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Environmental Assessment Record
on
Quintana Minerals Corporation's
Proposed Open Pit Copper Mine
at
Copper Flat, Sierra County, New Mexico

DRAFT

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
LAS CRUCES DISTRICT

EAR NO. NM-030-78-78

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ENVIRONMENTAL ASSESSMENT RECORD
on
QUINTANA MINERALS CORPORATION'S PROPOSED OPEN PIT COPPER MINE AT COPPER FLAT, SIERRA COUNTY, NEW MEXICO

WHITE SANDS RESOURCE AREA
LAS CRUCES DISTRICT
June 1977

ENVIRONMENTAL ASSESSMENT RECROD
ON
QUINTANA MINERALS CORPORATION'S
PROPOSED OPEN PIT COPPER MINE
AT COPPER FLAT, SIERRA COUNTY, NEW MEXICO

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

I. Purpose of this Report

This environmental assessment was initiated to assess the impacts anticipated if the rights-of-way applied for by Quintana Minerals Corporation for two electric transmission lines, a water pipeline, and an access road are granted. These rights-of-way are required to facilitate the opening and operating of an open pit copper mine at Copper Flat, Sierra County, New Mexico.

The mine and mining facilities will be operated under the 1872 mining laws and the State health and safety regulations. Thus, the Bureau will have no decision making nor administrative authority over the mining activities proper. This mining, however, is dependent upon the Bureau's approval for the rights-of-way which are now under application.

The National Environmental Policy Act of 1969 requires Federal agencies to analyze any environmental impacts which will result from a Federal action. Impacts are to be traced and analyzed wherever they may occur so as to measure the cumulative effects which will result from the Federal action. Therefore, this assessment evaluates the anticipated impacts of the two successive cumulative actions: the rights-of-way and the resulting action of mining if the rights-of-way are granted.

II. Developing the Environmental Assessment

Quintana Minerals Corporation has been actively interested in assessing the environmental effects which may result from their actions and in reducing adverse environmental impacts to an even greater extent than required by Federal, State or local controls. To facilitate this, the Corporation engaged an environmental consultant, Dr. Fred Glover, to conduct an environmental assessment and submit a report to the Corporation. A copy of that report is on file with Quintana Minerals Corporation and with the Las Cruces District, Bureau of Land Management.

The consultant did a number of things to make his report compatible with Bureau needs for an assessment:

1. He arranged for subcontracting of a number of specialized base-line evaluations of the area. These materials were used in his report.

2. The consultant conducted studies to obtain base-line data for his report and to establish environmental monitoring procedures requires by various regulatory agencies as well as for voluntary use by Quintana.

3. The consultant maintained a close liaison with BLM personnel during his development of the assessment and utilized comments and suggestions from Bureau personnel.

4. Bureau standards, procedures, and data were consulted for each resource activity analyzed in the report.

5. The consultant had access to and used Bureau planning system documents in preparing his report. These documents are the Caballo Planning Unit - Unit Resource Analysis of 1975, and the Management Framework Plan of 1975.

6. The consultant carried out and reported an elaborate analysis of the anticipated probable adverse and beneficial impacts from both the rights-of-way construction and the mining operation.

The Bureau environmental assessment for the rights-of-way for Quintana Minerals Corporation was prepared in the following manner:

1. The Bureau relied heavily on the various reports to Quintana Corporation, especially the consultant's report, copies of which were furnished to the Las Cruces District Office.

2. Various Bureau personnel reviewed and commented on draft materials of all portions of the consultant's report during all stages of its preparation.

3. Some resource field information was obtained, analyzed, and reports prepared by Bureau personnel, and the information then incorporated into the consultant's report.

4. Appropriate Bureau personnel reviewed the consultant's report for standards and adequacy, and reviewed the Bureau assessment to make certain that both documents properly assess the environmental situation.

5. Bureau personnel attest to the adequacy of both documents in being consistent with the various Bureau planning documents which are on file in the Las Cruces District Office.

6. This Bureau assessment deals with those anticipated impacts which may be significant, and only in summary with those that may be insignificant.

III. Historical Information

Development of the Hillsboro area surrounding this proposed mining operation was a direct result of a gold discovery made in 1877.

The area was originally named "The Las Animas Mining District" but the name was later changed to "The Hillsboro Mining District." The continued discovery of profitable placer gold deposits in the area created a boom town of Hillsboro, and by 1879, the population had reached 400 people. The demonetization of silver in 1893 put a severe strain on the town, and from this time on the economic stability of the community steadily declined.

From 1925 to 1934, there was a resurgence of activity in gold placer operations which lasted until about 1942. During the 1940's and 1950's, prospecting was continued by individuals interested in copper and gold, but no large scale activities were initiated. By 1950, the population of Hillsboro had declined to about 75 people. From the late 1950's through the 1970's, extensive copper exploration was conducted by various mining companies, including Quintana. Quintana's exploration results warranted additional efforts in 1974 and 1975, and in 1976 a mine feasibility study was completed which substantiated earlier hopes for the development of an open pit copper mine.

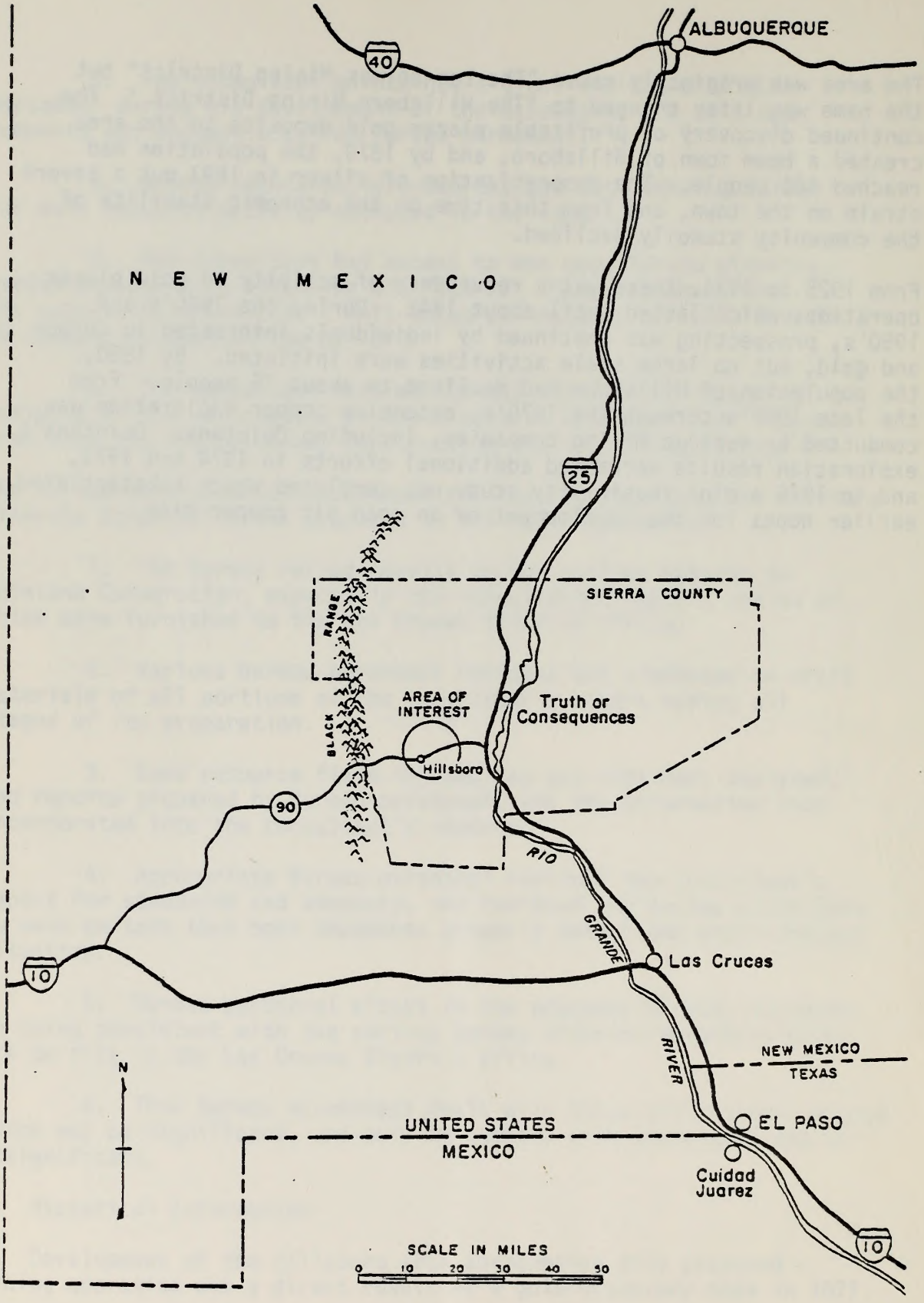


Figure 1 General area map of the proposed Copper Flat Project.

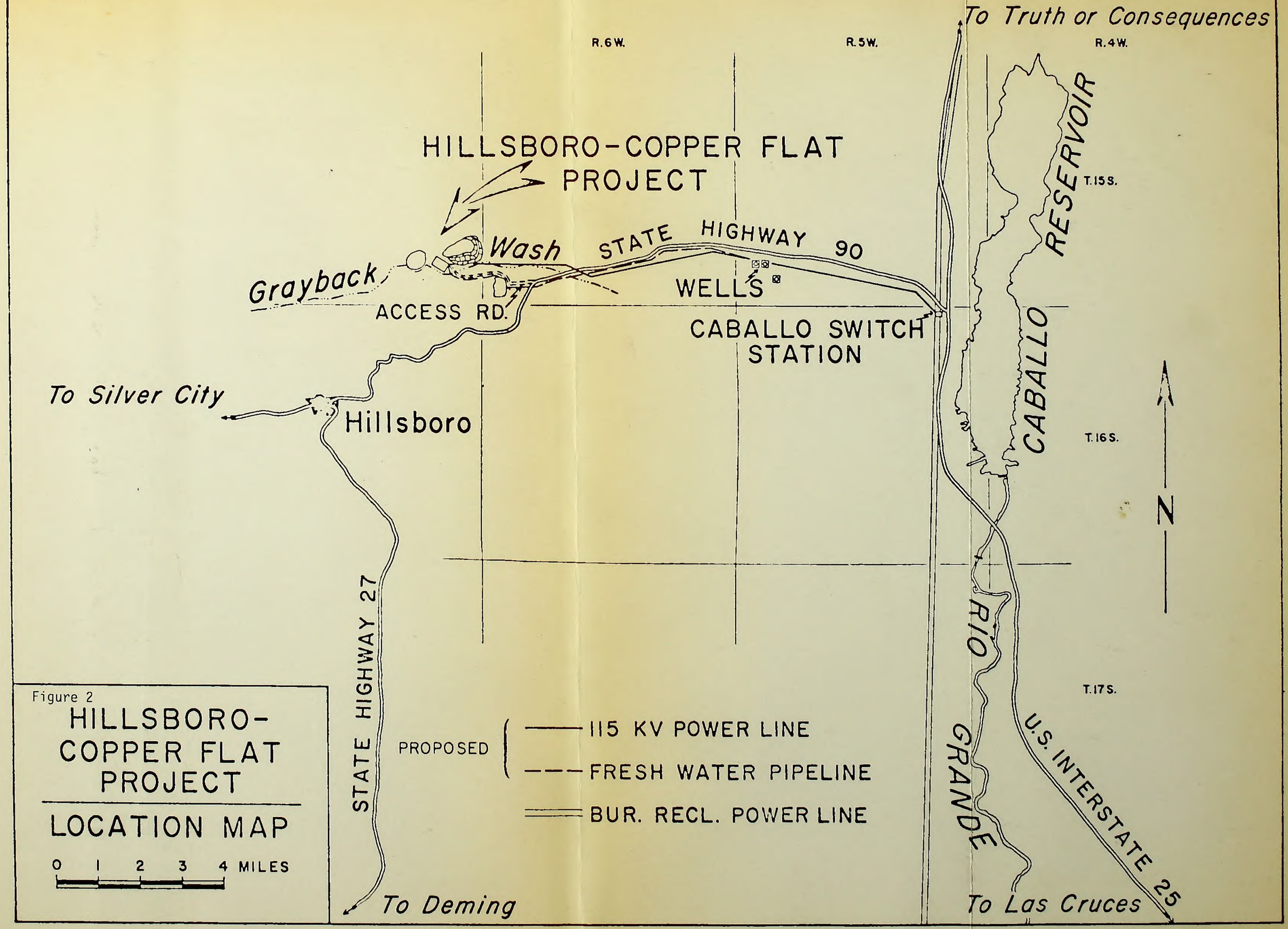
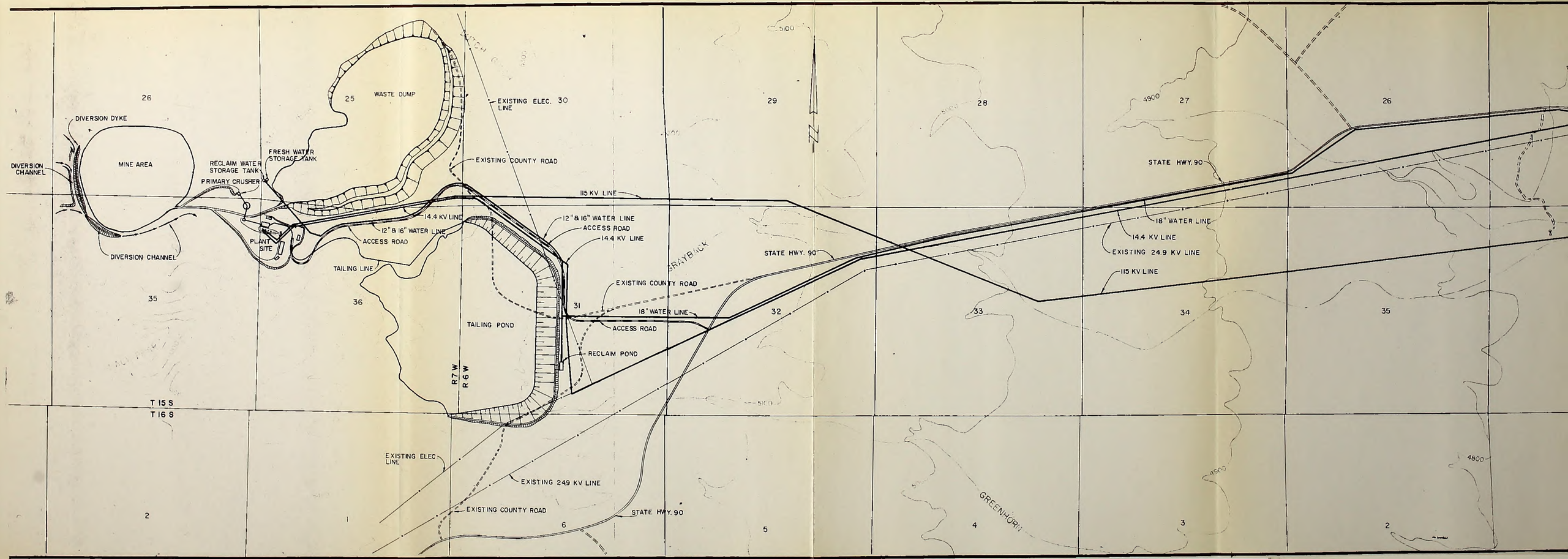


Figure 2

HILLSBORO-COPPER FLAT PROJECT

LOCATION MAP

0 1 2 3 4 MILES


DIVERSION DYKE
MINE AREA
DIVERSION CHANNEL
RECLAIM WATER STORAGE TANK
FRESH WATER STORAGE TANK
PRIMARY CRUSHER
PLANT SITE
WASTE DUMP
EXISTING ELEC. 30 LINE
EXISTING COUNTY ROAD
115 KV LINE
14.4 KV LINE
12" & 16" WATER LINE
ACCESS ROAD
TAILING LINE
TAILING POND
RECLAIM POND
18" WATER LINE
STATE HWY. 90
EXISTING 24.9 KV LINE
EXISTING ELEC LINE
GRAYBACK
GREENHORN
R7W
R6W
T15S
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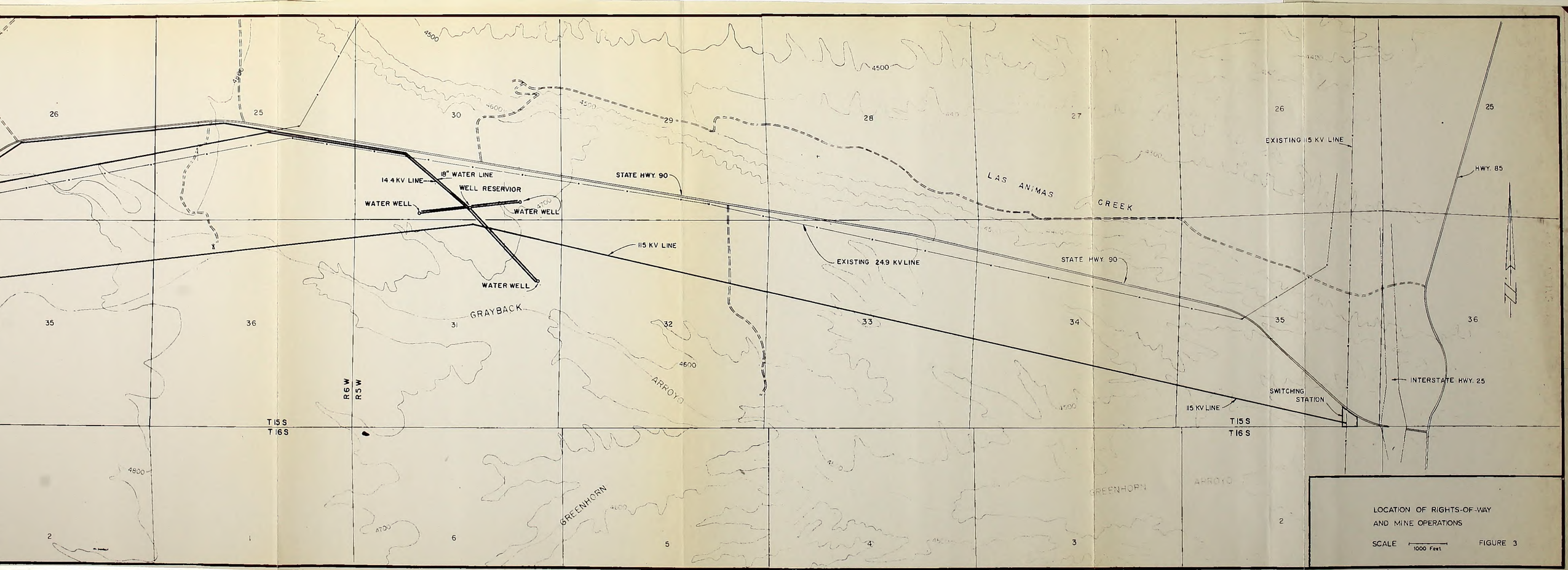
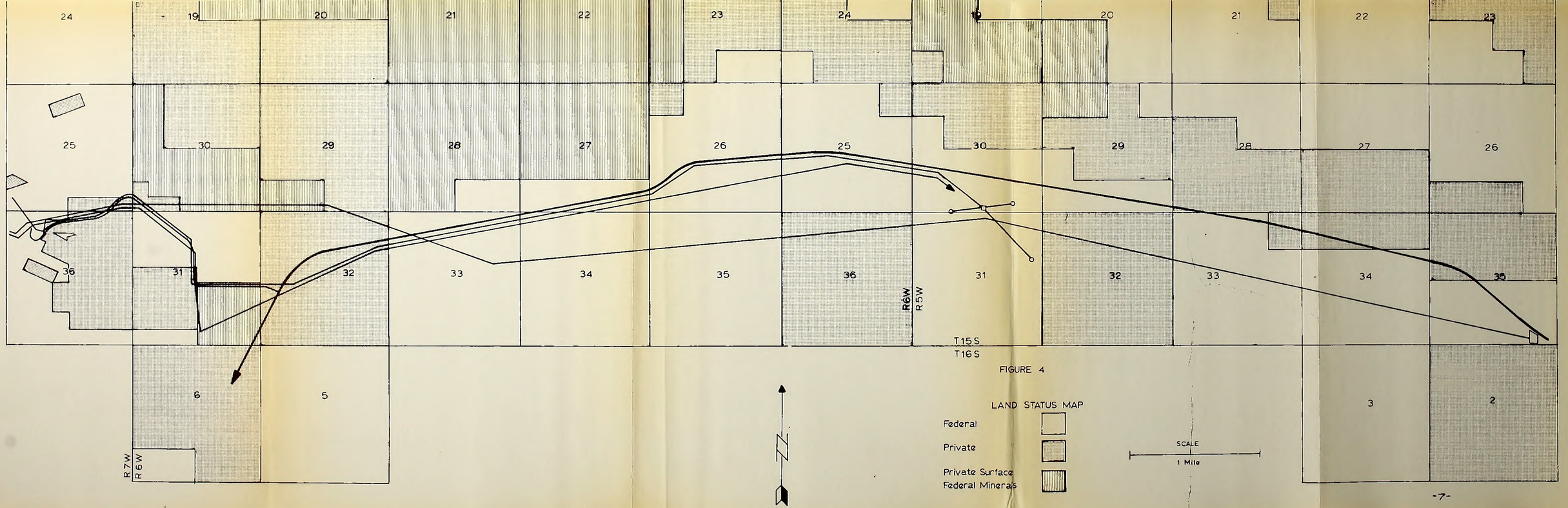


LOCATION OF RIGHTS-OF-WAY
AND MINE OPERATIONS

SCALE 1000 Feet

FIGURE 3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32
33
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R6W
R5W
T15S
T16S
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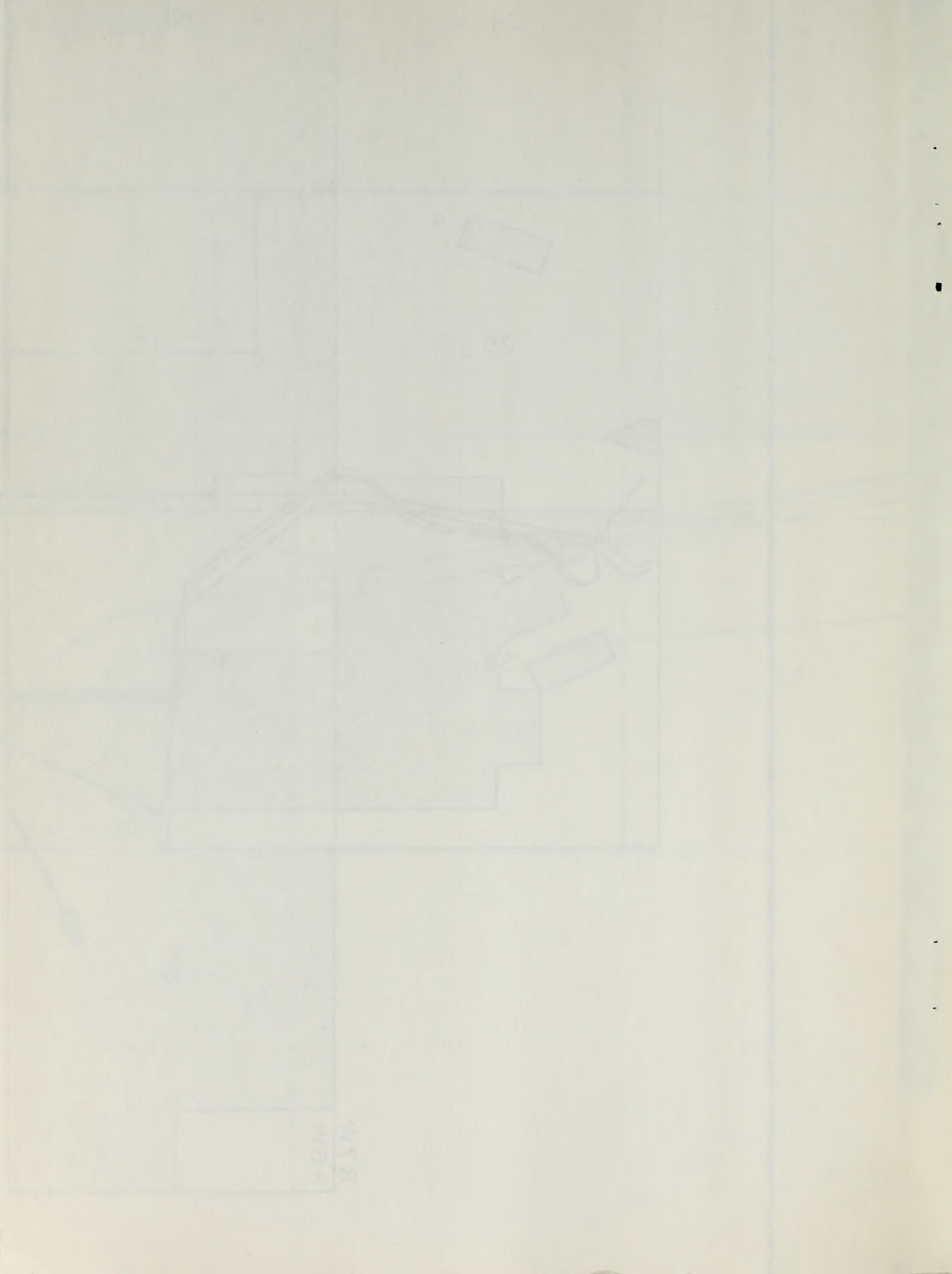
2
R7W
R6W
N
LAND STATUS MAP
Federal
Private
Private Surface
Federal Minerals
SCALE
1 Mile

FIGURE 4



I. Description of the Proposed Action and Alternatives

A. Proposed Rights-of-way: Powerlines, Waterline, and Access Road

The proposed action is to construct and maintain a 115 KV transmission line, a 14.4 Kv distribution line, an 18-inch water pipeline, and an access road. The proposed facilities will provide the power and water required in conjunction with the mining activities at the Copper Flats Project, owned and operated by Quintana Minerals Corporation. The proposed rights-of-way are shown in Figure 3.

The transmission line will be constructed by Plains Electric Generation and Transmission Cooperative. The 14.4 Kv distribution line will be constructed by Quintana and the access road will be built by Quintana. The total width of the rights-of-way area as follows:

115 Kv line	50'
14.4 Kv line	36'
Waterline	36'
Access road	60'

The rights-of-way will overlap each other for varying distances along a common general route. Due to the proximity of the projects and the similar ecosystems crossed, this environmental assessment will consider the impacts of the combined actions.

1. Proposed Actions

a. 115 Kv Transmission Line

Installation of this line is required due to the limited capacity of the existing transmission lines which are presently supplying the community of Hillsboro and the surrounding rural areas. The power required by the Quintana mining activities will exceed the load capacity of these lines. If Quintana were to be supplied from the existing lines, "brown outs" would occur and future population growth, both rural and urban, would be limited. Plains Electric has indicated that an adequate power source is available for this development.

The total length of the transmission line will be 12.1 miles; approximately 7.5 miles will be across public lands. The right-of-way will be 50 feet wide. Two substations are planned in conjunction with the transmission line; one (a switching station) in the SE¼SE¼, Sec. 35, T. 15S., R. 5W., and the other (a substation) at Quintana's plant site. Both substations

will be located on public lands. Installation of the transmission line will require approximately 50 days.

The proposed 115 Kv line will be wood-pole, H-frame construction. The current-carrying (phase) conductors will be supported from horizontal wood crossarms, and are normally spaced on 12.5 foot centers with the two wood poles also spaced 12.5 feet apart. The three-phase conductors will be approximately 266,800 circular mil size, 26/7 stranding, ACSR (aluminum cable steel reinforced).

The structures will also support two overhead static wires whose purpose is to protect the line from a direct lightning strike. These wires will be 3/8-inch, high strength steel, and will be spaced about 12.5 feet apart. Their location over the line will be such as to provide an angle of protection of about 30 degrees.

The wood poles will be Douglas fir, southern yellow pine, or equivelant, treated with a preservative to prevent deterioration from the elements. Structure heights will average about 60 feet above ground level, and ground clearance at midspan will be equal to or greater than 24 feet and will in all respects be in full compliance with State and national electric codes.

The span length between structures will average approximately 750 feet at an average of seven to eight structures per mile. Primary disturbance will be located at the structure locations.

Spacing of the conductors and the two overhead protection lines mentioned above will be such that raptor electrocution will be virtually eliminated. If deemed additionally necessary, modifications can be made to assure raptor protection.

There will be basically seven stages to the construction of the transmission line:

(1) Entry and Material Hauling

Poles, conductors, and hardware will be moved to their respective points of installation. No clearing units will be required.

(2) Framing

Crews will frame the structures at the proposed structure locations.

(3) Digging and Pole Setting

At each structure location, a hole will be dug with a truck-mounted auger approximately 30 inches in diameter to a depth of from 8 to 11 feet. The framed structure will then be placed in the hole, backfilled around the pole, and the soil compacted.

(4) Conductor Stringing

The conductor wire will be pulled through dollies attached to the insulator strings and brought up to sag. At no time will the conductor be allowed to touch the ground or any obstructions. The static wires will be pulled in a similar fashion. After stringing, the dollies will be removed and the conductor and insulator strings clipped in place. New hardware will then be installed.

(5) Clean-Up

All structures and the entire length of the right-of-way will be inspected and any discrepancies will be corrected.

(6) Erosion Control

Erosion control earthen structures will be placed where slopes dictate in accordance with existing BLM directives.

(7) Final Inspection

Final inspection will be conducted by all concerned landowners and agencies involved.

(8) Patrol-Maintenance

Once each month, when suitable weather and soil conditions exist, the line will be inspected by ground patrol; and if structure or line problems are found, they will be immediately corrected by maintenance personnel dispatched from Albuquerque. No maintenance road or clearing will be required.

b. 14.4 Kv Service Line

This line will be required to provide power to the production wells one and three located in Sec. 30, T. 15S., R. 5W., and production well two located in Sec. 31, T. 15S., R. 5W (see Figure 3 for location). It will also provide power to the main pumping station (well reservoir) on the 18-inch pipeline.

The time required for construction will depend upon whether restructuring or new construction is chosen. However, total time from start of construction to inservice will take approximately one year. The stages of implementation, with minor exceptions, will be the same as those required for the 115 Kv line. Examples of the exceptions are: the size for the poles will be smaller, the depth less; insulator strings will not be required, and conductor stringing may be different. Two approaches exist for stringing conductors; the conductors may be strung and the structures erected in one operation, or the structures may be completed and then the conductors strung.

c. 18-inch Water Pipeline

Quintana's mine and mill at Copper Flats will require approximately 1,500 to 2,500 gallons per minute of fresh water make-up while operating. This line will be necessary to transport the water due to the lack of sufficient water at the mill site. Several test wells were drilled, beginning at the mill site and moving eastward to the location of the three production wells (Sections 30 and 31, T. 15S., R. 5W.). These were the only wells which proved to have sufficient production capacity to satisfy the water demands at the time and mill. The wells are located in the Rio Grande aquifer, which is an open basin by State Engineer definition.

Installation of the steel pipe will begin at the pumping station (well reservoir) and follow the route shown in Figure 3.
Approximately six miles of pipeline will be located on public land. The width of the right-of-way will be 36 feet.

Installation will require trenching, as the pipe will be buried a minimum of two feet deep. After the pipe is placed in the trench, it will be backfilled. Equipment will include, but not be limited to, trucks, trenching equipment, and tractors. Due to the shallow soils which are present in the final three miles, blasting may be necessary to implant the pipe in the underlying basaltic materials.

Construction to inservice is expected to require approximately one year, but no initiation date has been designated.

There will be basically six stages of implementation, as follows:

(1) Entry and Material Handling

Sections of pipe will be moved and placed in sections along the route.

(2) Trenching

Machinery will be utilized to dig the trench required for the pipe.

(3) Setting of the Pipe

The sections of the pipe will be welded together and placed in the trench.

(4) Backfilling

Trenches will be backfilled to cover the pipe.

(5) Erosion Control

Surface of the trench will be leveled and water bars constructed where slopes dictate in accordance with BLM directives.

(6) Clean-Up

The entire length of the right-of-way will be inspected and all discrepancies corrected.

d. Production Wells

(1) Supply

The total water demand of the plant will be approximately 6000 gallons per minute. Of this, about 4500 gallons per minute will be reclaimed process water and approximately 1500 gallons per minute fresh water makeup from the production wells.

The plant fresh water supply will originate from three production wells, located approximately seven and one half miles from the plant site (well #1 - N½SW¼SE¼SE¼, Sec. 30, T. 15S., R. 5W., well # 2, S½NE¼SE¼NE¼, Sec. 31, T. 15S., R. 5W., and well #3, S½SW¼SE¼SW¼, Sec. 30, T. 15S., R. 5W., NMPM). These wells are located in the Rio Grande aquifer. Use of this water for beneficial purposes would establish the water right. These wells have the combined capacity of producing 4400 to 6000 gallons per minute without excessive drawdown. The water will be pumped from the wells by three 400 ph, 6-stage, deep well vertical pumps to a collecting, surface level reservoir. The production wells will be manifolded through 10 inch transit pipes to a well reservoir. This reservoir will be located on a water well site and water reservoir site to be located in the S½, Sec. 30, T. 15S., R. 5W. In addition

to the reservoir, the main pumping station will also be located on the water well site and water reservoir site. The reservoir will be below surface, and be constructed of steel and concrete. The well water pumps will be activated by water level controls located in the reservoir.

(2) Distribution

Water will be pumped from the reservoir at 1500 to 6000 gpm by four 350 hp, 9-stage, vertical turbine pumps and will be transported to a fresh water tank via a buried 18 inch diameter steel pipeline. The pipeline will be located within the proposed incoming right-of-way. Water will then be pumped from the fresh water reservoir to the fresh water head tank via a 10 inch diameter steel pipeline.

The reclaimed water will consist of tailing water reclaimed at the rate of 4490 gpm. An overflow line from the fresh water reservoir will serve as the make-up supply.

A sump and pumping installation will advance with the pit excavation to remove infiltrated and surface runoff water collected within the pit. This water, estimated at approximately 100 gpm, will be used either in pit operations or in the concentrator.

e. Access Road

The proposed location of the access road is shown in Figure 3. The major part of the road will be on private land. Approximately 3/4 mile of the proposed route will be on public land. The time required for access road construction may vary, but it is expected to be in service in 6 to 8 months after construction is begun. Quintana intends to turn the road over to Sierra County and the road will become a public road during the life of the mine and after the abandonment of the mine. The proposed right-of-way is 60 feet wide.

The stages of implementation will be as follows:

(1) Pioneering the Line

Clearing of vegetation (organic materials) to the toe of the surveyed embankment line will take place.

(2) Cut and Fill

Areas to be cut will be excavated and the earth materials hauled to the places where fill is required. Culverts and

drain pipes will be installed. Cut and crown ditches will be developed in cut areas to provide adequate drainage. All debris will be cleaned up and removed. Preliminary erosion controls will be initiated. The roadbed will be brought up to road subgrade.

(3) Grading

Aggregate base materials will be installed on subgrade and brought up to base level grade. Final drainage protection (cobble, rip-rap, and bank protection water bars) will be constructed according to BLM directives.

(4) Surfacing

The base material will be prepared by blading and leveling, followed by the application of an asphalt penetration coat on the base material. Asphaltic concrete will then be laid.

(5) Clean-Up

The entire length of the right-of-way will be cleaned up, the slopes finally shaped, sediment and water bars constructed where needed, road guards, signs, and traffic control devices installed, and finishing will take place.

(6) Reclamation

The areas disturbed during the construction of the access road will be prepared for seeding and will be seeded. Surface protection (mulch, netting, etc.) will be applied.

2. Alternatives to the Proposed Actions

Several alternate routes exist for each proposed right-of-way, as well as the alternative of "no action." Essentially, the alternate routes vary only to a minor extent from the proposed rights-of-way routes.

a. No Action

None of the proposed rights-of-way, i.e., the waterline, the 115 Kv powerline, the 14.4 Kv powerline, the access road, or the production wells would be granted.

b. Delayed Action

If a situation should arise (such as a decline in copper prices) where immediate construction would not be feasible,

the project could be placed in a state of suspension or moratorium. Then, after all regulatory and BLM requirements were met, permits could be issued for the proposed rights-of-way. Quintana Minerals Corporation then would have a period of five years within which to begin construction. If the delay were greater than five years, a reassessment and new applications for the rights-of-way would be required. The permits would be issued initially for the expected life (15 years) of the mine. Any intervening delay in the start of construction would be deducted from the valid permit period. A rental charge would be assessed, starting from the effective date of the permit, including intervening "lost time" before the start of construction.

c. Alternate Routes

(1) 115 Kv Transmission Line

Alternate routes for the proposed 115 Kv transmission line are listed below: (see Figure 5).

(a) Route the transmission line through Grayback Arroyo. This route would also be 12.1 miles long, and would run from the switching station in the SE¼SE¼, Sec. 35, T. 15S., R. 5W., to the SE¼NE¼, Sec. 33, T. 16S., R. 6W. At this point, the route would be the same as the proposed action route.

(b) At the point in the SW¼NE¼, Sec. 33, T. 15S., R. 6W., instead of cornering, extend the line west to the NE¼SE¼, Sec. 31, T. 16S., R. 5W.

(c) Route the transmission line from the switching station in Sec. 35, T. 15S., R. 5W., to the SE¼NE¼, Sec. 35, T. 15S., R. 5W., and thence along the Animas Valley to the NE¼SE¼, Sec. 23, T. 15S., R. 6W. At this point, the line would corner and extend to the southeast across Sections 22, 23, 27, 28, 29, and 30 to the mill site. All of the above mentioned lands are either privately owned or are State lands.

(2) 14.4 Kv Distribution Line

Alternate routes for the proposed 14.4 Kv distribution line are listed below:

(a) Construct a substation to service the production well pumps and the main pumping station. This substation would be built adjacent to the transmission line; the location would be dependent upon the route chosen for the 115 Kv line; short distribution lines would be required from the substation to each of the units to be serviced (see Figure 5).

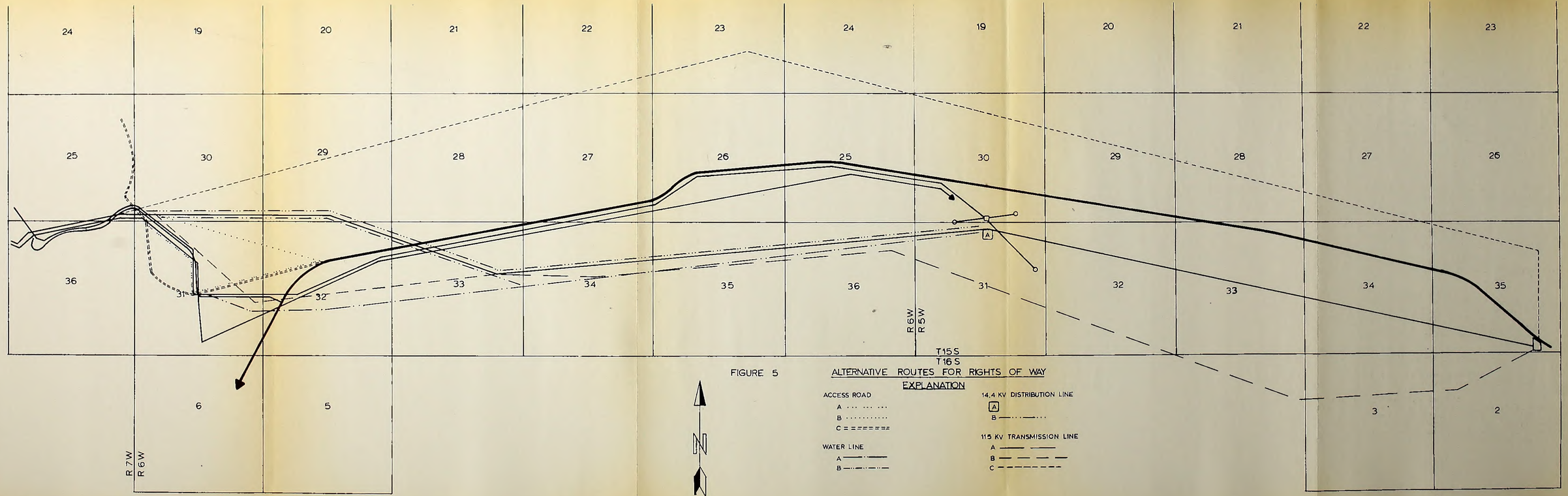


FIGURE 5 ALTERNATIVE ROUTES FOR RIGHTS OF WAY

EXPLANATION

ACCESS ROAD
A
B
C

WATER LINE
A
B

14.4 KV DISTRIBUTION LINE
A
B

115 KV TRANSMISSION LINE
A
B
C

(b) Route the 14.4 Kv line along the same route chosen for the 115 Kv transmission line.

(3) Water Pipeline

Alternate routes from the water pipeline are listed below:

(a) Route along Grayback Arroyo. The line would enter Grayback at approximately the NW¼NE¼, Sec. 31, T. 15S., R. 5W., and follow the arroyo westerly to the NE¼SE¼, Sec. 31, T. 15S., R. 6W. The line would turn to the northwest for approximately one mile, then corner to the west and continue to the mill site.

(b) Corner the proposed route or the alternate route (a) above in Sec. 33, T. 15S., R. 6W., to cross the highway and follow the route of the proposed route of the 115 Kv transmission line.

(c) Place the pipeline above ground from the reservoir to the mill operation.

(4) Access Road

Alternate routes for the access road are listed below:

(a) Alternate 1

Near the section line between Sections 25 and 30, the alternate route would intersect and follow the existing county road on a southeasterly heading across the southwest corner of Sec. 30. About 500 feet after the county road passes south into Sec. 31, the proposed access road leaves the county road alignment and heads east, then south around the downstream toe of the proposed tailing dam to a point in Sec. 31. Here it rejoins the alignment of the county road and follows to the east approximately one mile to the junction of the county road and State Highway 90.

(b) Alternate 2

Beginning at a point located in the NW¼NW¼, Sec. 36, T. 15S., R. 7W., NMPM, thence northeasterly through the N½N½, Sec. 36, to a point located in SE¼SE¼, Sec. 25, thence southeasterly through Sections 30, 31, and 32, T. 15S., R. 6W., to the point of terminus which is State Highway 90, located in said Section 32.

(c) Alternate 3

This is the existing county road. Beginning at a point on State Highway 90, located in the SE¼NW¼, Sec. 32, T. 15S., R. 6W., NMPM; thence southwesterly approximately 5000' to the center of Sec. 31; thence northwesterly approximately 1700'; thence north approximately 2000' to a point on the north line of said Sec. 31; thence northwesterly approximately 1300' through Sec. 30, T. 15S., R. 6W., and Sec. 25, T. 15S., R. 7W., to a point in Grayback Gulch; thence northerly along the east line of said Sec. 25 approximately 3500' to a point of terminus.

d. Alternative Methods

(1) Power Generation on Site

On site power generation from diesel engines could be used.

(2) Water Development on Site

Water wells to meet production needs could be drilled on site.

3. Reclamation

Reclamation of disturbed areas will take place progressively during the course of construction, or as soon as feasible following construction, in accordance with BLM directives and following the approach and techniques presented in greater detail in Section III of this chapter.

4. Abandonment

The power transmission line and water pipeline conceivably could be of use to Hillsboro, some other as yet undeveloped community, or for some purpose unknown at this time. However, if there were no use of the service facilities, the water pipeline would be left in place and the wells capped and secured. The power transmission lines would have salvage values. It can be assumed that the wire and fixtures would be salvaged by Sierra Electric or a salvage business. The poles would likely be removed by salvage operators and sold locally. Quintana would consider leaving poles at intervals of 1/2 - 3/4 mile for raptor roosting and nesting. Disturbed surface areas would be reclaimed to meet BLM requirements.

B. Proposed Mine Development

1. Schedule

The proposed schedule, Figure 6, shows a bar chart assessment of the primary components of the project in a time frame extending to a fully operational plant in approximately 24 months.

The major critical path item, permanent electrical power supply and connection, effectively controls the schedule. Subsidiary critical items are the acquisition and installation of major mechanical components, such as primary grinding mills and crushing equipment. It is anticipated that the schedule could be significantly reduced, to 18-22 months, by consolidating lead time requirements prior to construction.

The site location, topography, and accessibility, and the process plant design requirements do not appear to constitute any potentially serious problems in construction which would affect the schedule.

a. Permits

A list of permits for the project and their status is presented in Table 1.

2. Regulatory Structure

Quintana Corporation will develop the Copper Flat ore body in compliance with environmental, health, and safety regulations of governmental agencies. The State agencies primarily involved are the New Mexico State Environmental Improvement Agency (EIA), the New Mexico State Mine Inspectors' Office (MIO), the New Mexico State Engineer's Office, the New Mexico State Highway Department, and the New Mexico State Land Department.

EIA has jurisdiction over ambient air quality, discharges to groundwater, liquid waste disposal (sanitary facilities), and the process area health and safety regulations (covering all operations excluding the mine proper). MIO has jurisdiction within the mine; the State Engineer's Office is concerned with the tailing dam construction and operation.

a. Groundwater Regulations

(1) General standards and Requirements

The stated purpose of the proposed regulations of the New Mexico Environmental Improvement Agency is to protect the quality of the groundwater for potential future use. There are four categories of

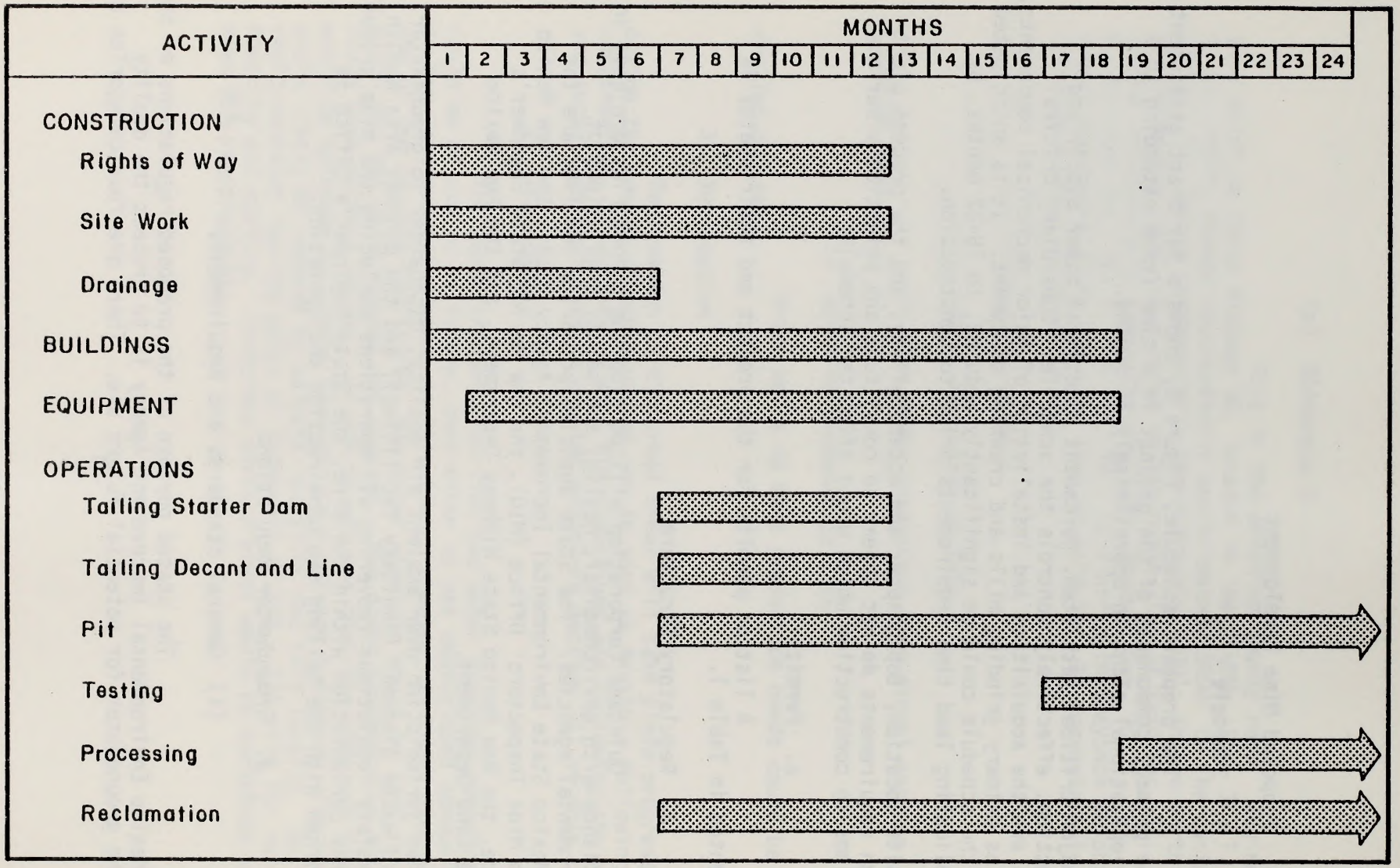


Figure 6 Project schedule.

Table 1 List of project permits, agency concerned, authority and status.

Type	Regulating Agency	Status	Authority
Construction	N.M.E.I.A.--Air Qual. Div.	Issued	New Mexico Air Qual. Reg. 702, Sec. 12-14-7 (NMSA 1953)
Construction and Operation, Tailing Dam	N.M. State Engineers Office	Issued	General Authority, Sec. 75-2-8 (NMSA 1953)
Discharge Plan	N.M.E.I.A.--Water Qual. Div.	Pending (Provisional)	Water Qual. Control Comm. Regs. 3-104. Pt. 3
Access Road	N.M. Highway Dept.	Pending	Sec. 55-2-7 (NMSA 1953)
Road Utility Crossing	N.M. Highway Dept.	Pending	Sec. 55-2-7 (NMSA 1953)
Easements--Powerline --Waterline	N.M. Land Dept. N.M. Land Dept.	Issued Issued	Sec. 7-8-61 (NMSA 1953) Sec. 7-8-61 (NMSA 1953)
Grayback Gulch Classif.	U.S. Corps of Engineers	Non-navig. classif.	Fed. Water Poll. Control Act amend 1972 Sec. 404 (Appendix, Blum letter 9-30-76)
Surface Runoff	U.S. E.P.A.--Dallas	Pending field review	Water Quality Act of 1965; Federal Water Pollution Control Act of 1972 as amended by the Clean Water Act of 1977; N. Mex. Water Quality Standards of 1969
Air Quality (Non-poll.)	U.S. E.P.A.--Dallas	Not subject to NSPS	Clean Air Act as amended 1977; N. Mex. Air Quality Control Act of 1967 as amended
Sanitation--Liquid Waste Disposal	N.M.E.I.A.	Pending	Water Qual. Control Comm. Regs. 3-105. Pt. 3
Powerline Right of Way	B.L.M.	Filed (Plains Elec.)	Fed. Land Mgt. and Policy Act of Oct. 1976, Public Law 94-579
Waterline Right of Way	B.L.M.	Filed	Fed. Land Mgt. and Policy Act of Oct. 1976, Public Law 94-579
Access Road	B.L.M.	Filed (Sierra Co.)	Fed. Land Mgt. and Policy Act of Oct. 1976, Public Law 94-579

groundwater quality, each of which is determined by intended use. The four categories in descending order of quality are:

(a) Human consumption
(b) Other domestic uses
(c) Livestock watering
(d) Agricultural irrigation

The primary standards or allowable contaminant concentrations for the four categories are defined in the proposed regulations. Discharge water that meets the quality specifications is exempt from discharge regulations. For discharging water that does not conform to the specifications, it is necessary to submit a discharge plan to the EIA for approval prior to commencing operations. The discharge plan covers the following types of information:

(a) Quantity, quality, and physical characteristics of the discharge liquor.

(b) Location of the discharge sites in reference to other bodies of water, water courses, or water sources within one mile.

(c) Location of proposed wells that would serve as monitoring wells.

(d) Surface depth and the quality of the groundwater that would be affected by the discharge.

(e) Flooding potential of the site.

(f) Location and design of sites and methods to be used for flow measurements and sampling.

(g) Methods and means of detecting control system failures.

(h) Contingency plans to cope with control system failures.

Additional items that might be required by the Director of the EIA as part of the discharge plan are:

(a) Detailed geographic and hydrological data on the site.

(b) Installation and use of effluent monitoring devices.

(c) Installation and use of groundwater monitoring devices (for the groundwaters most likely to be affected).

(d) Continuation of monitoring after operations have ceased.

(e) Periodic reporting of monitoring data to the EIA.

(f) Retention of monitoring data for five years.

(2) Requirements for Discharge

For waters of substandard quality, the regulations restrict the amount of water allowed to be discharged by subsurface seepage. A section of the regulation titled, "Discharge from Industrial Mining or Manufacturing Operations", covers seepage flow from tailing ponds. Subsection 1 of this part of the regulation reads as follows:

> "The amount of effluent that enters the subsurface from a surface impoundment shall not exceed 0.5 acre-foot per acre per year as certified by a registered professional engineer, a groundwater hydrologist, or soil scientist, or. . ."

This subsection allows a seepage flow of 3.74 gallons per square foot per year.

Quintana has obtained conditional approval of its discharge plan from New Mexico EIA.

b. Status of Tailing Pond Liquor

As presently designed, the process to be used in the Copper Flat concentrator will not discharge any overflow water from the tailing pond. All clarified overflow water will be returned to the process, and this stream will not be involved with discharge regulations. There may be, however, some seepage of effluent from the tailing pond. Calculations have been made as to the probable composition of the liquor that will be in the pond.

Using a "worst case" basis, theoretical solubility of lime and all other reagents remaining in solution, the tailing pond liquor would have a total dissolved solids (TDS) value in the range of 650 to 2000 milligrams per liter. The regulations list a maximum acceptable TDS value of 10,000 milligrams per liter.

None of the specific contaminants listed in the regulations would be added to the flotation process in sufficient quantity to reach an unacceptable level; however, the amount of lime used in the process could

leave the pH of the tailing liquor in excess of a value of 10. The acceptable pH range stated in the regulations is 6 to 9. Because of this parameter, and if there is subsurface seepage in excess of 0.5 acrefoot per acre per year, tailing pond seepage effluent might be in violation of New Mexico EIA regulations. However, there are many alternative plans to resolve tailing pond seepage problems if the discharge is in violation of New Mexico EIA regulations, i.e., pH adjustment, clay sealing, membrane sealing, pumpback wells, downslope injection wells to reverse hydraulic gradient, or an impervious barrier ditch.

c. Liquid Waste Disposal Regulations

The disposal of liquid wastes by means of a septic tank and drain field is regulated by the New Mexico EIA (Water Quality Control Commission Regulations 3104, Part 3). A permit application covering QMC's liquid waste disposal plan has been submitted; this permit will be issued to the contractor immediately prior to or at the time of the start of construction.

d. Occupational Health and Safety Regulations

The regulations dealing with the health and safety of the employees are administered by the State Mine Inspector's Office and MESA. These regulations deal with numerous safety and operating regulations including dust control and minimizing noise levels. For the mine to be operated, it will be necessary that it be in compliance with all State and Federal regulations. Consequently, appropriate dust collection and noise abatement equipment will be installed. Noise levels in both the mine area and the process area will be subject to MESA regulations.

e. Environmental Equipment

A number of items of equipment for the purpose of safeguarding the environment in accordance with State and Federal requirements, primarily dust control devices, will be used in the Copper Flat project. A list of this equipment and its respective capital costs is presented in Table 2.

3. Mining Alternatives

a. No Action

In the "No Action" alternative, QMC would cease present pursuit for rightsofway permits. BLM would be under no obligation to issue permits. Without suitable power lines and water pipeline the proposed mine development could not occur. QMC might continue further exploration and environmental monitoring activities. The present access roads would continue to be used.

Table 2 Environmental safeguard equipment with respective capital costs, based on 1976 estimates.

1.	Primary Crushing Plant--Dust control system comprised of wet scrubber, exhaust fan, fan motor & controls, ductwork, water supply piping & controls, slurry piping.	
	1 - 5000 CFM Ducon UW-4 Scrubber & Fan	$ 11,000.00
	1 - 10 HP, 1800, TEFC Motor & Controls	2,000.00
	2500 Lbs. Ductwork @ .00/lb.	7,500.00
	Water Supply Piping & Controls	1,500.00
	Slurry Piping & Pump	2,000.00
		$ 24,000.00
2.	Coarse Ore Reclaim--9000 CFM dust control system as described in "1" above.	
	9000 CFM X $4.75/CFM.	$ 42,000.00
3.	Secondary Crushing & Screening--30,000 CFM dust control system as described in "1" above.	
	30,000 CFM X $4.00/CFM	$120,000.00
4.	Fine Ore Storage--6000 CFM dust control system comprised of bag house, exhaust fan, fan motor & controls, ductwork.	
	6000 CFM X $4.50/CFM	$ 27,000.00
5.	Fine Ore Reclaim--10,000 CFM dust control system as described in "1" above.	
	10,000 CFM X $4.50/CFM	$ 45,000.00
6.	Moly Drying*--12,000 CFM dust control system as described in "1" above.	
	12,000 CFM X $4.50/CFM	$ 54,000.00
7.	Lime Storage--5000 CFM dust control system as described in "4" above.	
	5000 CFM X $4.50/CFM	$ 22,500.00
8.	Sample Preparation--1800 CFM dust control system comprised of exhaust fan, fan motor & controls, ductwork & hoods.	
	1800 CFM X $2.00/CFM	$ 3,600.00
9.	Fume Cabinet Exhaust--One 500 CFM perchloric acid fume cabinet, c/w fan, motor & controls and washdown & two 500 CFM bench type fume cabinets c/w fan, motor & controls.	
	500 CFM X $6.00/CFM	$ 3,000.00
	2 X 500 CFM X $4.00/CFM	4,000.00
		$ 7,000.00
10.	Atomic Absorption Exhaust--300 CFM fume control system comprised of 316 S.S. fan, motor & controls, 316 S.S. duct & hood.	
	300 CFM & $4.00/CFM	$ 1,200.00
11.	Water Trucks (2) and pumps and equipped for sprinkling roads for dust control.	$200,000.00
	SUB-TOTAL	$547,050.00
	Add 10% for Contingency	34,700.00
	5% for Engineering	19,000.00
	TOTAL	$600,750.00

*Will be omitted if alternate moly separation flow is used.

b. Interrupted Operations

In considering this alternative, it is assumed that all requirements for permits have already been met and the rights-of-way granted. An indefinite period of construction or operation might already have occurred. Planned, interrupted operations might be the result of: (a) regulatory restrictions, (b) a need for additional environmental data to assess the project's actions further, (c) disadvantageous mineral resource economic conditions, (d) uncertainty or lack of control of critical project resources (manpower, power, water, transportation, etc.), and/or (3) extended repairs, maintenance, or replacement of critical process equipment.

c. Underground Mining

Removal of minerals, utilizing underground mining techniques, would require rights-of-way for transmission lines, a water pipeline, production wells, and an access road; therefore, would require permits similar to those required for the originally proposed action.

4. Mining

a. General

The ore body at Copper Flat is located close to the surface and the surface configuration is conducive to mining by conventional open-pit methods. Preproduction stripping would remove overburden. The ore material will be drilled and blasted as necessary. The ore bearing materials will be loaded and hauled to reduction crushers and ultimately to the processing mill where the minerals will be removed by physical and chemical means. The daily operation will process about 15,000 tons of ore material. Ultimately, the pit is expected to be about 2200' x 3000', and 800' deep. An operational life expectancy for the mine of at least 15 years is projected at this time. A layout plan for the project is presented in Figure 7.

b. Operations

Proposed preproduction stripping of approximately 1,500,000 tons of overburden alluvium and waste rock will be over the breccia zone allowing production of a higher grade material during the early years of mine development. Selected alluvium and topsoil materials will be stockpiled near the pit for on-going, as well as subsequent, rehabilitation of disturbed areas. During the first six years, the anticipated average stripping ratio will be 1.08 to 1, and thereafter 2.23 to 1. Some of the waste rock will be used for lean ore pad preparation, plant site development, and in connection with disturbed area reclamation.

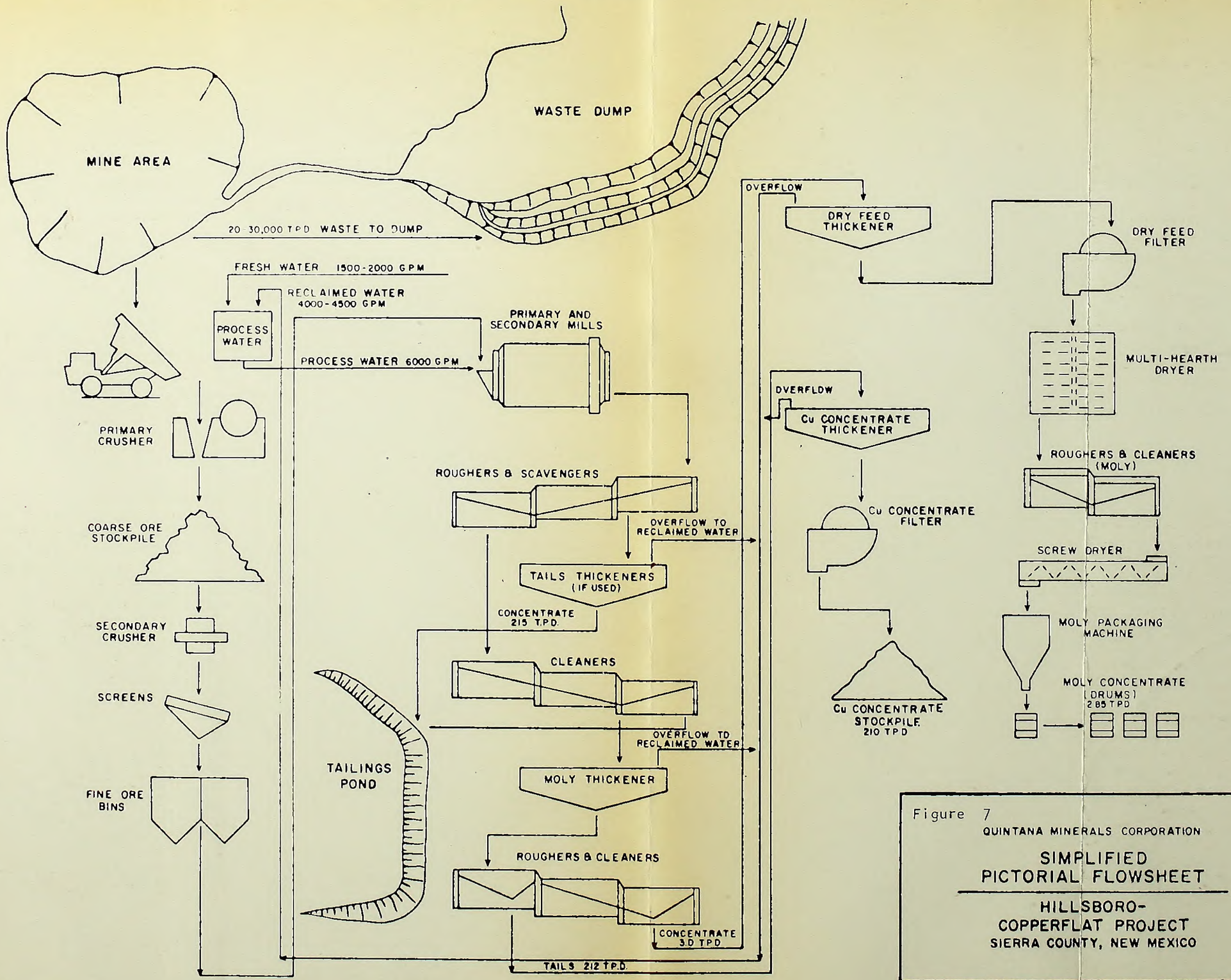


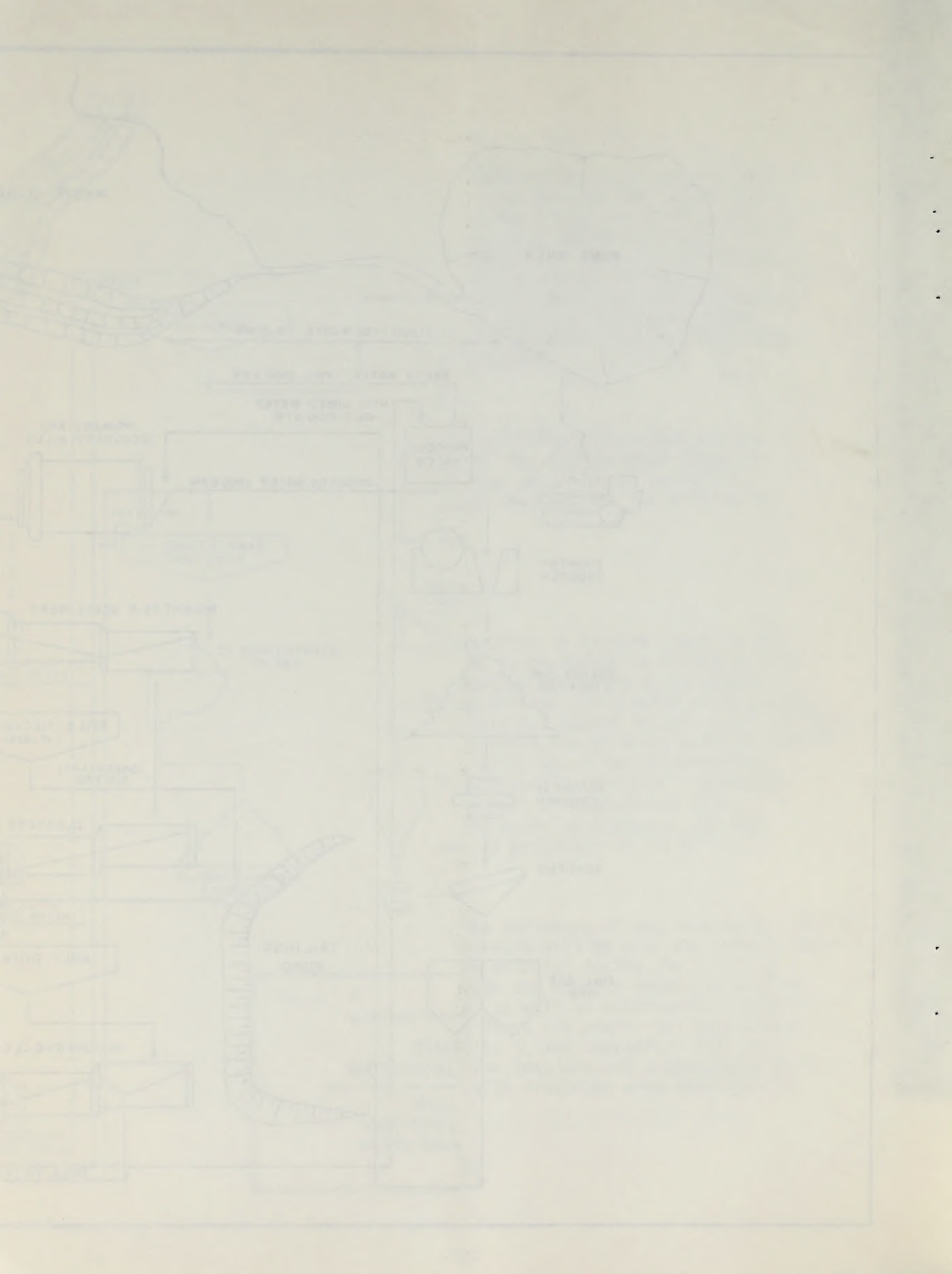
Figure 7

QUINTANA MINERALS CORPORATION

SIMPLIFIED PICTORIAL FLOWSHEET

HILLSBORO-COPPERFLAT PROJECT

SIERRA COUNTY, NEW MEXICO



Primary drilling will be by rotary diesel-driven drills, using 6 3/4 - 7 7/8 inch diameter rotary bits, drilling 25 foot deep holes, including five feet of subdrilling, with an average hole spacing of 18 feet. A small, rubber-tired, compressed air operated wet drill (in conformance with MESA requirements) will be used for secondary breakage when required.

Blasting will be done with primacord, ammonium nitrate, and fuel oil (ANFO), and suitable primers in dry holes. Where wet holes are encountered, a water resistant slurry will be used to charge the blast holes. An alternate method, consisting of pumping the water out and using a plastic sleeve liner which will allow the use of ANFO may be used. The expected powder factor is approximately 0.3 pound per ton.

Loading of both ore and waste will be accomplished by three 15-cubic yard rated front-end loaders. A fourth unit will be added in year six. During the first five years of operations, ore and waste haulage will be handled by a fleet of eight end-dump, diesel-powered haulage trucks of 85 ton capacity. Additional units will be added to the fleet as the pit is deepened. The ultimate size of the truck fleet is estimated at fifteen 85-ton units. Total material to be mined is estimated to be 162,569,000 tons, constituting of 59,897,000 tons of ore and 102,672,000 tons of waste.

The overall cutoff grade for the mine life was established at 0.25 percent copper. A cutoff grade of 0.30 percent copper was designated for the first three years of mining operations for supply to the concentrator. The balance of the ore, ranging from 0.25 percent to 0.30 percent grade will be stockpiled for subsequent treatment.

Ore will be hauled to a primary crusher located east of the mine. Waste will be hauled to an area presently designated north to northeast of the mill site.

c. Processing

(1) Concentrating Plant

The concentrator is designed to process 4,200,000 tons of ore per year at an average rate of 12,000 tons per day. The ore is amenable to a flowsheet of conventional design.

Run-of-mine ore (minus 48 inches) delivered by mine haul trucks will be dumped directly into a primary crusher intake hopper which has a live capacity of approximately 180 tons. Truck dumping will be controlled by the primary crushing station operator who will be able to view the crushing chamber from an elevated control room adjacent to the dump hopper. A control light standard and alarm will advise truck drivers of dumping conditions.

The material from the dump hopper will move across a variable-speed vibrating grizzly controlled by a crusher operator. Oversize material (plus six inches) will be discharged into a primary jaw crusher. The crusher product will be combined with the grizzly undersize (minus six inches) and discharged onto a belt conveyor which will elevate the material to a coarse ore stockpile. A pile-height sensing device will signal the crusher operator in sufficient time to clear the crushing system before the pile reaches maximum height.

(2) Fine Crushing

Crushed ore will be withdrawn from the stockpile through four draw-down points, each fitted with an electromagnetic vibrating feeder. Each feeder can be manually set to vary the feed rate by adjusting a controller located in the control room of the fine crushing and screening building. The vibrating feeders will discharge ore to a collecting belt conveyor.

A belt scale, installed on the collecting conveyor, will elevate the material to a doubledeck scalping screen located in the fine crushing and screening building. Oversize material (plus 1/2 inch) from both screen decks will be combined and fed into the secondary crusher. The undersize (minus 1/2 inch) passing through the screen, will bypass the secondary crusher and be combined with the finishing screens undersize material (minus 1/2 inch) on a belt conveyor which will elevate and discharge the material into the fine-ore storage bin.

The secondary and tertiary crusher products will be discharged onto a common scissor conveyor which will elevate the material to a distributing conveyor which will feed crusher ore to storage hoppers located overhead in the fine crushing and screening building. The hoppers will feed two double-deck finishing screens whose top decks serve primarily as relief decks.

The oversize (plus 1/2 inch) from each screen will pass directly into one of two tertiary crushers. The tertiary crusher products will be discharged onto the collecting belt conveyor previously loaded by the secondary crusher, thereby closing the tertiary crushing circuit.

The undersized (minus 1/2 inch) from the finishing screen will discharge as previously noted, onto the belt conveyor, feeding the fine ore storage bin. The fine ore bin is a cylindrically shaped reinforced concrete structure, covered for dust retention. The ore bin serves the functions of intermediate storage and regulation of feed to the grinding circuit.

(3) Grinding

The ore will be withdrawn from the fine ore storage bin through two parallel circuits. Each circuit has three drawdown points, each fitted with a variable-speed belt feeder. The three belt feeders of each circuit will discharge material onto a constant-speed conveyor which will transport the ore to a primary grinding ball mill. The variable-speed drive for each feeder is adjusted by a controller located in the control room of the concentrator building.

A belt scale installed on each conveyor will measure continuously flow rate and total tonnage of material fed to the grinding circuit. The belt scale readings are indicated and recorded on instruments mounted in the control room of the concentrator building.

Primary grinding will be done by two single-stage, wet overflow ball mills. Each ball mill will be operated in closed circuit, with four hydrocyclone classifier. Mill overflow will discharge into a collector sump and then will be pumped to the cyclone bank. Each cyclone bank overflow will independently flow by gravity to rougher flotation, and cyclone bank underflow will be returned by pipeline to the mill feed, thus closing the circuit.

(4) Bulk Flotation

Bulk flotation, which produces a combined copper-molybdenum concentrate, is accomplished in four stages: roughing, first cleaning, second cleaning, and scavenger cleaning.

The pulp will flow by gravity from the primary cyclones, be sampled, and fed to two parallel rougher sections, each section consisting of ten flotation cells.

The rougher tailings are sampled, laundered to the tailing sump, combined with scavenger tailings, and gravity fed to the tailing pond, or tailing thickener, if used in the plant design. The rougher concentrate will be collected in a sump and pumped to the regrind cyclone feed sump from which it will be pumped to three hydrocyclone classifiers.

The regrind cyclone underflow will be fed to the regrind ball mill. The regrind ball mill will discharge overflows to the regrind cyclone feed sump. The regrined cyclone overflow will discharge to one row of four first-cleaner flotation cells. The first cleaner tailing will be gravity fed to a bank of four cleaner-scavenger flotation cells. The scavenger tailing will be discharged into the tailing sump where it will be combined with rougher tailings and gravity fed to the tailing pond or tailing thickener if used. The scavenger concentrate will be laundered to a sump and pumped to the regrind circuit.

The first cleaner concentrate is collected in a sump and pumped to a single second-cleaner row consisting of two cells. The second-cleaner tailing is retreated in the first cleaner flotation cells. The second cleaner concentrate, which is the final bulk concentrate, is sampled and gravity fed to the molybdenum circuit feed thickener prior to separation of the copper and molybdenum values.

(5) Molybdenum Separation

The molybdenum circuit feed thickener overflow is laundered to the plant reclaim water sump. The underflow is pumped to the dextrin-circuit conditioner ahead of six rougher flotation cells, which are followed by four cleaner flotation cells. In both rougher and cleaner cells, molybdenite is depressed with dextrin while the copper mineral floats to form a froth product or concentrate. First cleaner tail and insoluble concentrate from the dextrin-circuit cleaner cells is combined with copper-rich products from initial dextrin separation processes, sampled, and gravity fed to the copper concentrate thickener.

The molybdenum collected in the dextrin rougher and cleaner cells tailing is gravity fed to a collection sump and pumped to the roaster feed thickener. The thickener overflow is discarded to the plant tailing line while the underflow is pumped to the roaster feed filter. The filter cake is discharged directly into the roaster and the filtrate is recycled by pump to the roaster feed thickener. The roaster product discharges directly into a conditioning tank ahead of insoluble flotation. The conditioned pulp is pumped to a row of four cells for insoluble rougher flotation. Insoluble elements and minor copper are floated to form a froth product, or concentrate, which joins the copper froth concentrate from the dextrin separation circuit and is pumped to the copper concentrate thickener.

The insoluble rougher tailing, which is the molybdenum-rich product, is fed to a conditioner tank and pumped to a bank of seven cells where molybdenum is floated from copper elements in a rougher concentrate. The tailing from this separation is combined with previously-produced copper-rich elements and pumped to the copper concentrate thickener.

Molybdenum rougher concentrate is fed to two first-cleaner cells; first cleaner concentrate is cleaned in a two-cell second-cleaner. The first and second cleaner tailings are combined and laundered to the sump feeding the roaster feed thickener.

The molybdenum second-cleaner concentrate flows by gravity to a regrind mill cyclone feed sump where it is pumped to a hydrocyclone classifier. The cyclone underflow is fed to a regrind ball mill which in turn overflows into the cyclone feed sumps.

The regrind mill cyclone overflow is gravity fed to a five-cell third-to-seventh-cleaner circuit. The concentrate from each cell is delivered to the following cell while the tailing from each succeeding cell passes by gravity to the previous cell in countercurrent fashion. Concentrate from the seventh-cleaner cell flows by gravity to a holding tank for molybdenum concentrate. Tailing from the third-cleaner cell is final cleaner tailing and flows by gravity to the sump ahead of the roaster feed thickener.

Molybdenum concentrate is pumped from the holding tank to a disc filter for dewatering. Filtrate is returned by pump to the molybdenum-cleaner flotation circuit. The dewatered molybdenum concentrate is dried in a Holo-flite dryer and discharged into a loading hopper, then fed through a weigh feeder and loaded into drums for shipment.

(6) Molybdenum Separation Alternate

As an alternate flowsheet to the dextrin process which requires a heating stage, laboratory testwork has developed an all-flotation circuit (subject to pilot plant confirmation) using ammonium sulfide and sodium hydrosulfide to depress copper minerals and float the molybdenite to a final product without the use of heat. The process flowsheet is described as follows:

The molybdenum circuit feed thickener overflow is laundered to the plant reclaim water sump. $(NH_4)_2S$ would have been added to the feed to the molybdenum circuit feed thickener (bulk concentrate) for increasing retention time needed to wash off collector coatings from the copper and molybdenite minerals. The thickener underflow is pumped to the conditioner tanks (in series) ahead of the molybdenite rougher flotation cells. $(NH_4)_2S$ is added to the first conditioner and NaHS to the second conditioner for copper mineral depression.

In the molybdenite rougher float, the copper is depressed into the tailing and the molybdenite mineral is floated into the froth product. The rougher tailing is laundered to a sump and pumped to the final copper concentrate thickener. The molybdenite rougher concentrate is pumped to the first cleaner; first cleaner concentrate is pumped to second cleaner, and the first cleaner tailing is laundered to the final copper concentrate thickener feed sump. The second cleaner concentrate flows by launder to the discharge sump of a regrind mill. Second cleaner tailing goes by gravity to the final copper concentrate thickener feed sump.

The combined regrind mill discharge and molybdenite second cleaner concentrate are pumped to a hydrocyclone. Cyclone overflow flows by gravity to the molybdenite third cleaner; cyclone overflow returns to the regrind mill for additional size reduction. Regrind mill discharge is combined with the molybdenite second cleaner concentrate and pumped to the cyclone.

The reground second cleaner concentrate is cleaned five additional times in series-flotation stages to produce a final product. The tailing from each succeeding cleaning stage passes by gravity to the previous cell in countercurrent fashion. Concentrate from the seventh-cleaner cell flows by gravity to a holding tank for molybdenum concentrate; tailing from the third-cleaner flows by gravity to the sump ahead of the molybdenum circuit feed thickener where it is recycled to process.

Molybdenum concentrate is pumped from the holding tank to a disc filter for dewatering. Filtrate is returned by pump to the molybdenum-cleaner flotation circuit. The dewater molybdenum concentrate is dried in a Holo-filter dryer and discharged into a loading hopper, then fed through a weigh feeder and loaded into drums for shipment.

(7) Copper Concentrate Filtration and Loadout

The copper concentrate thickener underflow is pumped to a two-way distributor which feeds a pair of concentrate disc filters. The filtered copper concentrate cake discharges onto a concrete pad from which it will subsequently be loaded into trucks to be hauled to the smelter. Filtrate is returned to the copper concentrate thickener. Thickener overflow is returned to the plant reclaim water system.

(8) Reagents

Reagents are delivered from commercial sources to the plant site by truck where facilities are provided for off-loading, storing, mixing, handling, and feeding.

Dithiophosphate (collector), potassium amyl-xanthate (collector, sodium hydrosulfide (copper depressant), and phosphonate (water softener) are delivered and stored in drums. All these reagents, and the emulsifier and fuel oil (collector) which are prepared together, are mixed in individual tanks and pumped to head tanks in the concentrator or molybdenum sections. Reagent feeders deliver the prepared solution to process.

Dextrin (molybdenum depressant) is received and stored in bags. Methyl isobutyl carbinol (frother) is received and stored in bulk. Mixing and introduction into the process is otherwise identical to the other reagents.

Lime (for alkalinity control) is received in pebble form by truck and is dumped into a receiving hopper. A screw conveyor transfers the material to a bucket elevator which lifts the lime to a point of discharge.

d. Concentrate Shipping

The copper concentrate will probably be custom contracted to American Smelting and Refining Company (ASARCO) and delivered to the smelter in El Paso, Texas. The ASARCO smelter operates at capacity as much as possible. The probable processing of Copper Flat copper concentrate would not expand ASARCO's capacity, but rather would be in substitute

of concentrate from other producers. The molybdenum concentrate will be packed in 55-gallon drums and sold at the plant site.

The concentrator will produce an average of 252 wet tons of copper concentrate per day at the rate of 10.5 tons per hour. The moisture content will be approximately 12 percent by weight and under such a situation the surface forms a hard cake that should not contribute to fugitive dust under shipping conditions.

Copper concentrate will be sold on site and transportation will be provided by a contract carrier. Two alternative methods of concentrate shipment have been considered: (1) a truck-rail combination, and (2) a direct truck delivery. At the present time, operating problems are expected to be encountered at the ASARCO smelter in the handling of truck shipments because the plant was designed essentially for rail receipts. However, the cost advantages of direct trucking at $6.25 per ton vs truck-rail at $8.62 per ton, and indications that ASARCO will be better equipped to handle truck shipment when Copper Flat comes on stream, dictate an assumption of direct trucking for this report.

The copper concentrate will be freely discharged from the filters at the filtration plant and will be loaded by front-end loaders into hydraulic dump trucks of approximately 25-ton capacity with a 10-ton towed trailer for transport to the El Paso smelter. The front-end loader will be permanently stationed at the filtration plant, but will be owned and operated by the contract carrier of the processed concentrate. The equipment operating cost is included in the unit shipping rate.

No smelting or refining will be conducted at Copper Flat.

5. Tailing

a. Disposal

The tailing disposal area will be located on patented mining claims, private surface, and millsite claims. The plant tailing will be transported by gravity pipeline from the concentrator and deposited via perimeter pipe to discharge into the impoundment area.

The tailing pond dike will be advanced in 30-foot high raises with 30-foot wide setbacks, each raise consisting of three, 10-foot high berms reclaimed from the edge of the pond. After each berm cycle is completed, a 1-foot deep layer of locally-borrowed soil from within the tailing area perimeter will be placed over the sand and vegetated to provide additional stability, reduce fugitive dust, and provide a

more ecologically compatible condition for vegetation establishment. The surface of the tailing area will be kept wet by spigot rotation, and if necessary to control dust, by sprinkling.

A total of 60,000,000 dry tons of tailing will be impounded over the approximate 15-year life of the plant. Tailing deposition would be at the rate of approximately 11,800 dry tons per day at a factor of 28 percent solids by weight (50%+ if a thickener is used). During progressive settlement, water will be decanted from the tailing dam and returned to the process circuit. Expected overall water recovery by reclaim systems would be 70 percent or above.

b. Dam

An initial starter dike will be constructed during site preparation for the impoundment of tailing for the first six months of plant operation. The starter dike will be of conventional design and will be constructed of local, on-site fill material. Construction and operation of the tailing dam is subject to regulations and approval by the State Engineer's Office, and it will be constructed according to their specifications. A Provisional Permit for dam construction has been obtained. (See Figure 8).

c. Decant System

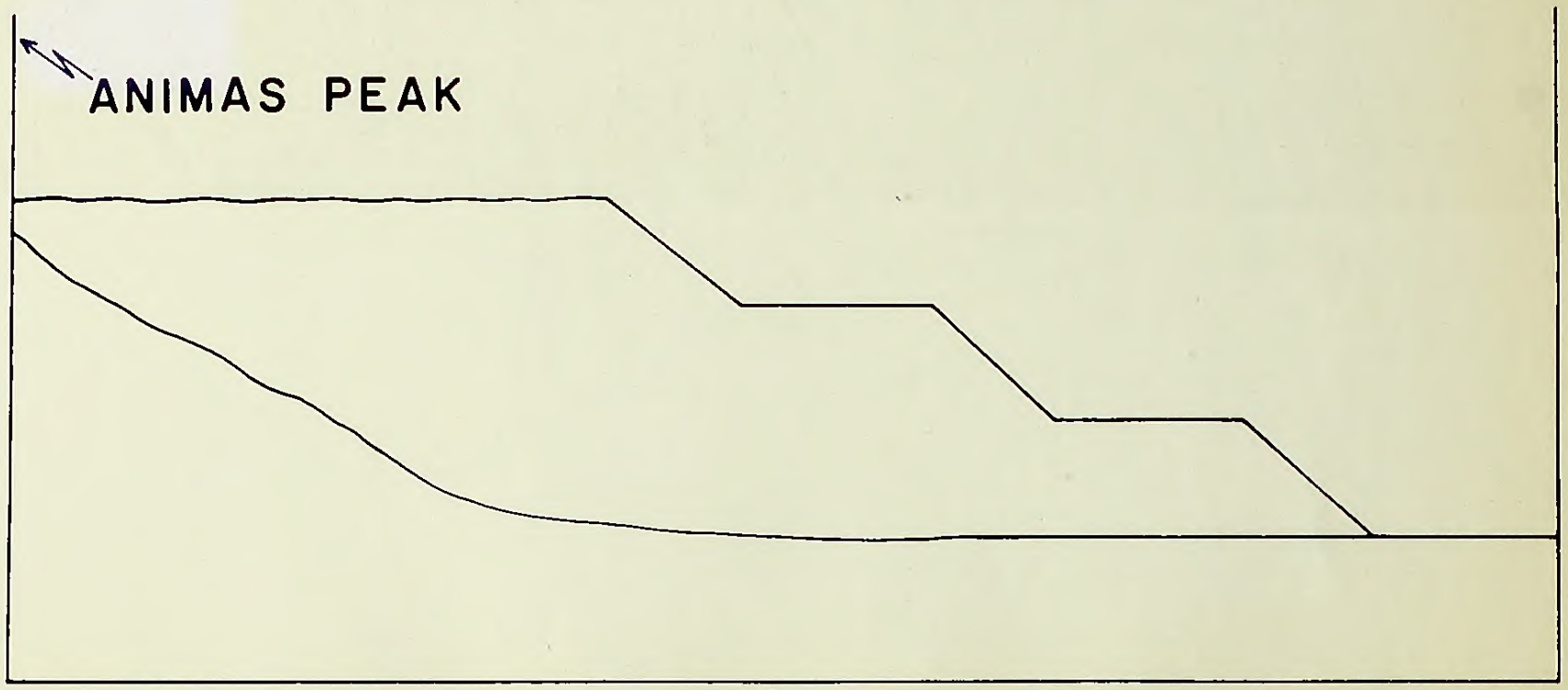
The tailing decant system is also predicated on conventional design within the industry, and consists of a circular, reinforced, concrete tower located near the center of the tailing disposal area. The tower will have a series of vertically-spaced, closable apertures, through which the surface water is decanted progresively as the tailing pond height is advanced. Decanted water will be discharged by pipeline to a collection pond and pumped back to the plant process water circuit. It is possible that the decant tower installation could be deferred, and the initial cleaning will be by decant pipeline only.

6. Waste Dump and Lean Ore Pad

The starting height of the waste dump will be at an elevation of approximately 5500 feet, climbing to 5550 feet by the end of year six, and eventually to the elevation of 5600 feet. Benches will be established at 50' vertical intervals (or less) to facilitate revegetation. Total waste material contained in the dump at the end of the expected life of the property will be approximately 100 million tons. This will include 20 million plus tons of rock assaying 0.20 to 0.25 percent copper that might be milled in future years if copper prices warrant.

Both the waste dump and the lean ore pile will be exposed to the weather. Because there will be continuous exposure of new surface to

LOOKING NORTH



CROSS SECTION
THROUGH WASTE DUMP

LOOKING NORTH

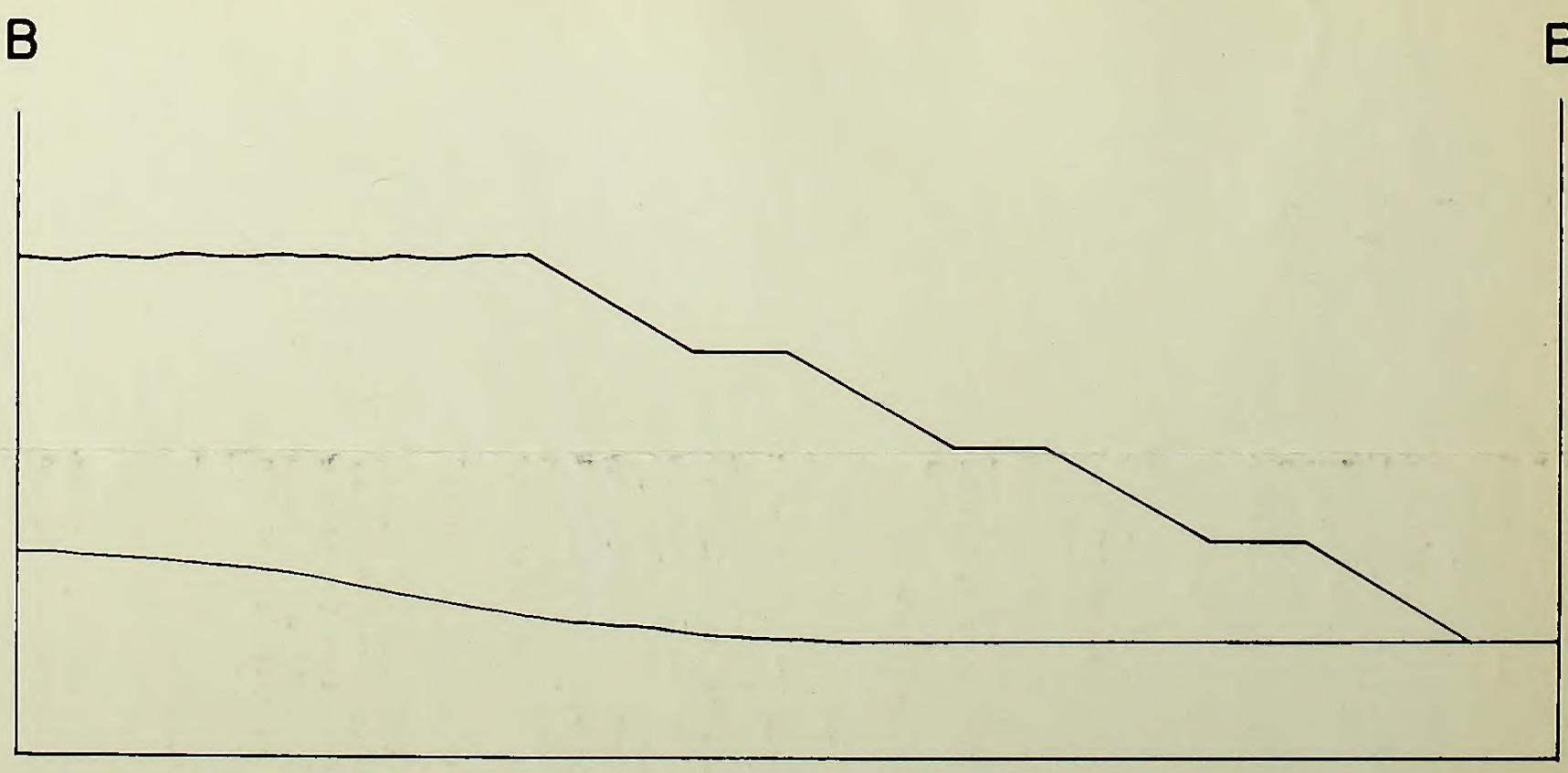


Figure 8 CROSS SECTION
THROUGH TAILINGS DAM

TRENCH WASTE DUMP
CROSS SECTION
LOOKING NORTH
A
A
A

rainfall as more material is added, there probably will be an increase in total dissolved solids (TDS) levels in runoff water. Oxidation of the exposed surfaces could add to the possibility of increasing the TDS values in the runoff water and seepage water. In addition, the oxidation might result in the runoff water having a pH of less than 7.0. However, this is not likely to occur because the surface water runoff will be naturally basic, and any acid derived from oxidation will tend to neutralize the surface water pH.

Particulate dust will be controlled by wetting down, as prescribed by MESA and MIO regulations.

To minimize surface oxidation, the waste dump will be capped with suitable reclamation materials and revegetated according to the reclamation plan.

Any harmful runoff will be controlled by diverting the runoff water into a collection ditch and then recycling it into the process water system.

7. Electricity

a. Source

Power for the project will be furnished by the Sierra Electric Cooperative by means of a 115 Kv overhead powerline from the Caballo switching station about 12.5 miles from the plant, and will terminate at a plant substation furnished by Quintana. From the substation, the voltage will be stepped down by primary transformers and distributed throughout the plant. The power will be furnished to Sierra Electric by Plains Electric Generation and Transmission Cooperative, who will generate and transmit the power, and maintain the line.

b. System

The substation will consist, essentially, of two, 12-mva, 115 - 4.16 kv transformers (one is standby), one 2,500 kva, 115-14.4 Kv transformer, 2160 v switchgear with a main breaker and five feader breakers, and 14.4 Kv switchgear with one breaker. The substation area will be gravel surface, fenced, and constructed in accordance with BLM stipulations.

8. Fire Protection

The fresh water supply tank pipeline will be designed to create a static fire reserve within the plant which will not be subjected to drawdown by process water requirements. The fire main will be

a closed-loop system pressured by the static reserve head tank. The fire protection system will be designed and installed to conform with the requirements of Factory Mutual standards for similar installations.

9. Surface Water

A storage tank of 250,000-gallon capacity will be located at a selected elevation for gravity distribution of fresh water.

A 1,000,000-gallon capacity process water reservoir will be used for the accumulation and distribution of process water to the plant. The reservoir will be supplied by water pumped from the reclaim water reservoir at the tailing dam, from the tailing thickener, and fresh water make-up from the production wells. The mining and concentrating process does not involve any discharge water to surface water courses. The only surface water discharge that might occur will be rainwater runoff from the waste dump and the lean ore pad, which has already been discussed.

In order to minimize surface water treatment, a system of diversion channels will be used to bypass the water runoff from undisturbed areas of the property. Monitoring of the effectiveness of the surface water control diversion system will be accomplished by sampling the water streams entering and leaving the property and analyzing the sampled water for turbidity and total suspended particles and other physical and chemical parameters as required by New Mexico EIA and EPA.

10. Groundwater

Open well piezometers will be located downslope from the tailing deposit and within the unsaturated zone to sample any possible seepage prior to its reaching the groundwater. Neutron logging of groundwater monitoring wells will be conducted on a monthly basis beginning at the time when tailing is first introduced into the pond. Monitoring stations will be installed at 500' intervals near the toe of the starter dike. In addition, existing wells downslope from the dam will be used as monitor wells. Any additional requirements for groundwater monitoring as required by NM EIA or EPA will be met.

11. Liquid Waste

Liquid waste will be disposed of through a series of septic tank and leaching fields; the construction and operation of these facilities are regulated by the regional office of the New Mexico Environmental Improvement Agency in Las Cruces. Results of percolation tests are presented in Table A liquid waste disposal permit is pending New Mexico EIA approval.

Table 3
Results of Plant Site Percolation Tests Conducted
December 14, 1976 at Copper Flat

Test No.	Duration	Inches of Fall	North Coord.	East Coord.
1	5 min.	1/4	715,890	595,155
1A	5 min.	3/16	715,915	595,130
2	5 min.	1/4	715,770	595,985
2A	5 min.	3/8	715,745	596,005
3	5 min.	1	714,895	596,410
3A	5 min.	1 1/8	714,925	596,440

12. Solid Waste

All solid waste produced by the Copper Flat Project will be disposed of by means of privately operated sanitary landfills within the waste rock dump. The solid waste generated by the Copper Flat operation will be scrap from operations which might be sold as salvage or disposed of by the landfill method. The landfill will involve the development of a trench in an inactive portion of the waste dump. As the waste accumulates, the trench will be filled and covered with waste dump material.

13. Air Quality

The particulate dust control programs for the Copper Flat operations are designed to meet all regulatory standards. Wet sprays, scrubbers, and/or vacuum devices are required to be present at all material transfer points.

a. Mine-generated Dust

Updated regulations published by the New Mexico State Mine Inspector's Office incorporate the same air quality standards as those in paragraph 57.5 of Mine Enforcement Safety Agency (MESA) regulations. Compliance with these regulations is mandatory and requires that water be used in the drilling operations, or that other efficient dust control methods be used to avoid health or safety hazards. The regulations specify that haul roads, waste piles, and ore transfer points are to be sprinkled or soaked with water as often as necessary to prevent hazardous health or safety conditions. Continuous sprinkling of the haul roads, ore loading or dumping and waste rock dumping has proven to be an adequate control measure.

MESA regulations also require dust surveys be conducted as frequently as necessary to determine the adequacy of the control measures. This will be accomplished in accordance with New Mexico EIA air quality guidelines.

b. Crushing and Screening Generated Dust

The crushing, screening, and conveying operations will have dust collector ducts and wet scrubber systems. Points in the crushing circuit not equpped with dust collection ducts and scrubber equipment will be equipped with water spray nozzles for dust control.

c. Tailing Pond Dust

Control of fugitive dust in the vicinity of the tailing pond will be attained by:

(1). keeping the exposed surfaces wet, which will involve active spigot rotation, and if necessary, sprinkling; and

(2). effecting an on-going reclamation program which will include capping the faces of the tailing dam with suitable materials for revegetation and the development of compatible, protective plant cover.

d. Gaseous Air Contaminants

No gaseous contaminants above allowable standards will be emitted to the atmosphere from the proposed operations. QMC has obtained an air non-pollution clearance from NMEIA.

e. Ambient Air Sampling

The EIA requires that dust-loading determinations be made periodically around potential dust-generating operations. In order to measure the dust contribution of the Copper Flat operation to the atmosphere, simultaneous sampling up wind and downwind of the operation will be conducted. At Copper Flat, there is some shifting in the wind direction, which is predominantly west to east and secondarily north to south. The present triangular arrangement of the three sampling stations (one north of the mine, one south of the mine, and one east of the mill area) with simultaneous sampling results in one predominantly upwind station and one predominantly downwind station, regardless of the general wind direction, would meet NM EIA air sampling criteria.

14. Ancillary Facilities

The ancillary facilities are generally defined as all non-process buildings, yard facilities, and general purpose mobile equipment.

a. Administration Building

The administration building will be a prefabricated, standard, rigid-framed steel structure approximately 60 feet wide by 120 feet long with 12-foot eave height. The building will have central heating, evaporative-type cooling, and ventilation. The building will accommodate the plant administration, engineering, accounting, secretarial, and clerical personnel.

b. Change House

The change house will be a prefabricated, standard, rigid-framed steel building approximately 40 feet wide by 144 feet long, heated by L.P. gas-fired unit heaters or solar collectors, and cooled by an evaporative cooling system, ventilated as required.

c. Assay Office/Laboratory

The assay and laboratory offices will be in a prefabricated, standard, rigid-framed steel building approximately 32 feet wide by 126 feet long. A small air compressor will be mounted on an exterior concrete pad to furnish air to the building.

d. Gate House Building

The gate house building will be a prefabricated, standard rigid-framed steel building 8 feet wide by 12 feet long.

e. Shop and Warehouse Building

The shop and warehouse will be a prefabricated, standard, rigid-framed, multipurpose steel building with a 90-foot wide by 360-foot long warehouse within an 18-foot eave height; an equipment servicing facility of approximately 60 feet by 240 feet with a 36 foot eave height; a mezzanine floor containing offices, an equipment rebuild area of approximately 30 feet by 120 feet, with a 13-foot eave height; and a concrete servicing apron of 40 feet by 210 feet designed for 85 to 100-ton mine trucks.

f. Reagent Building

The reagent building will be a prefabricated, standard, rigid-framed steel structure, approximately 70 feet wide by 72 feet long.

g. Parking Area

A blacktop surfaced parking area for employee's vehicles will be located adjacent to the main plant entry gate.

15. Access

Access to the mine and plant area will be via the proposed right-of-way route from State Highway 90. It will be approximately three miles long.

Within the mine and mill area, vehicular traffic and human movement will be controlled through the security system and the guards. All persons entering the area must establish contact at the guard house. The tailing and mine area will be fenced to discourage movement of people and cattle. Livestock grazing will be permitted in adjacent areas.

a. Access Road

The new access road will be constructed according to county road standards and to a minimum of the following criteria:

width of road surface - 24 feet
width of roadway, including shoulders - 36 feet
maximum horizontal curve - 260 feet radius
no reverse vertical curves
road surface - minimum 6-inch thick aggregate base with asphaltic concrete surface.

b. Plant Roads

The intraplant roads are designed for easy access and traffic movement within the plant. The roads will be surfaced, where necessary, over a gravel base, be well drained, conform essentially to the access road criteria, and if needed to control dust, be watered. The haul roads will be watered to help control dust.

16. Transporation

There will be an increase in traffic on NM Highway 90 as a result of the Copper Flat Project going into production. This increased traffic will be broadly grouped as follows:

a. Shipment of Concentrates

Shipment of concentrates by truck to El Paso, Texas or to Hatch, New Mexico for trans-shipment by rail to a smelter is anticipated. Tonnage of concentrate produced yearly is expected to be 75-85,000 wet tons. At 40 tons per trip, this will require six trips per day during a 350-day production year.

b. Incoming Supplies

An average of 10-15 trips per day by trucks of vendors and service departments of equipment suppliers and service for operations is anticipated. Most of these deliveries will be made during the day shift.

c. Employees and Visitors

It is expected that the operation will start with 225 employees. Most of these people are expected to share rides in car pools. Using 2.5 persons per car, this will result in from 90-100 round trips per day by employees. An additional 15-20 trips per day can be expected by visitors and sales representatives.

Quintana has no plans for a company operated employee transporation system. However, they will encourage a private contractor to offer bus transportation if the mine employees so desire.

No railroad access or facilities are envisioned for the Copper Flat project. No airstrips or helicopter pads are planned in connection with the mine development or operations.

17. Design Criteria

All mechanical, civil, structural, and architectural designs will be in accordance with applicable standards and codes. Equipment will be furnished with manufacturers standard paint finish, unless specified otherwise. Fabricated steel items will be retouched after erection. Safety painting will be in accordance with MESA standards and New Mexico Mining Codes. Buildings and facilities will be painted to blend with the surrounding landscape.

18. Employment Needs

a. Construction Phase

The construction force for development of the Copper Flat mine will average about 120 persons per day over an 18-22 month construction schedule and will generate a payroll of approximately $200,000 per month. Local procurement of construction materials and services will be approximately $60,000 per month.

b. Operational Phase

Based on information by Quintana Minerals Corporation staff, the estimated number of employees and annual payroll by general work categories is tabulated in the following table:

Table 4
Estimated number of employees, area of recruitment, and annual payroll by general work categories, Copper Flat Project (commensurate with standard rates).

	Number of Employees			Annual Payroll (est.) (1976 dollars)
	Local	Outside		
General and Admin. Staff	15	18		$500,000
Mine and Engineers (salary)	8	10		387,000
Mine (hourly)	25	28		964,000
Mill (salary)	--	13		262,000
Mill (hourly)	10	23		588,000
Maintenance (salary)	3	6		216,000
Maintenance (hourly)	25	41		1,177,000
Totals	86	+ 139	= 225	$4,094,000

c. Organization

The operation would be administered by a resident general manager through five principal subordinates: mine superintendent, concentrator superintendent, maintenance superintendent, comptroller, and industrial relations manager. Maintenance support facilities and staffing would be centralized for the servicing of mine, plant, and ancillaries.

d. Direct Work Force

As stated above, the total direct permanent work force for the Copper Flat mine and mill would be 225. Research conducted by the Denver Research Institute for projects similar in nature to this one ("An environmental impact analysis for a shale oil complex," Colony Development Operation, Atlantic Richfield Corporation, 1974; and "Revised construction and mine plant worker build-up for Colony Development Operation" July, 1974), indicate that 40 percent of this work force (90) would be single or married without their families with them, 40 percent (90) would be married and bring their families, and 20 percent (45) would be married but because of age have no children presently living with them. It is hoped by QMC that 40-50 percent of the work force could be obtained from nearby local communities.

e. Abandonment

When Quintana terminates the mining operation it is presumed that whatever reclamation work yet remains to be done would be accomplished by a "close out" work force.

The pit area would be appropriately fenced and posted according to MESA and New Mexico Mine Inspector's Office regulations. Access would be limited by a locked gate or earth blocking of the roads. The pit would probably fill with water from surface runoff and subsurface flow resulting in a permanent impoundment. If the impoundment remains, its water quality, surface level, stability, and health and safety effects would need to be ascertained before a decision on its ultimate use could be made. Several possible uses for the pit might be: (1) a recreational area, (2) a water reservoir for agricultural and grazing purposes, (3) a water supply for an industrial development, (4) a tourist attraction relating to mining history, (5) a scenic resort area, (6) a storage media or coolant for a solar energy installation, and/or (7) as a solid waste disposal site for the county.

Except for the final life, reclamation of the faces of the tailing deposit would already have been attained. The settling basin would be restructured by first pushing the holding banks over the contained sediments, working from the edge of the basin toward the center. General area grading would be performed so that the restructured site would blend and resemble the surrounding, adjacent topography. Then a deposit of top dressing soil material would be spread. The reconstituted surface would then be planted to an acceptable cover based on prior knowledge obtained from reclaiming other Copper Flat areas. Maintenance and care would be provided to attain an acceptable long-term protective cover.

Most of the waste dump would already have been subjected to reclamation activities. The remaining waste and the peripheral disturbed areas would be reshaped to approximate general adjacent topography and drainage. Following reshaping, the areas to be reclaimed would receive a layer of top dressing and be planted. Long term ecosystem associations of grasses and shrubs would be used.

All surface facilities, equipment and buildings would be removed from the area. The concrete building slabs and foundations would be broken up and used to help fill depressions. If needed, stockpiled alluvial fill material would be used followed by general area surface reshaping to conform to adjacent topography and utilize historic, natural drainage systems. Top dressing for the industrial area would be obtained from prior, on-site, stockpiled material. The reconstituted area would then be treated and planted to an acceptable long-term cover of grasses and shrubs.

Abandoned roads would be ripped, disked, and planted to short-term ecosystem associations (grasses, forbs, and legumes) to provide additional edge, diversity, and travel lanes for wildlife. The proposed access road would be administered and maintained by Sierra County as agreed to at the time of construction.

C. Proposed Reclamation Plan

Reclamation planning and operation must be an integral and dynamic part of the mining operation. The revegetation program must be environmentally sound, be publicly acceptable, and meet regulatory requirements. At present there are no federal or state regulations requiring reclamation of disturbed areas resulting from mine development and operations. However, QMC is presenting a proposed reclamation program to embrace disturbed areas on the proposed rights-of-way and the mine area.

Although revegetation has been conducted at many mine areas, there has been a wide variation in levels of success. The major shortcomings have been overreliance on exotic species, lack of site-specific orientation, an inability to coordinate activities with the creation of favorable microclimatic situations, lack of orientation of the program toward operational mining conditions, and relinquishment of responsibility necessary for long range success. This program is planned to be an on-going, integral part of daily mine operations, in which reclamation approaches currency with mining.

1. Goal

The goal of Quintana's reclamation program would be to leave the maximum amount of the environment in an undisturbed state and to restore disturbed areas to sustaining plant communities similar to those ecosystems on adjacent lands undisturbed by mining.

2. Objectives

a. To design a system of mined-land reclamation which would consider adjacent land uses, visual landscape values, wildlife habitat, recreation, and stabilize soil surfaces.

b. To revegetate areas disturbed by mine development and operations with a diverse mixture of plant species, emphasizing natives, which would become established and self-sustaining as soon as possible.

c. To protect and nurture revegetated areas with accepted conservation practices so as to reach and maintain a situation embracing stable plant communities.

3. Performance Criteria

a. Land Configuration and Reclamation

The topography, slopes, and aspects of the disturbed/reclaimed areas would be developed so as to blend in with area physiographic forms. Wherever possible the elevation, gradient, meander wavelengths, and lengths of drainage channels would approximate former, natural drainages. All ditches and earthen water control structures would be revegetated. Topsoil and suitable material for producing vegetation would be removed first from major disturbance areas (mine, roads, buildings, etc.), stockpiled, protected, and used in the reclamation process. Overburden and waste removed during mining would be used in physical reclamation. Texture and surface diversity would be attained by using a wide variety of materials available (sized rock, boulders, alluvium, waste, topsoil, etc.). An attempt would be made to favor initial revegetation on north and east aspects of gentle slopes to obtain additional moisture availability. A limited number of slopes might exceed a 3:1 condition but most slopes would be restructured to resemble existing topography or have a slope of 4:1 or flatter. The steeper slopes would be stabilized by physical media (boulders, alluvium, rock) as well as vegetative means to add to general diversity and stability. Access roads and utility crossings of drainages would be constructed so as to provide protection to the water course and a minimum of surface area disturbance.

4. Revegetation

Quintana proposes to revegetate the disturbed lands to as late and as stable an ecological successional stage in as short a period of time as possible. Vegetation and plant community density and diversity would be similar to those of undisturbed land. Whereas most physical reclamation could be conducted throughout the year, revegetation would be conducted in late August and early October, or March, April, and May to reduce competition by invading plants, of which many are regarded as weeds, and to take advantage of natural precipitation. In some locations where the native, invading plants have become established, it might be desirable to leave these plants undisturbed so surface stability can be maintained, with natural succession following. At other locations it might be desirable to work the invading plants into the topsoil surface to serve as a mulch before seeding the desired plants.

There is suitable soil material from pit overburden, from within the area to become the tailing deposit, and from facility development areas to cover the planned disturbed areas up to 6 inches. No outside areas will be disturbed to obtain reclamation materials. The soils of the area now are deficient in nitrogen, phosphorus, zinc, and sulfur. Therefore, fertilization likely would be necessary. However, to determine the desired soil additives a chemical analysis would be conducted.

Chemical fertilizer, aerobically digested sludge, and feedlot cattle waste would be used as available to fertilize reclaimed areas. The cost of sewage sludge is substantially less than the chemical fertilizer. The sludge is non-toxic and non-polluting, but must be analyzed for quality. The use of sewage sludge is good for several reasons: it reduces a solid wate disposal problem; it provides necessary plant nutrients; and it maintains good surface moisture condition. Ultimately, fertilization would be prescribed based on chemical analysis of disturbed/replaced soils.

A special effort would be made to use as little water as possible for irrigation to help revegetation establishment. However, at least one year of irrigation initially might be necesary to obtain satisfactory plant establishment. The amount of irrigation would depend upon water availability, land capabilities, soil characteristics, and plant requirements.

Unless a concerted effort is made, diversity of plant species on revegetated, disturbed lands could be substantially less than on undisturbed areas. However, it is Quintana's intent to establish native plant species (grasses, forbs, and shrubs) in a mix approximating adjacent areas. Suitable seed materials might be a limiting factor for the forbs and shrubs but it is hoped that local seed materials could be gleaned from adjacent undisturbed areas. Limited native grass seeds are available to revegetate disturbed lands.

5. Wildlife

Quintana would restore sustaining wildlife habitat as soon as possible and anticipates a greater complex of species in the future than before disturbance due to the additional habitat diversity created by the reclamation program. Suitable wildlife habitat includes water, food, vegetation, and physical components. All of these habitat factors would be considered in the revegetation program. It is likely that the revegetated, disturbed areas might function in an oasis capacity and be unusually attractive to wildlife. To attain maximum vegetation establishment, newly seeded and revegetated areas would be protected (fenced) from domestic livestock and extraneous human disturbance for a period of 3-5 years. Small mammals also might have to be controlled.

6. Schedule

Physical reclamation would be conducted at all times of the year as an integral part of the on-going, mining operations. Land treatment for revegetation would depend upon time of year, weather conditions, and plant species. For example, cool-season species would be planted in September-October or early spring to give them a competitive advantage over warm season invaders. In the event that land was ready for planting April through August, some invaders would become established, which would protect the exposed land from wind and water erosion. Prior to planting, the land surface could be disked or chiseled. The uprooted invaders

Depiction of reclamation sequence on the face of the proposed Copper Flat tailing deposit.

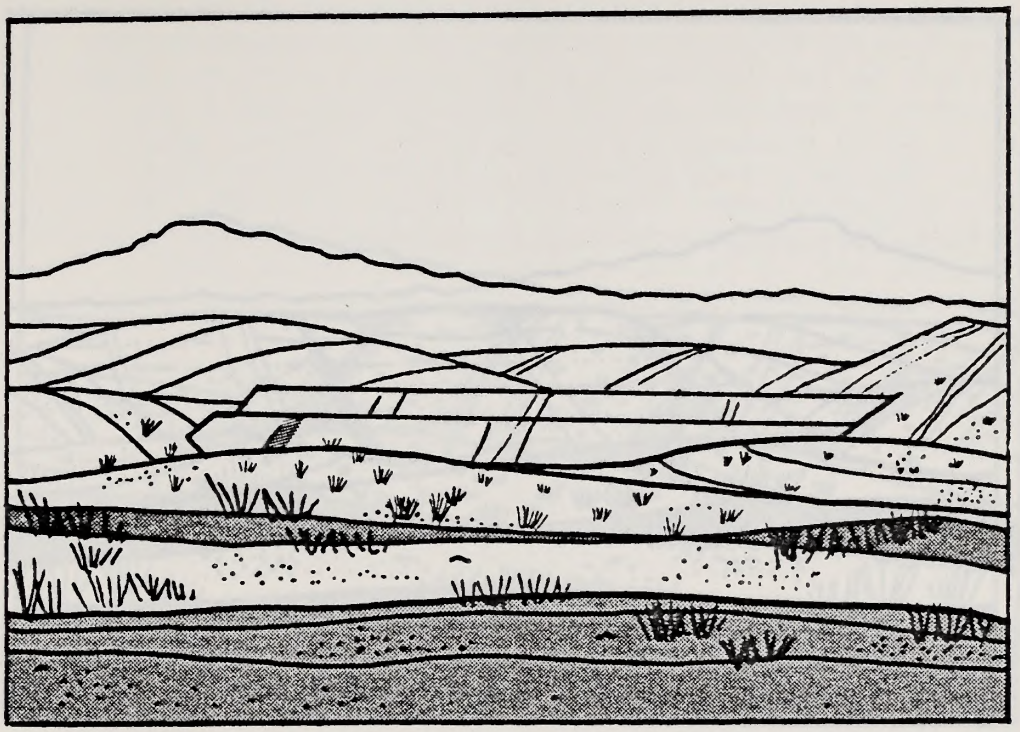


Figure 9 Starter dam and early-deposited lifts prior to reclamation.

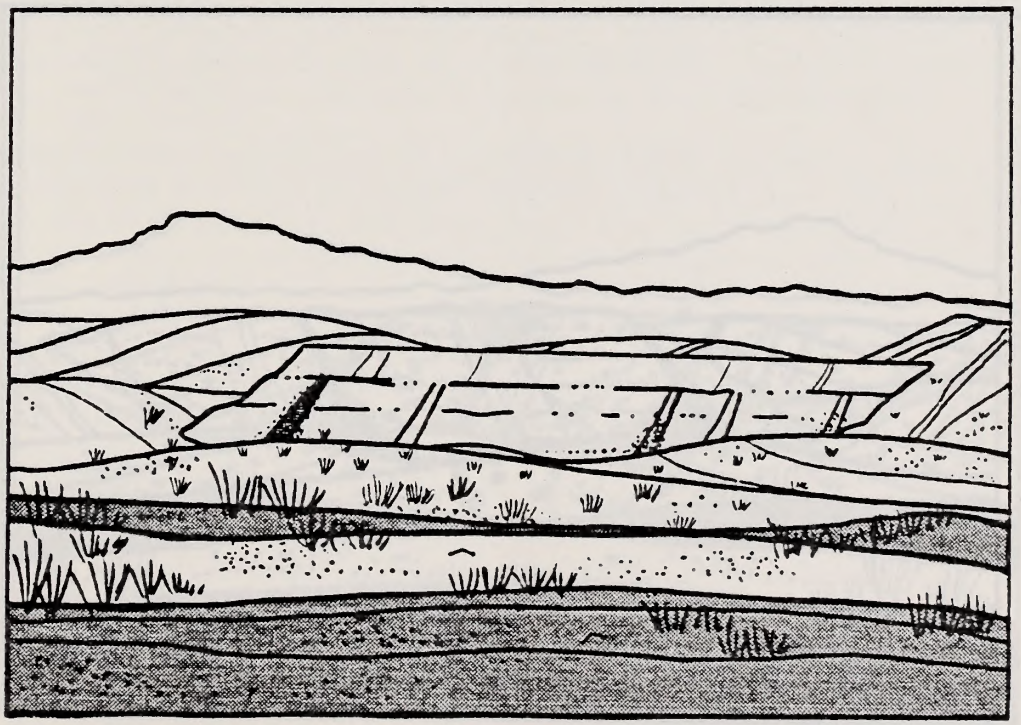


Figure 10 Preliminary reshaping, subcontouring, and development of drainage ways.

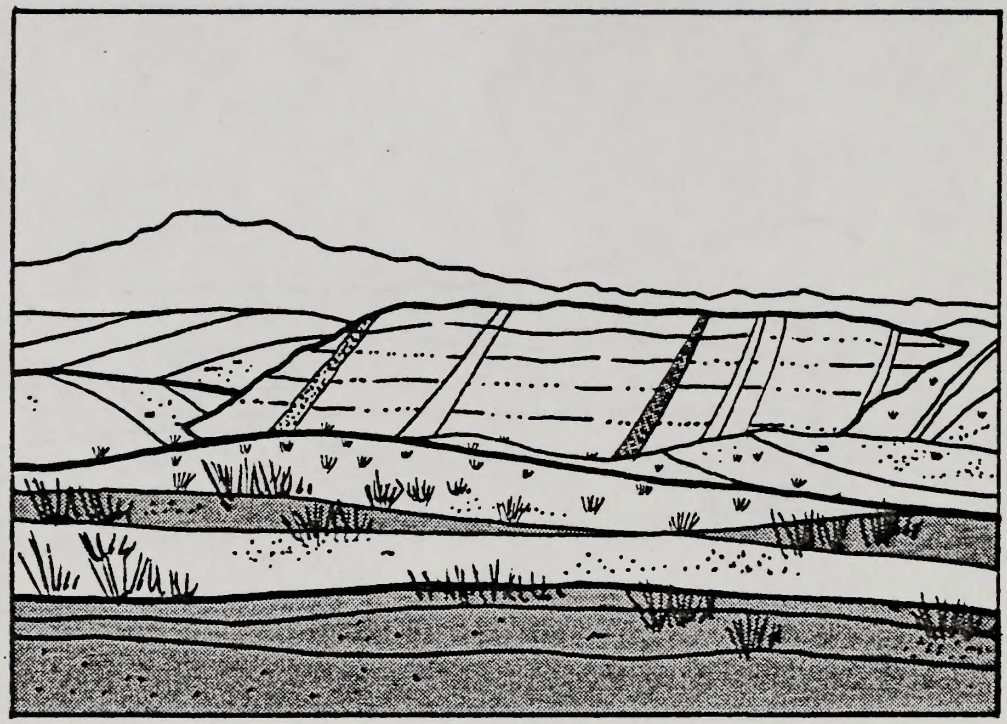


Figure 11 Ultimate height of proposed tailing face with initial vegetation establishment on the starter dam and early lifts.

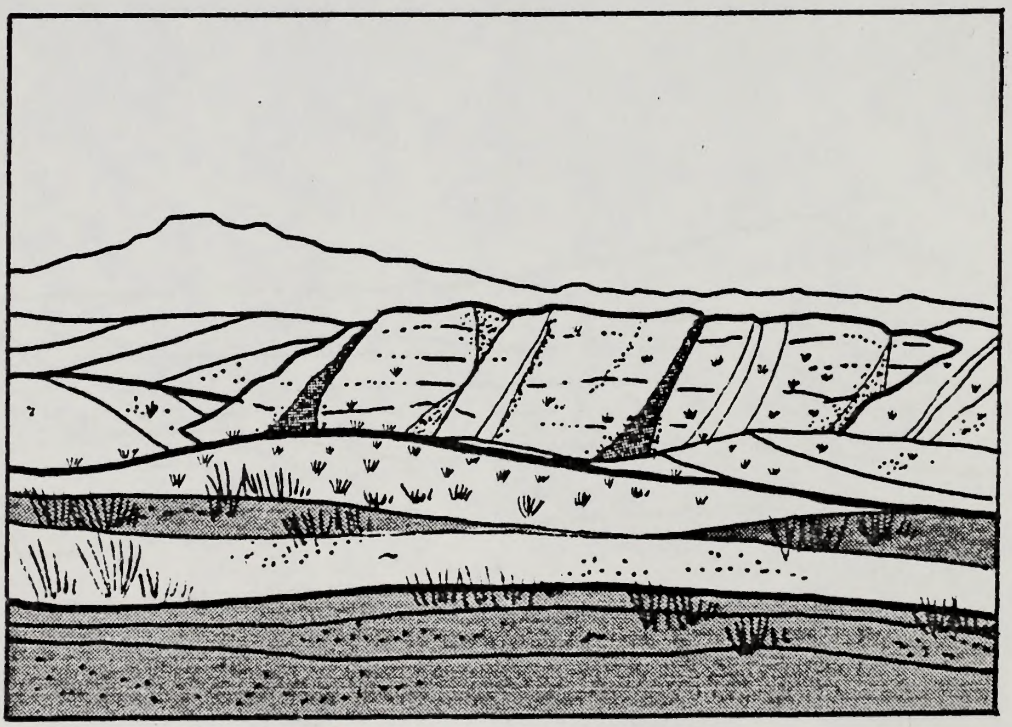


Figure 12 Progression of reclamation and vegetation establishment over face of tailing deposit.

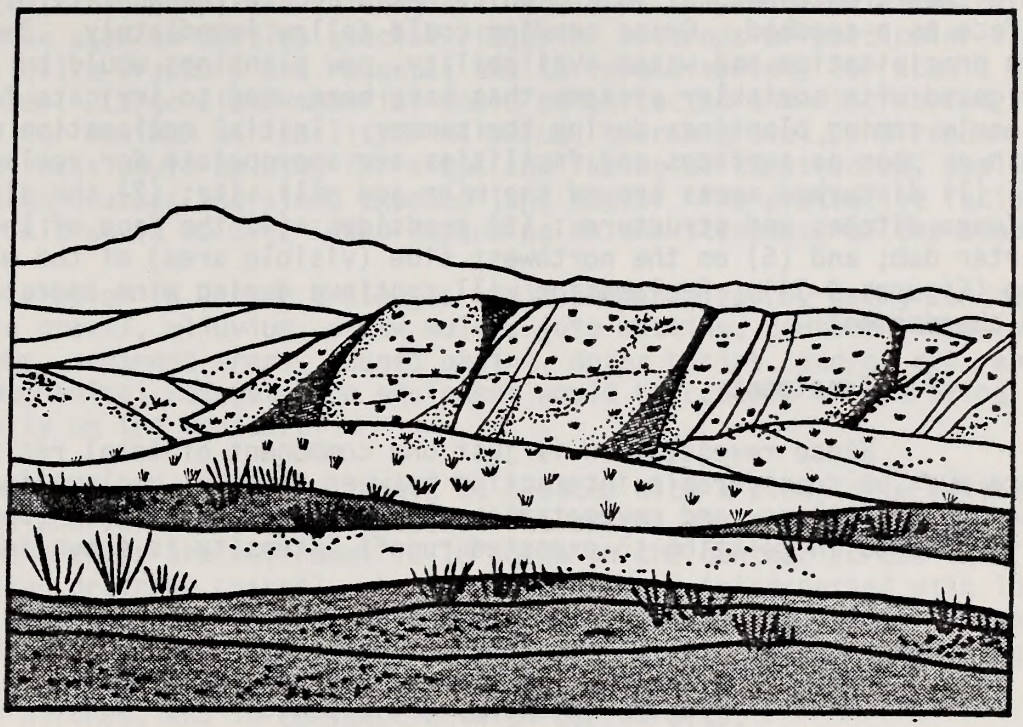


Figure 13 Vegetation development in response to microclimatic influences.

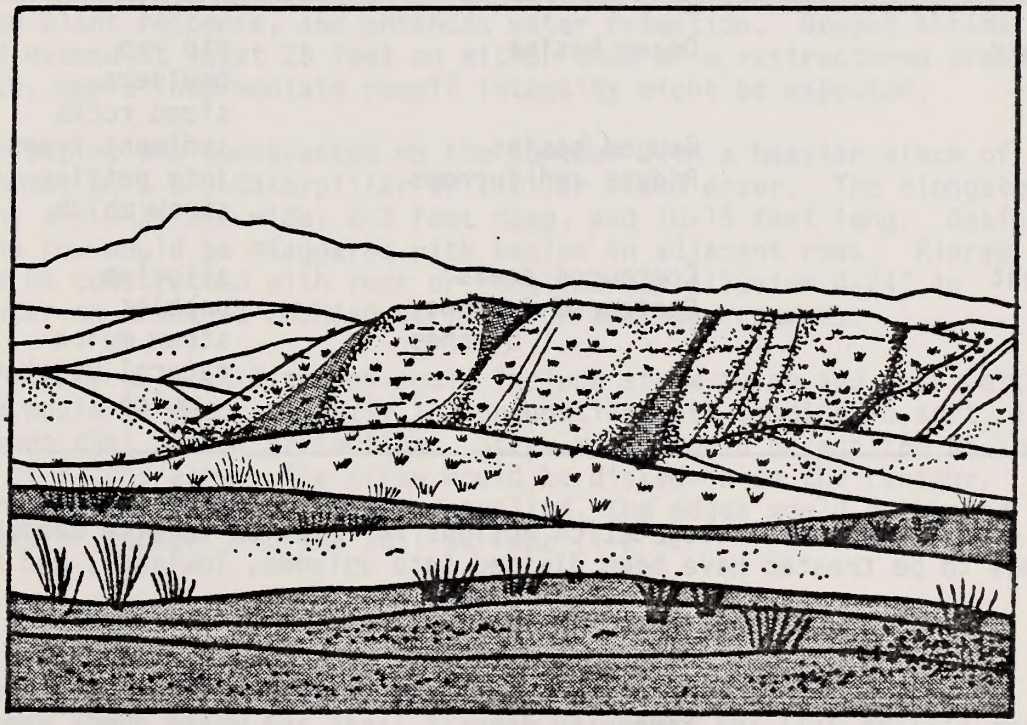


Figure 14 Reclaimed tailing face with established, self-sustaining vegetative cover that is in harmony with adjacent landscape.

would then create natural mulch, which would add to the quality of the surface as a seedbed. Grass seeding could follow immediately. Depending upon precipitation and water availability, new plantings would be irrigated with sprinkler systems that have been used to irrigate fall or early spring plantings during the summer. Initial reclamation would begin as soon as surfaces and facilities are appropriate for reclamation on: (1) disturbed areas around the mine and mill site; (2) the diversion drainage ditches and structures; (3) roadsides; (4) the face of the tailing starter dam; and (5) on the northwest side (visible area) of the waste dump (Figures 9-14). Reclamation will continue during mine operations and abandonment.

7. Treatments

Since revegetation is just one component of total reclamation, there must be considerable interaction between physical reclamation planning and operations, and revegetation planning and operations. Degree of treatments in relation to expected runoff intensity is shown in Table 5.

Table 5
Anticipated Physical Land Treatments in Relation to
Runoff Intensity Anticipated

	Treatments	
Runoff	Land Contouring	Other
Heavy	Dozer basins	rip rap boulders sized rocks
	Gouged basins	sediment traps
	Ridges and furrows	jute netting straw mulch
Light	Contoured areas	alluvium
	Contoured furrows/ ditches	pebbles straw mulch natural vegetation mulch

To clarify proposed revegetation actions in relation to site needs, the areas to be treated have been divided into uplands, lowlands, and riparian.

a. Uplands

This type of reconstituted terrain includes steep slope areas (1:1 to 3:1) and temporary deposit lands and waste dumps where the slope might be greater (slope of repose). The degree of revegetation and

physical stabilization would depend on the elapsed time and resources available, inherent stability, desired diversity, and regulatory restrictions. The stabilization of the steep slopes would combine a mix of physical and vegetative techniques. Boulders and unsorted sizes of rock would be used to develop special ridges or outcrops of particular value to wildlife (raptors and rodents) and to impose variety for scenic value purposes. Large sized material would be collected and distributed irregularly for maximum variability. Alluvium, coarse gravel, and random-run sized rocks would be used for sides and facing of constructed, small drainage courses and along exposed land edges. The protective facing materials would be 3-12" deep depending on the steepness of the slope.

Gully erosion in larger drainages would be minimized by using contour rows, pebble gravel, alluvium, straw mulch, jute matting, contour ridges and furrows, sediment traps, gouged basins, dozer basins, and/or rip rap. All mechanical revegetation equipment would be capable of operating normally on the contour.

Contour ridges and furrows would be created with a plow, alternating ridges and furrows on the contour. The ridges would be 6-8" high. Sediment traps are soil dams 12-18" high on the contour across the expected drainage channel. Larger, higher dams interspersed with lower ones might be necessary in larger drainage areas. The sediment traps would serve as excellent planting pits for shrubs or trees requiring additional moisture. Sediment traps would be used along roads, in drain ditches, and in conjunction with borrow pits.

Gouging, a new form of land preparation (staggered basins on the contour 1.3 feet wide by 3.5 feet long by 0.3 feet deep with 1.5 to 2.0 feet undisturbed between the basins) creates microclimatic diversity, varied plant response, and enhances water retention. Gouged basins could extend at least 25 feet on either side of a restructured drainage course, where intermediate runoff intensity might be expected.

Dozer basins are constructed on the contour with a heavier piece of equipment on a D-9 Caterpillar or similar sized dozer. The elongated basins are 2-3 feet wide, 2-3 feet deep, and 10-15 feet long. Basins in one row would be staggered with basins in adjacent rows. Riprap would be constructed with rock or conglomerate alluvium 4-24" in diameter to create a cobbled surface for drainage courses.

Other forms of stabilization could include straw mulch and jute netting. These would be used primarily in conjunction with seeding in soft, loose seedbeds that needed protection. Straw mulch would be applied at the rate of 3 tons/acre. The straw would be disked-in on the contour. After jute netting (1" mesh) was applied, the edges would be buried lightly or tucked into the soil surface (1-2").

b. Lowlands

Lowlands (slopes 4:1 or flatter) would likely constitute the major proportion of the areas to be revegetated. The basic treatments following physical reconstitution, reshaping, and topsoil distribution would be: chemical and physical testing of the soil, chisel plowing, fertilizing, plowing, mulching, seeding, fencing or protecting, contour plowing, mulching, or more intensive erosion control, as described in the Uplands section, might be desired.

c. Riparian

Rechannelization of drainages would have to be developed simultaneously with other physical reclamation; otherwise there would be multiple costs and disturbance impacts which would delay reaching the revegetation goal. Any rechanneled streambanks would approach replication of the natural streambanks. Alluvial material would be used along rechanneled drainage banks to serve as a filter for groundwaters entering the drainage and to provide suitable material for revegetation. Riparian and water-loving plant species (willows, cottonwood, cattails, sedges, etc.) could be introduced where appropriate by transplanting irregular clumps along the expected waterline. Irrigation would be applied as needed and available.

Rip rap and gabions would be constructed in areas of potential head cutting or steep-bank erosion. Anticipation of needed rip rap and gabions would be necessary to minimize erosion and to stabilize established revegetated areas.

d. Soil Testing

Because the replaced soil material would be a mixture of the upper soil horizons, soil testing would be necessary to determine what chemical and physical deficiencies might exist. The sampling rate, to determine the deficiencies, would be established on the basis of uniformity in soil characteristics and topography.

e. Chisel Plowing

After physical reclamation and topsoiling, the area would be worked with a chisel plow. This tool loosens and aerates the soil. If chisel plowing was conducted in later summer, other treatments could be done immediately when conditions were favorable.

f. Fertilization

Data from the chemical soil analysis would indicate the exact chemical needs. If available, either sewage sludge or feedlot cattle wastes, would be applied in amounts indicated by analysis in lieu of or to supplement chemical fertilizers. Generally, pelletized

agricultural fertilizers would be applied in the spring and at the time of seeding at a rate approaching 300 lbs/acre of 20-10-5-1 (N-P-K-Zn). A spin-type distributor would be used.

g. Plowing

Plowing would be conducted to incorporate the fertilizer into the soil. If the soil was not friable, disking might be desirable prior to mulching.

h. Mulching

Straw mulch would be applied at a rate of 2.5 to 3.0 tons/acre and worked in with a culti-packer. A layer of jute netting (1" mesh) might be laid down in drainage areas not protected by a combination of other materials and techniques. A light (0.10 - 0.50") dressing of small (0.25 - 1.0") gravel sometimes might be substituted for the jute. Sludge and feedlot waste also might be substituted for the mulch.

i. Seeding

Equipment designed for the turf industry would be best for planting grasses at a 0.5 inch depth, which is optimum for native as well as introduced grass seeds for permanent cover.

Transplanting to strategic or special areas would be conducted in combination with grass and forb seeding or at a later stage in revegetation development. Transplanting of natural plant material would be conducted to speed plant succession, to hasten establishment, to give additional stability, to increase plant diversity, to provide additional seed sources, to provide "instant" protective, remedial or emergency cover for problem areas, and to meet specific wildlife or scenic value needs. Plant materials such as clumps, strips, blocks, islands, and individuals would be used where transplants of both pure and mixed species are desired. For pure of single transplants, individual plants or pure stands would be used.

j. Irrigation

Soil moisture would be monitored to ascertain the amount and rate of application of irrigation. Generally, irrigation might be used during the first year an area is revegetated. Irrigation would be oriented toward plant species requirements with consideration for water availability and quality.

k. Fencing

Fence material of various types, size, and kinds might be necessary to control animals, people, mobile equipment, reduce wind

erosion, and help protect plants during early establishment. Fencing to control animal movements could be of the draft-fence type. For exclusion of small mammals, small-mesh, wire fences would be used. Judgment would be exercised to cope with each local situation.

8. Special Treatments

a. Temporary Stabilization

Areas requiring temporary protection from wind and water erosion but not yet ready for permanent vegetation (overburden, subsoil, stockpiled topsoil, alluvium, etc.) would be stabilized by mechanical conservation techniques (contouring, gouging, etc.) or planted to a quick cover crop. For protection of very short duration, a straw mulch, would be disked into the soil.

b. Herbicides

Herbicides would not be applied for weed control except in special cases (control of designated noxious weeds). Generally, weeds would not be controlled. But in cases where deemed desirable, mechanical and hand means would be used.

9. Costs

It is difficult to estimate likely future costs for an on-going reclamation program covering the life of the mine. However, costs might range from $2,000 - 5,000 per acre.

10. Holding Reclamation Plan

There is a possibility that continous full-scale production might be interrupted for a period of 2-10 years pending economic considerations or unforeseen circumstances. In this even, a partial or "holding" reclamation plan would be initiated.

a. Rights-of-Way

The powerlines and water pipeline would be inspected regularly and maintained as necessary. None of the facilities would be altered or removed. The main access road would receive county maintenance. The internal roads would receive minimal maintenance.

b. Pit

The pit area would be protected by fencing with a locked access gate. Dewatering might be necessary before startup in which case water from the pit would be pumped to the tailing storage area.

c. Tailing Deposit

The tailing basin area would be retained for development use, if and when it occurred. The dam face would already have been vegetated but limited care and maintenance would be performed as necessary to continue stabilization of the area. The surface of the tailing deposit would receive a top dressing of suitable soil material and alluvium, and then seeded to compatible grasses since the probability exists that with mine startup the area would be disturbed again.

d. Waste Dump

The faces of the waste dump would already have been subjected to reclamation activities. The unreclaimed waste would receive a top dressing of alluvial material and be planted to compatible grasses.

e. Other Disturbed Areas

Most of the peripheral, early-disturbed areas would already have been revegetated and stabilized. Any remaining disturbed surface areas not yet reclaimed would be planted to adaptable grasses for temporary protection.

f. Buildings

The process buildings, equipment, and support facilities would be guarded and maintained as necessary. None of the buildings would be destroyed or modified.

I. Description of Existing Environment

A. Environmental Base Data Investigation

Quintana Minerals Corporation's environmental consultant made several environmental field reconnaissances in 1974 and 1975 to aid in assessing probable and potential impacts that would result from the proposed copper mine operations and rights-of-way.

In 1976 an environmental monitoring program was begun by Quintana's consultant in the vicinity of the proposed mine and support facilities. The methodology used for that investigation is described below.

1. Abiotic Monitoring

a. Water

Samples were taken quarterly (Jan., Apr., July, and Oct.) at 3 locations on Grayback Gulch: Station A--where the creek enters QMC property; Station B--in the creek about 300 yards east of the estimated mine rim; and Station C--where the creek leaves the property. Samples have been analyzed by Front Range Laboratory and Colorado State University, Analytical Chemistry Facility.

b. Air

Samples were taken quarterly (Jan., Apr., July, and Oct.) at locations northwest, west, south, and northeast of the mine development area. Samples were analyzed by Colorado State University, Atmospheric Science Laboratory.

2. Biotic Monitoring

a. Vegetation

Sampling stations were established on cardinal radii (N, NE, E, SE, S, SW, W, and NW) at 1000' and 2000' distances from the estimated center of the mine pit. Plant samples were collected from each station and analyzed for stress, growth, and vigor characteristics. Sampling of lichen activity also was done at 12 stations on the cardinal radii. All samples were analyzed by Quintana's consultant.

b. Soil Micro-organism Activity

Activity of decomposer organisms was determined by burying sampling bags at four locations 2000' from the estimated center of the mine pit on cardinal radii. The samples were retrieved at later dates and weighed for organic matter loss. Samples were

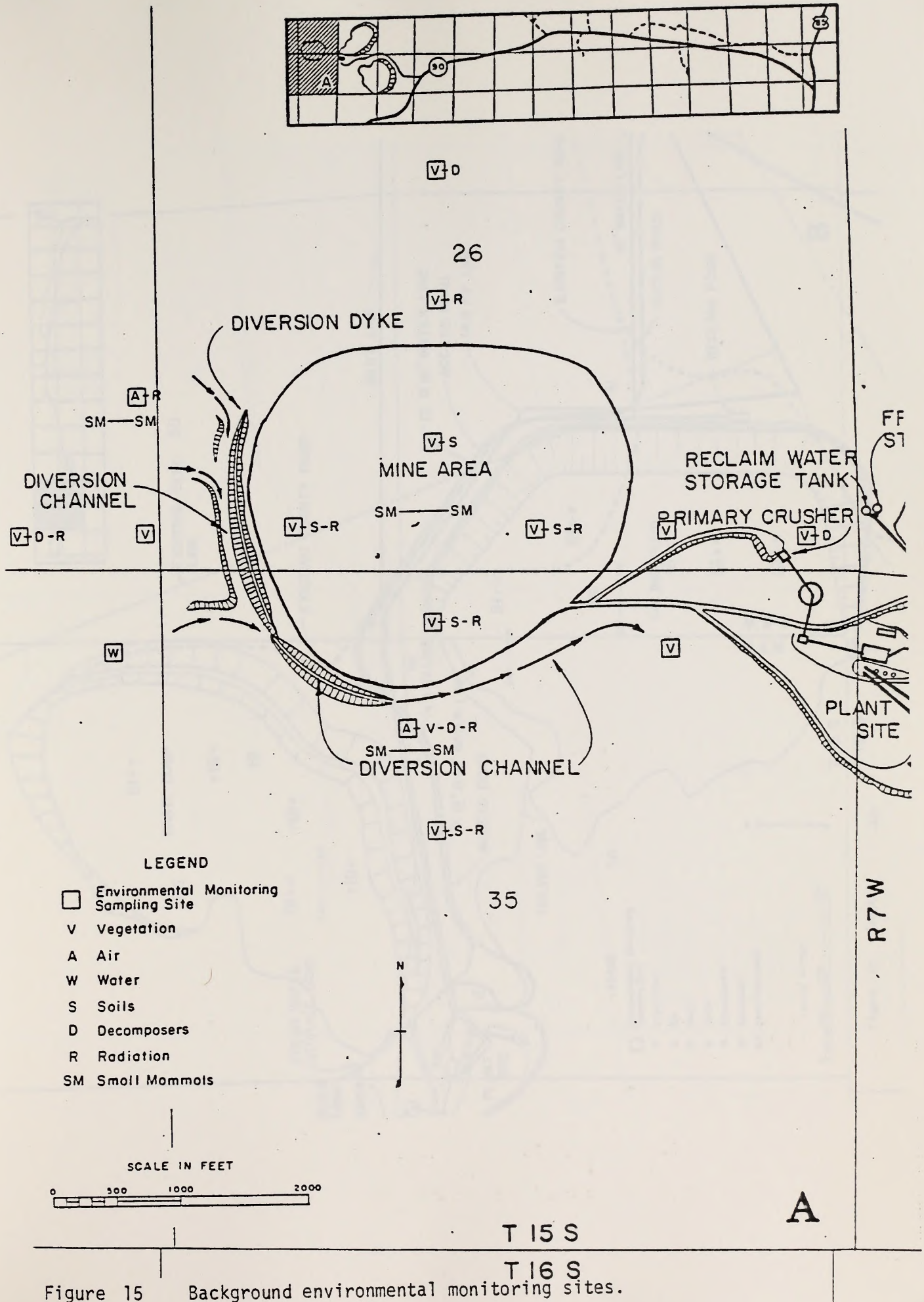
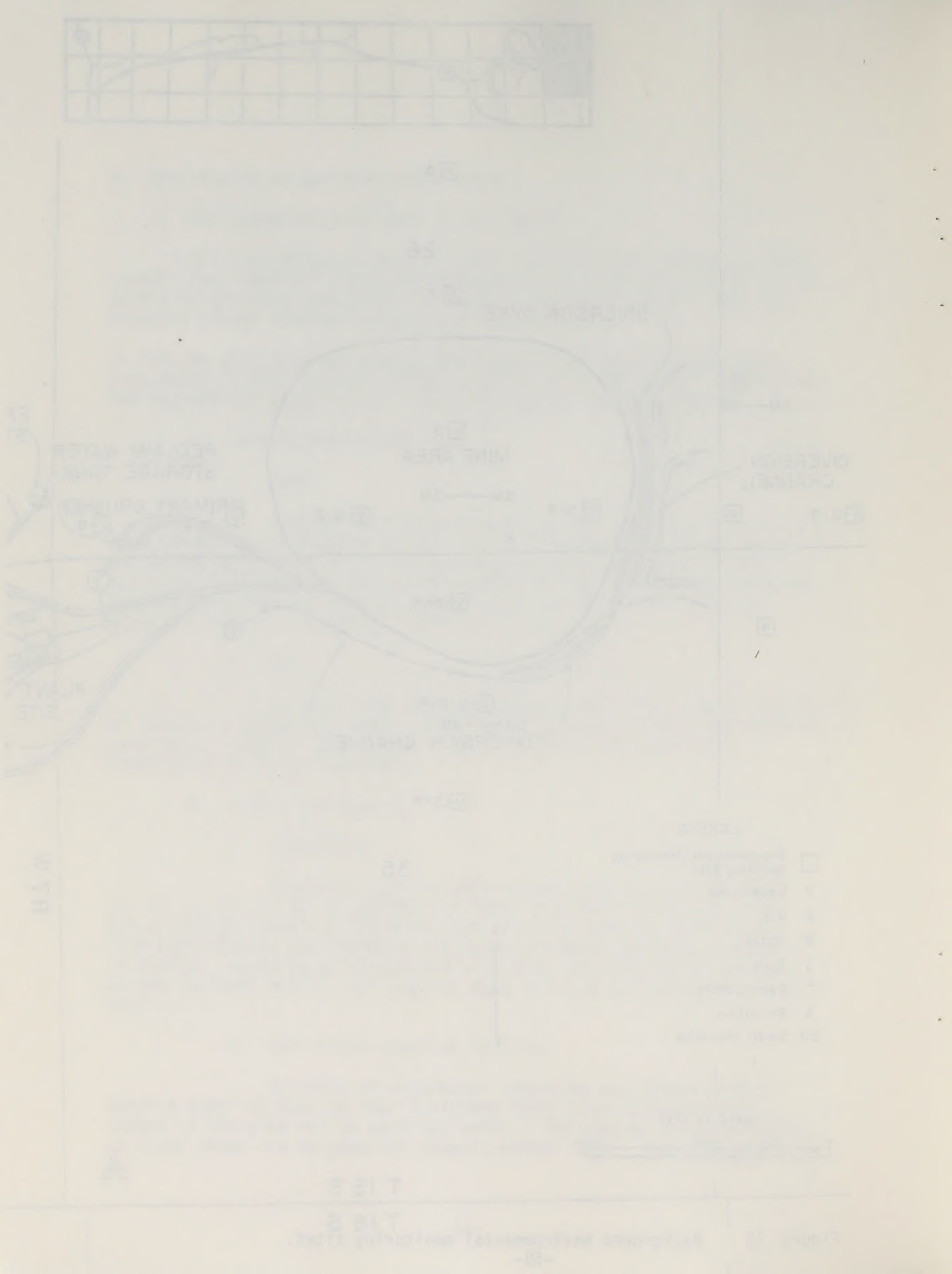


Figure 15 Background environmental monitoring sites.



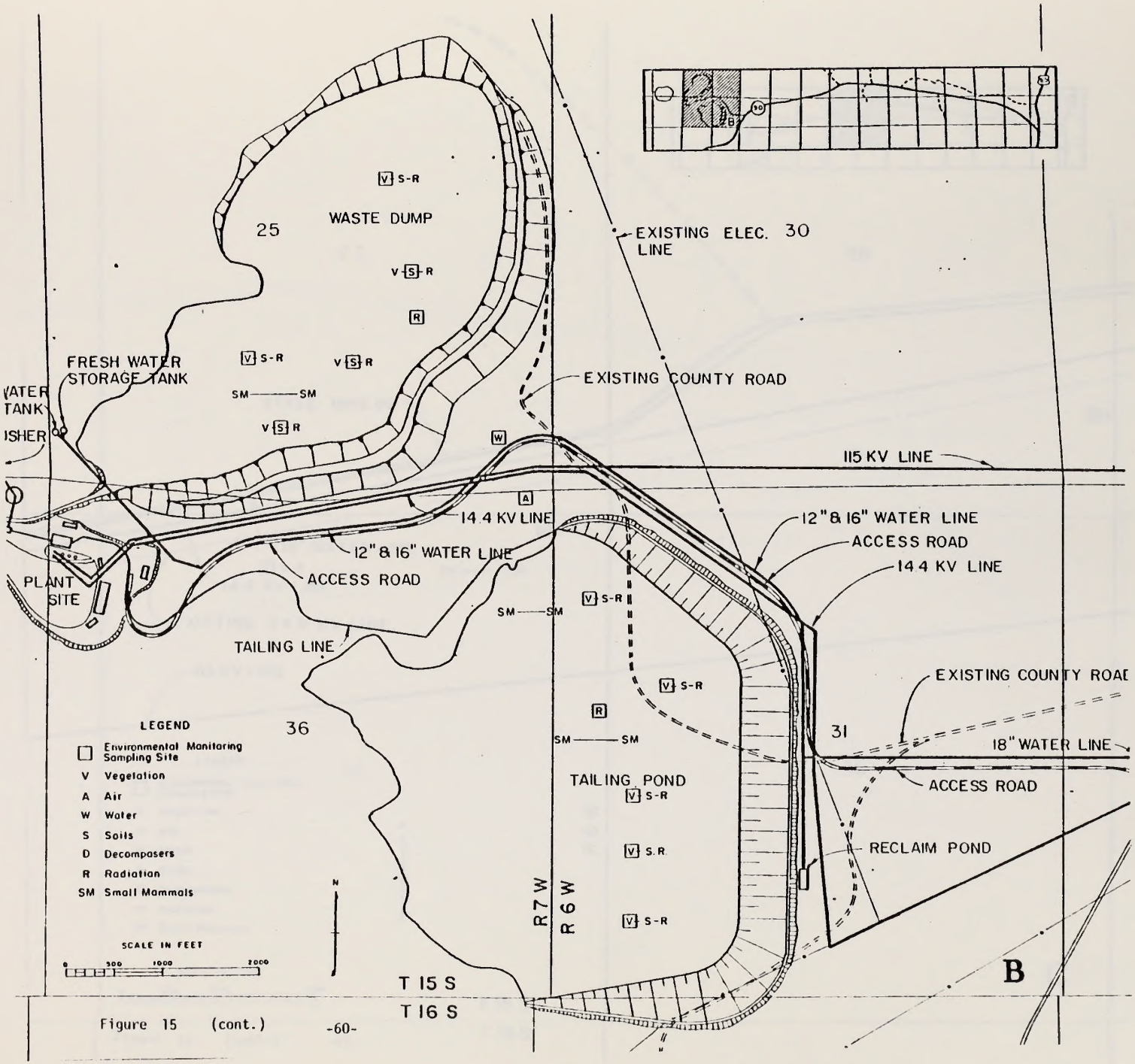


Figure 15 (cont.)

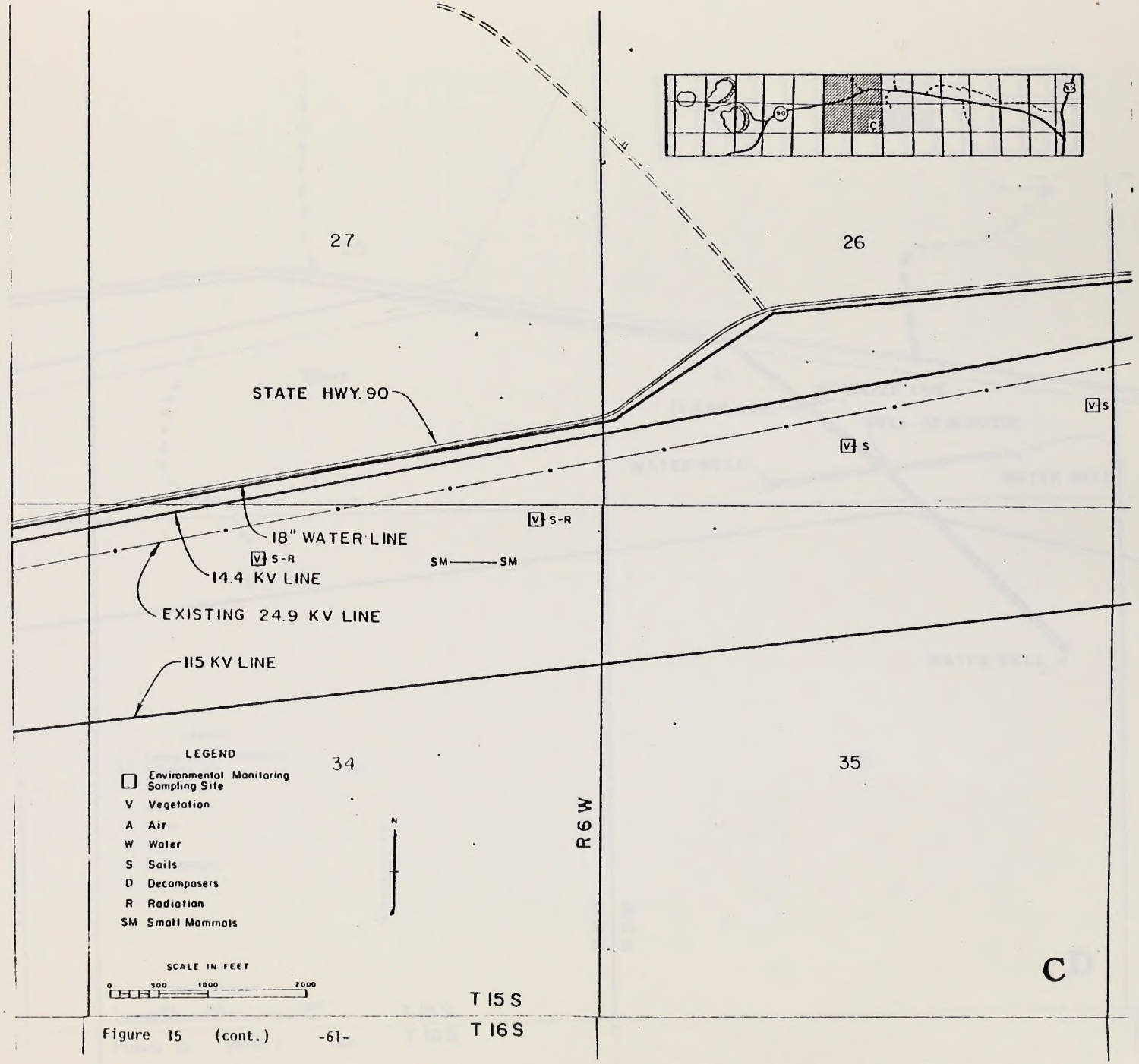
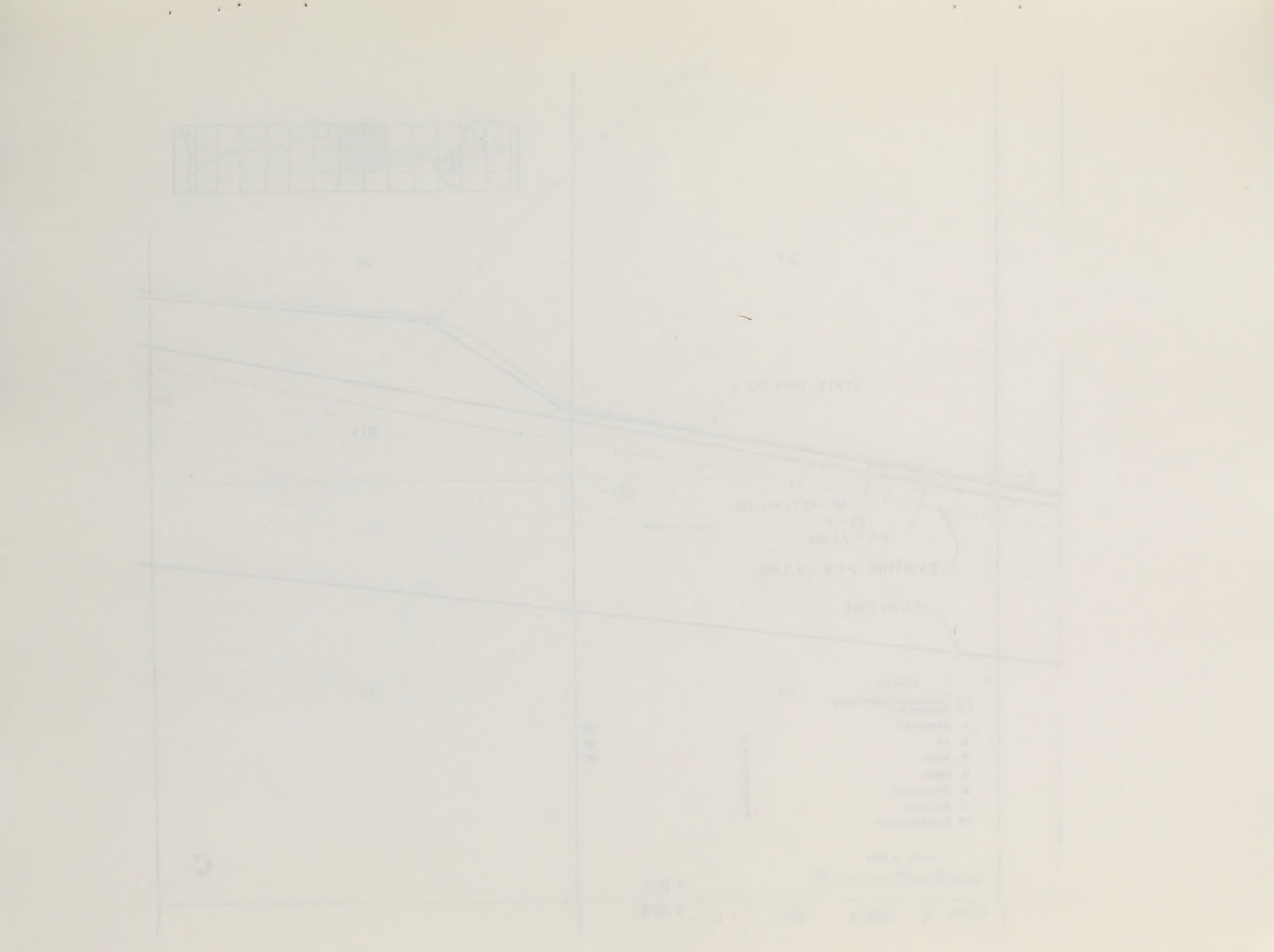


Figure 15 (cont.) -61-



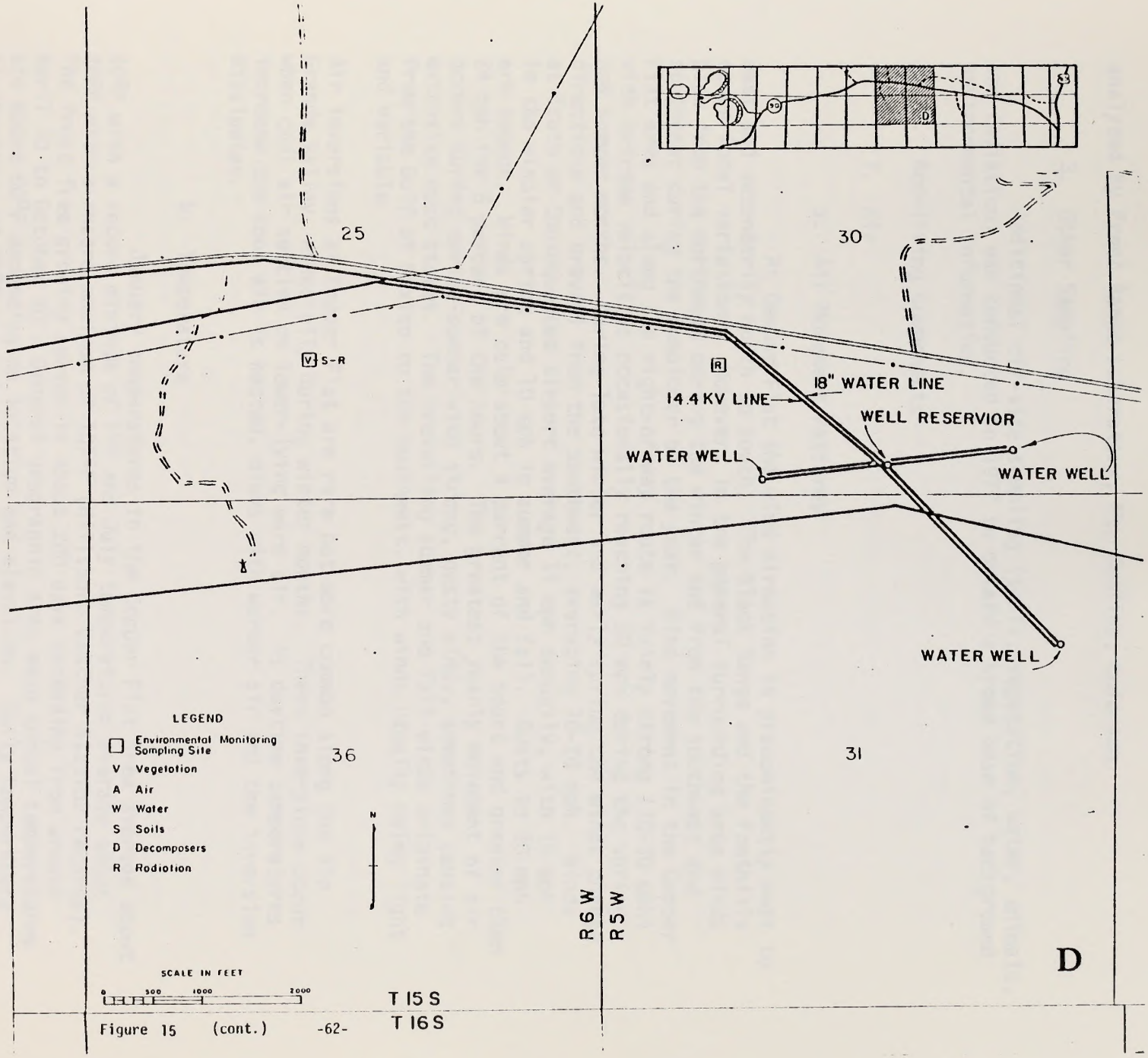


Figure 15 (cont.) -62-

analyzed by Front Range Laboratory, Ft. Collins, Colorado.

3. Other Sampling

Additional off-site sampling (soils, vegetation, water, animals, and radiation) was conducted in 1977 to obtain a broad base of background environmental information.

B. Non-living Components

1. Air

a. Air Movement Patterns

At Copper Flat the wind direction is predominantly west to east and secondarily north to south. The Black Range and the foothills cause local variations. However, in the general surrounding area winds blow from the northwest during the winter and from the southwest and southeast during the remainder of the year. Wind movement in the Copper Flat area and along the right-of-way route is fairly strong (10-30 mph) with extreme velocities occasionally reaching 50 mph during the spring and summer months. During late winter and early spring the winds change directions and prevail from the southwest, averaging 10-20 mph. Winds at Truth or Consequences airport average 11 mph annually, with 15 mph in the windier spring and 10 mph in summer and fall. Gusts to 30 mph are common. Winds are calm about 4 percent of the hours and greater than 24 mph for 5 percent of the hours. The greatest yearly movement of air occurs during spring-summer with strong, gusty winds, sometimes causing extensive dust storms. The prevailing summer and fall winds originate from the Gulf of Mexico to the southeast, with winds usually being light and variable.

Air inversions at Copper Flat are rare but more common along the Rio Grande Valley, especially during winter months. These inversions occur when cool air settles on lower-lying warm air. As daytime temperatures increase the cool air is heated, mixes with warmer air and the inversion dissipates.

b. Temperature

January temperatures in the Copper Flat area average about 40°F with a record minimum of 1°F and July temperatures average about 76°F with a record maximum of 107°F (Hillsboro Weather Station records). The frost free growing season is about 200 days extending from around April 10 to October 30. General geographic area mean annual temperatures are about 60°F depending on location and elevation. Daily temperature fluctuations of 30°F are common throughout the year. Summer days are warm (90°) and the nights temperate (55°-70°F). Winter days are mild and sunny with highs varying from 55°-65°F while 75 percent of the night time temperatures drop below freezing.

c. Solar Radiation

Sunshine occurs an average of nearly 3500 hours a year, or nearly 80 percent of the possible hours. The percentage is fairly evenly distributed throughout the year, but it is slightly lower in winter months. Average relative humidity at Truth or Consequences Airport ranged from 63 percent in the early morning hours to 34 percent in the warm afternoons, with May afternoons averaging 21 percent.

d. Precipitation-Evaporation

Average annual precipitation in the Copper Flat area is about 12 inches, with most of the precipitation occurring during the months of July (2.43" avg.), August (2.24" avg.), and September (2.05" avg.). Low rainfall occurs during the months of March (0.54" avg.), April (0.38" avg.), May (0.44" avg.), and June (0.59" avg.) (Hillsboro Weather Station records). From May to September precipitation is mostly in the form of local showers, with an occasional heavy rain approaching 30 percent of the annual average precipitation. There is a wide variation in precipitation from year to year and from month to month. Elevation is an important factor affecting precipitation. At Elephant Butte Dam (4576' elev.) the mean annual precipitation is 9.46"; whereas at Copper Flat (5,500'+ elev.) approximately 30 percent more precipitation falls.

Evaporation from a Class A pan at Elephant Butte Dam averages 118" annually, or 92" during the freeze-free season. The May through October average is 79". The evaporation loss decreases with elevation and at Copper Flat it is estimated that the annual average is less than 80". Low humidity and high winds are responsible for the evaporation loss.

e. Particulate Matter

No industry, population center, or permanent polluting sources are in the area; however, during the air sampling periods, mining exploration activities have contributed a low level, sporadic injection of fugitive dust particles to the atmosphere. In addition, high winds sometimes have created local dust storms. Three, high-volume, particulate air samplers (Weather Measure Corp. model APS-1) were located in a triangular pattern with the mine pit as the center. Sampling was conducted during 1976 (March, July and October) and 1977 (January, April and July). The average micrograms per cubic meter for each of the stations was as follows: east of pit--26.998; south of pit--22.185; and northwest of pit--19.475. According to the New Mexico Environmental Improvement Agency a level of particulates less than 50 micrograms/cubic meter is considered to be an indication of excellent quality and what could be expected in the Copper Flat area. The maximum allowable concentrations (NMEIA) of total suspended particulates in the ambient air are as follows: 24-hr. avg.--150 g/m^3, 7-day avg.--110 g/m^3,

30-day avg.--90 g/m^3; and annual geometric mean--60 g/m^3.

Most of the particulate matter suspended in the air over the general area is caused by gusty winds acting on unpaved roads and land bared for agricultural or construction purposes. Within the past three years, three monitoring sites maintained by the New Mexico Environmental Improvement Agency at Truth or Consequences, Hatch and Las Cruces have each yielded levels below the National Ambient Air Quality Standards for particulate matter. The highest seasonal concentrations, areawide, are during the spring months and are primarily caused by gusty winds. The lowest concentrations, areawide, are during the rainy summer months. The monitor at Truth or Consequences has remained fairly stable over the past few years.

f. Other Possible Contaminants

No monitoring data are available for the geographic area for carbon monoxide, nitrous oxide, sulfur dioxide nor photochemical oxidants (ozone, O_3). Annual hydrocarbon emissions for Sierra County have been recorded at 1,294 tons. This level is within the allowable National Ambient Air Quality Standards.

g. Radiological Contaminants

No known man-caused sources of radiological contaminants which might degrade the area are believed to exist within the assessment area. Results of a radiation survey of the area of interest are presented in Table 6. The data indicate an average, normal background level of radiation.

h. Non-ionizing Radiation

Radio transmitters and high voltage electric transmission lines exist within the assessment area. At this time, no problems in air quality are known to exist from non-ionizing radiation.

2. Land

a. Soils

The Copper Flat area has been significantly affected by the Cenozoic and Paleozoic eras embracing parts of the Pennsylvanian, Tertiary, and Quaternary periods with evidence of volcanism and intrusions. The soils are thin lithosols largely sandy with sandy-loam in areas of development.

The soil association which includes the topographical features of Copper Flat, Black Peak, Animas Peak, Grayback, and Wicks Gulches is classified

as Lehmans-Oro Grande-Rock Land. In Sierra County this association includes a relatively extensive area of rolling to hilly mountain foothills in the west-central part between the high mountains to the west and the alluvial fans that grade toward the Rio Grande on the east. Interspersed with the rolling and hilly landscapes are steep breaks, gently sloping to moderately steep alluvial fans, and narrow, gently to strongly sloping valley bottoms. Rock outcrops and shallow soils are common. In the rolling to hilly areas soils range from shallow to moderately deep. Small areas of soils in the valley bottoms (Copper Flat) are generally moderately deep and often gravelly. This soil association comprises only about 5 percent of the county. Where there are deep deposits of alluvium, up to 20 feet deep, or in the grassland areas, the A horizon may be 4-8" deep. On the gentle ridges and slopes, much of the soil surface is protected from wind and water erosion by a thin "pavement" of small gravel.

Table 6
Right-of-Way and Copper Flat Radiation Levels, July 11-15, 1977.
Sample Collection Areas are Shown in Figure 15

Location	Number in Sample	Millirems/Hr. Avg.
Waterline-Powerline R.O.W.	6	2.48
Tailing Deposit Area	6	2.69
Pit Area	3	3.10
Waste Dump Area	6	2.66
South Vegetation Monitoring Site	3	2.68
North Vegetation Monitoring Site	3	12.43
East Vegetation Monitoring Site	3	2.93
West Vegetation Monitoring Site	3	3.03
Air Sampling Station Z	3	7.0
Air Sampling Station Y	3	2.68

Lehmans soils occur on the moderately steep and rolling to hilly landscapes. They usually have a thin surface layer of brown, stony loam that is neutral in reaction. The subsoil is a reddish-brown gravelly or stony clay. The coarse fragments are often lime-coated on the underside in the soil layer immediately above bedrock. These soils are typically underlain by igneous bedrock within 20 inches of the surface.

Oro Grande soils in this area occur only on the north slopes and at the higher elevations. These soils have a surface layer of gray-brown, weakly calcareous, stony loam. This grades through a light brownish-gray, stony loam to igneous bedrock at about 20 inches.

Rock land consists dominantly of outcrops of igneous bedrock and very shallow soils occurring in a very complex pattern. Although the soils are typically shallow, small areas or pockets of moderately deep soils occur.

Probably none of the Lehmans-Oro Grande-Rock land associations in the Copper Flat area would be suitable for agriculture. However, it provides fair grazing for range livestock.

In the vicinity of the proposed tailing deposit the soils are classified as Cacique-Pinaleno-Hap association. This association includes broad, nearly level to gently sloping remnants of an old alluvial fan that extends from the mountain front toward the Rio Grande Valley in an easterly direction. The surface is relatively smooth with a weekly-defined drainage system. Past placer gold mining activities have severely disturbed the drainages. The undisturbed soils are moderately coarse to medium-textured alluvial sediments, gravelly and shallow over multi-layered cemented layers with a high lime content. These soils support sparse to fair stands of vegetation, are reddish, sandy and with a sandy-clay subsoil. Areas disturbed by past and present mining activities are considered to be in a critical erosional condition.

b. Soil Nutrient Properties

Neither the Lehmans-Oro Grande-Rock Land Association nor the Cacique-Pinaleno-Hap Association are suited for cropland under irrigation nor is any utilized for this purpose at this time. Unfavorable properties (shallow soil depth, low water-holding capacity, high gravel and cobble content, and varying slopes) requiring a high level of management limit the agricultural productivity potential. The results of analysis of soil samples from various areas concerned with the project are presented in Table 7.

c. Soil Erosion

Flash floods and sheet wash mostly occur during the summer rainy season. This type of erosion moves relatively large amounts of soil over a short time period, forming gullies or rills. The runoff varies from medium to rapid depending on soil type, slope, and intensity of storms. Gusty winds and dust devils also have a significant erosional effect on barren or sparsely vegetated lands. Wind erosion results in a relatively small amount of material moved over longer periods of time.

The Lehmans-Oro Grande-Rock Land Association occurs on hilly landscapes with steep breaks, rocky outcrops, narrow drainages, and steep alluvial

Table 7 Results of analyses of soil samples from 12 areas related to the Copper Flat Project, 1977.

SAMPLE	pH (Paste)	E.C. mmhos/cm	Ca meq/l	Mg meq/l	Na meq/l	SAR	NO_3 ppm	P ppm	K ppm	O.M. %	Sand %	Silt %	Clay %	Texture
Tailing A	7.5	0.4	3.3	0.5	0.2	0.1	31.2	9.6	543	1.3	56	20	24	SCL
Tailing B	7.5	0.3	3.0	0.4	0.2	0.2	37.0	15.6	293	1.2	66	14	20	SCL-SL
Tailing C	7.6	0.4	4.9	0.7	0.4	0.2	45.6	14.0	353	1.6	59	18	23	SCL
Pit A	7.2	0.3	2.1	0.9	0.3	0.2	23.9	18.4	297	0.8	65	17	18	SL
Pit B	7.6	0.5	3.5	1.1	1.4	0.9	21.7	7.4	136	0.6	33	36	31	CL
Pit C	7.1	0.3	1.8	0.9	0.3	0.3	6.7	26.3	338	0.6	70	13	17	SL
Powerline A	7.6	0.4	4.8	0.4	0.2	0.1	42.1	12.9	397	0.1	64	12	24	SCL
Powerline B	7.7	0.2	2.2	0.2	0.2	0.1	25.3	15.6	386	1.2	61	13	25	SCL
Powerline C	7.7	0.3	3.1	0.4	0.3	0.2	34.1	12.9	363	1.0	63	15	22	SCL
Waste Dump A	7.7	0.2	1.3	0.2	0.1	0.2	20.6	6.1	250	0.7	73	11	16	SL
Waste Dump B	7.8	0.2	3.5	0.1	0.3	0.2	22.8	8.0	86	1.2	64	11	25	SCL
Waste Dump C	7.7	0.2	1.8	0.2	0.1	0.1	23.9	18.4	165	1.8	60	16	24	SCL

fans. Protection from overgrazing or a minimum disturbance of the surface is necessary to prevent runoff erosion. The Cacique-Pinaleno-Hap Association is mostly sandy, gravelly soils on gently sloping alluvial fans. The thin surface layer is particularly vulnerable to wind or water erosion unless protected by a vegetative cover.

Erosion susceptibility of the two soil associations varies between soil types and depends upon vegetation density and characteristics, slope, and land use. These soils are stable under present management practices, however, with disturbance the wind erosional potentials are moderate to very high for the Cacique-Pinaleno-Hap Association and slight for the Oro Grande Rockland Association.

d. Geologic Structure

Copper Flat is in the Basin and Range Geological Province. The general setting is north-south oriented chains of uplifted mountains alternating with downdropped valleys. In the area of interest three principal structural areas are recognized:

(1) Cuchillo-Animas Trough--Sometimes referred to as the Winston-Hillsboro graben. This structural low is a series of narrow, irregular grabens, mostly filled with Tertiary and Quaternary volcanic rocks and clastics.

(2) Cuchillo-Animas Range--Adjacent (east side) to the Cuchillo-Animas Trough. A series of low uplifts of sedimentary rocks, generally tilted eastward and intruded by numerous dikes, sills, and irregular small intrusions. The range is mostly covered by volcanic rocks; however, along the western faulted edge, sedimentary rocks of Precambrian, Paleozoic, and Mesozoic ages are exposed.

(3) Rio Grande Graben--Just east of the Cuchillo-Animas uplift is the Rio Grande depression. The late Tertiary and Quaternary valley fill slopes eastward to the Rio Grande and is incised by several streams (Animas, Percha) and numerous other washes (Grayback Gulch, Animas Gulch, Wicks Gulch).

The disseminated mineralization is restricted entirely to a small quartz monzonite stock that has intruded a thick sequence of andesite flows. Most mineralization cuts off at the andesite contact. A few narrow latite and quartz latite porphyry dikes cut the quartz monzonite and are mineralized. Rare, very narrow postmineral basalt dikes also cut the deposit.

The central portion of the deposit, roughly corresponding to the area of alluvial cover in Copper Flat, is within a large breccia pipe which consists of fragments of quartz monzonite in a coarse-grained matrix of quartz, feldspar, biotite, pyrite, and chalcopyrite. The breccia pipe is about 1200 feet long, 600 feet wide and up to 1680 feet deep; it forms the high-grade core of the deposit. The copper occurs almost

exclusively as chalcopyrite with very rare bornite and tetrahedrite. Oxidation is generally restricted to 20 to 30 feet from the bedrock surface and very little copper oxide has developed. A small amount of supergene ore surrounding the breccia pipe has narrow chalcocite films developed in chalcopyrite.

e. Land Use Suitability and Compatibility

Major land uses occurring within the area of interest are mining, grazing, and recreation. These land uses have been recognized in the development of the Caballo Planning Unit (1975). The Caballo Planning Unit is one of the most mineralized areas in the Las Cruces District. About 75 percent of the mineral estate is administered by the government. Metallic mineral deposits occur in the Cuchillo-Animas chain along the west side of the Unit. There are numerous mining claims within the area.

The lands in the assessment area are open to mining under the Mineral Leasing Law (Act of Feb. 25, 1920) and the General Mining Laws of 1872, as amended, which provide that discovery of valuable locatable minerals on public lands or mineral reserved lands may entitle the discoverer to a patent for such lands. The procedure for acquiring a mineral patent is lengthy and cumbersome. BLM has reached the management decision that these public lands and the reserved minerals should remain available for development. About one-third of the Planning Unit area is covered by mining claims and considerable mining activity continues. The principal mineral production has been gold, silver, copper, lead, zinc, manganese and fluorspar.

The public lands involved are mineral in character in the vicinity of the proposed mine. Along the proposed rights of way there are no recognized mineral values. Development of the proposed mine would involve approximately 725 acres of public lands (ROW-125A., waste dump-358A., plant facilities-100A., tailing deposit-102A. and pit 30A.)

Mine development would require close coordination with other land uses (grazing, wildlife, recreation, and watershed) to minimize or eliminate as much surface disturbance as possible. Livestock grazing is the major, non-mineral, present land use in the assessment area.

3. Water

a. Hydrologic Cycle

The annual precipitation for this area is about 10-12 inches, most of which comes during the summer (July, August and September), usually in the form of brief, high-intensity thunderstorms.

The major surface runoff drainage system is to the east by Grayback Gulch and Grayback Arroyo; ultimately to the Rio Grande River. Subsurface

flow tends to follow general surface terrain physiography with more water available along the Animas River drainage. Grayback Gulch is an intermittent stream that typically is dry a significant portion of the year. The main drainage basin supplying water to Grayback Gulch covers approximately 1200 acres. Two subsidiary drainage areas north of Grayback Gulch encompass 494 acres. A drainage area to the south covers an additional 700 acres. All of these drainages ultimately contribute recharge to the groundwater in the Animas and Rio Grande valleys.

There are a few irregularly flowing springs in the foothills of the Copper Flat area. Groundwater occurs at various depths (20-100') depending on local geology and the limited aquifers present. Three wells were drilled in the vicinity of the proposed dam for the tailing pond. Water was encountered at a depth of about 100'; but quantities were inadequate for mine uses. One well in the vicinity of Gold Dust has water at a depth of 30-40' and is used for domestic and stockwatering purposes by the local resident.

b. Water Supply

Three production wells have been drilled to supply water for ore processing and other uses at Copper Flat. The well field is 7.5 miles east of the mine facilities. The production wells are not located in a declared basin. Water will be piped from the wells to the site. The wells have been drilled to the following depths: 960', 970', and 1,000'.

c. Water Quality

The quality of the water in Grayback Gulch has been determined from sampling during 1976 and 1977 (Tables 8-10). The results of water analysis of the three drilled wells 7.5 miles east of Copper Flat are presented in Table 11.

d. Sediment Load

Grayback Gulch runoff contains varying amounts of suspended and bedload sediments composed of sand and fine particles, depending on water flow rates and disturbances. The sediment load is highest during short periods of high flow immediately following high intensity thunderstorms. The sediment load also increases when livestock utilize the drainage bottoms heavily. Mining exploration activities occasionally have contributed to increased sediment load.

e. Dissolved Solids

The levels of dissolved solids occurring in Grayback Gulch during the sampling periods has not exceeded New Mexico Water Quality Standards. These dissolved solids include calcium, magnesium, sodium, potassium, chlorides, sulfates, carbonates, and bicarbonates.

Table 8 Results of water double-sample analysis from three stations[1] in Grayback Gulch, January 1977

Characteristics	Stations					
	A	B	C	A	B	C
pH	7.7	7.6	7.8	7.8	7.7	7.8
Elec. Conductivity (microhms/cm)	899	1159	1226	899	1178	1212
Total Dissolved Solids (mg/l)	720	800	840	800	800	880
Total Alkalinity (as $CaCO_3$) (mg/l)	317.2	280.6	262.3	305.0	292.8	268.4
Total Hardness (as $CaCO_3$) (mg/l)	1660.3	2394.8	2554.4	1596.4	2203.0	2477.7
Total Inorganic N (mg/l)	5.48	6.80	4.90	5.60	7.50	3.68
P (mg/l)	.40	.49	.47	.43	.50	.47
F (mg/l)	.4	.5	.4	.4	.5	.4
Cu (mg/l)	.04	.04	.03	.03	.05	.05
Ag (mg/l)	.01	.01	.01	.01	.01	.01
Mo (mg/l)	.01	.03	.03	.01	.03	.02
Zn (mg/l)	.05	.04	.04	.04	.04	.04
Fe (mg/l)	.23	.19	.23	.30	.29	.37
Mn (mg/l)	.01	.01	.01	.01	.01	.01
K (mg/l)	3.0	2.9	3.8	2.6	2.7	3.5

[1]Station A - where creek enters QMC property.

Station B - in creek 300 yards east of estimated mine rim.

Station C - where creek leaves QMC property.

Table 9 Results of water sample analyses from three stations in Grayback Gulch, March 1977.

Characteristics	Stations A	B	C
pH	7.9	8.0	8.1
Elec. Conductivity (microhms/cm)	916.3	916.3	1260.0
Total Dissolved Solids (mg/l)	1000	1080	1320
Total Alkalinity (as $CaCO_3$) (mg/l)	240.2	220.2	220.2
Total Hardness (as $CaCO_3$) (mg/l)	434.53	567.63	667.15
Total Inorganic N (mg/l)	3.8	3.3	3.6
P (mg/l)	0.46	0.41	0.38
F (mg/l)	0.2	0.5	0.3
Cu (mg/l)	<.005	<.005	<.005
Ag (mg/l)	<.01	<.01	<.01
Mo (mg/l)	0.01	0.08	0.08
Zn (mg/l)	<.01	0.02	0.02
Fe (mg/l)	0.10	0.15	0.10
Mn (mg/l)	<.01	<.01	<.01
K (mg/l)	3.0	2.5	3.1

Table 10 Results of water sample analysis from station B, July 1977.

Parameters	Sample
Cu (ppm)	< .005
Ag (ppm)	< .005
Mo (ppm)	0.05
Zn (ppm)	0.01
Mn (ppm)	0.07
Fe (ppm)	0.14
Ca (ppm)	168.5
Mg (ppm)	29.0
K (ppm)	8.9
SAR	1.8
Total Dissolved Solids	3200

Table 11
Results of Water Analysis From the Three Production
Drilled Wells 7.5 Miles East of Copper Flat

Constituents	Well #1	Well #2	Well #3
Temperature	76°F	76°F	76°F
Calcium	22.0 ppm	21.0 ppm	22.5 ppm
Magnesium	2.8 "	3.4 "	2.7 "
Sodium	38.0 "	39.0 "	44.0 "
Potassium	4.5 "	4.3 "	5.1 "
Carbonates	0.0 "	0.0 "	0.0 "
Bicarbonates	144.6 "	153.1 "	158.0 "
Chlorides	16.3 "	17.0 "	24.1 "
Sulphates	10.0 "	5.0 "	5.0 "
Nitrates	3.53 "	3.53 "	2.60 "
Fluoride	0.43 "	0.66 "	0.64 "
Total Dissolved Solids	217 @ 180°F	257 @ 180°F	243 @ 180°F
pH	7.8	8.1	8.0

f. Chemical, Heavy Metals, and Toxic Substances

The data presented in Tables 8-11 indicate levels within acceptable limits for copper, silver, molybdenum, zinc, iron, manganese, and fluorine. No data are available on pesticides present but it is not likely that significant quantities occur since the Copper Flat area is well removed (12-13 miles) and upstream from agricultural areas where the pesticides might be in use.

g. Nutrients

Nitrogen, phosphorus, and potassium occur at low levels in Grayback Gulch water. Limited sampling and the temporary character of Grayback Gulch flow have not permitted determination of seasonal variation in the chemical plant nutrients available.

h. Acid Balance

All of the water analyses to date have shown a pH within a 7.6 to 8.1 range, indicating the water to be alkaline. The pH values for the Rio Grande drainage are generally alkaline.

i. Temperature

The temperature of the water in Grayback Gulch varies widely depending on ambient conditions, solar radiation, and amount of flow. The temperature in the three drilled wells was 76°F.

j. Radiological Contaminants

No discrete data regarding possible radiological contaminants in water are known to be available at this time for the area of interest.

4. Mining Activities

The area of Quintana's proposed action lies within the Hillsboro-Las Animas Mining District which contains approximately 636 unpatented mining claims, 56 patented lode mining claims, and 4 patented placer mining claims. Inspiration Copper Co. has optioned to Quintana Minerals Corp. 268 lode and 94 placer claims. In addition, Quintana has located 64 placer claims. The only other known mining operation is that of El Oro Limited. This company operates intermittently a land dredge placer operation approximately one mile north of Gold Dust, New Mexico.

C. Living Components

1. Vegetation

The Copper Flat area is within the Mexican Highlands section of the Basin and Range Physiographic Province. The dominating influence is the low annual rainfall. The mountains rise abruptly from the plains, creating a multitude of localized topographic and climatic variations. In addition there are overlain variations in soils, slopes, and aspect. The intermixing of these environmental factors cause a correlative wide variation in the vegetation present. Essentially, the vegetation is composed of several desert associations. In the vicinity of Copper Flat the low elevation flats and foothills are characterized by creosotebush. The highest elevations are predominantly grasslands being invaded by scattered juniper. The intervening area is dominated by desert grasses with a mixture of shrubs. Much of the Copper Flat development area has been disturbed by roads, trails, old mines, tailing deposits, exploration drilling, mine wastes, placer piles, placer mining, flooding, overgrazing and fires.

As part of the on-going environmental monitoring program by Quintana's consultant, permanent vegetation sampling stations were established on cardinal radii (N, NE, E, SE, S, SW, W, and NW) at 1000' and 2000' distances from the probable center of the mine pit. A total of 1013 leaves from 15 plots were examined. Growth and vigor characteristics were excellent for 98.8% of the leaves, satisfactory for 1.2% and none were rated poor. A total of 307 leaves (30.3%) were damaged with portions missing averaging 22.4%. Very few (1.7%) of the leaves examined showed evidence of spotting. A total of 177 leaves had brown tips. The percentage of damaged leaves was lower in the west and southwest portion of the area than in the other quadrants. The spotting of leaves was highest in the north and west portions of the area. Brown tipping of damaged leaves was highest in the sampled areas located near the center of the pit. The vegetative composition, diversity and characteristics will be discussed with the appropriate biotic communities.

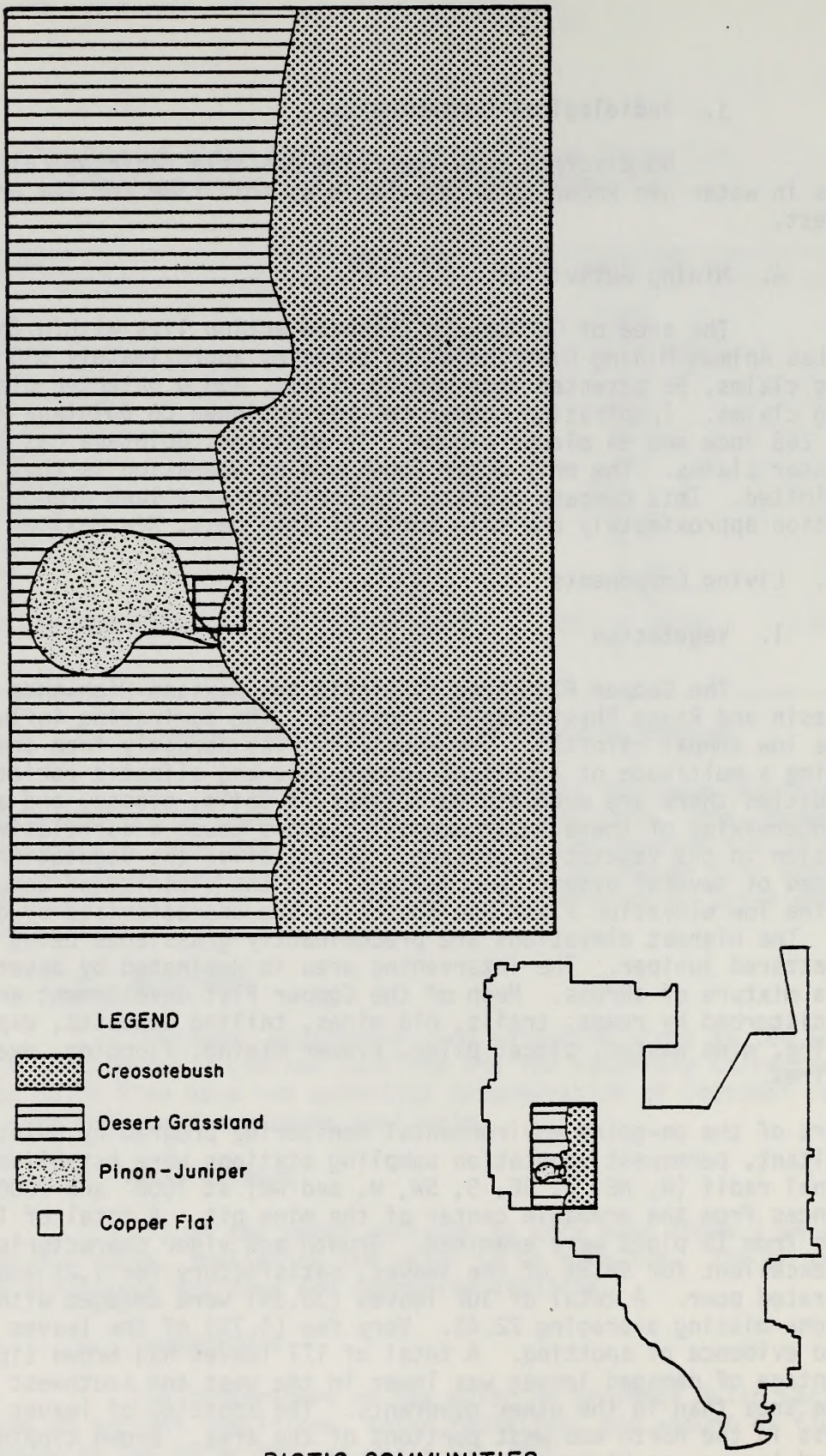


Figure 16 Vegetative communities of area.

Table 12
Vegetation Communities of the Coppr Flat Assessment Area

Vegetative Community	Total Acres	Percent of Total
Creosotebush	21,725	82
Desert Grassland	4,522	17
Pinon-Juniper	188	0.7

a. Aquatic Vegetation

For all practical purposes there are no aquatic plants in the Copper Flat area, mainly because of the temporary, intermittent character of Grayback Gulch and the lack of other water areas.

b. Terrestrial Vegetation

(1) Creosote Community

The lowland, foothill, hardpan flats east of Copper Flat along the Right-of-Way are characterized by a shrub cover of creosotebush (Larrea (Covillea) tridentata) and tarbush (Fluorensia cernua). This community covers 82 percent of the area (21,725 acres). Also prominent, but subdominant, are mesquite (Prosopis juliflora) and rabbitbush (Chrysothamnus spp. and Gutierrezia sp.).

Creosotebush grows on a variety of soil types but in the Copper Flat area its dominance seems related to the Cacique-Pinaleno-Hap soil association. Creosotebush is also associated with desert pavement, a collection of coarse, aggregate-gravel material 0.5-2" in diameter. The average height of creosotebush in the area is 3-5'. Creosotebush is an adaptable desert plant and is known for its ability to survive long periods of drought accompanied by high temperatures and low atmospheric humidity.

Table 13
Vegetation Characteristics in the Creosotebush Community
Along the Right-of-Way Route as Determined by 5, 1/10-Acre Plots

Plot	Dominant Vegetation	Plants/plot	Sub-dominant Vegetation	Plants/plot
1	Creosotebush	12	Rabbitbrush	1
2	Creosotebush	17	Rabbitbrush	14

3	Creosotebush	12	Rabbitbrush	2
4	Creosotebush	16	Rabbitbrush	23
5	Creosotebush	16	Rabbitbrush	2

Creosote grows in pure stands but in the vicinity of Copper Flat it is interspersed with tarbush and mesquite. A sub-dominant understory of a variety of grasses occurs: black grama (Bouteloua eriopoda), side-oats grama (Bouteloua curtipendula), mesa dropseed (Sporobolus flexuosus), three-awn (Aristida spp.), bush muhly (Muhlenbergia porteri), and fluffgrass (Triodia pulchella).

(2) Desert Grassland Community

The Desert Grassland community in the Copper Flat area dominates the landscape on the higher elevations of the rolling hills, in the gullies, ravines and washes, and on the slopes and low ridges. This community covers approximately 17 percent of the area (4,522 acres). A number of grass species are characteristic of this community. The major genera are: grama grasses (Bouteloua spp.), Hilaria spp., and three-awns (Aristida spp.). The grasses dominate the landscape and may grow in pure stands but in Copper Flat they are associated with a variety of sub-dominant shrubs (Yucca spp., Lemonade Sumac (Rhus trilobata), Baccharis pternoides, mesquite (Prosopis juliflora), Creosotebush (Larrea tridentata), Sage (Artemisia spp.), Rabbitbrush (Chrysothamnus spp. and Gutierrezia sp.), trees (Gambel Oak, Quercus gambelli; Emory Oak, Quercus emory; Willow, Salix gooddingi, Salix exigua, and Cottonwood, Populus spp.), and forbs (Cactus, Opuntia spp.; locoweed, (Oxytropis lambertii); Geranium sp., Solanum spp., Mimosa sp., and Haplopappus sp.). Some of the ridges and gentle slopes with above-average soils have excellent stands of sideoats grama. Most of the grasses are important for livestock forage as well as providing excellent watershed protection.

(3) Pinon-Juniper Community

The Pinon-Juniper Community occurs in the Copper Flat area as a fringe situation in which only Juniper is present. The community lies between the desert grasslands and the coniferous forests at an elevation of about 5,500'. All of the sites occupied by the Pinon-Juniper Community are on the higher knolls, northern aspects, and in steep, rocky terrain. This community covers less than one percent of the area comprising about 188 acres. The Pinon-Juniper Community is represented by Rocky Mountain Juniper (Juniperus scopulorum). The growth habits of the juniper in the Copper Flat area do not result in timber values. Occasionally it is utilized for fenceposts. This community is probably best known for its association with range forage plants: wheatgrass (Agropyron spicatum and A. smithii), blue grama,

Table 14 Vegetation characteristics in the Creosotebush Community in the tailing deposit area as determined by 5, 1/10-acre plots

Plot	Dominant Vegetation	Plants/plot	Sub-dominant Vegetation	Plants/plot
1	Tarbush	15	Mesquite	6
			Rabbitbrush	14
2	Tarbush	19	Mesquite	10
			Rabbitbrush	20
3	Tarbush	12	Mesquite	4
			Rabbitbrush	58
4	Tarbush	8	Mesquite	16
			Rabbitbrush	56
5	Tarbush	10	Mesquite	32
			Rabbitbrush	22

Table 15 Vegetation characteristics in the vicinity of the proposed tailing toe dam as determined by 5, 1/10-acre plots

Plot	Dominant Vegetation	Plants/plot	Sub-dominant Vegetation*	Plants/plot
1	Mesquite	7	Rabbitbrush	11
2	Mesquite	9	Rabbitbrush	4
3	Mesquite	4	Rabbitbrush	7
4	Mesquite	4	Rabbitbrush	16
5	Mesquite	6	Rabbitbrush	21

*Grasses were common in the intervening spaces between the shrubs.

Table 16 Vegetation characteristics in the vicinity of the proposed mine pit area as determined by 12, 1/10-acre plots

Plot	Dominant Vegetation	Plants/plot	Sub-dominant Vegetation	Plants/plot
South 1	Grass	NA	Lemonade Sumac	4
			Juniper	1
2	"	NA	Lemonade Sumac	4
			Rabbitbrush	2
3	"	NA	Lemonade Sumac	5
			Rabbitbrush	3
North 1	Grass	NA	None	
2	"	NA	Mesquite	3
			Rabbitbrush	25
3	"	NA	Mesquite	5
			Rabbitbrush	23
West 1	Grass	NA	Mesquite	4
			Rabbitbrush	13
2	"	NA	Rabbitbrush	7
3	"	NA	None	
East 1	Grass	NA	Mesquite	14
			Rabbitbrush	12
2	"	NA	Mesquite	8
			Rabbitbrush	9
3	"	NA	Mesquite	4
			Rabbitbrush	27

NA - Not appropriate. Density in stems/sq. in. was not obtained.

Table 17 Vegetation characteristics in the vicinity of the proposed waste dump area as determined by 5, 1/10-acre plots

Plot	Dominant Vegetation	Plants/plot	Sub-dominant Vegetation	Plants/plot
1	Mesquite	6	Rabbitbrush	32
2	Lemonade Sumac	4	Rabbitbrush	63
3	Creosotebush	9	Rabbitbrush	59
4	Creosotebush	9	Rabbitbrush	47
5	Creosotebush	21	Rabbitbrush	31

side-oats grama, needlegrass (Stipa spp.), and muhly (Muhlenbergia spp.). It is anticipated that none of this community will be disturbed by development of the mine.

(4) Endangered and Threatened Flora

A reconnaissance of the proposed plant site, pit, waste dump area, and tailing deposit site did not reveal any endangered or threatened plant species. A review of the list of endangered and threatened plant species prepared by the New Mexico Heritage Program did not reveal any known to occur in the Right-of-Way route or the Copper Flat area.

2. Animals

The Right-of-Way route is terrestrial habitat with an occasional grassy, dry wash. The Copper Flat mine development area is essentially terrestrial habitat with Grayback Gulch, a temporary, intermittent drainage, providing limited aquatic habitat on an irregular basis as water might occur. Observed species of animals, which can be considered as a minimum number of kinds in the area, are as follows: birds--36, mammals--17, and reptiles--6. No amphibians or fish have been noted. No information is available on the myriad of invertebrates present in the area.

a. Aquatic Animals

No aquatic mammals have been observed in the Copper Flat area. Two species of aquatic birds have been observed: Killdeer and Spotted sandpiper. Migratory water birds that frequent the Rio Grande Valley and the reservoirs on occasion may fly over the project development area.

b. Terrestrial Animals

(1) Mammals

The major factors responsible for the limited number of mammals occurring in the Right-of-Way and the Copper Flat area are: (1) low annual productivity of vegetative food and cover; (2) limited diversity in the plant communities present and (3) lack of water. The maximum number of mule deer observed at any one time was 6. Utilization of the various habitats by mammals varies with the degree and extent disturbance by man and the suitability of these habitats for occupancy by mammals. Transects in 1976 in suitable cottontail habitat indicated a late summer population of 1 per 24 acres. Trap removal transects for small mammals (mice and kangaroo rats) indicated the following population densities:

Powerline - Creosotebush Community - 1.54/Acre
Tailing Area - Creosotebush Community - 0.77/Acre
Pit Area - Desert Grassland - 0.38 Acre

Table 18
List of Birds Observed in the Copper Flat Area

Species Observed	
Turkey Vulture	Cathartes aura
Marsh Hawk	Circus cyaneus
Red-tailed Hawk	Buteo jamaicensis
Swainson's Hawk	Buteo swainsoni
Golden Eagle	Aquila chrysaetos
Kestrel	Falco sparverius
Scaled Quail	Callipepla squamata
Gambel's Quail	Lophortyx gambelii
Killdeer	Charadrius vociferus
Spotted Sandpiper	Actitis macularia
Mourning Dove	Zenaidura macroura
Roadrunner	Geococcyx californianus
Nighthawk	Chordeiles minor
Red-shafted Flicker	Colaptes cafer
Hairy Woodpecker	Dendrocopos villosus
Western Kingbird	Tyrannus verticalis
Say's Phoebe	Sayornis saya
Gray Flycatcher	Epidonax wrightii
Olive-sided Flycatcher	Nuttalornis borealis
Horned Lark	Eremophila alpestris
Stellar's Jay	Cyanocitta stelleri
Scrub Jay	Aphelocoma coerulescens
Black-billed Magpie	Pica pica
Crow	Corvus brachyrhynchos
Raven	Corvus corax
Cactus Wren	Camphylorhynchus brunneicapillus
Sage Thrasher	Oreoscoptes montanus
Robin	Turdus migratorius
Western Bluebird	Sialia mexicana
Loggerhead Shrike	Lanius ludovicianus
Meadowlark	Sturnella neglecta
Brown Towhee	Pipilo fuscus
Vesper Sparrow	Pooecetes gramineus
Sage Sparrow	Amphispiza belli
Slate-colored Junco	Junco hyemalis
White-crowned Sparrow	Zonotrichia leucophrys

Quantitative data on other mammals utilizing the Copper Flat area have not been obtained. However, it is likely that additional species with secretive activities (nocturnal, burrowing, etc.) frequent the area.

Other mammals utilizing the area of interest are domestic cattle (30-50 head of livestock), horses (2-4 head), and several feral-domestic goats.

(2) Birds

Species and numbers vary widely with the seasons. The list given in Table 18 should be considered minimal. During spring and fall migration the number and kinds of birds passing through the area far exceed the resident population. Gambel's quail is the most common game bird on the area. During 1975 and 1976 Gambel's quail (Lophortyx gambelii) numbers varied from a low of 43 to a maximum of 200 + utilizing the area. The breeding population is probably in the neighborhood of 20-40 pairs. Scaled quail (Callipepla squamata) have been observed infrequently in the Copper Flat area. Mearn's quail (Cyrtonyx montezumae) might utilize the area but none have been observed. Based on New Mexico Game Dept. data, the combined population density of Gambel's and Scaled Quail in high years in excellent habitat could be 80-100 birds/section and in low years 10/section. The mourning dove (Zenaidura macroura) is widely distributed and a resident breeding population is present in the Copper Flat area; however, no determination has been made as to numbers present. Mourning doves are migratory and during the fall (October) as many as 100-200 birds might be observed in the area in a day. These migrants do not remain long and usually have moved further southward in a week or so. Another buildup in numbers occurs during spring migration but it is not as striking as the fall migration. They tend to frequent Grayback Gulch and the water seeps.

A variety of raptors utilize the area of interest and the most common are: red-tailed hawk (Buteo jamaicensis), kestrel (Falco sparverius), and marsh hawk (Circus cyaneus). Golden eagles (Aquila chrysaetos) have been observed twice on 8 field visits. The foothills and rocky terrain apparently provide a suitable hunting area. No eagle nests nor regular roosting sites are known to occur in the Copper Flat area. One Swainson's hawk (Buteo swainsoni) has been observed. The numbers of raptors increase in the fall as migrants arrive and utilize the area during the winter (October-March).

(3) Reptiles

Six species of reptiles have been observed in the assessment area. By far, the most numerous are the different lizards. A variety of snakes, including rattlesnakes, are present in the area.

Table 19 List of mammals observed directly or by sign in the Copper Flat area.

Species Observed	
Big Brown Bat	*Eptesicus fuscus*
Blacktail Jackrabbit	*Lepus californicus texianus*
Desert Cottontail	*Sylvilagus nuttalli*
Rock Squirrel	*Otospermophilus grammurus*
Cliff Chipmunk	*Eutamias dorsalis*
Ord Kangaroo Rat	*Dipodomys ordii*
Deer Mouse	*Peromyscus maniculatus*
House Mouse	*Mus musculus*
Pocket Mouse	*Perognathus fasciatus*
Woodrat	*Neotoma mexicana*
Coyote	*Canis latrans*
Gray Fox	*Urocyon cinereoargenteus*
Raccoon	*Procyon lotor*
Striped Skunk	*Mephitis mephitis*
Badger	*Taxidea taxus*
Bobcat	*Lynx rufus*
Mule Deer	*Odocoileus hemionus*

Table 20 List of reptiles observed in the Copper Flat area.*

Species Observed	
Earless Lizard	*Holbrookia* sp.
Collard Lizard	*Crotaphytus collaris*
Fence Lizard	*Sceloporus* sp.
Skink	*Eumeces* sp.
Western Diamondback	*Crotalus atrox*
Black-tailed Rattlesnake	*Crotalus molossus*

*No amphibians observed in Copper Flat area
No fish observed in Copper Flat area.

(4) Invertebrates

A tremendous variety and abundance of invertebrates occur on the area of interest. The most numerous are the beetles (Coleoptera). Other common orders are the bugs (Hemiptera and Homoptera), flies (Diptera), grasshoppers and crickets (Orthoptera), bees and wasps (Hymenoptera), and centipedes (Chilopoda). Butterflies and moths (Lepidoptera) are seen infrequently.

One facet of the environmental monitoring program samples soil micro-organism activity by using decomposer sampling bags (2.0 gms. std. vegetation mix and grind buried in top 10 cm of soil surface). The sampling bags were buried at four locations 2000' from the pit center on cardinal radii (N, S, E, and W). Half of each sample was retrieved and weighed for organic matter loss at 128 days and the remainder at 218 days during the growing season. The greatest decomposer activity in 1976 was found to occur on the East plot and the least on the West plot. The North and South plots were nearly the same.

(5) Game Species Harvest

One mule deer has been known to have been harvested from the Copper Flat mine area during the period 1975-1977 (3 hunting seasons). Poaching may have removed up to 20 deer per year from the area of interest. Game Management Area #52 (including the Black Range) has had an average harvest of 857 animals and a population density of 6.5 deer/section over the past 6 years (N.M. Game Dept. Harvest Statistics, 1976). The Copper Flat habitat carrying capacity would be much lower than for Area #52 and hence a density of 1 deer/section would be reasonable. No data are available on quail and mourning doves harvested from the area but it is believed to be small since access to the area is restricted by locked gates. New Mexico Department of Game statistics show season hunter success for quail in Sierra County to be 5.2 birds/hunter and for mourning doves--15.0 birds/hunter (New Mexico Dept. Game and Fish, 1976). Probably less than 50 game birds are harvested from the Copper Flat area annually.

(6) Endangered and Threatened Fauna

A list of endangered and threatened fauna has been developed (December 1976) for Sierra County by the Bureau of Land Management (BLM contract No. NM-030-CT6-818). This list was the result of a survey of pertinent literature, contracts with persons, and agencies with specific knowledge, and from the species classified as endangered and threatened by Federal and State laws and regulations. Based upon this list, a comparison was made with known observations of species frequenting the Copper Flat area. None of the endangered and threatened fauna has been observed in the vicinity of Copper Flat. However, there is a remote possibility that some of the species

might be expected to occur because of proximity or habitat preferance (Table 21 and Figure 17).

The Peregrine Falcon occurs commonly in the Rio Grande Valley and can be expected to hunt occasionally in the foothills east of the Black Range. The hunting territory of this endangered falcon might, on occasion, include some or all of the Copper Flat area.

Table 21
Endangered and Threatened Fauna that Might
Occur in the Asessment Area

Mammals	
	None
Birds	
	Peregrine Falcon (Falco peregrinus anatum)
	McCown's Longspur (Calcarius mccownii)
	Baird's Sparrow (Ammodramus bardii)
Reptiles	
	Lyre Snake (Trimorphodon biscutatus wilkonsoni)

McCown's Longspur regularly winters in the Rio Grande Valley, mostly around agricultural areas. However, it frequents grasslands and on occasion might utilize the foothills of the Black Range, of which Copper Flat is a part.

Baird's Sparrow is a winter visitor and migrant to the Rio Grande Valley and hence may visit the foothill areas of the Black Range. It prefers grasslands and overgrown fields.

The Lyre Snake utilizes rocky desert areas with good cover. It has been recorded in the Hillsboro area, the Lower Rio Grande Valley, and in the breaks adjacent to Elephant Butte Reservoir.

The potential ranges mentioned consider species habitat preferences and present habitat conditions. These areas do not represent critical habitat but undoubtedly do include habitat that might be utilized by these species. Critical habitat for the endangered and threatened species have not been delineated.

D. Ecological Interrelationships

1. Terrestrial Ecosystems

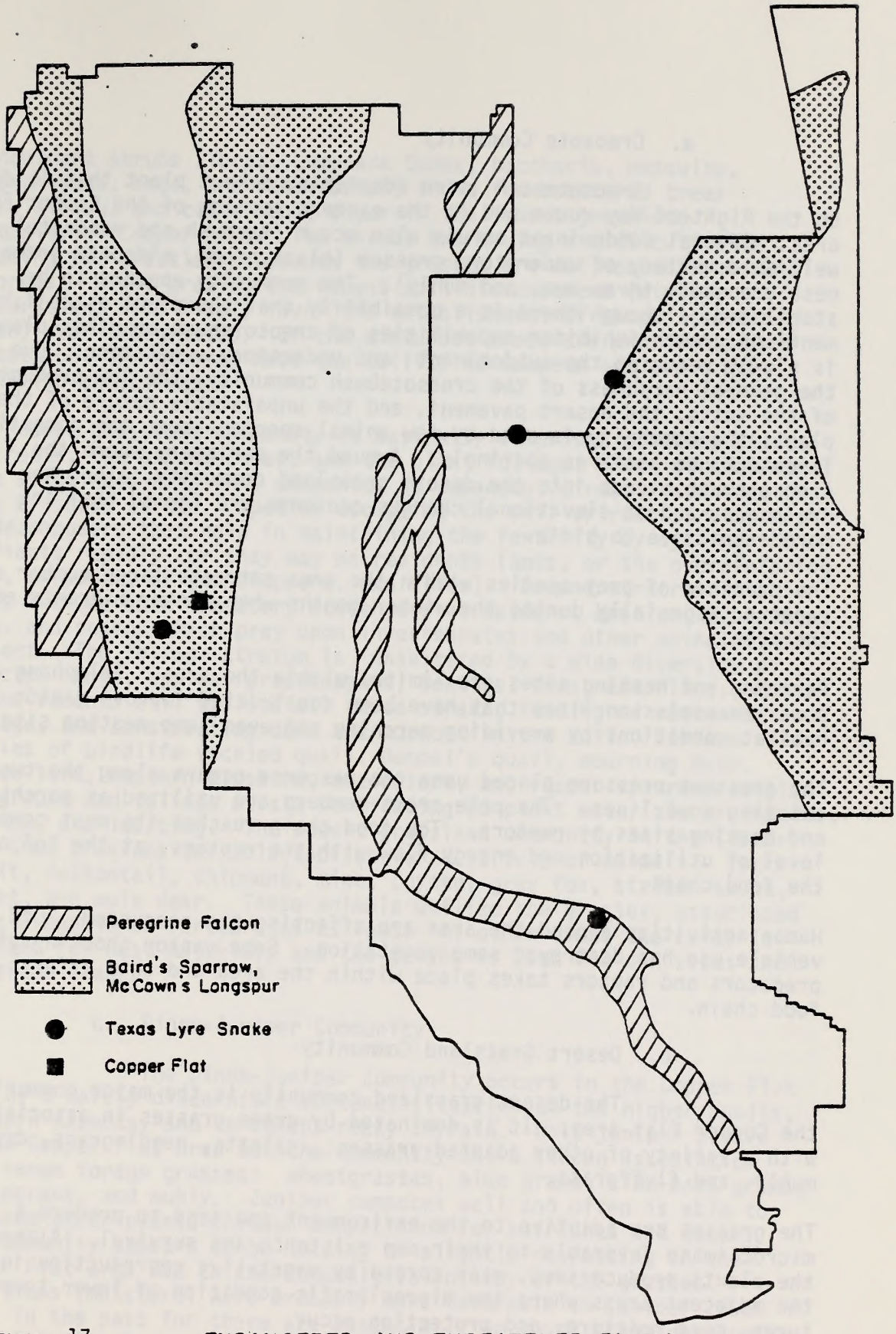


Figure 17 ENDANGERED AND THREATENED FAUNA

a. Creosote Community

Creosotebush is an adaptable, desert plant that is dominant on the Right-of-Way route and in the eastern portion of the Copper Flat area. Several subdominant shrubs also occur (tarbush and mesquite) as well as a variety of understory grasses (black grama, sideoats grama, mesa dropseed, three-awn, and muhly). The community appears to be stabilized, although there is a possibility that the plant establishment and growth inhibitor capabilities of creosotebush on other plants is slowly reducing the subdominant and understory vegetation. Due to the general harshness of the creosotebush community, the low productivity of the soils, the desert pavement, and the unpalatable nature of the plant, the community is used by few animal species--even the domestic livestock use the area sparingly. Around the periphery where the creosotebush blends into the desert grassland community, along the drainages, and at elevational changes ecotones are formed that are more attractive to biota.

The presence of prey species within the area attracts large number of raptors, especially during the winter months when winter migrants enter the area.

Perching and nesting sites are limited within the area. Telephone and power transmission lines that have been constructed improve raptor habitat conditions by providing perching and even some nesting sites.

The greatest pressure placed upon the resource occurs along the two existing powerlines. The pole cross members are utilized as perching and nesting sites by raptors. The food chain reaches its most complex level of utilization and energy flow with the raptors, at the top of the food chain.

Human activities around the area are affecting the ecosystem. Off road vehicle use has destroyed some vegetation. Some wanton shooting of predators and raptors takes place within the area and this affects the food chain.

b. Desert Grassland Community

The desert grassland community is the major community in the Copper Flat area. It is dominated by grama grasses in association with a variety of other adapted grasses: galetta, needlegrass, dropseed, muhly, and fluffgrass.

The grasses are adaptive to the environment and tend to produce a microclimate favorable to their own existence and survival. Although the plants produce seed, many spread by vegetative reproduction into the adjacent areas where the microclimatic condition of lower temperatures, more moisture, and protection occur.

Subdominant shrubs (Yucca, Lemonade Sumac, baccharis, mesquite, creosotebush, sage, and rabbitbrush) and a few scattered trees (oak, willow, and cottonwood) occur in the desert grassland community of Copper Flat. The shrubs are having a difficult time invading the grasslands because the grasses are well-established and vigorous. Light grazing and recent soil disturbances (mining exploration) will likely favor the establishment of shrubs (rabbitbrush) over the grasses. If the disturbed areas are provided proper protection, the grasses have the ability to compete and would re-establish themselves.

The desert grassland community is basically comprised of three strata: the roots, the ground cover, and the plant foliage. Most of the animal life associated with this community is dependent directly upon one or more of these strata. Species occupying the soil or root stratum may be decomposers that help in maintaining the fertility by cycling the nutrients rapidly or they may be residents (ants, or the overwintering eggs, or pupae, of grasshoppers, and flies). Ground stratrum inhabitants include such predatory scavengers as spiders, beetles, scorpions, mice, and snakes which prey upon invertebrates and other animal forms present. The foliage stratum is inhabitated by a wide diversity of insects: bugs, aphids, grasshoppers, beetles, bees, and flies. Most of the rodents will utilize all three strata, feeding on roots and foliage, and constructing dens and burrows in the soil. Various species of birdlife (scaled quail, Gambel's quail, mourning dove, horned lark, western bluebird, meadowlark, and vesper sparrow) utilize the ground and foliage strata for feeding on plant materials or insects, nesting, and loafting. The desert grassland community in the Copper Flat area provides suitable habitat for a variety of animals: jackrabbit, cottontail, chipmunk, mice, coyote, gray fox, striped skunk, bobcat, and mule deer. These animals utilize the grasses, associated insects and lower vertebrates as food. At other times the cover is utilized for nest materials and the ground is used for den sites and as escape areas.

c. Pinon-Juniper Community

The pinon-juniper community occurs in the Copper Flat area as a barely discernible ecotonal situation on the higher knolls, northern aspects, and in steep, rocky terrain. Only juniper occurs in the Copper Flat area but the community has a strong association with range forage grasses: wheatgrasses, blue grama, side-oats grama, needlegrass, and muhly. Juniper competes well and often is able to displace other plants through competition for nutrients and water. The community appears to be holding or slightly regressing in the Copper Flat area due to the competitive ability of the grasses. Conditions (moisture) were probably more favorable to juniper 25-50 years in the past for there are essentially no young trees developing. This situation is to be expected on the periphery of communities.

Because of the limited extent of this community in the area of interest, few species can be considered as related or associated specifically with the community. Almost all of the birds and mammals recorded in the Copper Flat area probably use the pinon-juniper community because of its juxtaposition to the dominating desert grassland community. The larger animals (coyote, fox, bobcat, and mule deer) are limited by a small food and water supply and also by lack of sufficient protective vegetative cover. The predatory species numbers vary and tend to fluctuate in response to their prey. Domestic cattle use the pinon-juniper community for cover, loafing, rubbing, and to a lesser degree for grazing.

2. Aquatic Ecosystems

Because of the temporary, intermittent character of Grayback Gulch and the lack of other water areas, the Copper Flat area provides essentially no aquatic environment.

E. Human Values

1. Visual Resources

a. Landscape character

(1) Landform Feature

(a) Form Element

The proposed mine development area is characterized by gently rolling, hilly terrain, low washes and flats with two dominating peaks (Black Peak, 6,280'; and Animas Peak, 6,170'). The ore body is located between these two peaks in a basin known as Copper Flat. The area is located in the foothills of the Black Range which is a major north-south mountain chain in south central New Mexico. This range forms the back-drop on the west horizon behind the planned project. There are high plains, foothills, and mountain peaks within the area. The plains lie east of the planned mine, with the proposed right-of-way routes crossing through them. The flat plains are cut by many arroyos of varying depth. Grayback Gulch is the dominant drainage. Past mine wastes also contribute to the form.

(b) Line Element

Naturally undulating lines are present in the relief. The horizontal ground pattern is broken only by sloping hills and arroyos. Elevations in the area rise from 4,940' to 5,600'. Past mine wastes break the horizontal ground pattern.

(c) Color Element

Dominant colors are reddish-brown and gray soils. The grayness is due to gravels associated with the soil.

(d) Texture Element

Texture varies from fine to medium due to the sandy-loam soils, alluvial fans, and rock outcroppings.

(2) Vegetation Feature

(a) Form Element

The vegetation patterns range in variety from the plains to the peaks. The lower elevation flats, arroyos, and foothills are characterized by uniform patches of creosotebush. The higher elevations are predominantly grassland with patches of juniper. Grayback Gulch is typical desert riparian habitat with intermittent grasses and shrubs.

(b) Line Element

Grass associations are broken only by creosotebush and juniper in a scattered pattern in the foothills and hillsides. A distinct free flowing feathered edge is formed by the vegetation along Grayback Gulch.

(c) Color Element

Dominant colors vary from light muted to dark brown and light-to-dark olive green vegetation.

(d) Texture Element

Texture varies from smooth (grasses) to coarse (creosotebush). Medium texture is exhibited by mesquite and juniper species.

(3) Structure Feature

(a) Form and Line Elements

Blocky structures are exhibited by warehouses, old mine shacks, concrete ore storage bins, and junk cars in the area. The pilot mine, located in the pit area, contains assorted structures such as a crusher, conveyor belt, and support building. Vertical lines are exhibited by the existing powerlines, warehouses, mine shacks, trailers, and buildings and derrick-like structures surrounding the pilot mine. Roads, trails, tailing deposits, mine wastes, and placer piles are also evident in the landscape. None are skylighted.

(b) Color Element

Roads show up white against the brown topography Warehouses are a dull-to-bright gray. Power poles are rustic brown as

KEY FACTORS	RATING CRITERIA AND SCORE		
① LAND FORM	Vertical or near vertical cliffs, spires, highly eroded formations, massive rock outcropa, severe surface variation. 4	Steep canyon walls, mesas, interesting erosional patterns, variety in size & shape of land forms. 2	Rolling hills, foothills, flat valley bottoms. 1
② COLOR	Rich color combinations variety or vivid contrasts in the color of soil, rocks, vegetation or water. 4	Some variety in colors and contrast of the soil, rocks & vegetation, but not dominant. 2	Subtle color variations, little contrast, generally muted tones. Nothing really eye-catching. 1
③ WATER	Still, chance for reflections or cascading white water, a dominant factor in the landscape. 4	Moving and in view or still but not dominant. 2	Absent, or prasent but seldom seen. 1
④ VEGETATION	A harmonious variation in form, texture, pattern, and type. 4	Some variation in pattern and texture, but only one or two major types. 2	Little or no variation, contrast lacking. 1
⑤ UNIQUENESS	One of a kind or very rare within region. 6	Unusual but similar to others within the region. 2	Interesting in its setting, but fairly common within the region. 1
⑥ INTRUSIONS	Free from aesthetically undesirable or discordant sights and influences. 2	Scenic quality is somewhat depreciated by inharmonous intrusions but not so extensive that the scenic qualities are entirely negated. 1	Intrusions ara so extensive that scenic qualities are for the most part nullified. -4

Scenery A = 15-24

Scenery B = 10-14

Scenery C = 1-9

EXPLANATION OF RATING CRITERIA

① Land Form or topography becomes more interesting as it gets steeper and more massive. Examples of outstanding land forms are found in the Grand Canyon, the Sawtooth Mountain Range in Idaho, the Wrangle Mountain Range in Alaska, and the Rocky Mountain National Park.

② Color. Consider the overall color of the basic components of the landscape (i.e., soil, rocks, vegetation, etc.) as they appaar during the high-use season. Key factors to consider in rating "color" are variety, contrast, and harmony.

③ Water is the ingredient which adds movement or serenity to a scene. The degree to which water dominates the scene is the primary consideration in selecting the rating score.

④ Vegetation. Give primary consideration to the variety of patterns, forms, and texture created by the vegetation.

⑤ Uniqueness. This factor provides an opportunity to give added importance to one or all of the scenic features that appear to be relatively unique within any one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is a number of not so spectacular elements in the proper combination that produces the most pleasing scenery - the uniqueness factor can be used to recognize this type of area and give it the added emphasis it needs.

⑥ Intrusions. Consider the impact of man-made improvements on the aesthetic quality. These intrusions can have a positive or negative aesthetic impact. Rate accordingly.

INSTRUCTIONS (See .1 for general procedures.)

Purpose: To rate the aesthetic quality of the scenic reaource on all BLM lands.

How to Identify Scenery Value: All Bureau lands nave scenic value.

How to Determine Minimum Suitability: All BLM lands are rated for scenic values. Also rate adjacent or intermingling non-BLM lands.

How to Delineate Rating Areas: Consider the following factors when delineating rating areas:

1. Like physiographic characteristics (i.e., land form, vegetation, etc.)
2. Similar visual patterns, texture, color, variety, etc.
3. Areas which have a similar impact from intrusions (i.e., roads, structures, mining operations, or other surface disturbances).

Table 22 Scenic Quality Chart

are the mine shacks. Waste piles exhibit colors from sandy to reddish brown. The crusher structure is rusty brown to black in the pit area. Mobile homes range from yellow to green.

(c) Texture Element

Road texture is fairly smooth while mine wastes and placer piles are relatively coarse. Buildings, structures, and transmission poles are medium in texture.

b. Scenic Quality

The scenic quality of the area is rated as Class C. Key factors inventoried that determined this rating were land, form, color, water, vegetation, uniqueness, and intrusions (see Table 22). When compared within the physiographic region for scenic values, the scenery is rated below average.

Intrusions are features (land, vegetation, or structures) which are generally considered out of context with the characteristic landscape. Usually these intrusions are modifications to the natural landscape resulting from man's activities. Intrusions can have negative or positive visual impacts and are a key factor in evaluating scenic quality.

Existing intrusions have been classified as to the degree which they have modified or intruded upon the natural landscape. This process is known as the "magnitude of contrast" and each intrusion (similar types of intrusions are grouped) was rated on one of three levels of contrast (see Table 23).

c. Visual Resource Management Class

To determine the visual resource management class, the scenic quality, the sensitivity level, and the visual zone maps are combined for the area.

The area was deemed low in sensitivity and was based on such criteria as use volume, use association, community relationships and attitudes, land use relationships, and other agency use and planning attitudes. Visual sensitivity is the visual response to specific areas in relation to the entire physiographic area.

The area is in the foreground-middleground distance zone (0 to 3 miles from the major highway) and New Mexico State Highway 90 parallels the right-of-way routes. The visual distance zone is simply a direct relationship between observer position and the landscape feature being observed.

Table 23 Classification of intrusions in the Copper Flat development area.

Intrusion	Magnitude of Contrast[1]
Roads and trails	High
115 Kv powerlines	Low
Mobile homes; abandoned mine houses; warehouses	Medium
Concrete storage bins; pilot mine structure with associated conveyor and crusher	High
Mine waste, placer piles, placer mines	Medium
Past flooding, overgrazing and fires	Low
Junked cars	Low

[1]Low - Contrast will not attract attention from landscape character.
Medium - Attracts attention and begins to dominate landscape character
High - Demands attention, will not be overlooked, dominates landscape character.

Detailed maps, overlays, and writeups are available in the BLM Las Cruces District Office. The area was classified as a Class IV visual management class. Class IV guidelines mandate that changes may be a dominant feature on the landscape in terms of scale, however the change must repeat the basic element (form, line, color, texture) in the characteristic landscape. The primary character of the landscape should be returned regardless of the degree of modification.

2. Recreation Resources

Because of Truth or Consequences' tourist industry, the city and surrounding area offer a variety of recreational opportunities and facilities. These range from bars and night clubs to motor boat racing to off-road vehicle courses. Elephant Butte, Caballo Lake, and the Percha Dam provide the largest water-oriented recreation areas in New Mexico. In the Truth or Consequences area there are 2 regulation softball fields, 5 tennis courts, 2 golf courses, a horseriding path, 1 indoor movie, 1 outdoor amateur theatre, 1 swimming pool, 8 parks, a library and a museum. Hillsboro has 1 tennis court. The nearby Black Range and Caballo Mountains offer hunting, hiking, exploring, rockhounding, riding, picnicking, camping, and many other recreational activities.

In Truth or Consequences the library is small, of good quality (24,121 volumes), and is open 6 days a week. Various programs in learning are offered, mainly for children. The Geronimo Springs Museum is open 6 days a week and there is a small fee charged. The museum presents material of local history--Indian, ranching, and mining.

The Black Range Museum is located in Hillsboro. Its presentations are of early mining, early settlers, and Indian artifacts.

3. Wilderness Resources

The proposed mine and development area are not within a BLM "roadless area" and need not be considered for wilderness values. The nearest wilderness area is in the Gila National Forest.

4. Socio-Cultural Interests

a. Educational/Scientific

The BLM land use plan (Caballo Unit Resource Analysis and Management Framework Plan) completed in 1974 and 1975 in the area of interest identified the general area embracing Copper Flat as having special interest for educational and scientific study of endangered fauna. It was recommended that studies be conducted to identify critical habitat, to gain more specific physiological knowledge, to determine habitat requirements, management priorities, and general life cycle information. The endangered fauna concerned with the area of interest are the Peregrine Falcon, McCown's Longspur, Baird's Sparrow, and the Lyre Snake. None of these species is known to

utilize the Copper Flat area specifically, although their general, potential ranges include Copper Flat. The recommended scientific studies have not yet been conducted.

b. Cultural Resources

Archaeological surveys of the mine development area and the rights-of-way were conducted in 1976 and 1977 by parties under the direction of Dr. Stanley Bussey, Cultural Resources Management Division, Dept. of Sociology and Anthropology at New Mexico State University in Las Cruces, New Mexico. The 1976 survey was a reconnaissance of those areas where disturbance created by the mine development might affect cultural resources. The survey results pointed to heavy historic mining use of the area, but very little other use during prehistoric or historic times. Although the rights-of-way were intensively surveyed, the discoveries there were limited to a few isolated stone flakes and some historic ranch improvements of undetermined age.

While no one site discovered in the area seems to warrant a nomination to the National Register of Historic Places, the sites as a group might qualify for nomination as IV-58, a National Historic Register District. The sites as a group would certainly qualify for inclusion on the New Mexico State Historical Register. There are, however, other mining districts in southern New Mexico which are very similar in terms of both their ages and their history, so the Copper Flats values should not be considered unique.

Information on specific sites in the area is stored at the New Mexico State University Museum. Survey reports on the mine development area and the rights-of-way are on file at the BLM office in Las Cruces, at Quintana Minerals Corporation offices in Tucson, and at the New Mexico State University Museum, as Reports 24 and 159, Department of Sociology and Anthropology, New Mexico State University, Las Cruces, New Mexico.

c. Social Welfare

This section presents the current socio-economic situation as best as can be determined based upon data available at the time of collection. It includes descriptions of the general population of New Mexico, Sierra County, Truth or Consequences, and limited information about surrounding communities such as Hillsboro.

(1) Population

The 1970 New Mexico state population was 1,019,100. Since that time it is generally agreed that the number has increased about 10 percent by 1976. Sierra County has remained fairly stable in population with a slow but steady growth. Table 24 compares the population trend of Sierra County with the state. In 1960 the

Table 24 A comparison of the population of Sierra County and New Mexico.

Year (mid-year)	Sierra County	New Mexico
1960	6,400	951,023
1961	6,400	965,000
1962	6,500	979,000
1963	6,700	989,000
1964	6,800	1,006,000
1965	6,900	1,012,000
1966	6,900	1,007,000
1967	7,000	1,000,000
1968	7,000	994,000
1969	7,100	1,011,000
1970	7,200	1,019,100
1971	7,300	1,044,800
1972	7,800	1,066,000
1973	8,000	1,099,200
1974	7,700	1,122,500
1975*	10,800	--
1976*	11,500 (est.)	--

Sources: U.S. Bureau of Census, 1960 & 1970, Census of Population. County data from Bureau of Business Research, UNM.

*Information from Dept. of Development, Economic Development Division, Santa Fe, New Mexico.

Sierra County population density was 1 person per 422 acres. By 1976 this density had increased to 1 person per 235 acres. A comparison of the birth:death ratio indicates that 3 times as many people came to Sierra County (immigration) as compared to the natural increase (New Mexico Statistical Abstract, 1975 edition). Except for the total population, the various component relationships probably have remained about the same. Females exceed males and most of the people are white.

(2) Ethnic Composition

The state is predominantly white and Sierra County is over 99 percent white, which according to the U. S. Bureau of Census method of tabulation includes the Spanish ethnic group. American Indians are the largest ethnic group (0.2 percent) in the state. However, about 36 percent of the population in Sierra County are persons of Spanish surname or language. This percentage is about 5 percent less than for the state.

(3) Education

The children in the area attend schools in Truth or Consequences. Table 25 shows school attendance characteristics in Truth or Conseuqnces during 1970. The median years of schooling was lower (9.7 yrs) in Truth or Consequences than for the state (12.2 yrs.) but was similar to Sierra County (Table 26). The greatest decline period was during high school and between high school and college. The median education attainment (9.9 yrs.) for persons residing in Sierra County was one of the lowest for the state.

There is one school district in Sierra County, with one high school, one junior high school and two elementary schools (Table 27). The schools are fully accredited by the North Central Association and the State Board of Education. Transporation is adequate with the longest bus run being 47 miles one way. The senior high school in Truth or Consequences is a modern, well-equipped structure built in 1965. It has a 2500 capacity stadium that was completed in 1967. The 1970 pupil:teacher ratio was 22.5:1, about the same as for New Mexico in general. In Albuquerque the ratio was 25:1. A self-supporting community college conducts night classes in Truth or Consequences. During the 1973-74 school year the cost per pupil at Truth or Consequences was $709, a rise of $161 per pupil in the last 5 years (New Mexico Dept. of Finance and Administration, Statistics, Public School Finance, 1948-1974).

Mr. Basil Burks, Superintendent of Schools at Truth or Consequences, has expressed concern about the following:

(a) There are no present plans for expansion of schools. Essentially the schools are now operating at full capacity

Table 25 School attendance characteristics in Truth or Consequences, 1970.

	T/C	% of Age Group
Percent enrolled:	5-6 years old	61.1
	7-13 " "	98.8
	14&15 " "	99.9
	16&17 " "	63.0
	18&19 " "	29.2
	20&21 " "	12.5

Source: U.S. Bureau of Census, Census of Population, 1970.

Table 26 Education attainment in Truth or Consequences, Sierra County and New Mexico, 1970.

	State	T/C	Sierra County
Total persons 25 yrs. +	489,623	3,387	4,709
No Education	16,263 (3.3%)	56 (1.7%)	122 (2.6%)
Elementary: 1-4 yrs.	27,301 (5.6%)	258 (7.6%)	
5-7 yrs.	45,610 (9.3%)	493 (14.5%)	1,974 (41.9%)
8 yrs.	46,206 (9.4%)	728 (21.5%)	
High School: 1-3 yrs.	83,&28 (17,1%)	639 (18.8%)	878 (18.6%)
4 yrs.	146,711 (30.0%)	696 (20.5%)	950 (20.2%)
College: 1-3 yrs.	61,354 (12.5%)	284 (8.4%)	444 (9.4%)
4 yrs.	33,155 (6.8%)	233 (6.8%)	341 (7.2%)
Median Yrs. Completed	12.2	9.7	9.9 (one of lowest % of counties)

Source: U.S. Bureau of Census, Census of Population, 1970.

(25 pupils/teacher and all classrooms being used). It would be possible to absorb only about 50 additional pupils without adding new facilities. Grades 5-8 now exceed capacity.

(b) All money for school operation accrues in the first two months of school. A significant influx of pupils after that time would have to be handled on existing money.

(c) Lead time for construction of new school facilities is about 6-7 months.

Table 27
Types of School Facilities Available in Sierra County

Type	Number	Teachers	Grades	Enrollment
Elementary	2	36	1-4	589
Junior High	1	23	5-8	543
High School	1	26	9-12	462
Vo-Tech	1	3		55
Private	1	1		6
Special Educ.	1	3	Mentally Retarded	35

Source: Mr. Burks, Superintendent of Schools, Truth or Consequences.

(4) Age Composition

In New Mexico the number of people over 40 years increased in 1970 over 1950 about 30 percent, and in those over 75, an average of about 57 percent. Another big change has been in the number of young people 10-24 years, who have increased 1970 over 1960 about 32 percent. The age distribution in Sierra County and the State are very dissimilar. Sierra County has a much larger proportion of its population in the older age groups than does the State in general. Fifty-four percent of the male work force (20-65 yrs.) is in the 45-65 age group. Approximately the same relationship exists for females in Truth or Consequences.

(5) Settlement Patterns

Urban growth has been positive while rural growth has been negative in New Mexico. The smaller towns of Sierra County have grown at a faster rate (12.2%) as compared to Truth or Consequences (9.1%) for the period 1960-1970. The number of people in rural households declined (-5.3%) during 1960-1970, with the biggest percentage decline in males.

More people reside per household in rural conditions as compared to the state as a whole. The size of the households in Sierra County (2.47) and Truth or Consequences (2.27) is considerably below the state average (3.43).

5. Economy of the Region

a. Structure

The economy of New Mexico is varied but the majority of employees are concerned with trade (21.0%) and educational service (11.7%). The labor participation rate for males (56.7%) is higher than for females (34.4%) in Sierra County. Most of the men are employed as professional, clerical, and service workers. Family income distribution for Truth or Consequences is presented in Table 28. Approximately 52 percent of the families have incomes less than $5,000 annually. The median income for Sierra County families is $4,833 and 24 percent are less than the poverty level. Primary shopping for the area is Truth or Consequences.

b. Industry Profile

The basic industries of Sierra County are related to tourism, trade, and agriculture. The value of mineral production, as determined in 1971-72, from U.S. Dept. of Interior, Bureau of Mines, Minerals Yearbook and Annual Area Reports, listed the following minerals in order of importance: sand and gravel, copper, gold, lead, silver, and zinc for Sierra County. Commercial trade in Truth or Consequences has been increasingly steadily at the rate of 10-15% per year as indicated by banking data and postal receipts. Tourism is one of the major sources of community income. Annual visitations to Elephant Butte Lake State Park in 1975 were 1,048,000, the highest of all the New Mexico Park system, and nearby Caballo Lake had an additional 354,000 visitations. Approximately 90 percent of this market originated in New Mexico (Albuquerque) and Texas (El Paso). According to the Truth or Consequences Chamber of Commerce, about 4,000 winter destination visitors are attracted to the area each year. Information supplied by Mr. Drunzer, which might be regarded as economic health indicators for Truth or Consequences, is presented in Table 29.

c. Employment

The New Mexico work force has been increasing in number, and at the same time the unemployment rate has been increasing. The unemployment rate in Sierra County (4.4%) was less in 1970 than for the state as a whole (5.9%). It is not known if this relationship still continues but in 1974 the relationship was similar (Employment Security Commission of New Mexico). Sierra County has one of the smaller labor forces as compared to other counties in New Mexico, ranking 25 in 32 counties.

Table 28 Truth or Consequences family income, 1970.

Income	% of Total
Less than $1,000	1.5
$1,000 to $1,999	9.5
2,000 to 2,999	10.7
3,000 to 3,999	17.6
4,000 to 4,999	12.4
5,000 to 5,999	7.3
6,000 to 6,999	6.7
7,000 to 7,999	6.6
8,000 to 8,999	6.6
9,000 to 9,999	4.4
10,000 to 11,999	5.5
12,000 to 14,999	5.6
15,000 to 24,999	2.5
25,000 to 49,999	2.5
50,000 +	---
Median - $4,844	
Avg. Per Capita Income, 1972 - $2,982*	

*New Mexico Statistical Abstract, 1975 ed., Bureau of Business and Economics Research, Univ. of New Mexico, Albuquerque, N.M.

Source: General Social and Economic Characteristics, New Mexico, 1970 Census of Population, U.S. Dept. of Commerce, Bureau of Census.

Table 29
Economic Health Indicators
Truth or Consequences, New Mexico

UTILITY CONNECTIONS:

	June 30, 1970	June 30, 1975	April 30, 197
Electric:	2270	2819	2856
Water:	1801	2150	2146
Building Permits	$597.00	$1,555.50	
Gross Receipts Tax	$109,815.01	$164,000.30	
City Population	4,656	5,683	5,722
County Population	7,189	8,775	8,835
HOT SPRINGS NATIONAL BANK			
ASSETS: 1970	$10,657,224.71	$20,723,623.77	
DEPOSITS: 1975	9,609,165.85	18,360,265.49	
FIRST STATE BANK		To March 1976:	
ASSETS: 1974	$ 1,693,000.00	4,580,365.00	
DEPOSITS:	1,060,495.00	4,005,631.00	
	1970	1975	
TOTAL POSTAL RECEIPTS:	84,046.59	140,790.53	

Source: Quentin Drunzer, City Manager, Truth or Consequences

August, 1976 registrations at the Truth or Consequences unemployment office included: 350 total of which approximately 120 are welders and equipment operators; 20 agricultural equipment operators; 27 machinists, mechanics, millrights, 12 professional and technical, and other unclassified.

6. Housing

The housing situation fluctuates seasonally and recently has been experiencing rapid turnover. There is no exact count of mobile home spaces available to rent or trailers to purchase in Truth or Consequences and Sierra County. However, Mr. Drunzer, states that spaces and trailers are plentiful. Hazel Johnson, of George Lambert and Associates, Realtors, stated that there was a minimum of 15 mobile homes, 57 lots, 8 houses, and 21 apartments available for rent or puchase. The price range for house purchase was $8,000 - $31,000. Mr. Drunzer believed that shortages exist in Truth or Consequences for housing, apartments, and good motels. A total of 14 apartment establishments and 30 motels are listed in the Truth or Consequences telephone book. The zoning plan for T or C offers good opportunity for residential expansion. Sun City., plans to develop 53 acres in the $30,000 - $40,000 residence price range near Truth or Consequences.

7. Commercial Services

A cross-section of the commercial services available in the Truth or Consequences area is given in Table 30 and for Hillsboro, Table 31.

8. Transportation

Truth or Consequences is a regional center; it can be reached by plane (private or charter), truck (Whitfield Transportation Co.), bus (Continental Trailways Bus Co.), and auto (I-25, U.S. 85, State 51, 52, 90 and 142). Parcel service is available from United Parcel Service and Bus Line Service. No railroad service is available at Truth or Consequences. Depots for the Santa Fe Railroad are in Hatch, Engle, and Rincon. Transportation services at Hillsboro are limited to auto and bus. Truth or Consequences is 76 miles from Las Cruces, 120 miles from El Paso, 149 miles from Albuquerque, and 70 miles from Socorro. The proposed Copper Flat mine is 27 miles from Truth or Consequences.

9. Municipal Services

Truth or Consequences has a mayor/city manager type of government. The police protection for the area includes 16 full-time policemen from Truth or Consequences, 3 county officers, and 3 state officers. Fire protection includes 24 volunteer firemen and 3 trucks. The fire insurance rating is class 8. There are 6 employees in the Truth or Consequences water department. Water is supplied from artesian wells. The maximum

Table 30 A cross-section of commercial services available in the Truth or Consequences area, August, 1976.

Type	Number
Attorneys	10
Banks	2
Savings and Loan	1
Finance and Loans	6
Auto Dealers	10
Beauty and Barber Shops	13
Building Materials	10
Plumbing Contractors	3
General Contractors	2
Department Stores	4
Furniture Stores	6
Meat Markets	3
Garages	12
Auto Service Stations	20
Insurance	11
Real Estate	13
Laundries	4
Liquor Stores	4
Pharmacies	3
Medical Doctors	8
Dentists	1

Table 31 A cross-section of commercial services available in Hillsboro, August, 1976.

Type	Number
Motels	2
Mobile Home - Trlr. Sites	2
General Store	1
Grocery Store	1
Earth Contractor	1
Auto Service Station	1
Garage	1
Restaurants	3
Bank-branch office	1

daily capacity is 1.6 million gallons. The quality of the water meets state health standards. The water system is increasing its capacity in to be able to service a population of 12,000 people. A sanitary sewer system serves 85 percent of the city. The sewage is treated by an Emhoff plant with a capacity of 0.65 million gallons per day. The present load is rated at 125 percent of capacity but this overload condition should drop this year since capacity is being increased to serve a population of 15,000. Sierra County has a planning commission with zoning regulations and approval of industrial plans is necessary.

Hillsboro, located on State Road 90 about seventeen miles west of Interstate 25 and Caballo Dam, is in the valley of Percha Creek. The community is incorporated under the Sanitary Projects Act for domestic water and sanitary sewer purposes. There are about forty families living in the area. A central domestic water system was completed in 1967.

The water supply is from a drilled well that taps valley fill of Quaternary age. The well is 180 feet deep and was tested at thirty-eight gallons per minute. Smaller diameter plastic line makes up the distribution system. A pneumatic system with a 1,000 gallon tank supplies pressure for the system.

The population is slowly increasing, and any revival of mining activity in the area will require additional water supply, water storage facilities, and larger main distribution line to provide fire protection to the community.

There is no central sewage collection and disposal facility for the community, and the inadequacy of septic tanks and cesspools now in use is obvious on warm summer days.

Lakeshore Estates, north of Truth or Consequences, formerly had a village type government but now it is unincorporated. Williamsburg, south of Truth or Consequences, has a village type government.

10. Utilities

Considering the extremely low density of population in Sierra County outside of Truth or Consequences, the county is very well served with basic utilities.

A sanitary landfill is located about two miles southwest of Gold Dust on public lands.

a. Electric Service

The City of Truth or Consequences distributes and sells within the city, power purchased from the Elephant Butte hydroelectric generating plant of the U.S. Bureau of Reclamation.

The towns of Caballo, Arrey, and Derry are served via a 24 KV transmission line from the Newman steam power plant located in El Paso County and owned by El Paso Electric Company. The system is interconnected with the U. S. Bureau of Reclamation system and the Thirty-Ninth Power Pool.

All other users of electricity in Sierra County are served by the Sierra County Electric Cooperative. Power is purchased from the U. S. Bureau of Reclamation, a member of the Thirty-Ninth Power Pool. Power is supplied, of course, from the Elephant Butte generating facility. No generating facilities are maintained by the cooperative. The electric capacity is being increased in 1976 in Truth or Consequences to serve a population of 15,000.

b. Gas Service

The Southern Union Gas Company provides gas service in the Rio Grande Valley from Truth or Consequences southerly including the communities of Williamsburg, Las Palomas, Caballo, Arrey, and Derry. Gas is supplied from El Paso Natural Gas Company via a four-inch line with an interconnect with the main transmission system in Dona Ana County. All communities in Sierra County other than those cited above are dependent on bottled gas.

c. Telephone Service

All of Sierra County with the exception of the towns of Arrey and Derry and the eastern portion of the county occupied by the White Sands Proving Ground is served by the Western States Telephone Company, a subsidiary of Continental Telephone, Incorporated. Arrey and Derry are served by the Mountain States Telephone and Telegraph Company.

South of Truth or Consequences and in the Williamsburg area new hookups will probably require a long wait (8-10 months) due to inadequate cable service, according to the Western States Telephone Company. The Lakeshore Estates area will likely be first with service beginning in early 1977. Hillsboro can handle probably 25 more hookups on the present system. Caballo will have no additional service in the near future and Kingston has no service now.

11. Medical Services

St. Ann's Hospital in Truth or Consequences is a general hospital (32 bed capacity) with an attached nursing home (25 bed capacity). The staff includes 5 doctors and 1 M.D. anesthesiologist with 24-hour rotating on-call emergency service. This size hospital would be considered sufficient for a population of about 8,000.

Table 32 Hospitals and doctors, by county, New Mexico, 1974.

	Hospitals	Doctors[1]	Persons per Doctor[2]
State	54	1,234	910
Sierra County	2	7	1,100

[1]Does not include military medical personnel or federal and state civil service medical personnel.

[2]1974 estimated population divided by 1974 number of private physicians and surgeons.

Source: New Mexico Health and Social Services Dept., Hospital Facilities in New Mexico, 1974, New Mexico Board of Medical Examiners, Official List of Physicians and Surgeons, 1974.

Carrie Tingley Hospital is a specialty type for crippled children. The hospital operates in cooperation with Cripplied Children's Services Section, New Mexico Health and Social Services Department. There are 76 orthopedic beds. The staff includes 8 doctors.

A Rescue Squad provides emergency transportation and ambulance service on a 24-hour basis with contact through the police department or the sheriff's office.

There is only one dentist in the area.

There are no medical facilities in Hillsboro.

12. Communications

There are two newspapers in Truth or Consequences, one with a circulation of 3600 and the other with a circulation of 3819. A radio station provides listening enjoyment and news for a 75-mile radius. Four Albuquerque TV channels are received in Sierra County by means of a translator. With cable television 6 channels are available. Telegraph Service is provided by Western Union and there is a Watts line to Albuquerque from Truth or Consequences. A first class post office is available at Truth or Consequences. Lesser service is available at the surrounding communities. Most of the area of the county is serviced by rural carrier.

13. Public Budgets

The taxes and revenue for Truth or Consequences and the assessed valuation for Sierra County is compared to the State for FY 1972-73 to 1974-75 in Table 33. Sierra County property tax is assessed at 33.3 percent of full value according to Elva Bencomo, County Assessor. The county depends almost entirely on the income from property taxes. Mr. Drunzer stated that the city property tax income is about $16,000 annually. Most of the income received comes from the sale of city utilities (water, sewer).

14. Economic Development

Among the plans for economic development in Sierra County are the following projects supported by the Southern Rio Grande Council of Governments:

a. Improvement of Elephant Butte Lake State Park

b. Improvement of Caballo State Park

c. Improvement of Williamsburg State Park

d. Community College

Table 33
Assessed Valuation by County, New Mexico
FY 1972-1973 to 1974-1975

	Assessed Valuation		
	1972-1973	1973-1974	1974-1975
State	$2,745,543,046	$2,978,317,391	$3,162,658,852
Sierra County	15,620,417	17,955,339	18,919,183
Truth or Consequences	6,719,564	7,224,868	7,190,844

Source: N.M. Department of Finance and Administration, Local Government Division, Annual Report.

III. Analysis of Proposed Action & Alternatives

A. Project Stages - Definitions

1. Construction

A period of approximately 22-24 months following permitting during which the site would be prepared, buildings erected, starter dam built, roads and facilities developed, water pipeline installed, and 115 Kv and 14.4 Kv transmission lines erected.

2. Operations

A minimum period of at least 15 years of mining operations directly concerned with the extraction and processing of mineral values.

3. Abandonment

A period after the termination of normal mining operations which results in a termination of economically-oriented activities at the site.

B. Alternatives

1. No Action

The "No Action" alternative would allow the continuation of exploratory mining activities. However, without approval for electric power and water pipeline rights-of-way it would not be possible to develop the mineral resource. The impacts of "No Action" would be a continuation of the general existing conditions.

2. Rights-of-Way Alternatives

Three alternative routes for the 115 Kv transmission line, two alternative routes for the 14.4 Kv transmission line, three alternative routes for the access road, and three alternative routes for the water pipeline were considered as well as the proposed routes for each. A wide array of alternative engineering design, sites, facilities, configurations, and operations were considered in reaching the proposed project actions.

a. No Action

If no new transmission lines are to be constructed there will be no way to distribute the needed power for mine development and operation nor to obtain the required power. Upgrading of present facilities will not meet power requirements. A water pipeline would be necessary for mine operations since adequate resources are not available in the

vicinity of Copper Flat.

b. Right-of-Way Routes

(1) 115 Kv Transmission Line

(a) Alternate Route A

This route was considered less desirable than the proposed route because the impacts to vegetation, soils and wildlife within the route would be greater than the proposed route.

(b) Alternate Route B

This route was rejected in favor of the proposed route because the transmission line along highway 90 would create a more severe visual impact.

(c) Alternate Route C

This route was rejected because the private lands needed for construction were not available to Quintana.

(2) 14.4 Kv Transmission Line

The proposed route in sections 31, 32, and 33, T. 15S., R. 6W. coincides with the existing Sierra Electric Cooperative feeder line (Animas Basin-Hillsboro) to utilize the existing electric line and to eliminate any additional lines.

(a) Alternate Routes A and B

These routes would have the same environmental impacts as the proposed routes but were rejected in favor of the proposed route because more resources would have to be utilized and capital construction costs would be greater.

(3) Water Pipeline

The proposed route would eliminate sharp bends in the line, reduce friction loss and provide for easier maintenance with the lowest level of probable environmental impacts.

(a) Alternate Routes A and B

These routes were rejected because of greater disturbance to soils, vegetation, and wildlife along Grayback Arroyo. Also, it is likely that livestock carrying capacity and revegetation forage production would be affected more adversely.

(b) Alternate Route C

This alternative would involve placement of the pipeline above ground on any of the routes. Although this alternative would create less soil disturbance and erosion would be minimal, the alternate was rejected because:

(i) It would constitute a physical barrier to livestock and animal movements.

(ii) It would present a visual impact.

(iii) Increased vandalism would occur.

(iv) Human interjection into the area by workmen to repair the pipeline as a result of vandalism would constitute additional frequent disturbance impacts upon soils, vegetation, and wildlife.

(4) Access Road

The proposed route is the result of Quintana's efforts to comply with New Mexico State Highway Department requirements. The proposed access road must approach Highway 90 at a 90^{o} angle so that maximum sight distance would be available to commercial and passenger vehicles. None of the alternate routes would meet this specification. In addition, the proposed access road route would provide for minimum disturbance to public lands. Environmental impacts on all routes would be similar and of approximately the same magnitude.

3. Mining Alternatives

a. Delayed Action

This alternative would constitute placing the proposed project in a suspended or moratorium state. Permits could either be issued for rights-of-way by BLM or the permits could be withheld pending imminent construction. Quintana could continue exploration activities and gathering of additional environmental data through its monitoring program. If BLM issued rights-of-way permits they could be valid for a period of 5 years, or if designated for a shorter period. If construction were delayed there would still be a rental charge by BLM for the intervening time.

Impacts anticipated during the proposed delay would include only those continuing impacts which reflect the conditions of the existing environment. If after a delay the proposed action is approved, the anticipated impacts would be the same as those of the proposed action. If this delay should result in the development of new permitting stipulations, it is assumed that some of the adverse residual impacts would be less and some of the beneficial impacts would be greater than those of the proposed action.

b. Operations Alternatives

(1) Water Development on Site

Three exploratory water wells were drilled at various locations on site but the flows obtained were inadequate for the project's needs. Projections of estimated runoff for an operational reservoir indicated lack of capability and high probability of uncertainty.

(2) Power Generation on Site

On site power generation from diesel engines was uneconomic as an alternative since costs were 5 times higher per Kw hour than that available through Sierra Electric.

(3) Underground Mine

Operation as an underground mine was not a viable alternative because:

(a) The ore body is covered by overburden of only 0-20 feet.

(b) The low grade and tonnage of the ore present will not support an expensive underground operation.

(c) Geometry of the ore body does not lend itself to underground mining techniques; and

(d) Numerous fractures occur in the vicinity which could constitute a hazardous condition for workers.

(4) Facility Siting

Four possible plant sites and 3 possible tailing areas were considered and each evaluated on the basis of engineering criteria (haul distance, processing compactness, operations relations, equipment costs, layout efficiency, etc.); and probable environmental impacts (protection of drainageways, minimum area of disturbance, minimum disruption of landscape scene, etc.). The major causes for alternate site rejection in favor of the proposed siting were as follows:

(a) Alternate Tailing Sites

High negative scenic degradation (unobstructed foreground view from Highway 90); high potential for fugitive dust with inherent increased difficulty and high costs to control; and high incompatibility with adjacent physiography for reclamation.

(b) Waste Dump

High negative scenic degradation (unobstructed mid-ground view from Highway 90).

(c) Plant Facilities

High negative scenic degradation (unobstructed mid-ground view and silhouette from Highway 90, lack of background blending potential) and possible significant disturbance of Grayback Gulch drainage.

C. Environmental Impacts

1. Anticipated Impacts

It has been assumed that the proposed action would result in significant economic benefits to the geographic region but not without some sociological and environmental costs. To a great extent the impacts recognized are generally similar in nature although the levels of severity vary between the stages of project implementation. Typically, the construction phase contains the most negative environmental impacts and this proposed project is no exception. Most of the positive benefits are expected to occur during the operational phase. Impacts of the abandonment stage are difficult to anticipate because close out might occur many years later than the expected 15-year life expectancy of the mine. However, during the abandonment stage both positive and negative impacts are expected to occur.

a. Non-living Components

(1) Air

No impacts upon air quality are foreseen during any of the proposed project stages of implementation relative to effects upon air movement patterns, ambient temperature regime, levels of carbon dioxide, hydrocarbons, nitrous oxides, sulfur oxides, radiation, and/or ionizing radiation.

Impacts upon air quality during the construction, operations and abandonment phase should be low negative, affecting only the immediate surroundings directly for the short time of disturbances. The disturbance of surface areas is expected to create fugitive dust. Vehicular movement and operation of various equipment would create fugitive dust and contribute emissions to the atmosphere. The low negative impact on air quality would degrade current ambient levels but through mitigative and impact reduction actions the area air quality would continue to be better than the acceptable level of compliance with state and federal air quality standards.

Table 34 Impact evaluation definitions.

Term	Definition
High Positive	Significant reduction of impact(s). Significant enhancement of environmental quality.
Moderate Positive	Provides some reduction of impact(s). Benefits one or more ecosystems. Noticeable enhancement of environmental quality.
Low Positive	Provides slight reduction of impact(s). Benefits at least one ecosystem. Minor enhancement of environmental quality.
No Change	No measurable or detectable change in environmental situation.
Low Negative	Minor loss of environmental quality. Disturbed area has ability to recover from impact(s).
Moderate Negative	Affects one or more ecosystems. Environmental quality affected noticeably but recovery is possible naturally or through rehabilitation.
High Negative	Significant degradation of the environment. Irretrievable or irreversible impact upon several ecosystems.

(2) Land

(a) Construction

The proposed action would result in impacts of varying degrees on the soils. These impacts would occur as a result of mechanical disturbances during construction. These impacts would include the complete removal of productive soils from the pit area, the mixing of soil horizons during grading for plant facilities and burying of the water pipeline, and the spreading of soil nutrients by equipment. The depths of various soil deposits would be disturbed. Along the ROW it has been calculated that up to 30 acres of Cacique-Pineleno-Hap and 3 acres of Lehmans-Oro-Rock soil associations might be disturbed. In the mine development area it has been determined that up to 87 acres of Cacique-Pineleno-Hap and 128 acres of Lehmans-Oro Grande-Rock soil associations might be disturbed. Some topsoil would be lost to erosional forces and a few places might have soils compacted. Most of this disturbance would be unavoidable as integral parts of project development. Essentially the impacts would be short-term because reclamation and revegetation would start as soon as final construction activities are cleared from the area. The impacts would be localized and would not be expected to have any regional influences. The soils impacts are likely to be low negative because of the limited areas to be affected (215 A) as compared to the area of interest (Copper Flat and ROW plus 1 mile peripheral buffer zone--21,725 acres of Cacique-Pineleno-Hap and 4,710 acres of Lehmans-Oro Grande-Rock associations).

(b) Operations

No impacts are expected from operation of the 115 Kv transmission line, 14.4 Kv transmission line, the water pipeline, or from minerals processing. Vehicular traffic on the access road would constitute a low negative impact that would be localized and of irregular short duration, mainly during the changing of shifts. Minor surface erosion would occur on the road. Mining operations in the pit would disturb up to 200 acres of surface soils and 700-900' of subsurface materials. This is regarded as a negative impact of long-term effect.

Up to 358 acres of undisturbed soils would be covered by the waste dump. The productivity of these soils would be lost until the area is fully reclaimed, a minimum of at least 15 years. Not all of the waste dump area would be removed from production at the same time but rather by annual operating increments. Much of this moderate negative, long-term impact could be mitigated by the on-going reclamation program which would ultimately reclaim about 350 acres. Besides being covered, the natural soils would sustain impacts from compaction, erosion, and materials oxidation. Operation of the tailing deposit would be moderate negative, long-term, and have local impacts upon the area soils. Some native soils would be buried by the deposits but over most of the floor of the tailing area the topsoil materials would be removed and stockpiled for later reclamation purposes.

Up to 515 acres would be disturbed by operation of the tailing pond. The stockpiled topsoil would experience short-term, low negative impacts. However, this soil material would be essential to the reclamation program of disturbed areas and hence would contribute to mitigation and positive benefits as the operations progressed. During the life of the mine it is anticipated that at least 500 acres would be reclaimed.

(c) Abandonment

No land (soils) impacts would be expected from abandonment of the water pipeline, access road, water control and drainage, and minerals processing. Salvage operations of the 115 Kv and 14.4 Kv transmission lines, plant facilities area, and pit should create minor, short-term soil disturbances in very localized areas. Limited slumpage or subsidence might occur at the pit, which would be long-term and localized in effects. Deactivating the waste dump and tailing pond should create low positive, local benefits for the long-term with decreases in erosion potential. There would be some short-term, local soil disturbance from the reclamation program. The abandonment stage of implementation should be the beginning of more stabilized conditions, permitting more rapid soil development and interaction with other environmental components.

(3) Water

(a) Construction

The proposed action would create moderate but mostly low negative water quality impacts due to increased sediment loads in runoff, changes in runoff patterns which might lead to interruptions in runoff, and in increases of surface runoff debris. Some areas might be influenced negatively by reducing the opportunities for groundwater recharge, while in other areas the groundwater recharge rate might be enhanced. Runoff from up to 87 acres of disturbed ROW and 178 acres of disturbed mine development area might be affected. Impacts on disturbed areas would be greatest during periods of high runoff following high-intensity, late summer thunderstorms and in the spring during frontal rainstorms. Most of the impacts would affect localized areas and be of short-term duration. The extent of water quality degradation would relate directly to the amount and kinds of disturbance to the protective vegetative cover (Table 34).

(b) Operations

No impacts would be expected from operation of the 115 Kv and 14.4 Kv transmission lines. Low negative, short-term, local impacts should occur from operation of the access road in which there would be hastening of runoff and reduced opportunity for infiltration and soil storage of water. Low negative, long-term impacts might occur

Table 35
Estimated Acreages of Disturbed Areas from Which Water Resources Would be Affected During Construction

Areas	Acres Disturbed*
ROW - 115 Kv	33
14.4 Kv	21
Water Pipeline	29
Access Road	4
Mine - Mine Development	123
Starter Dam	55
Total	265

*The ROW disturbed acres are not cumulative since the routes overlap and follow a common corridor.

from operation of the production wells and water pipeline which possibly could lower the water table in the adjacent area. Low negative, long-term, unavoidable, irreversible impacts could occur from operation of the waste dump, where the deposits would change the ground water recharge rate, change the area runoff patterns, and increase sediment load in the runoff. Over the life of the mine the water resources from up to 358 acres could be affected by operation of the waste dump. Minerals processing could have moderate negative impacts by using 1500-2500 gpm of water from subsurface resources. The use of water resources would be of moderate public interest over the general region surrounding Copper Flat because the minerals processing use might affect other uses (agriculture, grazing, domestic use, etc.). Low positive, long-term benefits could be expected for other components of the environment (livestock, wildlife, vegetation, reclamation) from increased availability of surface water at the drainage retention reservoirs, pit pumpout area, and tailing pond. The tailing pond area would contribute low positive benefits to the groundwater recharge rate, reduce area runoff rate, and provide an increase in surface water availability. The water resources would develop moderate positive enhancements from irrigation, surface water availability, increased groundwater recharge and reduced runoff as a result of the operational reclamation program.

(c) Abandonment

Abandonment of mine activities and decreased use of the access road should create no impacts upon the water resource. Roadside vegetation would develop to serve as a natural filter for runoff from the road surface. Increased sediment in the runoff would occur as the

result of disturbances in salvage operations of the 115 Kv and 14.4 Kv transmission lines and plant facilities areas. These impacts would decrease following reclamation and revegetation of the disturbed areas. Abandonment of the water control and drainage system would continue to exert low negative, long-term, localized effects. The local runoff pattern would continue to be altered, affecting about 1200 acres of formerly natural drainage. This could be expected to continue to have an effect upon the local ground-water recharge systems. In the vicinity of the earthen reservoirs the groundwater recharge rate would likely be increased over former natural conditions. Increased rate of runoff could be expected as long as the water control and drainage features continued to function. After that point the drainage would tend to revert back to the pre-project situation.

Water, both subsurface and surface, would accumulate in the pit. This could be regarded as both a long-term negative, or positive impact depending upon how the accumulated water was used. It is most likely that the stored water would be put to some beneficial use such as agricultural irrigation or for livestock, assuming the quality of the water were satisfactory for those purposes. If the pit water quality were not suitable for agricultural or livestock use, it could possibly be used for other purposes (industrial power, cooling, etc.) or treated to meet desired quality levels.

Abandonment of the waste dump and tailing deposit would create both low negative and low positive impacts to the water resources of the local area. There would be a decrease in sediment in the runoff and the runoff pattern would be changed for the long-term. There also would be a reduction in surface water available and the rate of groundwater recharge with cessation of the tailing slurry.

With the stoppage of minerals processing there would be considerable (1500-2500 gpm) water available for other productive uses. These could be regarded as long-term, moderate positive, localized benefits. Secondary, or indirect impacts, also could be regarded as beneficial to the region.

The abandonment reclamation program would use water for revegetation purposes. Besides benefiting the establishment of vegetation, it also would provide additional surface water for wildlife and increased groundwater recharge. After completion of the reclamation program these extra benefits would no longer occur. Abandonment of mine operations should create additional opportunities for productive water use.

b. Living Components

(1) Vegetation

(a) Construction

The proposed action would create low negative impacts from disturbance or destruction of vegetation. On the ROW about

32 acres of creosotebush and 5 acres of desert-grassland would be affected. In development of the mine and starter dam about 55 acres of creosotebush and 123 acres of desert-grassland are expected to be affected. Surface disturbance and vegetation destruction would result from construction activities, pipeline trenching, equipment movements, digging poleholes, and road building. Besides destruction, vegetation could be impacted through environmental changes such as soil characteristics, available nutrients, drainage, water availability, compaction, etc. These impacts are judged to be short-term in that most of the disturbed areas would be revegetated in a relatively short time after construction. This impact would be limited to a total of 215 acres of vegetation that might be disturbed or destroyed.

(b) Operations

No impacts would be expected on vegetation from operations of the 115 Kv transmission line, 14.4 Kv transmission line, water pipeline, and minerals processing. Low negative, short-term impacts would occur on the tailing deposit with the potential for disturbance and destruction of vegetation (creosotebush) on up to 515 acres over the life of the mine. This impact would be unavoidable but mitigatible through the operational reclamation program. Impacts from operation of the waste dump would be low negative, short term upon the vegetation that would either be covered or disturbed. A maximum of 358 acres of desert-grassland would be impacted during the life of the mine and most of this disturbance would have been reclaimed by the termination of mining operations.

Moderate negative, long-term, unavoidable, and irreversible impacts on desert-grassland vegetation would occur at the pit. These impacts would be the disturbance and destruction of vegetation on up to 200 acres, which would occur mostly early in the operations as the pit was being developed and expanded.

Moderate positive benefits would occur as a result of the operational reclamation program. It is expected that up to 850 acres would be reclaimed to provide long-term enhancement effects such as: increased per unit area production, increased diversity of species and vegetation density; and, secondary benefits to scenic values, air and water quality, soil development, wildlife and livestock carrying capacity, and ecological processes.

(c) Abandonment

Abandonment of minerals processing, pit operations, and access road activities would not be expected to create impacts on vegetation. Both low negative and low positive, short-term impacts would occur to vegetation related to the 115 Kv and 14.4 Kv transmission lines. Minor vegetation disturbance and destruction would occur during the salvage operations. Some low negative impacts to vegetation, particularly on reclaimed

and irrigated areas, could be expected from uncontrolled livestock overgrazing or from above carrying-capacity concentrations of wildlife. Reestablishing vegetation on the disturbed areas by the reclamation program would provide long term, local, moderate positive benefits.

(2) Animals

(a) Construction

The extent to which animals would be affected by the proposed action depends on the habitats affected and secondarily on the number of persons and vehicles operating in the area. Habitat disturbance or destruction would possibly affect up to 87 acres of creosotebush (32 acres on ROW) and 123 acres of desert grassland (5 acres on ROW). Habitat loss would create greatest animal stress during the winter and early spring months. Most of the impacts would be low negative except in the construction activities related to mine site development and water drainage and control where the habitat impacts would likely be moderate. Variances in vegetative composition and density, topography, water, food, and cover directly affect animal species distribution, diversity, and density.

Both direct and indirect influences would occur from humans in the area. Besides habitat destruction and disturbance there would be harrassment and poaching. The carrying capacity of the area would be reduced for wildlife as well as livestock. Movements of the larger animals would be changed as a result of proposed construction activities. Vehicular traffic and heavy equipment operations could be expected to cause mortality and temporary displacement of a wide variety of animals.

On the other hand, a reduction in the local small mammal population could be regarded as a low positive impact that would benefit vegetation development. Disturbance during the nesting season could cause abandonment of nests or young. The impacts would be expected to be short-term and localized. Most of the animals present on the area are sufficiently flexible to adapt to adjacent habitats or would be able to adjust to suitable habitat elsewhere. The expected construction impacts should be reduced by later mitigative action (revegetation and water retention structures).

(b) Operations

No operational impacts would be anticipated in connection with the minerals processing. Low negative, short-term impacts consisting of increased road mortalities and harrassment of animals by people would occur on the access road during operation of the mine. Long-term, low positive benefits would result from the additional perches and nest sites that would be provided by the 115 Kv and 14.4 Kv transmission line poles. Certainly more avian predators would find the poles more attractive than surrounding areas without an abundance of perches. Because

of the attractiveness of the area to avian predators there could be additional stress applied to the resident small mammal populations. Some low negative impacts might occur from people shooting birds which utilize the transmission lines. Impacts from operation of the water pipeline would be low positive, of a long-term nature, but local in effect through increasing the availability of water to birds, mammals, livestock, and wildlife. The availability of such water would attract more and different kinds of birds and mammals to the area. Operation of the pit would create moderate negative impacts to animals in the local area through disturbance and destruction of up to 200 acres of desert-grassland habitat. These long-term, unavoidable impacts would influence the movements of animals and affect the carrying capacity of the area. Impacts to animals from operation of the waste dump and tailing pond would be similar to those of the pit except that the acres of habitat disturbed would be different (waste dump--up to 358 acres, and tailing pond--up to 515 acres).

The surface water available at the tailing pond would be attractive to a wide variety of birds and small mammals. The operational reclamation program would provide moderate positive, long-term benefits to animals. The reclaimed areas would be unusually attractive because of vegetation species density and diversity. Increased per unit carrying capacity would occur on the reclaimed areas. The reclaimed areas also would harbor a greater variety of animal life than surrounding habitats.

(c) Abandonment

In general, animals should benefit from the abandonment of mine operations. There would be direct, site specific negative impacts but the indirect benefits from decreased human activity in the area would provide significant enhancements. During salvage operations there would be low negative, local disturbances to habitats, harassment of avian predators, and inadvertent small mammal and bird mortality. A few accidents to animals might occur at the abandoned pit. The abandonment reclamation program would provide long-term, local, moderate benefits to animals by providing a variety of habitats, food, and cover. Some local populations of animals might suffer negative impacts from above carrying capacity levels, necessitating control measures.

(3) Endangered or Threatened Flora and Fauna

No endangered or threatened species of flora or fauna are known to occupy or regularly utilize the ROW or the mine development area.

c. Ecological Interrelationships

(1) Construction

No significant changes in succession, food and/or cover relationships, trophic levels, or community relationships would be expected to occur from the proposed action disturbance on 215 acres.

The relative significance of the impacts is limited due to the limited variety of habitats (creosotebush--32 acres, and desert-grassland--128 acres) present.

(2) Operations

No impacts would occur during the mine operation period from the access road or minerals processing which would affect existing ecological interrelationships. From operation of the 115 Kv and 14.4 Kv transmission lines, and the water pipeline, low positive benefits would occur through the changing of local ecosystems from the early revegetation stage to secondary succession with invasion by native species. These changes would encourage long-term community stability. Adjacent habitat species would begin to establish themselves in the revegetated areas with consistency. Some of the early primary invading species would be forced out through competition and stress. Ecological interrelationship impacts from operation of the pit would be moderate negative, long-term, and unavoidable. The stresses would be particularly serious to the non-mobile, local small mammals. These impacts would be the result of the loss of habitat (up to 200 acres of desert-grassland) which in turn would affect local plants and animals from the tophic levels destroyed. Similar low negative impacts would occur during operation of the waste dump and tailing pond. Local food chains would be disrupted, indigenous species would vacate the area and might be lost to the local area ecosystem. The operational reclamation program would trigger low positive, long-term benefits. Reclamation and revegetation of disturbed areas would create an imbalance between trophic levels in the early-developing, micro-ecosystems. With the establishment of more stable ecosystems there would tend to be an increase in edge and diversity; thus increasing interrelationship actions. The new ecosystems would tend to attract the more mobile animal species to the area for food and cover. The densities of new invading species might result in higher local populations than in adjacent undisturbed, natural habitats. The constantly changing ecosystems would find the adaptable, tolerant natives gaining in abundance as time progressed.

(3) Abandonment

Abandonment of mine operations would generally enhance environmental ecological pressures. Impacts on succession, food relationships, and community relations would decrease, mainly through the reduction of intensive human use of the area. Salvage operations related to the 115 Kv and 14.4 Kv transmission lines and plant facilities areas would create local, low negative disturbances in successional trends. No impacts should occur from abandonment of minerals processing and the access road.

Impacts emanating from abandonment of operations at the pit, tailing pond, waste dump, and water control and drainage system would provide a mix of both low positive and low negative effects. In the vicinity of the water control and drainage system the availability of surface water and related vegetation development would attract and soon develop above-carrying

capacity population levels which could cause intra-trophic level stresses to occur. In the vicinity of the pit and waste dump the vegetative and physiographic diversity would cause changes which could influence several local trophic levels and their relative rates of productivity.

The additional environmental diversity resulting from the reclamation program would create lasting, positive benefits to the interrelated communities through a greater array of acceptable habitats to more species. The environmental situation would be enhanced generally as successional trends advanced in the area.

d. Human Values

Man is an important component of the environment and his actions have a tremendous effect upon the natural environment. Each individual has his own value system. Through individual and group communication, there has evolved a pattern of general acceptance for things and conditions "which are pleasing, desirable, or beneficial." Quantitative and qualitative determinations of esthetic values are most difficult. The following evaluation attempts to present a "reasonable consensus" regarding likely impacts.

(1) Visual Resources

(a) Landscape Character

Open space and the naturalistic quality of the area are the primary characteristics of the landscape. Open space is an area which provides minimum obstruction to movement and sight. The proposed areas has many man-made intrusions affecting open space. The effect of this is localized because of the vastness of the area.

Generally, natural, as opposed to man-made, features do not intrude open space except on a localized basis. The feeling of spaciousness is affected when the ability to see the horizon is restricted by natural or man-made structures. Black Peak, Animas Peak, and the Black Range form horizons that can be seen from great distances. Views from arroyo bottoms and deep canyons are restricted. Vegetation is generally not restrictive, although some arroyo bottoms contain relatively tall shrubs and trees which localize views and restrict movement. Alluvial valleys and rolling hills make up the topography of the rest of the area.

(i) Construction

The proposed rights-of-way and mine development area would cause detrimental intrusions to the open space and scenic quality of the area. Disturbance and destruction of vegetation, baring soil surfaces, changing drainage patterns, and erecting facilities would be foreign to the characteristic landscape and would cause impacts in color, form, line and texture. A variety of human activities (vehicles, construction equipment, etc.) would cause secondary impacts (litter, fugitive dust,

off-road disturbance, etc.). Some of these intrusions would be more visible than others. The proposed transmission lines and water pipeline would be particularly visible during construction even though a common corridor were utilized. Construction of contrasting structures, buildings and support facilities would not be visible from Highway 90 but the access road and starter dam activities would be visible for 20-28 seconds to passers-by at average highway speed. At a distance (5-10 mi) the assessment area would appear to be undisturbed. However, when the construction areas become mid or foreground, the man-made intrusions would be evident. A maximum of 215 acres of area might be disturbed, but only about 85 acres would be visible to highway travelers. All of the construction activities would be visible from overhead aircraft, but the nearest low altitude airway route passes 11.4 miles northwest of Copper Flat. The mine development area is not visible from Emory Pass due to higher obstructing terrain west of Copper Flat. Most of the impacts would be low-negative, and embrace the local area. However, a low positive benefit would result from construction of the starter dam and removal of topsoil deposits which would tend to obscure the old placer piles, abandoned equipment, and adjacent past-disturbed areas. The proposed construction actions would be long-term in nature, but conducive to later mitigation.

(ii) Operations

No impacts would be expected during the mine operational period from the water pipeline. Low negative, long-term unavoidable impacts would occur from the 115 Kv and 14.4 Kv transmission lines (foreign objects) in the natural landscape. Low negative impacts, such as increased litter, increased human use of the area, and possible increase in scenic degradation from off-road vehicles, would likely occur from the access road during the operation of the mine. Moderate, negative, long-term unavoidable impacts would continue to degrade the scenic values of the pit area. Similar impacts would occur from the operation of the waste dump. The presence and continued deposit of high-contrast, bare tailing material would create high negative impacts which could be mitigated through the reclamation program. Increased litter also could be expected as human use of the area occurs over time. Negative impacts on scenic values also would occur during early reclamation, when revegetated areas contrast with adjacent native, undisturbed vegetation. As time passes, this contrast will be reduced. Local, low positive benefits would occur as the tailing deposit further obscures and ultimately covers the old mining disturbances. The minerals processing buildings and support facilities would constitute moderate negative, long-term scenic impacts because of their contrasting shapes and forms even though they were to be painted a color to blend with the surrounding natural landscape. Some localized, positive enhancement would accrue from revegetation and landscaping around the plant facilities area. The reclamation program would provide moderate positive, long-term benefits to scenic values through the re-establishment of vegetation on disturbed areas.

(iii) Abandonment

Salvage operations of the 115 Kv and 14.4 Kv transmission lines and the plant facility structures (foreign objects to the natural landscape) would have moderate positive, long-term benefits to scenic values. The natural and reclaimed areas would tend to reduce the contrast impacts. These benefits would increase in quality and magnitude over time. Localized, low negative, limited impacts would occur as the salvage operations disturb already vegetated or previously undisturbed natural areas. Abandonment of the water control and drainage system would leave an artificial drainage system upon a natural one. This would be a long-term, low negative impact that would continue to degrade the area's scenic values. Removal of the system by restructuring the land configuration, followed by reclamation and revegetation, however, would likely cause severe environmental impacts. Low negative scenic impacts would occur at the pit, waste dump, and tailing deposit from human disturbances (vandalism and off-road vehicles, mainly). Similar negative impacts could occur to reclaimed areas where the damage might cause contrasting scars which would be difficult to control and reclaim. Long-term, positive benefits would occur to the landscape as a result of the reclamation program reaching its objectives: long-term, self-sustaining environments which approach physiographic and vegetative compatibility with the general area.

(b) Intrusions

Scenic quality is affected by aesthetically undesirable intrusions. One aspect of the scenery is open space. It can be concluded that any intrusions which are visible and obtrusive would be detrimental to present values. The effect of the intrusions will be less if they are intermingled with other structures where the natural scene has been previously disturbed. Structures contrasting with existing fixtures in shape, size, and color will have a greater effect regardless of their location. For example: if an electric power plant were to be located among farm buildings or other structures, or in the proximity of a community, it would be less obtrusive than if it were located in an open field or in native pasture lands.

The presence of man-made structures invades the natural scene. Often the feature is acceptable aesthetically, but it alters the landscape character. Localized intrusions distributed throughout the proposed right-of-way and mine area may be detrimental to scenic quality.

(c) Visual Resource Management

The Visual Resource Management (VRM) units and classes discussed in "The Existing Environment" section of this report and BLM's Contrast Rating were used to provide a basis for measuring impacts of the proposed action on the visual resources of the proposed development area.

There are five possible VRM classes in the area. Generally, these classes provide management objectives which can be used to assess the impact of an action by relating the modification and resulting visual contrast rating to the basic elements of form, line, color, and texture.

(i) Construction

The construction phase will impose a greater degree of impact on visual resources than any previous activity. A site-specific analysis of each proposed action during the construction phase will be necessary in order to fully assess the total impacts.

(ii) Operations

Impacts occurring during the operational phase will depend upon the location, size, color, architectural design, etc., of the production facilities. This phase will result in more significant impacts than the construction phase.

(iii) Abandonment

Impacts occurring during the abandonment phase will generally be beneficial to the characteristic landscape with the exception of where natural rehabilitation is uneconomical or detrimental.

(2) Recreation Resources

Recreational experiences, for the most part, will be impaired by the presence of heavy equipment, increased traffic, construction activities, and noise. This applies, in particular, to those persons seeking a measure of remoteness, hunting opportunities, sightseeing, camping, picnicking, hiking, and other general leisure pursuits. On the other hand, there would be some beneficial effects, such as increased access for hunters, increased off-road vehicle opportunities, and probably increased goods and services available to users.

(a) Construction

The construction phase will impose a greater impact on recreation resources than any previous activity. Service roads, vehicles, and pipelines will have the greatest overall adverse impact to recreation resources with the exception of off-road vehicles.

(b) Operations

Impacts occurring during the production phase will depend primarily upon location, but will result in more significant impacts than any previous phase.

(c) Abandonment

Impacts during this phase will be beneficial for the most part. Rights-of-way roads will provide access for the recreationists. Reclamation techniques will provide positive impacts as well as minimal negative impacts.

(3) Wilderness Resources

No roadless areas have been identified within the assessment area that contain over 5,000 acres of public domain. Therefore, no immediate local impact will be expected. Regional wilderness values may be decreased somewhat by the project.

(a) Construction

The Gila Wilderness and Primitive Areas, the latter proposed for future wilderness consideration, occur about 14 airline miles west of Copper Flat. Impacts upon these high quality environments would be the result of an increasing human population in the Copper Flat area seeking and using wilderness, primitive, and national forest areas for recreational purposes.

(b) Operations

Impacts upon wilderness, primitive areas, and nearby national forests would be similar to those described above for the construction phase. However, it would be reasonable to assume that additional recreational opportunities would occur in the area as time progressed and the community developed a more stable condition.

(c) Abandonment

A decrease in wilderness recreational demands would occur as a secondary effect of the area population reduction following shut down of Copper Flat mining operations. These effects would be most obvious during the first recreation season following shut down. As time progressed the impacts would become less noticeable and less associated with personnel formerly working at Copper Flat. It is not likely that regional recreational demands would be influenced to a discernible degree by abandonment of mining operations.

(4) Scientific/Educational

(a) Construction

Construction should have little adverse effect on these values.

(b) Operations

Positive benefits would occur during mine operations from increased public interest, educational visitations, and tourists observing the advances in reclamation and mining technologies. Most of this interest would center on the pit, waste dump, tailings, and minerals processing.

(c) Abandonment

Some of the positive benefits gained during the mine operational phase might be lost if special efforts are not made to maintain and preserve these values. Vandalism and disturbance of the mine area would probably be the greatest impacts creating negative values.

(5) Cultural Resources

(a) Construction

Construction of the transmission lines, water line, and access road will damage three historic sites identified as QMC-12, QMC-13, and QMC-14 (Bussey and Naylor 1975), as well as one site identified as QMC2-1 (Brethauer 1977). All impacts to cultural resources are permanent, and will result in loss of scientific information.

(b) Operations

No impacts to cultural resources are expected from operation of the transmission lines, water line, or access road. Operations at the pit will entail no new impacts. The waste dump and tailing could easily damage previously unrecorded historic sites, since no intensive survey of the area has been performed and New Mexico State University's 1975 reconnaissance indicated a high density of such resources in the area.

(c) Abandonment

Cultural impacts would not be expected to occur during abandonment as related to the 115 Kv and 14.4 Kv transmission lines water pipeline, water control and drainage system, and the waste dump. Low negative, long-term impacts could occur at the pit, tailing deposit, and plant facilities areas from vandalism of mining technology values. The major contributor to this vandalism and resulting cultural value losses would be the access road, which would provide continued access to the mine area. Low negative impacts also might occur to reclaimed areas with technological values. It is not likely that any impacts would occur during abandonment which would affect archaeological values.

(6) Socio-economic

(a) Construction

The construction force for development of the Copper Flat mine would average about 120 persons per day over an 18-24 month period and would generate a local monthly payroll of approximately $200,000. Local procurement of construction materials and services would be in the order of $60,000 per month. The creation of jobs through a direct payroll of construction employees would cause: (1) an increase in the number of people residing in Sierra County (293); (2) an increase in the number of children who might be enrolled in the county schools (51); (3) an increase in need for consumer services, municipal services, medical facilities, recreational facilities, and utility services; (4) improvement in the local economy ($780,000/mo.); and (5) an increase in the tax base available to the county and state.

The number of direct work force people who would be coming to the area during the construction period has been calculated to be 293, on the basis that 70 percent (90) would have skills not available or would be connected with construction-contractors. The remaining workers (30% - 40) would be hired locally. Direct work force jobs can be expected to generate additional indirect jobs. These have been calculated to be 96, of which 50 percent (48) would be filled by outsiders coming to the area and 50 percent (48) from local residents. Total direct (259) and indirect (202) persons concerned with the Copper Flat Project have been calculated to be 461.

From the population estimates, calculation of the likely household can be made: for mine and mill employees--1.1 workers/household, for indirect employment--1.5 workers/household, reflecting a larger number of women employed in outside service categories. The level of housing demand for outside employees was calculated to be 104. Because of the temporary, transient character of construction workers, this need is expected to be met by worker-owned mobile homes in rental spaces, local rental mobile homes, motels, and apartments. No construction mobile home facility is planned by QMC for the Copper Flat area.

It is generally recognized that direct dollars, in "cycling" through an area, develop a multiplier effect, about 3 times direct value. Thus, it was determined that QMC's local purchases and payrolls would generate a value to the Sierra County economy of probably about $780,000 monthly.

The expected population increase related to Copper Flat construction activities added to the estimated Sierra County population (8,000) gives a total of 8,293. This population is within the present capabilities of Truth or Consequences for police and fire protection, sewer, water, gas, and electricity. However, the smaller communities of Hillsboro and Williamsburg would find it difficult to cope with the influx of people and their needs for services.

(b) Operations

The direct work force for operation of the Copper Flat mine would be 225 persons, with an annual project payroll of $4,094,000. The project might easily generate an economic benefit to the county in excess of $5 million annually with application of the secondary accumulator benefits. Support services expenditures for Copper Flat would be expected to be about $1,012,000 per year. Estimated (1977 base) project taxes per year would be $2,063,000.

The mine operation would create jobs and a strong demand for goods and services. The mine operation also would cause: (1) an increase in the Sierra County population (524); (2) an increase in the number of children who might be enrolled in the county schools (108); and (3) an increase in housing demand (269).

As stated above, the total direct, permanent, operational work force would be 225. Research conducted by the Denver Research Institute for projects similar in nature to this one indicates that 40 percent of this work force (90) would be single or married without families, 40 percent (90) would be married and bring their families, and 20 percent (45) would be married but because of age have no children presently living with them. Thus, the calculated direct work force population would be 483 with a dependent population of 258. Of the 225 direct work force it has been estimated that 139 would be coming from "outside" and that 86 would be hired locally. Each permanent project job would generate an additional 180 jobs. This indirect employment would be generated by the disposable income, goods, and services demand of the employees. Assuming the indirect employees filling these positions in the aggregate would have families comparable to the direct work force, an additional population of 378 would result, for a total population increase of 861 attributable to the Copper Flat Project operations. It is estimated that of the total project-related personnel (861) about 35-45 percent (302-387) would be hired from the local area. Thus, approximately 525 persons would be new residents to the general area.

From the population estimates, calculations of housing demand due to Copper Flat operations can be derived. The level of demand for outside permanent employees (139 - 1.1 = 126) and indirect employment workers (180 less an estimated 50% as outsiders = 90 ÷ 1.5 = 60) for a total of 186.

QMC anticipates that 25 percent (46) of the housing demand would be supplied by mobile homes (90% owned = 41, and 10% rented = 5); 60 percent (112) would be met by single-family homes in the $20 - 35,000 range (85% owned = 95, and 15% rented = 17); 10 percent (19) would be duplexes or apartments built for rental; and 5 percent (9) would be single-family homes in the $40,000 plus range.

If the estimate determined earlier of 269 households (179 direct + 90 indirect) is taken and 40 percent (108) of this work force were married with an average of 1 school age child per family, then about 108 new children would be seeking enrollment. This would necessitate the hiring of 4 additional teachers (25 pupils to 1 teacher ratio). According to Mr. Burks, Superintendent of Schools, provision for meeting increased enrollment exists but that a lead time of 6-8 months would be necessary to secure adequate funding.

The Truth or Consequences hospital presently has a 32-bed capacity. For maintenance of desired standards the capacity should be increased to 40-45 beds for a population of 10,000 people. To be comparable to the state average, 1 additional medical doctor would be necessary. The present dental care level is low (1 dentist/8,000 people) so there would be an opportunity for 1-3 dentists in the community. Increasing the Sierra County population to 8,525± would call for 3 additional police officers and possible consideration for additional fire protection personnel to meet acceptable levels.

It is estimated that the Copper Flat Project workers would make expenditures approximately as follows:

Type	Expenditures	
	Local	Distant
Food	90%	10%
Rent	100%	---
Utilities	100%	---
Property Taxes	100%	---
Time Payments	85%	15%
Gasoline	75%	25%
Clothing	80%	20%
Medical	70%	30%
Banking	100%	---
Sales Taxes (4%)	100%	---
Entertainment/Recreation	75%	25%

Positive benefits would occur from the mine operation. The major negative impacts would be in the housing, school, police and fire protection, and medical-dental areas. Shortages would likely be short-term followed by actions to meet the demands. Besides the economic benefits to the region, other positive benefits might occur from the availability of electric power and water in the area.

(c) Abandonment

Permanent shut down of mining operations at Copper Flat would have a few positive benefits but mostly moderate to high negative, socio-economic impacts upon the local and regional areas.

A loss of 405 direct and indirect jobs would affect area income ($5 million annually). There would be a good possibility that the regional population would decrease 200-300 persons. Property values would decrease. There would be a corresponding reduction in needs for services and products. The general health level of the economy for the region would drop. A significant portion of the socio-economic impacts might be mitigated through the development of other uses for the power and water that would no longer be committed to the mining operations.

(7) Land Use

(a) Construction

On the rights-of-way, there is expected to be minor, low negative, short-term impacts (except for the access road which would be long-term) as a result of construction activities affecting livestock grazing and wildlife habitat. None of the direct impact area would be denied to livestock or wildlife but their feeding and movement patterns would be disturbed. A minor amount of forage would be destroyed. This land is rated by BLM at 7 head of livestock/section/year. Thus on the 33 acres of ROW that would be disturbed, the loss of grazing use would not be significant nor would the multiple use of the land be incompatible. Similar impacts would occur during development of the mine area. However, additional acres (178) would be affected and hence the area wildlife and livestock carrying capacity would be reduced. The commitment of the ROW land and the mine development area to mining is commensurate with BLM's recognition of the suitability of this area for development of mineral resources.

(b) Operations

No impacts would be expected during mine operations from the 115 Kv and 14.4 Kv transmission lines, the water pipeline, nor the access road relative to land use suitability and compatibility. Moderate positive, long-term benefits would occur from commitment of the land to operation of the pit and minerals processing for the extraction of mineral values. Maintaining the land values of the waste dump and tailing would hinge critically upon the reclamation program and the maintenance of area environmental quality. The operational reclamation program would be a low positive, long-term benefit by developing and maintaining a protective vegetative cover.

(c) Abandonment

Minor low level, localized impacts would likely occur which might influence the land use of the area. The long-term trend would be toward pre-project land use or status unless the lands were committed to other uses. The availability of electric power and water no longer needed for the mining operations would likely stimulate

the development of other land uses that would be suitable or compatible with the area. The reclaimed areas would hasten the trend toward pre-project status and, combined with the availability of water, might be significant in strengthening local livestock operations.

(8) Noise

(a) Construction

Vehicle traffic and construction equipment would create higher than present ambient noise levels. Such impacts would be low negative, of short duration, and very localized.

(b) Operations

No impacts would occur from operation of the 115 Kv and 14.4 Kv transmission lines, nor the water pipeline. Vehicle noise on the access road would continue at a steady rate during mine operations with peaks occurring at the change in shifts. The overall ambient noise level would probably decrease from that of the construction period. Low negative noise impacts would occur at the pit from drilling, blasting, loading equipment, and haul trucks. Similar impacts could be expected to occur at the waste dump. The operational reclamation program would develop low negative, short-term noise impacts from the operation of the reclamation equipment. The operational noise impacts would likely have none or minor effects upon other environmental components.

(c) Abandonment

Immediately following cessation of mining operations there would be a reduction in local area ambient noise levels. Low level, short-term noise impacts would occur from salvage and reclamation operations. Following completion of salvage and reclamation operations there would be further reductions in ambient noise levels which would approach pre-project conditions.

(9) Transportation

(a) Construction

Low negative, short-term impacts would occur for the 18-24 months construction period from the travel of project workers and suppliers. It is estimated that this impact would consist mainly of 60 round trips per day (avg. of 2 persons/vehicle) by the workers on several possible travel routes. State Highway 90 would be affected most by the additional traffic. Because of the variety of work being performed, there would be a correlative variety in the types of vehicles present; however, it is likely that 40-60 percent would be pickup trucks. Car pooling would occur where practical as a personal economy measure. Unfortunately, the number of construction workers whose jobs and activities

lend themselves to car pooling is small.

(b) Operations

Low negative impacts would occur from increased traffic and fuel consumption during the mine operation period. There would also be positive local economic benefits (vehicle sales, repairs, fuel and supply sales, parts, etc.). There would be an increase in traffic as compared to the construction level. It is expected that car pooling opportunities would be better during regular mine operations than during construction; however, it is likely that at least 100 vehicles would make daily round trips. State Highway 90 would carry the major part of this traffic load. Shipment of concentrates by truck from Copper Flat have been assumed to go to either Hatch, New Mexico (closest railhead) or to El Paso, Texas to a smelter. The mine production would require 6 trips per day on a 350-day production year. An average of 10-15 trips per day by trucks of vendors and service departments of equipment suppliers would occur, mostly during the day shift. Additionally, 15-20 trips should be expected by visitors and sales representatives. This additional traffic on State Highway 90 will cause more safety problems and the additional heavy trucks will cause an increase in the rate of pavement deterioration.

(c) Abandonment

Cessation of mining operations would cause a reduction in general area vehicle traffic, elimination of mobile mine equipment operations, and a decrease of fuel sales to mine-oriented vehicles. Decreased truck and hauling traffic would occur between Copper Flat and product shipping or processing points. These activities are closely related to the regional economic situation in a multitude of secondary impacts.

D. Possible Mitigating Measures

1. Rights-of-Way

a. Non-living Components

(1) Air

(a) Fugitive dust may be controlled by sprinkling disturbed areas and access road with water.

(b) Assure that emissions from mobile equipment meet federal and state air quality standards.

(c) Meet federal and state standards regarding fugitive dust.

(d) All measures designed to minimize soil and vegetation disturbance will help to maintain air quality.

(e) Reduce vehicle numbers and speed on access road.

(f) Encourage car-pooling.

(2) Soils

(a) Do not use mobile equipment when soil is water-saturated or during heavy rains.

(b) Construct water bars and sediment catch-basins for runoff control.

(c) Disturb a minimum area.

(d) All measures designed to reduce impacts to vegetation will reduce erosion by preserving the vegetative cover.

(e) Impacts caused by movement of vehicles over open terrain may be reduced by:

(i) Directing vehicles single file over a route.

(ii) Driving around large vegetation and critical topography.

(iii) Reducing the number of vehicles.

(iv) Requiring the construction of road barriers on critical areas to prevent further use.

(3) Water

(a) Measures taken to minimize impacts to soil and vegetation will help reduce impacts on water.

b. Living Components

(1) Vegetation

(a) Revegetate disturbed areas as soon as possible.

(b) Control off-road vehicle use.

(c) Compact water pipeline trench soils so that the disturbed surface lies 3-6 inches below adjacent undisturbed soil surfaces so as to encourage catchment of wind-blown soil particles, moisture, and seeds of indigenous plants.

(d) Measures taken to reduce impacts to soils will also reduce impacts to vegetation.

(e) Reasonable precautions should be taken to prevent and suppress fires.

(2) Animals

(a) Do not disturb or harass wildlife.

(b) Use raptor-safe pole construction.

(c) Assist in providing protection to wildlife.

(d) When pole lines are abandoned, the Authorized Officer may designate the retention of certain poles for raptor perching and nesting.

(e) Measures taken to reduce impacts to vegetation and soils will also reduce impacts to animals.

c. Ecological Interrelationships

(1) Mitigating measures which help reduce impacts to soils, vegetation, and animals will also lessen impacts on ecological interrelationships.

d. Human Values

(1) Visual Resources

(a) Use non-glare metallic parts on structures.

(b) Use poles and structures that have been color-treated to blend with the landscape.

(c) Measures which help reduce impacts to soils and vegetation will also reduce impacts to the visual resource.

(2) Scientific/Educational

(a) Measures taken to reduce all environmental impacts will educate others and help to promote the multiple-use concept.

(3) Cultural Resources

(a) If subsurface historic or prehistoric materials are encountered during the construction operations, the permittee or his on-site representative shall halt work and notify the District Manager of the occurrence. The District Manager will make a decision to require salvage of the resources or to allow work to continue within 5 working days.

(b) In order to mitigate the most significant impacts to cultural resources in the affected area, the local history should be written up from the notes previously collected by Quintana. The resulting historical report should include discussions of the historic settlement pattern, population density, and population distribution during different historic periods, since these topics are specifically those for which infomation will be lost as a result of Quintana's proposed action. The report should also relate historic changes in the level and type of activity in the Hillsboro mining district back to historic changes in national social or economic conditions.

This mitigation effort would have to be accomplished by someone with a Master's degree in history or ethnohistory and some background in cultural or economic geography. Some field examination and recordation of historic resources would also be required, but might best be handled in some way other than under contract for additional survey.

The State Historical Preservation Office has concurred in the opinion that this work is needed to offset the regional impacts of the proposed action. It should be made clear, however, that BLM is not authorized under the current mining regulations to require this work. Although several historic sites were discovered on BLM land along the waterline right-of-way, these sites are not significant enough individually to require substantial site-specific salvage work. The primary significance of these resources lies in their being parts of the systems for which additional work has been recommended.

(4) Socio-economic Values

(a) Assist local agencies in their planning efforts.

(b) Provide advance information to the public and appropriate agencies of company actions that may affect the region.

(c) Cooperate in assuring furtherance of multiple-use concept.

(d) Work with responsible agencies to maintain environmental quality.

(e) Meet health quality standards for noise.

2. Mine Operations

In addition to the mitigating measures described below, the appropriate possible mitigating measures for the rights-of-way should also apply.

a. Non-living Components

(1) Air

(a) Sprinkle haul roads, material transfer points, dump areas and other chronic dust areas.

(b) Manipulate tailing spigots for tailing moisture control.

(c) Construct the employee parking area with a blacktop of other hard surface to reduce the amount of fugitive dust.

(2) Soils

(a) Stockpile and protect all soil materials suitable for reclamation of disturbed areas.

(b) Utilize all stockpiled top soil for revegetation.

(3) Water

(a) Control sediment in runoff.

(b) Recycle maximum amount of water for minerals processing.

(c) Construct a drainage control system with catch basins, sediment traps, culverts, reservoirs, and a return system (where needed).

b. Living Components

(1) Vegetation

(a) Revegetate disturbed areas as soon as possible with maximum composition of compatible, indigenous plants.

(b) Reclaim maximum area possible annually.

(c) Control movements of livestock.

(2) Animals

(a) Standardize blasting for least animal disturbance.

c. Human Values

(1) Visual Resources

(a) Reshape and restructure reclaimed areas (tailing dam, waste dumps, etc.) to approach adjacent area physiography.

(b) Blend foreign shapes of structures into background landscape with compatible color scheme.

(2) Scientific/Educational

(a) Develop visitor center and interpretive displays on mining and reclamation technologies.

(3) Cultural Resources

Same as for "Rights-of-Way."

E. Recommendations for the Mitigation or Enhancement of Environmental Impacts

All of the "Possible Mitigating Measures" are recommended for the mitigation of environmental impacts.

F. Emergency Actions

1. Tailing Dam Break

The possibility of a tailing dam break is remote because engineering design safety factors (floods, possible earthquake effects, materials properties, etc.) have been considered before the State Engineer's Office approved construction and operation of the proposed tailing dam. An employee of QMC will be responsible for monitoring the tailing deposit 24 hours a day. If a break occurred, the tailing material flow would be shut off as soon as the line could be drained and cleaned of its load. Followup action would depend on an appraisal of the seriousness of the situation. Repair and cleanup operations would begin. When the structure was repaired, inspected by a State Engineer's Office representative and deemed satisfactory, operations would be continued.

2. Tailing Line Break

The tailing material flow would either be shut off upstream of the break or, if possible, the flow would be redirected. Emergency repairs or pipe replacement would be made and the spill would be cleaned up and redeposited in a suitable place. In most cases the spill ditch paralleling the pipeline and leading to the tailing pond would handle the material spilled from the break.

Other emergencies would be handled as necessary, following the expected procedures of appraising the situation, altering the operations as necessary, cleanup, repairing or replacing malfunctioning parts, testing, and then resuming operations.

G. Residual Impacts

1. Air

Maintenance of air quality standards cannot entirely eliminate minor atmospheric degradation by mining operations. Air quality would be affected mostly be short-term impacts but long-term, low level impacts might remain. During mining, subsurface materials with higher concentrations of certain soluble elements than are found in surface materials would be transported to the surface. Introduction of these elements into the surface environment changes interrelationships in varying degrees from what they were before.

2. Land (Soils)

Erosion processes are accelerated any time the protective cover is removed or the soil is disturbed. Mitigating measures after major disturbances would reduce erosion but very rarely eliminate it. Productivity of the natural vegetation would be reduced if the soil were disturbed or compacted. The original natural soil arrangement cannot be reconstructed after it is moved, stored, compacted, chemically treated, or altered during mining construction and operation. Unstable soil conditions leading to erosion might set up before a surface cover could be reestablished. These situations cannot always be mitigated. Whenever soil is disturbed, eroded, or removed, soil organisms would have their life cycles interrupted and populations would decline for an unknown time. Soils can be moved, stockpiled, and redistributed, but to some degree, the impacts would remain until the interactions again have time to reach equilibrium, a period that can be lengthened by low precipitation. Thus, nutrient recycling, profile development, and organic matter cycling cannot be completely mitigated. The major residual impact on the lands would be the inability to reclaim the pit surface area lost by mine development. In addition, some localized subsidence around the periphery of the pit could be expected.

3. Water

Possible reduction of water quantity for other uses cannot be avoided. Some drawdown of the subsurface reservoir waters in the vicinity of the production wells could be expected. It is not likely that the source of supply would be depleted since the aquifer being tapped is from a designated open basin. However, available current information is not adequate to determine if water usage could become a residual impact. The water runoff and drainage system in the vicinity of the pit could cause residual impacts in that the surface drainage pattern and related ground water recharge would be changed from the pre-project situation. This is not a loss of the resource but rather a re-direction of the drainage. There should be no significant residual impacts on water quality since the proposed project provides for water quality control and monitoring. However, toxic spills or leakage of toxic substances could occur through failure of containment structures or human accidents.

4. Cultural Resources

All impacts to cultural resources which are not mitigated before the area is disturbed will constitute residual impacts.

5. Reclamation

With adequate protection for the quality of the non-living environmental components, only short-term low-level residual impacts should occur to the living environmental components because of their flexibility and adaptability. The reclamation program would create new habitats on areas that had been disturbed. Animals would respond to these new habitats and a variety of micro-ecosystems would develop. The same species may not inhabit the reclaimed areas as for adjacent undisturbed habitats but new carrying capacities and trophic system interrelations would be developed.

Reclamation, as part of the abandonment phase, should remove any possible residual impacts that might accrue from roads, structures, or other facilities since it is planned to remove such objects foreign to the landscape and to revegetate the areas involved. There would be waste deposits in areas that once were uniformly sloped. The waste cannot be replaced entirely in a form which would blend perfectly with the undisturbed landscape. Mining alters topography and despite the best mitigation measures residual impacts would be evident.

6. Socio-Economic

Communities in the region would feel economic stress from the loss of jobs and tax base for a short time following close-out. Regulatory structure would suffer as well, since both the need for regulatory mechanisms and the method of their support is based on the size of the taxable population. Fortunately, man is an adaptable component of the environment and it is expected that adjustments would occur, new job sources would be developed, and recovery would result.

7. Safety

Accidental deaths and injuries would take place despite safety measures. If proper precautions are taken to protect the health and safety of the general public, accidental deaths, injuries, and health problems would be kept to a minimum. The hazards, however, cannot be completely mitigated.

H. Relationship Between Short-Term Use and Long-Term Productivity

Public lands concerned with the proposed Copper Flat mine development have been used mainly for livestock production, mining, wildlife habitat, and to a minor extent for recreational, cultural, scenic and open space values. Development of the proposed project would immediately affect the livestock and forage resources and to a minor extent recreational pursuits.

The major effects would be disturbance and loss of forage, habitat and recreational values. Minor losses would occur from erosional forces following surface disturbance.

The proposed project would tend to promote urban expansion in Truth or Consequences, Hillsboro, and Williamsburg. Peripheral suburban sprawl and discontinuous encroachment upon rural areas would occur. Both beneficial and negative impacts would occur from the proposed project that would have both short-term and long-term effects.

Considering both the prevailing circumstances and the historical uses of the land it could be assumed that the major land uses in the proposed project area would continue to be mining and livestock production. Protection of water sources and quality should remove any long-term impacts to livestock; and there would be an excellent possibility that through project water development, significant benefits could come to livestock production. Mining operations might be increased in the region due to "spin-off" attraction from the presence and operation of the proposed project. Recreational, cultural, scenic, open space, and wildlife values would suffer minor degradation in spite of a well-developed management and reclamation program.

The proposed project would have many short-term benefits and a few long-term benefits (water availability and distribution, electric power distribution). The mine development should not affect adversely the long-term productivity of the land.

I. Irreversible and Irretrievable Commitments of Resources

1. Mineral Extraction

The principal commitment concerns the extraction of copper, molybdenum, gold, and silver from the ground. Once the mineral resource is mined and has been processed for use it is gone and cannot be replaced; although, much of it can be recycled. The commitment to mine involves not only the extracted and processed minerals but also those mineral values lost and not recovered in the process. Also lost are the chemicals, electric power, and equipment fuels necessary to the extraction process. The removal of mineralized material from the pit would be an unavoidable, irreversible impact as a tradeoff for the long-term, regional, positive benefits associated with extraction of mineral values.

2. Air

Operating equipment would consume fuel and oxygen. As a result, carbon dioxide, hydrocarbons, nitrous oxides, and other gases in a heated mixture, would be released into the atmosphere. This would be an irreversible series of events.

3. Soil

Soil organisms would recover following soil disturbance to the degree that the soil in which they live is rehabilitated. Erosion irreversibly reduces the environment on which the organisms are dependent. Any action that results in soil erosion has a permanent impact on the soil. The magnitude of the loss depends upon the severity of the erosional forces--wind, water, and gravity. A permanent commitment of the natural soil would be made at the pit. However, the overburden soils would be used for reclamation of the waste dump, tailing deposit, and other disturbed areas.

4. Water

Ground water aquifers in the immediate vicinity of the pit might suffer in both quantity and quality. Adjacent areas that would be dependent upon a disrupted aquifer for water supply could be affected. Water that evaporates or is otherwise used and not returned to normal drainages is no longer available for former purposes.

5. Vegetation

Disturbed areas devoid of vegetation for a short period experience a loss of vegetation production during the time the area is out of production. This loss is irretrievable.

6. Ecological Interrelationships

Mining operations have their greatest impacts in areas that are in a natural, undisturbed condition. Natural ecosystems can be altered and reclamation can affect rehabilitation to the degree of ecosystem flexibility and adaptability. In any case, restoration to the original situation is impossible. The significance of the loss depends on the uniqueness of the area. No such areas are known to exist on the ROW or in the vicinity of Copper Flat.

7. Cultural Resources

Historic and archaeological resources are irreplaceable. All damage to these resources constitutes an irreversible commitment of resources. While reconstruction or reclamation may be effective for converting a resource to recreational use, there is not method for retrieving information of scientific importance after the damage has been done.

IV. Persons, Organizations, and Governmental Agencies Contacted

A. Persons and Organizations Contacted

Agricultural Stabilization Commission, T or C, NM
Bason and Cox, Inc., Hillsboro, NM
Allan Beck, County Agent, T or C, NM
Dr. Stanley Bussey, Dept. of Sociology and Anthropology, NMSU
Chamber of Commerce, T or C, NM
Chairman, County Commission, T or C, NM
Harvey Chatfield, Caballo, NM
City Manager, T or C, NM
Vern Cunningham, Hillsboro, NM
Diamond A Cattle Co., Roswell, NM
Dr. William Dick-Peddie, NMSU
Bob Donegan, Quintana Minerals Corp., Tucson, Arizona
Elephant Butte Irrigation District, Las Cruces, NM
El Paso Electric Co., Las Cruces, NM
Dave Foreman, The Wilderness Society, Glenwood, NM
W. B. and J. H. Jones, Winslow, Ariz.
Dr. William King, Dept. of Earth Sciences, NMSU
Mr. Wesley Leonard, El Paso, Texas
Mayor, Village of Williamsburg, Williamsburg, NM
Museum of New Mexico, Santa Fe, NM
Nan Nalder, Central Clearinghouse, Santa Fe, NM
The Nature Conservancy, Santa Fe, NM
Euel R. Nave, T or C, NM
Plains Electric, Albuquerque, NM
Jesse U. Richardson, Jr., Mesilla, NM
Sierra Electric, Elephant Butte, NM
Southern Rio Grande Council of Governments, Las Cruces, NM
Dr. W. J. Stone, NM Bureau of Mines and Mineral Resources, Socorro, NM
Elmore Taylor, Hatch, NM
Truth or Consequences School System, T or C, NM
Rollin Wickenden, Sierra Club, El Paso, Texas
Department of Wildlife Science, NMSU
Dr. Dale Zimmerman, Western NM Univ., Silver City, NM

B. State and Federal Agencies Contacted

Bureau of Reclamation, El Paso, Texas; T or C, NM; and Las Cruces, NM
Corps of Engineers, Albuquerque, NM
Environmental Improvement Agency, Las Cruces, NM
Environmental Protection Agency, Dallas, Texas
NM Bureau of Mines and Mineral Resources, Socorro, NM

NM Dept. of Game and Fish, Las Cruces, NM
NM State Engineer, Santa Fe, NM
NM State Highway Department, Santa Fe, NM
NM State Parks and Recreation Department, Santa Fe, NM
NM State Planning Office, Santa Fe, NM
Soil Conservation Service, Las Cruces, NM
U. S. Fish and Wildlife Service, Las Cruces, NM
U. S. Forest Service, Silver City, NM
U. S. Geological Survey, Albuquerque, NM, Artesia, NM and Menlo Park, CA

V. Intensity of Public Interest

On June 6, 1977, a public meeting was held by Quintana representatives at the Sierra County Courthouse in Truth or Consequences. Over 100 people, including BLM representatives from the Las Cruces District Office, were in attendance. Most of the comments at the meeting were directed toward the economic benefits that would result from the proposed mine development.

The Las Cruces District, BLM, then mailed letters to individuals, organizations, and federal, state, and local governmental agencies requesting additional input concerning Quintana's proposed mining project. Most of the replies were comments that were concerned with whether or not the environment would be adequately protected. Some of the comments received concerned the economic benefits to the Truth or Consequences area. Several letters contained suggested recommendations for the protection of the environment.

The overall viewpoint toward the proposed mine development appears to be positive. Citizens in the Truth or Consequences area feel that development would benefit the local economy without seriously affecting their life style.

VI. Summary Conclusion

Development of the rights-of-way and the mine would create a wide array of impacts on the environmental components. If the proposed copper mining project should develop, the negative impacts could be minimized and the positive benefits enhanced through the use of the mitigating measures and control procedures proposed in this assessment report. If no mining program develops, land productivity and the environment would not be affected.

A. Construction

1. Rights-of-Way

Impacts to environmental components during construction are expected to be low or negligible, of short term duration, capable of being mitigated, affecting areas of low environmental sensitivity and generally regarded by the public to be of low concern.

2. Mine Development

Extensive surface disturbances would seriously degrade scenic values and local animal habitats. Mitigative activities (revegetation, water control, dust control) could reduce the negative effects but would lag significantly following early disturbances; however, the mitigative efforts would catch up in the project operational phase. An increase in area human population with its attendant needs (housing, schools, utilities, transportation) would create adversities for the communities concerned. Significant socio-economic benefits in the form of more jobs, increased purchasing power, mine-tax benefits, etc., would accrue to the area.

B. Operations

1. Rights-of-Way

Most of the environmental impacts would be low negative, insignificant, or positive. The major negative impacts would be associated with the area access road. Positive benefits to many environmental components would occur through revegetation efforts, increased availability of surface water, and additional edge effects and increased diversity in animal habitats.

2. Mine Operations

Negative impacts would be related mainly to mining operations (pit, waste dump, and tailing deposit) where the effects would degrade

local scenic values. Progressive, operational reclamation and revegetation of the waste dump and tailing face would tend to reduce the severity of the impacts. Significant long-term benefits in the form of jobs, personal income, sales, minerals extraction and processing, and reclamation of disturbed areas would occur.

C. Abandonment

1. Rights-of-Way

Any negative impacts that might occur would be associated with possible salvage operations of the powerlines and continued, uncontrolled use of the access road. Positive benefits could be expected for scenic values and animal habitats due to less human disturbance, reclamation of remaining disturbed areas, and increased availability of water.

2. Mine Abandonment

Significant negative impacts would occur following termination of mining (loss of jobs, reduced per capita income and purchasing power, reduction in need for services, loss of tax benefits to municipalities, etc.). Positive benefits should develop for the area as a result of available electric power and water no longer being committed to mining operations at Copper Flat.

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Bussey, S. D. and Naylor, B. J., 1976, An Archaeological Reconnaissance Near Hillsboro, New Mexico, Cultural Res. Mgt. Div., Dept. Sociology and Anthropology, Report 24, N.M. State University