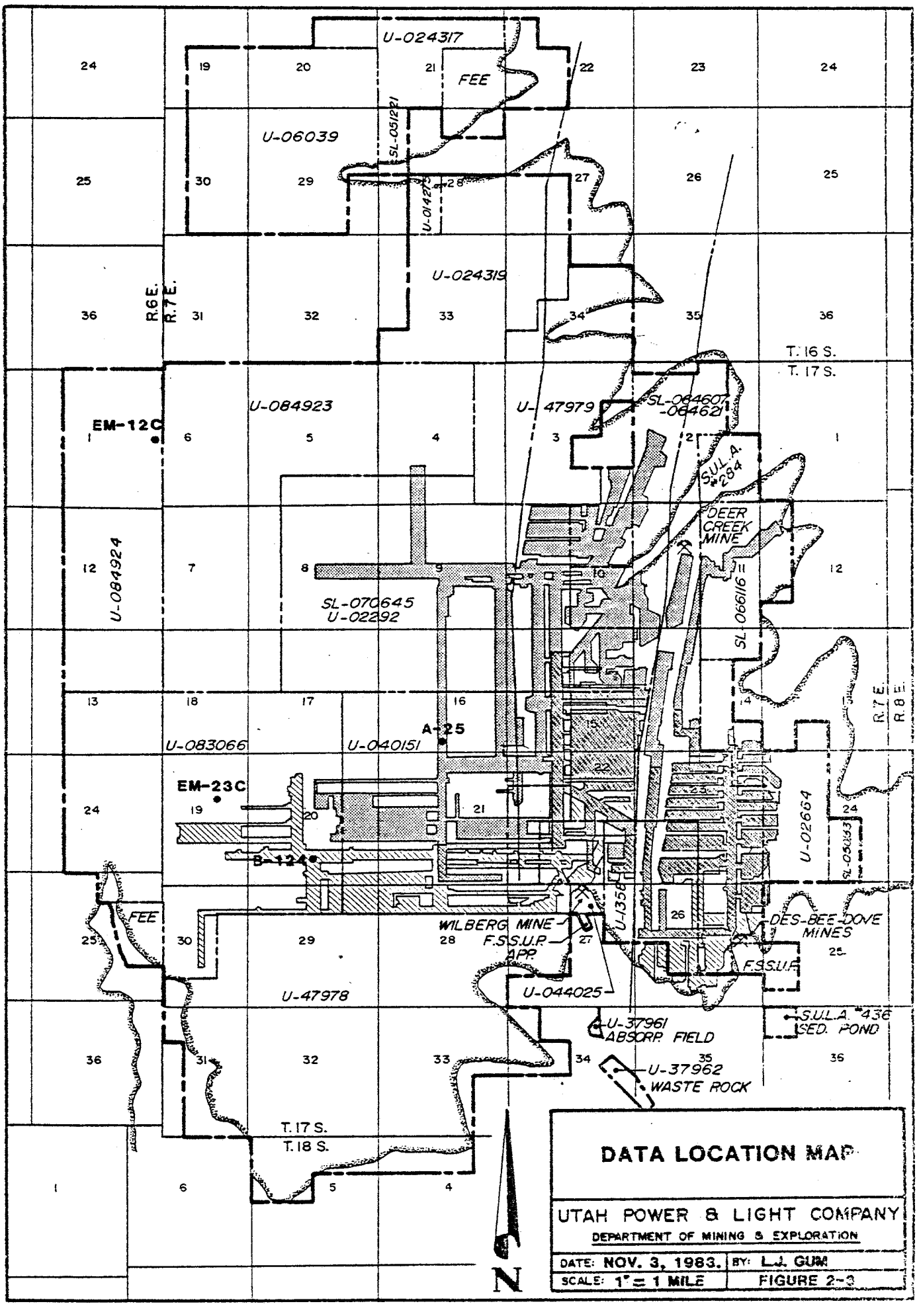
1,400 - 1,600 feet. However, the overburden above most of the coal is less than 1,300 feet.

Chemical Composition

In the development of the Des-Bee-Dove Mine and associated surface facilities, some of the strata and alluvium covering the coal seam was excavated to accommodate the facilities. In order to better understand the chemical and physical characteristics of the rock material that was excavated, over 130 samples from both outcrop and core from drill holes were analyzed.

Four drill holes were selected as data points in which core samples were analyzed for their chemical and physical properties (see Figure 2-3). These core drill holes were selected to give the best representation of the same rock sequence which was excavated at the Des-Bee-Dove Mine portals. Two of the holes were drilled from the surface of East Mountain (EM-12C and EM-23C), and two of the holes were drilled from within the Deer Creek and Wilberg Mines (A-25 and B-124).

Samples of rock core were collected from each lithologic unit that was penetrated within the selected drill holes. These samples consisted of a representative section of core averaging 0.3' in length usually taken from the center of each lithologic unit. Samples of rocks which were immediately overlain by minable coal seams were collected at the coal seam contact. The rock zones sampled and the sample



DATA LOCATION MAP

UTAH POWER & LIGHT COMPANY

DEPARTMENT OF MINING & EXPLORATION

DATE: NOV. 3, 1983.	BY: L.J. GUM
SCALE: 1" = 1 MILE	FIGURE 2-3

numbers are shown on the core logs for each drill hole (see core logs in Appendix).

In light of the recommendation made by the Office of Surface Mining (OSM) each sample was analyzed for the following:

- pH
- EC (electrical conductivity)
- % Calcium
- % Magnesium
- % Sodium
- SAR (Sodium Absorption Ration)
- Alkalinity (equivalent $CaCO_3$)
- % Iron
- % Zinc
- % Sulfate
- % Molybdenum
- % Boron

All of the samples of carbonaceous mudstone that were collected were also analyzed for their percent pyrite/marcasite content. The samples collected from immediately below a minable coal seam were analyzed for their clay content. In addition to these analyses, four or five representative samples of each of the rock types present, sandstone, siltstone, mudstone, interbeds (thinly laminated siltstone and mudstone), carbonaceous mudstone, and coal were tested for their physical properties. These samples were crushed to a size of -1/4" mesh and the product was screened for its percent sand, silt, and clay content.

Front Range Labs, Inc., of Fort Collins, Colorado, was selected to do the analytical work because of their expertise in testing the chemical and physical properties of coal overburden and their ability to perform all of the required analytical work.

Utah Power & Light had previously established an excellent data base regarding the coal quality within the East Mountain property. Within the past four years, samples have been collected from within the Deer Creek, Wilberg and Des-Bee-Dove Mines on a daily basis. These samples were analyzed by Standard Laboratories, Inc., in Huntington, Utah. Some of the data reported herein have been gleaned from this work.

The findings of these analyses are separated by formation, rock type and coal seam in Table A. For each rock type, the mean and standard deviations have been calculated for each of the various chemical and physical parameters. In general, the chemical content within a rock type is moderately consistent as shown by the standard deviations. However, the sulfate content of the sandstones and siltstones are variable due to sulfate enrichment by groundwater in some of these rock types and not others.

Utah Power & Light Company analyzes several hundred samples of the Blind Canyon and Hiawatha Seam annually. These samples have shown the sulfur and pyrite/marcasite content of the coal to be low. The sulfur content of the Hiawatha Seam averages 0.54% with the maximum value reported to be 0.77%. Of this total sulfur 16% is pyritic including marcasite. This equates to a pyrite/marcasite content of 0.16-0.23%.

The Blind Canyon Seam is slightly lower in sulfur content than the Hiawatha Seam. The sulfur content of this

TABLE A (Revised)
ANALYTICAL SUMMARY
OVERBURDEN ANALYSES

Lithology	Number of Samples: Chemical Tests	Number of Samples: Physical Tests	Chemical Tests: Ca Meg/L	Mg Meg/L	Na Meg/L	[1] SAR	Fe ppm	Zn ppm	SO_4-S ppm	Mo ppm	B ppm	pH (Paste)	[2] E.C. mhos/cm	Sat. %	Physical Tests: Pyrite FeS_2 [3]	Sand %	Silt %	Clay %	Crushed Rock Texture
Blackhawk Formation:																			
Sandstone:	26	2																	Sandy
Mean			4.37	8.18	2.13	1.05	8874	11.47	409.6	.1	.06	8.0	1.55	21.7	-	84.5	11.0	4.5	Loam
S.D.			3.91	5.13	1.08	0.69	6672	9.7	353.1	0	.06	0.96	0.89	3.36	-	0.71	1.41	2.12	
Siltstone:	24	5																	Sandy
Mean			3.06	6.24	2.30	1.69	14512.88	38.26	464.41	.1	0.18	7.88	1.41	20.81	2.3	71.6	17.8	10.6	Loam
S.D.			2.63	7.23	2.78	3.72	8782.4	21.29	1222.63	0	0.16	1.08	1.72	1.82	0	23.5	16.57	7.7	
Mudstone:	24	4																	Sandy
Mean			3.12	3.13	4.70	4.28	11074.13	70.31	233.96	.1	0.28	8.0	1.10	23.99	-	71.5	20.5	8.0	Loam
S.D.			2.36	2.89	12.76	12.58	5350.17	79.99	275.10	0	0.23	0.31	1.12	4.88	-	13.77	15.2	3.56	
Interbeds:	15	3																	Loamy
Mean			4.34	7.98	2.79	1.30	10982.13	21.58	346.95	.1	0.12	8.05	1.58	20.56	-	75.33	17.00	7.67	San'
S.D.			3.13	6.37	1.85	1.36	6584.59	9.97	359.46	0	0.11	0.23	0.92	1.33	-	7.64	9.54	3.06	
Carb-mudstone:	25	3																	Loamy
Mean			6.19	6.51	3.7	2.4	9933.76	58.04	438.86	.1	0.42	7.53	1.54	34.76	2.3	73.33	18.00	5.76	Sandy
S.D.			4.85	8.42	4.85	3.98	6112.12	38.94	378.81	0	0.34	0.85	1.14	9.94	3.29	20.60	16.82	3.53	
															Sulfur %				
Coal (Blind Canyon)	8	0																	
Mean			1.55	1.81	1.68	1.63	2089.38	10.19	103.88	.1	.06	8.0	.36	60.66	0.44				
S.D.			0.59	2.88	1.35	1.27	2557.56	8.82	66.88	0	.05	0.25	.05	18.59	0.06				
Coal (Hiawatha)	2	0																	
Mean			1.52	2.85	1.41	1.58	2532.41	10.82	97.32	.1	0.12	7.95	0.34	60.24	0.51				
S.D.			0.66	3.64	0.95	1.18	2718.02	8.41	72.14	0	0.21	0.24	0.07	16.84	0.06				
																Sand %	Silt %	Clay %	
Starpoint Sandstone																			
Sandstone	11	4																	Sandy
Mean			5.14	8.58	3.42	3.57	3798	9.47	1457	.1	0.11	6.76	2.49	30.46	-	90.75	4.75	4.50	Loam
S.D.			3.89	4.69	2.97	5.18	2965	6.98	2578	0	0.24	1.54	1.20	4.8	-	4.80	3.50	1.91	

1 SAR = Sodium Absorption Ratio
2 EC - Electrical Conductivity

seam averages 0.45% and the maximum value reported is 0.59%. Sixteen percent of the sulfur in the Blind Canyon Seam is also pyritic including marcasite. This equates to a pyrite/marcasite content of 0.13-0.18%. The majority of the sulfur contained within both the Hiawatha and Blind Canyon Seams is organic (79%) with the remainder other than pryitic sulfur being sulfate.

Generally, the physical tests which were completed on these samples indicate that all rock types present have the tendency to resist reduction of grain size when excavated and reclaimed and only a minimum of clay-sized particles will be liberated. As may be expected, the coarser-grained rocks, sandstones and siltstones produced much less clay-sized particles when crushed. Generally, the dominant rock type in the area of the Des-Bee-Dove Mine is sandstone; therefore, any interpretations made should recognize this fact.

In addition to the aforementioned analyses that were made of the general overburden, the strata immediately above and below the coal seam were analyzed for their potential alkalinity and pyrite/marcasite content and the strata immediately below the coal was analyzed for clay content as well. The results of these tests are as follows:

Zone Sampled	Number Of Samples	pH	% FeS_2 Pyrite/Marcasite)	% Clay	Potential Alkalinity (Equivalent $CaCO_3$ Mg/L)
Hiawatha Seam Roof	3	7.8	3.3	-	218,400
Hiawatha Seam Floor	3	7.5	1.3	5.5	127,300
Blind Canyon Seam Roof	2	8.1	0.5	-	252,600
Blind Canyon Seam Floor	3	8.3	1.3	9.0	3,500

Revised 11/21/83

These analyses have identified that the floor of the Blind Canyon Seam has a potentially high sodium absorption ratio and the Blind Canyon Seam roof is potentially high in pyrite/marcasite. No other abnormally high readings were identified.

A review of the data concerning the sodium absorption ratio of the Blind Canyon floor reveals that three out of four samples which were taken of that zone, have values less than 5.0 (4.8, 1.5 and 1.3). One sample has a value of 60.4 which raised the sample mean to 17.36 and created a high standard deviation of 25.14. This indicates that in general the Blind Canyon floor rock will not pose a problem from its sodium absorption ratio but from time to time high concentrations will be encountered. These concentrations will be diluted by other rocks with low SAR values upon reclamation.

Three samples of the Blind Canyon Seam roof and floor were tested for their pyrite/marcasite content. Two of these core samples are from drill hole B-124 and the other from EM-12C have a pyrite/marcasite content of 0.2% and 0.5% respectively. The third sample from drill hole EM-23C has a pyrite/marcasite value of 15.8%. This core contained vertical fractures which had secondary deposits of FeS_2. This sample is not representative of the Blind Canyon Seam roof pyrite/marcasite content as a whole but does show that localized high concentrations of iron-sulfides do occur.

This periodic high content of pyrite should not pose a problem in reclamation.

The analyses of the overburden samples tested show that in general no toxic or hazardous materials are present. The material excavated near the portal site is slightly alkaline. Generally, the soils in this region which are derived from the strata tested are alkaline as well. The overburden material which has been excavated will not degrade the quality of the soils in the area or of the groundwater percolating through this material.

HYDROLOGY

Groundwater (783.15)

For the past five years UP&L has been collecting data regarding the hydrology of the Des-Bee-Dove Mine and surrounding area including quantity and quality of both ground and surface water. This data collection program is part of a hydrologic monitoring program which has been approved by the Utah State Division of Oil, Gas and Mining and the Office of Surface Mining.

Data collected between 1979 and 1982 has been submitted to the Office of Surface Mining, the Utah State Division of Oil, Gas and Mining, the U. S. Forest Service and the Bureau of Land Management each year in the annual hydrologic monitoring reports. All data collected through 1982 are available in those reports; therefore, a duplication of those data will not be made here.

Data has been collected from 79 coal exploration drill holes, from within the mine workings and from the spring in the area. These data have not identified any laterally continuous aquifers which are present throughout the area but have identified localized perched water tables in the North Horn Formation and Blackhawk Formation.

Because the North Horn Formation is comprised of a variety of rock types which range from highly calcareous sandstone to mudstone, its permeability is variable. Lenticular sandstone channels are often times present in the upper portion of this formation. Water which percolates down

fractures from the overlying Flagstaff Limestone works its way into these sandstones forming the perched water tables. The actual lateral extent, or correlation between these perched water tables has not been identified nor is it practical to do so because they are limited in extent and variable in stratigraphic location. Many springs have been identified where these sandstone channels intersect the land surface. These springs will be discussed later in this report. Similar water-bearing sandstone are also present at the base of the North Horn Formation.

The depth of the aquifers in the North Horn Formation is variable due to the rugged topography. These localized perched water tables intersect the surface of the ground or may be covered by as much as 400 feet of overburden within the permit area. They are located at least 1,400 feet above the coal seam to be mined. Communication of water between the perched aquifers in the North Horn Formation and the water flowing into the mine has not been identified. The monitoring of the numerous springs located on East Mountain gives Utah Power & Light Company the ability to assess any effects that mining might have on the North Horn Formation perched aquifers.

Perched water tables have not been identified in the Price River or Castlegate Sandstones. Both of these formations are relatively permeable but lack sufficient recharge to make them water bearing.

Generally on East Mountain the lower portion of the Blackhawk Formation contains perched or limited aquifers which exist within the strata overlying the coal seams. The perched aquifers exist as fluvial channels (ancient river systems) which overlie and scour into the underlying strata. These channel systems were part of a deltic depositional setting active during and after the coal forming peat accumulation. The sandstone channels are mainly composed of a fine to medium-grain sand with similar porosity and permeability characteristics as that of the Starpoint Sandstone. The semipermeable and porous nature of these channels allows an effective route of water transport. Other rock type constituents of the Blackhawk Formation (i.e., mudstone, carbonaceous mudstone and interbedded material), generally act as aquicludes which impede water flow unless fracturing or faulting of these units has induced secondary permeability.

In the Deer Creek and Wilberg Mine to the east of the Deer Creek Fault many long-term water producing areas exist in these overlying fluvial channels. However, the Deer Creek Fault acts as a barrier to groundwater flow because the Des-Bee-Dove Mines are essentially dry with two exceptions. In the Little Dove Mine water producing areas were intersected in October 1981 in the 1st North entry between crosscuts 75 and 84. At that location, less than 10 gpm of water was flowing from fractures in the overlying sandstone until they dried up in the second quarter of 1982 (see Figure

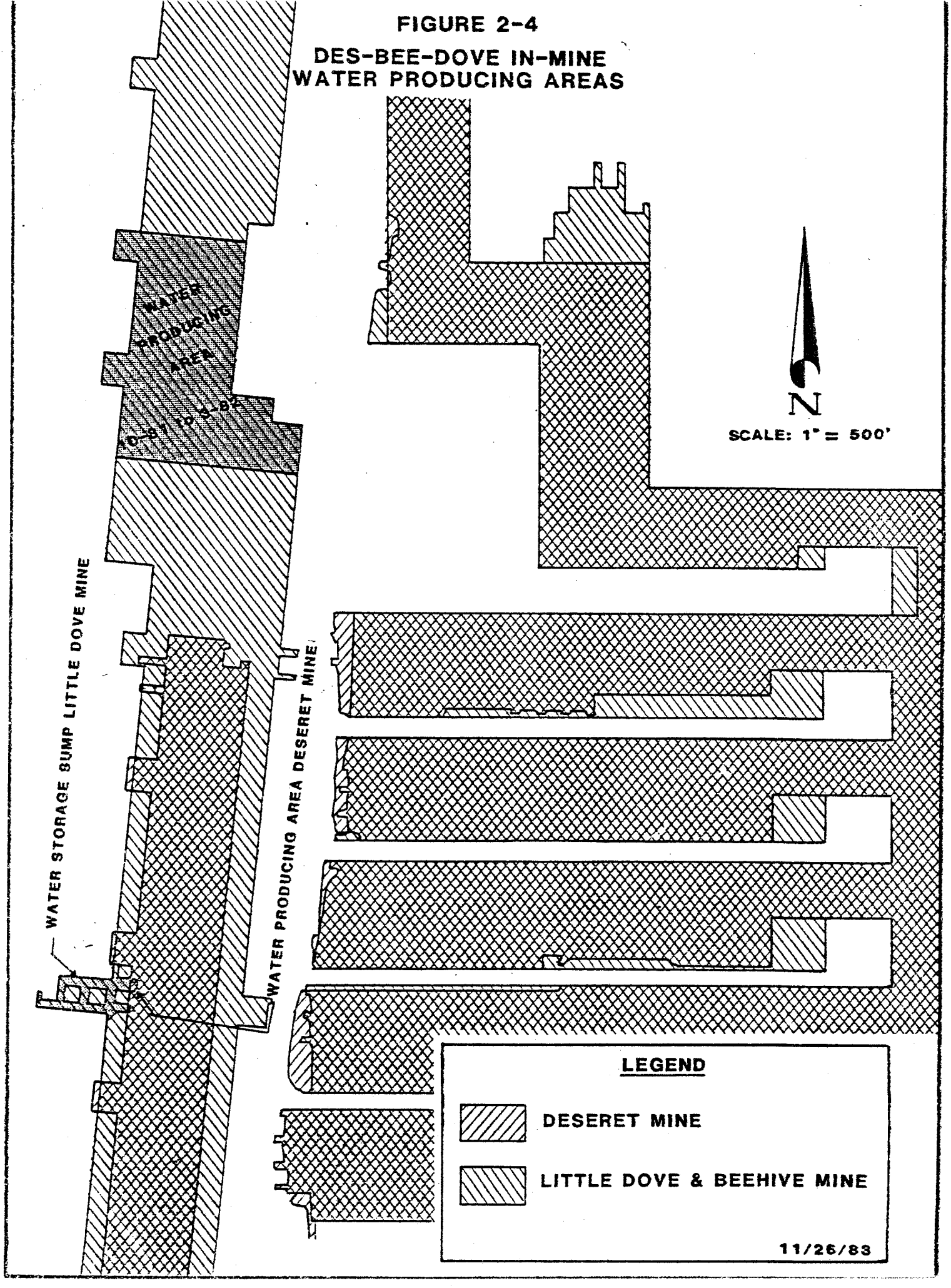
2-4). The other area is the Deseret 2nd North section at crosscut 54. In this area water is flowing down vertical fractures from the water storage sump in the Little Dove Mine which is directly overhead. This water producting area is considered artificial because the water is pumped from the Wilberg Mine into that sump where it is later used in mining.

The lack of water producing areas in the Des-Bee-Dove Mines is striking in comparison to the wet conditions present in the Wilberg and Deer Creek Mines to the west. Because most of the mining in the Des-Bee-Dove Mines is in final retreat it is not expected that significant water producing areas will be intersected. However, the workings are inspected on a quarterly basis for any new water producing areas. If any are found they will be monitored and sampled by the applicant.

Although much of the water transfer within the Blackhawk Formation is through fractures or faults, data indicates that many of the fractures become sealed by swelling clays which stops or limits the water transfer. Confirmation of this exists along the numerous faults and fractures over the area. Very few springs are found within the Blackhawk along the extensive faults in the Wasatch Plateau. The fact that the Deer Creek Fault separates areas of wet conditions on the west (Deer Creek and Wilberg Mines) from dry conditions on the east (Des-Bee-Dove Mines) supports this hypothesis. Apparently, fractures seal readily because of the ability of the shaley layers to swell and decompose to

FIGURE 2-4

DES-BEE-DOVE IN-MINE WATER PRODUCING AREAS



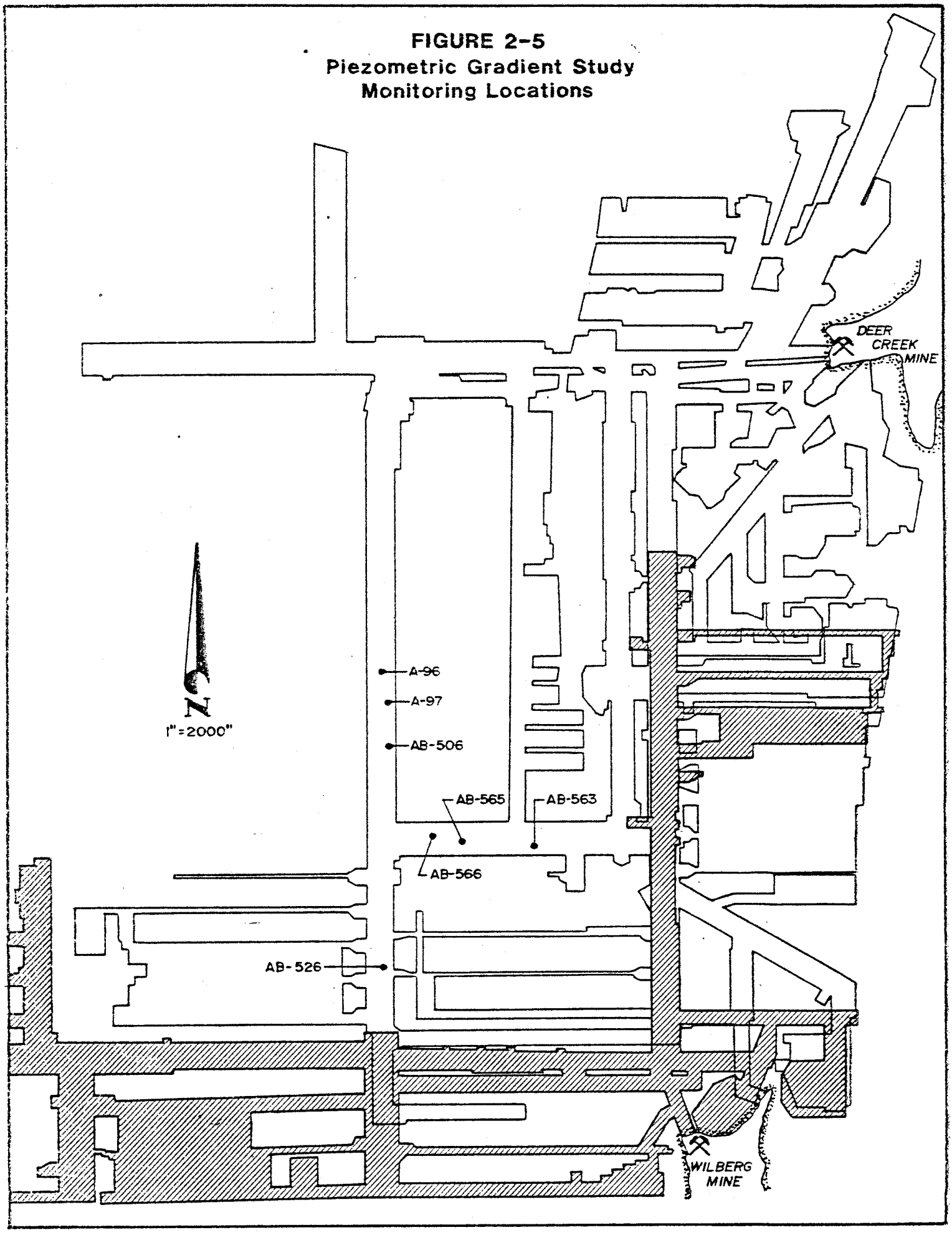
form an impervious clay, preventing significant downward percolation, collection, or conveyance of water along faults in the Blackhawk Formation. The coal seams in the Blackhawk Formation are impermeable and are not water saturated.

The Starpoint Sandstone immediately underlies the Hiawatha Coal Seam. This sandstone unit exhibits some characteristics of an aquifer but experiences little recharge. Most of water recharge in the Starpoint is where it has been intersected by the major canyons in the plateau. This fact plus the fact that the Starpoint is only slightly to moderately permeable allows only limited flow of groundwater through this formation. Within the Des-Bee-Dove permit area the Starpoint Sandstone receives no recharge from stream flow.

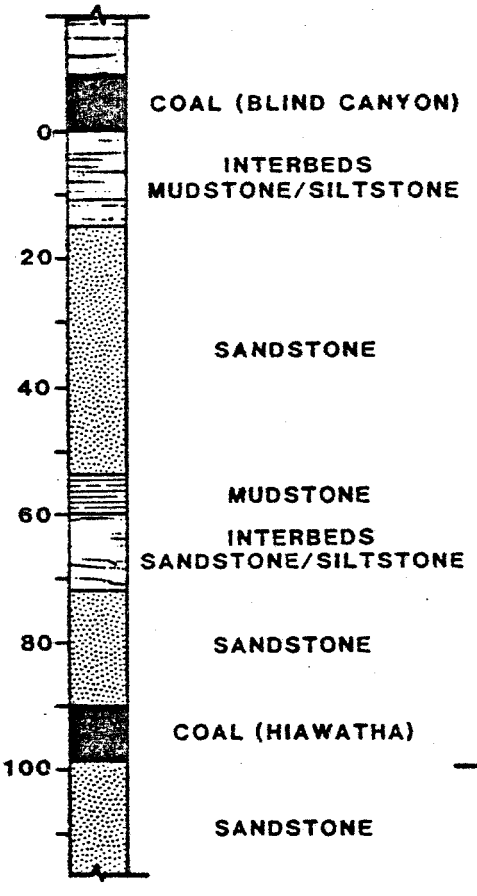
Water level elevations from all available East Mountain drill holes (surface and in-mine), were utilized to construct a piezometric gradient map. The degree of variability between the data points reveal no piezometric trends. Because of this fact this map has not been included herein. It is probable that in many drill holes the fluid level elevation was measured at artificial levels created by the drilling process and the data collected fail to show the true piezometric level.

Seven in-mine drill holes completed in the Deer Creek Mine to the west have been developed into water monitoring holes which are measured quarterly (see Figure 2-5 and 2-6). The drill hole depth and method of casing the holes are shown

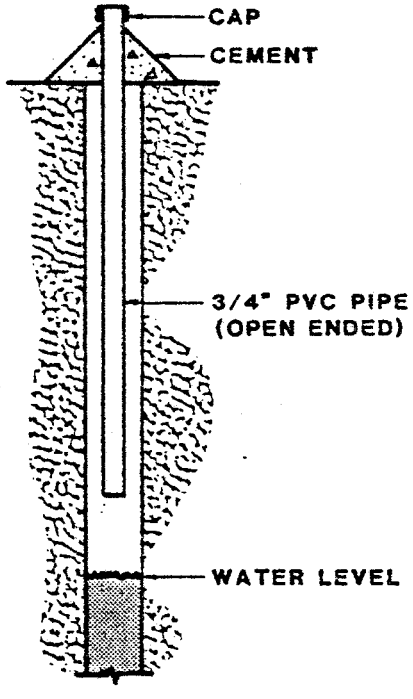
FIGURE 2-5
Piezometric Gradient Study
Monitoring Locations



DRILL HOLE #	COLLAR ELEVATION	DEPTH (FT.)	CASING DEPTH (FT.)	LOCATION OF HOLE BOTTOM	WATER DEPTH (FT.)	WATER ELEVATION
A-96	7576.0	103.5	20	11.2' Below Top Of Star Point	39.9	7536
A-97	7582.5	111.5	20	18.8' " "	37.2	7545
AB-506	7629.0	94.6	30	10.8' " "	11.0	7579
A-526	7590.0	110.0	80	22.0' " "	16.8	7607
AB-563	7605.0	98.4	20	21.0' " "	47.9	7557
AB-565	7603.0	103.5	20	20.0' " "	40.1	7562
A-566	7602.8	103.6	20	17.0' " "	49.0	7553
B-566	7602.8	75.0	20	12.0' Above Top Of Star Point	49.0	7553



TYPICAL GEOLOGIC SECTION



CASING DETAIL

DEER CREEK COAL MINE
Emery County, Utah

PIEZOMETRIC DRILL HOLE STUDY

UTAH POWER & LIGHT COMPANY
Department of Mining & Exploration

DATE: 15 NOV 1983	BY: A.W.BROW
SCALE: NONE	FIGURE 2-6

in Figure 2-6. Additional in-mine drill holes will be utilized during 1983 in an attempt to establish a piezometric gradient map for the area on the west side of the Pleasant Valley Fault system. The data currently available is insufficient to depict the piezometric gradient.

With the data available it is not possible to compile a piezometric map of the water-bearing strata in the North Horn Formation, the Blackhawk Formation or the Starpoint Sandstone. The data collected from the numerous drill holes completed shows no pattern in the water level of the North Horn Formation water-bearing strata. The data collected in the mine also shows the water level of the sandstone channels in the Blackhawk Formation to be variable and that these strata are rapidly dewatered on mining. Although many drill holes have intersected the Starpoint Sandstone no piezometric level has been observed. Generally when exploration holes are drilled from the surface through the overlying strata into the Starpoint Sandstone, water flows out of the bottom of the hole through fractures which are often present. This indicates that the piezometric level is below the level normally penetrated by the drill holes.

No alluvial aquifers are present within the permit area; however, they are present in Huntington Canyon to the north. No data is available regarding this aquifer.

In 1976 the applicant submitted a hydrologic monitoring plan to the Mining Supervisor of the U. S.

Geological Survey (MMS). This monitoring plan conforms with the regulations stipulated in CFR 211 and was reviewed and approved by the Office of Surface Mining. This plan meets the regulations stipulated in the Utah Mining Code and will continue to be followed throughout the mining process.

In-Mine Water Quality

As previously mentioned water was flowing into the 1st North section crosscuts 75 through 84 between the third quarter of 1981 and the second quarter of 1982. Several samples were collected and analyzed, the results of which are summarized in Table B.

Table B: Little Dove In-Mine Water Quality

Location	Date	pH	Alkalinity	TSS	TDS	SO_4	Flow (GPM)
1st N XC 75 2L	3-24-82	7.2	475	3.5	1268	754	0.08
1st N XC 84 1R	3-24-82	7.1	470	2.0	1197	677	0.08
1982 Mean		7.15	472.5	2.75	1232.5	715.5	0.08
1981 Min.		6.9	440	2.0	1078.0	444.0	0.02
Max.		7.6	576	4.0	1410.0	704.0	0.25
Mean		7.28	496	3.1	1179.2	548.4	0.08

The samples collected show a fairly high concentration of total dissolved solids. Water samples collected in the Deer Creek and Wilberg Mine has shown high TDS when the water is flowing down a fault. Therefore, it is felt that this water is flowing down the Deer Creek Fault.

Uses of the Groundwater

The only uses of the groundwater in the Des-Bee-Dove Mine area has been for water used in the mining process. This water is suppled by water flowing into the Wilberg Mine at the rate of 19 million gallons per year and is pumped

across the Deer Creek Fault into a sump where it is stored. It is, at a later date, pumped to the mine face where it is utilized. The amount of water transferred to the mine is recorded and reported in the annual Hydrologic Monitoring Report. No water wells have been drilled within the Des-Bee-Dove Mine property.

Surface Waters (783.16)

The surface drainage system on East Mountain is divided into two major drainages; the southwest portion forms part of the Cottonwood Creek drainage and the northeast portion of East Mountain contributes to the Huntington Creek drainage (see Maps 2-10 and 2-11). These drainage boundaries, including minor subdivisions to Cottonwood and Huntington Creeks, are designated on Map 2-10. Both Huntington and Cottonwood Creeks flow out of the Wasatch Plateau in a southeasterly direction. The creeks merge with Ferron Creek to form the San Rafael River which is a tributary to the Green River.

Huntington Creek Drainage System

The Huntington Creek is comprised of many smaller tributary streams that feed the main stream. Deer Creek is the only tributary to Huntington Creek that emanates from within the existing Utah Power & Light's coal mine portal areas.

Huntington Creek flow data are recorded on a continuous basis by Utah Power & Light at two locations; one

station is located near the Huntington Power Plant, the other being below Electric Lake which is about 22 miles upstream from the Huntington Plant. Flow records are maintained by Utah Power & Light Company in order to determine water entitlements and reservoir storage allocation for the various users on the river.

The Utah Power & Light station near the plant was established in the fall of 1973. Prior flow records were obtained from the U. S. Geological Survey station located about one mine downstream from Utah Power & Light's existing station. The U. S. Geological Survey station was established in 1909, was discontinued in 1970 in order to determine available water supply for Electric Lake Dam. The dam was completed in December 1973 and water storage commenced shortly afterward.

The following table (Table C) shows a summary of actual Huntington Creek flows below Electric Lake, at Huntington Plant, and calculated natural flow at Huntington Plant. The calculated natural flow considers actual flow recorded at the plant, plant diversions, Electric Lake storage change and lake evaporation. The average daily discharges for the 1979 water year (October 1978 - September 1979) at the two stations plus the calculated natural flow are found in the Hydrologic Monitoring Plan Annual Report.

During the 1979 spring runoff period, approximately 10,000 acre feet of water was impounded behind Electric Lake Dam. On June 27, 1979 the lake reached the maximum contents

TABLE C: Huntington Creek Water Flows

	Huntington Creek Below Electric Lake	Huntington Creek at Plant	Calculated Natural Flow at Plant
Total Yearly Flow (Ac. Ft.)	10,880	54,640	68,931
% of Normal	50*	78*	98
Average Discharge in Cubic Feet per Second (CFS)	15	76	95
Peak Discharge (CFS)	152	360	592
Date of Peak Discharge	August 8, 1979	May 28, 1979	May 28, 1979
Minimum Discharge in CFS	12	13	10
Date of Minimum Discharge	October 14, 1978	November 27, 1978	November 27, 1978

*Due to upstream storage in Electric Lake.

of 28,211 acre feet which is about 94% of full capacity. Fishery releases, power plant water needs and lake evaporation dropped the lake volume to about 25,000 acre feet by September 30, 1979 (end of water year).

A comparison of runoff values from 1978 and 1979 is presented in Table D to demonstrate the great fluctuation in surface discharges from year to year.

TABLE D: Comparison of 1978 and 1979 Runoff Values

	1978		1979		
	Amount	% of Normal	Amount	% of Normal	% of 1978
Runoff Stored in Electric Lake (Ac. Ft.)	14,000	150	10,000	107	71
Calculated Natural Flow at Plant (Ac. Ft.)	86,000	123	69,000	98	80
Actual Peak* Discharge at Plant (CFS)	585	-	360	-	62

* Peak flow is the maximum recorded for a 24-hour period.

Water quality information on Huntington Creek was compiled on a monthly basis during 1979. Vaughn Hansen Associates conducted the sampling program and the analyses were performed by Ford Chemical Laboratory. The location of water quality sampling stations on Huntington Creek that were considered for this report are listed below (refer to Map 2-10).

1. Below Electric Lake
2. Above the Forks
3. Above the Power Plant Diversion
4. Below the Power Plant

Specific water quality constituents which were analyzed are shown in Table E. Values are in milligrams per liter unless otherwise noted. Raw data can be found in Appendix to the Annual Hydrologic Monitoring Report.

In general, the water shows a gradual increase in concentration of dissolved minerals as the flow proceeds down Huntington Canyon.

The values at the station below Electric Lake do not express the actual natural drainage water quality characteristics because of the lake effect but it appears that the surface flow in Huntington Canyon is of very high quality in the upper reaches with some natural degradation occurring as the flow proceeds to the canyon mouth.

The comparison of water quality characteristics within the Huntington drainage for 1978 and 1979 is presented in Table F. This comparison merits consideration in order to evaluate the changes in water quality from year to year. Average values are presented in milligrams per liter.

An examination of Table F indicates that the values for 1978 and 1979 are fairly consistent and uniform in comparison. TDS, specific conductance, turbidity, alkalinity and total hardness values were somewhat higher in 1979 while other constituents were about the same.

TABLE E: Huntington Creek Water Quality

Parameter	Below Electric Lake			Right Fork Above Left Fork			Above Power Plant			Below Power Plant		
	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.
pH (N.U.)	7.6	8.5	7.0	8.0	8.7	7.1	7.4	8.6	7.4	8.1	8.7	7.5
Diss. Oxy.	8.8	10.4	7.6	9.1	11.8	7.9	9.5	12.3	8.1	9.3	10.7	8.1
Sulfate	53	194	14	13	19	10	25.3	52	8.2	52	108	21
T. Susp. Solids	3.3	8.0	1.0	20	114	4.0	81	227	8.0	79	166	6.0
T. Diss. Solids	197	400	120	203	250	140	232	310	148	281	399	179
Spec. Cond. (umhos)	279	430	220	317	380	240	364	470	230	437	610	280
Turbidity (FTU)	3.6	10	0.5	5.5	30	0.4	-	-	-	-	-	-
Alkalinity (TOT.)	135	142	124	195	218	178	154	220	134	194	232	142
T. Hardness	153	170	138	196	222	174	202	250	136	233	298	158

TABLE F: Huntington Creek Water Quality Comparison 1978-1979

Parameter	Below Electric Lake		Right Fork Above Left Fork		Above Power Plant		Below Power Plant	
	1978	1979	1978	1979	1978	1979	1978	1979
pH (N.U.)	7.6	7.6	7.9	8.0	8.0	7.4	8.0	8.1
Diss. Oxy.	9.2	8.8	9.4	9.1	9.5	9.5	9.6	9.3
Sulfate	17	53	27	13	25.2	25.3	42.4	52
T. Susp. Solids	-	3.3	-	20	27.5	81	74.2	79
T. Diss. Solids	160	197	215	203	214	232	246	281
Spec. Cond. (umhos)	245	279	330	317	329	364	380	437
Turbidity (FTU)	1.6	3.6	4.2	5.5	18.8	-	28.4	-
Alkalinity (TOT.)	133	135	176	195	182	154	186	194
T. Hardness	142	153	187	196	195	202	214	233

Deer Creek is a tributary to Huntington Creek and flows from the same canyon in which the Deer Creek portal is located. Permanent runoff sampling sites were established in 1980. They include the following locations (see Map 2-10):

1. Above the Mine

Location: (Approximately 600 feet upstream from the mine facility) 2,000 feet North, 800 West of the Southeast corner of Section 10, Township 17 South, Range 7 East.

2. Below the Mine

Location: (Approximately 12,000 feet downstream from the mine facility) 480 feet South, 3,360 East of the Northwest corner of Section 1, Township 17 South, Range 7 East.

To obtain accurate flow measurements during runoff periods Parshall flumes were installed at each of the sampling locations in the Deer Creek drainage. The installation took place during the month of May 1982. The first set of runoff samples were collected before the installation of the flumes, only estimated flow data was recorded. These sites were selected because they would allow optimum conditions for flow measurement and sampling and they would provide data showing any water quality change in the disturbed area.

A water sampling schedule was established in 1981 which includes collection of water quality samples (grab type) along with quantity measurements. This information is

collected on a monthly basis during the first or second week of each month throughout the duration of the runoff season. In all cases, samples are taken above and below the Deer Creek Mine (disturb area) with an hour interval. Permanent sampling locations and consistent scheduling should help in correlating water quality with runoff flow fluctuations from a year to year basis.

The results of the 1982 quality analysis are listed in Table G and H. The minimum, maximum and mean values are given for each year in which data was collected along with the historical results. Values are in milligrams per liter unless otherwise noted. Complete raw data can be found in Appendix C of the 1982 Hydrologic Monitoring Report. It is apparent from the tables that the quality of the Deer Creek runoff degradates slightly from the upper to the lower sampling point. The quality of the lower sampling point is possibly affected by the Mancos Shale which surrounds the sampling location. An examination of Tables G and H indicates that the data for 1982 follows closely with the historical data, except for total suspended solids and iron, in which these parameters show a considerable decrease for both locations.

TABLE G: DEER CREEK SURFACE WATER QUALITY

ABOVE THE MINE

1982 Sample Dates	pH (Units)	Conductivity UM HOS/CM	TDS	TSS	Iron Total	Manganese
5-3	8.0	510	289	92	0.87	0.18
6-1	7.3	510	280	52	0.80	0.16
7-6	7.8	500	276	9.0	0.81	0.13
8-3	7.9	510	281	0.5	0.76	0.12
9-15	8.2	490	308	1.5	0.19	0.06
10-11	8.1	640	359	12.0	0.15	0.12
Min.	7.3	490	276	0.5	0.15	0.06
Max.	8.2	640	359	92.0	0.87	0.18
Mean	7.9	526.7	298.8	27.8	0.6	0.13
1978*						
Min.	7.0	360	235	521	0.29	0.19
Max.	7.0	360	235	521	0.29	0.19
Mean	7.0	360	235	521	0.29	0.19
1979						
Min.	7.7	470	260	4.6	0.32	-
Max.	8.5	470	310	1400	40.1	-
Mean	8.1	470	285	702.3	20.2	-
1980						
Min.	7.9	570	337	0.5	0.07	0.01
Max.	8.0	820	533	3592	0.20	0.24
Mean	7.9	695	435	1796.3	0.13	0.13
1981						
Min.	8.3	600	332	0.5	0.09	0.01
Max.	8.3	700	482	3.5	0.20	0.02
Mean	8.3	633.3	384.7	1.7	0.13	0.01
Historical 1978 - 1981						
Min.	7.0	360	235	0.5	0.07	0.01
Max.	8.5	820	533	3592	40.1	0.24
Mean	8.0	588.6	353.6	690.4	5.2	0.08

* Only one sample collected.

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TABLE H: DEER CREEK SURFACE WATER QUALITY
BELOW THE MINE

1982 Sample Dates	pH (Units)	Conductivity UM HOS/CM	TDS	TSS	Iron Total	Manganese
5-3	8.0	880	520	183	1.78	0.23
6-1	7.7	650	367	54	1.79	0.19
7-6	7.9	720	399	3.5	1.13	0.20
8-3	8.0	900	497	29.5	1.00	0.19
9-15	8.2	1180	649	4.5	0.27	0.09
10-11	8.3	1380	868	2.0	0.10	0.09
Min.	7.7	650	367	2.0	0.10	0.09
Max.	8.3	1380	868	183.0	1.80	0.23
Mean	8.0	951.7	550	46.1	1.01	0.17
1978*						
Min.	6.9	420	273	1124	0.39	0.21
Max.	6.9	420	273	1124	0.39	0.21
Mean	6.9	420	273	1124	0.39	0.21
1979						
Min.	7.4	730	440	40.6	0.65	-
Max.	8.4	730	477	20.540	170	-
Mean	7.9	730	459	10.290	85.3	-
1980						
Min.	7.9	790	452	9.5	0.16	0.01
Max.	8.0	870	567	396	0.30	0.27
Mean	8.0	830	510	203	0.21	0.14
1981						
Min.	8.2	1500	959	2.5	0.09	0.01
Max.	8.3	1650	1021	5.5	0.24	0.03
Mean	8.3	1575	990	4.0	0.17	0.02
Historical 1978 - 1981						
Min.	6.9	420	273	2.5	0.09	0.01
Max.	8.4	1650	1021	20,540	170	0.27
Mean	7.9	993.3	598.4	3159.7	24.5	0.11

* Only one sample collected.

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Cottonwood Creek Drainage System

The western and southern portions of East Mountain are intersected by Cottonwood Creek and its associated tributaries, including Grimes Wash. The Cottonwood Creek drainage is about equal in size to the Huntington drainage and total discharge from each drainage is about 70,000 acre feet per year. The major cultural feature on Cottonwood Creek is the Joe's Valley Reservoir which is located about 12 miles west of the town of Orangeville. The 63,000 acre foot reservoir was constructed by the U. S. Bureau of Reclamation and provides storage water for irrigation, industrial and municipal needs in the Emery County area.

Limited flow information for 1979 was acquired from the Emery Water Conservancy District and the Cottonwood Consolidated Irrigation Company. Joe's Valley storage on September 30, 1978 was 48,530 acre feet. Total storage on September 30, 1979 was equal to 45,040 acre feet, or a net decrease of 3,490 acre feet for the water year.

Joe's Valley filled on June 4, 1979 and spill occurred until July 2. A peak flow of 585 CFS was observed below Joe's Valley Dam on June 15. About 68,000 acre feet of water was delivered for irrigation during the year and net runoff from the Cottonwood Creek drainage was approximately 64,000 acre feet, or 90% of normal. By comparison, the Cottonwood drainage yielded about 85,000 acre feet of water

during 1978, indicating that 1979 runoff amounted to 76% of 1978.

Water quality information for Cottonwood Creek (Straight Canyon) was acquired from the U. S. Geological Survey. The sampling station is located at the USGS stream gauging station site and is shown on Map 2-10. Table I shows the water quality characteristics of the samples obtained during 1979 plus a comparison with 1978 values. Additional quality data can be found in the Hydrologic Monitoring Plan Annual Report.

TABLE I: Cottonwood Creek (Straight Canyon) Water Quality

Parameter	1979			1978		
	Avg.	Max.	Min.	Avg.	Max.	Min.
pH	8.2	8.8	7.5	7.9	8.5	7.5
Sulfate	57.0	110	24	49	110	21
Total Dissolved Solids	283	353	215	271	372	203
Specific Conductance (umhos)	468	610	380	447	635	360

An analysis of the preceding table and lower Huntington Creek water quality indicates that both creeks have similar water quality characteristics. It would appear that the presence of Joe's Valley Reservoir would likely affect the characteristics of upstream runoff in a manner similar to Electric Lake on Huntington Creek. However, no water quality information is available to support that assumption.

The concentrations of the parameters shown in the table were somewhat higher in 1979 than the 1978 values. Water supplies were lower in 1979, which may account for higher mineral concentrations in the reduced water supply.

Utah Power & Light obtained water samples in two of the tributaries of the Cottonwood Creek drainage system, Cottonwood Creek and Grimes Wash (see Map 2-10).

The location where these samples were taken are as follows:

1. Above the Trail Mountain Mine

Location: 1,000 feet South, 2,100 feet West of the Northeast corner of Section 25, Township 17 South, Range 6 East.

2. Below the Trail Mountain Mine

Location: 1,000 feet North, 1,500 feet West of the Southeast corner of Section 25, Township 17 South, Range 6 East.

3. U.S.G.S. Flume

Location: 1,700 feet North, 200 feet East of the Southwest corner of Section 31, Township 17 South, Range 7 East.

4. Above Straight Canyon

Location: 300 feet South, 1,700 feet West of the Northeast corner of Section 7, Township 18 South, Range 7 East.

These sample data are discussed below.

Cottonwood Creek was sampled by Utah Power & Light in 1979 in the vicinity of the UP&L proposed Cottonwood portal to the Wilberg Mine. Five samples were obtained by Utah Power & Light during the period August through November 1979. The average values of the sample analyses are shown in Table J. Complete inorganic analyses of Utah Power & Light samples as well as water quality information furnished by the USGS can be found in Appendix E of the Water Monitoring Report. Location of the sample stations is shown on Map 2-13.

TABLE J: Water Quality of Cottonwood Creek

Parameter	Above Trail Mtn. Mine	Below Trail Mtn. Mine	At USGS Flume	Above Straight Canyon
Alkalinity	262	266	244	272
Iron	0.14	0.20	0.23	0.18
Oil and Grease	1.05	2.48	0.40	0.64
Sulfate	53	50	50	76
Suspended Solids	8.25	9.0	16.0	8.0
Total Dissolved Solids	386	356	332	391
pH	7.5	7.7	7.6	7.8

Limited flow information at the USGS flume on Cottonwood Creek shows that summer discharges vary from 250 to 350 gallons per minute or about 0.67 cubic feet per second on the average. It is assumed that spring runoff is much greater but USGS flow data was not available to support that assumption.

Grimes Wash is a tributary to Cottonwood Creek and flows from the same canyon in which the Wilberg Mine and the Deer Creek Mine 9th East breakout are located. Three

permanent runoff sampling sites were established in 1980. They include the following (see Map 2-10).

1. Right Fork

Location: (Approximately 1,500 feet upstream from the inlet culvert for the disturbed area.) 550 feet North, 1,500 feet West of the Southeast corner of Section 22, Township 17 South, Range 7 East.

2. Left Fork

Location: (Approximately 50 feet upstream from the inlet culvert for the disturbed area of the Wilberg Mine.) 200 feet South, 2,350 feet East of the Northwest corner of Section 27, Township 17 South, Range 7 East.

3. Below the Wilberg Mine

Location: (Approximately 500 feet downstream from the outlet culvert below the disturbed area.) 1,770 feet South, 1,820 feet West of the Northeast corner of Section 27, Township 17 South, Range 7 East.

These locations were selected because they offer the best conditions for installation of flumes and accurately monitoring flow from the stream. Samples are, and will be, collected and flow measurements made by the applicant at these sites on a monthly basis during the runoff period. The sampling locations upstream from the mine workings are monitored within the same hour as the location which is downstream from the mine.

A sampling schedule was established in 1981 which includes collection of water (grab type) quality samples

along with quantity measurements. This information is collected on a monthly basis during the first or second week of each month throughout the duration of the runoff season. If the drainage runoff persists through the winter months sampling will continue on a quarterly basis until the beginning of next runoff period.

Table K shows the average results of the 1979 sampling in Grimes Wash. Raw data can be found in the Hydrologic Monitoring Report.

TABLE K: Grimes Wash Water Quality

Parameter	Right Fork Above Mine (4 Samples)	Right Fork Below Mine (3 Samples)	Left Fork Above Mine (1 Sample)
Alkalinity	317	252	263
Iron	3.4	6.8	0.8
Oil and Grease	1.9	1.4	0.1
Sulfate	90	128	30
Suspended Solids	677	407	28
Total Dissolved Solids	523	308	327
pH	8.0	8.0	8.7

Of particular interest in Table K are the extremely high suspended sediment values from the Right Fork of Grimes Wash. The samples were obtained during May and June which coincides with the 1979 spring runoff period. It is expected that these high values would be reduced to lower values during low flow conditions occurring in late summer, fall, and winter.

The Des-Bee-Dove Mines are located in a dry wash to Grimes Wash. This wash rarely experiences water flow and

then only during cloudburst storms. For this reason and because the only access to the wash is by foot along steep slopes that are very slick when wet, it is not felt prudent to risk injury to collect samples; therefore, no samples have been taken.

East Mountain Springs

A number of springs and seeps contribute to the surface water bodies on and adjacent to UP&L East Mountain properties. An aerial survey and subsequent field work during the summer of 1979 confirmed the location of over 50 springs producing measurable amounts of water (see Map 2-11).

Table L is a tabulation of flow data and a listing of the formations from which these springs flow. The majority of springs on East Mountain occur in the North Horn Formation with the major flowing springs restricted to this formation. The North Horn Formation is composed of a sedimentary sequence of variegated shales, sandstone, conglomerates and fresh water limestone. The variability of composition of this formation would likewise lead to a variation in permeability.

Overlying the North Horn Formation is the Flagstaff Limestone, a highly fractured unit. The fractured nature of the Flagstaff allows for good vertical transport of water with little lateral movement resulting in the occurrence of few springs. The majority of water percolates down to the North Horn Formation. When an impermeable zone is intersected during the water's vertical movement, a lateral

migration is promoted. If the ground surface is intersected by these waters, a spring is formed. This often is the case in the North Horn Formation where a large number of springs is to be found. Some portion of the water will make its way down to the Price River Formation where a few springs are located.

A review of the flow measurements presented in Table L reflects the influence of seasonal melt waters on spring water production. The large producing springs experienced a decrease in flow from between 82% to 93% from July to October. The smaller springs which are flowing from less permeable strata showed little or no difference in flow rates. These springs have a greater lag time thus responding to variations in recharge supplies more slowly.

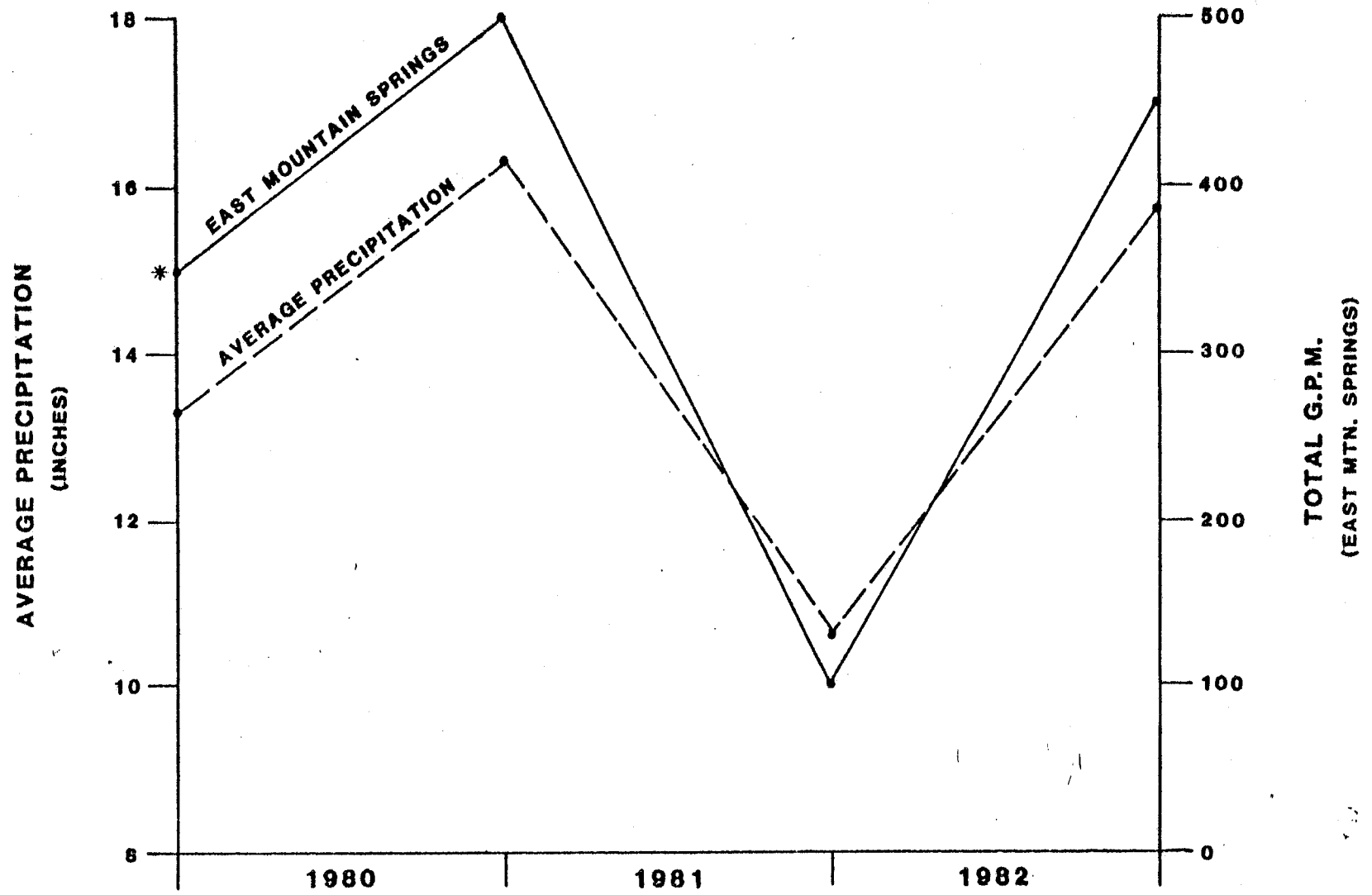
The volume of water discharged from the various springs on East Mountain is closely related to the amount of precipitation recorded. Figure 2-7 reflects the direct correlation between spring discharge and precipitation. The annual precipitation is an average of the four weather stations reported in the Climatology section, i.e., Hunter Plant, Huntington Plant, Electric Lake and East Mountain. This comparison will be vital in determining mining effects on spring discharge versus general changes in annual precipitation.

The USGS conducted an extensive flow monitoring program on East Mountain during 1979. The results of flow monitoring for specific springs are presented in Table M.

TABLE L: East Mountain Springs Discharges

Spring	Elevation	Formation	Sample Date	Flow (GPM)	Sample Date	Flow (GPM)
Sheba Spring	9740	TKN-TF	7/10/79	12.0	10/22/79	0.95
Pine Spring	9940	TF	7/10/79	4.1	10/22/79	Dry
Pine Spring Trough	9920	TF	7/10/79	6.6	10/22/79	Dry
Upper Elk Spring	9350	TKN	7/10/79	1000.0 ?	10/22/79	75.0
Lower Elk Spring	9300	TKN	*7/10/79	350.0		
Ted's Tub	9250	TKN	7/10/79	65.0	10/22/79	12.0
Cove North Spring	8980	KPR	7/10/79	0.67		
Burnt Tree Spring	9260	TKN	7/10/79	12.0	10/22/79	1.9
79-1	9650	TKN-TF	7/10/79	40.0	10/22/79	5.0
79-2	9290	TKN	7/10/79	0.5		
79-3	9340	TKN	7/10/79	2.6		
79-4	9910	TF	7/11/79	2.4		
79-5	9910	TF	7/11/79	3.1		
79-6	9720	TKN-TF	7/11/79	0.86		
79-7	9710	TKN-TF	7/11/79	0.53		
79-8	9490	TKN	7/12/79	2.0		
79-9	9650	TKN	7/12/79	4.1		
79-10	9430	TKN	7/12/79	6.0		
79-11	9220	TKN	7/12/79	6.0		
79-12	9320	TKN	*7/12/79	8.5		
79-13	9290	TKN	7/12/79	6.0		
79-14	9340	TKN	7/12/79	1.5		
79-15	9290	TKN	7/13/79	2.0		
79-16	9600	TKN	7/13/79	12.0		
79-17	9450	TKN	7/13/79	0.5		
79-18	9500	TKN	7/14/79	4.0		
79-19	9460	TKN	7/14/79	3.0		
79-20	9500	TKN	7/14/79	40.0		
79-21	9340	TKN	7/14/79	20.0		
79-22	9340	TKN	7/14/79	14.0		
79-23	9030	TKN-KPR	7/14/79	8.5		
79-24	8870	KPR	*7/14/79	34.0	10/22/79	2.4
79-25	8910	TKN-KPR	7/15/79	10.0		
79-26	9340	TKN	7/15/79	8.0		
79-27	9330	TKN	7/15/79	10.0		
79-28	9340	TKN	*7/15/79	3.0	10/22/79	3.0
79-29	9350	TKN	7/26/79	4.0		
79-30	8900	TKN-KPR	7/26/79	1.5		
79-31	9270	TKN	7/26/79	0.6		
79-32	8850	KPR	7/26/79	1.4		
79-33	8710	KPR	7/26/79	1.4	10/22/79	1.3
79-34	9160	TKN	7/26/79	10.0		
79-35	9590	TKN-TF	7/26/79	20.0		
79-36	9080	TKN-KPR	7/27/79	1.3		
79-37	9140	TKN	7/27/79	1.4		
79-38	9070	TKN-KPR	7/27/79	2.0		
79-39	9270	TKN	8/23/79	14.0		
79-40	9030	KPR	8/23/79	0.4		

*No sample collected from these locations
TF - Flagstaff Limestone
TKN - North Horn Formation
KPR - Price River Formation



*INCLUDES ESTIMATED DISCHARGE
OF SPRINGS NOT SAMPLED IN 1979

FIGURE 2-7

AVERAGE YEARLY PRECIPITATION vs. TOTAL SPRING DISCHARGE

A comparison of 1978 and 1979 discharges from East Mountain springs is presented in Table N. The numbers shown represent average values for each year.

TABLE M: USGS Flow Data for East Mountain Springs

Spring	Elevation	No. of Measurements	Flow (gpm) Avg.	Max.	Min.
Sheba Spring (Roans Canyon)	9,740	5	10.1	27	2.2
Pine Spring	9,940	5	11.8	49	0
Elk Spring	9,350	5	235	566	63
Burnt Tree	9,260	5	17.2	30	10
Jerk Water	-	5	2.3	3.8	1.2
Ted's Tub	9,250	5	51.3	167	3.3

TABLE N: East Mountain Springs Discharges 1978-1979

Spring	1978 Flow in gpm	1979 Flow in gpm	1979 Expressed as % of 1978
Sheba Spring	4.9	10.1	206
Pine Spring	2.0	11.8	590
Elk Spring	164	235	143
Burnt Tree Spring	7.8	17.2	220
Jerk Water Spring	1.8	2.3	128
Total	180.5	276.4	153

An examination of the table reveals that discharges from East Mountain springs were greater in 1979 for the five springs listed. Total average flow for 1979 amounted to 153 percent of the 1978 flows. Interestingly, surface discharges in Cottonwood and Huntington Creeks were lower in 1979 while East Mountain spring discharges were significantly higher.

The water at all spring locations are highly mineralized but of good quality. Calcium carbonate derived from the dissolution of calcareous strata contributed to the high concentration of dissolved solids and alkalinity. A summary of the average values obtained for specific East Mountain springs is presented in Table O. Raw data for individual springs can be found in the Hydrologic Monitoring Plan Annual Report.

TABLE O: East Mountain Springs Water Quality

Parameter	Sheba	Pine	Elk	Ted's Tub	Cove North	Burnt Tree
pH	8.1	8.4	8.2	7.9	8.3	7.8
Alkalinity	223	392	241	272	256	278
Suspended Solids	0.2	32	1.9	2.3	0.1	0.1
Total Dissolved Solids	250	227	250	295	304	291
Sulfate	7.0	8.2	15.1	20.4	10.7	7.8
Iron	0.4	1.8	0.16	0.1	0.03	0.07
Oil and Grease	0.6	0.1	0.6	2.2	0.1	0.7
Turbidity (NTU)	0.4	6.3	0.6	1.5	5.0	1.2

Uses of Surface Waters

Nine springs have been developed in Huntington Canyon to provide for domestic, industrial and commercial water needs. Presently, Huntington City utilizes two springs in Huntington Canyon, Big Bear Canyon Springs and Little Bear Canyon Springs. The average discharge from these two springs amounted to 390 gallons per minute during 1979. The North Emery Water Users Association also utilizes springs in Huntington Canyon to provide for domestic and industrial water needs in areas outside of Huntington City. Presently, the Association is utilizing water from three springs in

Rilda Canyon as well as from four other springs in the general area which are shown on Map 2-10 and 2-11.

Available data indicate that the combined flow from the nine springs is approximately 230 gallons per minute. However, this flow represents average conditions and does not account for seasonal highs and lows.

Water discharge from all the springs identified on East Mountain will be measured in early July of each year by the applicant. Generally, access to all the springs is not possible before early July because of snow drifts. Discharge of the springs that are accessible will also be measured each October to document seasonal flow variation.

Baseline water quality data has been established by sampling all of the springs since 1979. These data show little variation of water quality in time. Because of this the applicant will only test water samples annually from the springs that are within the boundary of the area to be mined in the next five years or those that overly the existing mine workings. As the five year mine plan takes in new areas, springs within those areas will be sampled and tested annually.

Figure 2-8 shows the springs which are currently within the area of the Des-Bee-Dove Mine workings and their relationship to the mine workings. Water quality samples are collected from all of these springs at least once per year.

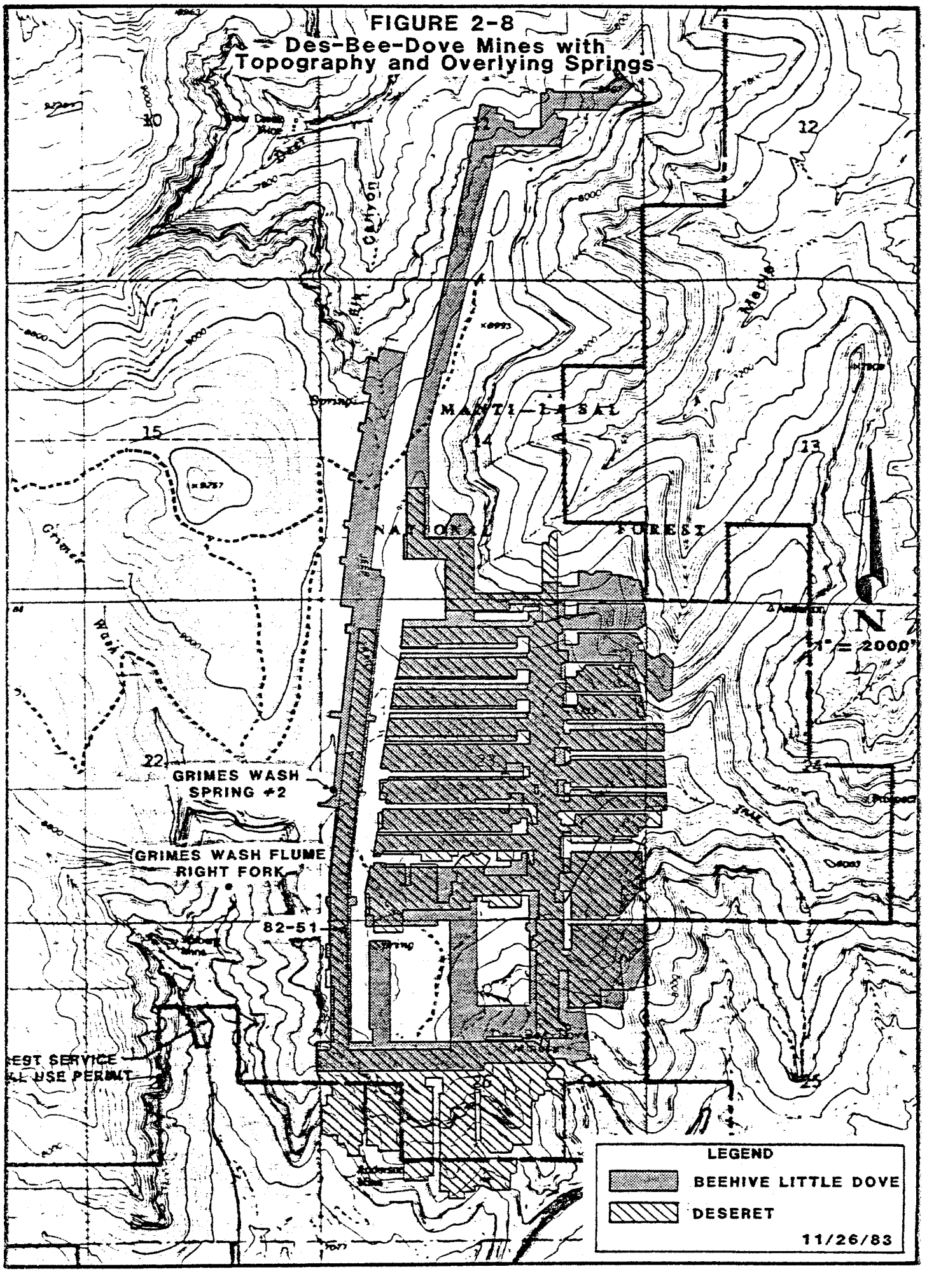


FIGURE 2-8
Des-Bee-Dove Mines with
Topography and Overlying Springs
MANTI-LA SAL
NATIONAL
FOREST
GRIMES WASH
SPRING #2
GRIMES WASH FLUME
RIGHT FORK
82-51
N
1" = 2000'
LEGEND
BEEHIVE LITTLE DOVE
DESERET
11/26/83

Some of the springs on East Mountain have been developed for watering livestock by installing troughs. Also, Elk Springs and Burnt Tree Springs have limited use as culinary water for cabins in the area.

All data collected regarding the hydrology of East Mountain will be summarized by the applicant in an annual Hydrologic Monitoring Report. Copies of the report will be submitted to the OSM, U. S. Forest Service and Utah State Division of Oil, Gas and Mining. In addition, any raw data collected will be submitted to the Utah State Division of Oil, Gas and Mining on a quarterly basis.

Alternative Water Supply Information (783.17)

Because the area overlying the Des-Bee-Dove Mines is very dry it is not expected that the mining activities will have any effect on the surface conditions; however, there are two springs which overly the mine workings as shown in Figure 2-8 which could, however unlikely, be effected by mining. If this occurs water will be diverted by the applicant from other springs in the area to replace the loss of water.

If the springs on East Mountain were not an ample water supply to replace the disrupted water, then water could be pumped to the surface from the Deer Creek Mine, surrounding streams, or wells which could be developed on the property.

CLIMATOLOGICAL INFORMATION (783.18)

Precipitation

Precipitation in Emery County during 1979 followed a pattern similar to the southern intermountain area, being characterized by heavy winter snowfall and light summer and fall rainfall.

Precipitation amounts have and will be recorded at the Hunter and Huntington Power Plants, Electric Lake Dam and on East Mountain. Table P shows the historical average precipitation at each location and the 1982 precipitation on a monthly basis. All data collected since 1979 has been documented in the Hydrologic Monitoring Report.

TABLE P: Emery County Precipitation

	Hunter Plant		Huntington Plant		Electric Lake		East Mountain	
	Historical Average[1]	1982[2]	Historical Average	1982	Historical Average	1982	Historical Average	1982
Oct	0.20	0.58	0.95	1.12	2.03	4.18	1.13	1.95
Nov	0.53	0.27	0.65	0.25	2.03	1.44	1.65	0.40
Dec	0.22	0.45	0.47	1.30	2.62	4.79	1.15	0.90
Jan	0.79	0.94	0.80	1.63	2.53	5.26	1.59	2.90
Feb	0.61	0.45	0.61	0.20	2.07	1.66	1.03	0.60
Mar	0.98	0.54	0.79	0.73	2.45	5.06	1.50	1.40
Apr	0.34	0.00	0.47	0.00	1.50	1.11	0.41	0.20
May	0.77	0.02	0.77	0.17	1.76	1.40	0.63	0.40
June	0.03	0.00	0.38	0.00	0.65	0.59	0.07	0.05
July	0.39	0.15	0.67	0.08	1.13	1.26	1.18	1.95
Aug	0.67	1.06	0.87	0.71	1.21	2.29	1.14	1.25
Sep	1.01	1.23	0.84	1.91	1.45	5.38	2.44	2.45
Year Total	6.54	5.69	8.27	8.10	21.43	34.42	13.92	14.45

[1] Historical Average:

Hunter Plant	1975-1982
Huntington Plant	1970-1982
Electric Lake	1970-1982
East Mountain	1980-1982

[2] 1982 Water Year Oct 81 - Sept 82

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Temperature

Temperatures were highly variable during 1979 in Emery County. Winter temperatures were much colder than normal while summer temperatures were much warmer than normal. The average monthly temperatures and departures from normal during the 1979 water year are presented in Table Q.

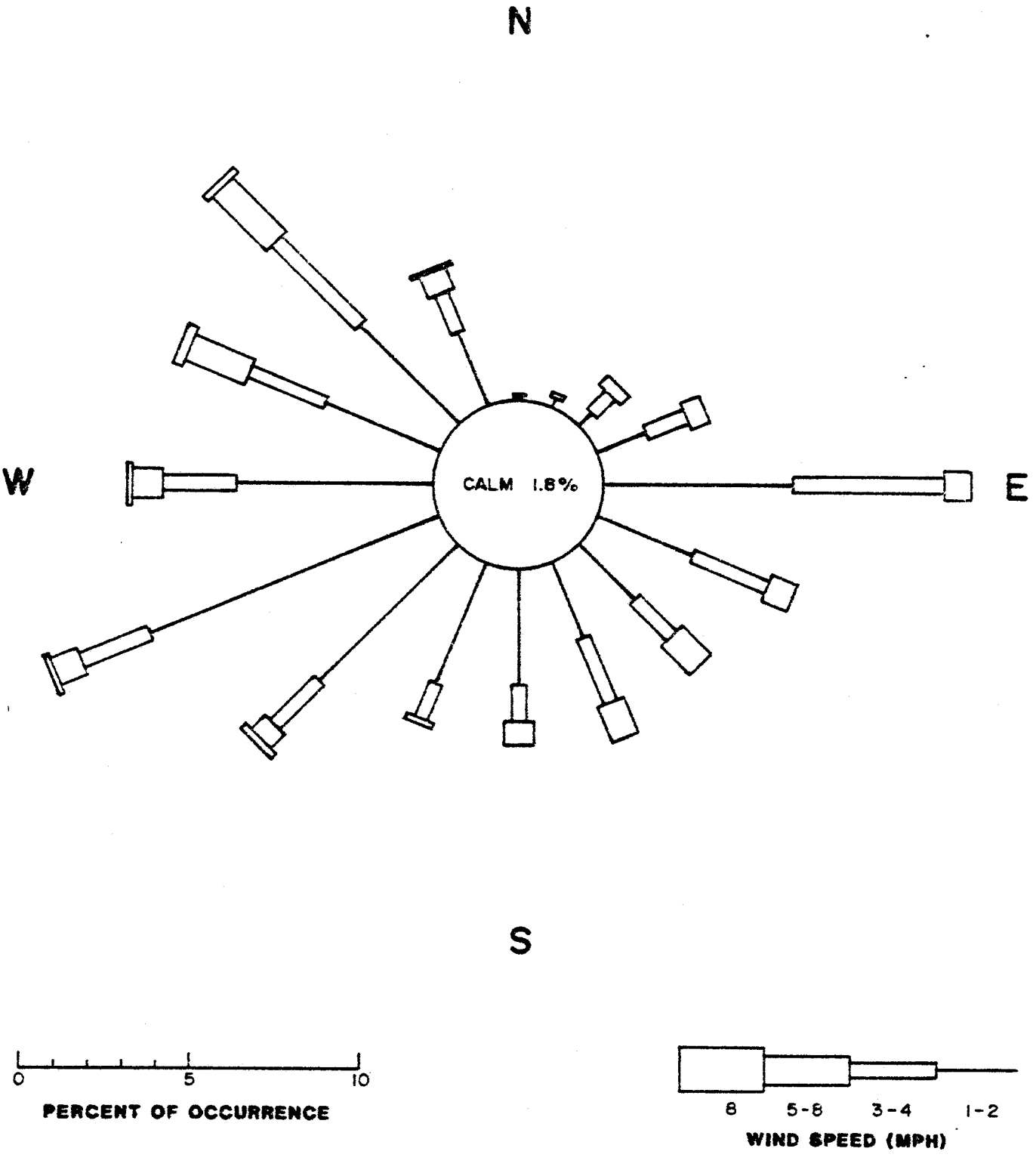
TABLE Q: Temperatures in Emery County, Utah

Month	Average Temp. (°F)	Departure From Normal	Average Temp. (°F)	Departure From Normal	Average Temp. (°F)	Departure From Normal
Oct.	53.4	+5.0	55.2	+5.8	43.4	+5.9
Nov.	37.8	+2.6	38.7	+2.7	27.4	+1.7
Dec.	17.4	-9.3	22.1	-5.3	12.4	-3.4
Jan.	13.4	-10.7	17.5	-6.1	11.8	-2.8
Feb.	20.1	-8.3	24.1	-6.1	17.9	-1.4
Mar.	35.5	-0.3	36.8	-0.9	25.1	+4.3
Apr.	45.9	+1.3	46.0	+0.9	31.7	+3.0
May	56.9	+4.8	55.9	+1.0	38.9	-0.1
June	68.0	+6.6	66.1	+0.3	49.8	+1.2
July	75.4	+7.0	73.5	+1.8	59.0	+3.3
Aug.	71.3	+4.9	67.2	-2.2	56.0	+2.2
Sept.	69.5	+10.8	65.6	+5.2	53.2	+5.7
Oct./Sept.	47.1	+1.2	47.4	-0.2	35.6	+1.7

A weather station was installed on East Mountain above the Des-Bee-Dove Mine in October of 1979 (see Map 2-11 for location). Since that time temperature, humidity, and precipitation has been recorded. The data collected between October 1, 1979 and September 30, 1982 has been summarized in the 1982 Hydrological Monitoring Report, pages 4 to 15.

Winds

The winds in the area are generally variable. The wind rose presented in Figure 2-9 displays this variability for the Meetinghouse Ridge area for January to December 1978.



MEETINGHOUSE RIDGE JAN.-DEC. 1978

ALL TIMES

FIGURE 2-9

Vegetation Information for the Des-Bee-Dove Mines

Report Prepared for

Utah Power & Light Company

by

Jerry R. Barker, Ph.D.
Range Ecologist
Bio-Resources, Inc.
P.O. Box 3447
Logan, Utah 84321

July 1982

VEGETATION INFORMATION FOR THE DES-BEE-DOVE MINES

This reports the vegetation information for the Des-Bee-Dove Mining area. The Des-Bee-Dove Mines were existing at the time of vegetational sampling. No new disturbances are planned within the permit area.

Methodology

Six vegetation types were identified within the permit area and adjacent areas and mapped (scale 1:24,000). Aerial photography (scale 1: 24,000) and field reconnaissance were utilized to construct the vegetation map. Aerial photography (taken in 1962) and the vegetation of adjacent canyons and areas were used to infer what species composition and aerial cover were before the present disturbance occurred at the Des-Bee-Dove mining site (see May 2-12).

Reference sites to represent vegetation types disturbed by mining were located as close to the disturbed areas as feasible. Differences in species composition, total plant cover, aspect, soil and geology were minimized between the disturbed area and reference site. The reference sites were marked in the field with metal T-posts and located on the vegetation map (Maps 2-12 and 2-16 in Soils Section). Pinyon-juniper and salt desert shrub were the only two vegetation types disturbed by mining activities.

Vegetation analyses of the reference sites consisted of developing a list of plant species by life form, measuring total plant cover, and determining shrub density and composition. Also, tree density by size class was determined.

Total plant cover was measured by the step-point method. Plant species, litter, rock or bare ground was determined every third pace along a 20 point transect. The starting point and direction of each transect was randomly selected.

The point-center quarter method was used to measure shrub density. At each sampling point two perpendicular lines were inscribed to delineate four quarters centered over the sampling point. The distance from the nearest shrub in each quarter to the sampling point was measured and then the shrub was identified. Shrub density was determined by the following equations:

$$A_j = (Y_1 + Y_2 + Y_3 + Y_4/4)^2$$

$$D = U(\Sigma A_j/N)$$

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where:

Y_i = distance from point to nearest shrub in ith quarter,

A_j = mean area per sampling point,

N = sample size,

D = density, the number of shrubs per unit area,

U = unit area.

Five sampling points were placed 15 paces apart along a transect. The starting point and direction of each transect was randomly located.

Tree density was obtained by a complete enumeration by species within each reference site. Tree size class was determined by measuring diameter at breast height (DBH) for all tree species except pinyon pine and Utah juniper which were measured at the base.

Statistical adequacy for sample size for aerial plant cover and shrub density was determined by the following formula:

$$N_{min} = t^2 s^2 / (d\bar{x})^2$$

where:

N_{min} = minimum sample size,

t = t-value for a 2-tailed test,

s = standard deviation,

d = allowable change in sample mean,

$\bar{x}$ = sample mean.

Sample size for aerial cover was tested at the 90 percent confidence level ($t_{0.10,\infty}$ =1.645) with a 10 percent error of the mean (d=0.10). Shrub density sample size was tested at the 80 percent confidence level ($t_{0.20,\infty}$=1.282) with 10 percent error of the mean (d=0.10). Adequacy for aerial cover and shrub density was calculated after 10 and 20 samples, respectively. Table 1 gives the minimum sample size and observed sample size for the reference areas. Data presented hereafter are based on the overall sample size.

Shrub composition based on density was determined by the following formula:

$$C = S_i / T$$

$$T = \Sigma S_i$$

where: S_i = total individuals of the ith species,

T = total number of shrubs sampled,

C = shrub composition.

Jaccard's Community Coefficient was used to quantify the similarity in plant species between the reference and disturbed area. The equation is:

$$I.S. = (C/A+B-C)100\%$$

where: I.S. = index of similarity,

A = total species in community a,

B = total species in community b,

C = number of species common to both.

The Shannon Index was used to calculate species diversity for the reference areas. The index is:

$$H'=\Sigma P_i \ln P_i$$

where: H'=species diversity index,

P_i=proportion of the observations found in category i.

Diversity calculations are based on ground cover by species. The maximum possible diversity for a reference area is:

$$H'_{max}=\ln K$$

where: H'_{max}=maximum diversity,

K=the number of categories, i.e., species.

The ratio between H' and H'_{max} is referred to as species evenness. This is calculated as:

$$J=H'/H'_{max}$$

where: J=species evenness.

Data for aerial cover, species list by life form, and tree density for the Des-Bee-Dove Mines were collected August 12-15, 1980 and analyzed September 8 and 9, 1980. Shrub density was measured April 16, 1982 with data analyzed April 21, 1982.

United States Forest Service and Utah Division of Wildlife Resources personnel located in Price, Utah were consulted on August 15 and 16, 1980 with regards to livestock and big game vegetational use within the permit area.

Personnel involved with vegetational sampling, data analysis, and report writing:

Jerry R. Barker
Bio-Resources, Inc.
P.O. Box 3447
Logan, Utah 84321

Marianne Barker
Bio-Resources, Inc.
P.O. Box 3447
Logan, Utah 84321

Mark Johnson
Emery Mining Corporation
P.O. Box 310
Huntington, Utah 84528

Personnel consulted in preparation of the information:

Alvin R. Southard
Department of Soils and Biometeorology
Utah State University
Logan, Utah 84321

Christian Shingelton
Utah Power & Light Company
P.O. Box 899
Salt Lake City, Utah 84110

Larry Dalton
Wildlife Biologist
Division of Wildlife Resources
Price, Utah 84501

Bob Graves
Range-Wildlife Specialist
United States Forest Service
Price, Utah 84501

Permit Area Vegetation

The mine property permit area is 2,800 acres. Six major vegetation types were identified within the permit area and adjacent land (see 2-12, Vegetation Map). Mixed conifer, pinyon-juniper, sagebrush, grass, riparian and salt desert shrub are the six vegetation types (Table 2). The mixed-conifer type occurs primarily at the higher elevations (above 9,000 ft.) or at lower elevations with a northern exposure. The pinyon-juniper vegetation type is found on the steep, rocky slopes with a southern exposure and the relatively flat ground at lower elevations (7,000 ft.). At the higher elevations and on north-facing slopes, it is common for the pinyon-juniper community to inter-mix with the mixed-conifer community. Elevation for this vegetation type varies from 7,000 to 9,000 feet. The sagebrush and grass vegetation types also occur at the high elevations, but are restricted to the drier sites than the mixed conifer. The riparian vegetation type is located along Deer Creek, Cottonwood and Grimes Wash. This vegetation type is better developed along Deer Creek below the mine, than along Cottonwood and Grimes Wash. The salt-desert shrub vegetation type is not found within the permit area, but is located on adjacent land. It has a southern exposure and elevation varies from 6,600 to 7,600 feet.

Productivity

Productivity measurements for the pinyon-juniper range type on steep slopes is not available. Data collection has been confined to the benches below these slopes because of their value to livestock. Very little if any livestock grazing occurs on these steep slopes, most of the forage use is by wildlife.

The current range condition of the mine reference area is judged as fair when correlated with BLM's assessment of the Grimes Allotments (BLM letter, June 1982). The opportunity for improvement is very limited because of the inherent characteristic of the pinyon-juniper overstory to inhibit understory development. Also these steep sites are limited by the lack of soil and numerous rock masses.

Pinyon-Juniper Productivity[1]

1. Soil Conservation Service, Soil Survey Carbon-Emery Area 1970

   a. Kenilworth very stony sandy loam, Lower Grimes Wash Wood Hill Range Site, Price, excellent condition (understory intact) 900-1,250 lbs./acre (dry weight).

   b. Deseret Shale Range Site, Deseret Shrub fair condition 100-285 lbs./acre (dry weight).

2. U. S. Forest Service, Ferron Ranger District
   John Healy, Range Conservationist
   East Mountain Allotment, two pinyon-juniper bench sites rated in 1982, fair condition 300-324 lbs./acre (dry weight).

3. Bureau of Land Management, San Rafael Planning Unit East and West Grimes Allotments, fair condition current stocking rates 600-100 lbs./acre (dry weight)[2].

The productivity for the pinyon-juniper reference site on the steep slopes is estimated at 25-100 lbs./acre (dry weight). This is inferred from the data on the benches and comparisons of the sites.

1. Fifty percent of the total forage production is the annual growth of the pinyon and juniper trees.

2. Based on 800 lbs. forage per AUM.

United States Department of the Interior

IN REPLY REFER TO
4190/3400
(U-067)

BUREAU OF LAND MANAGEMENT
Moab District
San Rafael Resource Area
P. O. Drawer AB
Price, Utah 84501

June 24, 1982

Mr. Jerry Barker
c/o Bio Resources
P. O. Box 3447
Logan, Utah 84321

Dear Mr. Barker:

You have requested information concerning Sections 34 and 35 of T. 17 S., R. 7 E.

The two sections are made up of three range sites:

1. Waste - Comprised mainly of cliff and rock outcrop areas.

2. Pinyon-Juniper - Made up of varying amounts of pinyon-juniper, saltbush, bitterbrush, Morman tea, blacksage, mahogany and several grass species. Plant density is between 5-18% and plant vigor is considered weak for most forage species.

3. Desert saltbush - Made up of shadscale, mat saltbush, castle valley clover, Morman tea, blacksage, and seven grass species including curlygrass, sandsage, Indian ricegrass, bull grass, and blue gramma. Plant density is between 0 and 20%.

Range condition could be estimated between fair and good. Vegetative production is low due to range site characteristics. Presently we have no current production or condition figures. There has not been any significant livestock use in the area for the last few years, due to the lack of water.

Our range survey, which was prior to 1966 indicates that Section 34 comprises 640 acres and has a carrying capacity of 9.7 AUM's. Section 35 comprises 640 acres and has a carrying capacity of 18.2 AUM's.

We hope this is the information you need.

Sincerely yours,

Neil A. Simmons

Acting Area Manager

Area Disturbed by Mining

Table 3 lists the vegetation types and acres disturbed by mining activities.

Des-Bee-Dove Mines

The disturbed area of the Des-Bee-Dove Mines totals about 20 acres. Elevation is 7,500 ft. The general slope varies from 33-36°. Average annual precipitation is 6-8 inches. A southern exposure dominates the topography. The vegetation type disturbed within this area was a pinyon-juniper (Table 4). Important woody plants were Utah juniper, pinyon pine, curlleaf mountain mahogany, saskatoon serviceberry and Cutler ephedra. Bluebunch wheatgrass, salina wildrye, and Indian ricegrass were the important grasses. Total aerial plant cover varied from 25 to 30 percent. The soil was probably a Torriorthent.

Deseret Pond

The disturbed area of the Deseret Sedimentation Pond is 1.5 acres. Elevation is 6,800 feet. Average annual precipitation is 6 inches. A southern exposure dominates the topography. Slope varies from 5-15°. The vegetation type disturbed within this area was dominated by cuneate saltbush, greasewood and salina wildrye (Table 5). Total aerial cover was about 25 percent. The soil was probably a Torriorthent.

Reference Sites

Two reference sites were established to represent the vegetation types disturbed by mining activities (Table 6, Maps 2-13 and 2-16).

Des-Bee-Dove Mines

The reference site (2,700 m^2) for the pinyon-juniper vegetation type has a southwestern exposure and an elevation of 7,800 feet. Slope varies around 33°. Important plants include Utah juniper, pinyon pine, Saskatoon serviceberry, curlleaf mountain mahogany, saline wildrye and bluebunch wheatgrass (Table 7). Aerial plant cover is 30 percent with trees providing the majority of cover (Table 8). Shrub density is 147 plants per acre (Table 9). Curlleaf mountain mahogany is the most common shrub while low rabbitbrush is the least common. Tree density is 23 plants per acre (Table 10). Pinyon pine is more common than Utah juniper. The species diversity index is 1.71. The soil belongs to the Sunup series of the loamy-skeletal mixed mesic Lithic Ustic Torriothent.

Deseret Pond

The reference site (3,096 m^2) for the salt desert shrub vegetation type (Deseret Pond) has a southwestern exposure with an elevation of 6,900 feet. Slope varies from 5-15°. Dominant plants include cuneate saltbush, salina wildrye, greasewood, and shadscale (Table 11). Total aerial plant cover is 26 percent with shrubs providing most of the cover (Table 12). Shrub density is 2,578 plants per acre (Table 13). Cuneate saltbush is the most common and greasewood the least common. Only two Utah juniper trees occur in the plot (Table 7). The species diversity index is 1.54. The soil belongs to the Chipeta soil series of the clayey mixed calcaeous mesic Typic Torriorthent.

Wildlife and Livestock

The mining permit area is located within the Ferron Ranger District of the Manti-LaSal National Forest managed by the United States Forest Service. Both wildlife and livestock utilize the permit for grazing. However, wildlife and livestock grazing is limited to the higher elevations. Very little wildlife and livestock grazing occurs on the steep slopes where the mine is located.

Deer, elk, and moose utilize the area for grazing (Table 14). Deer have a greater impact on the vegetation than elk or moose because of their high numbers.

Besides wildlife use, the area provides summer grazing for cattle (Table 15). Cattle grazing occurs on the East Mountain allotment of the Ferron Ranger District. For the past several years, there has been a 10 percent non-use of the available AUM's. During 1980, all AUM's were utilized. Overall range condition is fair.

Endangered or Threatened Plants

During the vegetation sampling, no endangered or threatened plant species were identified.

Table 1. Sample adequacy for total plant cover and shrub density for the pinyon-juniper and salt desert reference areas at Des-Bee-Dove Mines.

Reference Site	Parameter	$N_{min.}$[1]	$\bar{x}$	S.D.	$N_{obs.}$
Pinyon-juniper	Plant cover	20	31.00	8.43	20
	Shrub density	42	31.16[2]	15.78	50
Salt-desert shrub	Plant cover	13	26.00	5.68	15
	Shrub density	45	2.25[2]	1.17	50

[1]Determined after 10 and 20 samples for aerial cover and shrub density, respectively.

[2]Sample mean of mean area per plant (m^2).

Table 2. Vegetation types and size of each that are found within the permit area and adjacent land.

Vegetation Type	Total Acres	% of Permit Area
Mixed-conifer	9,037.1	50.2
Pinyon-juniper	4,524.4	25.1
Sagebrush	4,053.0	22.5
Grass	301.5	1.7
Riparian	84.0	0.5
TOTAL	18,000.0	100
Salt-desert shrub[1]	281.7	0

[1]The salt-desert shrub type is located on land adjacent to the permit area. It is influenced by the Des-Bee-Dove Pond (see vegetation map).

Table 3. Vegetation types, number of acres, and percent of vegetation type disturbed by mining at the Des-Bee-Dove Mining Area.

Vegetation Type	Acres Disturbed	% of Vegetation Type
Pinyon-juniper	20	0.4
Salt-desert shrub	1.5	0.5

Table 4. Plant species that were inferred to have grown within the disturbed portion of the pinyon-juniper vegetation type at the Des-Bee-Dove Mines.

Scientific Name	Common Name
Trees	
Juniperus osteosperma	Utah juniper
Pinus edulis	Pinyon pine
Shrubs	
Amelanchier alnifolia	Saskatoon serviceberry
Cercocarpus ledifolius	Curlleaf mountain mahogany
Chrysothamnus viscidiflorus	Low rabbitbrush
Ephedra cutleri	Cutler ephedra
Forbs	
Cryptantha sp.	Cryptantha
Grasses	
Agropyron spicatum	Bluebunch wheatgrass
Elymus salinus	Salina wildrye
Oryzopsis hymenoides	Indian ricegrass

Table 5. Plant species that were inferred to have grown within the salt-desert shrub vegetation type at the Des-Bee-Dove Pond.

Scientific Name	Common Name
Trees	
Juniperus osteosperma	Utah juniper
Shrubs	
Atriplex confertifolia	Shadscale
A. cuneata	Cuneate saltbush
Sarcobatus vermiculatus	Greasewood
Forbs	
Atriplex patula	Fat-hen saltbush
Petradoria pumila	Rock goldenrock
Grasses	
Elymus salinus	Salina wildrye

Table 6. Similarity between the pinyon-juniper and salt-desert shrub reference areas and their respective disturbed areas at Des-Bee-Doves Mines.

	Pinyon-juniper		Salt-desert shrub	
Parameter	REFERENCE	DISTURBED	REFERENCE	DISTURBED
Cover, %	30.4	25-30	26	23-27
Density, No/acre				
Shrub	147	-	2578	-
Tree	23	-	4	-
Species composition, s[1]	12	10	9	7
Aspect	Southwest	Southwest Southeast	Southwest	Southern
Elevation, ft.	7,800	7,500	6,900	6,800
Slope, °	33-36	33-36	5-15	5-15
Soil	Torriorthent	Torriorthent	Torriorthent	Torriorthent
Geology	Colluvium	Colluvium	Alluvium	Alluvium
H'	1.71	-	1.54	-
H'_{max}	2.39	-	2.19	-
J	0.72	-	0.70	-
Index of Similarity, %	83.3		87.5	

[1]s = total plant species

Table 7. Plant species occurring within reference site of the pinyon-juniper vegetation type at the Des-Bee-Dove Mines.

Scientific Name	Common Name
Trees	
Juniperus osteosperma	Utah juniper
Pinus edulis	Pinyon pine
Shrubs	
Amelanchier alnifolia	Saskatoon serviceberry
Atriplex confertifolia	Shadscale
Cercocarpus ledifolius	Curlleaf mountain mahogany
Chrysothamnus viscidiflorus	Low rabbitbush
Ephedra cutleri	Cutler ephedra
Forbs	
Cryptantha sp.	Cryptantha
Salsoli kali	Russian thistle
Grasses	
Agropyron spicatum	Bluebunch wheatgrass
Elymus salinus	Salina wildrye
Oryzopsis hymenoides	Indian ricegrass

Table 8. Ground cover by species for the pinyon-juniper reference area at the Des-Bee-Dove Mines.

Item	Percent Cover	
Trees	11.6	
Pinyon pine		8.3
Utah juniper		3.3
Shrubs	5.4	
Curlleaf mountain mahogany		3.3
Cutler ephedera		1.0
Low rabbitbrush		0.8
Shadscale		0.3
Forbs	0.6	
Cryptantha		0.3
Russian Thistle		0.3
Grasses	12.8	
Bluebunch wheatgrass		6.0
Salina wildrye		5.3
Indian ricegrass		1.5
Total plant cover	30.4	
Litter	5.0	
Rock	30.5	
Bare ground	34.5	

Table 9. Shrub density and composition for the pinyon-juniper reference area for the Des-Bee-Dove Mines.[1]

Species	Composition, %	Density, No./Acre
Curlleaf mountain mahogany	61	90
Cutler ephedra	36	53
Low rabbitbrush	3	4
	100	147

[1]Based on 50 observations. The mean area per plant was 27.5 m^2.

Table 10. Tree size class (DBH) and number of trees found within each size class by species for the pinyon-juniper and salt-desert shrub vegetation type reference areas for the Des-Bee-Dove Mines.

	Diameter at Breast Height CM				
Vegetation Type	0 - 10	10 - 25	25 - 50	> 50	% of Total
Pinyon-juniper					
Pinyon pine	9	8	5	0	65
Utah juniper	3	5	4	0	35
% of Total	35	38	27	0	
Salt-desert shrub					
Utah Juniper	2	0	0	0	100

Table 11. Plant species occurring within the reference site of the salt desert shrub vegetation type at the Deseret Pond.

Scientific Name	Common Name
Trees	
Juniperus osteosperma	Utah juniper
Shrubs	
Atriplex Canescens	Fourning saltbrush
Atriplex confertifolia	Shadscale
A. cuneata	Cuneata saltbush
Sarcobatus vermiculatus	Greasewood
Forbs	
Atriplex patula	Fat-hen saltbush
Eriogonum corymbosum	Corymbed eriogonum
Petradoria pumila	Rock goldenrod
Grasses	
Elymus salinus	Salina wildrye

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Table 12. Ground cover by species for the salt desert shrub reference area at the Deseret Pond.

Item	Percent Cover	
Trees	0.3	
Utah juniper		0.3
Shrubs	11.8	
Cuneate saltbush		8.7
Shadscale		1.7
Greasewood		1.1
Fourning saltbush		0.3
Forbs	3.6	
Corymbed eriogonum		2.0
Fat-hen saltbush		1.3
Rock goldenrod		0.3
Grasses	10.3	
Salina wildrye		10.3
Total plant cover	26.0	
Litter	3.0	
Rock	13.3	
Bare ground	57.7	
	100.0	

Table 13. Shrub density and composition for the salt-desert shrub reference area for the Des-Bee-Dove Mines.[1]

Species	Composition, %	Density, No/acre
Cuneate saltbush	70	1805
Shadscale	29	747
Greasewood	1	26
	100	2578

[1]Based on 50 observations. The mean area per plant was 1.57m^2

Table 14. Deer, elk and moose vegetation utilization on the Ferron Ranger District of the Manti-LaSal National Forest

Wildlife	Unit	High Priority[1] Summer Range	Winter[2] Range	AUM[3]	No.[4]
Deer	34 N	6,500	-	274	289
	35 S	5,450		282	297
			3,055	73	65
Elk	Manti Range	12,685		365	126
			2,320	27	8
			Critical 1,040	120	35
Moose	Entire Allotment (Year long)		15,005	130	13

[1]Total acres
[2]Total acres
[3]Animal unit month
[4]Total animals

Table 15. Cattle vegatation utilization on the East Mountain allotment of the Ferron Ranger District, Manti-LaSal National Forest.

Total Acres	Land Ownership	AUM
1,959	Private[1]	845
19,328	USFS	1,710

[1]Private land but still managed by the USFS.