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HYDROLOGIC CHARACTERISTICS

HIDDEN VALLEY MINE
AND
SURROUNDING AREAS

Soldier Creek Coal Company

HIDDEN VALLEY MINE

P.O. Box AS
Price, Utah 84501

HYDROLOGIC CHARACTERISTICS

HIDDEN VALLEY MINE

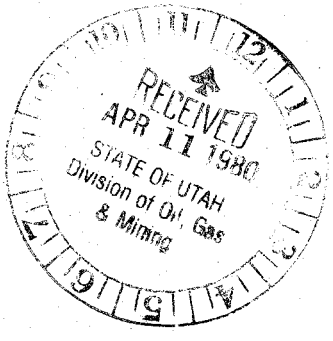
and

SURROUNDING AREAS

Submitted to the

State of Utah
Department of Natural Resources
Division of Oil, Gas and Mining
1588 West North Temple
Salt Lake City, Utah

April 1980



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HYDROLOGIC CHARACTERISTICS
HIDDEN VALLEY MINE AND SURROUNDING AREAS

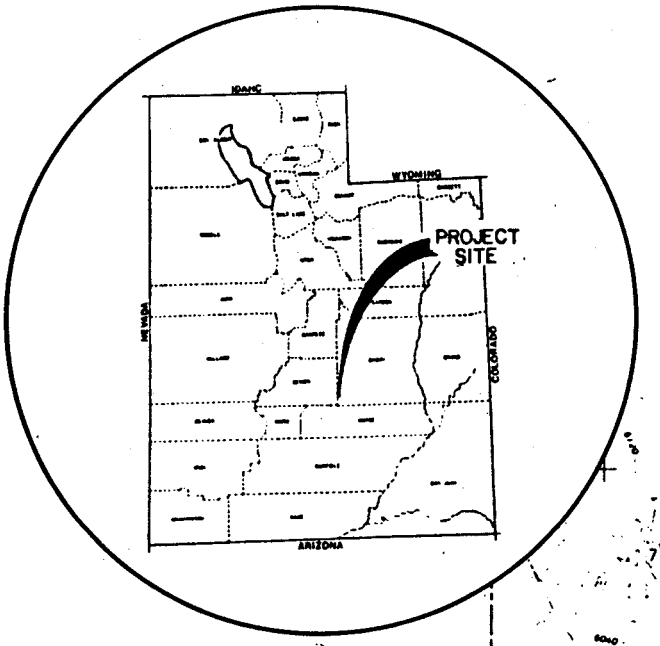
INTRODUCTION

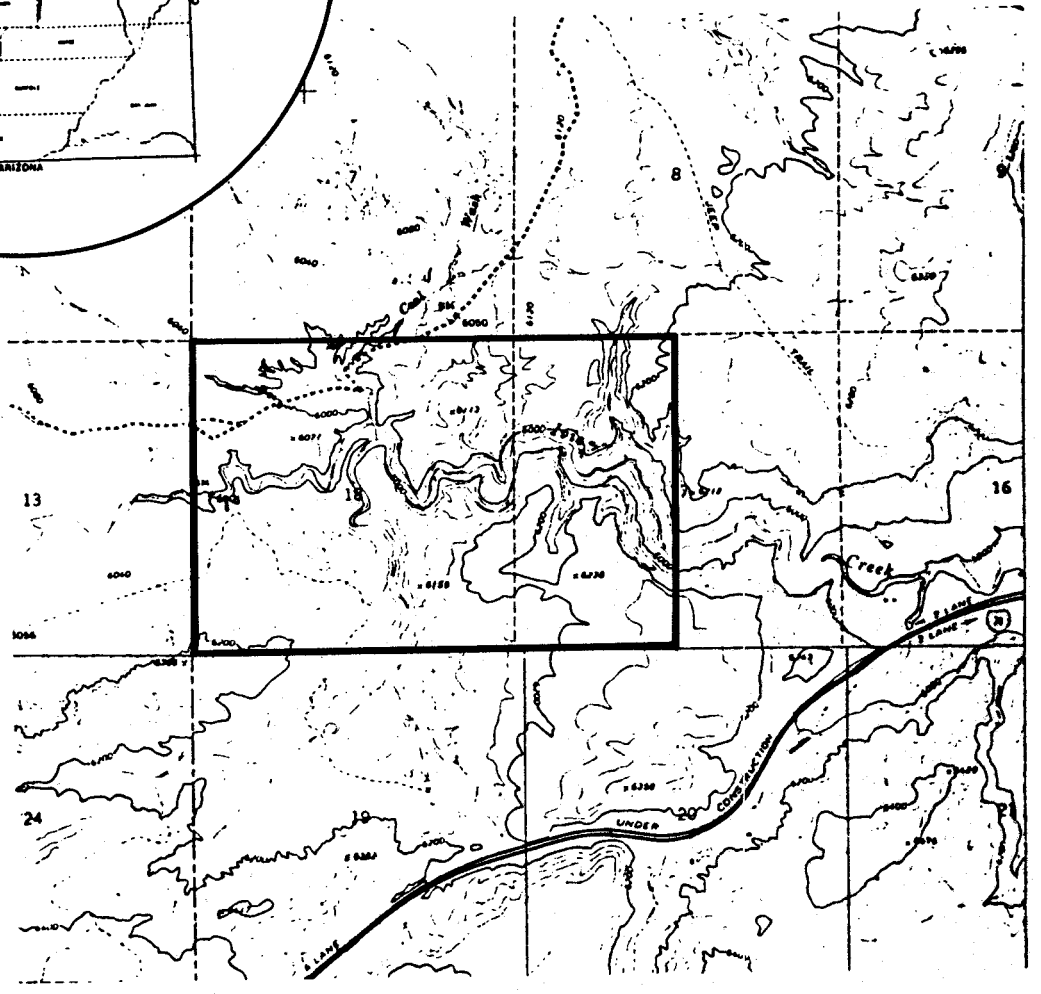
Recent regulations established by the U. S. Office of Surface Mining, Reclamation, and Enforcement (OSM), require the monitoring of all surface and groundwater systems which may be adversely effected by underground mining activities. Such monitoring programs should adequately describe the surface and groundwater quantity, quality, and hydrologic regime. The purpose of this program is to protect the hydrologic balance, both within the proposed mine plan area and in adjacent areas.

Hidden Valley Mine, which is located approximately seven miles southwest of Emery, Utah, (Figure 1), has been collecting baseline hydrological data since August 1978. The purpose of this report is to describe the hydrologic characteristics of the Hidden Valley Mine property and surrounding areas.

HIDDEN VALLEY MINE SITE

Township 23 South, Range 6 East
Salt Lake Base and Meridian
Section 18 & the West 1/2 of Section 17





mesa Butte
Walker Flat

REVISIONS		
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Soldier Creek Coal Company

HIDDEN VALLEY MINE

SCALE:	TITLE:	DRAWING NO.
NONE	HIDDEN VALLEY MINE LOCATION	A-005

Figure 1.
Page 2.

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SURFACE WATER HYDROLOGY

GENERAL GEOLOGY

Hidden Valley Mine is centrally located in the Emery coal field and is closely surrounded by the most productive part of this field. Structurally, the Emery coal field represents gentle northwest sloping beds on the flank of the San Rafael Swell. The regional inclination is towards the Wasatch Plateau. The strike of the beds is mainly northeast, but as they disappear under the volcanics at the south end of the field they are aligned nearly east to west. Faults are inconsequential over most of the area, except along the Joes Valley - Paradise fault which partially marks the west boundary of the coal field (Doelling, 1972).

The most important stratigraphic unit in the Emery coal field is the early Upper Cretaceous Ferron Sandstone Member of the Mancos Shale (Doelling, 1972). It is in the Ferron Sandstone Member that the major coal seams are found. It is also the major geologic formation exposed within the mine property.

DRAINAGE BASIN CHARACTERISTICS

The Hidden Valley Mine site is located within the 1590 square mile area which forms the Muddy Creek drainage basin. The largest stream in the area is Muddy Creek, with Quitchupah and Ivie Creeks being the only other streams of significant size. Muddy Creek flows southwest and converges with the Fremont River which then forms the Dirty

Devil River. The Dirty Devil River converges with the Colorado River in southeastern Utah.

The Muddy Creek drainage basin derives most of its runoff from snowmelt in mountainous areas, upstream from any area of significant use by man. Altitudes in headwaters of tributaries to Muddy Creek commonly range from 9,000 to 11,000 feet. Precipitation received for altitudes greater than 10,000 feet generally exceed 30 inches. Approximately 70 percent of this precipitation falls as snow from October thru April. Maximum snowmelt from mountainous areas usually occurs during May, but the downstream effects of this snowmelt are commonly minimal because of upstream diversions and storage (Mundorff, 1978).

GENERAL SURFACE WATER QUALITY

The chemical composition of natural water is derived from many different sources of solutes, including gases, and aerosols from the atmosphere, weathering, and erosion of rock and soil solution or precipitation reactions occurring below the land surface, and cultural effects resulting from activities of man (Hem, 1970).

According to Mundorff (1978), the most pronounced change in chemical characteristics of water in the Dirty Devil River basin occurs in a 15-mile reach of Muddy Creek between the major diversion 5 miles north of Emery and the point at which Highway I-70 crosses Muddy Creek. Dissolved solids concentrations at the diversion are generally less than 300 milligrams per liter and at the lower end of the reach are commonly greater than 2,000 milligrams per liter.

Factors that contribute to the deterioration in the chemical quality of water in the Emery area are the soluble

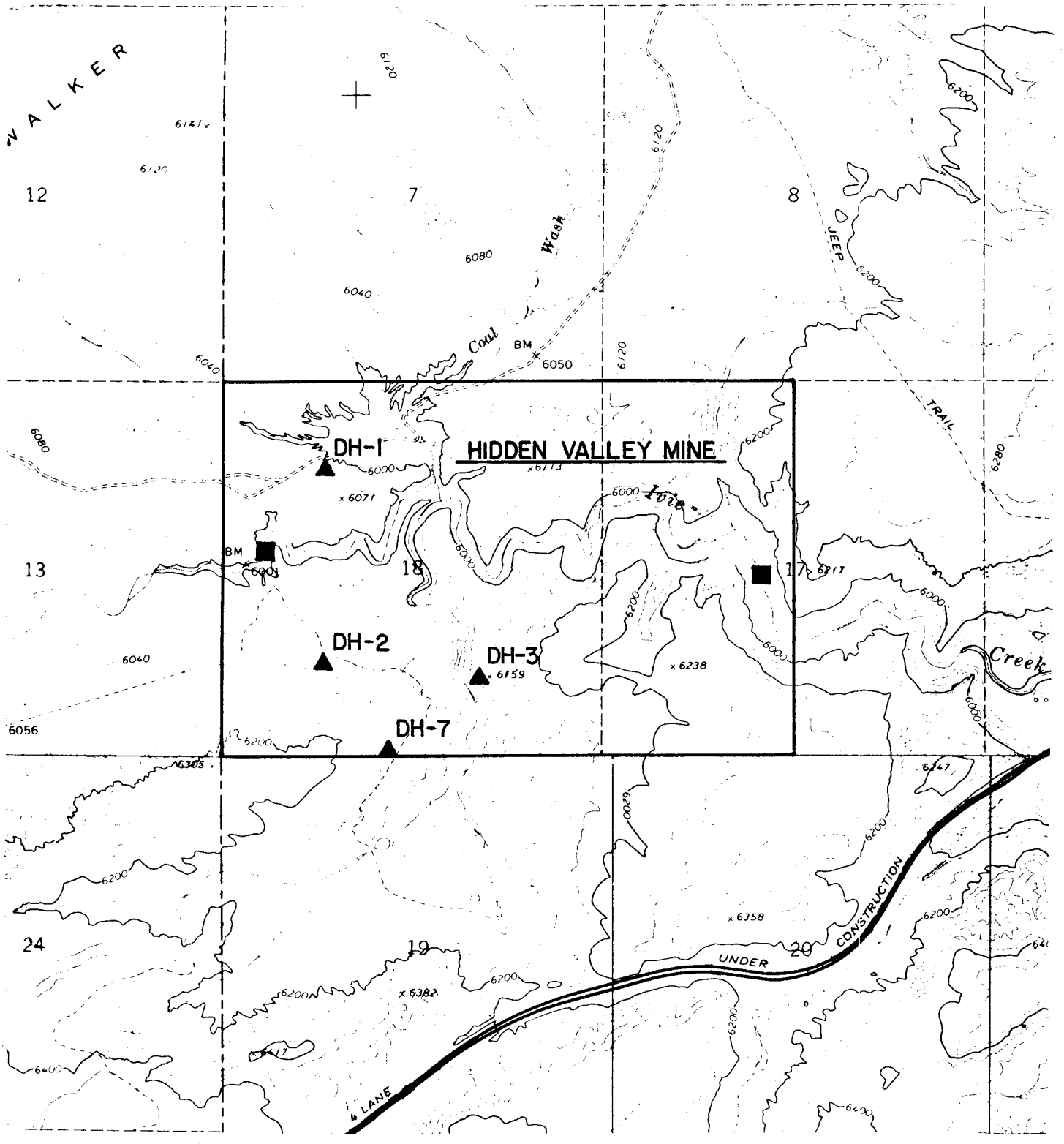
minerals in the rock of Cretaceous age that crop out in the area, the major or total diversions of flow, and the irrigation of and return flow from soils that have commonly developed on material derived from gypsum bearing marine shale (Mundorff, 1978).

The Emery Sandstone Member, Blue Gate Member, and Tununk Member of the Mancos Shale are all fine-grained marine deposits that contain soluble evaporite minerals. Irrigation of the soils developed on these rocks or on their weathered products probably result in irrigation return flow having high concentrations of calcium, sodium, and sulfate. Many of the soils in the Emery area are moderately to strongly saline, thus, runoff and return flow from such soils would be expected to have high concentrations of dissolved solids.

Even during flash floods and high water discharge resulting from intense thunderstorms, the chemical quality of the water does not necessarily improve. The high concentrations during the infrequent high discharges may result from the solution of large quantities of soluble salts, which are precipitated in drainage channels during long periods of low flow, and large amounts of salt efflorescence, which develops on saline and alkali soils. It is postulated that these soluble salts are dissolved during infrequent periods of intense runoff (Mundorff, 1978).

BASELINE MONITORING PROGRAM

With the exception of direct precipitation, Ivie Creek is the only naturally occurring source of surface water within the Hidden Valley Mine property. Initial monitoring of Ivie Creek began in November 1978. At present an ongoing



▲ - Groundwater monitoring station.
■ - Proposed surface water monitoring station.

Figure 2. Surface and groundwater monitoring stations.

surface water monitoring program is being conducted in accordance to the following parameters and frequencies:

Samples and measurements are being taken monthly near the east and west property boundaries, (Fig.2), providing there exists a measurable flow and the areas are accessible. Monthly and quarterly samples are being analyzed in accordance to the parameters listed in Table 1.

IVIE CREEK WATER QUALITY

Ivie Creek is a tributary to Muddy Creek within the area described by Mundorff (1978), as showing the most pronounced change in chemical characteristics in the Dirty Devil River basin. Total dissolved solids in this area commonly exceed the value of their headwaters by 2,000 mg/l.

The Utah Division of Health has classified Ivie Creek, below the crossing of Highway U-10, as 3C and 4. Class 3C is defined as protected for non-game fish and other aquatic life, including the necessary aquatic organisms in their food chain. Class 4 water is protected for agricultural uses including irrigation of crops and stock-watering. The numerical standards determined by the state for these classifications are presented as Appendix C.

Data collected during the baseline surface water monitoring program is presented as Appendix A. These analyses show that most parameters are well within the established numerical standards. Cadmium, copper, and dissolved iron occasionally exceed the Class 3C chemical standards. Boron and total dissolved solids consistantly

TABLE I

HIDDEN VALLEY MINE WATER MONITORING

SAMPLE PARAMETERS

Monthly Parameters

Acidity (when pH is less than 8.3)
Conductivity
Iron (Dissolved)
Iron (Total)
Manganese
Oil & Grease
Sulfate
Suspended Solids
Total Dissolved Solids
pH Units
Temperature (Air & Water)
Flow

Quarterly Parameters

Acidity (when pH is less than 8.3)
Arsenic
Barium
Bicarbonate
Boron
Cadmium
Calcium
Carbonate
Chloride
Chromium
Conductivity
Copper
Fluoride
Hardness
Iron (Dissolved)
Iron (Total)
Lead
Magnesium
Manganese
Mercury
Nickel
Nitrate
Oil & Grease
Potassium
Selenium
Silica
Silver
Sodium
Sulfate
Suspended Solids
Total Dissolved Solids
Turbidity NTU
Zinc
pH Units
Temperature (Air & Water)
Flow

exceed the Class 4 standards.

It is important to note that most of the state numerical standards are for dissolved constituents. Most parameters during the baseline monitoring period were analyzed on an as is basis. That is no special sample preparations were made to distinguish between total and dissolved constituents. Therefore, it is expected that the true dissolved values would be somewhat lower than the values obtained during the baseline period.

The most significant exceedance of the state chemical standards was total dissolved solids (TDS). The values determined varied from 700 mg/l to 6,400 mg/l. They were only under the determined limit of 1,200 mg/l during the spring runoff.

Other parameters for which the state has not established numerical standards and were found to be consistantly high were sodium, sulfate, and hardness.

High concentrations of sodium, sulfate, calcium, and consequently total dissolved solids can be attributed to the gypsum-bearing marine shales and fine-grained sediments of the Emery area (Mundorff, 1978). Soils developed from these formations usually contain an appreciable amount of soluble evaporite minerals.

In semiarid and arid regions soils usually are not fully leached and surplus solutes will accumulate (Hem, 1970). In the Emery area the runoff volume is relatively small in proportion to the supply of solutes. Also the natural leaching process is accelerated by the effects of irrigation. As a result, surface water in the Emery area tend to be comparatively high in dissolved solids.

IVIE CREEK FLOW CHARACTERISTICS

The U. S. Geological Survey operated a gaging station on Ivie Creek from 1950 to 1970. This gaging station was approximately eight miles southwest of Hidden Valley Mine. Daily flow records were kept until 1961, after which time only the maximum annual flows were recorded. The station was discontinued in 1970.

The average monthly flow distribution on Ivie Creek above the major diversions is presented in Figure 3. This is only a general representation of the actual flow encountered at Hidden Valley Mine due to the effects of irrigation, evapotranspiration, and seepage losses.

Monthly flow distributions across Hidden Valley Mine, when compared to those in Figure 3, are most significantly altered during the months of July, August, and September. Irrigation needs are greatest during these months, and the entire upstream flow may be diverted. Additional flow depletion also occurs from the effects of evapotranspiration.

Flows measured during the baseline surface water monitoring program varied from 0 to 970 gpm. The maximum flow recorded during the monitoring period occurred during the month of April 1979 (USGS, 1979). No surface water was encountered during the months of July, August, and September on the west property boundary. It was also evident that the stream channel was above the local water table in this area during these months.

The U. S. Geological Survey has determined the mean annual runoff for the upper Ivie Creek drainage to be 1.08 inches per year. Elevations within the drainage area monitored ranged from 7,000 to more than 9,000 feet. Annual precipitation in this area may be as much as 30 inches.

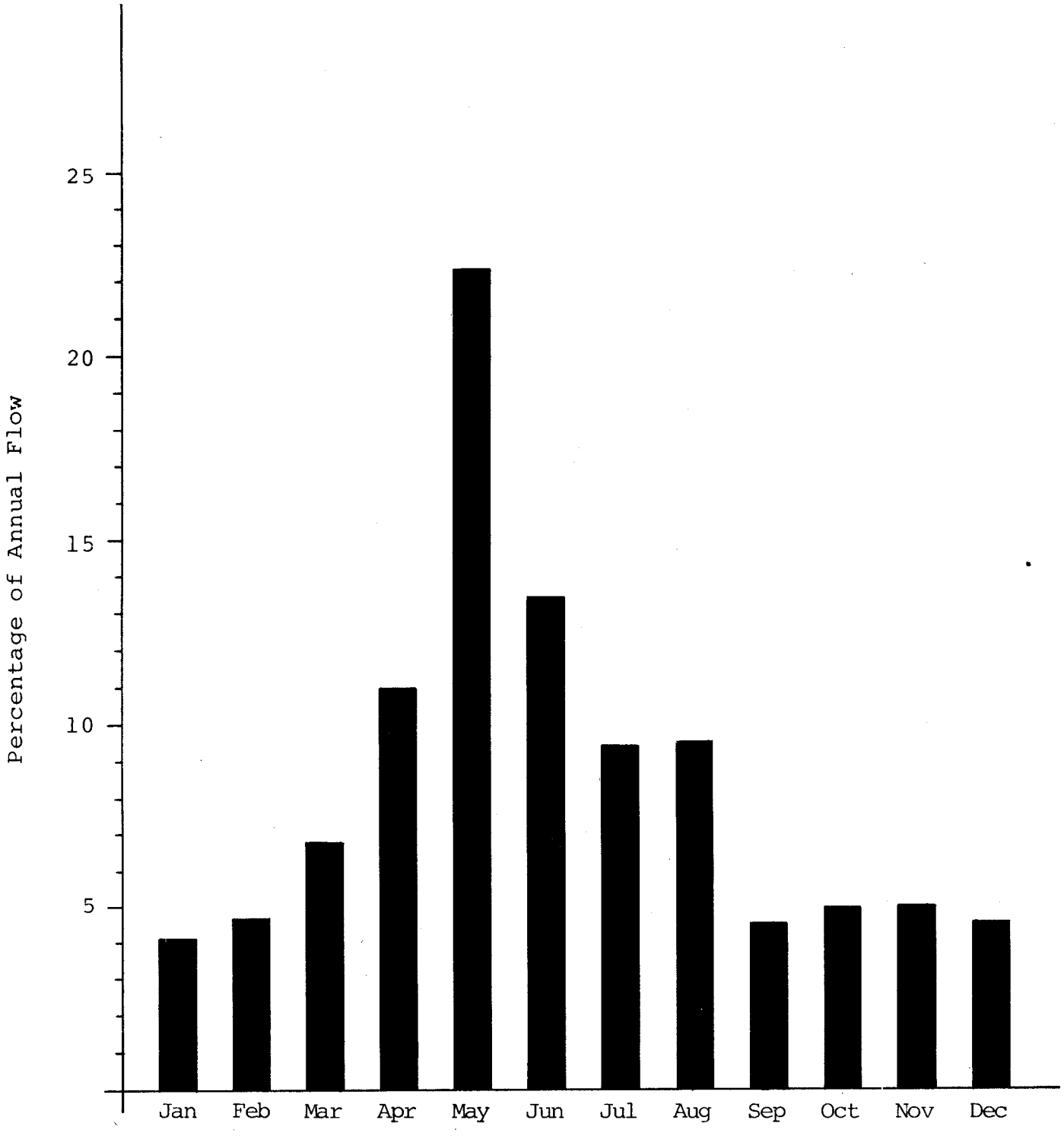


Figure 3. Average monthly flow distribution on Ivie Creek from 1951 thru 1961. (U.S. Geological Survey gaging station No. 09331500)

The average elevation at Hidden Valley Mine is approximately 6,000 feet with the mean annual precipitation being slightly more than seven inches per year. Therefore, it is speculated that the mean annual runoff for the mine property would be only a fraction of the 1.08 inches per year determined for upper Ivie Creek.

ANNUAL SEDIMENT YIELD

Most of the sediment discharge by streams in arid and semiarid regions is transported during short periods of time. The highest suspended sediment concentrations usually occur as a result of thunderstorms. Sediment concentrations and discharges may increase significantly during snowmelt runoff, but are relatively low when compared to the high-intensity runoff created by thunderstorms.

The natural sediment yields for Hidden Valley Mine property were estimated using the Universal Soil Loss Equation (U. S. Soil Conservation Service, 1976). The complete equation is:

$$A = RKLSCP$$

Where A is the computed soil loss (sheet and rill erosion) in tons per acre per year; R is the rainfall factor for a given geographical area; K is the soil erodibility factor; L is the slope-length factor; S is the slope-gradient factor; C is the cropping management factor; and P is the erosion control practice factor.

Values used to determine the average annual sediment yield were obtained from appropriate tables and soil interpretations furnished by the U. S. Soil Conservation Service (1976 and 1978). The values used in the Universal

Soil Loss Equation are as follows:

R = 15

K = 0.35

LS = 1.21

C = 0.24

P = 1.0

This results in a computed soil loss of 1.52 tons per acre per year. Assuming a sediment weight of 80 pounds per cubic foot, the total annual sediment yield from the Hidden Valley Mine property is estimated at 0.84 acre-feet per year.

PROPOSED OPERATIONAL SURFACE WATER MONITORING PROGRAM

Analysis of the water samples taken during the base-line monitoring program indicated no unusual or unexpected values for the parameters tested. Ivie Creek seems to be representative of the surface water found throughout the Emery area.

During the summer months no flow of surface water in Ivie Creek is commonly observed. Also during the winter months accurate flow measurements are impractical due to ice in the stream channel. It is speculated that any long-term changes within Ivie Creek can be adequately monitored on a biannual basis. Hidden Valley Mine, therefore, proposes the following operational surface water monitoring program:

Measurements and samples of Ivie Creek will be taken biannually, once in the spring and once in the fall. This is providing there exists a measurable flow. Sample stations will be located near the east and west property boundary (See Figure 2). Samples taken during

the fall will be analyzed in accordance to the parameters in Table 1, which were previously referred to as quarterly parameters. Samples taken in the spring will be analyzed in accordance to the parameters in Table 1, which were previously referred to as monthly parameters.

Any discharge of mine or surface water will be monitored in accordance to the frequency and parameters described by the required N.P.D.E.S. permit.

All results generated by an approved operational surface water monitoring program will be promptly reported to the appropriate state and federal agencies.

GROUNDWATER HYDROLOGY

GEOLOGY AND HYDROLOGY OF THE FERRON SANDSTONE MEMBER

Geology is the principal factor controlling the occurrence and availability of the groundwater. The Ferron Sandstone Member of the Mancos Shale is the most important water-bearing formation within the Emery area. It is also the only known water-bearing formation located within the Hidden Valley Mine site.

According to Doelling (1972), the Ferron Sandstone Member can be divided into two parts on the basis of lithology. The lower Ferron is a gray, fine-grained, carbonaceous, calcareous marine sandstone, and siltstone. The upper beds consist mainly of alternating thick to massive beds of tan, yellow-gray, mostly medium-grained sandstone, shaley sandstone of the same color and shale. The shales are clayey, silty, and carbonaceous. It is in the shaley division that the coal beds are usually found.

The Ferron Sandstone Member can also be divided hydrologically into the upper and lower Ferron (Morrissey, oral commun., 1979). These divisions correlate with the geologic division. The marine deposited sandstone of the lower Ferron are much more consistent and cleaner than those of the upper Ferron. These qualities enhance the water-bearing properties of the formation making it a better water carrier. Generally the depth of penetration into the Ferron Sandstone Member is directly proportional to the quality and quantity of groundwater.

The upper Ferron was a result of a decided change in sedimentation (Doelling, 1972). Its deposition was the result of an influx of flood plain and swamp type sediments ranging from 0-500 feet thick. These characteristics make the upper Ferron a less desirable aquifer than the lower Ferron. It is within the upper Ferron Member that groundwater encountered at Hidden Valley Mine is believed to originate.

Groundwater recharge for the Ferron Member is believed to enter along the fault zone which parallels the Wasatch Plateau. Water entering the Ferron at this point seems to be part of another hydrological system which is not clearly understood at this time. However, it is postulated that the ultimate source of water is the Wasatch Plateau (Morrissey, oral commun., 1979).

SPRINGS AND SEEPS

Ivie Creek which runs west to east, generally bisects the Hidden Valley Mine property. It has formed a substantial canyon through the Ferron Sandstone Member. The topographic relief near the eastern property boundary is in excess of 350 feet. The general structure of the Ferron in this area is uniform with a dip of approximately 3° to the northwest.

All mineable coal seams present at Hidden Valley Mine outcrop within the Ivie Creek Canyon. Therefore, the overlying strata and subsequently any regional overlying aquifers would also outcrop within the canyon.

There are no existing springs on the property, but several seeps along the stream channel have been identified. It is evident during periods of low flow that the majority of these seeps are nothing more than the surfacing of water

already present in the stream channel. This is due to the alluvial deposits on the west property boundary which thin and eventually disappear as Ivie Creek continues through the Ferron Sandstone Member.

The number of seeps which are believed to be the direct inflow from water-bearing formations is very minimal. There is no significant inflow to Ivie Creek from these formations. Usually the only physical evidence indicating a seep is the isolated stand of riparian vegetation it supports.

It is important to note that a majority of the seeps encountered were within the eastern half of the mine property. Supported by drill hole data, it is speculated that the aquifers encountered have reached their eastern boundary near the central portion of our property.

BASELINE MONITORING PROGRAM

There are seven exploratory drill holes located within the Hidden Valley Mine property. Four of which have flowed or are currently flowing under artesian pressure (see Fig. 2). These four drill holes (DH - 1, 2, 3, and 7) have been cased and permission has been granted by the Utah Division of Water Rights to develop these wells. The other three exploratory drill holes did not intersect any water-bearing formations.

At present an ongoing groundwater monitoring program is being conducted in accordance to the following parameters and frequencies:

All flowing wells, when accessible are being measured monthly for flow and quality. Monthly and quarterly samples are being analyzed in accordance to the parameters listed in Table 1.

All non-flowing wells which have intersected the groundwater system are being measured to determine the water elevation twice a year, once in the fall and once in the spring.

WATER QUALITY

The summarized analyses results collected during the baseline monitoring program are presented as Appendix B. With the exception of maximum total coliforms, all parameters are within the 1A numerical standards set by the state (Appendix C). Class 1A is defined as protected for use as a raw water source for domestic water systems without treatment.

Coliform bacteria have long been used as indicators of sewage pollution, although the group includes bacteria from diverse natural sources. If a water sample contains an appreciable coliform count, the source of the sample is considered to have a disease-producing potential. The maximum total coliforms allowed by the state for Class 1A water is 1 per 100 ml. The results of the bacteriological examination showed less than 2.2 coliforms per 100 ml. This is an insignificant amount, but may require some disinfection for domestic use.

Values of total and dissolved iron obtained from drill holes 1 and 7 are somewhat higher than those values obtained from drill hole 3. It is speculated that the higher values of iron are due to corrosion of the iron casing within the well. The higher flows encountered at drill hole 3 more adequately flush the system prior to sampling. Therefore, the actual iron content of the groundwater is believed to be best represented by drill hole 3.

PROPOSED OPERATIONAL GROUNDWATER MONITORING PROGRAM

The movement of groundwater in an aquifer is usually slow enough that changes in quality with time are satisfactorily shown by samples taken annually. This is because there is a considerable time span available for the completion of slow chemical reactions. Presumably, any reaction that reasonably could be expected to reach equilibrium would do so in the usual aquifer system (Hem, 1970).

It is evident from the analyses results, presented in Appendix B, that the groundwater quality is consistent. Most of the parameters tested for showed little more than insignificant changes during the baseline monitoring program. Therefore, Hidden Valley Mine proposes the following operational groundwater monitoring program:

All drill holes shown in Figure 2 which are producing measurable flows, will be sampled once a year during the fall. Analysis of the samples will be in accordance to the parameters in Table 1, which were previously referred to as quarterly parameters. Non-flowing drill holes will be measured once a year, to determine the groundwater elevation. Measurements will be made during the fall.

Exploritory drill hole data indicates that underground mining operations may encounter groundwater within the western half of the property. Initial mining operations will be confined to the eastern portions of the property. Therefore, it is speculated that groundwater will be encountered only after several years of development. If groundwater is encountered it is proposed that

any discharge of mine water will be monitored in accordance to the frequency and parameters described by the required N.P.D.E.S. permit.

All results generated by an approved operational groundwater monitoring program will be promptly reported to the appropriate state and federal agencies.

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APPENDIX A

SURFACE WATER ANALYSES

All sample analysis was performed by Ford Chemical Laboratory, Inc., Salt Lake City, Utah.

The east property boundary is not accessible during the winter months. The west property boundary commonly has no flow during the summer months.

The proposed hydrologic monitoring guidelines were received from the state in a letter dated May 30, 1979. Sample frequencies and parameters may vary prior to this date.

HIDDEN VALLEY MINE - BASELINE WATER MONITORING

IVIE CREEK - EAST PROPERTY BOUNDARY

ANALYSIS SUMMARY

Date	Nov. 3-78	May 6-79	May 29-79	July 6-79	Aug. 2-79	Sept. 11-79	Oct. 1-79	Nov. 1-79	Nov. 28-79
Acidity as CaCO3 mg/l	*	20.0	18.0	*	2.5	10.0	4.5	4.0	18.0
Conductivity umhos/cm	6,650	*	990	3,250	3,850	4,300	4,500	3,600	4,500
Iron as Fe Dissolved mg/l	*	0.529	2.560	0.300	0.340	0.190	0.170	0.188	0.200
Iron as Fe (Tot) mg/l	0.241	8.330	20.600	0.310	0.370	0.210	0.210	0.230	2.450
Manganese Mn (Tot) mg/l	0.083	0.158	0.236	0.022	0.014	0.017	0.009	0.018	0.095
Oil and Grease mg/l	2.4	<1.0	<1.0	<1.0	1.8	1.4	<1.0	1.2	<1.0
Sulfate as SO4 mg/l	2,700	*	260	1,180	1,190	1,160	1,719	1,800	400
Suspended Solids mg/l	13.0	262	572	*	7.0	8.0	4.0	10.0	70.0
Total Dissolved Solids mg/l	4,310	3,100	705	2,100	2,500	2,800	2,950	3,100	2,950
pH Units	8.06	7.65	7.29	7.93	8.24	7.90	7.90	8.00	7.80
Temperature	*	*	*	78°F	80°F	68°F	64°F	34°F	30°F
Flow	*	*	*	62gpm	3gpm	66gpm	114gpm	316gpm	246gpm

*Not available.

ADDITIONAL QUARTERLY PARAMETERS

IVIE CREEK - EAST PROPERTY BOUNDARY

Date	Nov. 3-78	July 6-79	Oct. 1-79
Arsenic as As mg/l	0.001	0.002	0.001
Barium as Ba mg/l	0.030	0.020	0.030
Bicarbonate as HCO3 mg/l	358.68	314.76	285.48
Boron as B mg/l	0.850	0.620	0.150
Cadmium as Cd mg/l	<0.001	<0.001	<0.001
Calcium as Ca mg/l	288.0	136.0	496.00
Carbonate as CO3 mg/l	<0.01	4.80	<0.01
Chloride as Cl mg/l	200.0	116.0	144.0
Chromium as Cr mg/l	<0.001	<0.001	0.002
Copper as Cu mg/l	0.020	0.009	0.007
Fluoride as F mg/l	0.36	0.61	0.56
Hardness as CaCO3 mg/l	2,150	752	1,260
Lead as Pb mg/l	0.036	<0.001	<0.001
Magnesium as Mg mg/l	343.2	98.88	4.80
Mercury as Hg mg/l	<.0002	<.0002	<.0002
Nickel as Ni mg/l	0.059	0.035	0.010
Nitrate as NO3-N mg/l	<0.02	<0.01	<0.01
Potassium as K mg/l	10.75	7.49	7.35
Selenium as Se mg/l	<0.001	0.003	0.001
Silica as SiO2 mg/l	9.75	8.00	6.45
Silver as Ag mg/l	0.004	0.004	0.003
Sodium as Na mg/l	587.0	410.0	444.00
Turbidity NTU	6.0	5.50	4.50
Zinc as Zn mg/l	0.017	0.006	0.012

HIDDEN VALLEY MINE - BASELINE WATER MONITORING

IVIE CREEK - WEST PROPERTY BOUNDARY

ANALYSIS SUMMARY

Date	Nov. 3-78	May 6-79	May 29-79	Oct. 1-79	Nov. 1-79	Nov. 28-79	Dec. 27-79	Feb. 1-80
Acidity as CaCO3 mg/l	*	30.0	6.0	6.0	12.0	32.0	66.0	14.0
Conductivity umhos/cm	7,610	*	1,000	8,850	4,600	3,700	9,800	2,500
Iron as Fe Dissolved mg/l	*	0.072	2.490	0.120	0.120	0.650	0.210	0.139
Iron as Fe (Tot) mg/l	0.500	24.000	14.100	0.160	0.200	6.850	0.420	0.250
Manganese Mn (Tot) mg/l	0.088	0.438	0.187	0.008	0.020	0.510	0.107	0.035
Oil and Grease mg/l	6.6	<1.0	<1.0	<1.0	1.6	<1.0	0.8	2.5
Sulfate as SO4 mg/l	3,160	*	300	3,500	1,158	1,265	3,700	1,120
Suspended Solids mg/l	41.0	1,052	528	9.0	20.0	152	35.0	91.5
Total Dissolved Solids mg/l	4,950	3,500	700	5,790	4,100	2,400	6,400	1,630
pH Units	8.06	7.72	7.52	7.80	7.80	7.60	7.80	7.95
Temperature	*	*	*	61°F	37°F	30°F	*	40°F
Flow	*	*	*	87gpm	335gpm	**	**	**

* Not available.
** Inaccessible for flow due to ice.

HIDDEN VALLEY MINE - BASELINE WATER MONITORING

IVIE CREEK - WEST PROPERTY BOUNDARY

ANALYSIS SUMMARY

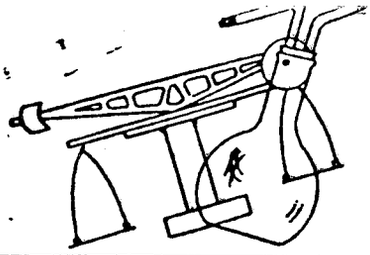
Date	Mar. 2-80
Acidity as CaCO3 mg/l	20.0
Conductivity umhos/cm	1,400
Iron as Fe Dissolved mg/l	.150
Iron as Fe (Tot) mg/l	.265
Manganese Mn (Tot) mg/l	.030
Oil and Grease mg/l	3.40
Sulfate as SO4 mg/l	900
Suspended Solids mg/l	1,080
Total Dissolved Solids mg/l	910
pH Units	7.60
Temperature	$40^{O}F$
Flow	**

**Inaccessible for flow due to ice.

ADDITIONAL QUARTERLY PARAMETERS

IVIE CREEK - WEST PROPERTY BOUNDARY

Date	Nov. 3-78	Oct. 1-79	Dec. 27-79
Arsenic as As mg/l	0.002	0.003	<0.001
Barium as Ba mg/l	0.070	0.030	0.030
Bicarbonate as HCO3 mg/l	358.68	292.80	519.72
Boron as B mg/l	0.980	1.000	1.400
Cadmium as Cd mg/l	0.005	<0.001	<0.001
Calcium as Ca mg/l	340.0	1,128.0	412.0
Carbonate as CO3 mg/l	<0.01	<0.01	<0.01
Chloride as Cl mg/l	238.0	304.0	386.0
Chromium as Cr mg/l	<0.001	0.001	<0.001
Copper as Cu mg/l	0.022	0.018	0.025
Fluoride as F mg/l	0.27	0.28	0.31
Hardness as CaCO3 mg/l	2,650	2,950	3,290
Lead as Pb mg/l	0.046	<0.001	<0.001
Magnesium as Mg mg/l	432.0	31.20	108.48
Mercury as Hg mg/l	<0.0002	<0.0002	<0.0002
Nickel as Ni mg/l	0.203	0.014	0.077
Nitrate as NO3-N mg/l	0.03	<0.01	0.16
Potassium as K mg/l	13.21	11.90	14.40
Selenium as Se mg/l	<0.001	<0.001	<0.001
Silica as SiO2 mg/l	8.75	4.10	13.50
Silver as Ag mg/l	0.007	0.004	0.002
Sodium as Na mg/l	586.0	646.0	1,510.00
Turbidity NTU	55.0	3.90	5.0
Zinc as Zn mg/l	0.019	0.020	0.042



Ford Chemical LABORATORY

Bacteriological and Chemical Analysis

40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
485-5761

WATER SAMPLE FOR BACTERIOLOGIC EXAMINATION

Lab No. 4649
Name Hidden Valley Mine
Address
Date of Collection 10/31/78 Time
Send Report To
Sample Collected By

TO BE FILLED OUT BY SAMPLER

Sample collected from	Name
Check one: ☐ Waterworks System	
☐ Stream	
☐ Other, Describe Private Well, etc.	
Exact Description of Sampling Point	West Boundary
County	

Unchlorinated ☐ Chlorinated ☐
Residual ppm

Volume ml.	Presumptive 24	Presumptive 48	Confirmed (BGL BB) 24	Confirmed (BGL BB) 48	Confirmed (BGL BB) 24	Confirmed (BGL BB) 48	Confirmed (BGL BB) T	Fecal @ 44.5° C. 24	Fecal @ 44.5° C. 48	Fecal @ 44.5° C. 24	Fecal @ 44.5° C. 48	Fecal @ 44.5° C. T
10.0	/5	/5	/	/	/	/	/5	/	/	/	/	/5
1.0	1/5	4/5	1/1	/	4/4	/	5/5	0/1	/	0/4	/	0/5
10 -1	0/5	4/5	/	/	3/4	1/1	4/5	/	/	0/4	/	0/5
0 -2	0/5	2/5	/	/	0/2	0/2	0/5	/	/	0/2	/	0/5
10 -3	0/5	0/5	/	/	/	/	0/5	/	/	/	/	0/5
10 -4	0/5	0/5	/	/	/	/	0/5	/	/	/	/	0/5

MPN Coliform Results 1,300 /100 ml. MPN Fecal Results < 20 /100ml.

Volume ml.		10	10	10	10	10
Presumptive	24 hr.					
	48 hr.					
Confirmed	24 hr.					
	48 hr.					

SATISFACTORY ☐ MPN Coliform
UNSATISFACTORY ☐ Results in 10 ml. volume /100ml.

M.F. Ml. Sample ml Colonies Coliform /100 ml.
Plate Count /ml.

Examine For

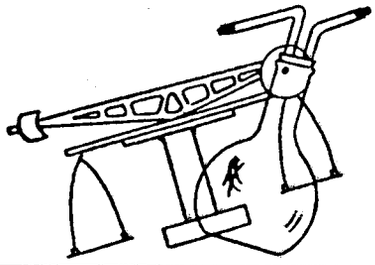
☐ Coliforms in 10 ml Portions ☐ Fecal Coliform in 10 ml Portion
☑ MPN Coliforms per 100 ml ☑ MPN Fecal Coliforms per 100 ml
☐ Membrane Filter (MF) ☐ Plate Count-24 hrs. @ 35°C.

Date Received 11/3/78

Date Reported 11/7

Dyke Ford
Ford Chemical Lab.

Form #7A



Ford Chemical LABORATORY

Bacteriological and Chemical Analysis

40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
485-5761

WATER SAMPLE FOR BACTERIOLOGIC EXAMINATION

Lab No. 4648
Name Hidden Valley Mine
Address
Date of Collection 10/31/78 Time
Send Report To
Sample Collected By

TO BE FILLED OUT BY SAMPLER

Sample collected from	Name
Check one: ☐ Waterworks System	
☐ Stream	
☐ Other, Describe Private Well, etc.	
Exact Description of Sampling Point	East Boundary
County	

Unchlorinated ☐ Chlorinated ☐
Residual ppm

Volume ml.	Presumptive 24	Presumptive 48	Confirmed (BGL BB) 24	Confirmed (BGL BB) 48	Confirmed (BGL BB) 24	Confirmed (BGL BB) 48	Confirmed (BGL BB) T	Fecal @ 44.5° C. 24	Fecal @ 44.5° C. 48	Fecal @ 44.5° C. 24	Fecal @ 44.5° C. 48	Fecal @ 44.5° C. T
10.0	/5	/5	/	/	/	/	/5	/	/	/	/	/5
1.0	2/5	3/5	2/2	/	3/3	/	5/5	0/2	/	0/3	/	0/5
10 -1	0/5	2/5	/	/	1/2	1/1	2/5	/	/	0/2	/	0/5
1 -2	0/5	1/5	/	/	0/1	0/1	0/5	/	/	0/1	/	0/5
1 -3	0/5	0/5	/	/	/	/	0/5	/	/	/	/	0/5
10 -4	0/5	0/5	/	/	/	/	0/5	/	/	/	/	0/5

MPN Coliform Results 490 /100 ml. MPN Fecal Results < 20 /100ml.

Volume ml.		10	10	10	10	10
Presumptive	24 hr.					
	48 hr.					
Confirmed	24 hr.					
	48 hr.					

SATISFACTORY ☐ MPN Coliform
UNSATISFACTORY ☐ Results in 10 ml. volume /100ml.

M.F. Ml. Sample ml Colonies Coliform /100 ml.
Plate Count /ml.

Examine For

☐ Coliforms in 10 ml Portions ☐ Fecal Coliform in 10 ml Portion
☑ MPN Coliforms per 100 ml ☑ MPN Fecal Coliforms per 100 ml
☐ Membrane Filter (MF) ☐ Plate Count-24 hrs. @ 35°C.

Date Received 11/3/78

Date Reported 11/7

Dyke Ford
Ford Chemical Lab.

Form #7A

APPENDIX B

GROUNDWATER ANALYSES

All sample analysis was performed by Ford Chemical Laboratory, Inc., Salt Lake City, Utah.

Drill holes are winterized and not accessible for samples during months of potential freezing temperatures.

The proposed hydrologic monitoring guidelines were received from the state in a letter dated May 30, 1979. Sample frequencies and parameters may vary prior to this date.

HIDDEN VALLEY MINE BASELINE WATER MONITORING

GROUNDWATER - DH-1

ANALYSIS SUMMARY

Date	Aug. 14-78	July 6-79	Aug. 2-79	Sept. 11-79	Oct. 1-79	Nov. 1-79
Acidity as CaCO3 mg/l	*	*	22.0	28.0	4.2	8.0
Conductivity umhos/cm	985.0	950.0	1,150	1,200	930	850
Iron as Fe Dissolved mg/l	*	1.750	2.040	2.460	2.630	1.550
Iron as Fe (Tot) mg/l	0.104	4.030	2.860	4.100	4.460	3.610
Manganese Mn (Tot) mg/l	0.035	0.021	0.039	0.041	0.041	0.045
Oil and Grease mg/l	*	<1.0	<1.0	1.4	<1.0	13.4
Sulfate as SO4 mg/l	250.0	239.0	240.0	232.0	232.0	248.0
Suspended Solids mg/l	*	*	220	639	14.0	10.0
Total Dissolved Solids mg/l	640.0	610.0	750.0	780.0	615.0	750.0
pH Units	7.51	7.50	7.94	7.80	7.70	7.60
Temperature	*	59°F	60°F	59°F	58°F	59°F
Flow	*	10.7gpm	20.5gpm	18.8gpm	16.7gpm	17.6gpm

*Not Available.

ADDITIONAL QUARTERLY PARAMETERS

GROUNDWATER DH-1

Date	Aug. 14-78	July 6-79	Oct. 1-79
Arsenic as As mg/l	<0.001	0.004	<0.001
Barium as Ba mg/l	0.05	0.03	0.05
Bicarbonate as HCO3 mg/l	273.28	297.68	285.48
Boron as B mg/l	0.27	0.200	0.850
Cadmium as Cd mg/l	<0.001	<0.001	<0.001
Calcium as Ca mg/l	27.2	29.6	49.6
Carbonate as CO3 mg/l	<0.01	<0.01	<0.01
Chloride as Cl mg/l	24.0	12.0	12.0
Chromium as Cr mg/l	<0.001	<0.001	0.002
Copper as Cu mg/l	0.003	0.003	<0.001
Fluoride as F mg/l	0.60	0.48	0.66
Hardness as CaCO3 mg/l	136.0	140.0	138.0
Lead as Pb mg/l	0.004	0.002	<0.001
Magnesium as Mg mg/l	16.32	15.84	3.36
Mercury as Hg mg/l	<0.0002	<0.0002	<0.0002
Nickel as Ni mg/l	<0.001	<0.001	<0.001
Nitrate as NO3-N mg/l	0.04	<0.01	0.02
Potassium as K mg/l	5.70	5.13	4.26
Selenium as Se mg/l	<0.001	<0.001	0.001
Silica as SiO2 mg/l	2.50	12.50	15.00
Silver as Ag mg/l	<0.001	<0.001	0.002
Sodium as Na mg/l	180.0	166.0	160.0
Turbidity NTU	6.50	35.50	2.60
Zinc as Zn mg/l	0.056	0.009	0.014

HIDEEN VALLEY MINE BASELINE WATER MONITORING

GROUNDWATER DH-3

ANALYSIS SUMMARY

Date	Aug. 14-78	May 29-79	July 6-79	Aug. 2-79	Sept. 11-79	Oct. 1-79	Nov. 1-79
Acidity as CaCO3 mg/l	*	8.0	*	10.0	26.0	<0.1	8.0
Conductivity umhos/cm	950	1,000	950	1,160	1,290	930	880
Iron as Fe Dissolved mg/l	*	0.140	0.230	0.310	0.150	0.160	0.164
Iron as Fe (Tot) mg/l	0.149	0.320	0.240	0.720	0.170	0.200	0.181
Manganese Mn (Tot) mg/l	0.028	0.010	0.005	0.016	0.009	0.005	0.010
Oil and Grease mg/l	*	<1.0	<1.0	<1.0	1.6	<1.0	0.2
Sulfate as SO4 mg/l	259.0	180.0	243.0	251.0	243.0	246.0	300.0
Suspended Solids mg/l	*	4.0	*	14.0	6.0	2.0	3.0
Total Dissolved Solids mg/l	615.0	698.0	620.0	754.0	840.0	610.0	780.0
pH Units	7.86	7.58	7.65	7.61	7.70	8.00	7.80
Temperature	*	*	59°F	60°F	61°F	60°F	60°F
Flow	*	*	60gpm	62gpm	60gpm	60gpm	60gpm

*Not Available.

ADDITIONAL QUARTERLY PARAMETERS

GROUNDWATER - DH-3

Date	Aug. 14-78	July 6-79	Oct. 1-79
Arsenic as As mg/l	<0.001	<0.001	<0.001
Barium as Ba mg/l	0.03	<0.01	0.02
Bicarbonate as HCO3 mg/l	246.44	300.12	275.72
Boron as B mg/l	0.26	0.18	0.654
Cadmium as Cd mg/l	<0.001	<0.001	<0.001
Calcium as Ca mg/l	32.80	34.40	56.00
Carbonate as CO3 mg/l	<0.01	<0.01	<0.01
Chloride as Cl mg/l	18.0	10.0	12.0
Chromium as Cr mg/l	<0.001	<0.001	<0.001
Copper as Cu mg/l	0.008	0.002	0.002
Fluoride as F mg/l	0.25	0.61	0.67
Hardness as CaCO3 mg/l	152.0	150.0	154.0
Lead as Pb mg/l	0.003	<0.001	<0.001
Magnesium as Mg mg/l	16.8	15.36	3.36
Mercury as Hg mg/l	<0.0002	<0.0002	<0.0002
Nickel as Ni mg/l	<0.001	<0.001	<0.001
Nitrate as NO3-N mg/l	0.05	<0.01	0.96
Potassium as K mg/l	3.52	3.84	3.66
Selenium as Se mg/l	0.001	<0.001	0.001
Silica as SiO2 mg/l	4.20	13.00	16.50
Silver as Ag mg/l	<0.001	<0.001	0.002
Sodium as Na mg/l	161.0	162.0	159.0
Turbidity NTU	0.5	5.5	5.8
Zinc as Zn mg/l	0.057	0.003	0.006

HIDDEN VALLEY MINE BASELINE WATER MONITORING

GROUNDWATER - DH-7

ANALYSIS SUMMARY

Date	May 29-79	July 6-79	Aug. 2-79	Sept. 11-79	Oct. 1-79	Nov. 1-79
Acidity as CaCO3 mg/l	*	*	*	<1.0	<1.0	<1.0
Conductivity umhos/cm	1,000	1,000	1,300	1,210	940	850
Iron as Fe Dissolved mg/l	0.100	1.820	1.110	1.780	1.620	1.100
Iron as Fe (Tot) mg/l	0.100	1.870	1.230	1.640	1.520	1.520
Manganese Mn (Tot) mg/l	0.024	0.051	0.045	0.060	0.056	0.063
Oil and Grease mg/l	*	<1.0	<1.0	1.8	<1.0	2.0
Sulfate as SO4 mg/l	251.0	250.0	235.0	250.0	243.0	220.0
Suspended Solids mg/l	*	*	1.0	6.0	1.0	<0.1
Total Dissolved Solids mg/l	700.0	673.0	850.0	805.0	612.0	780.0
pH Units	7.57	8.56	8.62	8.30	8.20	8.40
Temperature	*	54°F	52°F	59°F	52°F	52°F
Flow	*	4.8gpm	4.6gpm	*	*	5.0gpm

*Not Available.

ADDITIONAL QUARTERLY PARAMETERS

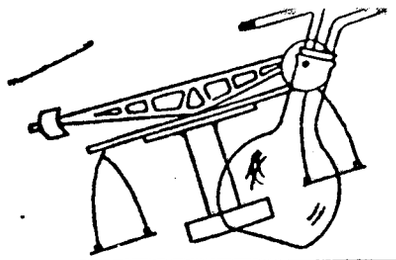
GROUNDWATER - DH7

Date	May 29-79	July 6-79	Oct. 1-79
Arsenic as As mg/l	<0.001	0.001	<0.001
Barium as Ba mg/l	0.04	0.02	0.02
Bicarbonate as HCO3 mg/l	350.00	185.44	270.84
Boron as B mg/l	0.35	0.16	0.05
Cadmium as Cd mg/l	<0.001	<0.001	<0.001
Calcium as Ca mg/l	44.00	19.20	44.00
Carbonate as CO3 mg/l	<0.01	36.00	<0.01
Chloride as Cl mg/l	10.0	10.0	14.0
Chromium as Cr mg/l	<0.001	<0.001	<0.001
Copper as Cu mg/l	<0.001	0.001	<0.001
Fluoride as F mg/l	0.30	0.55	0.69
Hardness as CaCO3 mg/l	152.0	104.0	124.0
Lead as Pb mg/l	<0.001	<0.001	<0.001
Magnesium as Mg mg/l	10.08	13.44	3.36
Mercury as Hg mg/l	<0.0002	<0.0002	<0.0002
Nickel as Ni mg/l	<0.001	<0.001	<0.001
Nitrate as NO3-N mg/l	0.20	<0.01	0.04
Potassium as K mg/l	4.39	3.99	3.98
Selenium as Se mg/l	<0.001	<0.001	0.001
Silica as SiO2 mg/l	17.00	0.80	2.25
Silver as Ag mg/l	<0.001	<0.001	0.002
Sodium as Na mg/l	160.0	171.0	163.0
Turbidity NTU	2.4	6.0	7.2
Zinc as Zn mg/l	0.001	0.028	0.003

HIDDEN VALLEY MINE BASELINE WATER MONITORING

GROUNDWATER - DH-2

The elevation of the groundwater within drill hole 2 was measured on November 13, 1979. This elevation was determined to be equal to the collar elevation of the well or 6046 ft.



Ford Chemical LABORATORY

Bacteriological and Chemical Analysis

40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
485-5761

Volume	Presumptive		Confirmed (BGL BB)					Fecal @ 44.5° C.				
	24	48	24	48	24	48	T	24	48	24	48	T
10.0	5/5	5/5					5/5					5/5
1.0	5/5	5/5					5/5					5/5
10 -1	5/5	5/5					5/5					5/5
1 -2	5/5	5/5					5/5					5/5
10 -3	5/5	5/5					5/5					5/5
-4	5/5	5/5					5/5					5/5

MPN Coliform Results _____ /100 ml. MPN Fecal Results _____ /100ml.

Volume ml.		10	10	10	10	10
Presumptive	24 hr.	—	—	—	—	—
	48 hr.	—	—	—	—	—
Confirmed	24 hr.					
	48 hr.					

SATISFACTORY ☒ MPN Coliform
UNSATISFACTORY ☐ Results in 10 ml. volume 42.2 /100ml.

M.F. Ml. Sample _____ ml Colonies _____ Coliform _____ /100 ml.

Plate Count _____ /ml.

Form #7A

WATER SAMPLE FOR
BACTERIOLOGIC EXAMINATION

Lab No. 3524 DH-1
Name Ivie Creek Mine (Tom Paluso)
Address P.O.Box as Price, UT 84501
Date of Collection 8/14/78 Time 12:45
Send Report To Tom Paluso
Sample Collected By Tom Paluso

TO BE FILLED OUT BY SAMPLER

Sample collected from	Name
Check one ☐ Waterworks System	
☐ Stream	
☒ Other, Describe Private Well, etc.	
Exact Description of Sampling Point	
County	

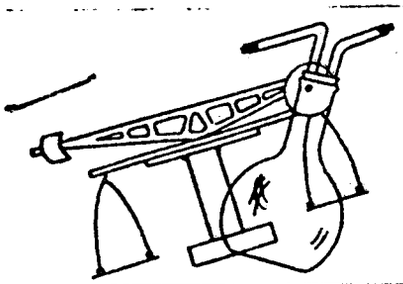
Unchlorinated ☒ Chlorinated ☐
Residual _____ ppm

Examine For

☒ Coliforms in 10 ml Portions ☐ Fecal Coliform in 10 ml Portion
☐ MPN Coliforms per 100 ml ☐ MPN Fecal Coliforms per 100 ml
☐ Membrane Filter (MF) ☐ Plate Count-24 hrs. @ 35°C.

Date Received 8/15/78
Date Reported 8/17/78

Ford Chemical Lab.



Ford Chemical LABORATORY

Bacteriological and Chemical Analysis

40 WEST LOUISE AVENUE
SALT LAKE CITY, UTAH 84115
485-5761

Volume	Presumptive		Confirmed (BGL BB)					Fecal @ 44.5° C.				
	24	48	24	48	24	48	T	24	48	24	48	T
10.0	5/5	5/5					5/5					5/5
1.0	5/5	5/5					5/5					5/5
10 -1	5/5	5/5					5/5					5/5
1 -2	5/5	5/5					5/5					5/5
10 -3	5/5	5/5					5/5					5/5
-4	5/5	5/5					5/5					5/5

MPN Coliform Results _____ /100 ml. MPN Fecal Results _____ /100ml.

Volume ml.		10	10	10	10	10
Presumptive	24 hr.	—	—	—	—	—
	48 hr.	—	—	—	—	—
Confirmed	24 hr.					
	48 hr.					

SATISFACTORY ☒ MPN Coliform
UNSATISFACTORY ☐ Results in 10 ml. volume 42.2 /100ml.

M.F. Ml. Sample _____ ml Colonies _____ Coliform _____ /100 ml.

Plate Count _____ /ml.

Form #7A

WATER SAMPLE FOR
BACTERIOLOGIC EXAMINATION

Lab No. 3525
Name DH-3 Ivie Creek Mine
Address P.O. Box AS Price, Ut 84501
Date of Collection 8/14/78 Time 2:15
Send Report To Tom Paluso
Sample Collected By Tom Paluso

TO BE FILLED OUT BY SAMPLER

Sample collected from	Name
Check one ☐ Waterworks System	
☐ Stream	
☒ Other, Describe Private Well, etc.	Well
Exact Description of Sampling Point	
County	Emery

Unchlorinated ☒ Chlorinated ☐
Residual _____ ppm

Examine For

☒ Coliforms in 10 ml Portions ☐ Fecal Coliform in 10 ml Portion
☐ MPN Coliforms per 100 ml ☐ MPN Fecal Coliforms per 100 ml
☐ Membrane Filter (MF) ☐ Plate Count-24 hrs. @ 35°C.

Date Received 8/15/78
Date Reported 8/17/78

Ford Chemical Lab.

APPENDIX C

UTAH DIVISION OF HEALTH NUMERICAL STANDARDS

NUMERICAL STANDARDS FOR PROTECTION OF BENEFICIAL USES OF WATER

Constituent	CLASSES											
	Domestic Source			Recreation & Aesthetics		Aquatic Wildlife				Agri-culture	Indus-try	Special
	1A	1B	1C	2A	2B	3A	3B	3C	3D	4	5	6
Bacteriological (No./100 ml)												
(30-day Geometric Mean)												
Maximum Total Coliforms	1	50	5,000	1,000	5,000	*	*		*	*		
Maximum Fecal Coliforms	*	*	2,000	200	2,000	*	*		*	*		
Physical												
Total Dissolved Gasses	*	*	*	*	*	(b)	(b)		*	*		
Minimum DO (mg/l) (a)	*	*	5.5	5.5	5.5	6.0	5.5		5.5	*		
Maximum Temperature	*	*	*	*	*	20°C	27°C		*	*		
Maximum Temp. Change	*	*	*	*	*	2°C	4°C		*	*		
pH	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0		6.5-9.0	6.5-9.0		
Turbidity increase (c)	*	*	*	10 NTU	10 NTU	10 NTU	10 NTU		15 NTU	*		
Chemical (Maximum mg/l)												
Arsenic, dissolved	.05	.05	.05	*	*	*	*		*	.1		
Barium, dissolved	1	1	1	*	*	*	*		*	*		
Cadmium, dissolved	.010	.010	.010	*	*	.0004(d)	.004(d)		*	.01		
Chromium, dissolved	.05	.05	.05	*	*	.10	.10		.10	.10		
Copper, dissolved	*	*	*	*	*	.01	.01		*	.2		
Cyanide	*	*	*	*	*	.005	.005		*	*		
Iron, dissolved	*	*	*	*	*	1.0	1.0		1.0	*		
Lead, dissolved	.05	.05	.05	*	*	.05	.05		*	.1		
Mercury, total	.002	.002	.002	*	*	.00005	.00005		.00005	*		
Phenol	*	*	*	*	*	.01	.01		*	*		
Selenium, dissolved	.01	.01	.01	*	*	.05	.05		*	.05		
Silver, dissolved	.05	.05	.05	*	*	.01	.01		*	*		
Zinc, dissolved	*	*	*	*	*	.05	.05		*	*		
NH_3 as N (un-ionized)	*	*	*	*	*	.02	.02		*	*		
Chlorine	*	*	*	*	*	.002	.01		*	*		
Fluoride, dissolved (e)	1.4-2.4	1.4-2.4	1.4-2.4	*	*	*	*		*	*		
NO_3 as N	10	10	10									
Boron, dissolved	*	*	*	*	*	*	*		*	.75		
H_2S	*	*	*	*	*	.002	.002		*	*		
TDS (f)	*	*	*	*	*	*	*		*	1200		
Radiological (Maximum pCi/l)												
Gross Alpha	15	15	15	*	*	15(g)	15(g)		15(g)	15(g)		
Radium 226, 228 combined	5	5	5	*	*	*	*		*	*		
Strontium 90	8	8	8	*	*	*	*		*	*		
Tritium	20,000	20,000	20,000	*	*	*	*		*	*		
Pesticides (Maximum ug/l)												
Endrin	.2	.2	.2	*	*	.004	.004		.004	*		
Lindane	4	4	4	*	*	.01	.01		.01	*		
Methoxychlor	100	100	100	*	*	.03	.03		.03	*		
Toxaphene	5	5	5	*	*	.005	.005		.005	*		
2, 4-D	100	100	100	*	*	*	*		*	*		
2, 4, 5-TP	10	10	10	*	*	*	*		*	*		
Pollution Indicators (g)												
Gross Beta (pCi/l)	50	50	50	*	*	50	50		50	50		
BOD (mg/l)	*	*	5	5	5	5	5		5	5		
NO_3 as N (mg/l)				4	4	4	4		*	*		
PO_4 as P (mg/l)(h)	*	*	*	.05	.05	.05	.05		*	*		

STANDARDS WILL BE DETERMINED ON A CASE-BY-CASE BASIS

STANDARDS WILL BE DETERMINED ON A CASE-BY-CASE BASIS

* Insufficient evidence to warrant the establishment of numerical standard. Limits assigned on case-by-case basis.

(a) These limits are not applicable to lower water levels in deep impoundments.

(b) Not to exceed 110% of saturation.

(c) For Classes 2A, 2B, 3A, and 3B at background levels of 100 NTUs or greater, a 10% increase limit will be used instead of the numeric values listed. For Class 3D at background levels of 150 NTUs or greater, a 10% increase limit will be used instead of the numeric value listed. Short term variances may be considered on a case-by-case basis.

(d) Limit shall be increased threefold if $CaCO_3$ hardness in water exceeds 150 mg/l.

(e) Maximum concentration varies according to the daily maximum mean air temperature.

Temp. °C	mg/l
12.0 and below	2.4
12.1 to 14.6	2.2
14.7 to 17.6	2.0
17.7 to 21.4	1.8
21.5 to 26.2	1.6
26.3 to 32.5	1.4

(f) Total dissolved solids (TDS) limit may be adjusted on a case-by-case basis.

(g) Investigations should be conducted to develop more information where these pollution indicator levels are exceeded.

(h) PO_4 as P(mg/l) limit for lakes and reservoirs shall be .025.

NUMERICAL STANDARDS FOR PROTECTION OF CLASS 3C WATER USE

Physical	
Minimum D.O. (mg/l)	5*
Maximum Temperature	27°C**
Maximum Temperature Change	4°C
pH	6.5-9.0
Turbidity Increase (NTU)	15****
Chemical (Maximum mg/l)	
Cadmium, dissolved	0.004
Chromium, dissolved	0.1
Copper, dissolved	0.01
Cyanide	0.005
Iron, dissolved	1.0
Lead, dissolved	0.05
Mercury, total	0.0005
Phenol	0.01
Selenium, dissolved	0.05
Silver, dissolved	0.01
Zinc, dissolved	0.05
Chlorine	0.2
H_2S	0.02
Radiological (Maximum pCi/l)	
Gross Alpha	15
Gross Beta	30
Pesticides (Maximum mg/l)	
Endrin	0.004
Lindane	0.01
Methoxychlor	0.03
Toxaphene	0.005
Pollution Indicators* **	
BOD (mg/l)	5.0
NO_3 as N (mg/l)	4.0

*Minimum D.O. (mg/l) limitation is 4 in the following segments:
San Rafael River and tributaries, from confluence with Green River to confluence with Ferron Creek
Malad River and tributaries, from confluence with Bear River to state line

**Maximum temperature limitation is 35°C in the following segments:
Virgin River and tributaries from state line to headwaters except as listed in APPENDIX B

***Investigations should be conducted to develop more information where these pollution indicator levels are exceeded

****At background levels of 150 NTU's or greater, a 10% increase limit will be used instead of the numeric values. Short term variances may be considered on a case-by-case basis

CLASSIFICATION OF WATERS OF THE STATE	USE CLASSES							
	DOMESTIC SOURCE	RECREATION AND ESTHETICS		AQUATIC		WILDLIFE		AGRICULTURE
	1C	2A	2B	3A	3B	3C	3D	4
UPPER COLORADO RIVER BASIN								
COLORADO RIVER DRAINAGE								
Paria River and tributaries, from state line to headwaters			X			X		X
Escalante River and tributaries, from Lake Powell to confluence with Boulder Creek			X			X		
Escalante River and tributaries, from confluence with Boulder Creek, including Boulder Creek, to headwaters			X	X				X
Dirty Devil River and tributaries, from Lake Powell to Fremont River						X		
Fremont River and tributaries, from confluence with Muddy River to Capitol Reef National Monument						X		X
Fremont River and tributaries, through Capitol Reef National Park to headwaters	X			X				X
Pleasant Creek and tributaries, from confluence with Fremont River to East boundary of Capitol Reef National Park						X		
Pleasant Creek and tributaries, from East boundary of Capitol Reef National Park to headwaters				X				
Muddy River and tributaries, from confluence with Fremont River to Highway U-10 crossing						X		X
Muddy River and tributaries, from Highway U-10 crossing to headwaters				X				X
Quitchupah Creek and tributaries, from Highway U-10 crossing to headwaters				X				X
San Juan River and tributaries, from Lake Powell to state line except as listed below:	X		X		X			X
Johnson Creek and tributaries, from confluence with Recapture Creek to headwaters	X			X				X
Verdure Creek and tributaries, from Highway U-47 crossing to headwaters				X				X
North Creek and tributaries, from confluence with Montezuma Creek to headwaters	X			X				X

CLASSIFICATION OF WATERS OF THE STATE	USE CLASSES							
	DOMESTIC SOURCE	RECREATION AND ESTHETICS		AQUATIC		WILDLIFE		AGRICULTURE
	1C	2A	2B	3A	3B	3C	3D	4
UPPER COLORADO RIVER BASIN (continued)								
COLORADO RIVER DRAINAGE (continued)								
South Creek and tributaries, from confluence with Montezuma Creek to headwaters				X				X
Spring Creek and tributaries, from confluence with Vega Creek to headwaters				X				X
Montezuma Creek and tributaries, upstream from Monticello	X			X				X
Colorado River, from Lake Powell to state line	X		X		X			X
Indian Creek and tributaries, from confluence with Colorado River to Indian Creek State Park					X			X
Indian Creek and tributaries, through Indian Creek State Park to headwaters				X				X
Kane Canyon Creek and tributaries, from confluence with Colorado River to headwaters						X		X
Mill Creek and tributaries, from confluence with Colorado River to headwaters				X				X
Dolores River and tributaries, from confluence with Colorado River to state line			X			X		X
Roc Creek and tributaries, from confluence with Dolores River to headwaters				X				X
LaSal Creek and tributaries, from state line to headwaters				X				X
Lion Canyon Creek and tributaries, from state line to headwaters				X				X
Little Dolores River and tributaries, from confluence with Colorado River to state line						X		X
Bitter Creek and tributaries, from confluence with Colorado River to headwaters						X		X