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ENVIRONMENTAL ASSESSMENT REPORT
for the
OCCIDENTAL OIL SHALE, INC. LOGAN WASH PROJECT
and
RELATED DEVELOPMENTS

by
Arnold M. Ruskin

for
OCCIDENTAL OIL SHALE, INC.
Bakersfield, California and Grand Junction, Colorado

November 1976

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17. *Yield*
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B. *Oil*
C. *Gas*
D. *Sludge*
E. *Residue*
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Introduction

The Energy Research and Development Administration has requested proposals for demonstrating the technical and economic feasibility of different in situ shale oil recovery methods. Corollary objectives are to demonstrate the best explosive fracturing and rubbleizing technique for the process and to determine operating conditions necessary to obtain desired retorting results. Occidental Oil Shale, Inc. has responded to this request and proposes to conduct these demonstrations for their modified in situ process.

Occidental proposes to do some early retort formation and operation studies at its Logan Wash site (known also as the D. A. Shale site) near DeBeque, Colorado, and to undertake the technical and economic feasibility demonstrations at another, as yet unnamed, site. The latter site has a higher grade of ore and is more suitable for the demonstrations, but it will not be ready for this purpose for approximately two years. Hence, early work on retort formation and operation will be done on the existing site.

Agencies of the Federal Government are required to assess the nature and extent of environmental impacts that may result from their proposed actions. Where significant impacts on the human environment are projected, the agencies are required to prepare a detailed environmental impact statement to accompany their proposals through agency review processes (40 CFR 1500.2 (b) and the National Environmental Policy Act of 1969, Section 102 (2) (c)). This assessment report has been prepared in accord with these requirements for the shale oil recovery demonstration that is being proposed for ERDA funding by Occidental Oil Shale, Inc.

I. The Proposed Action

A. Specific Experiment

The Occidental process consists of mining an amount of low grade shale below and above an ore body, rubbleizing the shale between the mined areas, and retorting the rubble in place. An over-burden of several hundred feet typically remains above the rubble. The amount of material mined is only that necessary to provide mine access and a bulk porosity in the rubble of 15 to 25 percent.

Retorting is begun by introducing a fuel and air to burn at the top of the rubble pile until the shale is heated sufficiently to produce oil and gas and a carbonaceous residue. The oil flows to a sump at the bottom of the retort and is drawn off through pipes that were installed before the rubble pile was formed. The gas is also piped off at the bottom of

The first research and development... for their welfare in any way.

Occidental progress in the early... be done on the existing site.

Agencies of the National Government... that is being proposed for the... 1945.

1. The proposed action

A. Specific objectives

The first objective is to... of 1945.

It is to be noted that... this one feature. The...

the retort. The carbonaceous residue burns as air is continued and the fuel is turned off. As the residue burns, the rock below the flame is heated further and continues to produce oil, gas, and more residue. The latter then burns, continuing the process until the retorting front reaches the bottom of the retort. The front moves downward at a rate of approximately a foot per day, depending upon such factors as the rate at which air is supplied.

In addition to oil and gas, the process produces water of combustion. The water contains significant amounts of dissolved solids and other impurities and must be treated if it is to be discharged to either ground or surface waters. Depending on the amount, it may be used in the process. If limited amounts must be discarded, they can be evaporated in such a way that the residue will not degrade ground and surface waters.

The stack exhaust is relatively clean. Particulates, oxides of nitrogen and sulfur dioxide are virtually nil. For the Logan Wash site, unburned carbon monoxide, hydrocarbon and hydrogen sulfide emissions are sufficiently low that they can be discharged through a tall stack without causing air quality standards to be violated. For the larger demonstration at the new site, sulfides will be removed from the exhaust, which will then be burned to recover its heating value. This will result in the hydrocarbons and carbon monoxide being converted to water and carbon dioxide.

True, but what about H₂S and hydrocarbons.

Disturbance of the terrain at either site will be minimal. No spent shale and only minimal amounts of raw (natural) shale will be disposed of on the surface; the latter will be placed in canyons or gulches and vegetated to resemble their surroundings. Water supplies will be protected from pollution by runoff from or percolation through these mineral waste piles. There will be some surface facilities, e.g. roads, buildings, stacks and equipment, but only a small fraction of either site will be affected. Care will be taken to locate such facilities so that important habitats and vistas are not adversely affected. Upon eventual abandonment of a site, surface facilities will be reduced and the terrain will be restored as much as practical.

? 20% is not minimal and if combined in situ and above-ground retorting is used, there will be spent shale.

A developmental phase of the project has been underway at Logan Wash since June 1972 and now employs about 182 people, 152 at the site and 30 in a Grand Junction office. There are also up to 50 contractor personnel at the Logan Wash site. The Occidental work force at Logan Wash is not expected to grow over a two-year period, nor is growth expected in the maximum number of contractor personnel. The personnel situation for the new site has not yet been formulated, but it will be detailed and reviewed with ERDA and other concerned governmental agencies as it is developed. Thus, adequate plans can be laid for housing, schooling, etc. in advance of the need.

The proposed demonstration continues an on-going experiment and consists of three phases. Phase I will occur at Logan Wash and involves rock-breaking and rubblizing experiments with subsequent retorting evaluation. This phase will continue but not enlarge the existing operation.

Phases II and III will occur at the new site, with Phase II beginning two years after the overall project is initiated. Phase II involves technical evaluation of the formation and simultaneous burning of a two-retort cluster that will produce 2,500 barrels of oil per day. Phase III involves economic evaluation of two clusters of two retorts each, i.e. formation and simultaneous burning of four retorts. These will produce 5,000 barrels of oil per day.

Environmental baseline studies for Phase I, i.e. for the Logan Wash site, have been conducted in the following sixteen areas:

- | | |
|-------------------------|--------------------------|
| Meteorology | Engineering geology and |
| Ambient air quality | — soil engineering |
| Air pollution modeling | Noise |
| Ground water hydrology | Seismometry |
| Surface water hydrology | Subsidence and uplift |
| — Archaeology | Process water treatment |
| — Paleontology | and disposition |
| — Flora | — Vegetation experiments |
| Fauna | Socioeconomic impacts |

Work performed on these studies was defined in consultation with cognizant government agencies. A minimum of one year's baseline data gathering has been completed for all environmental dimensions where this is relevant. Other studies answer specific questions for planning, evaluation, or permits. Over sixty permits have been obtained for the project on the basis of these studies and design information; a list is available on request. Work in these various areas is described in the appropriate sections below, and reports now available on the studies are listed in Table 1.

Environmental research will be continued at Logan Wash in the following areas during Phase I:

- | | |
|-------------------------|---------------------------|
| Meteorology | Fauna |
| Ambient air quality | Subsidence and uplift |
| Air pollution modeling | Process water disposition |
| Ground water hydrology | Vegetation experiments |
| Surface water hydrology | Socioeconomic impacts |
| Flora | |

These studies will provide information and analyses to allow actual impacts, if any, to be detected and evaluated and to plan for reclamation of the site when it is eventually abandoned.

The proposed development consists of an existing building and outbuildings on the site. The site is located at the corner of Main Street and 1st Street. The site is zoned for commercial use. The proposed development is consistent with the zoning regulations. The site is located in the downtown area of the city. The proposed development will provide additional office space for the city's growing economy. The site is well-served by public transportation and parking facilities. The proposed development will be constructed in accordance with all applicable codes and regulations. The site is a prime location for a variety of commercial uses. The proposed development will enhance the city's urban environment and provide a valuable asset to the community.

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Site location	Corner of Main Street and 1st Street
Zoning	Commercial
Proposed use	Office space
Site area	0.5 acres
Adjacent properties	Commercial buildings
Public transportation	Bus stop
Parking	10 spaces
Utilities	Water, sewer, gas
Access	From Main Street
Other features	Historic building

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Table 1

Baseline Environmental Reports
for Occidental's Logan Wash Site

1. H. E. Cramer Co., Inc., Comparison of Upper-Air Data at Logan Wash, Colorado, with Upper-Air Data at Grand Junction, Colorado, February 1, 1976 (prepared for Claremont Engineering Company).
2. H. E. Cramer Co., Inc., Verification of the Diffusion Model Used by H. E. Cramer Co. to Calculate the Stack Height for Room 4 at Logan Wash, Colorado, February 1, 1976 (prepared for Claremont Engineering Company).
3. David B. Thomas, Archaeological Survey of the Garrett Research and Development Co., Inc. Logan Wash Site, Garfield County, Colorado, October 1974 (prepared for Claremont Engineering Company).
4. Daniel Guthrie, Paleontological Survey of Proposed Dump Sites on the D. A. Shale/Callahan Trust Lands, Carfield County, Colorado, October 1974 (prepared for Claremont Engineering Company).
5. Wm. O. Wirtz, II, et al., An Ecological (Vertebrate) Survey of the Garrett Research and Development Co., Inc. Logan Wash Oil Shale Site (plus 3 supplements and a summary report), October 1974; January, April, August, and September 1975 (prepared for Claremont Engineering Company).
6. Neil E. West, et al., An Ecological Baseline Study of Flora, Vegetation, and Soils on the Occidental Oil Shale, Inc. Logan Wash Site Near DeBeque, Colorado, March 26, 1976 (prepared for Claremont Engineering Company).
7. Alfred B. Focke, Background Noise Measurements in the Vicinity of DeBeque and Grand Valley, Colorado, 1 March to 1 November 1975, March 30, 1976 (prepared for Claremont Engineering Company).
8. Carl F. Petersen, Seismic Measurement at Grand Valley, Colorado, December 12, 1975 (prepared for Claremont Engineering Company).
9. Leighton and Associates, Geotechnical Evaluation of Proposed Oil Shale Development Activities by Occidental Oil Shale, Inc. Near Grand Valley, Colorado, March 26, 1976 (prepared for Claremont Engineering Company).
10. R. T. Chew, L. C. Bender, and I. G. Studebaker, Environmental Considerations for a Proposed Mineral Waste Disposal Pile in Logan Wash, 1975 (prepared for Occidental Oil Shale, Inc.).

Table 1, continued

11. W. O. Wirtz and R. L. Redmond, Cliff Nesting Raptors on the Logan Wash Site, Garfield County, Colorado, June 15, 1976 (prepared for Claremont Engineering Company).
12. Neil E. West and James R. Irvine, Distribution and Extent of *Astragulus lutosus* Jones, *Ceanothus martinii* M. E. Jones, and *Festuca dasyclada* Hack, September 1975 (prepared for Claremont Engineering Company).

Table 1. continued

- 11. W. G. Wirtz and J. E. Johnson, Civil Highway Engineers on the State
and City, California Council, 1934-1935, 1936 prepared for
California Engineering Council.
- 12. Walter E. Wood and James A. Taylor, Registration and License of
Engineers, California Council, 1934-1935, 1936, and
California Engineering Council, 1937 prepared for California
Engineering Council.

Environmental baseline studies for Phases II and III, i.e. for the new site, have been completed in the following thirteen areas:

- | | |
|-------------------------|------------------------------------|
| Meteorology | Flora |
| Ambient air quality | Fauna |
| Air pollution modeling | Ecosystem relationships |
| Ground water hydrology | Soil productivity |
| Surface water hydrology | Socioeconomic impacts |
| Archaeology | Revegetation of disturbed surfaces |
| Scenic values | |

These studies have also been defined in consultation with cognizant government agencies. Since negotiations for the site are just being finalized, it is not possible to give more information about the studies at this time. Perhaps it will suffice to say (1) that environmental research will be continued at the new site during Phase I as preparation for Phases II and III and (2) that as soon as possible these results will be reviewed with ERDA in conjunction with plant design information to make any revisions needed. Moreover, environmental research will be conducted during Phases II and III in accord with a plan worked out with ERDA before ERDA-sponsored work takes place on the new site. In the meantime, it should be noted that Phases II and III will be designed to meet applicable environmental regulations.

B. Known Environmental Issues

The Occidental modified in situ process for producing shale oil has many environmental advantages over alternative processes. These include relatively clean atmospheric exhausts, relatively little consumptive use of water, relatively little surface disturbance, no surface disposal of spent shale, minimal requirements for a temporary construction force, and a relatively smaller permanent work force. There are, however, some environmental considerations that need to be understood if the process is to be managed properly. These considerations are:

1. Minimizing atmospheric pollution economically
2. Avoiding water pollution economically.
3. Oil mist recovery.
4. Reclaiming sites economically upon abandonment.

An environmental research effort is planned to address each of these issues during the proposed program. Each aspect of this research is described later in connection with discussions of potential environmental impacts (see Section III.B.).

There will be a Net increase in H₂O, mainly from combusting hydrocarbons to CO₂

only if the gas is treated

20% Raw shale will cover much land

Environmental health studies for 1981 and 1982, the new data have been reported in the following tables:

Table	Subject
Table 1	Acute leukemia
Table 2	Chronic leukemia
Table 3	Myelodysplastic syndromes
Table 4	Polycythemia vera
Table 5	Essential thrombocythemia
Table 6	Primary myelofibrosis
Table 7	Myeloid metaplasia with myeloid metaplasia
Table 8	Myeloid metaplasia with fibrosis

These studies have also been defined in considerable detail in the Environmental Health Studies for 1981 and 1982. Some of the studies are just being finalized. It is not possible to give a complete listing of the studies at this time. Further information is available in the Environmental Health Studies for 1981 and 1982. (1) and (2) and as well as specific study reports will be available with the Environmental Health Studies for 1981 and 1982. The Environmental Health Studies for 1981 and 1982 will be designed to meet specific environmental health needs.

Environmental Health Studies

The Environmental Health Studies for 1981 and 1982 are designed to provide information on the environmental health studies for 1981 and 1982. The Environmental Health Studies for 1981 and 1982 are designed to provide information on the environmental health studies for 1981 and 1982. The Environmental Health Studies for 1981 and 1982 are designed to provide information on the environmental health studies for 1981 and 1982.

1. Identifying specific environmental health studies for 1981 and 1982.
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Environmental Health Studies for 1981 and 1982
Table 1
Table 2
Table 3
Table 4
Table 5
Table 6
Table 7
Table 8

II. The Existing Environment

A. Locations

The Logan Wash site is in Garfield County, Colorado, 51 miles by road northeast of Grand Junction; see Figure 1. It is north of the Colorado River, west of Parachute Creek, and east of Roan Creek. It includes part of Spruce Ridge on the north side of Logan Wash north of Mt. Logan and includes Mt. Callahan.

The Logan Wash property, Figure 2, total 4360 acres and comprises most of Section 23, the north half of Sections 26 and 25, and the southeast quarter of Section 24, in T7S, R97W; and the south half of Section 18, the north half and southwest quarter of Section 19, the northwest quarter of Section 30, the south half and northeast quarter of Section 17, the north half of Section 20, the southwest quarter of the southeast quarter and the southwest quarter and the north half of Section 16, the south half of Section 9, the southwest quarter of Section 10, and the northwest quarter of Section 15 in T7S, R96W. The nearest towns are Grand Valley, six and a half miles away, and DeBeque, nine miles away (straight-line distances to the adits).

The new site lies further north, closer to the center of the Colorado oil shale region. Its exact location cannot be described until negotiations for its acquisition have been completed.

B. Geology

1. General

The Logan Wash site lies at the south edge of the Piceance Creek structural basin which was the site of a vast lake covering much of northwestern Colorado and northeastern Utah during the Eocene Epoch (37 to 54 million years before present). Within this crustal warp were deposited as much as 3500 feet of lake sediments consisting of near-shore sands grading laterally to silt and clay toward the center of the basin. These deposits included organic-rich layers which accumulated on the lake bottom following periods when particularly abundant plant and animal life existed in the lake. Gradual lithification of the sediments produced the sandstone, shale, and marlstone of the Green River and Uinta Formations. The organic material contained in the marlstone was converted to a solid hydrocarbon, or kerogen. The kerogen-rich marlstone is commonly called oil shale. The principal geologic formations and their subunits (or members) underlying the Logan Wash property and surrounding areas are illustrated on the Geologic Index Map, Figure 3.

1. Introduction

The first step in the investigation of the field is to determine the scope of the problem. This involves a study of the literature and a consultation with the experts in the field. The next step is to determine the objectives of the investigation. This involves a study of the objectives of the organization and a consultation with the management.

The third step is to determine the methods of investigation. This involves a study of the methods used by other investigators and a consultation with the experts in the field. The fourth step is to determine the personnel of the investigation. This involves a study of the personnel of the organization and a consultation with the management.

The fifth step is to determine the data of the investigation. This involves a study of the data of the organization and a consultation with the management. The sixth step is to determine the results of the investigation. This involves a study of the results of the organization and a consultation with the management.

2. Objectives

The first objective of the investigation is to determine the scope of the problem. This involves a study of the literature and a consultation with the experts in the field. The second objective is to determine the objectives of the investigation. This involves a study of the objectives of the organization and a consultation with the management.

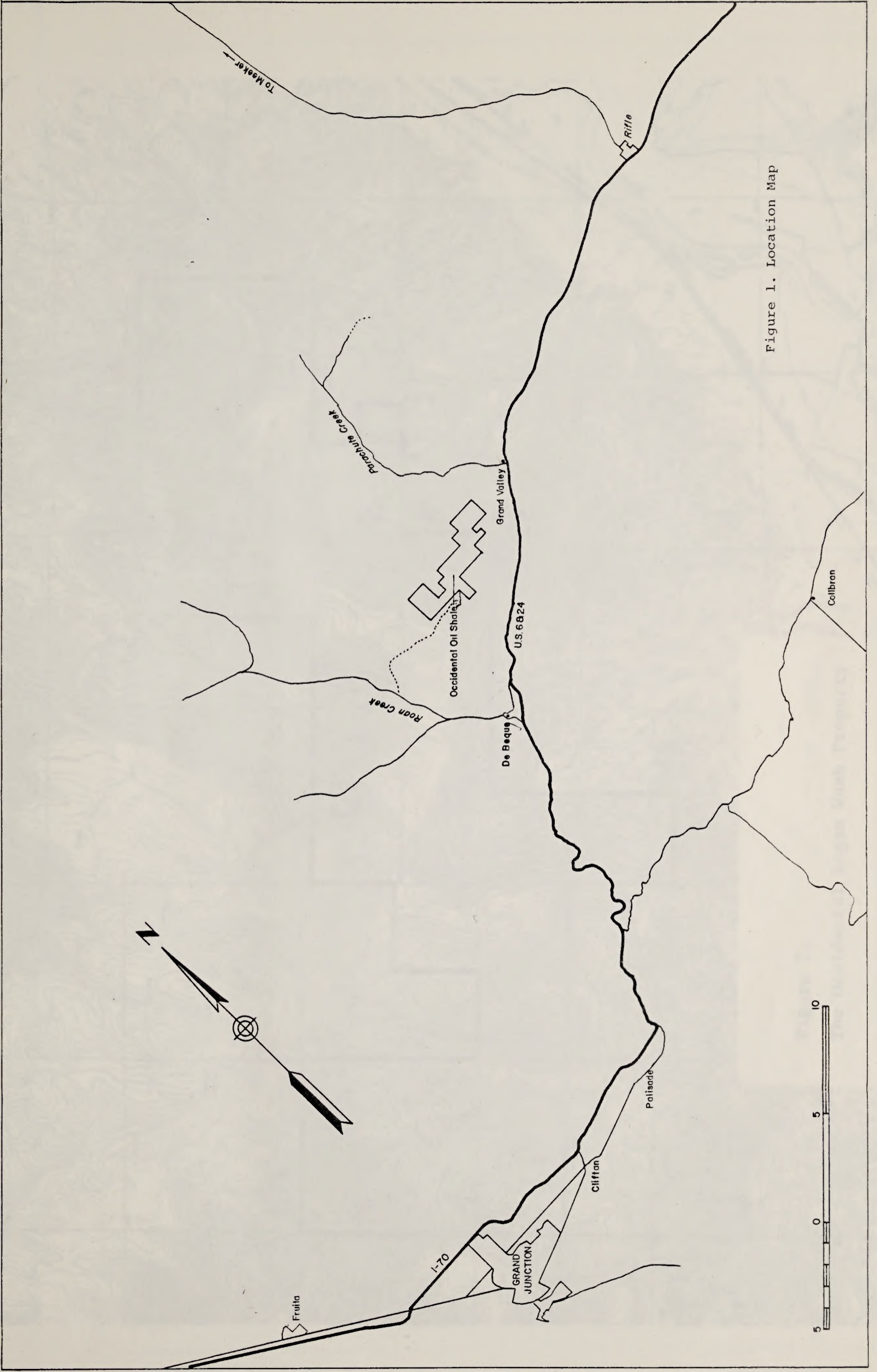


Figure 1. Location Map

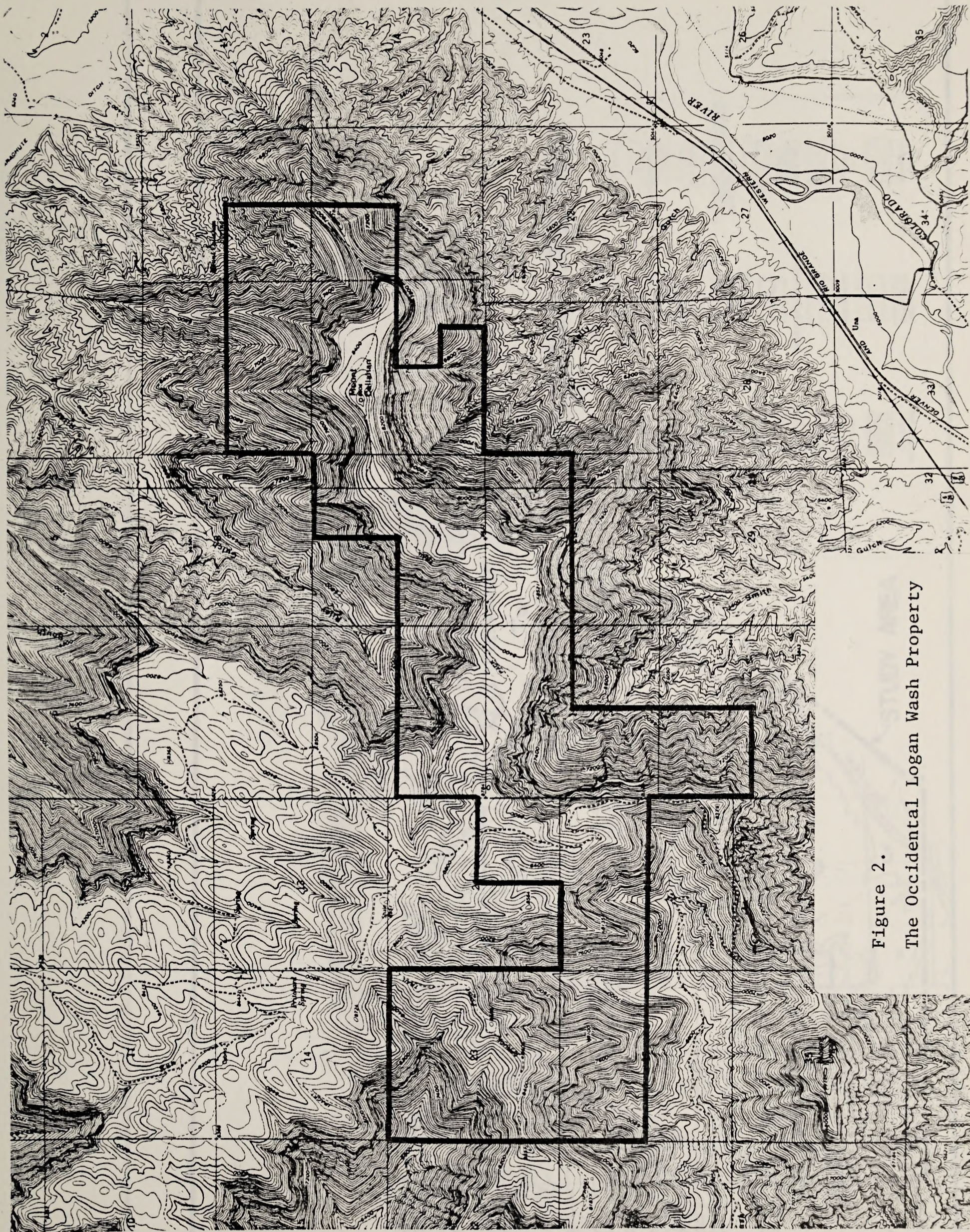
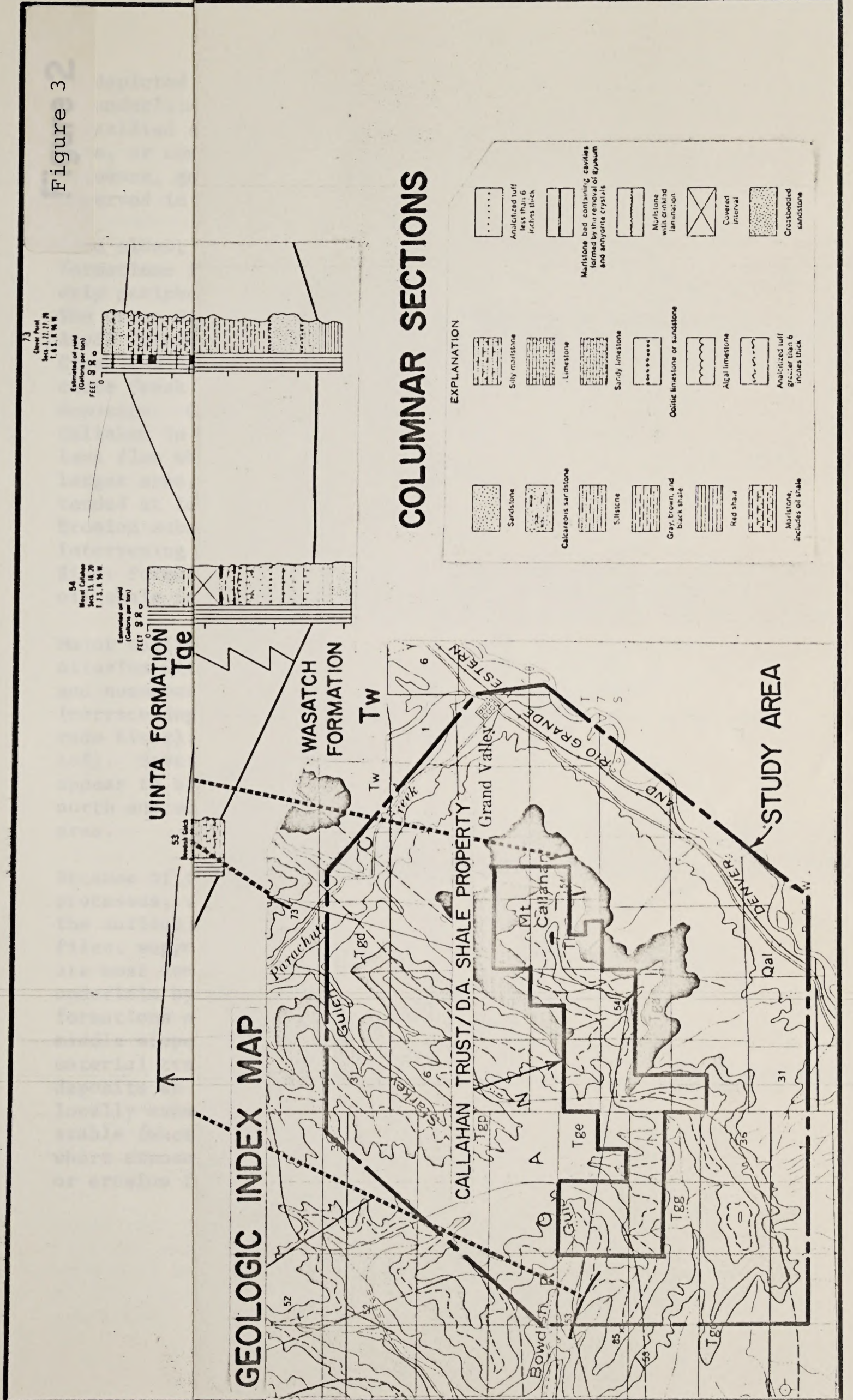
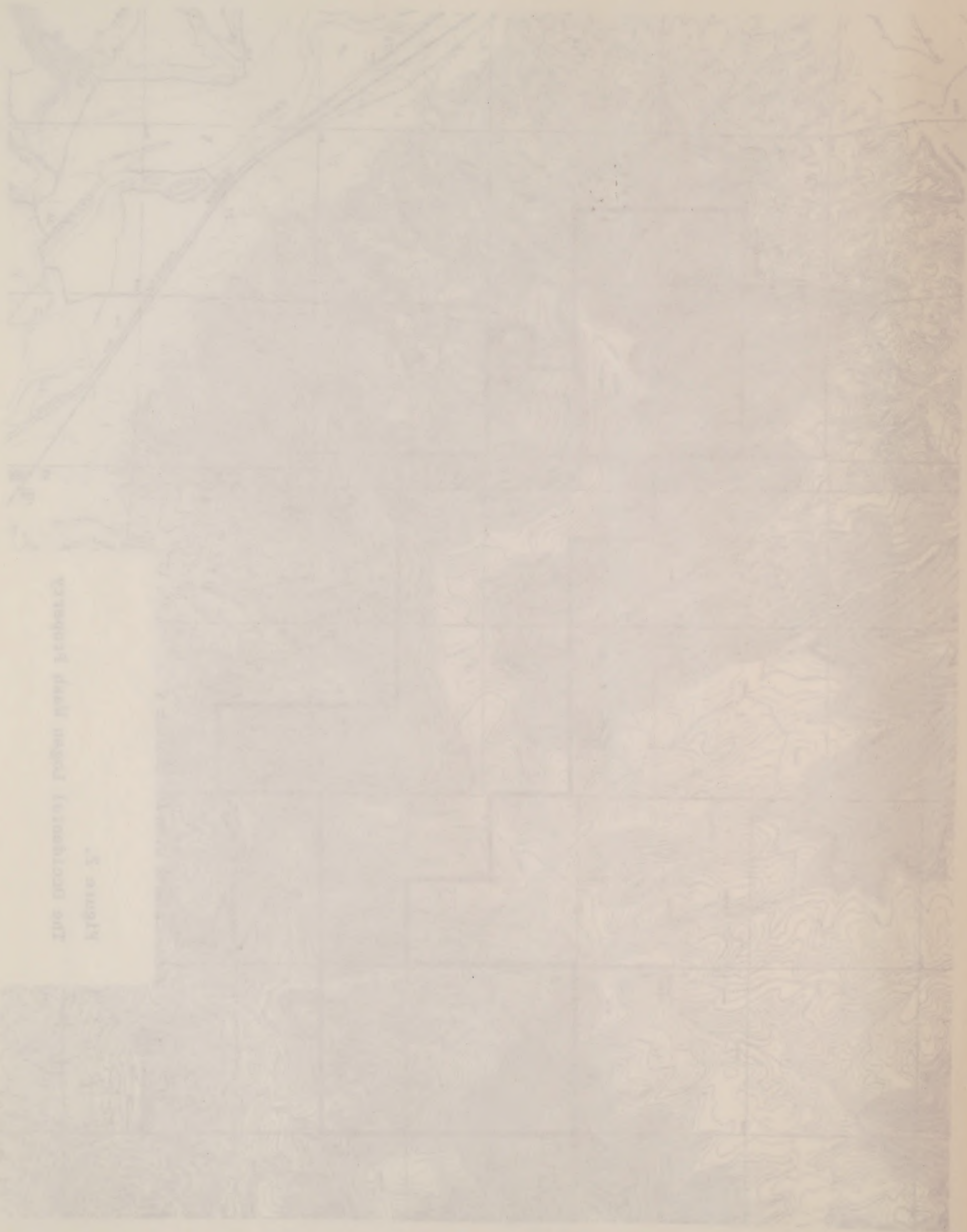


Figure 2.
The Occidental Logan Wash Property

Figure 3

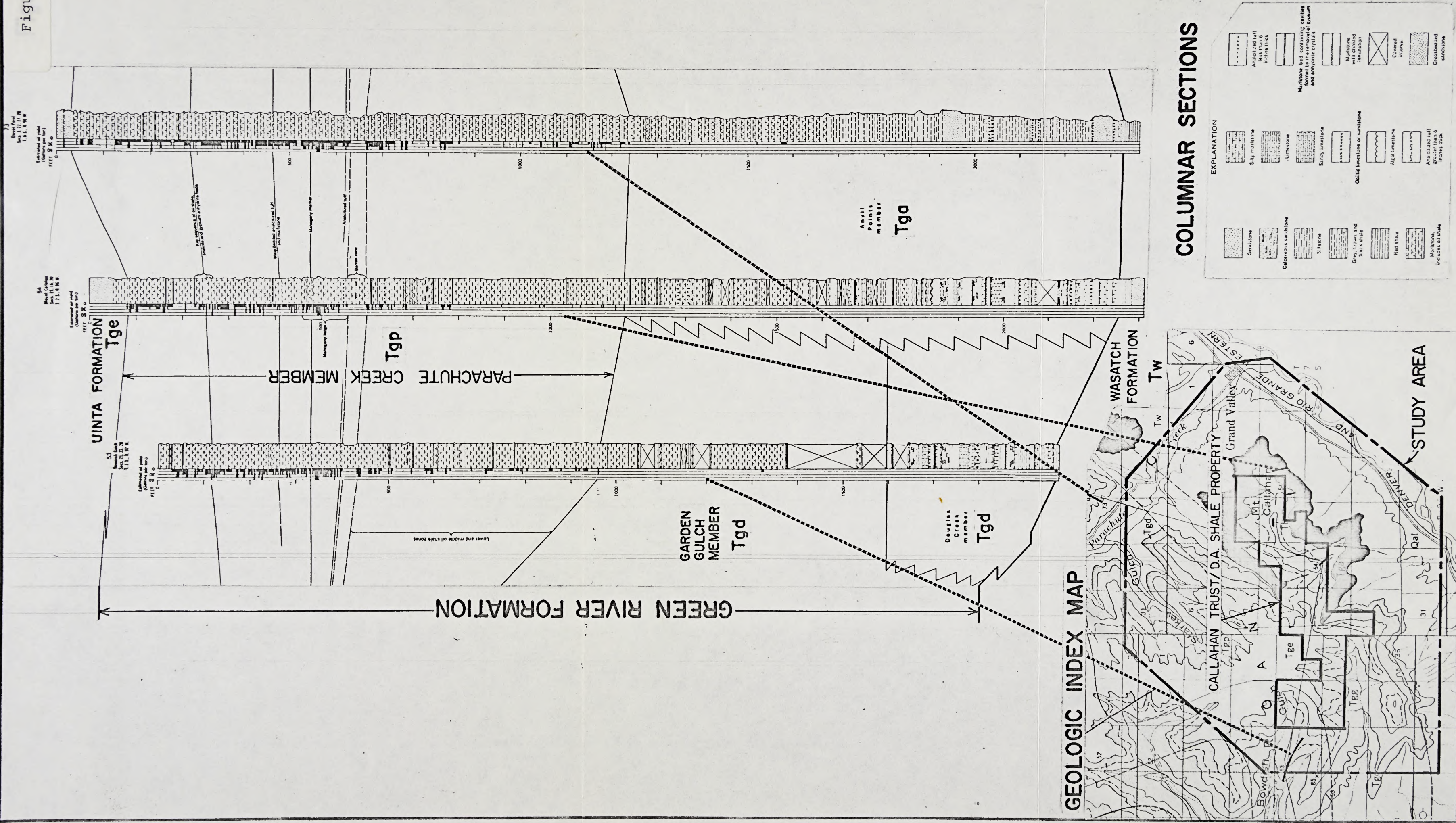




Где находится район реки Волга

Лист 5

Figure 3



GEOLOGIC INDEX MAP

COLUMNAR SECTIONS

EXPLANATION

[Symbol]	Sandstone	[Symbol]	Silty marlstone	[Symbol]	Marlstone bed containing cavities formed by the removal of brine and argillaceous crusts
[Symbol]	Siltstone	[Symbol]	Limestone	[Symbol]	Marlstone containing thin bedded laminae
[Symbol]	Shale	[Symbol]	Silty limestone	[Symbol]	Covered interval
[Symbol]	Gray, brown and black shale	[Symbol]	Shaly limestone	[Symbol]	Crossbedded sandstone
[Symbol]	Red shale	[Symbol]	Clastic limestone or sandstone		
[Symbol]	Marlstone, includes all shale	[Symbol]	Algal limestone		
[Symbol]		[Symbol]	Analized luff, greater than 6 inches thick		
[Symbol]		[Symbol]	Analized luff, less than 6 inches thick		

As depicted by the Geologic Index Map, the Logan Wash area is underlain by a sequence of essentially horizontally stratified sedimentary formations of Eocene age. Boundaries, or contacts between the various formations, as a consequence, generally follow the ground surface contours when observed in map view.

From oldest to youngest, and ascending in elevation, the formations include the Wasatch (at the southernly and easterly periphery of the area), the Green River, and the Uinta. The Green River Formation is further subdivided into the Anvil Points Member (which is equivalent to the Douglas Creek and Garden Gulch Members on the west), and the Parachute Creek Member containing the principal oil shale deposits. Overlying the Uinta Formation and capping Mt. Callahan in Section 16 is a small remnant of a basaltic lava flow which once undoubtedly covered a significantly larger area. It is believed to be part of a flow that extended at least to Grand Mesa about 25 miles to the south. Erosion subsequent to its formation has removed it from the intervening areas. Detailed columnar section of the Green River Formation are shown on the Geologic Index Map. The oil shale intervals are identified on the sections.

Major surficial deposits within the study area include the alluvium within the Colorado River valley, Parachute Creek, and numerous smaller valleys; remnants of older alluvium (terrace deposits on ridges about 800 feet above the Colorado River); talus deposits, slopewash, colluvium, and topsoil. Several areas of suspected ancient landslide deposits appear to affect portions of the Wasatch Formation, both north and south of the subject site but within the general area.

Because of the semi-arid climate and the normal erosional processes, very little residual soil remains in place at the surface as a result of bedrock weathering. Soil profiles, supporting varying densities and types of vegetation, are most common on north-facing slopes and those areas underlain by the more easily weathered, less resistant formations such as the Uinta and Wasatch. On the steeper middle slopes, the soil is developed from surficial rock material transported primarily by gravity and includes such deposits as colluvium, slopewash and talus. These materials, locally exceeding a depth of ten feet, can be relatively stable (where covered by vegetation) or only marginally stable, where exposed to continual creep movement, rock-fall action, or erosion from slope runoff.

2. Mineral Resources

The mineral resource of the Logan Wash site consists of approximately 300 feet of medium to low grade oil shale and nothing else. The Occidental process can use the entire ore body, i.e. "high grading" is neither necessary nor intended by Occidental.

The mineral resources of the new site consist of several hundred feet of oil shale of varying grade and of nahcolite and dawsonite deposits of potential economic value at considerable depths below the shale. Nahcolite and dawsonite are also present to a very minor extent in the shale zones, but these latter deposits are so dispersed and represent such low overall concentrations that it is deemed uneconomic to recover them.

3. Seismic Probability

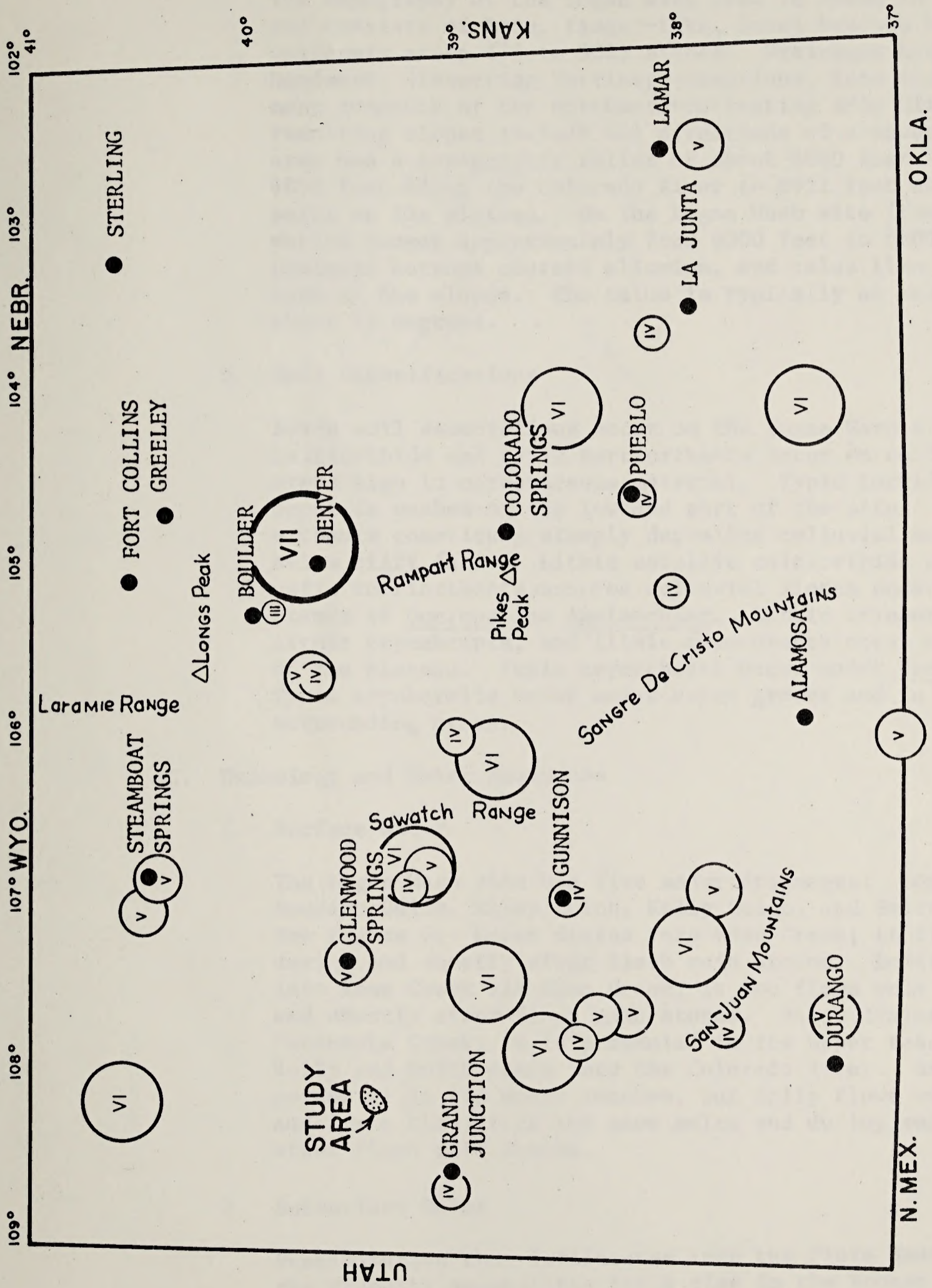
The Seismic Risk Map of the United States (U.S. Department of Commerce) includes all of Colorado within Zone 1, the lowest risk zone, on a scale ranging as high as Zone 3 (which includes California and portions of Utah, Idaho and Montana). Sites within Seismic Risk Zone 1 are subject to earthquake intensities ranging up to V and VI (Modified Mercalli Scale), which could cause minor damage to certain types of structures.

Past earthquake activity in Colorado has been in the western two-thirds, or west of the Front Range, and generally within 50 miles of the post-Oligocene-age extrusive volcanic rock areas. Refer to the Seismic Index Map, Figure 4, for the location of recorded earthquake epicenters during the period between 1880 and 1967. The largest historic earthquake was an intensity VII event occurring in 1967 near Denver. This earthquake had a Richter Magnitude of 5.3. As can be seen on the Seismic Index Map, the Logan Wash area has been relatively inactive. The epicenter closest to the site was the intensity V earthquake located approximately 40 miles east, at Glenwood Springs. Smaller, instrumentally recorded epicenters (not shown on the map) have been recorded as close as about 37 miles.

The Logan Wash area is also free of known major faults which could be sources of future seismic shaking or ground rupture risk (U.S. Geological Survey, 1959, Geological Map of Colorado). Faults have been mapped, however, as close as 10 to 15 miles south of the property, east of DeBeque Canyon.

It is anticipated that earthquake intensities at the site will not exceed the historic high for the state (VII modified Mercalli) and will most likely be considerably less because of the apparent absence of major faults and nearby historic epicenters.

SEISMIC INDEX MAP OF COLORADO



Earthquake Epicenters for Events 1880-1967
 (Showing Modified Mercalli Intensity)
 Modified from Hadsell, 1968
 Approximate Scale: 1" = 51 miles

LEIGHTON S4297

FIGURE 4

4. Topography

The topography of the Logan Wash area is shown in Figure 5 and consists of long, finger-like, level benches bounded by uniformly steep (70 to 90%) slopes. Drainages have worked headward, dissecting Tertiary formations, into the southernmost remnants of the northward-retreating Roan Cliffs. The resulting slopes include all directions of exposure. The area has a topographic relief of about 4000 feet, ranging from 4890 feet along the Colorado River to 8951 feet at the high point on the plateau. On the Logan Wash site itself, the elevation ranges approximately from 6000 feet to 8600 feet. Drainage bottoms contain alluvium, and talus lies against the base of the slopes. The talus is typically no steeper than about 37 degrees.

5. Soil Classifications

Seven soil associations occur on the Logan Wash site. Typic calciorthids and typic torriorthents occur on colluvial areas high in carbonaceous material. Typic torrifuvents occur in washes on the lowland part of the site. Scree and orthents constitute steeply deposited colluvial materials below cliff faces. Lithic ustollic calciorthids and lithic ustic torriorthents occur on colluvial slopes under dense stands of Quercus and Amelanchier. Lithic cryoborolls, lithic cryumbrepts, and lithic cryochrepts occur on uplands of the plateau. Typic cryorthents occur under Pseudotsuga. Typic cryoborolls occur under aspen groves and in surrounding areas.

C. Hydrology and Water Resources

1. Surface Water

The Logan Wash site has five major drainages: Logan Wash, Bowdish Gulch, Riley Gulch, Kelly Gulch, and Smith Gulch. See Figure 6. Logan drains into Roan Creek; it flows only during and shortly after flash rain storms. Bowdish drains into Roan Creek via Conn Creek; it too flows only during and shortly after flash rain storms. Riley drains into Parachute Creek; it is perennial in its upper reaches. Kelly and Smith drain into the Colorado River. Smith is perennial in its upper reaches, but Kelly flows only during and for a time after the snow melts and during and shortly after flash rain storms.

2. Subsurface Water

Precipitation that infiltrates into the Uinta Sandstone capping the property accumulates for a time in the Broken Zone at the top of the Parachute Creek Member of the Green River Formation and then moves downward, through fractures rather than intergranular spaces, through successive stratigraphic sections till

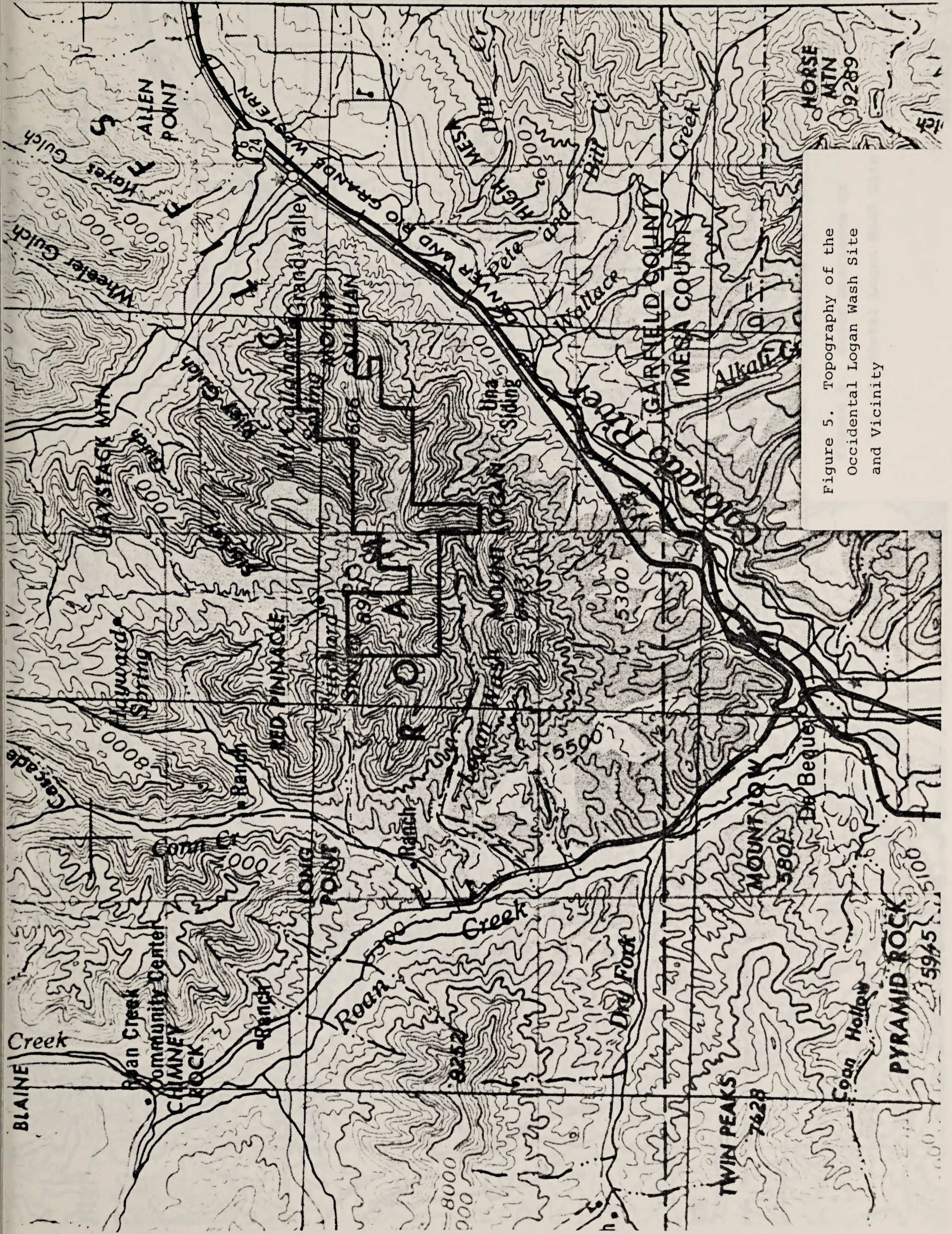


Figure 5. Topography of the Occidental Logan Wash Site and Vicinity

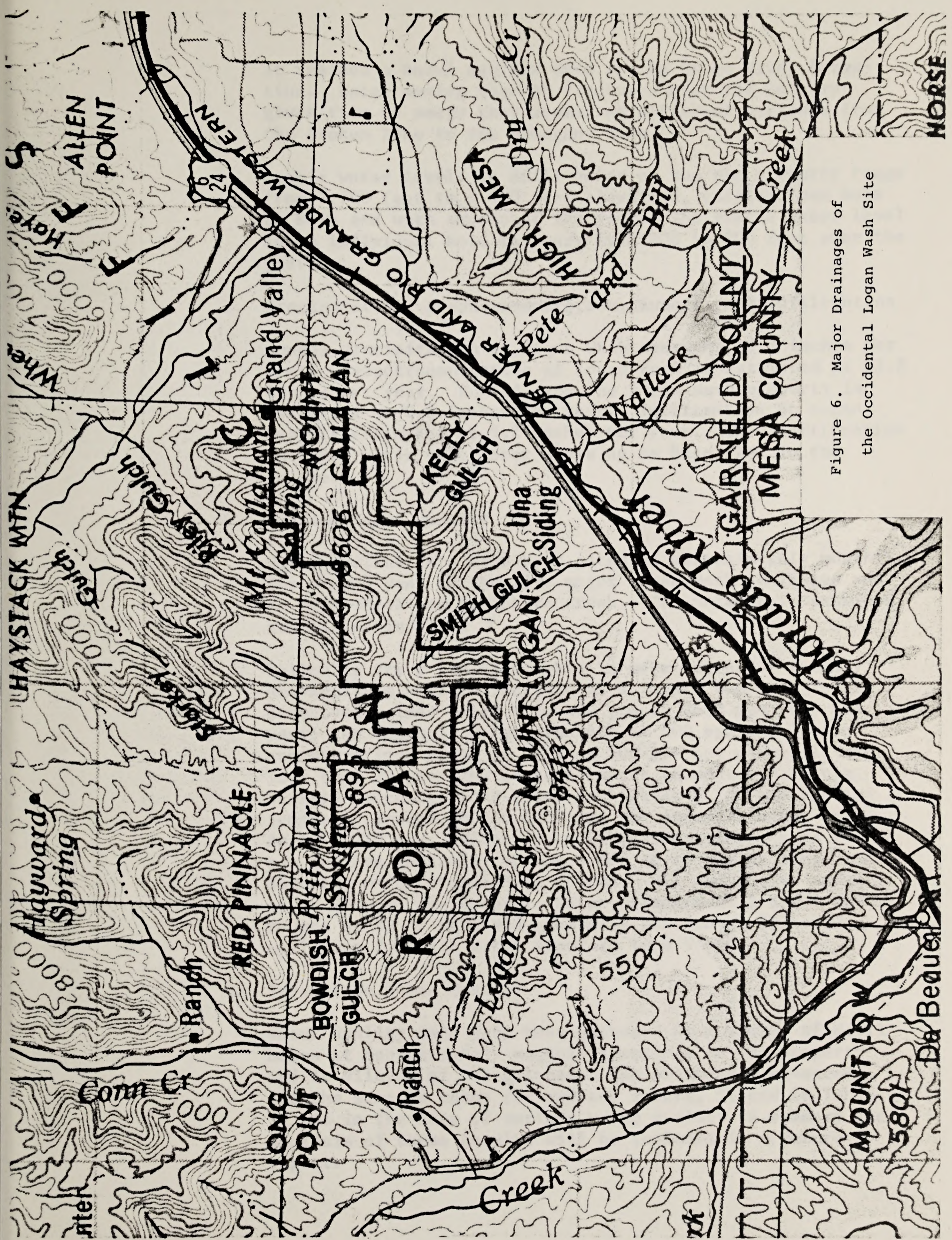


Figure 6. Major Drainages of
the Occidental Logan Wash Site

it reaches a basal aquifer deep in the Green River Formation. Water moving through fractures near the outcrop gives rise to seeps that appear at different horizons from the Broken Zone to the Mahogany Zone.

Static water levels in drill holes on top the property range from 7,700 feet to 8,400 feet elevation, varying from hole to hole and with season of the year. The static water level in an individual hole may vary from 200 to 300 feet over the year.

3. Precipitation, Evapotranspiration, Runoff, and Infiltration

Annual precipitation at Logan Wash averages 19.2 inches per year. Evapotranspiration at Logan Wash is estimated at 13.8 inches per year. Runoff from the Logan Wash property is estimated at 0.6 inches per year. Infiltration at Logan Wash is estimated at 5.2 inches per year. This infiltration includes water that later shows up as base flow in the gulches.

4. Surface Water Quality

Water quality data have been gathered approximately monthly for over a year on the five major Logan Wash drainages and on Roan Creek and Parachute Creek. The parameters examined are listed in Table 2.

Following are a few highlights; a more extensive summary and analysis will be included in a future report. Total dissolved solids range from 400 ppm to 2600 ppm over the year; the domestic water standard is 500 ppm. Chloride concentrations range as high as 100 ppm but generally are less than 20 ppm; the domestic water standard is 27 ppm. Sulfate concentrations range as high as 1,700 ppm but are generally around 300 to 600 ppm; the domestic water standard is 250 ppm. Nitrate concentrations range up to 19 ppm and are generally of the order of 10 ppm or less; the domestic water standard is 45 ppm. Oil and grease range up to 26 ppm; the domestic water standard is 2 ppm. BOD₅ ranges up to 66 mg/l and generally runs about 20 to 30 mg/l; the domestic water standard is 0.5 ppm.

5. Subsurface Water Quality

Water quality data have been gathered at a number of drill holes at approximately monthly intervals on the property and in alluvia of the gulches. The parameters measured are the same as those for surface waters, listed in Table 2. As in the case of surface water quality, a summary and analysis of these results will be included in a future report.

Table 2
Water Quality Parameters

Pesticides (Chlorinated), $\mu\text{g/l}$	Potassium, mg/l
Color, Platinum Cobalt Scale	Arsenic, mg/l
Specific Conductance, μmhos	Selenium, mg/l
Turbidity, FTU	Mercury, mg/l
pH	Cadmium, mg/l
Total Alkalinity, mg/l CaCO_3	Zinc, mg/l
Bicarbonate, mg/l CaCO_3	Iron, mg/l
Total Organic Carbon, mg/l	Magnesium, mg/l
Suspended Solids, mg/l	Calcium, mg/l
Soluble Solids, mg/l	Boron, mg/l
Volatile Solids, mg/l	Thallium, mg/l
Sulfate (SO_4), mg/l	Chromium, mg/l
Hardness, mg/l CaCO_3	Vanadium, mg/l
Chloride, mg/l	Cobalt, mg/l
Fluoride, mg/l	Nickel, mg/l
Chemical Oxygen Demand, mg/l	Strontium, mg/l
Odor, ASTM OII	Copper, mg/l
Fecal Coliform Bacteria, colonies/100 ml	Barium, mg/l
Phenol, mg/l	Manganese, mg/l
Phosphorus, mg/l	Silver, mg/l
Sulfite (SO_3), mg/l	Zirconium, mg/l
Bromide, mg/l	Titanium, mg/l
Nitrogen-Kjeldahl, mg/l	Molybdenum, mg/l
Nitrogen-Ammonium, mg/l	Antimony, mg/l
Nitrate, mg/l	Tin, mg/l
BOD ₅ , mg/l	Gallium, mg/l
Oil and Grease, mg/l	Lead, mg/l
Sulfide, mg/l	Aluminum, mg/l
Nitrite, mg/l	Beryllium, mg/l
Cyanide, mg/l	Yttrium, mg/l
Surfactants, mg/l	Scandium, mg/l
Silicon, mg/l	α , pCurie/l
Lithium, mg/l	β , pCurie/l
Sodium, mg/l	Radium 226, pCurie/l

D. Meteorology

1. Climate

The climate at Logan Wash is semi-arid with six to twenty inches of precipitation annually, depending upon elevation and topography. Temperatures range from about -20°F to $+90^{\circ}\text{F}$.

2. Surface Meteorology

South and southwest winds occur approximately 50% of the time in all seasons of the year. The next most frequent wind directions are from the north and north-northwest; these directions occur approximately 20% of the time in all seasons. The average wind speed in all seasons is about 13 mph (11.5 knots), with wind speeds under 3.5 mph (3 knots) occurring less than 3% of the time.

3. Upper Air Meteorology

Early morning and late afternoon rawinsonde flights generally show near-neutral or unstable thermal stratification with moderate-to-strong wind speeds in the first three thousand feet above the elevation of Mt. Callahan. Data were taken twice daily for one year. Upper-air wind and temperature data show good agreement with concurrent observations obtained at corresponding altitudes at Grand Junction, Colorado.

Strong surface temperature inversions almost never occur at Mt. Callahan. Measurements at Mt. Callahan of the temperature difference between the top and base of the 100 ft. tower, obtained as part of the hourly surface observation program, show that the temperature at the top of the tower exceeds the temperature at the tower base by 1.5°C or more about 17% of the time. However, positive temperature differences larger than 2.5° occurred only 0.5% of the time and there is only one case in which such differences persisted for more than three hours.

4. Normality of Measurement Period

The surface and upper air observations obtained during the one-year observation period at Mt. Callahan show that high dilution/dispersion conditions are present throughout the year. There is an almost complete absence of both calms and persistent strong temperature inversions typically present at lower elevations. The year of record at Mt. Callahan seems to be typical.

1. Meteorology

a. Climate

The climate of the region is semi-arid with an average annual rainfall of 10 inches. The temperature ranges from 10 to 40 degrees Celsius.

b. Seasonal Meteorology

Summer months are hot and dry with occasional light rain. Winter months are cool and wet with frequent rain. The monsoon season is from June to September.

c. Storms and Thunderstorms

Thunderstorms are common during the monsoon season, bringing heavy rain and strong winds. Tornadoes are rare but have been reported in the past.

Strong winds are common during the winter months, often bringing dust storms. The region is prone to drought during the dry season.

d. Availability of Water Resources

The availability of water resources is a major concern in the region. The main source of water is the Colorado River. There is a significant deficit of water during the dry season.

E. Societal Considerations

1. Community Populations and Characteristics

The overwhelming majority of Occidental employees have one of seven towns as their mailing addresses. The towns, all lying along the Colorado River and within an hour's drive of the mine or the office, are Fruita, Grand Junction, Clifton, Palisade, DeBeque, Grand Valley, and Rifle; see Figure 1. Since Occidental began operations at Logan Wash in mid-1972, the number of employees not living in these towns has averaged only eight to nine and has never exceeded twenty-eight. The number of employees claiming one of these towns as a mailing address has always totaled at least eighty-seven percent of the Occidental work force.

Fruita is a town of about 2000 people ten miles northwest of Grand Junction, just north of the Colorado River and Interstate Highway 70. The census tracts centered on Fruita have a population of about 6000. The community has a downtown area with a range of services, but much of the trade goes to Grand Junction. Many of the town's residents work in Grand Junction.

Grand Junction, located 51 miles by road southwest of the mine, is the county seat of Mesa County. With a population of about 27,000, it is the largest city in western Colorado. It is thus a regional commercial and service center for the Western Slope. The immediately surrounding population, when added to Grand Junction's own population, results in a total of about 60,000 people in the area. This latter figure includes the populations of Fruita, Clifton, and Palisade. The nearest larger communities are Provo, Utah, and Denver, Colorado, approximately 230 to 250 miles away.

Clifton is an unincorporated area seven miles east of Grand Junction. The census tracts centered on Clifton have a population of about 3500 to 4000. The community is less self-sufficient than Fruita and its residents rely heavily on Grand Junction for goods and services.

Palisade is a town of about 1000 people thirteen miles east of Grand Junction, lying between the Colorado River and Interstate Highway 70. The census tracts centered on Palisade have a population of about 2000. The town is part of the Grand Junction economy, with a downtown geared mostly to needs that are more neighborhood than regional in character.

DeBeque is a town of about 325 people in northern Mesa County, near the Garfield County line. It lies just east of Roan Creek and north of the Colorado River and Highways 6 and 24 and future Interstate Highway 70. The town is the most accessible community to Occidental's Logan Wash site, twelve miles by road to the north and east. It is 39 miles east of

Grand Junction. The town has minimal commerce and no professional services. Many of the town's residents commute to Grand Junction and Rifle for work; others, of course, work at the Occidental mine. The school district serving the town includes parts of both Mesa and Garfield Counties.

Grand Valley is a town of about 500 people 53 miles east of Grand Junction. The census tracts centered on Grand Valley have a population of perhaps 1000 to 1200. The town lies along the Colorado River on Highways 6 and 24 and future Interstate Highway 70, six and a half miles north and east of the Logan Wash site. The distance to the site by road, however, is 26 miles. A limited business district exists but not professional services. Most local citizens trade in Rifle or Grand Junction.

Rifle is a town of about 2750 people 69 miles east of Grand Junction. The census tracts centered on Rifle have a population of about 4000. The town lies on Interstate Highway 70 and Highway 13, making it a convenient business and service center for the surrounding area. The town provides retail shopping, medical and other professional services, a courtroom, and a hospital.

2. Development Trends

a. Fruita, Grand Junction, Clifton, and Palisade

It has not often been practical to obtain data on the growth of amenities and services in the individual communities of Fruita, Grand Junction, Clifton, and Palisade. These communities are, however, over fifty miles from the mine site and within thirteen miles of their own local population center. Thus, from the perspective of the mine, the four towns appear as a single population center and are treated as such.

Even as a group, it was difficult to obtain some data. However, these communities and their immediate environs contain over 90% of the population of Mesa County. Mesa County statistics were therefore used as a proxy for the towns' statistics.

Compound annual growth rates of population and number of households; employment and business payroll; assessed valuation; elementary and secondary school enrollment; social service caseloads; physicians, dentists, and lawyers in private practice; municipal court traffic cases and county court civil and criminal cases; accidents investigated, speeding tickets issued, and penalty assessment tickets issued by the State Patrol; and fire calls answered in the city and rural fire district for the period 1972 through 1975 are listed in Table 3.

Table 3

Annual Growth Rates in Mesa County, Colorado, 1972-1975

	<u>Annual Growth Rate</u>	<u>1975 Value</u>
Population	2.6%	61,500
Number of Households	2.8%	20,241
Employment, Non-Agricultural	8.1%	23,470 ¹
Business Payroll, 1967 dollars	9.1%	15,123,000 ²
Assessed Valuation, 1967 dollars	1.1%	64,879,000
Elementary School Enrollment, District 51 ³	2.5%	6,593
Elementary School Enrollment, Grand Junction and Clifton	5.8%	5,765
Secondary School Enrollment, District 51 ³	1.6%	6,870
Secondary School Enrollment, Grand Junction and Clifton	4.8%	5,491
Social Services Caseload	-4.9%	4,202
Physicians in Private Practice ⁴	5.2%	92
Dentists in Private Practice ⁴	4.6%	32
Lawyers in Private Practice ⁴	5.3%	70
Municipal Court Traffic Cases	13.3%	5,595
County Court Civil Cases	6.8%	907
County Court Criminal Cases	4.4%	3,856
Accidents Investigated by State Patrol	10.7%	1,265
Speeding Tickets Issued by State Patrol	12.1%	2,803
Penalty Assessment Tickets Issued by State Patrol	11.0%	4,624
Fire Calls ⁵	5.7%	659

¹1974 value.

²1973 value.

³School District 51 includes Fruita, Grand Junction, Clifton and Palisade and excludes Collbran and DeBeque.

⁴Excludes Collbran and DeBeque.

⁵Grand Junction City and Rural Fire District.

b. DeBeque

Compound annual growth rates of population, assessed valuation, and school enrollment for DeBeque for the period 1972 through 1975 are listed in Table 4.

c. Grand Valley

Compound annual growth rates of population, assessed valuation, school enrollment, and social service caseload for Grand Valley for the period 1972 through 1975 are listed in Table 5.

d. Rifle

Compound annual growth rates of population; residential building permits; assessed valuations; school enrollments; social service caseloads; physicians, dentists, and lawyers in private practice; and municipal court traffic cases and county court civil and criminal cases for Rifle for the period 1972 through 1975 are listed in Table 6.

3. Land

a. Ownership

The ownership of land immediately surrounding the Logan Wash site is shown in Figure 7. The owners are the United States Government, several oil companies, and other private interests.

b. Land Use

The Logan Wash site is used for summer range by cattle. It has no other use. Except for a small amount of land that is needed for surface facilities, the surface is not disturbed or altered. Significant new surface construction is not contemplated, and the land may continue to be used for grazing during the proposed program.

4. Water Use

The Logan Wash site is not a source of surface water for any domestic or industrial use. Springs and streams serve wildlife and cattle. No change in the use of surface water is envisioned.

1. Introduction

The purpose of this study is to investigate the effects of various factors on the growth and development of the plant species under study. The study was conducted over a period of 12 weeks, with data recorded at regular intervals.

2. Materials and Methods

The study was conducted in a controlled environment. The plants were grown in pots of equal size and capacity. The soil used was a standard potting mix. The plants were watered and fertilized according to a standard schedule. The data recorded included height, leaf number, and biomass.

3. Results

The results of the study show that the plants grown under the control conditions showed a steady increase in height and biomass over the 12-week period. The plants treated with the growth hormone showed a significantly higher rate of growth, particularly in the first 6 weeks. The data is presented in Table 1.

4. Discussion

a. Growth Rate

The growth rate of the plants under study was significantly higher in the treatment group compared to the control group. This suggests that the growth hormone has a positive effect on plant growth. The increase in growth rate was most pronounced in the first 6 weeks of the study.

b. Biomass Accumulation

The biomass of the plants in the treatment group increased significantly over the 12-week period. This indicates that the growth hormone not only increases the rate of growth but also leads to a greater accumulation of biomass. The increase in biomass was consistent throughout the study.

5. Conclusion

The study concludes that the growth hormone has a significant positive effect on the growth and development of the plant species under study. The treatment group showed a higher rate of growth and a greater accumulation of biomass compared to the control group. These findings have important implications for agricultural practices.

Table 4

Annual Growth Rates in DeBeque, Colorado, 1972-1975

	<u>Annual Growth Rate</u>	<u>1975 Value</u>
Population	17.9%	325
Assessed Valuation, Residential, 1967 dollars	23.3%	986
Assessed Valuation, Total, 1967 dollars ¹	-8.01%	1,810,000 ²
Assessed Valuation, Total, 1967 dollars ³	-1.01%	115,000
Public School Enrollment	8.1%	151

¹Garfield County part of the DeBeque School District, JT-49.

²1974 value.

³Mesa County part of the DeBeque School District, JT-49.

Table 2

Annual Growth Rates in Output, 1973-1975

Year	Annual Growth Rate	Annual Growth Rate	Annual Growth Rate
1973	17.9%	17.9%	17.9%
1974	15.3%	15.3%	15.3%
1975	15.0%	15.0%	15.0%
1976	14.0%	14.0%	14.0%
1977	13.0%	13.0%	13.0%
1978	12.0%	12.0%	12.0%
1979	11.0%	11.0%	11.0%
1980	10.0%	10.0%	10.0%
1981	9.0%	9.0%	9.0%
1982	8.0%	8.0%	8.0%
1983	7.0%	7.0%	7.0%
1984	6.0%	6.0%	6.0%
1985	5.0%	5.0%	5.0%
1986	4.0%	4.0%	4.0%
1987	3.0%	3.0%	3.0%
1988	2.0%	2.0%	2.0%
1989	1.0%	1.0%	1.0%
1990	0.0%	0.0%	0.0%
1991	-1.0%	-1.0%	-1.0%
1992	-2.0%	-2.0%	-2.0%
1993	-3.0%	-3.0%	-3.0%
1994	-4.0%	-4.0%	-4.0%
1995	-5.0%	-5.0%	-5.0%
1996	-6.0%	-6.0%	-6.0%
1997	-7.0%	-7.0%	-7.0%
1998	-8.0%	-8.0%	-8.0%
1999	-9.0%	-9.0%	-9.0%
2000	-10.0%	-10.0%	-10.0%
2001	-11.0%	-11.0%	-11.0%
2002	-12.0%	-12.0%	-12.0%
2003	-13.0%	-13.0%	-13.0%
2004	-14.0%	-14.0%	-14.0%
2005	-15.0%	-15.0%	-15.0%
2006	-16.0%	-16.0%	-16.0%
2007	-17.0%	-17.0%	-17.0%
2008	-18.0%	-18.0%	-18.0%
2009	-19.0%	-19.0%	-19.0%
2010	-20.0%	-20.0%	-20.0%
2011	-21.0%	-21.0%	-21.0%
2012	-22.0%	-22.0%	-22.0%
2013	-23.0%	-23.0%	-23.0%
2014	-24.0%	-24.0%	-24.0%
2015	-25.0%	-25.0%	-25.0%
2016	-26.0%	-26.0%	-26.0%
2017	-27.0%	-27.0%	-27.0%
2018	-28.0%	-28.0%	-28.0%
2019	-29.0%	-29.0%	-29.0%
2020	-30.0%	-30.0%	-30.0%
2021	-31.0%	-31.0%	-31.0%
2022	-32.0%	-32.0%	-32.0%
2023	-33.0%	-33.0%	-33.0%
2024	-34.0%	-34.0%	-34.0%
2025	-35.0%	-35.0%	-35.0%

Source: Bureau of Economic Analysis, Department of Commerce, Washington, D.C. 20540. All figures are in constant 1982 dollars.

Table 5

Annual Growth Rates in Grand Valley, Colorado, 1972-1975

	<u>Annual Growth Rate</u>	<u>1975 Value</u>
Population	13.1%	500
Residential Assessed Valuation, School District, 1967 Dollars	24.2%	344,000
Total Assessed Valuation, School District, 1967 Dollars	-4.6%	2,019,000 ¹
Total Assessed Valuation, Town, 1967 Dollars	2.4%	294,000 ¹
Elementary School Enrollment	5.0%	95
Secondary School Enrollment	22.1%	82
Total School Enrollment	9.0%	177
Social Services Caseload	-4.6%	58

¹1974 value.

Table 7

Annual County Income in Cents for 1971-1972

Category	1971	1972
Population	11.12	10.00
Residential (including mobile homes)	24.12	24,000
Commercial (including hotels, motels, etc.)	4.02	1,019,000
Local government (including town, city, village)	1.12	134,000
Elementary school enrollment	1.02	42
Secondary school enrollment	12.12	23
Total school enrollment	13.14	65
Postal service (carriers)	1.12	28

1972-1973

Table 6

Annual Growth Rates in Rifle, Colorado, 1972-1975

	<u>Annual Growth Rate</u>	<u>1975 Value</u>
Population, Town	10.5%	2,750
Population, Urban Area	11.0%	4,870 (est.)
Single Family Building Permits	140.0%	23
Total Residential Building Permits, No. of Units	169.0%	29
Residential Assessed Valuation, 1967 Dollars	47.3%	3,321,000
Total Assessed Valuation, School District, 1967 Dollars	-4.4%	9,843,000 ¹
Total Assessed Valuation, Town, 1967 Dollars	-1.5%	2,766,000 ¹
Elementary School Enrollment	5.7%	851
Secondary School Enrollment	6.9%	720
Total School Enrollment	6.6%	1,571
Social Service Caseload	4.9%	257
Physicians in Private Practice	18.6%	5
Dentists in Private Practice	35.8%	2.5
Lawyers in Private Practice	25.7%	5
Municipal Court Traffic Cases	11.0%	423
County Court Civil Cases	16.2%	48
County Court Criminal Cases	48.0% ²	65

¹1974 value.

²The trend in criminal court cases is not stable and 48% is at best a crude estimate of the recent history.

Table 2

Annual Growth Rates in 1974, 1975, and 1976

Variable	1974	1975	1976
Population	1.3%	1.5%	1.8%
Investment	15.5%	16.2%	17.1%
Government Expenditure	18.2%	19.1%	20.5%
Total Expenditure	16.8%	17.5%	18.4%
Household Consumption	12.1%	12.8%	13.5%
Government Expenditure	15.5%	16.2%	17.1%
Total Expenditure	14.3%	15.0%	15.8%
Government Expenditure	18.2%	19.1%	20.5%
Household Consumption	12.1%	12.8%	13.5%
Total Expenditure	15.1%	15.9%	16.7%
Government Expenditure	15.5%	16.2%	17.1%
Household Consumption	12.1%	12.8%	13.5%
Total Expenditure	13.8%	14.5%	15.2%
Government Expenditure	18.2%	19.1%	20.5%
Household Consumption	12.1%	12.8%	13.5%
Total Expenditure	15.1%	15.9%	16.7%
Government Expenditure	15.5%	16.2%	17.1%
Household Consumption	12.1%	12.8%	13.5%
Total Expenditure	13.8%	14.5%	15.2%

The data in this table are based on the annual reports of the relevant agencies.

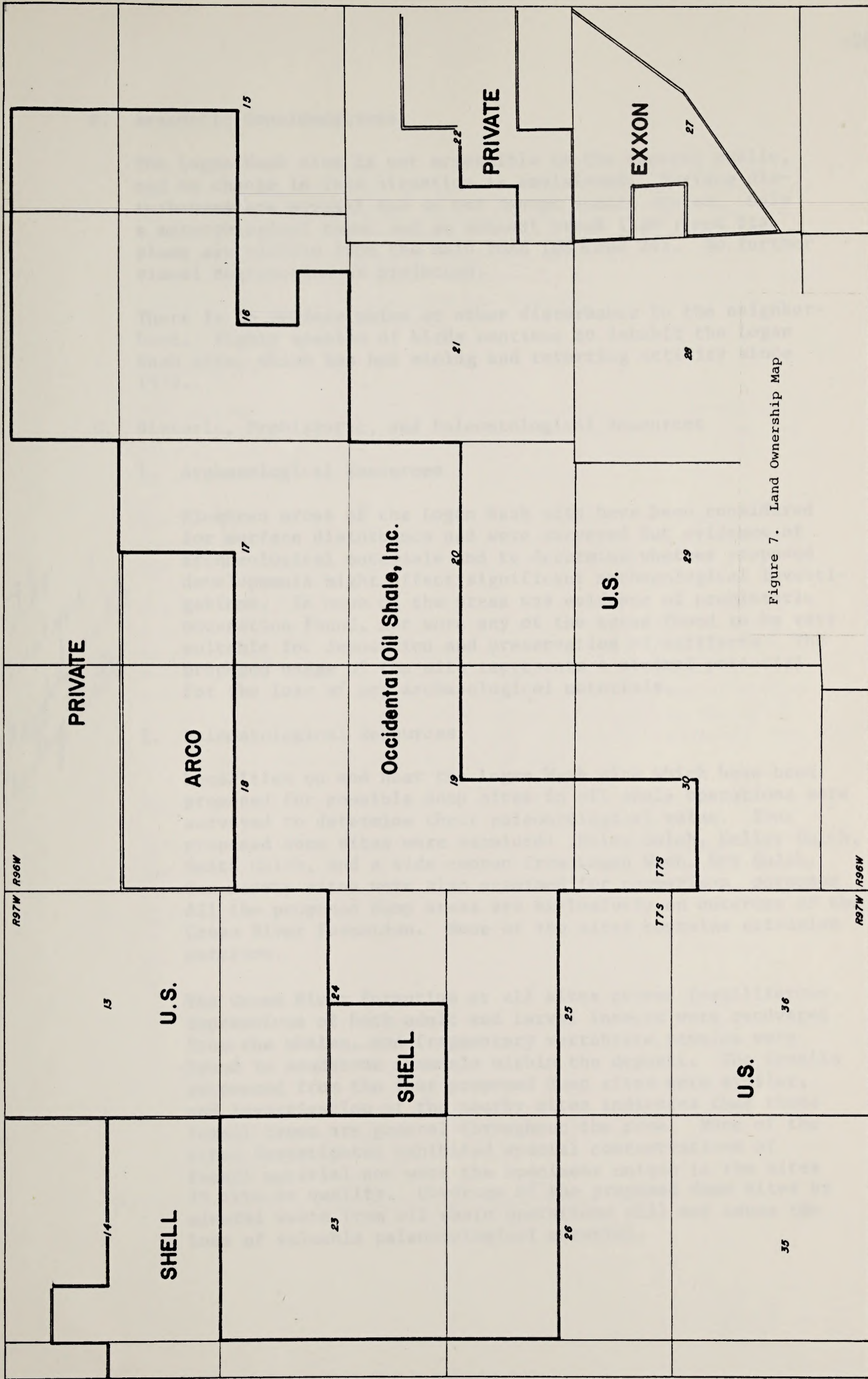


Figure 7. Land Ownership Map

F. Aesthetic Considerations

The Logan Wash site is not accessible to the general public, and no change in this situation is envisioned. Surface disturbances are minimal and do not damage scenic vistas. Only a meteorological tower and an exhaust stack (130') and its plume are visible from the main road (US 6 and 24). No further visual degradation is projected.

There is no serious noise or other disturbance to the neighborhood. Eighty species of birds continue to inhabit the Logan Wash site, which has had mining and retorting activity since 1972.

G. Historic, Prehistoric, and Paleontological Resources

1. Archaeological Resources

Nineteen areas of the Logan Wash site have been considered for surface disturbance and were surveyed for evidence of archaeological materials and to determine whether proposed developments might affect significant archaeological investigations. In none of the areas was evidence of prehistoric occupation found, nor were any of the areas found to be very suitable for deposition and preservation of artifacts. The proposed usage of the site represents a minimal potential for the loss of any archaeological materials.

2. Paleontological Resources

Localities on and near the Logan Wash site which have been proposed for possible dump sites in oil shale operations were surveyed to determine their paleontological value. Four proposed dump sites were examined: Riley Gulch, Kelley Gulch, Smith Gulch, and a side canyon from Logan Wash, Dry Gulch. Two nearby sites were also examined for comparison purposes. All the proposed dump areas are exclusively on outcrops of the Green River Formation. None of the sites contains extensive outcrops.

The Green River Formation at all sites proved fossiliferous. Impressions of both adult and larval insects were recovered from the shales, and fragmentary vertebrate remains were found in sandstone channels within the deposit. The fossils recovered from the four proposed dump sites were similar, and investigation of the nearby sites indicates that these fossil types are general throughout the area. None of the sites investigated exhibited special concentrations of fossil material nor were the specimens unique to the sites in type or quality. Coverage of the proposed dump sites by mineral waste from oil shale operations will not cause the loss of valuable paleontological material.

*Who did the profiles - analysis?
Does it comply with Fed. Antiquity Act?*

4. Analysis of the material

The first part of the report is devoted to the general description of the material and its origin. It is followed by a detailed description of the material and its properties. The results of the analysis are given in the following tables.

There is no further information on the material. The results of this analysis are given in the following tables. This also includes the results of the analysis of the material.

5. Results of the analysis

5.1. General description

The first part of the report is devoted to the general description of the material and its origin. It is followed by a detailed description of the material and its properties. The results of the analysis are given in the following tables.

5.2. Detailed description

The first part of the report is devoted to the general description of the material and its origin. It is followed by a detailed description of the material and its properties. The results of the analysis are given in the following tables.

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H. Political Considerations

Prior surveys of residents and local public officials indicate that people in the area of the Logan Wash site generally favor an experimental oil shale development that provides jobs and income and that does not have a significant adverse impact on the physical environment.¹ Feelings about population growth and its consequences vary. Occidental, however, does not contemplate adding personnel for the proposed project, thereby making the latter point moot.

I. Economic Environment

The proposed project will be a continuation of an existing operation, and growth in employment is not contemplated. New employees will not be imported. Land now in agriculture will not be removed from agriculture by the project.

The average annual wage of Occidental employees is \$13,266. Average annual wages in Mesa and Garfield Counties are \$7,218 and \$7,480, respectively (all in 1975 dollars).

During the time that Occidental has been active at Logan Wash, i.e. since mid-1972, social service caseloads have declined at annual rates of 4.6% in Grand Valley and 4.9% in Mesa County. There appear to be no social service cases in DeBeque for public assistance or food stamps. Rifle shows an increase of 4.9% p.a. in social service caseload, but it is only half of the 10.5% p.a. growth rate of the population. Further, Occidental employees represent a zero net influx into Rifle.

J. Institutional Considerations

Refer to the Appendix for a listing of relevant regulations and responsibilities to local, state, and federal government.

K. Biological Environment

1. Flora

One hundred eighty-four species of vascular plants were recorded on the Logan Wash property. These include 7 trees, 25 shrubs, 16 grasses, 134 forbs, and 2 succulents. Five grasses and two forbs could not be identified. Ninety-one percent of the plant species are native to the site. There are ten vegetation communities on and near the site. The vegetation is typical of the Roan Cliffs.

¹C-b Shale Oil Project, Socio-Economic Assessment, Section IX (1976).

2. Statistical description

The statistical description of the data is given in Table 1. The data were obtained from a series of experiments in which the subjects were asked to perform a task under various conditions. The results are presented in terms of the number of correct responses and the time taken to complete the task. The data are analyzed using a two-way analysis of variance, with the factors being the number of trials and the number of subjects. The results show that the number of correct responses increases with the number of trials, and that the time taken to complete the task decreases with the number of trials. The analysis also shows that there are significant differences between the different groups of subjects.

3. Results and discussion

The results of the experiments are shown in Table 2. The data show that the number of correct responses increases with the number of trials, and that the time taken to complete the task decreases with the number of trials. The analysis also shows that there are significant differences between the different groups of subjects. The results are discussed in terms of the underlying cognitive processes that are involved in the task.

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4. Conclusions

The results of the experiments show that the number of correct responses increases with the number of trials, and that the time taken to complete the task decreases with the number of trials. The analysis also shows that there are significant differences between the different groups of subjects.

5. References

The results of the experiments are shown in Table 2. The data show that the number of correct responses increases with the number of trials, and that the time taken to complete the task decreases with the number of trials. The analysis also shows that there are significant differences between the different groups of subjects. The results are discussed in terms of the underlying cognitive processes that are involved in the task.

The results of the experiments are shown in Table 2. The data show that the number of correct responses increases with the number of trials, and that the time taken to complete the task decreases with the number of trials. The analysis also shows that there are significant differences between the different groups of subjects.

2. Vegetation Potential

Experiments are underway to determine how best to vegetate raw mineral waste. Results to date indicate that it is possible to vegetate raw shale with little difficulty. Spent shale is not brought to the surface and does not need to be vegetated.

3. Fauna

Twenty-five species of mammals, eighty species of birds, and seven species of reptiles have been recorded at the Logan Wash site. No fish or amphibians have been noted. Included among the mammals are fifteen rodent species and seven carnivore species. The reptiles include three snake species and four lizard species. The distribution of species according to habitat has been recorded for four seasons of the year.

4. Threatened and Endangered Plants and Animals

a. Plants

One species found on the Logan Wash site, Astragalus lutosus, is classified "endangered." It has been found to be fairly abundant on steep scree-colluvial slopes of the Green River Formation, where lack of access and dangerous topography probably inhibited previous discovery.

A new record is festuca dasyclada, which was listed as "possibly extinct." Festuca dasyclada has been found to occur throughout Garfield County, Colorado, on steep, xeric scree-colluvial slopes at the contact of the Upper Parachute Creek Member of the Green River Formation and the Uinta Sandstone Formation.

b. Animals

There appears to be no rare or endangered animal species residing on the Logan Wash property or immediate environs. Prairie and Peregrine Falcons have been sighted over the area, but detailed studies have shown neither to be nesting there.

L. Facilities

No increase in Occidental employment at Logan Wash is contemplated for the proposed project. Consequently, there will be no new demand for housing, schools, public health facilities, recreation facilities, or points of interest as a result of the project.

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Utilities adequate to serve the project itself are already installed. No new demands are projected.

Transportation to and from the site is and will continue to be by motor vehicle. Supplies and product oil are trucked. Personnel travel by personal vehicles and car pools. No increase in transportation service is envisioned during the project.

Public safety manpower and equipment requirements will not be affected by the proposed project. As mentioned above, there will be no increases in motor vehicle travel or population to give rise to an increased need for public safety manpower or equipment.

III. Potential Environmental Impacts

A. Construction Phase

No new surface construction is contemplated at the Logan Wash site. Consequently, there will be no environmental impacts associated with such activities.

B. Operational Phase

1. Effects on Water

A study of the hydrology of the Logan Wash site is underway and will be continued during the proposed project as part of the environmental research plan. The objective of the study is to develop an accurate model of the existing surface and subsurface hydrologic system (water balance) so that the effect on the environment of any mining, retorting, and waste disposal activity can be predicted and adequately monitored. A water balance for the operations is also being developed.

Drill holes extending 800 feet below the surface to the lower reaches of the ore are being used to obtain water quality samples monthly and to measure water level seasonally. Slug tests have been made in three locations on the plateau in the upper Green River formation to measure transmissibilities and storage constants. The Green River formation below the ore is being monitored, at the elevation of the mineral waste pile. Observation wells in the alluvia of nearby gulches are being monitored seasonally. Streams carrying runoff from the property are being studied in terms of maximum flow, seasonal water quality, and actual seasonal flow.

Water depth will be monitored monthly and water quality will be monitored seasonally in existing wells during the project. Additional holes may be monitored to determine the extent of any changes if the holes in the immediate vicinity of the

10. The Commission shall have the right to request the necessary information from the Member States and to conduct the necessary investigations.

11. The Commission shall have the right to request the necessary information from the Member States and to conduct the necessary investigations.

12. The Commission shall have the right to request the necessary information from the Member States and to conduct the necessary investigations.

III. Financial Provisions

A. Contributions

1. The contributions shall be paid by the Member States in accordance with the provisions of the Treaty.

B. Expenditure

1. Personnel

The Commission shall have the right to request the necessary information from the Member States and to conduct the necessary investigations.

The Commission shall have the right to request the necessary information from the Member States and to conduct the necessary investigations.

The Commission shall have the right to request the necessary information from the Member States and to conduct the necessary investigations.

mine show significant effects. Stream gauging and seasonal water quality monitoring will be continued during the project. Present flume installations will be improved in light of recent storm data. An evaporation pan is being installed and a lysimeter is being considered.

Water quality will be analyzed during the project according to a list containing approximately half the parameters listed in Table 2. The exact list has not yet been determined. The purpose in shortening the list is to allow more samples to be monitored without increasing the cost of the analysis program. These data will be used to identify any adverse effects that require corrective action.

From time to time, slightly more water is produced than is needed for current activities. The sources of water are mine water and water produced in retorting. There is also process water, which is either mine water or retort water that has subsequently been used in the process. Much of the excess is contained in underground sumps in the mine for later use. Any residual excess is evaporated on the surface of the mineral waste disposal pile in such a way that neither surface nor sub-surface waters are degraded. This approach was developed in consultation with the Water Quality Control Division of the Colorado Department of Health, and the procedure will be continued during the proposed project.

There are no adverse impacts on water apparent which cannot be avoided. Monitoring of wells, surface streams, and the rock near underground oil and water sumps will be used to assure that this condition indeed exists.

Leaching of spent retorts and contamination of ground water is a possible long-term effect which will be mitigated. Isolation of the shale, diversion of potential leachate, and deliberate leaching of soluble salts are possible ways to prevent long-term leaching. Retort data indicate that deliberate leaching is indeed a viable possibility, and laboratory leaching studies are now underway to determine optimum amounts of water and time required. The studies will be extended to retort experiments if the laboratory results are favorable. Isolation of spent shale and diversion of potential leachate will also be considered as alternative means of controlling ground water pollution from spent shale retorts.

← Glen

No beneficial impacts on the hydrology are envisioned.

2. Effects on Land

Refer to Figures 6, 8, and 9 for maps and photographs of the Logan Wash area. Note the mineral waste disposal pile in Figures 8 and 9, in Dry Gulch, off Logan Wash. This disposal pile was approved by Garfield County after review by eleven state and federal agencies.

and show significant effects. The results of the analysis are given in Table 1. The results show that the effect of the treatment is significant at the 5% level. The results also show that the effect of the treatment is significant at the 1% level.

Table 1. Results of the analysis of variance. The results show that the effect of the treatment is significant at the 5% level. The results also show that the effect of the treatment is significant at the 1% level.

from time to time, although some water is consumed during the period for nutrient utilization. The results of the analysis are given in Table 2. The results show that the effect of the treatment is significant at the 5% level. The results also show that the effect of the treatment is significant at the 1% level.

Table 2. Results of the analysis of variance. The results show that the effect of the treatment is significant at the 5% level. The results also show that the effect of the treatment is significant at the 1% level.

The results of the analysis of variance are given in Table 3. The results show that the effect of the treatment is significant at the 5% level. The results also show that the effect of the treatment is significant at the 1% level.

The results of the analysis of variance are given in Table 4. The results show that the effect of the treatment is significant at the 5% level. The results also show that the effect of the treatment is significant at the 1% level.

Table 5

The results of the analysis of variance are given in Table 5. The results show that the effect of the treatment is significant at the 5% level. The results also show that the effect of the treatment is significant at the 1% level.



Mineral Waste
Disposal Pile

Figure 8. Aerial Photograph of
the Occidental Logan Wash Site
and Vicinity.

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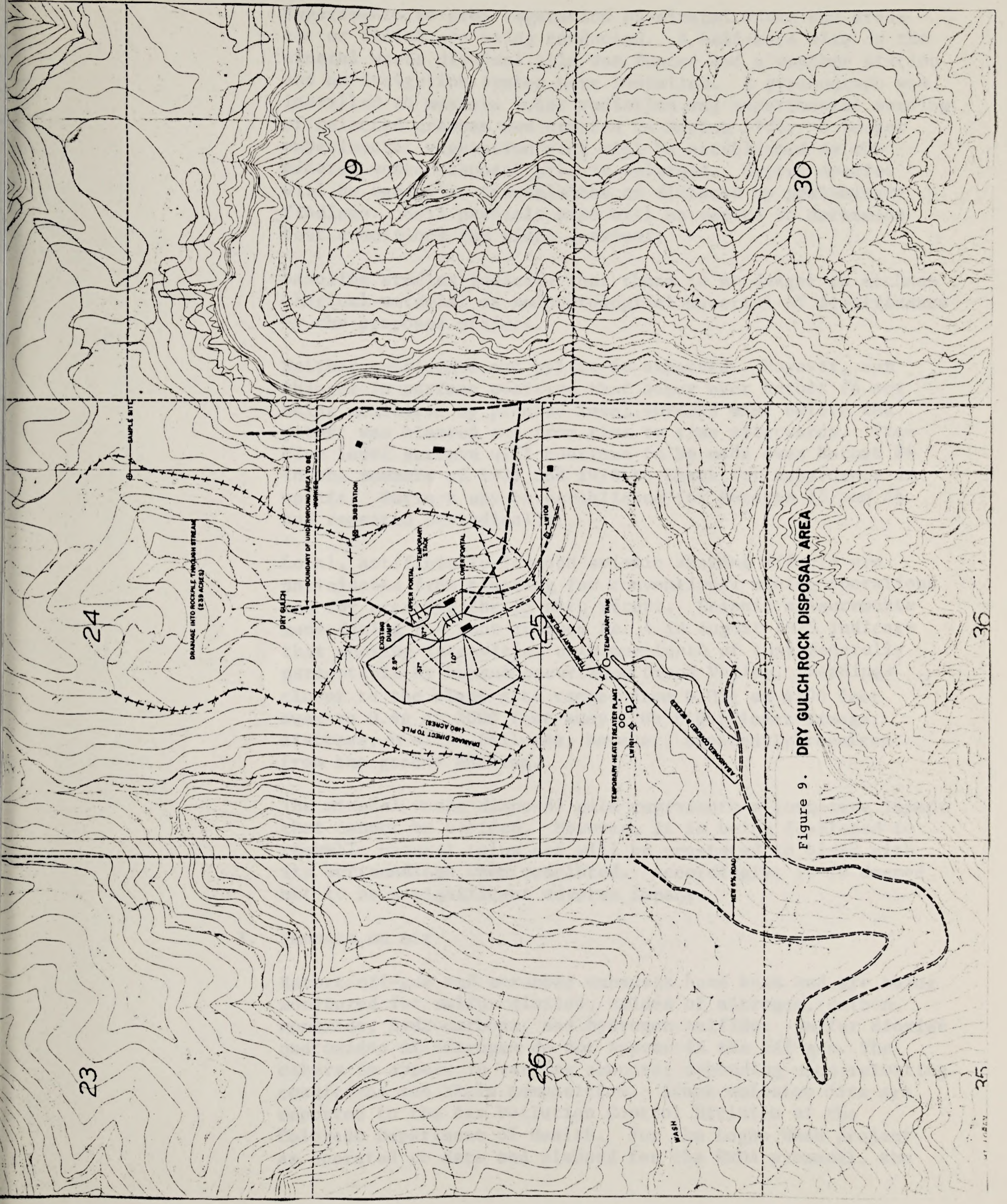
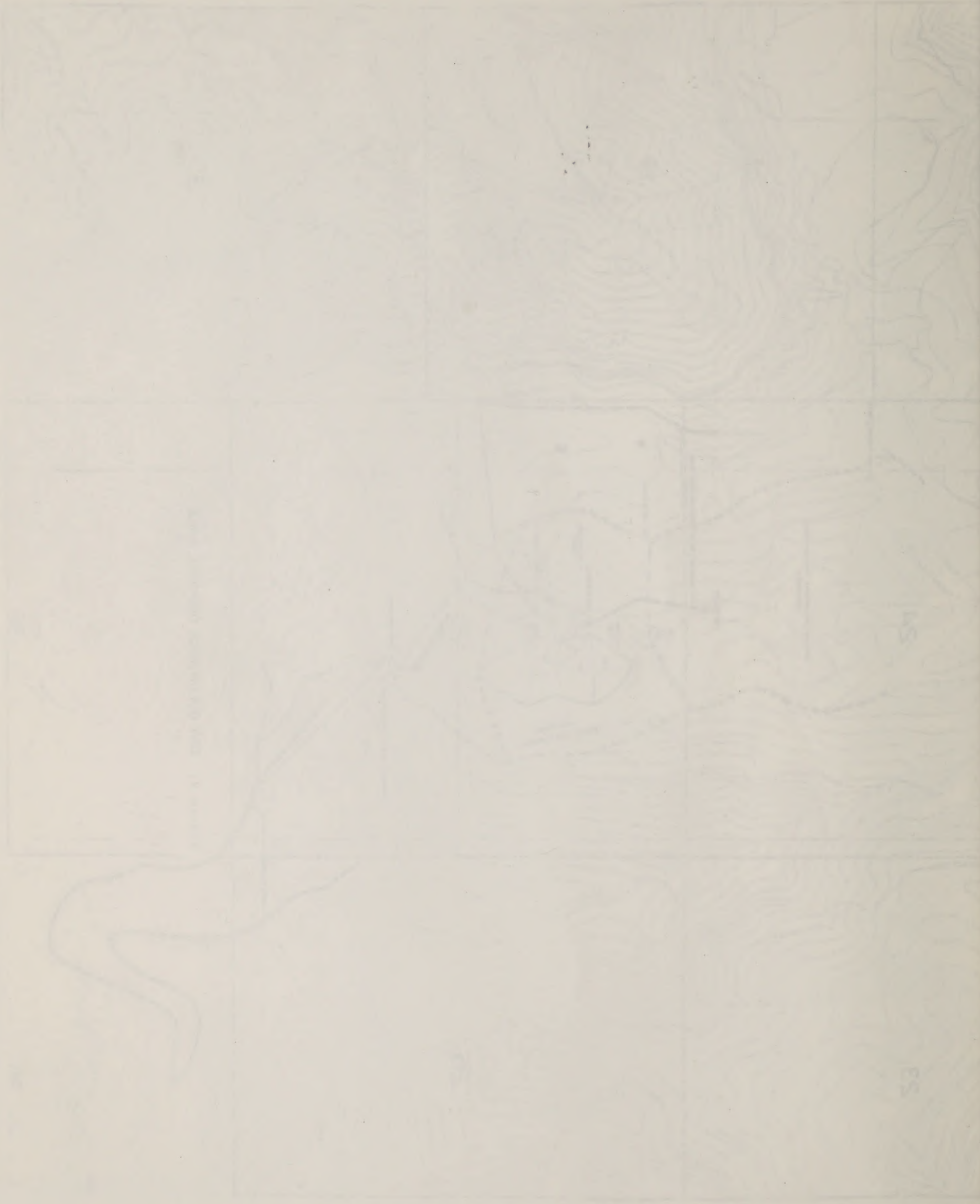


Figure 9. DRY GULCH ROCK DISPOSAL AREA



1:50,000 Scale

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Experiments to grow vegetation on mineral waste and areas cut or filled are being conducted. A half-acre site on the mineral waste disposal pile was fenced and a weather station and an irrigation system were installed. A pyranograph was installed to measure solar radiation and experimental seeding of selected grasses was started in Spring 1976. A larger experimental vegetation plot will be established as the mineral waste disposal pile is enlarged. Native species will be seeded or transplanted as dictated by preliminary findings. Soil particle size will be varied to determine best conditions for plant survival.

Baseline studies indicate that there is no danger to archaeological material or paleontological material of significance by the proposed project.

Neither subsidence nor uplift is expected. However, any changes in surface position that occur over Retort #4 are being monitored by precise level surveys made before the retort was blasted and from time to time afterwards. Precise level surveys will continue to be made over Retort #4 in the summers of 1977 and 1978 to check for subsidence or uplift. Surveys may be established for Retorts #5 and #6 and repeated periodically.

Local, artificially-induced seismic shaking effects are anticipated from blasting for conventional mining operations and for creating the in situ retort. Seismic measurements made during the shot in Room No. 4 in August 1975 indicate that shaking intensities only one-tenth of that generally perceptible by humans occurred at Grand Valley. Readings closer to the blast site ranged from 0.05g at 4100 feet away to 0.4g at 3000 feet away. No significant damage, distress, or slope failures, however, apparently resulted from the ground shaking.

The mineral waste disposal pile represents a long-term impact that cannot be avoided. However, it is being developed to resemble natural talus and will be vegetated to blend with its surroundings when completed. Accordingly, it is deemed not to be a significant adverse impact.

3. Impacts on Air

Retort off-gas and scrubbed exhausts have been and are being monitored for sulfur dioxide, oxides of nitrogen, carbon monoxide, hydrocarbons, and hydrogen sulfide. Sulfur dioxide and oxides of nitrogen do not appear in the off-gas. The others do appear in varying amounts, depending upon retorting conditions and shale composition. Stack emission data are reported to the Air Pollution Control Division of the Colorado Department of Health. For the Logan Wash project as operated to date and planned for the ERDA proposal, the

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total amounts of the pollutants that appear are sufficiently low that they can be dispersed by a suitable stack and thereby not violate air quality standards.

Ambient concentrations of SO₂, NO_x, hydrocarbons, CO, particulates, and H₂S have been measured at a point where the plume was expected to have maximum impact. Pollutants have been sampled for 24 hours every six days for one year beginning February 1, 1975, in accord with a program approved by the Air Pollution Control Division, Colorado Department of Health. Data have been submitted quarterly to APCD. The ambient air quality will be monitored while retorts are in operation and for one month afterwards to assure that air quality standards are not being exceeded. The existing station may be relocated in light of existing meteorological data.

Experiments have been performed to determine nitrogen oxide emissions from burning crude shale oil in a boiler. Results indicate that current regulations can be met.

No infringements of air quality standards are projected for the Logan Wash project, either short-term or long-term. Pollutants released at the top of the property will not be trapped under inversion layers or be subject to cold air drainage.

Sulfide in the off-gas presents an air pollution problem in general, although it is not a serious difficulty for the proposed project at Logan Wash. When off-gas volumes are significantly larger than planned for Logan Wash, the gas will be burned to recover its heating value, and the sulfide must be removed before burning in order to prevent the formation of sulfur dioxide. Various approaches to controlling the sulfide concentration in the off-gas have been tried, e.g., scrubbing in Venturi scrubbers and in spent retorts. Other approaches to controlling sulfide emissions are catalytic oxidation to sulfur dioxide (which would then be removed conventionally or by absorption in a spent retort) and reduction to elemental sulfur by the Stretford process. The latter process has been tried successfully on a laboratory scale. Both catalytic oxidation and the Stretford process will be evaluated for large scale application during the proposed contract (probably at the new site).

Oil mist has occasionally appeared in the off-gas. The oil in the gas has been characterized, and steps are being taken to prevent its occurrence in the future. Electrostatic precipitation has been successfully tested on a small scale. Electrostatic precipitation or a suitable alternative will be evaluated full-scale during the ERDA contract.

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No particulates have been found in the retort exhaust. However, attempts to measure them have sometimes been thwarted by the presence of water in the exhaust. The interference is annoying but has not caused a problem in controlling pollutant emissions.

It is planned to use radioactive krypton as a tracer to provide detailed information on pollutant transport for the specific Logan Wash situation. This work will be done in conjunction with tracer testing of the retorts.

4. Meteorology

Wind speed and direction and temperature and delta temperature data have been measured continuously on a 100 ft. tower near the single proposed stack location on the plateau from February 1, 1975. Rawinsonde temperature and wind data were taken twice daily every six days from February 1975 to February 1976 to obtain upper air data above the plateau; these data have been correlated with upper air data taken in Grand Junction. Relative humidity and precipitation data have also been taken, at the air quality monitoring site, from February 1, 1975. The data have been collected in accord with a program approved by the Air Pollution Control Division, Colorado Department of Health, and are being submitted quarterly to APCD. Wind speed and direction, temperature and delta temperature, relative humidity, and precipitation measurements will be continued for the duration of the project to increase the data base.

Data from the meteorology and ambient air quality studies are being used in conjunction with plant design data to model pollution concentrations from stacks and to establish stack design requirements.

The radioactive krypton tracer study described above will also serve to confirm the air pollution model or provide information to refine it.

There is almost a complete absence of upper air inversions above the Logan Wash site. See Section II.D.3.

5. Socioeconomic Impacts

The Logan Wash project is a continuation of an on-going operation and involves no new Occidental or contractor personnel. Accordingly, there will be no new demands for services or facilities nor new impacts on nearby communities. See Sections II.E., II.I., and II.L. for information on the existing situation.

The particulates have been found in the worst cases... However, attempts to measure them have been... limited by the presence of water in the exhaust. The... information is necessary but has not passed a problem in... monitoring pollution conditions.

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Meteorology

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Conclusions

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It is envisioned that additional research and development will be continued at Logan Wash upon completion of work under the PON. If and when the site is ever phased out, it is expected that the personnel will be shifted to the maximum extent practical to other Occidental projects. If the site is considered for conversion to a commercial operation, an appropriate socioeconomic impact analysis will then be performed.

6. Occupational Safety and Health

The Logan Wash site is being operated in compliance with pertinent mining regulations. Carbon monoxide, methane, and hydrogen sulfide monitors placed throughout the mine are used to warn of escaping retort gas. The oxygen level is also monitored throughout the mine. Personnel working at the base of the stack carry hydrogen sulfide monitors on their belts.

Product oil, water, shale and natural materials have been examined for benzo(alpha)pyrene. Various products and by-products of the project will be subjected as appropriate to a toxicological screening program to be defined as part of the environmental research plan.

So what was the finding?

A fully equipped ambulance and a second emergency vehicle are located at the mine. The latter can be readily converted to an ambulance with equipment kept ready for the purpose. Emergency medical technicians attached to the DeBeque Fire Department are located twelve miles from the site by road. Occidental and the DeBeque Fire Department have made prior arrangements for assistance in case of emergencies.

Solid waste disposal procedures are in accord with the Garfield County Sanitarian and the Colorado Department of Health. The mineral waste disposal pile is in accord with Garfield County regulations and related Colorado regulations.

C. Post Operational Impacts

When the Logan Wash site is eventually abandoned, the area will be reclaimed in accord with a plan to be approved by the Colorado Mined Land Reclamation Board. The mine will be secured from unintended entry, all unneeded wells and core holes will be properly completed, drill pads and unneeded roads and benches will be graded to blend with their surroundings and vegetated, and unwanted surface facilities will be removed. The mineral waste disposal pile will be appropriately contoured and vegetated to minimize percolation through the pile. Excessive dust will be controlled during these operations.

It is anticipated that additional research and development will be conducted at the site in order to determine the extent of contamination. It is also anticipated that the site will be used for other purposes in the future. The site is currently being used for residential purposes. The site is currently being used for residential purposes.

B. Geotechnical Safety and Health

The large Wash site is being excavated to construct a parking garage. The site is currently being used for residential purposes. The site is currently being used for residential purposes.

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C. Past Geotechnical Reports

The site is currently being used for residential purposes. The site is currently being used for residential purposes.

The retorts will be extinguished before abandonment so that noxious gases do not escape. Retort leaching will be prevented, as described in Section III.B.1., and water that enters the mine will be allowed to pass to lower strata or seep to the outcrop.

IV. Mitigations

A. Water

Sumps in the mine in which water and oil are collected are placed in strata that are believed to be impermeable to lateral flow. Where any uncertainty exists, the sumps are either lined with gunnite or with a clay-like silt that is carried with the water and settles out. Nevertheless, some check holes may be drilled in nearby rock in order to verify that the sumps are not leaking laterally.

As mentioned above, any excess of water that occurs above current requirements and available storage is evaporated by spraying on the face of the mineral waste disposal pile. Water treatment and discharge were deemed not to be a satisfactory alternative, for treatment facilities for the relatively small amount of water are unduly expensive. Also, the preferred approach of evaporating the water provides an opportunity to learn how to optimize the procedure. This learning can then be transferred to other settings that may require evaporation as the final disposition of "blowdown" from a treatment plant.

The hydrology study will provide information on aquifer communication. In strata above the ore, at least, communication between various parts of the Green River Formation is principally by fractures.

B. Oil

Oil is handled and stored on the Logan Wash site in accord with an Oil Spill Prevention and Countermeasure Plan.

C. Air

A tall stack is used to disperse retort off-gas, which is sufficiently low in volume and pollutant concentrations that air quality standards are not violated. Flaring was considered not to be a good alternative, for it produces sulfur dioxide unless the hydrogen sulfide present is scrubbed first. Scrubbing required long lead-time equipment. Moreover, the equipment is unduly expensive for small-scale operations.

From this, one would think H_2S and hydrocarbons are less ~~pollutants~~ than SO_2 and NO_x

The process will be distinguished by the fact that the gas will be allowed to pass to the water tank to the water.

IV. Nitrogen

A. Water

When in the time in which water and oil are separated in a tank it is believed to be impossible to place in water that are believed to be separated in a lateral flow. Where an extremely small, the water is either lined with a lining or with a clay-like shell. The water is carried with the water and water out. However, the water holes may be drilled in nearby rock to water in order to find the source and not being laterally.

As mentioned above, the source of water that is separated in a tank is believed to be impossible to place in a lateral flow. Where an extremely small, the water is either lined with a lining or with a clay-like shell. The water is carried with the water and water out. However, the water holes may be drilled in nearby rock to water in order to find the source and not being laterally.

The hydrology study will provide information on whether the water is separated in a lateral flow. Where an extremely small, the water is either lined with a lining or with a clay-like shell. The water is carried with the water and water out. However, the water holes may be drilled in nearby rock to water in order to find the source and not being laterally.

B. Oil

Oil is separated and stored in the tank which is used with an oil spill prevention and containment plan.

C. Air

A spill catch is used to dispose of any oil that is collected in a spill catch. The spill catch is used to dispose of any oil that is collected in a spill catch. The spill catch is used to dispose of any oil that is collected in a spill catch. The spill catch is used to dispose of any oil that is collected in a spill catch.

Dust is controlled in various ways. The road and parking areas are treated with a dust palliative. Mine dust and dust from disposing of mineral waste are controlled by water spraying. Barren areas are vegetated where possible.

System leaks are monitored by carbon monoxide, methane, and hydrogen sulfide alarms throughout the mine and by carbon monoxide alarms at various surface points, for example, at the adits and at base of the stack. The ambient air quality is monitored during retorting to assure that air quality standards are not violated.

D. Fire

Fire control procedures are in accord with the Colorado Bureau of Mines and Occidental's insurance company. Halon gas units are placed where electrical fires are a major possibility, e.g. the control rooms and the electrical room. Dry powder extinguishers are placed throughout the mine, in the maintenance shops, at storage tanks above ground, and on each piece of mobile diesel equipment. Foam units are installed in storage sumps and tanks. They are also available on wheels at the control rooms and at the heater-treater unit in Logan Wash. Office trailers are equipped with compliance fire extinguishers. High pressure pumps and hose are available to spray mine water if needed to extinguish a fire.

Thirty percent of the staff at the mine site have been trained in the use of the above equipment. Additional assistance is available on call from the DeBeque Fire Department, twelve miles away by road. The mine has a microwave telephone link to Grand Junction that can be used to telephone DeBeque.

E. Socioeconomic Considerations

There are no new socioeconomic impacts to be derived from the Logan Wash project, for the proposed work is an extension of an existing operation.

Emergency provisions exist at the Logan Wash site to accommodate personnel who are stranded there because of bad weather or for other reasons.

V. Alternatives

Alternatives to proceeding with the proposed project are doing the project at another site and not doing the project at all. The information to be gained from the project is vital to evaluating the technical and economic feasibility of modified in situ oil shale processing. This knowledge is essential if informed choices are to be made concerning energy sources. In view of the facts that the Logan Wash site is "ready to go" and is the only site in such a position and that no further construction-related and socio-economic impacts will accompany the project, it is recommended that the project be undertaken at Logan Wash.

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But is provided in various ways. The tank and piping
around the reactor with a heat exchanger. When that tank
heat from disposal of electrical waste are available as
heat recovery. For the other air, ventilation should provide

System leaks are maintained by carbon monoxide, methane, and
hydrogen sulfide; air is throughout the mine and its use on
various stages of various sulfur, sulfur, and oxides, as
the sulfur and as base of the ore. The sulfur, its quality
is controlled during reworking to assure that the quality
standards are not violated.

D. Pile

The control systems are in accord with the various stages
of mine and operational insurance coverage. When the pile
are placed where electrical lines are a major hazard,
e.g. the control rooms and the electrical lines, the
extinguishers are placed throughout the mine, in the
lower levels, at storage tanks above ground, and in the
of mobile electrical equipment. Some units are installed in
storage tanks and racks. They are also available in
of the control rooms and at the main control room in
mine. Other units are equipped with extinguishers and
extinguishers. High pressure hoses and other electrical
equipment also water is needed to extinguish a fire.

Thirty percent of the total at the mine are also located
in the use of the above equipment. Additional equipment is
available on call from the Bureau of Fire Department, Seattle
within four hours. The mine has a mine fire fighting unit
to stand by until they can be used as fire-fighting equipment.

E. Environmental Considerations

There are no new socio-economic impacts to be derived from the
large waste project, but the program does have an extension of
an existing program.

Emergency provisions exist at the mine for fire or explosion
fire personnel who are trained to handle such situations in
or for other reasons.

V. Alternatives

Alternatives to proceeding with the proposed project are
the project at another site and not doing the project at all. The
information to be gained from the project is vital to evaluating
the economic and environmental benefits of waste disposal
in this area. This knowledge is essential to informed choices
and to be made concerning waste disposal. The view of the fact
that the large waste site is "ready to go" and is the only site
with a position and that an earlier construction-related site
economic impacts will accompany the project, it is recommended
the project be undertaken at large waste.

Appendix

Requirements and Suggested Actions
for Environmental Protection and
Compliance with Environmental Regulations

Formula

Formula for the determination of the
coefficient of friction and
the angle of repose

Requirements and Suggested Actions
for
Environmental Protection and Compliance with Environmental Regulations

<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirements</u>	<u>Regulation</u>	<u>Suggested Actions</u>
1	Unpaved roads or parking lots	>165 vehicles per 24-hr. day (3-day average)	Obtain APCD ¹ * approval of fugitive dust control plan. ²	Colo. Air Qual. Reg. No. 1	Pave or oil road to control dust and minimize maintenance problems.
2	Earth moving or grading	>5 acres of land involved	Obtain APCD approval of fugitive dust control plan.	Colo. Air Qual. Reg. No. 1	Spray or otherwise control dust during operations.
3	Detonating explosives	--	Obtain APCD approval of fugitive dust control plans.	Colo. Air Qual. Reg. No. 1	Design dust control provisions for adits.
4	Visible dust	<30 mph wind	Dust not permitted to cross property line.	Colo. Air Qual. Reg. No. 1	Revegetate disturbed surfaces as necessary to control fugitive dust.
5	Smoke emissions	Solid or liquid fuels; continuous duty	Not more than 20% reduction in light transmission permitted.	Colo. Air Qual. Reg. No. 1	Install photoelectric smoke detector in stack; install precipitators or scrubbers as required to meet the requirement.
6	Smoke emissions	Solid or liquid fuels; pilot, experimental, or start-up conditions	Up to 40% reduction in light transmission permitted not more often than 2 minutes in any 60-minute interval for a period not greater than 180 days from beginning operations.	Colo. Air Qual. Reg. No. 1	-ditto-

73 minutes

* Numbered footnotes appear at the end of the table.

2. Detailed description of the work to be done

1	General description of the work to be done	General description of the work to be done	General description of the work to be done
2	Specific description of the work to be done	Specific description of the work to be done	Specific description of the work to be done
3	Methodology	Methodology	Methodology
4	Results	Results	Results
5	Conclusions	Conclusions	Conclusions
6	References	References	References
7	Appendices	Appendices	Appendices
8	Summary	Summary	Summary
9	Index	Index	Index
10	Bibliography	Bibliography	Bibliography

11. Detailed description of the work to be done

<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirements</u>	<u>Regulation</u>	<u>Suggested Actions</u>
7	Particulate emissions	Ground level measurements <i>times 10⁶</i> <i>Class II area</i>	Air to contain no more than 150 $\mu\text{gm}/\text{m}^3$ averaged over 24 hours and to average not more than 45 $\mu\text{gm}/\text{m}^3$ (annual arithmetic mean of 24 hour values).	Colo. Air Qual. Reg. No. 1	Model emissions to predict particulate levels; install precipitators or scrubbers as required.
8	Fuel burning	<10 ⁶ Btu/hr.	Particulate emissions must be less than 0.5 lb./10 ⁶ Btu.	Colo. Air Qual. Reg. No. 1	Install monitor for particulates; use precipitators or scrub the effluent as required to meet the requirement.
9	Fuel burning	>10 ⁶ Btu/hr.; <500 x 10 ⁶ Btu/hr.	Particulate emissions must be less than amount shown on page 1.5, Colo. Air Qual. Reg. No. 1.	Colo. Air Qual. Reg. No. 1	-ditto-
10	Fuel burning	>500 x 10 ⁶ Btu/hr.	Particulate emissions must be less than 0.1 lbs./10 ⁶ Btu.	Colo. Air Qual. Reg. No. 1	-ditto-
11	Fuel burning	-- <i>Stipulated to build 5000, 5 year for 5000 and 10000</i>	Oxides of nitrogen (as NO ₂) must be less than 0.2 lb./10 ⁶ Btu input for gaseous fuels; less than 0.3 lb./10 ⁶ Btu input for liquid fuels, and less than 0.7 lb./10 ⁶ Btu input for solid fuels (2-hr. averages).	Colo. Air Qual. Reg. No. 6	Install NO ₂ monitor in stack; scrub effluent as necessary to reduce NO ₂ emissions.
12	Fuel burning	Measurements made on the ground	Carbon monoxide must be less than 10 $\mu\text{gm}/\text{m}^3$ (8-hr. average). [This value may be exceeded not more than once per year providing it does not exceed 40 $\mu\text{gm}/\text{m}^3$ (1-hr. average) more than once per year.]	Federal Register, 36, April 30, 1971, 8187.	Model region to determine where CO build-ups may occur and site stack to minimize build-ups; monitor CO where build-ups may occur; burn or adsorb CO as req'd to reduce build-ups to satisfactory level.

<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirements</u>	<u>Regulation</u>	<u>Suggested Actions</u>
13	SO ₂ emissions	Liquid fuels burning <i>MS Dept of Environment</i>	<0.8 lb. per 10 ⁶ Btu from liquid fuel (max. 2-hour average)	Colo. Air Qual. Reg. No. 6	Clean any SO ₂ present out of stack gas by scrubbing or use low sulfur fuel which is analyzed daily,
14	SO ₂ emissions	Solid fuel burning	<1.2 lb. per 10 ⁶ Btu from solid fuel (max. 2-hr. average)	Colo. Air Qual. Reg. No. 6	-ditto-
15	SO ₂ emissions	Continuous duty; measurements made at source	After 1979: <150 ppm, OR <500 ppm and <5 tons/day Before 1980: <500 ppm	Colo. Air Qual. Reg. No. 1	Monitor feed or stack gas for sulfur compounds; scrub out SO ₂ as necessary.
16	SO ₂ emissions	Ground level measurements; Class I region	Air quality to be degraded no more than 75 µgm/m ³ averaged over 3 hours, or 15 µgm/m ³ averaged over 24 hours, or 3 µgm/m ³ averaged over 1 year (arithmetic average).	Colo. Air Qual. Reg. No. 1	Model emissions to predict degradation; control emissions accordingly.
17	Hydrocarbon emissions <i>Section G #1</i>	Hydrocarbons in contact with flame or heated in presence of oxygen before emission; discharge >15 lb./day or 3 lb./hr.	Reduce hydrocarbon emissions by 85% by burning or adsorption. Convert 90% of C to CO ₂ if burning is used.	Colo. Air Qual. Reg. No. 7 <i>Section G</i>	Monitor hydrocarbon concentrations before and after final burning; burn or adsorb as necessary.
18	Hydrocarbon emissions	Hydrocarbons not heated in presence of oxygen and not in contact with flame	Maximum allowable discharge is 40 lbs. per day and 8 lbs. per hour for photoreactive solvents. Maximum allowable discharge is 3000 lbs. per day and 450 lbs. per hour for non-reactive solvents.	Colo. Air Qual. Reg. No. 7 <i>Section G #2 + #3</i>	Monitor hydrocarbon concentration before and after final burning; burn or adsorb as necessary.

SM 1/3
Note

Station	Depth	Temperature	Direction	Force	Remarks
1	0.0	18.5	000	0.0	Surface observation
2	10.0	18.0	000	0.0	10m depth
3	20.0	17.5	000	0.0	20m depth
4	30.0	17.0	000	0.0	30m depth
5	40.0	16.5	000	0.0	40m depth
6	50.0	16.0	000	0.0	50m depth
7	60.0	15.5	000	0.0	60m depth
8	70.0	15.0	000	0.0	70m depth
9	80.0	14.5	000	0.0	80m depth
10	90.0	14.0	000	0.0	90m depth
11	100.0	13.5	000	0.0	100m depth
12	110.0	13.0	000	0.0	110m depth
13	120.0	12.5	000	0.0	120m depth
14	130.0	12.0	000	0.0	130m depth
15	140.0	11.5	000	0.0	140m depth
16	150.0	11.0	000	0.0	150m depth
17	160.0	10.5	000	0.0	160m depth
18	170.0	10.0	000	0.0	170m depth
19	180.0	9.5	000	0.0	180m depth
20	190.0	9.0	000	0.0	190m depth
21	200.0	8.5	000	0.0	200m depth
22	210.0	8.0	000	0.0	210m depth
23	220.0	7.5	000	0.0	220m depth
24	230.0	7.0	000	0.0	230m depth
25	240.0	6.5	000	0.0	240m depth
26	250.0	6.0	000	0.0	250m depth
27	260.0	5.5	000	0.0	260m depth
28	270.0	5.0	000	0.0	270m depth
29	280.0	4.5	000	0.0	280m depth
30	290.0	4.0	000	0.0	290m depth
31	300.0	3.5	000	0.0	300m depth
32	310.0	3.0	000	0.0	310m depth
33	320.0	2.5	000	0.0	320m depth
34	330.0	2.0	000	0.0	330m depth
35	340.0	1.5	000	0.0	340m depth
36	350.0	1.0	000	0.0	350m depth
37	360.0	0.5	000	0.0	360m depth
38	370.0	0.0	000	0.0	370m depth
39	380.0	0.0	000	0.0	380m depth
40	390.0	0.0	000	0.0	390m depth
41	400.0	0.0	000	0.0	400m depth
42	410.0	0.0	000	0.0	410m depth
43	420.0	0.0	000	0.0	420m depth
44	430.0	0.0	000	0.0	430m depth
45	440.0	0.0	000	0.0	440m depth
46	450.0	0.0	000	0.0	450m depth
47	460.0	0.0	000	0.0	460m depth
48	470.0	0.0	000	0.0	470m depth
49	480.0	0.0	000	0.0	480m depth
50	490.0	0.0	000	0.0	490m depth
51	500.0	0.0	000	0.0	500m depth
52	510.0	0.0	000	0.0	510m depth
53	520.0	0.0	000	0.0	520m depth
54	530.0	0.0	000	0.0	530m depth
55	540.0	0.0	000	0.0	540m depth
56	550.0	0.0	000	0.0	550m depth
57	560.0	0.0	000	0.0	560m depth
58	570.0	0.0	000	0.0	570m depth
59	580.0	0.0	000	0.0	580m depth
60	590.0	0.0	000	0.0	590m depth
61	600.0	0.0	000	0.0	600m depth
62	610.0	0.0	000	0.0	610m depth
63	620.0	0.0	000	0.0	620m depth
64	630.0	0.0	000	0.0	630m depth
65	640.0	0.0	000	0.0	640m depth
66	650.0	0.0	000	0.0	650m depth
67	660.0	0.0	000	0.0	660m depth
68	670.0	0.0	000	0.0	670m depth
69	680.0	0.0	000	0.0	680m depth
70	690.0	0.0	000	0.0	690m depth
71	700.0	0.0	000	0.0	700m depth
72	710.0	0.0	000	0.0	710m depth
73	720.0	0.0	000	0.0	720m depth
74	730.0	0.0	000	0.0	730m depth
75	740.0	0.0	000	0.0	740m depth
76	750.0	0.0	000	0.0	750m depth
77	760.0	0.0	000	0.0	760m depth
78	770.0	0.0	000	0.0	770m depth
79	780.0	0.0	000	0.0	780m depth
80	790.0	0.0	000	0.0	790m depth
81	800.0	0.0	000	0.0	800m depth
82	810.0	0.0	000	0.0	810m depth
83	820.0	0.0	000	0.0	820m depth
84	830.0	0.0	000	0.0	830m depth
85	840.0	0.0	000	0.0	840m depth
86	850.0	0.0	000	0.0	850m depth
87	860.0	0.0	000	0.0	860m depth
88	870.0	0.0	000	0.0	870m depth
89	880.0	0.0	000	0.0	880m depth
90	890.0	0.0	000	0.0	890m depth
91	900.0	0.0	000	0.0	900m depth
92	910.0	0.0	000	0.0	910m depth
93	920.0	0.0	000	0.0	920m depth
94	930.0	0.0	000	0.0	930m depth
95	940.0	0.0	000	0.0	940m depth
96	950.0	0.0	000	0.0	950m depth
97	960.0	0.0	000	0.0	960m depth
98	970.0	0.0	000	0.0	970m depth
99	980.0	0.0	000	0.0	980m depth
100	990.0	0.0	000	0.0	990m depth

NO 5 with 50% vapor recovery
NO 7 with 70% vapor recovery
NO 9 with 90% vapor recovery
NO 10 with 100% vapor recovery
NO 11 with 100% vapor recovery
NO 12 with 100% vapor recovery
NO 13 with 100% vapor recovery
NO 14 with 100% vapor recovery
NO 15 with 100% vapor recovery
NO 16 with 100% vapor recovery
NO 17 with 100% vapor recovery
NO 18 with 100% vapor recovery
NO 19 with 100% vapor recovery
NO 20 with 100% vapor recovery
NO 21 with 100% vapor recovery
NO 22 with 100% vapor recovery
NO 23 with 100% vapor recovery
NO 24 with 100% vapor recovery
NO 25 with 100% vapor recovery

Item	Activity or Situation	Conditions	Requirements	Regulation	Suggested Actions
19	Hydrocarbon storage	>40,000 gallon tank; vapor pressure <11 psia	Prevent vapor loss by pressurizing with floating roof or cover or by using vapor recovery system.	Colo. Air Qual. Reg. No. 7	Design underground storage vessels with vapor recovery systems. ⁴
20	Hydrocarbon storage	>40,000 gallon tank; vapor pressure >11 psia	Vapor recovery system required.	Colo. Air Qual. Reg. No. 7	Design underground storage vessels with vapor recovery systems. ⁴
21	Hydrocarbon storage	>3500 gallon tank	Vessel must have permanent submerged fill pipe or vapor recovery system.	Colo. Air Qual. Reg. No. 7	Design vessels as required. ⁴
22	Water/petroleum product separators	Separation equipment >200 gallons	Control vapor loss; may use floating roof or cover, solid cover with all openings sealed, or vapor recovery system.	Colo. Air Qual. Reg. No. 7	Design equipment as required. ⁴
23	Storage tanks and settling basins	Containing known or experimental carcinogens (see Colo. Air Qual. Reg. No. 8 for list)	Minimize carcinogen emissions; monitor for their presence.	Colo. Air Qual. Reg. No. 8 <i>Appendix A</i>	Submit plan to APCD for monitoring and controlling possible carcinogen emissions.
24	Diesel powered equipment	Off-road; <8000 feet elevation	<30% reduction in light transmission required (except for non-continuous periods of 15 seconds).	Colo. Air Qual. Reg. No. 1	Use calibrated smoke glass to check; adjust or modify equipment as required to meet requirements.
25	Diesel powered equipment	Off-road; >8000 feet elevation	<40% reduction in light transmission required except for non-continuous periods of 15 seconds).	Colo. Air Qual. Reg. No. 1	-ditto-

Handwritten notes at bottom of page, including "40 & 120 Part 60", "50% NSPS", "Vapor recovery", and "NO 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25".

<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirements</u>	<u>Regulation</u>	<u>Suggested Actions</u>
26	Construction of any facility, process, or activity which may emit a contaminant	Excluding analytical laboratory equipment, certain ventilating systems, fuel burning equipment <500,000 Btu/hour input, internal combustion engines <1000 hp, and selected additional items	Review plans with APCD before beginning any work.	Colo. Air Qual. Reg. No. 3	Prepare plans and secure APCD's approval thereof.
27	Construction of any facility, process, or activity which may emit a contaminant	Excluding analytical laboratory equipment, certain ventilating systems, fuel burning equipment <500,000 Btu/hour input, internal combustion engines <1000 hp, and selected additional items	Take baseline environmental data as determined in conference with APCD.	Colo. Air Qual. Reg. No. 3	Approved air quality and meteorology baseline monitoring completed.
28	-ditto-	-ditto-	File impact statement with APCD as specified in preplanning review. Statement to include applicable climatic conditions and topographic features affecting diffusion, existing and expected growth of human and other habitation, and control steps to be taken regarding emissions, odor, photo-reactivity, toxicity, and damage to materials. Statement may have to describe impact on air quality in adjacent political subdivisions. Model of air behavior and integration with data from others may be required.	Colo. Air Qual. Regs. Nos. 3 & 8	Prepare impact statement after plant design is proposed.

Permit

to follow:
The first group will
be composed of
the following:
The second group
will consist of
the following:
The third group
will consist of
the following:
The fourth group
will consist of
the following:
The fifth group
will consist of
the following:

Group 1
Group 2
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Group 1
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Group 1
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Group	Members	Notes
Group 1
Group 2
Group 3
Group 4
Group 5

<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirement</u>	<u>Regulation</u>	<u>Suggested Actions</u>
29	Construction of any facility, process, or activity which may emit a contaminant	-ditto-	Prepare curtailment procedures in the event of an "upset."	Colo. Air Qual. Reg. No. 3	Assess nature, extent, and consequences of possible "upsets"; develop countermeasures.
30	Operation of any facility, process, or activity which may emit a contaminant	-ditto-	<p><i>Not needed; see below</i></p> <p>File contaminant emission notice with APCD, one per stack or vent not sooner than 60 days and not later than 30 days before beginning operation.</p>	Colo. Air Qual. Reg. No. 7	Follow requirement; prepare for inspection by APCD shortly after beginning operations.
31	Any construction or any disturbance of existing topography (including road construction, pipeline laying, and landfilling or dumping)	In Garfield County	<p>Obtain Garfield County's permission to disturb existing topography by filing impact statement showing no significant adverse impact (1) on lawful use of water through depletion or pollution, (2) on use of adjacent land through generation of dust, vapors, smoke, noise, glare, vibration, or other emanations, (3) on use of abutting property by virtue of the proximity of the proposed operation, (4) on wildlife and domestic animals via creation of hazardous attractions, alteration of vegetation or water supply, blockage of migration routes, or disruption of use patterns, (5) on other parts of county via hazards or nuisances caused by traffic.</p>	Garfield County Zoning Resolution, Section 4.03.07	Submit reports on hydrology, waste disposal, flora, fauna, seismology, noise, and air quality in support of construction/disturbance applications.

<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirements</u>	<u>Regulation</u>	<u>Suggested Actions</u>
32	Any construction or any disturbance of existing topography (including road construction, pipe-line laying, and landfilling or dumping)	-ditto-	Rehabilitate any site disturbance. This includes contouring, providing for drainage, controlling erosion, and establishing vegetation.	Garfield County Zoning Resolution, Section 4.03.07	Meet the requirement.
33	-ditto-	-ditto-	Avoid destroying or covering archaeological and paleontological artifacts.	Garfield County Zoning Resolution, Section 4.03.07	Most areas of planned disturbance already surveyed for artifacts; no loss of artifacts anticipated at site; survey alternative pipeline routes before choosing alignment.
34	Employment of 500 or more people at any one time at any given location	---	File impact statement with APCD showing number of employees, their methods of transportation, the generation of secondary business, and the results of using the APCD model of air pollution from secondary sources.	Colo. Air Qual. Reg. No. 3	Develop employee transportation schemes that minimize pollution from secondary sources. Model the projected impact and prepare impact statement.
35	Discharge of effluent or sewage into soil	---	Meet standards for individual sewage disposal systems.	Colo. Water Qual. Regs., Chap. 66, Article 44	Prepare sewage disposal plan.
36	Discharge of effluent into state waters (including ground waters)	---	Monitor discharges as required by WQCD.5	Colo. Water Qual. Regs., Chap. 66, Article 28	Consult WQCD for monitoring requirements.

I don't think Colo has an indirect source review

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<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirements</u>	<u>Regulation</u>	<u>Suggested Actions</u>
37	Discharge of effluent into state waters (including ground waters)	---	<ol style="list-style-type: none"> Five-day biological oxygen demand <45 mg/l averaged over 7 days and <30 mg/l averaged over 30 days. Suspended solids <45 mg/l averaged over 7 days and <30 mg/l averaged over 30 days. Residual chlorine <0.5 mg/l. 6.0 < pH < 9.0 Oil and grease <10 mg/l; no visible sheen. Fecal coliform bacteria <1000/100 ml (geometric mean of five samples in 30-day period). Turbidity increase <10 Jackson units. Dissolved oxygen >5 mg/l. Free from taste, color, odor, settleable solids, floating solids, and toxic materials. 	Colo. Water Qual. Regs., Chap. 66, Article 28 and Chap. 25, Article 8	Determine best way to use or treat and dispose of waste mine and process water
38	Discharge of waste water	---	<p>Secure a permit to discharge wastewater from WQCD; receiving water must not be degraded.⁶</p>	Federal Register, 38, May 22, 1973, 13528.	Monitor receiving body to determine its quality; develop appropriate waste-water treatment scheme; secure permit to discharge.
39	Mine drainage	---	<p>Prevent ground or surface water from entering mine to extent practical. Minimize the formation and discharge of pollutional drainage to state waters.</p>	Colo. Water Qual. Regs., Chap. 66, Article 28	Minimize water entering mine; collect water entering mine and handle it in accord with plan developed for item #37.

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<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirements</u>	<u>Regulation</u>	<u>Suggested Actions</u>
40	Subsurface emplacement of fluids	Storage or disposal (discharge) of fluid by injection or subsurface emplacement.	Preinjection tests must conclusively demonstrate that emplacement will not interfere with present or potential uses of water resources nor result in other environmental hazards.	Federal Register, 39, April 9, 1974, 12922-23.	Select site and depth carefully and make preinjection tests; provide appropriate monitoring and contingency plans.
41	Drilling of wells, cores, etc.	Wells which are greater than 3000 ft. in depth; wells which are not owned by owner of surface estate (regardless of depth); wells which are not for appropriation of water for beneficial use (regardless of depth).	Owner or operator to notify Colo. Div. of Water Resources on form designated by the Division of intent to drill or rework a well.	Colo. Water Qual. Regs., Chap. 66, Article 28	Meet the requirement.
42	-ditto-	-ditto-	Owner or operator to maintain a \$25,000 bond for all wells or file a \$10,000 bond for operations subject to a specific notification.	Colo. Water Qual. Regs., Chap. 66, Article 28	Meet the requirement.
43	-ditto-	-ditto-	Owner or operator to file with Water Res. Div. a drill report consisting of a map, lithologic log, drilling date, well diameter and depth within 60 days of completion of drilling program.	Colo. Water Qual. Regs., Chap. 66 Article 28	Meet the requirement.
44	-ditto-	---	Prevent pollution of ground and surface waters by contamination from wells.	Colo. Water Qual. Regs., Chap. 66, Article 28	Construct and protect wells sufficiently to prevent pollution of ground and surface waters; fill, plug, or seal unused or abandoned wells sufficiently to prevent pollution of ground and surface waters.

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<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirements</u>	<u>Regulation</u>	<u>Suggested Actions</u>
45	Odor emissions	Measured at the property line	A violation exists if odors are detected after being diluted with 15 or more volumes of odor-free air.	Colo. Air Qual. Reg. No. 2	Check for odors at the site. If odors are not detected at the site, there should be no problem at the property line. If odors are detected at the site, check for odors at the property line (without dilution). If odors are detected at the property line without dilution, check for them with dilution. If odors are detected with dilution, determine sources and reduce emanations.
46	Raw shale	Containing known or experimental carcinogens (see Colo. Air Qual. Reg. No. 8 for list)	---	---	Determine release of carcinogens from freshly mined and weathered raw shale; compare with naturally occurring processes.
47	Potential oil spills (from tanks, basins, pipes, transfer equipment, etc.)	---	Design facilities to minimize chance of oil spills and to minimize adverse consequences; prepare a "Spill Prevention and Countermeasure Plan"; have the plan certified by a Professional Engineer that it is in accord with good engineering practice; report spills as required in the regulations.	Dept. of Transportation Title 49, Chap. 1, Part 195; Federal Water Pollution Control Act Amendments of 1972; and Code of Federal Regulations, Title 40, Chap. 1, Subchap. D., Part 112.	Meet the requirements.

<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirements</u>	<u>Regulation</u>	<u>Suggested Actions</u>
48	Use of federal lands	E.g. a pipeline across federal lands	Obtain Special Land Use Permit; file environmental impact report as required.	Nat'l Environmental Protection Act of 1969	Prepare comprehensive environmental impact analysis (see also items 28, 31, and 34).

Footnotes

- 1 APCD: Air Pollution Control Division, Colorado Department of Health.
- 2 Applications for approval of fugitive dust control plans must contain
 - (1) description of nature and scope of activity,
 - (2) proposed dust abatement and preventive measures,³
 - (3) time schedule for dust abatement and preventive measures, and
 - (4) description of any monitoring and sampling methods proposed to record and report data to APCD.
- 3 See Section II.D.9, Colorado Air Quality Regulation No. 1.
- 4 It may be possible to use one vapor recovery system for a battery of vessels and other equipment.
- 5 WQCD: Water Quality Control Division, Colorado Department of Health.
- 6 There is a proposal to prevent all industrial discharges of wastewater in the Colorado River basin that could reach either ground or surface waters, regardless of water quality. See "Proposed Water Quality Standards for Salinity, Including Numeric Criteria and Plan of Implementation for Salinity Control, Colorado River System," Colorado River Basin Salinity Control Forum, June 1975. p. 85.

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Requirements and Suggested Actions
for
Environmental Protection and Compliance with Environmental Regulations

<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirements</u>	<u>Regulation</u>	<u>Suggested Actions</u>
30	Construction or operation of a new direct air contamination source	Excluding analytical laboratory equipment, certain ventilating systems, heater treaters burning sweet gas, fuel burning equipment <500,000 Btu per hour input, and selected additional items.	File permit application and air contaminant emission notice with APCD, one per stack or vent, not later than 95 days before desired use.	Colo. Air Qual. Reg. 3	File sooner if possible to allow time for APCD to review materials and obtain any additional information needed. The 95 day clock begins only when APCD has in hand all necessary information.
49	Alteration of an existing direct air contamination source	1. Excluding analytical laboratory equipment, certain ventilating systems, heater treaters burning sweet gas, fuel burning equipment <500,000 Btu per hour input, and selected additional items. 2. Applies to any modification or relocation of stacks, vents or other equipment. 3. Applies to changes in activity or method of operation that may increase air contamination emissions.	-ditto-	Colo. Air Qual. Reg. 3	-ditto-

<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirements</u>	<u>Regulation</u>	<u>Suggested Actions</u>
50	Modified operation of an existing direct air contamination source	<p>1. Excluding analytical laboratory equipment, certain ventilating systems, heater treaters burning sweet gas, fuel burning equipment <500,000 Btu per hour input, and selected additional items.</p> <p>2. Applies to changes in methods of operation (but not equipment) that do not increase air contaminant emissions.</p>	File air contaminant emission notice with APCD, one per stack or vent, not later than 95 days before desired use.	Colo. Air Qual. Reg. No. 3	--
51	Underground storage of liquid petroleum products	--	Maintain and analyze records of inventory, receipts, and discharges to detect leaks early.	Proposed Colo. Water Quality Control Reg. No. 7-5.2	Install meters to record tank inflows and outflows, measure inventories directly, and compare results daily.
52	-ditto-	Submerged pump system installations or modifications	Install approved leak detectors or indicators.	Proposed Colo. Water Quality Control Reg. No. 7-5.3	Consult WQCD for approved detectors or indicators.
53	-ditto-	--	Post approved test instructions.	Proposed Colo. Water Quality Control Reg. No. 7-5.4	Obtain test instructions from State Inspector of Oils.
54	-ditto-	Leaks suspected	Test pipes and tanks and record results for state review; save records for one year; repair any leaks detected.	Proposed Colo. Water Quality Control Reg. No. 7-5.5, 5.6	Use standard report form obtained from State Inspector of Oils.

<u>Item</u>	<u>Activity or Situation</u>	<u>Conditions</u>	<u>Requirements</u>	<u>Regulation</u>	<u>Suggested Actions</u>
55	-ditto-	Leaks greater than 250 gallons either suspected or confirmed	Report leaks within 36 hours of suspicion or confirmation to State Inspector of Oils.	Proposed Colo. Water Quality Control Reg. No. 7-5.7	--
56	-ditto-	System installation or modification	Conform to Uniform Fire Code's "Recommended Standard for Corrosion Protection of Pipe, Fittings, and Tanks Containing Flammable Liquids."	Proposed Colo. Water Quality Control Reg. No. 7-5.10	--

No.	Description	Quantity	Unit	Value	Remarks
101	100 lbs. Sugar	100	lbs.	10.00	Sugar
102	50 lbs. Flour	50	lbs.	5.00	Flour
103	25 lbs. Rice	25	lbs.	2.50	Rice
104	100 lbs. Beans	100	lbs.	10.00	Beans
105	50 lbs. Corn	50	lbs.	5.00	Corn
106	25 lbs. Apples	25	lbs.	2.50	Apples
107	100 lbs. Potatoes	100	lbs.	10.00	Potatoes
108	50 lbs. Onions	50	lbs.	5.00	Onions

Form 1279-3
(June 1984)

BORROWER'S CA

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Ruskin, Arnold
Environmental
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