east. The water-supply spring is located along Alder Creek, a tributary of the Red Rock River, three-quarters of a mile southwest of the town of Lima. Alder Creek flows from the north slope of Lima Peaks located along the southeastern end of the Tendoy Mountains.

Source History

Spring and Water Distribution System

The Town of Lima water system has about 200 service connections and serves about 270 residents. The source of water for the system is Alder Spring. Alder Spring discharges from a hillside along the east side of the Alder Creek drainage. Brush growing around the spring is visible against a hillside along the eastern edge of an alluvial fan at the mouth of the Alder Creek drainage (Appendix B, photos B-1 and B-2). Infiltration galleries have been buried in the hillside around the spring discharge site to collect ground water for the water system (Figure 3). In addition, two, 4-inch diameter PVC pipes drain excess ground water from around the infiltration galleries into a pond constructed at the spring site (Appendix B, photo B-3). At the time of the HA visit, no flow was observed from the north pipe. Discharge from the south pipe was estimated to be 3 gallons per minute (gpm). The combined discharge from the pond and from the storage tank overflow into the canal was estimated to be 100 gpm. Overflow from the storage tank is discharged into the diversion canal on the alluvium below the reservoir (Figure 4) and (Appendix B, photo B-4). Total discharge from Alder Spring was not measured but must be in excess of 100 gpm based on observations made at the site.

The water level of the pond at the spring site is regulated by a headgate near the intake building (Figure 3). The surface water is discharged through the headgate into a canal that carries the water across the Alder Creek fan (Appendix B, photo B-2) and (Figure 4). Ground water from the infiltration galleries buried in the hillside flows into two pipes that run along the bottom of the pond and empty into an intake house located on the west side of the pond (Figure 3). The intake house is used as a cistern and is constructed of stone block and mortar that appears to be quite old (Mike Brayton, DEQ, personal communication, 2000). Cracks in the intake house walls may allow surface water from the adjacent pond to leak through the walls into the water supply. Insects and rodents may be able to enter the water supply through gaps in the intake house structure. The water in the intake house drains into a 6-inch water line to a concrete storage reservoir (Figure 5) and (Appendix B, photo B-5). A second 6-inch line carries water from the storage reservoir to the towns main water-distribution line. The storage reservoir is located at the spring site and is a 100,000-gallon capacity rectangular, concrete box with a concrete cover. The reservoir was constructed in response to water system improvements recommended by Ellsworth Engineering and Bill Anderson, P.E., who provided the design work. According to a DEQ memo dated May 15, 1995, a recommended mainline improvement (changing 6-in to 12-in) to town was not constructed. The main water line to town is still 6-in diameter. The recommended improvements to the water system were apparently in response to a water-pressure problem to the service connections in town. A water-pressure test was conducted on the Lima water supply system at a hydrant near the school by Bill Anderson, P.E., in May 1995. The flow at the hydrant was 175 gallons per minute (gpm) at 20 pounds per square inch

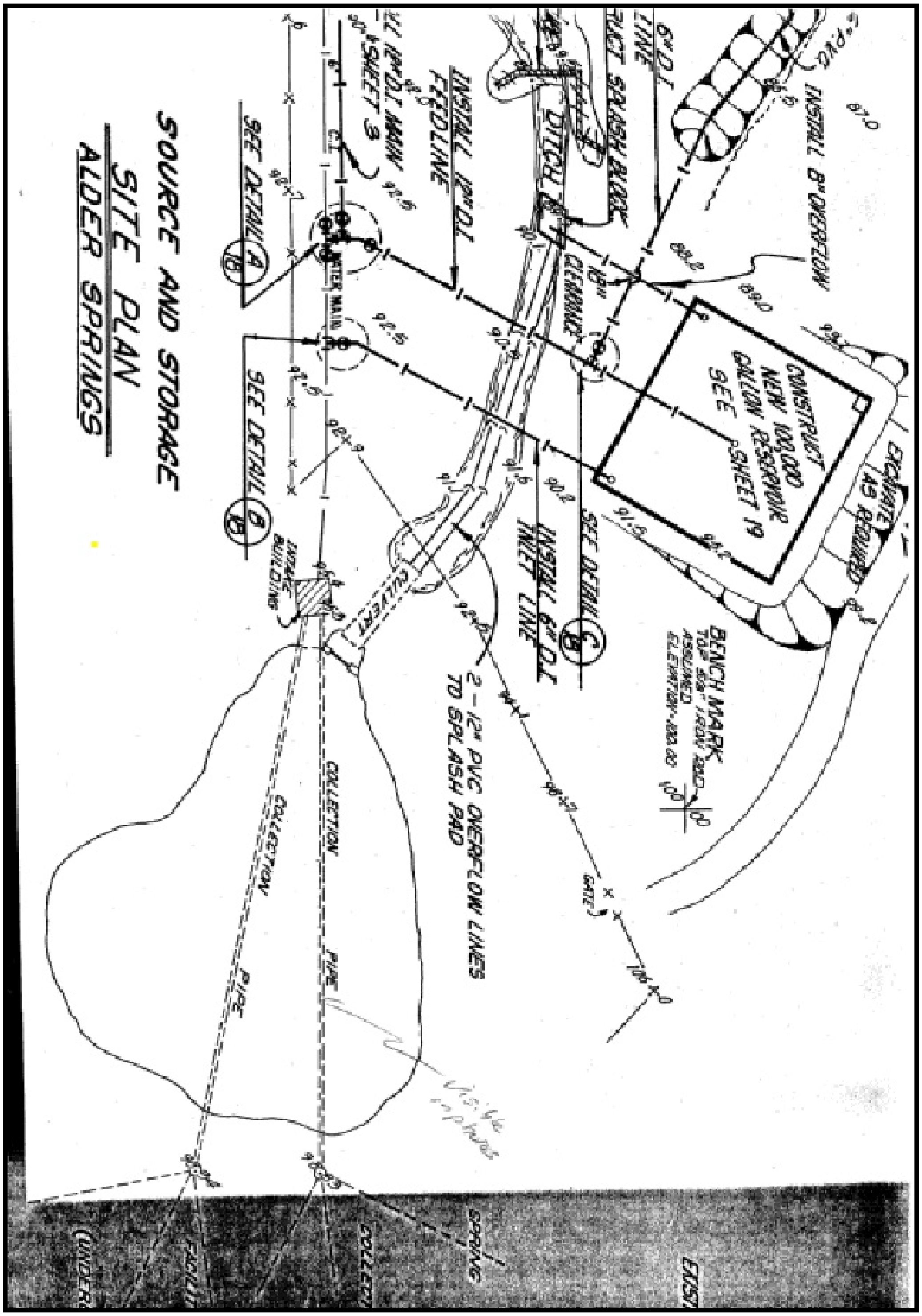

Figure 3. Engineer’s drawing of water-distribution system showing the infiltration galleries, the

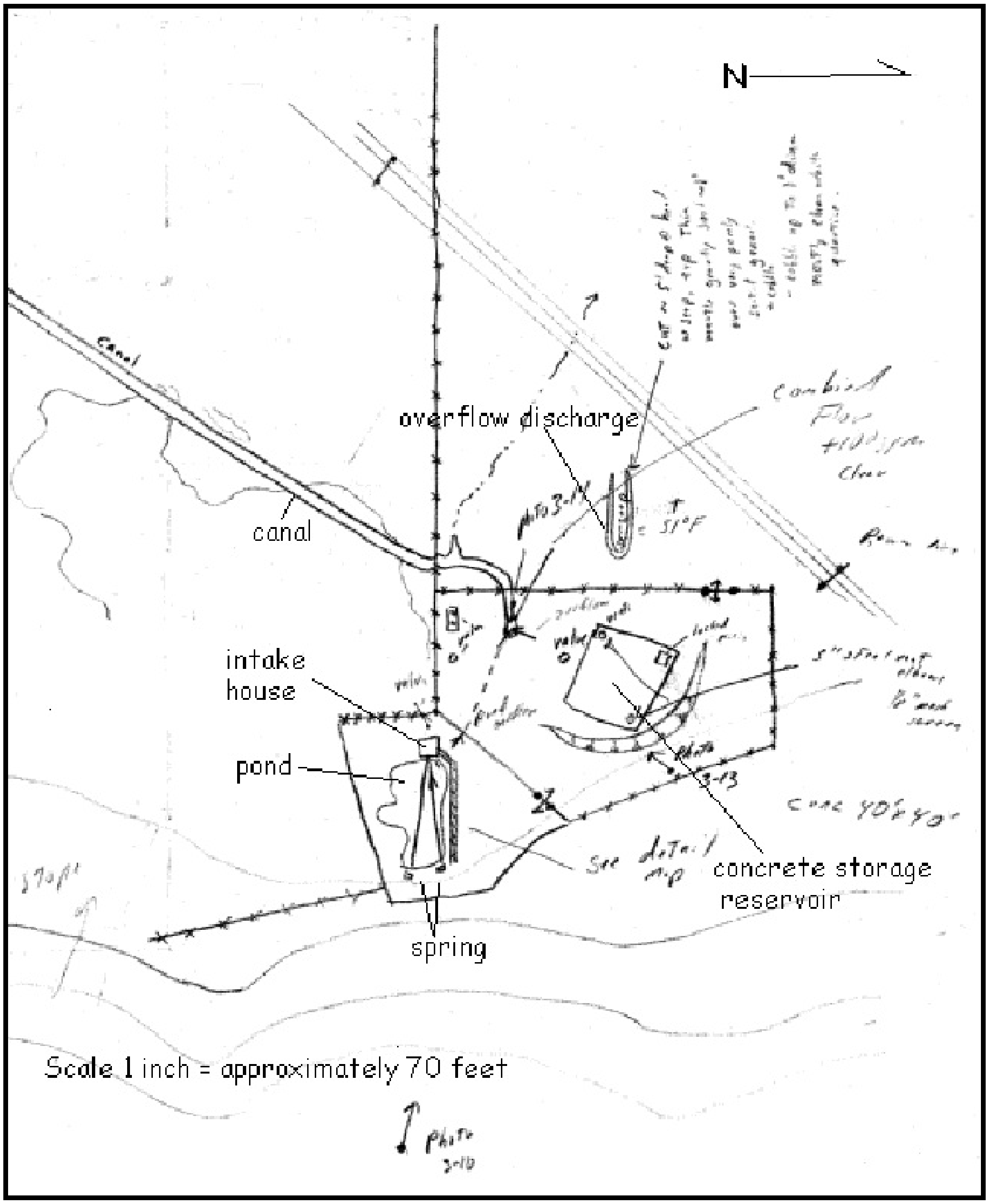

Figure 4. Sketch map of spring site showing the pond, the canal, the spring-discharge area, the lower spring on the alluvial fan and the concrete-storage reservoir.

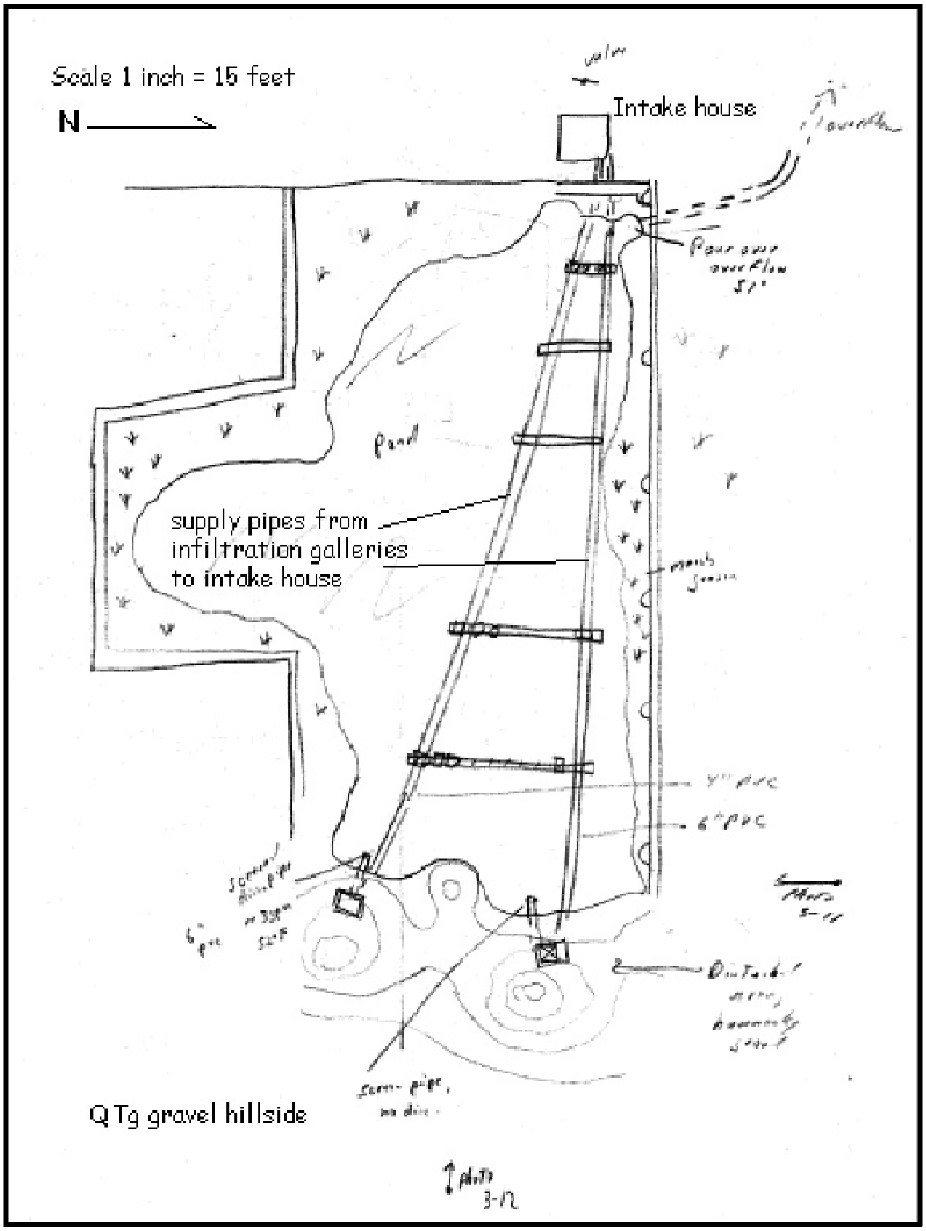

Figure 5. Sketch map of the spring site showing the pond, the PVC discharge pipes, the collection lines from the infiltration galleries to the intake house and the canal from the pond.

(psi). During the test, the local restaurant temporarily lost water pressure. Water pressure is maintained by gravity flow through the distribution system.

A summary of a sanitary survey of the Lima water supply conducted October 7, 1992, on file with the DEQ, notes that there is no chlorinator on the water supply system. The system operator keeps a bucket of chlorine tablets at the spring site. No records of chlorination residuals are recorded.

GEOLOGY

Topography and Land Use

Alder Spring is located along the east edge of the Alder Creek valley at 6,440 ft elevation where the valley widens and empties into the Red Rock River valley (Appendix B, photo B-1). The Town of Lima is located north of the spring site at 6,260 ft elevation (Figure 2). South of the spring, in the foothills of the Tendoy Mountains, the Alder Creek drainage is a narrow, V-shaped valley that widens to the north. The bottom of the drainage is filled by Quaternary alluvium. Where the valley widens, the floor is covered by an alluvial fan which forms a relatively flat, gently north-sloping plain along the mountain front into the Red Rock River valley. The land surface is covered primarily by sagebrush and sparse grasses. Section 16, the location of Alder Spring is a state owned section (USDA, 1996). The land is undeveloped and may be leased to local ranchers for grazing sheep and cattle.

Regional Geology

The Lima Peaks of the southern Tendoy Mountain Range rise to the south of Lima. The Tendoy Mountains are composed of Paleozoic and Mesozoic sediments that were folded and uplifted during the Laramide Orogeny (Scholten, 1950). The hills at the base of the Tendoy mountains are composed the late-Cretaceous, Lima Conglomerate Member of the Beaverhead Group (Jeff Lonn (MBMG) personal communication, 2000). The Lima Conglomerate consists of a number of alluvial-fan and flood-plain deposits of poorly bedded and poorly sorted, rounded to sub-rounded fragments of Mississippian-age limestones and cherts, Quadrant, Kinnikinic and Belt quartzites and Dillon Granite Gneiss eroded from the Tendoy Mountains and surrounding mountain ranges (Scholten, 1950). The clasts of conglomerate range in size from pebbles and cobbles up to boulders several feet in diameter; that are closely spaced and well cemented with thick layers of calcite cement filling the voids between the rock fragments (Wilson, 1967). Due to faulting and deformation, the conglomerate beds dip 35 degrees to the north at Alder Creek (Klepper, 1950).

The river valleys and drainages at the base of the mountains are filled with unconsolidated alluvial sediments that were deposited during the Tertiary and Quaternary Periods. The valley fill consists of alluvial fan, stream and flood plain deposits of gravels derived from the bedrock of the surrounding mountains. The mapped deposits include older Quaternary-Tertiary stream-deposited alluvial gravels (QTg); older Quaternary alluvial fan deposits (Qafo), composed of alluvial fan, stream and flood-plain deposits, and Quaternary alluvium (Qal), which are recent stream deposits (Skipp, 2000). Some of the older gravels have themselves been eroded and reworked and can be found in localized deposits along hillsides, on benches below the hills, and in the creek drainages and river valleys (Scholten, 1950).

Faults in the area are commonly located along the mountain fronts and valley margins. The most recent movement along these faults is typically normal displacement with the down-dropped block on the valley side of the fault (Ruppel, 1993). Fault displacement is often not visible in the unconsolidated alluvium.

Local Geology

The hills south of Lima are predominantly composed of bedrock belonging to the Lima Conglomerate of the Beaverhead Group, which is estimated to be about 2,500 ft thick in the Lima area (Appendix B, photo B-1). The topography is characterized by gently rolling uplands along the base of the Tendoy Mountains (Appendix B, photo B-1).

The north end of the hills, at the Alder Spring site, are composed of unconsolidated Tertiary to Quaternary age gravel deposits (Figure 6) (Appendix B, photo B-1). Alder Spring discharges from a steep hillside composed of the QTg gravels along the east side of the Alder Creek drainage (Figure 6). Skipp (2000) described the QTg unit as gravels of uncertain affinity. The unit is similar to terrace gravels mapped in the area which consist of stream-channel deposits containing pebbles, cobbles and boulders. The clasts in the gravels are typically well rounded and are derived from erosion of the Paleozoic and Mesozoic sediments of the surrounding mountains, including rocks of the Beaverhead Group. The gravels in the QTg are unconsolidated, not cemented, and have large pore spaces that make a good water-bearing and water-transmitting aquifer. The topography developed on the gravels is hummocky, uneven terrain in contrast to the gently rolling uplands of the Lima Conglomerate located further to the south (Appendix B, photo B-1).

The alluvial fans that emerge from the mountain valleys near Lima extend from the major drainages onto the Tertiary aged valley-fill sediments in the Red Rock River valley (Appendix B, photo B-5). The fans contain pebbles, cobbles and boulders in a sandy matrix which are composed of material eroded from the surrounding bedrock, primarily the Beaverhead Formation (Scholten, 1950) (Appendix B, photo B-4). The alluvial deposits are late-Tertiary to Quaternary in age, and some may be Holocene in age. The younger alluvial fans formed during the Quaternary are typically thin, 10-15 ft thick in the mountain valleys, and thicken to 10's of feet thick where the fan emerges from the hills along the valley margins (Jeff Lonn, MBMG, personal communication, 2000). The fans in many of the drainages appear to control the stream courses. The alluvial fan along Alder Creek appears to be inactive and Alder Creek has incised into and eroded some of the fan material along the valley bottom.

Alder Spring is located in the vicinity of a series of valley-margin normal faults mapped by Skipp (2000) (Figure 6). Some of the alluvial fans along the mountain front are displaced by Holocene movement along the Red Rock normal faults (Scholten, 1950). Fault movement may also contribute to steepening of the hill slope where the spring emerges. The most recent displacement on faults along the south side of the Red Rock River valley has been normal movement with the north, or valley side, block dropped relative to the south, or mountain side, block.

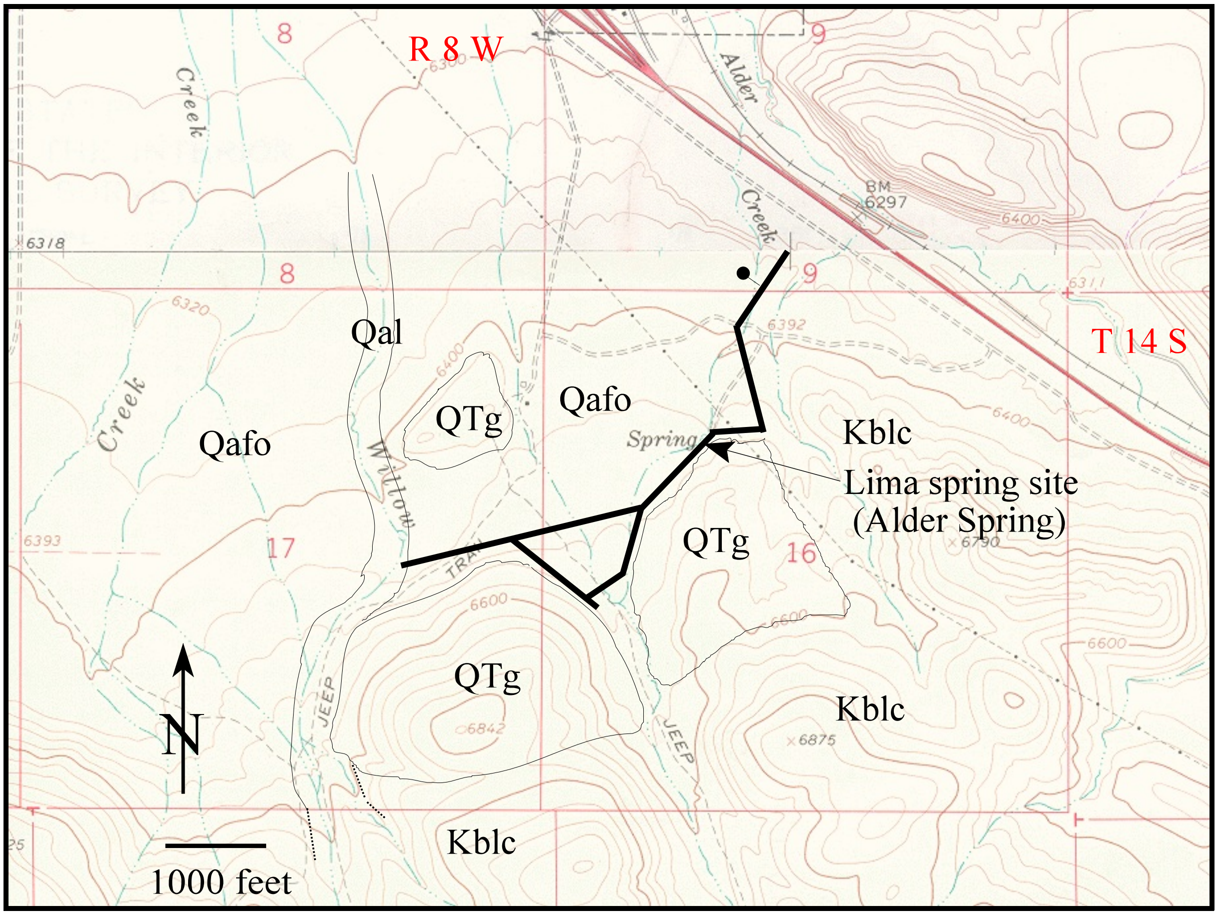

Figure 6. Geologic map of the Alder spring site (modified from Skipp, 2000) on the Lima Peaks topographic quadrangle map (USGS, 1965). The map shows the late-Tertiary to possibly Quaternary age, unconsolidated gravels (QTg) southeast of the spring, which are the source of ground water for the spring. Kblc is the Lima Conglomerate of the Beaverhead Group (Cretaceous age), Qafo are older alluvial fan deposits of Quaternary age, and the Qal is more recent alluvium deposited by the creeks. The heavy lines are faults mapped by Skipp (2000). Most of the faults show normal movement, with the north side dropped relative to the south side. Many similar faults in the area show signs of recent movement and displacement of recent alluvial sediments.

HYDROLOGY

Surface Water

The climate at Lima is semiarid; on average only about 12 inches of precipitation falls here each year (WRCC, 2000). Streams in the area receive water from snowmelt and precipitation runoff in the mountains and discharge the water into the major streams and rivers in the valleys. Alder Spring is located along Alder Creek, which flows from the southern Tendoy Mountain range, and is a tributary to the Red Rock River. Alder Creek is an ephemeral stream and is one of a series of creeks that drains north and east into the Red Rock River drainage basin at Lima.

Regional Ground-Water Flow

No ground-water studies have been completed in the Lima area. Characterization of the shallow ground-water systems were based on observations made at the site, regional reports of ground-water movement and aquifer characteristics, MBMG Ground-Water Information Center (GWIC) well and ground-water records, and inferences made from the local topography.

Movement of shallow ground-water in the region generally follows surface-water patterns flowing from the higher elevations in the mountains toward the drainage valleys and down into the valley bottoms. The bedrock in the mountains is consolidated and has very low primary permeability and probably contains very little water except in cracks and fractures in contact with the land surface.

Shallow ground water in the unconsolidated colluvial and alluvial fill in the drainages and along the valley bottoms is recharged by precipitation falling on the land surface and from the infiltration of streamflow into the alluvial material. Streams may gain or lose water to the alluvium causing water to flow into or out of the unconsolidated sediments along the valley bottoms, especially near creeks and rivers. The interconnectivity of the alluvial ground water may be complex depending upon the permeability of the alluvial deposits. In some areas ground water may flow easily between the different alluvial deposits, in other areas low permeability material within the aquifers may prevent or slow ground water movement.

Local Ground-Water Flow

Alder Springs flows from a steeply sloping hillside composed of QTg gravel along the Alder Creek drainage (Figure 6). The spring occurs where the water table intercepts the more steeply sloping land surface. Alder Spring is also located along the inferred trace of a valley margin fault which may have some influence on local ground-water movement and the spring. The QTg gravels contain large pore spaces between the gravel, pebbles, cobbles, and boulders which allow for the easy and rapid movement of ground water. The ground water in the gravels is recharged by precipitation falling on the land surface, and from drainage through a hydraulic connection with the alluvium along the creek bottoms uphill from the spring site. The total surface area of the gravels exposed at the land surface is small and the area receives low annual precipitation; so the contribution to recharge from precipitation is probably small. The total thickness of the QTg gravel aquifer is not known, however, the thickness of the aquifer that lies above the spring is relatively thin because the land surface of the gravel hills rise only 160 ft above the spring site (Figure 6). This relatively shallow thickness cannot provide adequate quantities of water to continuously supply the spring. The gravel also receives very little water from the tightly cemented Lima Conglomerate that forms the hills south of the gravel deposits

(Appendix B, photo B-1). The conglomerate would act as a barrier to ground-water movement. Therefore, most of the recharge to the gravel aquifer must come from the nearby alluvium in the Alder Creek drainage and possibly from the drainage east of the spring site. Alluvium in both drainages are recharged primarily by the infiltration of surface water from streams.

WATER QUALITY

Background Ground-Water Quality

Water temperature of the spring discharge was the only field parameter measured during the HA visit. The water temperature was 52° F at the PVC spring discharge pipe, 51° F at the pond discharge and 51° F at the overflow discharge (Figure 4) and (Appendix B, photo B-4). No records for Alder Spring are available from the MBMG's Ground-Water Information Center (GWIC, 2000). Water-quality analysis results for eight samples collected from the Lima water system are on file with the DEQ and were used to characterize the water quality of Alder Spring (Appendix C). Results of the analyses from the State Health Department lab are reported in Table 1. The water samples used for the analyses were collected at various outlets around town. Ground water from the spring is calcium-bicarbonate type and has a measured specific conductance between 397 and 405 µmhos/cm @ 25°C.

Table 1. A summary of pH, SC, TDS, and nitrate and nitrite data on file with the DEQ for the Town of Lima water system.

Sample date	pH	Specific Conductance (µmhos/cm @25°C)	Total Dissolved Solids (mg/L)	Nitrate as Nitrate and nitrite (mg/L)
10/7/91	8.18	403.0	--	0.39
5/12/89	7.73	401.0	--	0.49
11/6/85	7.33	398.0	--	0.43
3/9/83	7.76	399.0	--	0.40
12/20/79	8.00	397.2	312.7	0.37
10/26/76	8.00	403.0	316.3	0.38
2/25/76	7.95	405.0	318.9	0.41
11/13/73	7.80	399.0	314.8	1.70

Inorganic Ground-Water Chemistry

Water-quality analyses from the eight water samples (collected between 1973 and 1991) (Appendix C), and a trace-metals analysis of ground water from Alder Springs collected in 1995, are on file with the DEQ and show that all values for trace metals are below detection.

Organic Ground-Water Quality
No pesticides or herbicides were detected in water samples collected from taps at the Lima school and one other location in town in February 1995. The sample results are on file with the DEQ.

Bacteria Analyses
Results of monthly sampling for bacteria contamination in the Lima water supply are on record with the DEQ (Mike Brayton, DEQ, personal communication, 2000). Table 2 shows that coliform and fecal-coliform bacteria have been detected in four water samples collected since 1995.

Table 2. Water quality analyses from DEQ records for the Town of Lima water supply system in which coliform or fecal-coliform bacteria were detected.

Sample Date	Bacteria Analysis Results
6/15/98	non-acute
7/7/97	acute, fecal present
6/10/97	acute, fecal present
2/6/95	fecal present
6/21/93	coliforms present

Bacteria occurred in the water samples collected in February, a typically low-flow period for most mountain springs in Montana, and four times in June and July, during the period of spring snowmelt and high runoff from the mountains. Fecal-coliform bacteria originate in animal or human waste and are a strong indicator of surface-water influence. The fecal-coliform bacteria in Alder Spring may originate from animal waste on the land surface up slope from the spring site or from the alluvium in the stream drainages upgradient from the spring site. Based on the analytical results, it appears that the spring water source is most vulnerable during springtime snowmelt and runoff when the amount of infiltrating water from the land surface to the shallow ground-water system is greatest. The infiltration of snowmelt or rainfall from the land surface into the coarse-grained aquifer material of the gravels may transport the bacteria into the ground water. The coarse-grained nature of the aquifer may not allow adequate filtration of the water as it moves to the spring. With the exception of the occasional occurrence of fecal-coliform bacteria in water samples, the quality of the Alder Spring water is acceptable as a public water supply source.

CONCLUSIONS

Determination of Direct Surface-Water Influence

Based on an interpretation of the characteristics of the ground-water system that supplies water to Alder Spring and records of water quality on file with DEQ, **it appears that the Alder Spring water may be under the direct influence of surface water**. Shallow ground water from the unconsolidated gravels that form the hill on the east side of Alder Creek is the source of water to Alder Spring. Evidence from the HA investigation suggests that the ground water in the gravels receives recharge from the infiltration of water through the land surface, the ground water moves rapidly through the system, and the ground water is discharged at the spring a relatively short time after it has entered the gravels. The coarse-grained nature of the gravels would allow for aerobic conditions in the ground water and would not allow for adequate filtration of the ground water as it flows through the system. Although the quality of water from Alder Spring is generally good, the detection of fecal-coliform bacteria in the water system is a strong indicator that the ground water is influenced by surface water. Based on the data available, the surface-water influence may be restricted to periods when the rate of infiltration of surface water into the ground water is high. Such conditions are most common during the springtime.

The shallow depth to ground water in the gravels, the coarse-grained nature of the aquifer material and the relatively short travel distance of ground water from surface recharge areas to the spring discharge site increase the vulnerability of the spring water to surface-source contamination. Portions of the water-supply system, particulary the water pipes routed through the spring site pond and the old intake house may present the potential for the infiltration of surface water into the water-supply system. Because the water system has no chlorinator, the risk of fecal-coliform bacteria entering the water system is great.

RECOMMENDATIONS

Because of repeated occurrences of fecal-coliform bacteria in water samples collected from the Lima water system, and based on the characterization of the aquifer, **an MPA is recommended to determine if surface water is a contributor to spring water discharge**. Because the occurrence of fecal-coliform bacteria appears to coincide with periods of high runoff in the springtime, the MPA should be conducted during the springtime when snowmelt and runoff water contributions to the spring water are greatest. In addition to conducting an MPA, other conditions that should be evaluated to ensure a safe drinking water supply include:

- Review the Lima water system records to determine if the system is regularly chlorinated and if records of chlorine residual in the system are available.

- Evaluate the need for a chlorinator.

- Do not allow animals to graze on the gravel hillside upgradient from the spring site. Restrict all access to the gravel recharge area on the hillside east and south of the spring.

- Look at draining or relocating the pond or relocating the pipes that flow from the infiltration galleries to the intake house so that the pipes are not routed through the pond water.

- Eliminate the intake house cistern from the system. The age, construction, and location of the intake house present a potential site for the infiltration of surface water into the water supply. Running pipes from the infiltration galleries directly into the concrete storage reservoir would eliminate this potential source of surface water contact.

- Be sure all pipes, vents and openings into the water system, especially at the spring site, are sealed or screened to keep rodents and insects out of the system.

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Appendix A

Preliminary Assessment Form

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

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

SYSTEM NAME Town of Lima PWS ID # 00276
SOURCE NAME Alder Spring COUNTY Beaverhead
DATE 2/4/97 _ NC NTNC C POPULATION 267

Index Points

A. TYPE OF STRUCTURE (Circle One)

Well	GO TO SECTION B
Spring	40
Infiltration Gallery/Horizontal Well	40

B. HISTORICAL PATHOGENIC ORGANISM CONTAMINATION

History or suspected outbreak of *Giardia,* or other pathogenic organisms associated with surface water with current system configuration	40
No history or suspected outbreak of *Giardia* .	0

C. HISTORICAL MICROBIOLOGICAL CONTAMINATION (Circle all that apply)

Record of acute MCL violations of the Total Coliform Rule over the last 3 years (circle the one that applies)

No violations	0
One violation	5
Two violations	10
Three violations	15

Record of non-acute MCL violations of the Total Coliform Rule over the last 3 years (circle the one that applies)

One violation or less	0
Two violations	5
Three violations	10

DHES-verified complaints about turbidity . . .	5

D. HYDROLOGICAL FEATURES

Horizontal distance between a surface water and the source

greater than 250 feet	0
175 - 250 feet	5
100 - 175 feet	10
less than 100 feet	15
unknown	15

E. WELL CONSTRUCTION

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

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

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

F. WELL INTAKE CONSTRUCTION

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

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

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

TOTAL SCORE 50

PRELIMINARY ASSESSMENT DETERMINATION (Circle the one that applies)

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

ANALYST James Rose (for Alan English)
ANALYST AFFILIATION MBMG

COMMENTS: The water supply is a spring flowing from a hillside along Alder Creek approximately 3/4 of a mile south of the town of Lima. Spring water is collected through infiltration galleries buried in the hillside where the spring emerges. There is no chlorination system for water supply.

Appendix B

Photo B-1. View of Alder Spring and Tendoy Mountains showing geologic contacts.

Photo B-2. Over view of spring site.

Photo B-3. Alder Spring discharge site.

Photo B-4. View of the discharge overflow.

Photo B-5. Close-up view of the water storage reservoir.

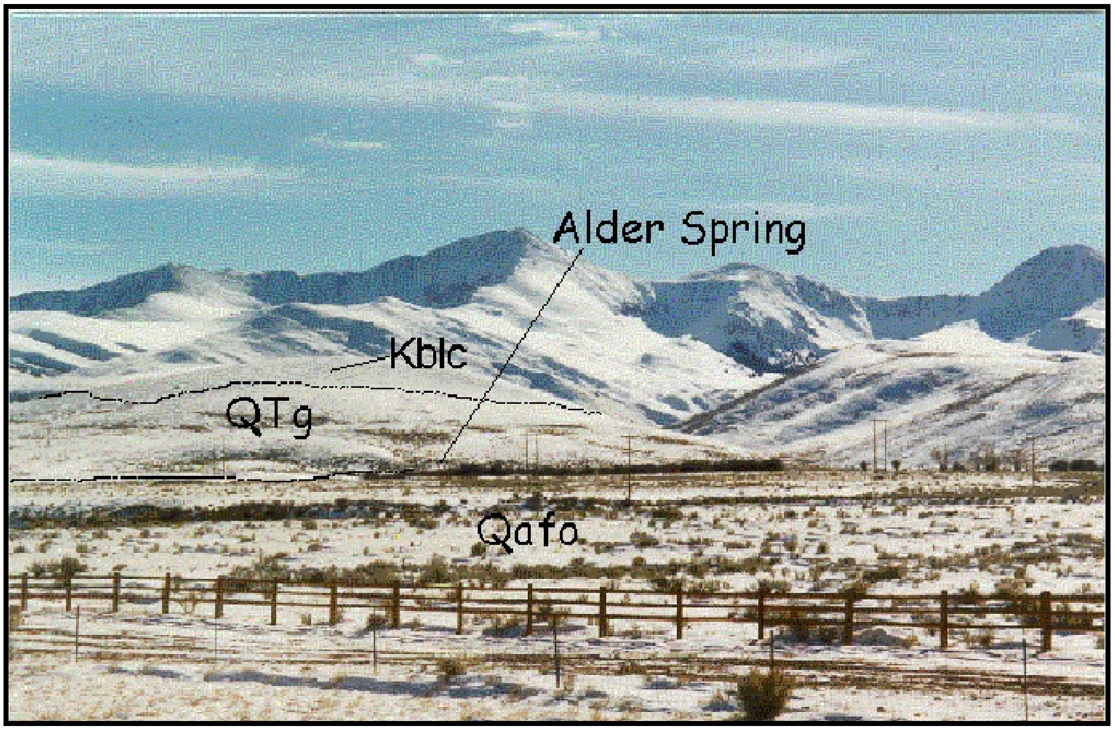

Photo B-1. View looking south towards Alder Spring showing hills south of spring and approximate contact between the QTg, source gravels for the spring and the Lima conglomerate (Kblc). The land in the foreground is Quaternary alluvial fan deposits (Qafo). The Alder Creek drainage is to the right of the spring and the Lima Peaks of the Tendoy Mountains are visible in the background.

Photo B-2. Overview of spring site looking northwest from the gravel hillside across the Alder Creek alluvial fan. The view shows the spring, the collection pond, the storage reservoir, the lower spring, and the diversion canal. The town of Lima is visible in the background.

Photo B-3. Alder Spring discharge site. PVC drain pipes are located at the edge of the pond, the water-system collection pipes from the infiltration galleries are located below the concrete blocks.

Photo B-4. View of overflow discharge below the storage reservoir. Note the size of the

Photo B-5. Close-up view of the 100,000 gallon water storage reservoir. View is looking northwest across the Alder Creek alluvial fan and down the Red Rock River valley. The Tendoy Mountains are visible to the left and the Town of Lima is visible to the right.

Appendix C

Water Quality analyses

STATE HEALTH DEPT.   WATER QUALITY BUREAU   HELENA, MONTANA 59620

STATE	MONTANA	COUNTY	BEAVERHEAD
LAT.-LONG.		SAMPLE LOCATION	
STATION CODE	00276	ANALYSIS NUMBER	91W3243
DATE SAMPLED	10-07-91	DRAINAGE BASIN	
TIME SAMPLED	1610	WATER FLOW RATE	
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE		ALTITUDE OF LAND SURFACE	
WATER USE	PUBLIC SPLY	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQB	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: LIMA - SEYBOLD YARD HYDRANT

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	62.7	3.129	BICARBONATE(HCO3)	205.0	3.359
MAGNESIUM (MG)	14.0	1.152	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	4.8	0.209	CHLORIDE (CL)		
POTASSIUM (K)			SULFATE (SO4)	27.7	0.577
			FLUORIDE (F)	.23	0.012
			PHOSPHATE(PO4 AS P)		
			NO3+NO2 (TOT AS N)	.39	0.028
SUM CATIONS	81.5	4.489	SUM ANIONS	233.3	3.976

LABORATORY PH	8.18	TOT HARDNESS(MG/L-CACO3)	214
FIELD WATER TEMPERATURE (C)		TOT ALKALINITY(MG/L-CACO3)	168
SUM-DISS. IONS MEAS.(MG/L)		LABORATORY TURBIDITY (NTU)	
LAB CONDUCTIVITY-UMHOS-25C	403	SODIUM ADSORPTION RATIO	0.1

A D D I T I O N A L   P A R A M E T E R S

ARSENIC,TR (MG/L AS AS)	<.001	CADMIUM, TR (MG/L AS CD)	<.001
LEAD,TR (MG/L AS PB)	<.001	MERCURY, TR (MG/L AS HG)	<.0002
SELENIUM,TR (MG/L AS SE)	<.005	SILVER, TR (MG/L AS AG)	<.001
IRON,TR (MG/L AS FE)	.01	MANGANESE,TR(MG/L AS MN)	<.005
BARIUM, TR (MG/L AS BA)	.019		

REMARKS: DRINKING WATER PROGRAM   LOIS MERRELL, PO BOX 184
LIMA, MT 59739

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

- -

SAMPLE NO-   SAMPLER-GJW HANDLING-   ANALYST-LAB LAB-   SCAN-NO
COMPLETED-11/05/91 COMPUTER RUN-12/04/91 DATA-0684/PGM-0984 FUND-

STND DEV. ION BALANCE=		CA	MG	NA	K	CL	SO4	HCO3	CO3	NO3
MPDES-		69.7	25.7	4.7	0.0	0.0	14.7	85.3	0.0	0.0
CALC. MEQ/L=	4.003 TO	4.424								

91W3243

WATER QUALITY BUREAU-MONT STATE HEALTH DEPT. HELENA, MONTANA 59601

WATER QUALITY ANALYSIS

STATE	MONTANA	COUNTY	BEAVERHEAD
LATITUDE-LONGITUDE		LOCATION	
SAMPLE TYPE		LAB NO.	73 2104
GEOLOGICAL SOURCE		SAMPLE OR BOTTLE NO.	
DRAINAGE BASIN		AGENCY AND STATION CODE	
DATE SAMPLED	11-13-73	DEPTH WATER ENTERS WELL	
TIME SAMPLED		SWL ABOVE(+) OR BELOW GS	
DATE ANALYZED	11-30-73	ALTITUDE OF SAMPLE POINT	
SAMPLE HANDLING		WATER FLOW RATE	
METHOD SAMPLED		FLOW MEAS METHOD	
SANITARY CONDITION		PRINCIPAL USE OF WATER	

PROJECT LIMA WATER SUPPLY RESERVOIR COMPLETE
REMARKS SAMPLED BY MORRISON-MAIERLE

PARAMETERS REPORTED IN MILLIGRAMS PER LITER EXCEPT AS INDICATED

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	57.	2.840	BICARBONATE(HCO3)	217.	3.559
MAGNESIUM (MG)	13.1	1.077	CARBONATE (CO3)	0.	0.0
SODIUM (NA)	4.7	0.204	HYDROXIDE (OH)	0.	0.000
POTASSIUM (K)			CHLORIDE (CL)	5.0	0.141
TOT. IRON (FE)			SULFATE (SO4)	16.0	0.333
MANGANESE (MN)			NITRATE (NO3)	1.7	0.027
ALUMINUM (AL)			FLUORIDE (F)	.2	0.011
SILICA (SIO2)			PHOSPHATE (PO4)		
TOTAL CATIONS		4.121	TOTAL ANIONS		4.071

STANDARD DEVIATION OF CATION-ANION BALANCE -0.29 SIGMA

LABORATORY PH	7.80	CARBONATE HARDNESS AS CACO3	178
FIELD TEMPERATURE		NON-CARB. HARDNESS AS CACO3	18
CALCULATED DISSOLVED SOLIDS	314.8	TOTAL HARDNESS AS CACO3	196
EVAPORATED SOLIDS AT 105 C		TOTAL ALKALINITY AS CACO3	178
SPECIFIC CONDUCTANCE IN		LANGLIER SATURATION INDEX	
MICROMHOS/CM AT 25 C	399.0	RYSNAR STABILITY INDEX	
SODIUM ADSORPTION RATIO	0.1	TECH. CORROSION INDEX	

ADDITIONAL PARAMETERS

TR IRON (FE) <.01

NOTE. PARAMETERS ARE TOTAL DISSOLVED UNLESS LABELED TR-TOTAL RECOVERABLE

DILUTE SPECIFIC CONDUCTANCE

MEAS DSC 0. CALC DSC 401.

ERROR DSC 0.0

PERCENT REACTANCE VALUES

CA	MG	NA	K	CL	SO4	HCO3	CO3	NO3
69	26	5	0	3	8	88	0	1

ANALYST JH

PROCESSING PROGRAM 72(REV3)

NOTE. IN CORRESPONDENCE RELATED TO THIS ANALYSIS REFER TO NUMBER 73 2104

STATE HEALTH DEPT. WATER QUALITY BUREAU HELENA, MONTANA 59601

STATE MONTANA COUNTY BEAVERHEAD
LAT.-LONG. 443824N 1123542W SAMPLE LOCATION 14S 8W 5DD
STATION CODE ANALYSIS NUMBER 76W0337
DATE SAMPLED 02-25-76 DRAINAGE BASIN 41A
TIME SAMPLED 1015 WATER FLOW RATE .
METHOD SAMPLED GRAB FLOW MEASUREMENT METHOD
SAMPLE SOURCE ALTITUDE OF LAND SURFACE
WATER USE DOMESTIC TOTAL WELL DEPTH BELOW LS
AQUIFER(S) SWL ABOVE(+) OR BELOW LS
SAMPLED BY WQBH SAMPLE DEPTH BELOW SURFACE

SAMPLING SITE: TOWN OF LIMA - TAP AT TOWN MTC BLDG

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	55.	2.752	BICARBONATE(HCO3)	211.	3.461
MAGNESIUM (MG)	14.2	1.165	CARBONATE (CO3)	0.	0.0
SODIUM (NA)	4.5	0.196	CHLORIDE (CL)	3.0	0.085
POTASSIUM (K)	1.3	0.033	SULFATE (SO4)	29.0	0.604
IRON (FE)			FLUORIDE (F)	.22	0.012
MANGANESE (MN)			NITRATE (NO3 AS N)		
ALUMINUM (AL)			NO3+NO2 (TOT AS N)	.41	0.029
			PHOSPHATE(PO4 AS P)		
TOTAL CATIONS		4.146	TOTAL ANIONS		4.190

LABORATORY PH	7.95	TOTAL HARDNESS AS CACO3	196
FIELD WATER TEMPERATURE (C)	4.5	TOTAL ALKALINITY AS CACO3	173
DISSOLVED SOLIDS CALCULATED	318.9	LAB TURBIDITY (JTU)	
LAB CONDUCTIVITY-UMHOS-25C	405.	SODIUM ADSORPTION RATIO	0.1

A D D I T I O N A L P A R A M E T E R S

LEAD, TOTAL (MG/L AS PB)	.003	CADMIUM,TOT (MG/L AS CD)	< 0.001
CHROMIUM,TOT(MG/L AS CR)	.001	MANGANESE, TOT (MG/L-MN)	< 0.01
IRON, TOTAL (MG/L AS FE)	.08	BARIUM,TOTAL(MG/L AS BA)	< 0.1
SILVER, TOT (MG/L AS AG)	.01	ARSENIC,TOT (MG/L AS AS)	< 0.001
SELENIUM,TOT(MG/L AS SE)	< 0.001	MERCURY,TOT (MG/L AS HG)	.0003

REMARKS: DRINKING WATER TOWN'S WATER SUPPLY IS SPRING

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

SAMPLE NO 010 SAMPLER RDB HANDLING 4201 ANALYST ME LAB WQBH
COMPLETED 04-09-76 COMPUTER RUN 04/16/76 PROGRAM SYS 75 FUND 0650

		CA	MG	NA	K	CL	SO4	HCO3	CO3	NO3
STND DEV. ION BALANCE 0.26										
SEGMENT	NPDES	66.4	28.1	4.7	0.8	2.0	14.6	83.4	0.0	0.0

76W0337

STATE HEALTH DEPT. WATER QUALITY BUREAU HELENA, MONTANA 59601

STATE	MONTANA	COUNTY	BEAVERHEAD
LAT-LONG	443324N 1123542W	SAMPLE LOCATION	14S 8W 5DD
STATION CODE		ANALYSIS NUMBER	76W2641
DATE SAMPLED	10-26-76	DRAINAGE BASIN	041A -RED ROCK R
TIME SAMPLED	1145	WATER FLOW RATE	
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE	SPRING	ALTITUDE OF LAND SURFACE	
WATER USE	DOMESTIC	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQB	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: OUTSIDE FAULET, TOWN SHOP, LIMA, MT

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	56.	2.804	BICARBONATE(HCO3)	209.	3.432
MAGNESIUM (MG)	14.8	1.221	CARBONATE (CO3)	0.	0.0
SODIUM (NA)	4.9	0.213	CHLORIDE (CL)	4.5	0.127
POTASSIUM (K)	1.0	0.026	SULFATE (SO4)	25.0	0.520
IRON (FE)			FLUORIDE (F)	.06	0.003
MANGANESE (MN)			PHOSPHATE(PO4 AS P)		
ALUMINUM (AL)			NO3+NO2 (TOT AS N)	.38	0.027
SUM CATIONS	76.930	4.263	SUM ANIONS	239.337	4.109

LABORATORY PH	8.00	TOT HARDNESS(MG/L-CACO3)	201
FIELD WATER TEMPERATURE (C)		TOT ALKALINITY(MG/L-CACO3)	172
SUM-DISS. IONS MEAS.(MG/L)	316.3	LABORATORY TURBIDITY (JTU)	
LAB CONDUCTIVITY-UMHOS-25C	403.0	SODIUM ADSORPTION RATIO	0.2

A D D I T I O N A L P A R A M E T E R S

SILVER, TOT (MG/L AS AG)	< 0.005	CADMIUM,TOT (MG/L AS CD)	< 0.001
SELENIUM,TOT(MG/L AS SE)	< 0.001	ARSENIC,TOT (MG/L AS AS)	< 0.001
CHROMIUM,TOT(MG/L AS CR)	< 0.005	LEAD, TOTAL (MG/L AS PB)	< 0.005
IRON, TOTAL (MG/L AS FE)	.16	MANGANESE, TOT (MG/L-MN)	< 0.01
BARIUM,TOTAL(MG/L AS BA)	0.1	MERCURY,TOT (MG/L AS HG)	< 0.0002

REMARKS: DRINKING WATER PROGRAM

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

SAMPLE NO 001 SAMPLER RDB HANDLING 4201 ANALYST MAD LAB WQBH
COMPLETED 11-30-76 COMPUTER RUN 12/03/76 DATA 0975/PROG 0876 FUND 0663

		CA	MG	NA	K	CL	SO4	HCO3	CO3	NO3
STND DEV. ION BALANCE -0.99										
SEGMENT NPDES		65.8	28.6	5.0	0.6	3.1	12.8	84.1	0.0	0.0
CALC. MEQ/L=	4.035 TO	4.460								

76W2641

ATE HEALTH DEPT.   WATER QUALITY BUREAU   HELENA, MONTANA 59601

STATE	MONTANA	COUNTY	BEAVERHEAD
LAT.-LONG.	443824N 1123542W	SAMPLE LOCATION	14S 8W 5DD
STATION CODE	0000276	ANALYSIS NUMBER	79W3103
DATE SAMPLED	12-20-79	DRAINAGE BASIN	041A -RED ROCK R
TIME SAMPLED	1130	WATER FLOW RATE	
ETHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE		ALTITUDE OF LAND SURFACE	
WATER USE	PUBLIC SPLY	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQBH	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: CITY SHOP - LIMA, MT

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	58.6	2.924	BICARBONATE(HCO3)	207.8	3.405
AGNESIUM (MG)	12.8	1.053	CARBONATE (CO3)	0.0	0.0
SODIUM (NA)	4.2	0.183	CHLORIDE (CL)	4.1	0.115
OTASSIUM (K)	1.4	0.035	SULFATE (SO4)	23.5	0.489
			FLUORIDE (F)	< .25	
			PHOSPHATE(PO4 AS P)		
			NO3+NO2 (TOT AS N)	0.37	0.026
SUM CATIONS	77.0	4.195	SUM ANIONS	235.7	4.036

LABORATORY PH	8.00	TOT HARDNESS(MG/L-CACO3)	199
IELD WATER TEMPERATURE (C)		TOT ALKALINITY(MG/L-CACO3)	170
SUM-DISS. IONS MEAS.(MG/L)	312.7	LABORATORY TURBIDITY (NTU)	
LAB CONDUCTIVITY-UMHOS-25C	397.2	SODIUM ADSORPTION RATIO	0.1

A D D I T I O N A L   P A R A M E T E R S

ARSENIC,TR (MG/L AS AS)	< .001	CADMIUM, TR (MG/L AS CD)	< .001
LEAD,TR (MG/L AS PB)	< .005	MERCURY, TR (MG/L AS HG)	< .0002
SELENIUM,TR (MG/L AS SE)	<.002	CHROMIUM,TR (MG/L AS CR)	< .005
SILVER, TR (MG/L AS AG)	<.005	IRON,TR (MG/L AS FE)	< .01
MANGANESE,TR(MG/L AS MN)	.005	BARIUM, TR (MG/L AS BA)	< 0.10

EMARKS: DRINKING WATER PROGRAM LIMA,TOWN OF % BLC LOCKYER-BOX G
LIMA,MT
XPLANATION: MG/L=MILLIGRAMS PER LITER MEQ/L=MILLIEQUIVILENTS PER LITER
LL CONSTITUENTS DISSOLVED (DISS) EXCEPT AS NOTED. TOT=TOTAL SUSP=SUSPENDED
M)= MEASURED(R)=REPORTED (E)=ESTIMATED M=METERS TR=TOTAL RECOVERABLE

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AMPLE NO   SAMPLER RR HANDLING   ANALYST CLW LAB WQBH
OMPLETED 03-10-80 COMPUTER RUN 03/20/80 DATA 0975/PROG 0876 FUND 6254

	CA	MG	NA	K	CL	SO4	HCO3	CO3	NO3
TND DEV. ION BALANCE -1.03									
EGMENT MPDES	69.7	25.1	4.4	0.8	2.9	12.2	84.9	0.0	0.0
ALC. MEQ/L= 4.028 TO	4.452								

79W3103

STATE HEALTH DEPT.   WATER QUALITY BUREAU   HELENA, MONTANA 59620

STATE	MONTANA	COUNTY	BEAVERHEAD
LAT.-LONG.		SAMPLE LOCATION	
STATION CODE	276	ANALYSIS NUMBER	83W0383
DATE SAMPLED	03-09-83	DRAINAGE BASIN	41A
TIME SAMPLED	1600	WATER FLOW RATE	
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE		ALTITUDE OF LAND SURFACE	
WATER USE	PUBLIC SPLY	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	WQBH	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: LIMA-TOWN SHOP

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	60.9	3.039	BICARBONATE(HCO3)	212.3	3.479
MAGNESIUM (MG)			CARBONATE (CO3)	0.0	0.0
SODIUM (NA)	4.6	0.200	CHLORIDE (CL)		
POTASSIUM (K)			SULFATE (SO4)		
			FLUORIDE (F)	0.22	0.012
			PHOSPHATE(PO4 AS P)		
			NO3+NO2 (TOT AS N)	0.40	0.029
SUM CATIONS	65.5	3.239	SUM ANIONS	212.9	3.519

LABORATORY PH	7.76	TOT HARDNESS(MG/L-CACO3)	
FIELD WATER TEMPERATURE (C)		TOT ALKALINITY(MG/L-CACO3)	174
SUM-DISS. IONS MEAS.(MG/L)		LABORATORY TURBIDITY (NTU)	
LAB CONDUCTIVITY-UMHOS-25C	399.0	SODIUM ADSORPTION RATIO	

A D D I T I O N A L   P A R A M E T E R S

ARSENIC,TR (MG/L AS AS)	< .001	CADMIUM, TR (MG/L AS CD)	< .001
LEAD,TR (MG/L AS PB)	< .005	MERCURY, TR (MG/L AS HG)	< .0002
SELENIUM,TR (MG/L AS SE)	< .002	CHROMIUM,TR (MG/L AS CR)	< .005
SILVER, TR (MG/L AS AG)	< .01		

REMARKS: DRINKING WATER PROGRAM LIMA,TOWN OF-C/O DON TYLER-LIMA 59739

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

- -

SAMPLE NO-   SAMPLER-JDM HANDLING-   ANALYST-JAH LAB-   SCAN-NO
COMPLETED-03/28/83 COMPUTER RUN-04/04/83 DATA-0383/PGM-0383 FUND-6254

	CA	MG	NA	K	CL	SO4	HCO3	CO3	NO3
STND DEV. ION BALANCE=									
NPDES-	93.8	0.0	6.2	0.0	0.0	0.0	100.0	0.0	0.0

CALC. MEQ/L=   3.961 TO   4.378   83W0383

STATE HEALTH DEPT. WATER QUALITY BUREAU HELENA, MONTANA 59620

STATE	MONTANA	COUNTY	BEAVERHEAD
LAT.-LONG.	443843N 1123609W	SAMPLE LOCATION	14S 8W 5
STATION CODE	0000276	ANALYSIS NUMBER	85W2487
DATE SAMPLED	11-06-85	DRAINAGE BASIN	041A -RED ROCK R
TIME SAMPLED	1200	WATER FLOW RATE	
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE		ALTITUDE OF LAND SURFACE	
WATER USE	PUBLIC SPLY	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	HWQB	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: POST OFFICE -LIMA

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	60.9	3.039	BICARBONATE(HCO3)	202.5	3.319
MAGNESIUM (MG)	13.3	1.094	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	4.6	0.200	CHLORIDE (CL)		
POTASSIUM (K)			SULFATE (SO4)	26	0.541
			FLUORIDE (F)	.24	0.013
			PHOSPHATE(PO4 AS P)		
			NO3+NO2 (TOT AS N)	.43	0.031
SUM CATIONS	78.8	4.333	SUM ANIONS	229.2	3.904

LABORATORY PH	7.33	TOT HARDNESS(MG/L-CACO3)	207
FIELD WATER TEMPERATURE (C)		TOT ALKALINITY(MG/L-CACO3)	166
SUM-DISS. IONS MEAS.(MG/L)		LABORATORY TURBIDITY (NTU)	
LAB CONDUCTIVITY-UMHOS-25C	398	SODIUM ADSORPTION RATIO	0.1

A D D I T I O N A L P A R A M E T E R S

ARSENIC,TR (MG/L AS AS)	<.001	CADMIUM, TR (MG/L AS CD)	<.001
LEAD,TR (MG/L AS PB)	<.005	MERCURY, TR (MG/L AS HG)	<.0002
SELENIUM,TR (MG/L AS SE)	<.002	CHROMIUM,TR (MG/L AS CR)	<.005
SILVER, TR (MG/L AS AG)	<.01	IRON,TR (MG/L AS FE)	<.01
MANGANESE,TR(MG/L AS MN)	<.005	BARIUM, TR (MG/L AS BA)	.01

REMARKS: DRINKING WATER PROGRAM LIMA,TOWN OF %TOWN CLERK LIMA,MT. 5
9739

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

- -

SAMPLE NO- SAMPLER- RR HANDLING- ANALYST- KK LAB- SCAN-NO
COMPLETED-12/05/85 COMPUTER RUN-01/02/86 DATA-0684/PGM-0984 FUND-

	CA	MG	NA	K	CL	SO4	HCO3	CO3	NO3
STND DEV. ION BALANCE=									
MPDES-	70.1	25.2	4.6	0.0	0.0	14.0	86.0	0.0	0.0

CALC. MEQ/L= 3.951 TO 4.367 85W2487

STATE HEALTH DEPT.   WATER QUALITY BUREAU   HELENA, MONTANA 59620

STATE	MONTANA	COUNTY	BEAVERHEAD
LAT.-LONG.		SAMPLE LOCATION	
STATION CODE	0000276	ANALYSIS NUMBER	89W1330
DATE SAMPLED	05-12-89	DRAINAGE BASIN	041A -RED ROCK R
TIME SAMPLED	0900	WATER FLOW RATE	
METHOD SAMPLED	GRAB	FLOW MEASUREMENT METHOD	
SAMPLE SOURCE		ALTITUDE OF LAND SURFACE	
WATER USE	PUBLIC SPLY	TOTAL WELL DEPTH BELOW LS	
AQUIFER(S)		SWL ABOVE(+) OR BELOW LS	
SAMPLED BY	HWQB	SAMPLE DEPTH BELOW SURFACE	

SAMPLING SITE: EXXON STATION - TOWN OF LIMA

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	60.5	3.019	BICARBONATE(HCO3)	202.5	3.319
MAGNESIUM (MG)	13.5	1.111	CARBONATE (CO3)	0.0	0.000
SODIUM (NA)	4.4	0.191	CHLORIDE (CL)		
POTASSIUM (K)			SULFATE (SO4)	24.1	0.502
			FLUORIDE (F)	.21	0.011
			PHOSPHATE(PO4 AS P)		
			NO3+NO2 (TOT AS N)	.49	0.035
SUM CATIONS	78.4	4.321	SUM ANIONS	227.3	3.867

LABORATORY PH	7.73	TOT HARDNESS(MG/L-CACO3)	207
FIELD WATER TEMPERATURE (C)		TOT ALKALINITY(MG/L-CACO3)	166
SUM-DISS. IONS MEAS.(MG/L)		LABORATORY TURBIDITY (NTU)	
LAB CONDUCTIVITY-UMHOS-25C	401	SODIUM ADSORPTION RATIO	0.1

ADDITIONAL PARAMETERS

ARSENIC,TR (MG/L AS AS)	<.001	CADMIUM, TR (MG/L AS CD)	<.001
LEAD,TR (MG/L AS PB)	<.005	MERCURY, TR (MG/L AS HG)	<.0002
SELENIUM,TR (MG/L AS SE)	<.001	CHROMIUM,TR (MG/L AS CR)	<.005
SILVER, TR (MG/L AS AG)	<.001	IRON,TR (MG/L AS FE)	.03
MANGANESE,TR(MG/L AS MN)	<.005	BARIUM, TR (MG/L AS BA)	.009

REMARKS: DRINKING WATER PROGRAM   TOWN OF LIMA BOX 184 LIMA, MT 59739   VOC REPORTED SEPARATELY RC#2507

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

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SAMPLE NO-   SAMPLER-SYS   HANDLING-   ANALYST-LAB   LAB-   SCAN-NO
COMPLETED-05/30/89   COMPUTER RUN-06/22/89   DATA-0684/PGM-0984   FUND-

STND DEV. ION BALANCE=		CA	MG	NA	K	CL	SO4	HCO3	CO3	NO3
MPDES-		69.9	25.7	4.4	0.0	0.0	13.1	86.9	0.0	0.0
CALC. MEQ/L=	3.982 TO	4.401								89W1330