FINAL

SITE SPECIFIC ANALYSIS

RUBY CONSTRUCTION COMPANY
PEABODY COAL COMPANY
W. R. GRACE & COMPANY
ENERGY FUELS CORPORATION

Mine and Reclamation Plans

AND W. R. GRACE & COMPANY

Railroad Plan

ENVIRONMENTAL STATEMENT

NORTHWEST COLORADO COAL

U.S. DEPARTMENT OF THE INTERIOR
March 3, 1849

PREFACE

This is the second volume of the Northwest Colorado Coal Environmental Statement. Contained herein are site-specific environmental analyses for mine and reclamation plans proposed by Ruby Construction Company, Peabody Coal Company, W. R. Grace and Company, and Energy Fuels Corporation. One tramroad right-of-way analysis is also included for W. R. Grace and Company's proposed railroad plan. Although these analyses are intended to stand alone, some reference is made to the Regional Analysis volume of the Statement. Impact assessments for these proposals are based, for each benchmark year, upon the projected future environment without the proposed and possible future Federal actions, presented in Chapter II of the Regional Analysis. Following is an index to these five site-specific analyses, indicating the sequence in which they appear in this volume and corresponding page numbers.

RUBY CONSTRUCTION COMPANY Mine and Reclamation Plan

PEABODY COAL COMPANY Mine and Reclamation Plan

W. R. GRACE AND COMPANY Mine and Reclamation Plan

ENERGY FUELS CORPORATION Mine and Reclamation Plan

W. R. GRACE AND COMPANY Railroad Plan

RUBY CONSTRUCTION COMPANY

Mine and Reclamation Plan

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FOR
RUBY CONSTRUCTION-WESTERN MINES

Chapter I

Description of the Proposed Action

THIS CHAPTER IS A DETAILED DESCRIPTION OF RUBY CONSTRUCTION COMPANY'S PROPOSAL TO MINE AND RECLAIM FEDERAL COAL LANDS IN ROUTT COUNTY, COLORADO. THE CHAPTER IS DEVELOPED BY DESCRIBING THE STAGES OF IMPLEMENTATION OF THE COMPANY'S PROPOSAL. THESE ACTIONS ARE USED IN CHAPTER III TO IDENTIFY AND ANALYZE IMPACTS. THE FEDERAL ACTIONS THAT WOULD BE REQUIRED ARE DESCRIBED ON AN AGENCY-BY-AGENCY BASIS, AND OTHER DEVELOPMENTS IN THE AREA OF THE PROPOSED ACTION ARE DESCRIBED TO THE EXTENT THAT THEY MAY CONFLICT WITH OR COMPLEMENT THE PROPOSAL.

The Applicant's Proposal

The action before the Federal Government with respect to Ruby Construction Company is approval of their mining and reclamation plan for a proposed underground mine on Federal coal lease D-051698 (refer to Chapter 1 of the Regional Analysis for a description of the Federal procedures required for this approval).

On December 18, 1974, Ruby Construction Company submitted a mining and reclamation plan to the Office of the Area Mining Supervisor of the U.S. Geological Survey in Denver, Colorado, and filed a supplement to this plan on February. 10, 1975. The company proposes to open an underground mine on Federal lease land that would produce 200,000-300,000 tons/year. The coal produced would supply the local domestic market as well as other users. Production was originally scheduled to begin in March 1975, and it would now start as soon as this environmental report is completed and Federal approval is granted. The mine plan is depicted in Figure WI-1.

Site Location

The proposed mine operation is located in Section 12, T.4N., R.89W., in Routt County, Colorado, 12 miles southwest of Hayden, Colorado. The lease is situated in Hayden Gulch within the Williams Fork Mountains, approximately one mile north of the East Fork of the Williams Fork River. County Road 53 passes through the southeast portion of the lease in an area where the Rice seam has been eroded away.

The lease contains 146.26 acres located in lots 2, 3, and 4 of Section 12. The surface of lots 2 and 4 is privately owned, while the surface of lot 3 is publicly owned. Figure WI-2 depicts the location of the mine.

Stages of Implementation

Mining procedures

The following description of mining and reclamation activities is taken from the mining and reclamation plan submitted by Ruby Construction Company:

At present, there are two coal beds feasible to mine in the lease area; they are commonly referred to as Pinnacle No. 1 (Sun) seam and Pinnacle No. 3 (Rice) seam. The eight-foot-thick No. 3 seam lies approximately 125 feet above the six-foot-thick No. 1 seam (see Figure WI-3). The No. 1 seam was mined by the previous lessee, while Ruby Construction plans on mining the No. 3 seam. The No. 3 seam strikes N.45° W. and dips 9° to the northeast on the lease area. Both seams are classified as High Volatile C Bituminous.

The mine would be opened as a drift mine by three entries from a coal outcrop. The coal seam would be mined by standard room-and-pillar methods using conventional mining equipment. Mining would begin in the north-central part of Section 12 with the development of three entries to the west. The northernmost entry would be fresh-air intake; the center would be a conveyor and travel-way entry; and the southernmost entry would be an exhaust airway. Because of the limited coal reserves on the lease, only one operating section could be supported, and three entries should prove sufficient for such an operation. However, should air quantities beyond the capacity of the three-entry system be required for future expansion, the system could be converted to five entries, and the main east-west entry system could be extended to the canyon just west of the current lease boundary, thereby increasing the fresh-air intake capacity of the mine.

Mining would be done by first undercutting the coal with a cutting machine. The face would be drilled using a coal drill and the holes loaded with permissible explosive and shot, using electric detonating caps. The coal would be loaded with a crawler-mounted loading machine. Coal haulage would be accomplished by shuttle car in the immediate face area, and by conveyor belt from there to the crusher at the surface. Following the loading cycle, roof bolts would be installed with a rubber-tired bolting machine. All mining and conveying equipment would be electrically powered and would utilize 440-volt, three-phase, alternating current. All units would be permissible and would be in compliance with current safety regulations. Blasting would be done with permissible explosives in compliance with Federal and State regulations.

Drilling information indicates a mine roof of massive sandstone or massive shaly-sandstone; a full bolting plan would be utilized to insure good roof control. Roof bolts would be set on a maximum of five-foot centers for the width and length of underground openings, and additional spot bolting would be used as required. Bolts would be 48 inches in length by 5/8 inches in diameter. Timber props would be used for additional roof support as well. The Rice seam would be mined full height.

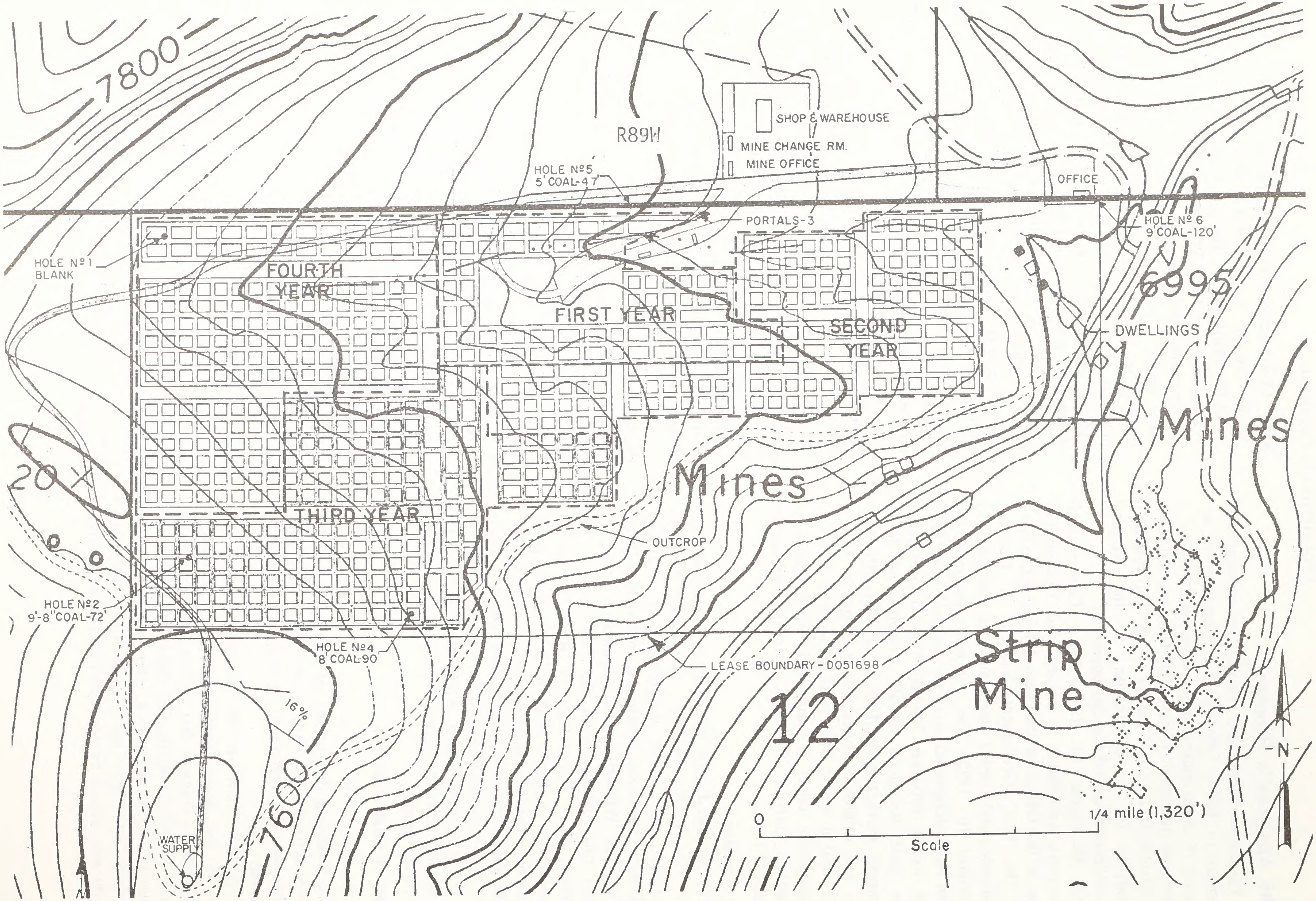


FIGURE WI-1

Mine sequence map and surface facilities for Ruby Construction Company's Sun Mine project.

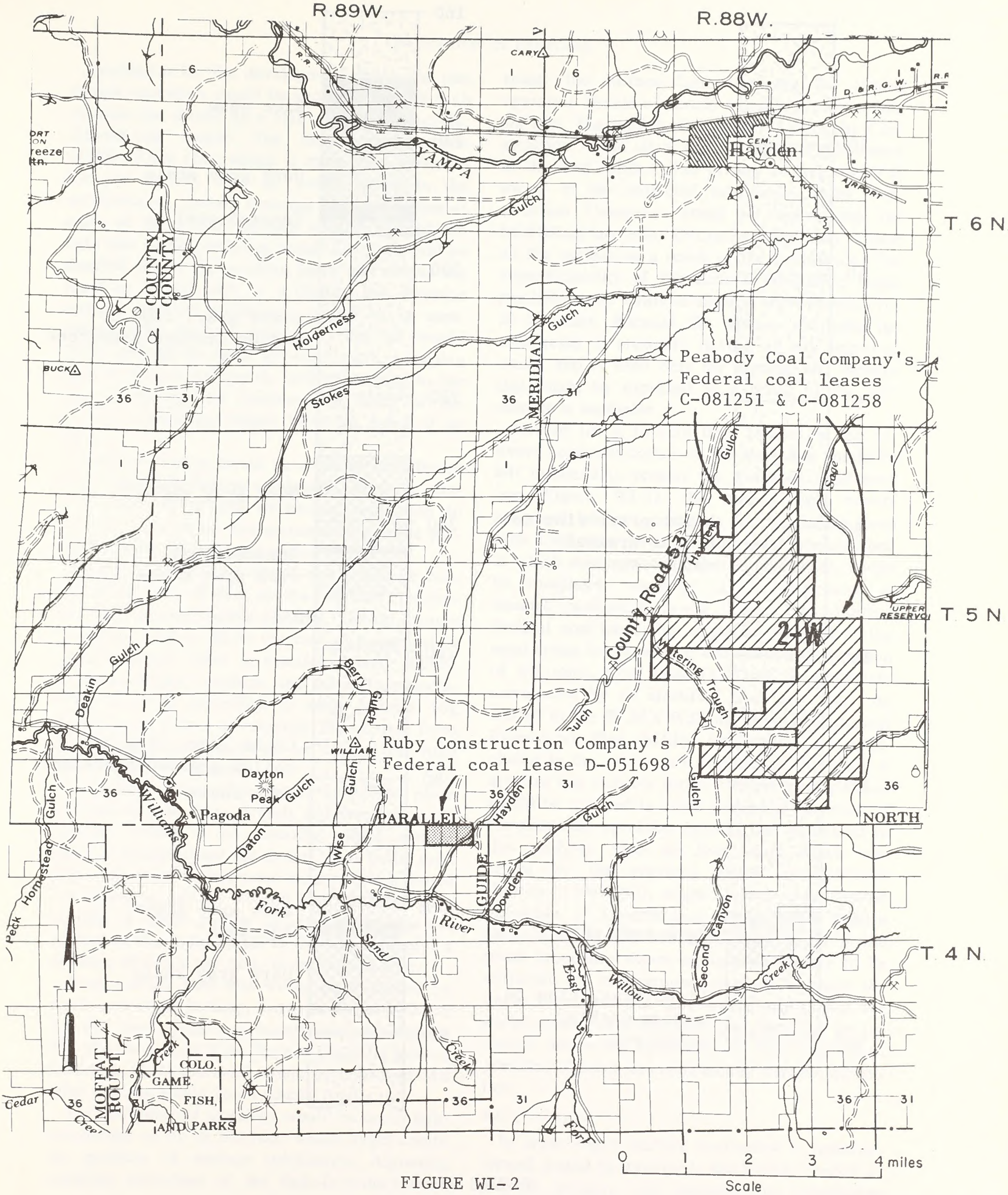


FIGURE WI-2

Site location map for Ruby Construction Company's Sun Mine project.

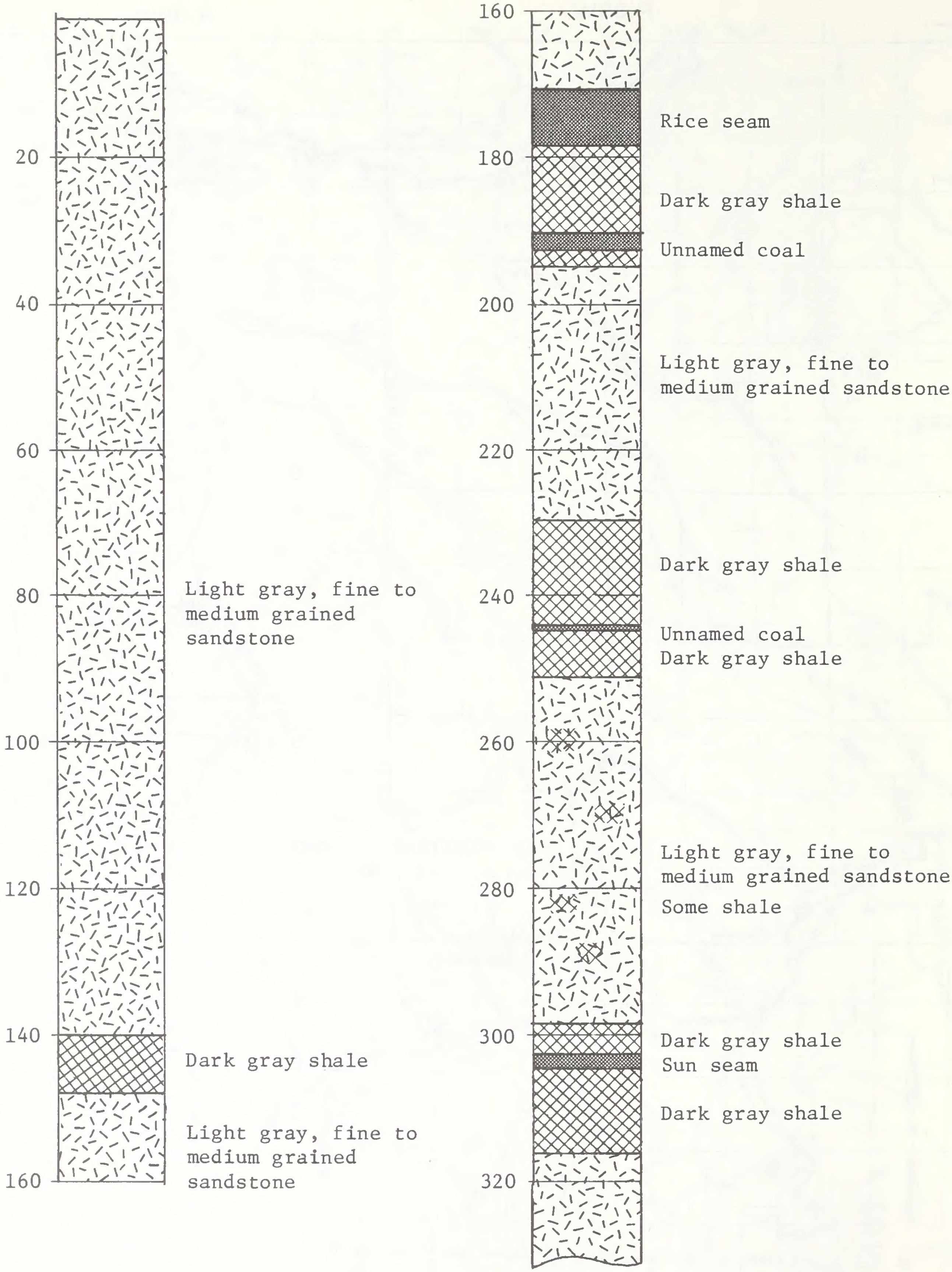


FIGURE WI- 3

Typical cross-section of Ruby Construction Company's Sun Mine project.

Ventilation for the development phase and one section operation would be supplied by a 48-inch Axivane fan driven by a 5HP, 3-phase, 60-cycle, 220/440-volt motor. The fan would provide 28,000-35,000 cfm, which is more than adequate for one section. The air would intake in the northernmost portal, coursing the northernmost entry of the 3-entry system until it entered the right side of the operating panel. The air would be directed across the working faces and out of the panel on the left side by a brattice line. Brattice material and its installation would be in compliance with Federal regulation. The air would return through the outer left-hand entry, sweeping seals of abandoned panels, and exhausting to the surface through the southernmost entry of the 3-entry system (see Figure WI-4 for detail of air flow).

Methane checks would be made in compliance with applicable Federal regulations. Methane content would be diluted by proper ventilation to keep the level below the maximum allowable percentage in working places and airways.

Dust in haulage and travelways would be controlled by rock dusting to the required percentages of non-combustible material. Trickle dusters would be used to dilute the coal dust content in return airways. Dust at transfer points, chutes, discharge points, crushers, and actual face operations would be controlled by spray nozzles, fog nozzles, and hoses, as required. Waste rock from the mining operation would be utilized for road and yard maintenance.

Very little surface disturbance would take place on Federal land. Mine portals and some adjacent facilities would be on federally owned surface land. A storage space for timber, roof bolts, rock dust, and other underground mine supplies would be located in part on Federal land near the mine portals. A small portion of an already existing road from the mine portal to the water supply, a distance of about one mile, is on Federal land.

Most surface land that would be disturbed by roads and other facilities between Hayden Gulch and the mine portals is privately held. An existing half-mile-long road from Hayden Gulch to a truck loading point at the mine would be improved. All other haulage would be on county roads.

The underground workings would be under light overburden of up to 120 feet, which might create the problem of surface subsidence. Assuming complete extraction of the eight-foot-thick Rice seam, the surface land overlying the mining operation should uniformly subside approximately six feet. The mining plan proposed by Ruby Construction would allow for this uniform subsidence of the land surface. The private surface owner is aware of the projected subsidence. Ruby Construction Company would be responsible for backfilling any holes or cracks which may appear on the surface as a result of the subsidence. The unpredictability of the surface subsidence might preclude some forms of surface improvements for 20-30 years. Because the surface overlying the coal seam is presently devoid of any improvements and is used only for grazing, the damage that might be expected as a result of the subsidence is negligible.

Except for a 10-acre tract located in the extreme northeast corner of the lease that would be left unmined to protect the overlying residences (see Figure WI-1), the mining plan covers proposed mining operations for the entire lease area. Coal reserves in the Rice seam, the coal bed in which mining is scheduled to take place, would be completely extracted in four-five years at planned production levels. There are adjoining Federal coal lands that might be acquired as the need arises for expansion and continued operation of the mine. Coal lease D-051698 is completely surrounded by an identified coal lease tract, included in the BLM's Williams Fork Management Framework Plan (MFP). Although it is not included in the applicant's proposal at this time, it appears that possible future Federal leasing action would be required to allow continued operation of the proposed operation beyond that addressed in this analysis. Also the Sun seam, which was mined by the previous lessee of D-051698 (Barton, 1940-1946), might contain some limited quantities of minable coal which would furnish the operation with additional reserves. It is the usual procedure where multiple seams are to be extracted by underground methods to mine the upper seam first and then sequentially extract the lower seams. The Sun seam can therefore be extracted following extraction of the Rice seam, provided it exists in economically minable quantities.

Reclamation

In areas where surface excavation is required, topsoil would be removed, stockpiled, seeded to prevent erosion, and retained for subsequent

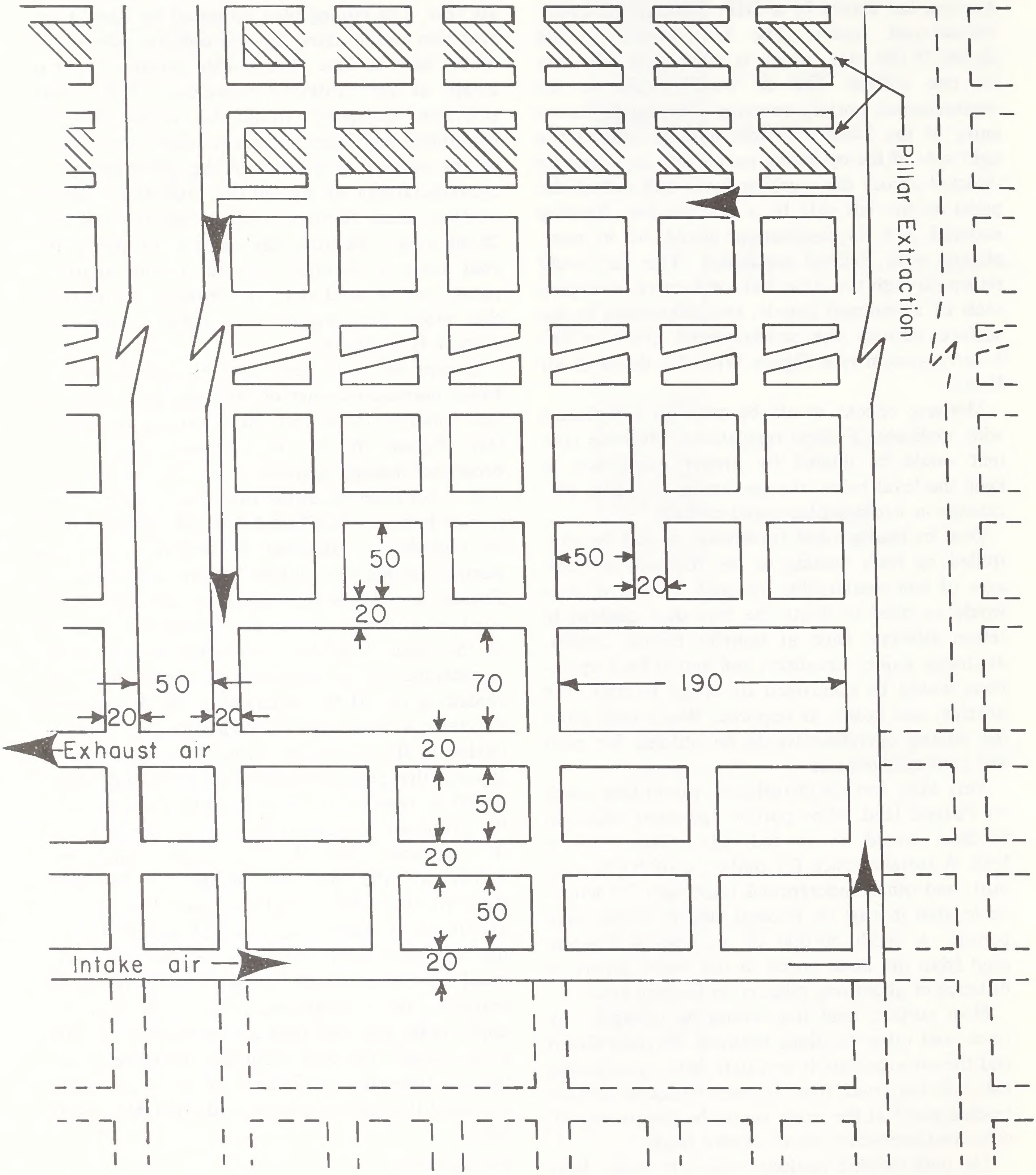


FIGURE WI- 4

Air flow and mine sequence.

reclamation. Disturbed areas would be reclaimed when they are no longer in the area of operations. Disturbed areas would be regraded to approximate the contour of the original surface; the stockpiled topsoil would be spread, and the area would be reseeded. Vegetation to be planted would be contingent upon recommendations of the Area Mining Supervisor and the BLM, taking into account the wishes of the landowner.

Soil erosion would be prevented or controlled by minimal disturbance of the existing surface, use of existing roads if at all possible, and use of water bars in roads.

Refuse and unmarketed coal by-products would be disposed of by burying in trenches; the soil material from the trenches would be stockpiled for subsequent reclamation. Waste rock would be utilized for road and yard maintenance, and any rock not so used would be used for erosion control in an adjacent canyon.

Pollution of surface and ground water would be controlled through the use of check dams to allow settlement of sediment from run-off waters before they reach the flowing streams, non-use of reagents and chemicals in the operations, and plugging of exploratory and diamond-drill holes with cement. A catch-basin would be maintained below the portal site to eliminate any possibility of silt from disturbed areas being carried into streams at lower elevations. The catch-basin would be formed behind a compacted earthen dam designed with suitable volume and spillways to prevent damage to the dam or loss of settled silt during periods of peak runoff. Fresh water generated by mining operations would be utilized for mining, livestock, and game animal watering facilities, surface facility requirements, and roadway dust control.

At the time of abandonment, the mine portals would be sealed with reinforced concrete, with a minimum of 20 feet of rock and soil between the seals and the surface. The portal site would be regraded to approximate original ground contour, covered with stockpiled topsoil, and reseeded. All surface structures would be removed, regraded to approximate original ground contour, and reseeded. Rock and waste not utilized for road and site maintenance would be graded to a slope compatible with the adjacent terrain, which can be worked by mobile equipment, and revegetated.

Surface facilities

Roads and surface storage areas

An existing road from the mine office site in the southern portion of Section 36, T.5N., R.89W. to the mine water supply tank in Section 12 (see Figure WI-1), a distance of approximately one mile, might be improved. A small portion of this road crosses Federal surface in Section 11. An existing road on private land from Hayden Gulch to a truck loading point at the mine, a distance of ½ mile, would also be improved. Truck haulage of coal would be over this road to Hayden Gulch, and thence over County Road 53 to a rail-loading facility to be constructed near the Hayden power plant.

Office and shop

Surface facilities would be constructed on private surface land (Figure WI-1). They would include an office building (28' x 60'), a warehouse building (50' x 125'), a mine office (14' x 60'), and a change room (14' x 60'). The company does not anticipate the need for a coal washing plant. Processing facilities would be limited to a small screening and crushing operation. A tipple for screening and sizing would be installed near the mine site.

Mining equipment

Underground mining equipment would consist of a coal cutting machine, a coal drill, a loading machine, two shuttlecars, and a roof bolting machine. All equipment is classified as permissible for use in underground coal mines.

Power and water

Power for operation of mining equipment, shop and office facilities, etc., would be supplied from an existing transmission line that runs parallel to County Road 53. The powerline to the mine site would pass over private surface land and the Federal lease, so no Federal right-of-way approval would be required.

A two-inch water line would run along the surface from a water supply tank, just south of the lease, to the mine portal area. This water would be used for dust suppression within the mine and would furnish a fire-fighting supply. The line would be heat-taped to prevent freezing.

Mining sequence

The company plans to begin operations in the northern portion of Section 12 with development of three main entries. These main entries would be turned to the south approximately 500 feet, and would then be turned to the east, whereupon they would be driven to near the outcrop. Panels would be mined north and south of this west-east main entry. Pillar extraction would begin in each panel, following advancement of the panel to the lease boundary or the coal outcrop. Following extraction of coal from the last panel off the west-east mains, the north-south mains would be extended, and panels would be driven west. Mining sequence by year is shown in Figure WI-1. Additional unleased Federal coal lies adjacent to the lease and would be applied for as production need arises.

Transportation and marketing

A portion of the coal mined by Ruby Construction Company would supply the local domestic market; fuel would be furnished to homes, schools, hospitals, and other local users. Many homes and ranches in the area continue to rely on coal as a primary winter fuel, and are finding adequate supplies from local mines increasingly difficult to obtain. There is at present only one other small mine in the general area producing coal for the domestic market; this mine produces only about 50 tons/day and is not adequate to fulfill demands. In addition coal might be supplied to users at other locations in Colorado and neighboring states.

Most of the coal sold to local users would be transported by truck; storage bins for truck loading would be constructed at the mine site.

The remainder of Ruby Construction Company's production would be transported via truck on County Road 53 to a loading facility to be constructed near the Hayden power plant. This would limit heavy truck traffic through the town of Hayden, and would allow both Ruby Construction Company's coal and Peabody Coal Company's Seneca 2-W coal to be transported over the same improved road.

Relationship to Other Developments in Immediate Area

There are at present no other operators actively mining coal in the immediate vicinity of Ruby Construction Company's lease. However, there are two companies that have indicated their intent to begin coal mining operations in the vicinity of Ruby Construction in the future. Peabody Coal Company's proposed Seneca 2-W Mine area would be located four miles northeast of the Ruby Construction Mine site. A portion of Ruby Construction's coal would be transported over County Road 53 to a loadout facility to be constructed near the Hayden power plant. This road passes along the west side of the Seneca 2-W area and would be used for haulage of the 2-W coal to the Hayden power plant as well. The road would be improved by Peabody Coal Company prior to initiation of operations at Seneca 2-W; increased traffic volume resulting from coal trucks hauling from two mines could be adequately handled on the county road following its improvement.

American Electric Power Corporation holds Federal coal lease C-012894, located five miles northwest of the proposed Ruby Construction Mine site. The company plans to open an underground mine, provided additional reserves can be acquired. Operation of Ruby Construction Company's Mine should have no effect on American Electric Power Corporation's plans.

Chapter II
Description of the Environment

THE FOLLOWING SECTION DESCRIBES THE PHYSICAL, BIOLOGICAL, AND CULTURAL RESOURCE VALUES WHICH CONSTITUTE THE SITE-SPECIFIC ENVIRONMENT IN WHICH RUBY CONSTRUCTION COMPANY PROPOSES TO DEVELOP FEDERAL COAL. THE DESCRIPTION FOCUSES ON ENVIRONMENTAL DETAILS MOST LIKELY TO BE AFFECTED BY RUBY CONSTRUCTION'S PROPOSED ACTION AND ALTERNATIVES. ALTERATIONS OF THESE EXISTING RESOURCE VALUES WOULD RESULT FROM THE IMPLEMENTATION OF THE COMPANY'S PROPOSAL.

Non-living Components

Geologic and Geographic Setting

TOPOGRAPHY

Coal lease D-051698, where the mine would operate, lies within Hayden Gulch about one mile north of the East Fork of Williams Fork River (see Figure WII-1). The company's maps and reports indicate it plans to mine only on the northwest side of the gulch.

This part of Williams Fork Mountains, north of the river, consists mostly of high north-to-northeast trending ridges separated by intermittent and small perennial streams that drain southward into the East Fork of Williams Fork River. The river flows west-northwestward in a narrow valley that opens up to about one-half mile wide just downstream from the Hayden Gulch junction at 6,780 feet elevation. The crest of the Williams Fork Mountains, one and a half to two miles north and northwest of the mine area, is about 7,950-8,325 feet.

The surface of the ridge where mining would occur has a northeastward slope averaging about 20 percent. The steepest general slope on the site is about 65 percent, and locally 100 percent on the escarpment overlooking Hayden Gulch beyond the southeast end of the planned mine. Hayden Gulch, along which an improved gravel road runs, has an average slope of about three percent.

STRATIGRAPHY

Coal beds of interest in this mine plan are in the Iles Formation of the Mesaverde Group. The underlying Mancos Shale forms the lower 100 feet or so of the ridges at the mouth of Hayden Gulch, and the bedrock over which the East Fork of Williams Fork River flows for several miles. The Trout Creek Sandstone Member, at the top of the Iles, lies about 500 feet above the coal beds.

A "typical cross section" at the proposed mine site, described by the company from its drill holes, shows the following:

Sandstone, light gray, fine to medium grained	140	feet
Shale, dark gray	8	feet
Sandstone, light gray, fine to medium grained	21	feet
Coal, Rice bed	7	feet
Shale, dark gray	12	feet
Coal, unnamed bed	3	feet
Shale, dark gray	3	feet
Sandstone, light gray, fine to medium grained	36	feet
Shale, dark gray	13	feet
Coal, unnamed bed	1	foot
Shale, dark gray	8	feet
Sandstone, light gray, fine to medium grained, some shale	43	feet
Shale, dark gray	6	feet
Coal, Sun bed	2	feet
Shale, dark gray	10	feet
Sandstone	16+	feet

The company describes the coal-bearing strata of this site as interbedded sandstones and shales that contain two coal seams of economic significance: the Sun and Rice seams. Core-drill records indicate the roof of the proposed mine to be massive sandstone, locally grading upward to shaly sandstone. The interval between the seams generally is interbedded sandstone and shale approximately 125 feet thick.

STRUCTURE

Structure of the proposed mine site appears to be relatively simple (Bass, Eby, and Campbell 1955). The coal-bearing beds dip rather uniformly about ten degrees northeast. These beds are on the northeast flank of the west- to northwest-trending Pagoda Dome or Anticline, one of a series of anticlinal structures which cause the northward dip of beds all along the Williams Fork Mountains.

No faults are known or believed to occur on or near the mine site. Most fractures probably would be minor joints, but no fracturing has been reported by the company or in geological literature; however, no detailed geologic work has been done in the area.

GEOMORPHOLOGY

Landforms present are the result of erosion of gently to moderately dipping rock strata of varying degrees of hardness. The Trout Creek Sandstone Member forms a vertical to very steep cliff almost one hundred feet high. Thinner, hard sandstone beds form smaller cliffs and ledges and the shales and other less resistant beds form gentle slopes between the cliffs and ledges. Most beds of the Iles Formation are fairly resistant, so that most hill slopes are rather rugged.

PALEONTOLOGY

The coal beds of interest are in the Iles Formation, which is known to contain fossil leaves, ammonites, and inoceramus clams (in adjacent marine shales). Although no on-site paleontological survey has been completed, a further indication of fossil potential is contained in an Environmental Impact Analysis (EIA) completed by the U.S. Geological Survey (USGS) (February 12, 1975). It indicates that the lease was originally is-

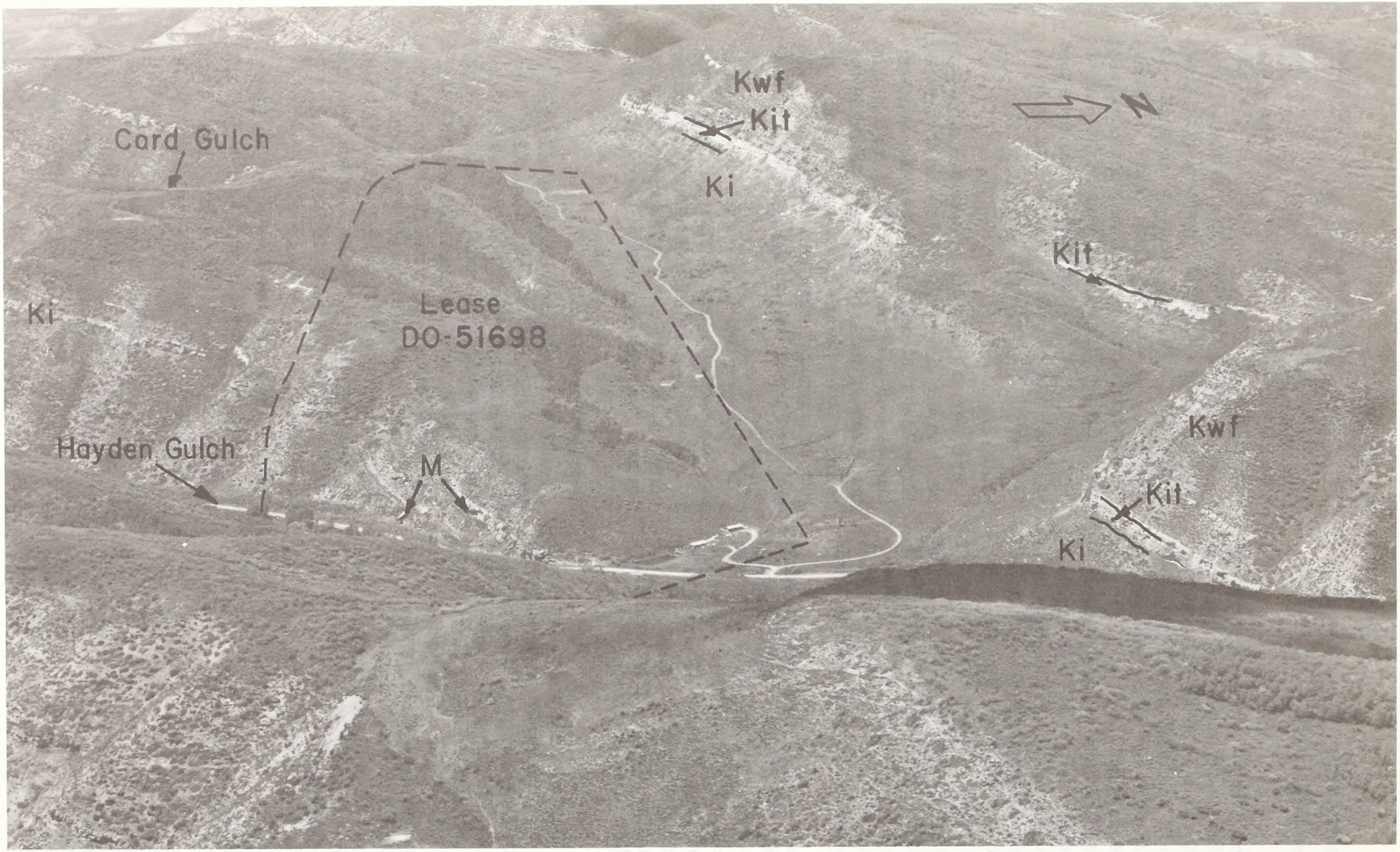


FIGURE WII-1

Aerial oblique photograph, looking west, showing the proposed mine site of Ruby Construction Company (dashed lines). Note the relatively smooth north-sloping and heavily wooded surfaces interrupted by cliffs and steep slopes of the Iles (Ki) and Williams Fork (Kwf) Formations. Principal cliff-forming bed is the Trout Creek (Kit) Sandstone Member. Two abandoned underground mine portals (M) are in the lease area.

sued to a Mr. Thomas Barton who operated the mine until his death in 1968; "Mr. Barton was killed when he struck his head on a dinosaur imprint that protruded downward from the mine roof".

Mineral Resources

OIL AND GAS

Except for coal, no mineral resources are known or believed to be present in the area of this mine plan. Minor sand and gravel deposits occur along alluvial valleys, but this plan would not affect any of them.

The Pagoda Dome Gas Field is 4½ miles southwest of the mine site, and about 3,500 feet structurally higher. Therefore, except for the possibility of stratigraphic traps, no oil or gas are believed to occur at the site. Numerous oil and gas test holes would have to be drilled to prove the existence of such a stratigraphic trap on the site; such drilling would be unlikely in the foreseeable future.

COAL

Coal beds of interest in this mining plan are the Rice and Sun seams, both in the Iles Formation. The Rice seam, also known as the Pinnacle No. 3, is approximately 125 feet stratigraphically above the Sun seam, which is also known as the Pinnacle No. 1. The proposed mine would extract coal only from the Rice.

The Rice coal averages eight feet thick and is classified as high volatile C bituminous. Company analyses indicate 5.0 percent ash content, 4.75 percent fixed carbon, 0.6 percent sulfur, and 11,500-12,500 Btu per pound. Other analyses are shown in Table WII-1. The Webber (Rice) Mine across Hayden Gulch produced coal from the Rice seam, where it averaged slightly less than ten feet thick (Bass, Eby, and Campbell, 1955).

The Sun coal, reported by the company to be about six feet thick, also is high volatile C bituminous, contains 5.6 percent ash, 46.8 percent fixed carbon, 0.5 percent sulfur, and 11,500-12,000 Btu per pound.

Quantity of coal at the proposed mine site can only be roughly estimated because of the lack of precise drill hole data. The company plans to mine at the rate of 200,000-300,000 tons per year. Based on this production rate the Area Mining Supervisor of the USGS estimates mine life to be four or five years. The lease area is 146.26 acres, but the company's overburden map shows the coal was removed by erosion in Hamilton Gulch, so the coal bed to be mined underlies slightly less than three-fourths of the lease area. The general mine layout map of the company indicates mining would take place under about 98 acres; however, with the space limitations shown by the company only about 89 acres would be mined.

All the mining is planned on the Rice coal bed, which is reported by the company to average eight feet in thickness. Using the standard 1,800 tons/acre foot, an eight-foot coal bed would have 14,400 tons/acre. Total reserves of the Rice bed in 98 acres is about 1.411 million tons, and in 89 acres, about 1.282 million tons. At a yearly rate of 250,000 tons, mining total coal present under 98 acres would support a 5.6 year program, and under 89 acres, a 5.1 year program; a 50 percent recovery rate (generally stated for underground mines) would support a program of less than three years. The company mentions "pillar extraction" and shows a "Typical Layout" of this in its mining plan. Calculations based on this map indicate that coal would be totally removed from about 80 acres; this would amount to about 1.152 million tons, and at an annual rate of 250,000 tons, would support a 4.6 year program.

The Sun coal bed is about six feet thick and would contain about 1.65 million tons under the entire lease area, if it is continuous and of uniform thickness. The company has raised doubts as to this possibility; "5 drill-holes completed in the 1974 drilling season failed to show any occurrence of coal in commercial thickness in the Sun Seam. These holes surrounded the Sun workings on 3 sides, the 4th side being the outcrop, indicating that no significant tonnage of Sun Seam coal having economic potential exists." However, a memorandum of February 14, 1975 from D. V. Haines, geologist, to the Area Mining Supervisor, USGS, suggests that correlation problems in the drill holes may have misled the lessee. Additional exploration can be undertaken at a later date, and provided mineable quantities of the Sun seam exist, can be mined following extraction of the Rice seam.

Overburden at the proposed mine site ranges from a maximum of about 120 feet to a minimum of slightly less than 40 feet (Figure WII-2). The company's description of the overburden indicates that they anticipate stable roof and floor conditions.

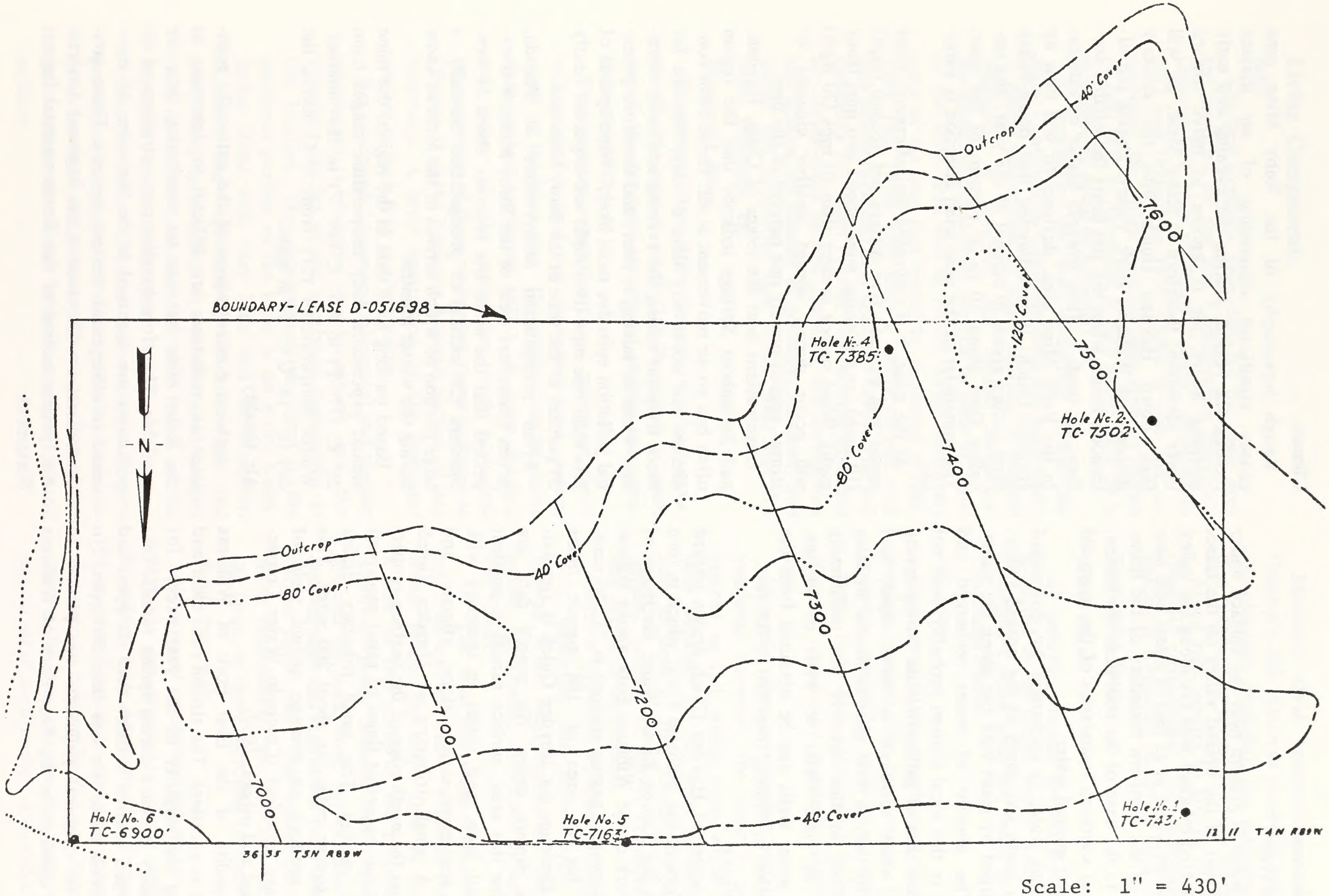
TABLE WII-1

Analysis of Coal Near Ruby Construction Company's Proposed Mine Site

(Made at the Pittsburg laboratory of the U.S. Bureau of Mines. Form of analysis: A, as received; B, air dried; C, moisture free; D, moisture and ash free)

Mine and location	No. on map	Location in mine	Coal bed and group	Formation	Lab. no	Air-drying loss	Form of analysis	Proximate: Moisture	Proximate: Volatile matter	Proximate: Fixed carbon	Proximate: Ash	Ultimate: Sulfur	Ultimate: Hydrogen	Ultimate: Carbon	Ultimate: Nitrogen	Ultimate: Oxygen	Heating value: Calories	Heating value: Btu
Sun mine (formerly Green), in Hayden Gulch, NE¼ sec. 12, T. 4 N., R. 89 W.	264	10 ft cut at face	Bed *T*, lower coal group.	Iles	2210	3.4	A	11.3	34.5	49.6	4.6	.5	----	----	----	----	----	----
							B	8.2	35.7	51.3	4.8	.5	----	----	----	----	----	----
							C	----	38.9	55.9	5.2	.6	----	----	----	----	----	----
							D	----	41.0	59.0	----	.6	----	----	----	----	----	----
Do	264	End of 180 ft entry	do	do	9693	4.8	A	12.2	35.8	47.4	4.6	.44	5.51	64.99	1.41	23.03	6,320	11,380
							B	7.8	37.6	49.8	4.8	.46	5.23	68.27	1.48	19.71	6,640	11,950
							C	----	40.8	54.0	5.2	.50	4.73	74.02	1.61	13.88	7,200	12,960
							D	----	43.0	57.0	----	.53	4.99	78.13	1.70	14.65	7,600	13,680
Do	264	Face of main heading, 215 ft from portal.	do	do	C33662	3.5	A	10.8	36.8	46.8	5.6	.5	5.7	66.1	1.4	20.7	----	11,560
							B	7.6	38.1	48.5	5.8	.6	5.5	68.5	1.5	18.1	----	11,980
							C	----	41.3	52.4	6.3	.6	5.0	74.2	1.6	12.3	----	12,960
							D	----	44.0	56.0	----	.6	5.3	79.1	1.7	13.3	----	13,830
Rice mine (also known as Webber mine), in Hayden Gulch, NE¼ sec. 12, T 4N., R. 89 W.	263	190 ft in by portal to main heading.	Bed *R*, lower coal group.	Iles	B34465	6.3	A	11.8	34.4	50.2	3.6	.5	5.9	66.6	1.4	22.0	----	11,650
							B	5.9	36.7	53.6	3.8	.6	5.5	71.0	1.5	17.6	----	12,420
							C	----	39.0	56.9	4.1	.6	5.2	75.4	1.6	13.1	----	13,200
							D	----	40.7	59.3	----	.6	5.4	78.6	1.6	13.8	----	13,760
Core hole, NE¼ sec. 34, T. 5 N., R. 89 W.	325a	Depth: 142 ft 9 in. to 148 ft 3 in. (8 in. bone rejected).	Bed *D*(?) lower coal group.	do	D24614	0.9	A	9.9	35.3	47.3	7.5	.6	5.8	64.3	1.4	20.4	----	11,370
							B	9.1	35.6	47.7	7.6	.7	5.7	64.9	1.4	19.7	----	11,480
							C	----	39.2	52.4	8.4	----	5.2	71.4	1.6	12.7	----	12,630
							D	----	42.8	57.2	----	----	5.7	77.9	1.7	13.9	----	13,780
Do	325a	Depth: 196 ft 11 in to 201 ft 8 in. (2 in. coal lost).	Bed *C*(?) lower coal group.	do	D24615	1.0	A	9.8	35.6	50.5	4.1	.5	5.7	68.4	1.3	20.0	----	11,920
							B	8.9	35.9	51.1	4.1	.5	5.6	69.1	1.3	19.4	----	12,030
							C	----	39.4	56.1	4.5	.5	5.1	75.9	1.4	12.6	----	13,210
							D	----	41.3	58.7	----	.6	5.3	79.5	1.5	13.1	----	13,840
Do	325a	Depth: 263 ft 2 in. to 264 ft 6 in. (1½ in. coal lost).	*B* zone, lower coal group.	do	D24616	1.1	A	11.2	35.8	50.3	2.7	.5	5.8	68.2	1.3	21.5	----	11,790
							B	10.2	36.2	50.9	2.7	.5	5.7	68.9	1.4	20.8	----	11,920
							C	----	40.3	56.7	3.0	.6	5.1	76.8	1.5	13.0	----	13,280
							D	----	41.5	58.5	----	.6	5.3	79.1	1.5	13.5	----	13,690
Do	325a	Depth: 284 ft 4½ in. to 287 ft 1 in. (6½ in. coal lost).	----	do	D24617	1.0	A	10.0	35.2	47.0	7.8	.7	5.6	64.1	1.5	20.3	----	11,270
							B	9.1	35.6	47.4	7.9	.7	5.6	64.8	1.5	19.5	----	11,390
							C	----	39.1	52.2	8.7	.7	5.0	71.3	1.6	12.7	----	12,520
							D	----	42.8	57.2	----	.8	5.5	78.0	1.8	13.9	----	13,710
Do	325a	Depth: 315 ft 3½ in. to 316 ft 8¾ in.	----	do	D24618	1.3	A	10.1	35.2	49.4	5.3	.6	5.8	67.1	1.5	19.7	----	11,750
							B	8.9	35.7	50.0	5.4	.6	5.7	68.0	1.5	18.8	----	11,900
							C	----	39.1	55.0	5.9	.7	5.2	74.6	1.6	12.0	----	13,060
							D	----	41.6	58.4	----	.7	5.5	79.3	1.8	12.7	----	13,890
Do	325a	Depth: 329 ft 4 in. to 330 ft 6 in	----	do	D27658	3.8	A	10.7	34.2	51.4	3.7	.5	5.7	67.0	1.5	21.6	----	11,720
							B	7.1	35.6	53.5	3.8	.5	5.5	69.6	1.6	19.0	----	12,190
							C	----	38.3	57.6	4.1	.6	5.1	75.0	1.7	13.5	----	13,120
							D	----	40.0	60.0	----	.6	5.3	78.2	1.8	14.1	----	13,690

SOURCE: U. S. Geological Survey Bulletin 1027-D



Scale: 1" = 430'

FIGURE WII-2

Overburden thicknesses and structure contours on coal bed, in feet, at Ruby Construction Company's proposed mine site.

SOURCE: Ruby Construction Company

Water Resources

GROUND WATER

Ground water is present near the surface under the central part of the upland valley on the lease. This is indicated by giant wild rye along the valley bottom, and by water at 25 feet in a test hole near the center of the northern boundary of the lease. Test holes to the base of the coal near the easten, western, and southern boundaries of the lease did not encounter ground water.

The ground water is recharged by downward percolation north and south of the upland valley, and discharged by giant wild rye along the valley bottom. The amount of water recharged and discharged in this local system probably does not exceed a few tens of gallons/minute during spring snowmelt, when recharge is most rapid, and decreases to only a few gallons/minute in later summer. Coal in this area is not sufficiently permeable to yield water to wells or springs. However, water wells can be obtained from the Iles Formation by drilling from 100 to 200 feet.

SURFACE WATER

Surface water of Hayden Gulch drains toward the East Fork of the Williams Fork, which in turn drains into the Yampa River. Water discharge of the East Fork of the Williams Fork above Willow Creek (the nearest gaging station) is 77,520 acre-feet/year, for an area of 108 square miles (1956-70). Drainage for Hayden Gulch is approximately six square miles. No runoff data are available for this area; surface runoff is greatest in May and June, and varies in intensity with prevailing vegetative cover, slope, climate, and exposure. A small tributary of Hayden Gulch which drains the north edge of the surface property will not run except at times of rapid snowmelt or intense rainfall. The small tributary drains about 0.3 square miles, or about 200 acres. This area may produce an average annual yield of about twenty acre-feet (Colorado Water Conservation Board and others, 1969).

Water quality of the East Fork of Williams Fork River is excellent. The stream runs clear and cold during the majority of the year except for some turbidity increase during spring runoff. Dissolved oxygen content is more than six ppm, and total dissolved solids are less than 500 ppm. No biological or chemical pollutants are present in significant amounts in the East Fork of Williams Fork.

Climate

Rough topography of the Ruby Mine area causes significant channeling of air masses passing the region. During the evening and early morning hours, air is known to move toward lower elevation; therefore at Ruby Mine, air will flow down Hayden Gulch into the easterly drainage of Williams Fork Valley. During the afternoon hours when the sun heats the earth's surface, air tends to flow towards higher elevations. In the Ruby Mine area, daytime air will flow up Hayden Gulch. It is estimated that down-valley flow occurs about 50 percent of the year, and up-valley flow about 10 to 20 percent of the year. The remainder of the year wind direction is variable.

At the mine, it is estimated that afternoon wind speed will average five meters per second (mps) (10 mph), and evening wind speed two mps (four mph). Wind speeds greater than 10 mps (20 mph) will occur during abrupt weather changes or storms approximately one percent of the time.

Observations near the towns of Craig, Hayden, and Steamboat Springs indicate that the region often has no air movement at all. These calm conditions can occur any time of day, but are far more frequent during the evening and early morning, when air mixing is poor, and therefore potential pollution episodes most likely. Wind speeds of less than one mps (two mph) are expected nearly 20 percent of the time at the Ruby Mine site.

From precipitation observations at Pagoda, seven kilometers west of the Ruby Mine, it is expected that the mine site receives about 51 centimeters (20 inches) of precipitation annually, a large portion of which arrives in the form of snow during the winter months.

Based on long term data in the region, the mine should experience daily temperature ranges from 25° C (77° F) to 6.7° C (44° F) in the summer. Winter temperatures vary from 5° C during the day to −15° C (5° F) at night.

Air Quality

Ambient concentrations of the nationally regulated air pollutants are difficult to determine at the Ruby Mine because no monitoring data are available. Therefore baseline concentrations of air pollutants are assumed to be the same as measured in other rural western regions. These concentrations are discussed in the Regional Analysis Air Quality section of this Environmental Impact Statement.

Living Components

Soils

The best available soils data for the mine area are provided by the Soil Conservation Service's General Soil Map of Routt County, prepared in 1972 and revised in 1975. There is one soil association, 59, within the coal mine area, as shown on Soil Map 8, Appendix B. Soil association 59 is described in detail in Appendix D.

In summary, the soils occurring within the Ruby Construction Company lease are moderately to highly susceptible to water erosion, if present vegetation is removed and topsoil disturbed. Revegetation capabilities are fair to poor on most of the lease area due to excess slope, however, most of the area that would be disturbed is relatively flat. These soils have a loamy subsoil with high amounts of clay that compact easily. The soil suitability for roads is poor due to their potential for shrink-swell hazard. Detailed soil inventories and studies are needed to quantify, measure, and locate soil properties that affect their use for roads, buildings, etc.

Terrestrial Flora

Vegetation of the Ruby Construction lease area, though the area is small (146.26 acres), is quite varied, due to rapid elevational change and variations in aspect.

Two primary vegetative types, mountain shrub and sagebrush, and one secondary type, aspen, occur on the lease area. These types can be easily distinguished in Figure WII-1. A more detailed description of the vegetation and ecological requirements of these vegetative types is found in Chapter II of the Regional Analysis section of this statement. A brief description of the dominant species in each type is given below.

Big sagebrush (*Artemesia tridentata*) and slender wheatgrass (*Agropyron trachycaulum*) are the dominant species of the sagebrush community at this location. The sagebrush type found in the southeast portion of the lease is on a dry south-facing slope with very little soil development; therefore the vegetation is of poor vigor and many bare spots occur. A few scattered juniper trees (*Juniperus utahensis*) are also found on the dry, rocky areas of this type.

Giant wildrye (*Elymus cinereus*) is a very prominent component of the sagebrush community in the draw along the northern boundary of the lease where the water table is near the ground surface.

Mountain shrub community is dominated by Gambel's oak (*Quercus gambelii*) and serviceberry (*Amalanchier alnifolia*); the associated grass species is mountain brome (*Bromus marginatus*).

Aspen type occurs as groves of quaking aspen (*Populus tremuloides*); the dominant understory species is Kentucky bluegrass (*Poa pratensis*).

Terrestrial Fauna

Wild fauna

All terrestrial faunal species that are known or expected to be found within Ruby Construction Company's lease area are listed in Appendix D, Terrestrial Fauna.

Big game

Black bear (*Ursus americanus*) may occasionally wander through the lease area, but none are known to inhabit the lease on a regular basis.

Both mule deer (*Odocoilius hemionis*) and elk (*Cervus canadensis*) regularly inhabit the lease area.

Mule deer. One or two deer remain in this area yearlong; however, the lease is generally considered to fall within their winter range. Mule deer densities on the lease probably vary from zero to three or four animals, depending on the season, amount of snow, condition of browse, and degree of harassment.

Cover is provided by trees, brush, and terrain. Oak, sagebush, and serviceberry are used as browse. Water requirements are met by scattered ponds, stocktanks, snow, and to some degree by Dry Creek.

Elk. The lease lies along a major elk migration route as well as within Williams Fork elk herd's winter range. The major flow of migrating elk is a mile or two north of the proposed mine site; however, many animals are expected to pass through the lease area. An increase in elk migration through this region has been noted in the last two or three years. Elk winter cover, food, and water requirements are basically the same within the lease, as those indicated for mule deer.

Small mammals

No unusual or unexpected species or population densities are known to occur within the lease boundary (see Appendix D, Terrestrial Fauna). Rodent and predator densities appear normal for this type of habitat. Rabbit and hare numbers are abnormally low, but this has been reported over almost all of northwestern Colorado.

Game birds

Mourning dove (*Zenaidura macroura*) inhabit the lease area in spring and summer. Dove densities are apparently increasing in this part of the state. A few blue grouse (*Dendragapus obscurus*) are probably found within the area from time to time, perhaps even nesting and raising broods in the vicinity.

Other birds

A wide variety of non-game birds inhabit this area. The greatest species diversity and greatest numbers of birds occur during summer; however, a few birds remain as yearlong or winter residents.

No unusual or unexpected species or population densities are known to occur within the lease boundary. If bald eagle (*Haliautus leucocephalus*) utilize the area, as the species list suggests, they are expected to be infrequent visitors, and probably only in the winter.

Amphibians and reptiles

No information is presently available on species or habitat status for the herpitofauna of this site. Nothing unusual has been reported in this general area in the past, but almost no work has been done, so any potential unusual occurrences would not have been detected.

Terrestrial invertebrates

No information is currently available concerning the use of the subject area by species of this segment of terrestrial fauna.

DOMESTIC FAUNA

Only one livestock operator utilizes lands involved within the lease area. They are used for grazing by sheep during summer and early fall.

Based on records and knowledge of the area, the ability of the vegetation to support domestic animals is broken down as follows: three acres/AUM (Animal Unit Month) in aspen type, 5.5 acres/AUM in mountain shrub type, and 5.75 acres/AUM in sagebrush type.

Using these figures, the estimated carrying capacity of the lease area would be about 36 AUMs.

Livestock water is provided by Dry Creek as well as several stocktanks and ponds located in the area.

Aquatic Biology

According to information tabulated by the Colorado Division of Wildlife (Colo. DOW 1972), the East Fork of the Williams Fork River supports a trout fishery of "blue ribbon" quality. The existing fishery habitat is ideal in every respect (e.g., pool-riffle ratio, water quality, and substrate composition). The Colo. DOW has delineated the fish population as 90 percent cutthroat trout, five percent rainbow trout, and five percent mountain whitefish. In addition, a few suckers and sculpins could be expected to be present.

Members of the benthic invertebrate community are abundant and exhibit great diversity; the composition of the benthic community is the best indicator of the overall excellent water quality of the stream. The periphyton and plankton communities are also healthy and diverse. The fish food supply in the East Fork of Williams Fork River is rated as excellent by the Colo. DOW.

Cultural Components

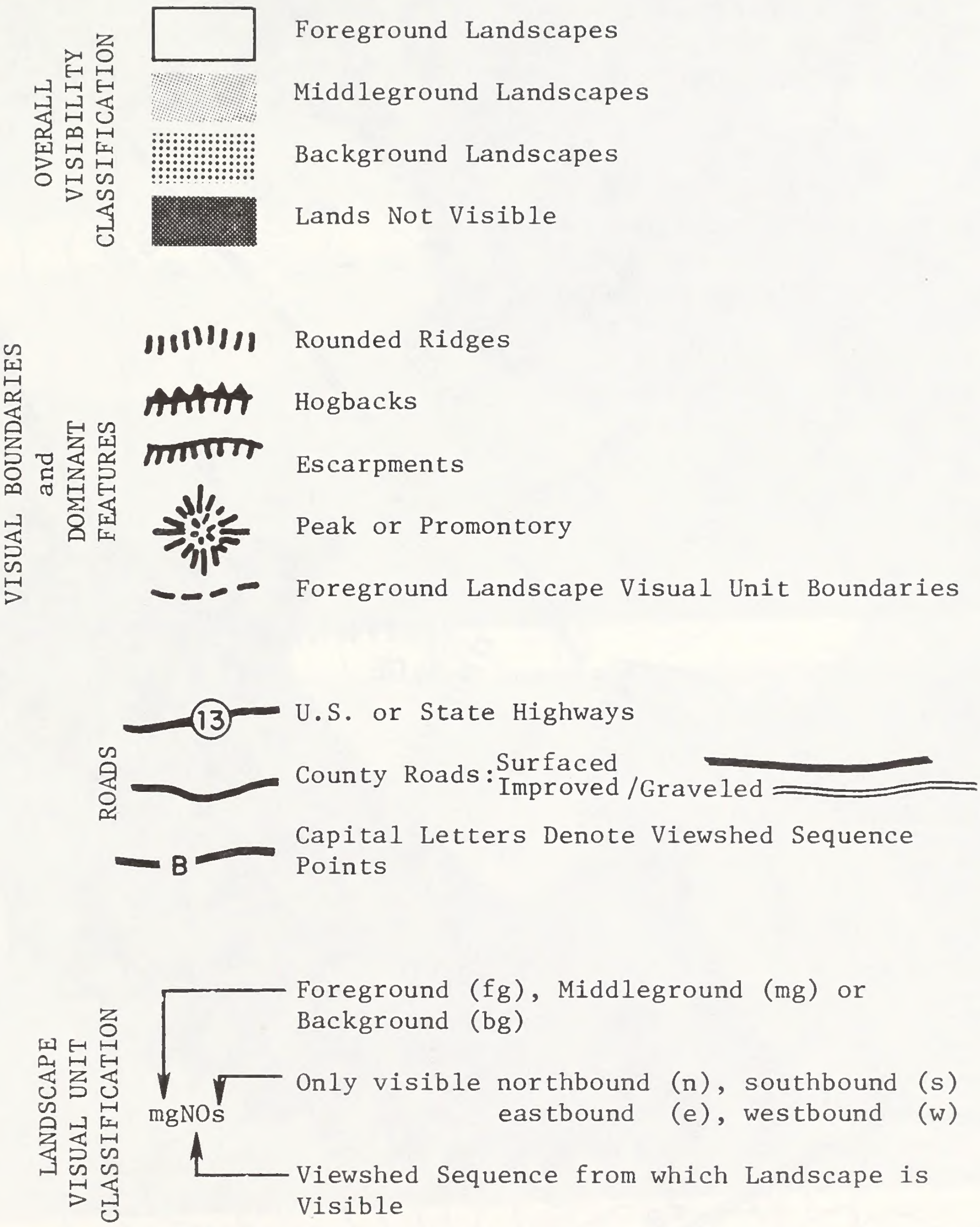
Archeological Resources

Dr. Alan Olson completed a field reconnaissance survey of "a site for proposed construction of mine buildings located on Lots 2, 3 and 4, located in the NE ¼ of the NW ¼ of Section 12, T.4.N., R.89.W." This quotation is from Dr. Olson's letter to Ruby Construction Company reporting that "the proposed location for the buildings is not in relationship to the present topography to be coincident with any archaeological materals." The aforementioned legal description does not agree with the area delineated by Lots 2, 3, and 4, so it is unclear as to exactly what area was surveyed. However, Dr. Olson states that "Surface examination would suggest that no archaeological material would be disturbed by the project," and he recommends that archeological clearance be given.

Historical Resources

The old Rice Mine lease, D-050236 (88.42 acres), was issued to J. E. (Ed) Weber on October 29, 1937. The lease was subsequently reassigned three times and finally terminated on October 28, 1963. The mine was in production under the Rice-Pinnacle Coal Company from 1937 to 1959 with an average annual production of 7,000 tons.

Immediately adjacent to and east of the proposed action area and County Road 53, lies an



Legend for landscape visibility maps.

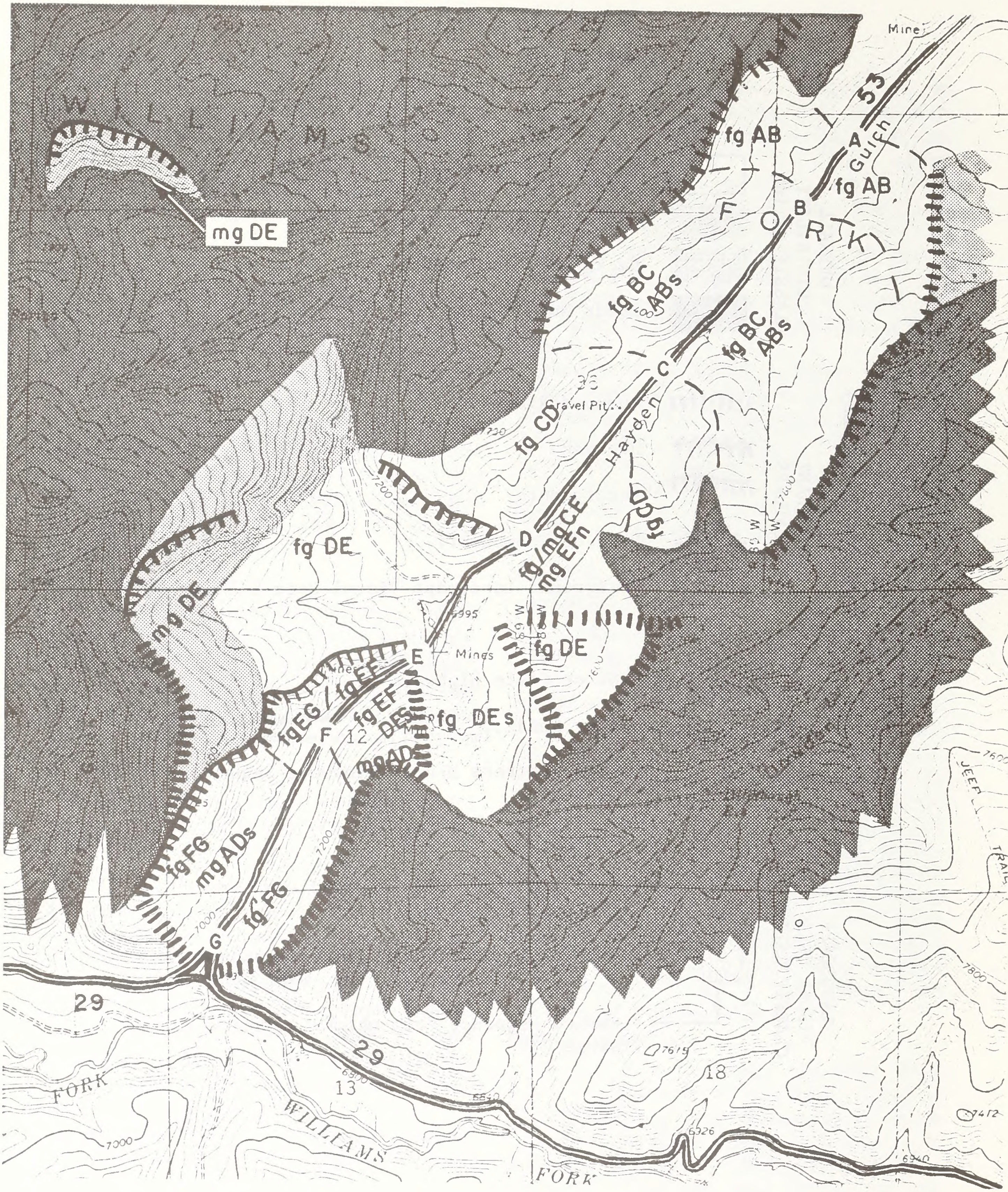


FIGURE WII-3

Landscape visibility map - - Ruby Mine.

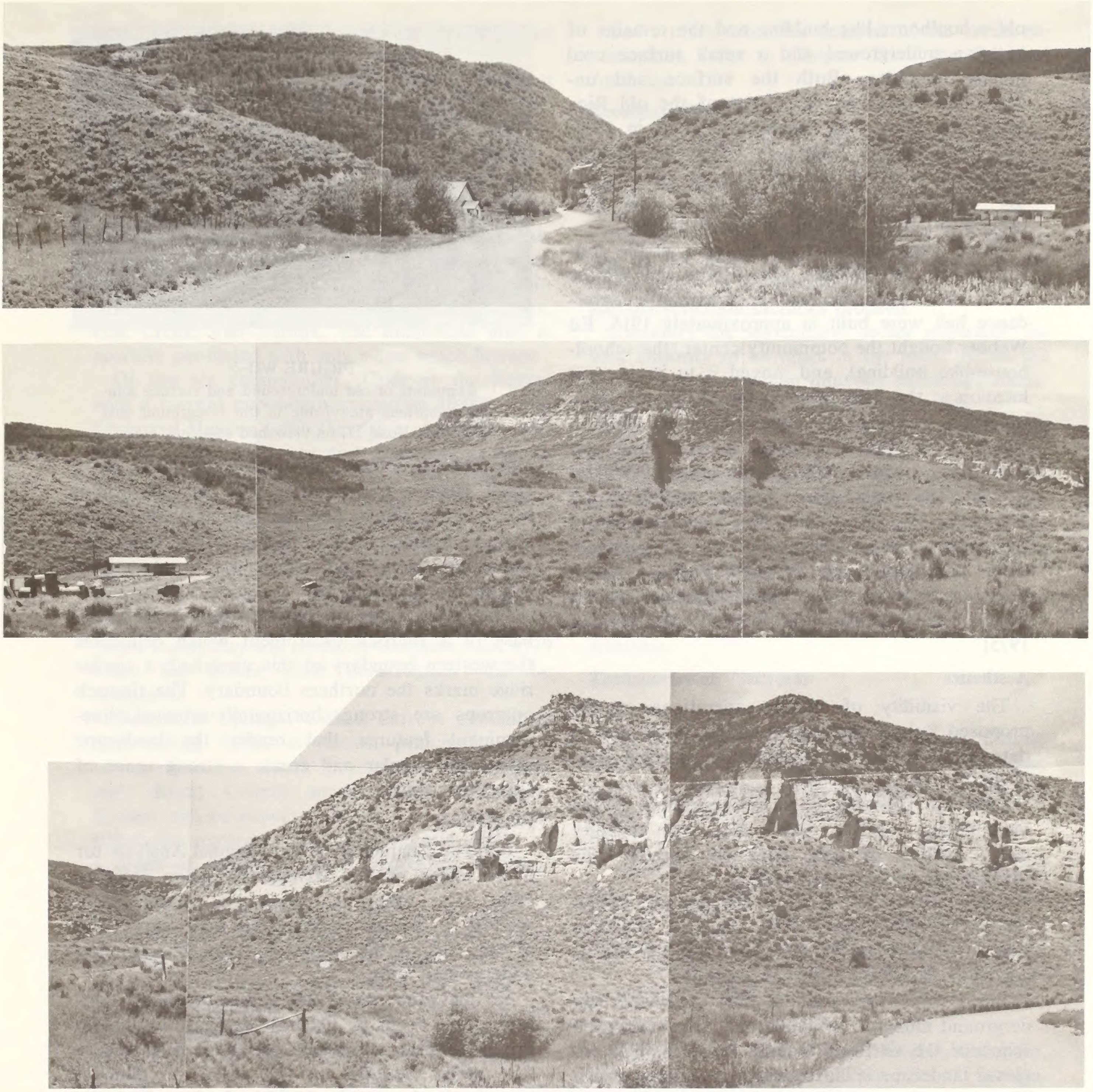


FIGURE WII-4

Nearly a one-mile segment of County Road 53 provides visual access, from viewshed sequence DE, into this enclosed landscape, in which the proposed underground mine portal and associated surface facilities would be placed (middle photo). This 180° panorama illustrates views to the south, west, and north.

old schoolhouse-like building and the remains of both an underground and a small surface coal mining operation. Both the surface and underground operations were part of the old Rice Mine; the mine first began production in 1937. The Routt County Assessor's Office has records indicating that the surface acreage surrounding the aforementioned old structures was first deeded to Fern R. Darling on March 8, 1909.

Three miles southeast of the mine, at the confluence of the Williams Fork River and Willow Creek, a schoolhouse and a community center-dance hall were built in approximately 1915. Ed Webber bought the community center (the schoolhouse-like building), and moved it to its present location at the Rice Mine in the 1930's, to serve as living quarters for mine employees (Milton Yoast 1975). These buildings, plus a store and post-office, once constituted the town of Willow Creek. The post-office began operation on February 21, 1923, and was discontinued in November, 1943. Older post-offices in relatively close proximity once included Pagoda, which began on February 15, 1890, and Dunckley, which began on December 16, 1892 (Louis Wyman 1975).

Aesthetics

The visibility of mining operations at the proposed Ruby Construction underground mine is determined by public access routes: in this area, County Road 53.

Refer to Appendix D for a description of the methodology used to derive landscape visibility maps. Analysis of these maps will suggest areas that are more visible than others.

Refer also to Chapter II of the Regional Analysis for a discussion of the regional aesthetic setting of the Ruby Construction area as well as a general discussion of visual resources.

Views into the area of the proposed underground mine are available only from viewshed sequence DE on Routt County Road 53. This enclosed landscape is illustrated on a landscape visibility map (Figure WII-3) and a panoramic photo (Figure WII-4). Figure WII-5 shows remnants of old underground and surface mining operations visibe from viewshed sequence DE.

The most visually sensitive portion of Federal coal lease D-051698 is the eastern three-fourths, which lies in the foreground distance zone. Presently the landscape lying west of the road contains strongly form, line, and color-dominant

FIGURE WII-5
Remnants of old underground and surface mining operations are visible in the foreground east of County Road 53, on viewshed sequence DE.

man-made structures, an unimproved road, and a small electric transmission line. An old school house, mine tipple, and the remnants of a small surface mining operation lie east of the road. The remaining foreground landscape visual unit is largely in its natural state.

The western end of the lease terminates at the base of a rimrock escarpment which delineates the western boundary of this viewshed; a similar ridge marks the northern boundary. The rimrock outcrops are strong, horizontally-oriented, line-dominant features that render the landscape somewhat angular and create a strong sense of spatial enclosure.

Recreation

Refer to Chapter II of the Regional Analysis for a discussion of the existing recreation environment. The following paragraphs outline more specific recreation resources and their current use in the area of the proposed Ruby Construction underground mine.

No big game, small game, nor non-game concentrations occur on Federal coal lease D-051698. Private surface ownership precludes road access for public hunting on 40 acres of national resource lands contained within the lease boundaries. See Chapter II, Terrestrial Fauna and Aquatic Fauna, for a more complete description of the wildlife and fisheries resources for the Ruby Construction area.

All of Federal coal lease D-051698 has a moderate recreation capability to attract and sustain recreation use, which is based on topographic and landscape variety, interesting vegetation, and upland wildlife viewing opportunities (BLM 1974).

There are no private nor public recreation developments on or adjacent to the proposed mine area, and no on-site visitor-use data are available.

Social Environment

The social environment that would be affected by Ruby Construction's proposed mine extends from the immediate surrounding area of the mine site in Hayden Gulch, north to Hayden, west to Craig and Meeker, and east to Steamboat Springs, Oak Creek, and Yampa. The immediate area is sparsely populated with only a few ranch houses.

Of the six communities, Craig is the largest with a current population exceeding 10,000. Both Craig and Hayden (with Hayden's current population of about 1,700), are now experiencing boomtown conditions, due to the construction of Colorado-Ute Electric Association's power plant and Utah International's surface coal mine. The housing market is tight; the crime rate is increasing sharply; and new demands are being placed on already over-utilized social support facilities, (e.g., water and sewer treatment, schools, etc.). These conditions will probably continue until 1979 when the power plant construction will be completed.

Steamboat Springs, with a current population approaching 6,000, is known principally as a winter recreation resort. According to the preliminary Routt County master plan, Steamboat Springs can be expected to grow to a permanent population exceeding 10,000 by the mid-1980's, as a result of additional winter recreation developments.

Oak Creek and Yampa, with populations of 1,200 and 350 respectively, are relatively small communities in the southern portion of Routt County. Both communities can expect some increase in population as a result of winter recreation developments in Routt County, although not as extensive as that expected near Steamboat Springs.

Meeker, with a current population of about 1,800, is also encountering some growth problems as a result of preliminary development of oil shale resources in the Piceance Basin. Housing shortages, increased crime, and increased demands for social support facilities will continue in the future as oil shale development reaches commercial stages.

For a more extensive analysis of the social environment, refer to Chapter II of the Regional Analysis.

Economic Conditions

In areas that would be affected by the development of Ruby Construction's mine, the industrial sectors employing the most people are agriculture, retail trade, and construction. In the future, it is expected that the mineral-extracting and recreation service sectors will gain in importance, as the development of non-coal-related energy resources and of recreation facilities proceed.

Currently the agricultural sector generates the vast majority of earnings in the area, but in the future, earnings in the minerals extractive industries (other than coal) will expand rapidly.

The standard of living in the area, measured in terms of 1973 per capita personal income, is about $4,700, approximately six percent less than State and national averages. This difference from State and national levels is probably the result of the lack of a strong manufacturing sector, which traditionally is a high income industry.

For a more extensive analysis of the economic conditions, refer to Chapter II of the Regional Analysis.

Transportation Networks

Highways

The Sun Mine is serviced by Routt County Road 53 running from the mine north to Hayden, Colorado. This road is oil and gravel-surfaced and designed for light traffic only.

Railroads

There is no direct rail line to or near the Sun Mine. The closest rail line is the Denver and Rio Grande Western Craig branch line which passes through Hayden. It is a single track line equipped with Centralized Traffic Control (CTC) to be completed by 1976.

Airlines

Yampa Valley Airport near Hayden, Colorado, is the closest airport to the Sun Mine. It is regularly served by Frontier Airlines, and is now undergoing a 10-million dollar improvement program.

Chapter III

Environmental Impacts of the Proposed Action

THIS CHAPTER ANALYZES IMPACTS OF RUBY CONSTRUCTION COMPANY'S PROPOSED MINE AND RECLAMATION PLAN ON THOSE RESOURCE VALUES DESCRIBED IN THE PRECEDING CHAPTER. IT IS ASSUMED IN THIS CHAPTER THAT NO EFFORTS WILL BE MADE TO MITIGATE IMPACTS. IN THIS MANNER ALL PROBABLE IMPACTS CAN BE IDENTIFIED AS THE BASE FOR THE DETERMINATION OF MITIGATING MEASURES AND UNAVOIDABLE ADVERSE IMPACTS IN THE TWO SUCCEEDING CHAPTERS. WHERE DATA ARE AVAILABLE, IMPACTS ARE LINKED TO SPECIFIC ASPECTS OF THE PROPOSED ACTION AND ARE QUANTIFIED AS TO MAGNITUDE, INTENSITY, DURATION, AND INCIDENCE. ALTHOUGH THE PURPOSE OF RUBY CONSTRUCTION COMPANY'S RECLAMATION PLAN IS TO LESSEN ADVERSE CONSEQUENCES OF SURFACE DISTURBANCE, THE IMPACTS RESULTING FROM IMPLEMENTATION OF THEIR PLAN ARE ADDRESSED IN THIS CHAPTER.

Non-living Components

GEOLOGIC AND GEOGRAPHIC SETTING

Impacts of the proposed mining operation on the geologic and geographic setting would be minimal during the life of the project. Minor ground leveling for surface facilities is indicated, and three portals would be opened near the center of the north lease line; two additional entries might be required later.

A more important potential impact would be subsidence, particularly after all the coal has been mined out and the mine abandoned. Where full retreat mining takes place at shallow depths, as the company's mine plan describes, rupturing and collapse of overlying sedimentary rock would be inevitable. If collapse reaches the surface, as much as eight feet of subsidence of the ground surface could occur over the mined-out areas. Thin overburden increases the likelihood of subsidence, and the likelihood that the amount of subsidence will approach the thickness of the coal removed. Once subsidence has begun it probably would proceed relatively rapidly, resulting in open fractures, broken ground, and a hummocky surface.

Proximity of the coal bed being mined to the land surface also would increase another possible hazard that would take place if subsidence occurred: ignition of the remaining coal by spontaneous combustion. There have been and now are fires in similar abandoned mines of this region. Subsidence of brittle overlying strata would allow fractures to open from the coal bed to the surface, resulting in a supply of oxygen to the abandoned mine, and to any resulting fire. Extinguishing such fires is difficult.

PALEONTOLOGY

Adverse impacts to fossils would occur if they are destroyed in the coal mining operation. Given the overall character of the stratigraphic section, it is likely that at least some fossil destruction would result. Beneficial impacts would occur if unearthed fossils would be collected and studied.

There is a moderately high likelihood that this stratigraphic section would yield significant information, in view of the reference to possible dinosaur fossils. This is especially noteworthy because of the area's distant proximity to previously discovered dinosaur remains.

Mineral Resources-Coal

A beneficial impact of the proposed plan would be recovery of about 60-70 percent of the coal available in the mined bed.

A detrimental impact would be forced abandonment of the remaining 30-40 percent of the coal resources because of subsidence of the overburden. Future recovery of such coal generally is not feasible with present technology. Destruction of part or all of the remaining coal could result from fires. This loss would amount to approximately 250,000 tons.

The underground mining plan would not allow recovery of a three-foot coal bed 12 feet below the mined bed, and thus an additional 5,400 short tons per acre would be lost to this as well as future mining. This amounts to about 529,000 short tons under the 98 acres where mining is planned.

Water Resources

GROUND WATER

The underground mine proposed for this lease would lower the water table to the base of the coal, or from five to ten feet in the part of the lease where there is water in the coal. In the remainder of the lease there would be no effect on ground water. Lowering of ground water outside the lease would be limited to a zone that extends only a few hundred feet north of the mined area. No wells or springs in the area would be affected in any way by the mining operation.

During the spring snowmelt the discharge from the mine might exceed the amount needed for mining operations. This discharge, which probably would not exceed 30 gpm, would flow into Hayden Gulch. The water would be expected to be similar to water from other mines in the area (see Appendix D). No adverse impacts are expected from this amount of discharge.

SURFACE WATER

Natural runoff and drainage would be altered a minimal amount by this operation. Because of fracturing associated with subsidence, some surface runoff would infiltrate into the mine.

Air Quality

EMISSIONS FROM THE MINE

In order to determine the impact on air quality due to operation of the Ruby Mine, emissions from the mining operation must be determined. These emissions must then be interpreted in terms of the ambient pollutant concentrations they produce in the air.

Based on current regulations, the only significant emissions from the Ruby Mine would be suspended particulates and fugitive dust.

Since the Ruby Mine is underground, the only emissions from the mining operation would come from coal conveying, sorting, and storage processes that produce fugitive dust. An emissions factor representing the percent of dust emitted from these processes, per mass of coal handled, was computed (Appendix D). When control devices such as baghouses and watering are employed, the emissions factor is reduced.

The Ruby Mine would be expected to produce 180,000 metric tons of coal per year. Emissions estimates for this quantity of coal are shown in Table WIII-1 as controlled and uncontrolled emissions.

Near the mine, there would be vehicle exhaust emissions from haulage trucks and gasoline powered cars and trucks. Emissions from haulage trucks are calculated in Appendix D. The values are summarized in Table WIII-1.

TABLE WIII-1

Ruby Mine Air Pollutant Emissions

(Metric Tons per Year)*

Source	Air Pollutant	Uncontrolled	Controlled	
Process	Suspended Particulates	9	4.5	
			Trucks	Cars
Vehicle Exhaust Off Mine	Suspended Particulates		0.37	0.19
	Hydrocarbons		1.0	2.3
	Carbon Monoxide		6.3	12
	Nitrogen Oxides		10	1.8
	Sulfur Oxides		0.75	0.045
Fugitive Dust from Off Mine Roads	Suspended Particulates	540	380	

* 1 metric ton = 1.1016 short tons

RESULTANT AIR QUALITY

Particulates

In order to assess the impact of the mine on the atmospheric environment, estimates must be made of the ambient total suspended particulate concentrations resulting from the emissions specified in Table WIII-1. To do this, an atmospheric diffusion model has been applied to the mine site. The uncertainty in the calculated total suspended particulate concentrations can be approximated from the combined uncertainties of the inputs and the errors in the model itself. It is estimated that the modeled concentrations are correct within a factor of three. This uncertainty could be reduced only by much more detailed measured emissions and meteorological data.

Table WIII-2 is a compilation of Federal and State ambient air quality standards, existing background concentrations, and diffusion model predictions. As shown in Table WIII-2, the decrease in concentration with distance will be rapid. However, concentrations (including the background of 20ug/m³) will never exceed the Annual Federal Secondary Standard (60) or Colorado Standard (45).

Meteorological circumstances resulting in the largest predicted 24-hour total suspended particulate concentrations are those which contributed most to the annual average, the existence of stable conditions. It has been assumed that stable conditions with a wind speed of one meter per second (2 mph) persist for at least eight hours. This could occur in any direction, but is most likely to the south. The meteorological information available indicates that concentrations on the order of those in Table WIII-1 would occur between 10 to 30 days per year. The predicted concentrations shown in Table WIII-2 are below the Federal secondary and State standards. EPA non-degradation guidelines for Class II areas also would not be exceeded.

Gaseous pollutants

Vehicle emissions would be the only source of gaseous air pollutants at the mine. Emissions of hydrocarbons, carbon monoxide, and nitrogen oxides from off-mine vehicles would be so small that there would be no significant impact in relation to the established air quality standards. General estimates using approximation techniques from EPA, 1974, indicate that 100 meters from the road annual nitrogen dioxide concentrations would not be altered, and one-hour concentrations of carbon monoxide would be no greater than 40 ug/m³.

Because the off-mine roads would not be paved, fugitive dust emissions would be expected. However, over a 24-hour period, concentrations would not be expected to increase more than 10 ug/m³ even during worst case meteorological conditions.

TABLE WIII-2

Air Quality in the Vicinity of the Ruby Mine

Predicted Worst Case Concentrations ($\mu g/m^3$) from Sources at the Mine

Pollutant	Averaging Time	Ambient Air Quality Standards: Federal Primary	Ambient Air Quality Standards: Federal Secondary	Ambient Air Quality Standards: State	Existing Ambient Air Quality	Distance from Mine (km)	Maximum Predicted Concentrations	Predicted Plus Background Concentrations
Total Suspended Particulates	Annual	75	60	45	20	0.5	5.3	25
						2	0.35	20
	24 Hour	260	150	150	20	0.5	14	34
						2	1.7	22

Living Components

Soils

Underground mining would result in minimal disturbance of surface soils. The impacts would be greatest in the areas where the mine facilities and roads are constructed, approximately 10 acres. These soils would either be buried beneath the road bed, removed for construction of mine facilities, or stockpiled for revegetation. This would change all the soil characteristics and alter micro-organisms and soil relationships which have been established over geologic time.

These disturbances would result in fine to moderately coarse-textured soil material exposed to water action. Soil permeability and infiltration would be reduced by compaction, increasing runoff, soil erosion, and sedimentation. Some dust would be lifted into the atmosphere during construction of the road and other facilities, adding to the soil loss. As all physical, chemical, and biological systems would be disturbed to an unknown degree, the overall result of the disturbed soil areas undoubtedly would be lower soil productivity.

Additional soil impacts outside the area would result from upgrading the county road from the mine to point of delivery at Hayden. Soil disturbance would occur on an additional 26 acres to meet the population needs associated with the mining operation. Increased recreational use, solid waste disposal, schools, and other social facilities would create additional unquantified soil impacts such as compaction, erosion, and sedimentation. The greatest impact outside the mine facilities area would be subsidence within the mined lease area. This would alter the soil surface characteristics, surface drainage patterns, infiltration, and stability. Undoubtedly accelerated soil erosion and sedimentation would increase in some places, dependent upon their gradient and relationship to existing surface drainage patterns. Because of the small area that would be disturbed by the mining operation, the magnitude of the impacts listed above would be quite small.

Terrestrial Flora

Little surface disturbance would be associated with the underground Ruby Construction Mine. Mining associated construction would result in disturbance of approximately 10 acres of sagebrush type by the construction of an office, warehouse and shop, portal areas, and roads. This area would be disturbed for the full four-five-year life expectancy of the mine.

Removal of coal from the northern edge of the lease area would destroy the existing watertable near the surface. The removal or lowering of this watertable would destroy the species giant wildrye (*Elymus cinereus*) found in this area, because this species requires a mesic condition. This would constitute a very minor impact to the existing vegetative ecosystem as a whole. In some areas of the mine there is relatively little overburden material above the coal seam being mined, and it has been noted that subsidence of the overburden material is very likely. Depending upon the degree and location of subsidence, some vegetation would undoubtedly be disturbed, but it is impossible to predict the extent of this impact. If areas of subsidence are small and produce exposures that are very steep and expose bare soil material, vegetation loss might be significant. However, if the subsidence would be over a large area, and would not produce abrupt changes in topography, the impact on vegetation would probably be quite small.

Terrestrial Fauna

Wild fauna

As proposed, this mine would be underground. Therefore, the most significant impacts on terrestrial fauna would result from construction of roads, maintenance facilities, potential subsidence, and increased human activity.

Current plans call for 22,750 feet of new road; 240,000 square feet would be used for shops, office, and other buildings; 90,000 square feet would be cleared around the portal areas. About ten acres of sagebrush habitat and associated soil would be lost from these actions, resulting in lost habitat values, and reduced use of these disturbed areas. Any fauna specifically limited to the giant wildrye community would be forced to relocate into undisturbed areas, with the expected losses as described in the Regional Analysis. Some additional habitat changes would occur as a result of subsidence, and some direct loss of animal life might occur to animals caught in the collapses. The lost habitat would result in a corresponding reduction in the associated wildlife.

Increase in human activity and vehicular traffic in the area would result in the harassment of a variety of wildlife species, such as deer, elk, small mammals, and birds, as well as increasing the probability of vehicle-animal collisions. The wildlife harassment would create anxiety and disruption of diurnal activities; and if they occurred during periods of high reproductive efforts, would result in possible reduction in this activity. The relatively short length of new road and confined surface disturbance would make these impacts minor.

Domestic fauna

Only limited impacts on domestic fauna would be expected from the development of this mine. Ten acres of surface disturbance would result from the road, buildings, and portal construction, almost entirely in the sagebrush vegetation type. The area's ability to support domestic livestock would be reduced by about one AUM, resulting from this ten-acre disturbance. Another important impact on the domestic fauna would be the additional harassment and threat to livestock safety from increased truck traffic in the area.

Aquatic Biology

Road and other surface construction activities associated with the proposed mining activity could increase the sediment load in Hayden Gulch; however, it is unlikely that this would significantly affect the East Fork of Williams Fork River.

Cultural Components

Archeological Resources

Ten acres of total surface disturbance is projected for the Ruby Mine site; however, up to 146 acres (lease size) would probably be subsequently disturbed by surface subsidence following the mining operation. Regardless of the relatively small size, impacts to archeological resources might occur. Dr. Olson's analysis of the area was only a reconnaissance survey and not an intensive survey; therefore unknown sites may be destroyed by surface-disturbing activities.

Because no intensive base inventory data are available, and because the area occupies a strategic topographic position that would have provided a seasonal passageway to adjacent areas, there is a moderate likelihood that significant local archeologic resources could be impacted.

Historical Resources

Because the Rice Mine and the old Willow Creek Community Center lie east of Routt County 53, impact to these sites due to outright physical displacement would not be anticipated. However, due to the building's close proximity to the proposed mine, impact might occur from vandalism.

Both local and regional historic inventory data indicate a low likelihood of encountering other significant historic resources; those present are of local significance. Anticipated impacts would have only moderately low significance locally.

Aesthetics

All proposed surface developments at the Ruby Construction site would occur in the foreground landscape. They would be visible for about one-half mile, on viewshed sequence DE, to both northbound and southbound motorists. Due to its proximity to the county road, the proposed office building would be an especially large-scale element in this foreground. The mine office, change room, and shop-warehouse buildings would also be large-scale elements.

Form, line, and color dominance of these buildings will produce minus deviations by their inability to borrow dominance elements from the characteristic landscape. Reflective surfaces, bright colors, and tall structures are examples of potential adverse aesthetic impacts that may accrue to building construction.

The large cuts necessary to open the three mine portals would produce strong form and line-dominant minus deviations from the characteristic landscape. Construction of parking areas and upgrading the short one-half mile haul road (to County Road 53) would result in similar impacts. The conveyor belt from the mine portal, and screening, loadout, and possibly crushing facilities (if needed), would also be strongly form and line-dominant features in this undulating foreground landscape.

Road and coal dust would create short-lived landscapes foreign to the natural landscape character.

The overall aesthetic experience at the proposed mine area would also be adversely impacted, though to a lesser degree than other aesthetic values, given the present man-made structures in the area and the proximity of the county road. Notwithstanding the subjective nature of mood-atmosphere conditions, coal loading activities, trucks hauling coal, and ultimate surface slumping above the mine itself would affect the character of the area in terms of its ability to kindle respect for the landscape's natural grandeur. The proposed action would adversely impact these qualities by modifying the natural landscape, but it might also beneficially impact them by allowing a greater understanding of the area's geologic and natural processes.

No traffic volume data are available to project numbers of potential viewers and help define visual sensitivity in the area of projected aesthetic impacts.

Aesthetic impacts to this area would have only moderately low significance due to the small size of the proposed action area, existing intrusions, and moderate visual exposure to essentially local motorists.

Recreation

Unknown archeological sites might be destroyed by mining operations and therefore lose their inherent capability to attract and accommodate recreation use, irrespective of existing public access deficiencies. This loss could occur through actual destruction of the resource by mining itself, either by direct removal, or by off-site influences, such as seismic damage from blasting, or vandalism and pot hunting by mine employees. Projected employment levels would reach 65 in 1976 and would be scheduled to remain constant.

Additional heavy truck traffic on County Road 53 would create additional road hazards to other motorists; flying rocks on the graveled portion of the road would create especially serious safety hazards.

Beneficial impacts from the proposed mining operation might be realized in the form of greater capabilities for geologic and industrial interpretation. Points along County Road 53 offer potential for informing the visiting public of the physical and economic conditions conducive to the development of this underground mine. This could be accomplished by explanatory signing, and interpretive-educational brochure development, as well as by guided tours.

Adverse recreation impacts would have low significance, due to the relative abundance of similar recreation resources locally.

Social Environment

Table WIII-3 presents the population impact by county and community of the development of the Ruby Construction Company leasehold; it also indicates expected new school enrollment by county. These data were generated by the gravity employment multiplier model described in Chapter II of the Regional Analysis, Future Social Environment Without the Proposed Action. They represent incremental increases over and above the base scenario presented in the same section of the Regional Analysis.

Requirements for new social support facilities including housing, health care, education, water and sewage treatment, fire protection, and law enforcement are functions of increases in population. Table WIII-3 indicates that development of the Ruby Mine would induce a relatively small increase in population; therefore, impacts on existing social support facilities would be minimal. It is the cumulative impact of several new developments that generates significant new requirements for social support facilities; these requirements are addressed in depth in Chapter III of the Regional Analysis.

Population projections show that there would be an increase of 255 people in the tri-county region by 1990 due to development of the mine. An estimated 26 acres for additional residences and community facilities would be needed to accommodate this growth.

There have been no expressions of local attitudes specifically oriented toward the development of this mine; rather attitudes are directed toward the subject of regional and community growth in general and are therefore examined in the Regional Analysis.

For an extensive analysis of the regional impacts, mitigations, and unavoidable adverse effects to which the development of the Ruby Mine would contribute, refer to the appropriate sections of the Regional Analysis.

Economic Conditions

Table III-4 presents the economic impact of development of the proposed Ruby Mine in terms of employment and earnings. These data were generated by the gravity employment multiplier model described in Chapter II of the Regional Analysis, Future Economic Environment Without the Proposed Action. The data represent the incremental impact over and above the base scenario described in the same section. Note that in each of the benchmark years, the greatest induced employment and earnings impacts from the Ruby Mine development fall in Routt County.

TABLE WIII-3

Population Impact of Ruby Mine Development

	1980	1985	1990
Direct Employment at Ruby Mine	65	65	65
New Population			
Moffat County Total	91	97	99
Craig	91	97	99
Rio Blanco County Total	18	19	19
Meeker	18	19	19
Routt County Total	127	133	137
Hayden	25	27	29
Oak Creek	23	25	25
Steamboat Springs	71	73	74
Yampa	8	8	8
Total	236	249	255
New School Enrollment			
Moffat County	16	19	21
Rio Blanco County	4	4	4
Routt County	24	26	28
Total	44	49	53

TABLE WIII-4

Economic Impact of the Ruby Mine Development

	1980	1985	1990
Direct Employment at Ruby Mine	65	65	65
Induced Employment			
Moffat County	18	20	22
Rio Blanco County	4	4	4
Routt County	17	24	27
Total	39	48	53
Direct Earnings from Ruby Mine*	1455	1626	1823
Induced Earnings*			
Moffat County	179	227	287
Rio Blanco County	38	44	49
Routt County	226	265	350
Total	443	536	686

* Thousands of 1974 constant dollars.

No adverse economic impacts would be expected to be associated with the development of the Ruby Mine because both the direct and induced employment and earnings would be relatively small compared to the economic base of the region.

Transportation Networks

HIGHWAYS

The Ruby Mine would be expected to produce between 200,000 and 300,000 tons of coal/year. About two-thirds of the total production would be trucked to the railroad spur at the Hayden power plant to be transported by rail from there. The remainder would be sold at the mine site to local customers. This would present transportation problems from local coal purchasers hauling coal north over Routt County 53. The interaction between the vehicles of such private coal purchasers and the coal trucks of Ruby Construction and Peabody Coal could result in greatly increased accident rates from congestion on this county road north of the Sun Mine. The unimproved nature of the road between the Ruby Mine and Seneca 2-W Mine could increase the danger to non-commercial vehicles.

The non-locally consumed coal would be transported by truck to the railroad. If total production would be considered to be 250,000 tons/year, then the amount to be so transported would be 166,667 tons/year. Using a haul schedule of 225 days/year, an eight-hour daytime shift, and 25-ton coal loads in the trucks, this would amount to 30 truckloads/day or one loaded truck every 16 minutes (with empty trucks returning in the same sequence). This traffic would have to interact with trucks from the Peabody Coal Company's Seneca 2-W Mine located slightly north; that mine would be transporting 900,000 tons of coal/year over the same road. The proposed action would generate additional vehicular traffic volumes from mine workers' vehicles. These volumes would move principally between Hayden and the mine site between 7:00 and 8:00 a.m. and again in the afternoon from 4:30 to 5:30 p.m. These increased volumes would lead to some increase in auto accidents.

The road that would be used is Routt Councy Road 53. Approximately nine miles of the road would be used from a point where the mine has access to the road about 11 miles south of Hayden, Colorado, to a point about two miles south of Hayden, where a specially constructed haul road would leave County Road 53, branching east and north to terminate at the Hayden power station (see Figure PI-6 Peabody). At a loadout tipple coal would be transferred to the rail spur located at the power plant. County Road 53 is an unimproved, two-lane, surfaced (but not paved) light vehicle road; without extensive improvements such as resurfacing and widening, the road would not stand such excessive use without failure.

Noise levels would also increase significantly from coal hauling activities on Routt County 53; the exact levels are presently unknown.

RAILROADS

With non-locally consumed production of 500 tons/day, unit train operations out of the loading point at the Hayden power plant are not considered practical by the Ruby Construction Company; they are considering trainloads of ten cars to transport their coal. If facilities are available some stockpiling might be done, but the amount of coal involved would still not warrant unit train operations. No firm contracts with D&RGW for hauling coal have been made at this time. The impact of this volume of coal on the D&RGW rail system would not be significant since it entails only working a few coal cars into other trains.

Any necessary incoming equipment for mining operations should be transferable to trucks for transport to the Sun Mine site with no real problem. The loading point at the Hayden power plant could be used and equipment trucked over Routt County 53; this would further increase the traffic over Routt County 53.

Chapter IV
Mitigating Measures

THIS CHAPTER PRESENTS MEASURES THAT WOULD LESSEN OR ELIMINATE THE ADVERSE IMPACTS OF RUBY CONSTRUCTION COMPANY'S PROPOSED ACTION. THESE MEASURES ARE DISCUSSED IN THREE CATEGORIES: THOSE INCLUDED IN RUBY CONSTRUCTION COMPANY'S PROPOSAL, THOSE REQUIRED BY LAW OR REGULATION, AND THOSE MEASURES THAT WOULD BE APPLIED AS SPECIAL CLAUSES OR STIPULATIONS TO LEASES OR PERMITS. IN EACH OF THESE CATEGORIES, MEASURES ARE PRESENTED BY IMPACTED ENVIRONMENTAL COMPONENT. BECAUSE SOME MEASURES LESSEN IMPACTS TO MORE THAN ONE RESOURCE, SOME REPETITION OF MITIGATIONS IS UNAVOIDABLE. ALL MEASURES ARE ASSESSED AS TO THEIR PROBABILITY OF IMPLEMENTATION AND/OR SUCCESS. MITIGATING MEASURES ARE PRESENTED AND ANALYZED AS PROCEDURES THAT WOULD BE REQUIRED IF THE PROPOSED ACTION IS APPROVED.

Measures Included in the Applicant's Proposal

Geologic and Geographic Setting

The company's plan to regrade any disturbed surface to the approximate contour of the original surface, if carefully implemented with proper consideration of the character of the natural terrain, would provide sufficient mitigation for the surface disturbance.

Water Resources

Pollution of surface water and ground water would be controlled through the use of check dams to allow settlement of sediment from runoff waters before they reach the flowing stream. A catch basin would be maintained below the portal site to eliminate any possibility of silt from disturbed areas being carried into streams at lower elevations. The catch-basin would be formed behind a compacted earthen dam designed with suitable volume and spillways to prevent damage to the dam or loss of settled silt during periods of peak runoff. An average annual runoff of about twenty acre-feet may be expected; therefore, a pond to contain this amount of water and attendant sediment would be required.

Terrestrial Flora and Soils

In areas where surface excavation is required, topsoil would be removed, stockpiled, seeded to prevent erosion, and retained for subsequent reclamation. Terrain would be regraded to approximate original surface contour; stockpiled topsoil would be spread, and the area would be reseeded. Vegetation to be planted would be contingent on recommendations of the Area Mining Supervisor and the Bureau of Land Management (BLM), taking into consideration the wishes of the landowner.

Soil erosion would be prevented or controlled by minimal disturbance of existing surface, use of existing roads if at all possible, and use of water bars in roads.

Refuse would be disposed of by burying in trenches with surplus soil stockpiled for subsequent reclamation. Waste rock would be utilized for road and yard maintenance, and any rock not used would be filled in an adjacent canyon and used for erosion control.

At the time of abandonment, the portal site would be regraded to approximate original ground contour, covered with stockpiled topsoil, and reseeded. All surface structures would be removed, with sites being regraded to approximate original ground contour, and reseeded. Any unmarketed coal by-products would be buried, and rock and waste not utilized for road and site maintenance would be graded to a slope which could be worked by mobile equipment, and would be compatible with the adjacent terrain, covered with topsoil, and reseeded.

Terrestrial Fauna

Ruby Construction plans to rehabilitate all disturbed areas after they are no longer required by the mine operation. This would mitigate some permanent wildlife and livestock losses.

Fresh water generated by the mining operation would be partially utilized for livestock and game animal watering facilities.

As stated in the mine plan, existing roads would be used whenever possible.

Archeological Resources

Ruby Construction's mine plan, December 18, 1974, states that measures to be taken by the company would include "any and all applicable Federal, State, County or other duly constituted regulatory bodies rules and regulations. These rules and regulations are to be supplemented by additional items shown to be desirable or necessary by experience and/or industry practice." See Measures Required by Law or Regulation for an explanation of this section's implications.

Historical Resources

The aforementioned applicant's proposals relating to archeology also apply to historical resources.

Aesthetics

The removal of all mine structures upon abandonment, regrading of portals and the mine site to approximate the natural contour, and reseeding would mitigate the adverse aesthetic impacts on these structures in the long run.

Recreation

Construction of a catch basin below the mine portal would help reduce downstream siltation; this would help maintain inherent capabilities of downstream fisheries in the Williams Fork River.

Measures Required by Law and Regulation

The laws and regulations pertaining to the development of the proposed Ruby Construction Mine, which grant the Secretary of the Interior, the Environmental Protection Agency, the Mining Enforcement Safety Administration, and the Colorado Department of Natural Resources authority to impose measures that would mitigate adverse impacts on the natural and human environment, are listed in Chapter IV of the Regional Analysis.

Paleontology

Measures provided for in the 1906 Antiquities Act and 43 CFR 6010.2(a), (b)(2), when implemented, would provide protection for fossils which are of actual and real scientific significance. This would be accomplished by requiring the operator to conduct an on-the-ground intensive survey to ascertain the possible occurrence of dinosaur or other significant vertebrate fossils. The mine operator is also required to prevent or minimize damage to significant paleontological resources pursuant to 43 CFR Subpart 3041, Section 3041.2-2(d). See the Regional Analyses for a more detailed description of how such surveys would be implemented.

Water Resources

To mitigate adverse impacts on water quality the Area Mining Supervisor of the U.S. Geological Survey (USGS) made stipulations to Ruby Construction's mining plan. These stipulations would require Ruby Construction to procure a standard water analysis for sub-surface waters that may affect or be affected by mining operations. These data would be used to determine a background to establish pollutant limits set forth in guidelines of Federal and State environmental protection regulations. Water discharged from or affected by mining operations would be sampled and analyzed as directed by the Area Mining Supervisor.

In accordance with 30 CFR 211.40(a)(11), all roads utilized in the proposed mining activity would be designed, constructed, and reclaimed as completely and quickly as possible to minimize surface erosion. In areas where reclamation is not feasible or possible (e.g., steep grades), rip-rap would be utilized to prevent erosion of disturbed surfaces (30 CFR 211.40(a)(3)).

Terrestrial Flora and Soils

The Colorado Department of Natural Resources, under CRS (1973) 34-22-101, has the authority to examine the surface area disturbed by underground coal mines, to require methods of stabilization and reclamation to prevent landslides and erosion, and to revegetate disturbed areas. Compliance with this regulation could partially mitigate the impact on soils and vegetation and increase reclamation potential.

30 CFR 211.40(a)(4) requires that topsoil be removed for replacement on reshaped areas, and that stored topsoil be protected from wind and water erosion and establishment of noxious plant species, and be in a condition for sustaining vegetation when used during reclamation. Therefore, topsoil stockpiles would not be placed in areas of water accumulation. Also, after disturbed areas have been regraded and topsoil replaced, if equipment has compacted the topsoil so that root and moisture penetration would be restricted, and thus the topsoil not in a condition for sustaining vegetation, the area would be chiseled, or ripped, in a manner to loosen the soil. For the topsoil to be in the best condition for sustaining vegetation, it would be replaced in the spring or fall, so the area can be reseeded immediately to perennial vegetation to protect against erosion and weed invasion.

30 CFR 211.40(a)(13)(i) requires the operator to establish on regraded spoils and all other affected lands, such as the maintenance facilities and roads of the Ruby Construction Mine, a diverse vegetative cover native to the area and capable of regeneration and plant succession, at least equal in density and permanence of the natural vegetation; therefore, the seedings at the Ruby Construction Mine would utilize as many native species as possible, with the addition of introduced species that have proven locally successful for stabilizing disturbed areas. To provide a vegetation of permanence, the disturbed areas would be seeded with a drill to insure that the seeds are buried at a proper depth for germination and establishment. After the topsoil is replaced, it would be analyzed to determine the necessity of fertilizer applications, to encourage permanent vegetation.

30 CFR 211.62(b) requires that revegetated areas be evaluated by the Area Mining Supervisor to determine whether satisfactory vegetative growth is being established, or whether additional

revegetation efforts should be ordered. Therefore, if climatic or soil conditions are such that revegetation attempts fail on the affected area, the area would be recovered with suitable topsoil and/or reseeded, until vegetation is established to the satisfaction of the Area Mining Supervisor.

30 CFR 211.40(a)(14)(ii) provides that revegetated areas would be fenced to regulate public access and protect the area from livestock grazing. To allow for permanent vegetation growth, livestock grazing would be allowed on a limited basis after the second growing season.

Terrestrial Fauna

To mitigate adverse impacts on wildlife populations, the Area Mining Supervisor of the USGS made stipulations to the Ruby Construction mining plan. These stipulations would require Ruby Construction to avoid or minimize disturbances, and give seasonal protection to calving, fawning, nesting, and other critical habitats that provide a limiting factor for any species.

Archeological Resources

Legislative backing for protection of archeological resources comes from a variety of legislation. The Regional Analysis contains a detailed accounting of how these regulations would be implemented.

The 1906 Federal Antiquities Act (P.L. 59-209; 34 Stat. 225) makes it illegal to damage, destroy, appropriate, or excavate any historic or prehistoric object; to help enforce these provisions, issuance of antiquities permits to qualified professionals for purposes of conducting surveys, testing, and excavation on Federal lands is also required. Authorization for the Secretary of the Interior to maintain the National Register of Historic Places is given by the 1966 Historic Preservation Act (P.L. 89-665, 80 Stat. 915); the Advisory Council on Historic Preservation is also established by the Act. All Federal actions affecting existing or proposed National Register Properties must be reviewed by the Advisory Council (according to Section 106 of the Act). The National Environmental Policy Act (NEPA) of 1969 (P.L. 91-190) also identifies the Federal Government's continuing responsibility to preserve important historic and cultural aspects of our national heritage. Establishment of the Federal Government in a leadership role of preserving, restoring, and maintaining cultural resources was accomplished by Executive Order 11593, 1970 (36 F.R. 8921). Most recent Federal legislation is the Archeological and Historical Data Conservation Act of 1974 (P.L. 93-291) which requires protection of cultural resources affected by any Federal or federally-licensed construction project. These provisions would be implemented by requiring intensive cultural resource surveys that not only identify all sites but also evaluate their significance.

Additional legislative backing is provided for protection of cultural resources in 43 CFR Subpart 3041. Sec. 3041.2-2(d) directs Ruby Construction to take action to protect cultural resources identified by the required intensive surveys. This would be accomplished by constructing fenced exclosures, interpretive signing, etc. as appropriate on a case-by-case basis.

In order to identify all cultural resource values adequately to satisfy legal requirements, an intensive archeological survey must be completed by the lessee, and an evaluation of National Register significance must be made. If significant sites are found, Ruby Construction would be responsible for nominating them to the National Register of Historic Places, and subsequently contacting the State Historic Preservation Officer (SHPO) to comply with Advisory Council review procedures concerning site protection. The surveying archeologist would also make specific recommendations, to be adhered to by Ruby Construction, concerning the possible need for on-site archeological reconnaisance during mining and other surface disturbing activities. These recommendations must be on a location-specific basis to ensure discovery, evaluation, and protection of significant sub-surface archeological resources. Dr. Olson's cultural resource study was completed as a reconnaisance survey, which does not fulfill the law's requirements.

The relative probability of these measures' success would be influenced by several factors. Some sites would not be identified in the required survey if they are buried by alluvium and hidden from view. The regulations themselves would also do little to prevent theft and vandalism of cultural resources.

Archeological values derive their primary value from being preserved in-place; their secondary value occurs in excavation. Archeological testing or excavation stemming from intensive surveys on proposed action areas may be permitted where the site is not in imminent danger of being destroyed. This would not preserve the site's primary in-place value, and also would not allow utilization of improved archeological survey and analysis techniques in site excavation at a future date when more sophisticated techniques could be employed. However, salvage excavation would allow partial mitigation of adverse impacts where a site is threatened by actual physical displacement.

See the Regional Analysis for a more detailed analysis of how these legal provisions would be implemented.

Historical Resources

All current antiquities legislation enumerated in the Archeological Resources section is also applicable to protection of the area's historical resources, as are the actual mitigations.

Aesthetics

Regulation No. 1, Emission Control Regulations for Particulates, Smokes, and Sulphur Oxides for the State of Colorado, Section II-D, Fugitive Dust, (Colorado, 1971) prohibits mining operations from occurring without a permit that specifies fugitive dust control measures. Implementation of these measures would reduce potential for creating atmospheric haze. Regular sprinkling with water, or oiling would be required to control dust on all haul and access roads; though such dust control measures are approximately 30 percent efficient.

The Colorado Department of Health's water quality standards (1974) provide regulations consistent with the provisions of the Federal Water Pollution Control Act amendments of 1972. Enforcement of this legislation would prevent the proposed mine from contributing floating debris, scum, and discoloration to the Williams Fork River. Enforcement of provisions of 43 CFR Subpart 3041, Section 3041.2-2(d) would ensure that Ruby Construction takes the visual resources identified in this statement into account in the planning, design, location and construction of facilities at the proposed underground mine. To comply with these regulations, all proposed mine offices, warehouses, and other buildings would be built to a low profile to enable them to borrow from the strong horizontal components of the rimrock ledges that lie in the middle-ground landscape visual units. These structures would be painted a non-reflective warm green, brown, or buff color that enables them to borrow color from the adjacent landscape. Screening and load-out facilities would also be similarly painted; silver metallic-colored surfaces would be avoided.

Ruby Construction would also maintain a litter-free environment by implementing a regular cleanup program to properly dispose of waste, litter, and discarded equipment. Refuse disposal areas would be screened and painted to borrow from the characteristic landscape. 43 CFR, Subpart 3041, Section 3041.2-2(f)(8) further requires Ruby Construction to dispose of rubbish to prevent air pollution.

Cut and fill slopes resulting from the haul road, mine portal, building pads, and parking areas would be shaped to a rounding grade that meets the adjacent terrain at a very low angle. By avoiding this angular contact with natural terrain, these projects would more easily borrow form from the adjacent landscape.

Implementation of 43 CFR, Sec. 3041.2-2(f)(12)(ii) would minimize visual impacts accruing to road construction because it requires all roads to be located on flatter slopes to minimize disturbance; this is also required by 30 CFR Part 211, Section 211.40(a)(12)(ii). Reestablishment of a diverse vegetative cover on all disturbed lands is required by Section 3041.2-2(f)(13)(i); this would help mitigate visual impacts on denuded areas; it is also provided for in 30 CFR Part 211, Section 211.40(a)(13)(i). Reclamation efforts on these areas would begin as soon as they are constructed. By planting shrubs and grasses and arranging them in an irregular pattern, aesthetic impacts of reclaiming disturbed areas would be less harsh.

Impacts to mood-atmosphere values that would be caused by increased noise levels would be partially mitigated by implementing the provisions of Colorado Senate Bill 197 (1971) which establishes maximum permissible noise levels and abatement procedures. Adherence to federal noise pollution guidelines outlined in P.L. 91-604, The Clean Air Act (Section 401)—Noise Pollution and Abatement Act of 1970, and enforcement by The Office of Noise Abatement and Control (established by this Act) would achieve the lowering of noise levels adjacent to the Ruby Mine.

The above legislative acts and regulations would be effective only to the extent that they are enforceable, that the standards set forth are indeed enforced, and that these minimum standards are actually effective in reducing impact. The probability of all of these actually being enforced, on the ground, would be something less than 100 percent, as evidenced by impacts presently occurring from similar ongoing operations in the region.

Recreation

Water quality standards established by the Colorado Department of Health (1974) also provide regulations that would require all State waters to be free of substances or conditions toxic to plant, animal, or aquatic life, that produce undesirable aquatic life, and that import any undesirable taste to fish flesh or make fish inedible. 30 CFR, Part 211, Sec. 211.40(a)(8)(i) and 43 CFR Subpart 3041, Sec. 3041.2-2(d)(8)(i) require more specifically that Ruby Construction dispose of rubbish and noxious substances in a manner to prevent water pollution. Enforcement of these regulations would prohibit mine-caused damage to the recreational potential of downstream fisheries in the Williams Fork River.

The recreational value of archaeological and historical resources would be protected by enforcement of the provisions of current Federal and State Antiquities Legislation. Refer to the archeology and history sections of this chapter for a discussion of how these mitigations would be implemented and their relative probability of success.

Enforcement of provisions of 43 CFR Subpart 3041, Section 3041.2-2(d) would ensure that Ruby Construction would act to protect recreational resources identified in this statement. This would be accomplished by adherence to aesthetic and water quality mitigations to maintain a pleasing visual environment and prevent damage to downstream fishing capabilities.

The degree to which these legislative enactments would be successful in mitigating impacts would be dependent upon their inherent enforceability and actual on-the-ground enforcement. Based upon past observations of similar coal mining operations, enforcement of current laws would not be complete in mitigating applicable impacts.

Measures to be Included if Authorization is Granted

Terrestrial Flora and Soils

If possible, topsoil stockpiles would be placed in areas already disturbed, or areas to be disturbed. After regrading, topsoil should be replaced to a minimum of eight inches, and a proper seedbed prepared and reseeded. Fertilizer applications would be applied in early spring or after seedling emergence on spring seedings.

Terrestrial Fauna

Maintaining a daytime hauling schedule would mitigate the potential of animal-vehicle collisions. All vehicular traffic would be kept on the existing roads whenever possible, to reduce the impacts to wildlife habitat resulting from off-road-vehicle use.

Fencing all work areas would help mitigate wildlife and livestock losses due to conflicts with the mine operation.

Historical Resources

Although the Willow Creek Community Center building appears to lack significance and integrity (of location) to warrant eligibility for the National Register of Historic places, it would not be destroyed by mining activity because of its local historic value.

Recreation

Speeds of haul trucks traveling on the unsurfaced portion of County Road 53 would be reduced to avoid throwing rocks into oncoming sight-seeing and recreational traffic, and to maintain overall highway safety.

Chapter V

Adverse Impacts Which Cannot Be Avoided

THIS CHAPTER PRESENTS THE RESIDUAL ADVERSE IMPACTS OF RUBY CONSTRUCTION COMPANY'S PROPOSED ACTION THAT WOULD REMAIN AFTER APPLICATION OF THE MITIGATING MEASURES DISCUSSED IN THE PRECEDING CHAPTER. THE FOLLOWING DISCUSSION COMPLETES THE ANALYSIS EQUATION: IMPACTS MINUS MITIGATIONS EQUALS ADVERSE IMPACTS WHICH CANNOT BE AVOIDED.

Adverse environmental effects which cannot be avoided under the proposed mining plan would include minor alterations to the land surface from installation, use, and removal of surface facilities, and the subsequent reclamation of the area. Subsidence of 4-8 feet would likely occur over the mined-out coal bed. This continued subsidence would result in fracturing and slumping of the surface thereby setting the stage for erosion and hazards to livestock, wildlife, and people. Because of the difficulty in predicting when subsidence is completed and the potential for underground fires, some forms of land surface utilization may be delayed for many years.

Impacts to all fossils would be difficult to mitigate; some fossils would probably be destroyed.

Adverse environmental effects which cannot be avoided under the proposed mining plan would include the loss of about 30 to 40 percent of the total resources in the mined coal bed, approximately 450,000 tons. Also, about 529,000 tons in the 3-foot coal bed that exists 12 feet below the mined bed would be lost.

Only slight sedimentation increases would be expected in Hayden Gulch and the East Fork of Williams Fork. While the increase in total dissolved solids (TDS) from ground water runoff may impact the water quality of Hayden Gulch, potential TDS increase in the East Fork would not be significant enough to affect the aquatic community. An increase in TDS in Hayden Gulch would be rendered insignificant at its confluence with the East Fork due to the much greater volume flow in the river.

The 36 acres of soil disturbance associated with the mining operation would be unavoidable. Loss of existing soil profile conditions would be unavoidable. Soil disturbance would lower natural soil productivity of the area to some degree by compaction, mixing natural soils, and causing accelerated erosion and sedimentation. Present soil biota and soil-forming processes would be altered on the affected area. New soils formed after reclamation would have many characteristics unlike those prior to mining.

Approximately 36 acres of existing vegetation would be unavoidably destroyed during the life of the mine. The existing stage of plant succession would be unavoidably lost when vegetation is removed. However, since the entire soil system would not be disturbed and topsoil would be replaced, return to native vegetation should be possible through natural succession, if encouraged by sound reclamation practices. The loss of the species giant wildrye (*Elymus cinereus*) on approximately ten acres would be unavoidable if the water table is lowered, and loss of vegetation caused by subsidence would be unavoidable if mining occurs in areas of shallow overburden. Also, if the subsidence would create new areas of moisture accumulation, minor changes in vegetation patterns would occur.

Surface disturbance and portal construction would create unavoidable impacts on terrestrial fauna by reducing total potential habitat of the region by about 36 acres. Increase in vehicular traffic would be unavoidable and would increase the probability of vehicle-animal collisions. Changes in surface configuration and slope aspects would result from subsidence.

Presently unknown archeological sites could be subject to damage by vandalism and pothunting; the significance of impact would depend on the nature of the unknown resource. Other adverse impacts could also result from salvage excavation; both adverse and beneficial impacts could result from excavation of significant sites that is done solely for study purposes.

Minor impacts upon the old Rice Mine and the former Willow Creek Community Center building might occur from theft and vandalism due to greater numbers of people (mine employees) in the area.

There would be definite alteration of the natural landscape character; all visually incongruous elements of the proposed action cannot be totally mitigated. Screening, loadout, and possibly crushing facilities cannot totally borrow dominance elements from the characteristic landscape, (because painting with special colors is no panacea). Impacts of all surface disturbances would remain until successful revegetation has occurred. All aesthetic impacts due to dust and noise levels could not be totally mitigated. Adverse impacts upon the area's mood-atmosphere qualities would remain unmitigated for the life of the mine. Economic considerations may generally preclude the imposition of government controls over private industry for aesthetic considerations that return unknown or questionable economic gains. Internal economic considerations by Ruby Construction may also preclude their desire to employ all these mitigating measures. Relative values of these unavoidable adverse impacts depend on visual exposure of the landscape unit in which they occur. All of these could be seen only from a one-half mile segment of County Road 53 which has a relatively low volume of local resident traffic. The scale of the proposed Ruby Construction operation compared to adjacent landscapes would be very small, commensurate with unavoidable adverse aesthetic impacts.

Destruction of recreation capabilities of unknown cultural resources could not be totally avoided. The relative values of this unavoidable adverse impact is small because of existing access limitations and availability of other similar recreation opportunities in the region. As no public surface having legal public access would be involved, only the private landowner would be immediately affected. The nature of the unknown cultural resource would determine whether significant public values are also present.

All road hazards caused by the increased volume of heavy truck and other mine-related traffic between the Ruby Construction area and Hayden would be unavoidable. Adverse impacts would include these increased traffic hazards to motorists on County Road 53, and increased road deterioration from increased traffic volumes.

Chapter VI

The Relationship Between Short-Term Uses and Long-Term Productivity of the Environment

THIS CHAPTER DISCUSSES THE EXTENT OF LONG-TERM IMPAIRMENT OR ENHANCEMENT OF RESOURCE VALUES THAT WOULD OCCUR, GIVEN THE SHORT-TERM USES OF THE ENVIRONMENT PROPOSED IN RUBY CONSTRUCTION COMPANY'S MINE AND RECLAMATION PLAN. IN THIS ANALYSIS OF TRADE-OFFS OVER TIME AND TRADE-OFFS AMONG RESOURCE VALUES, SHORT-TERM REFERS TO THAT PERIOD WHEN SUBSTANTIVE PARTS OF RUBY CONSTRUCTION COMPANY'S PROPOSED ACTION TAKE PLACE. LONG-TERM IS THAT PERIOD IN WHICH SUBSEQUENT IMPACTS, BOTH ADVERSE AND BENEFICIAL, STILL AFFECT THE ENVIRONMENT.

The short-term effects on the land surface would not be substantial, but the long-term effects could be, if subsidence is not prompt and complete, or if fire from spontaneous combustion should start.

Unavoidable paleontological impacts would be experienced in the short-term during the mine's operation. After completion of the mining operation, no further impacts would occur. Options for future use of these subsurface resources would be foreclosed by any fossil destruction. However, a beneficial impact may result from the operation itself disclosing fossils heretofore unknown; this would create options for future generations to benefit from the newly-found resources.

The short-term use of the Ruby Construction mining operation would result in the destruction of existing soils and vegetation on approximately 36 acres. Since disturbance of the soils at the mining site would be relatively shallow and topsoil would be replaced, the area would have a high potential of being returned to existing productivity if sound reclamation practices would be utilized. If subsidence would produce areas that are steep and expose bare soil material, the long-term vegetative productivity of the site would be decreased to an extent that is presently indeterminable.

Short-term use of the area by wildlife would not be significantly affected by this mine. Long-term productivity of wild and domestic fauna should not be significantly altered as a result of this mine.

Archeological values, if present, would be impacted during the short-term by actual surface disturbance. Increased resource exposure to vandalism would also occur in the short-term. Options for future use of cultural resources would be foreclosed to the degree that there would be unavoidable impact from the mining operation. However, required intensive cultural surveys may reveal presently unknown values; this would create options for future generations to benefit from the newly-found resources.

Unavoidable impacts upon historical resources would occur only in the short-term. Once mining operations cease, the increased potential for vandalism and destruction of structures would return to its present state.

After 1979, long-term unavoidable impacts on the area's aesthetics would still remain, such as gradual surface subsidence following the room-and-pillar mining operation, though they would be less significant than short-term impacts. However, long-term impacts would be partially mitigated with the passage of time.

Short-term use of the area would cause both adverse and beneficial impacts to recreation resources. After 1979, some recreational productivity would remain. Success in reclamation and decisions by Ruby Construction would ultimately determine whether beneficial recreational capabilities would actually be realized through on-the-ground interpretive development.

Chapter VII

Irreversible and Irretrievable Commitments of Resources

THIS CHAPTER QUANTIFIES THOSE RESOURCES THAT WOULD BE CONSUMED AND PERMANENTLY LOST AS A RESULT OF THE IMPLEMENTATION OF RUBY CONSTRUCTION COMPANY'S PROPOSED ACTION. SUCH LOSSES ARE IRRETRIEVABLE COMMITMENTS; I.E., ONCE THESE RESOURCES ARE USED, THEY CANNOT BE REPLACED.

THIS CHAPTER ALSO OUTLINES THOSE USES OF ENVIRONMENTAL COMPONENTS THAT COULD NOT BE REVERSED SHOULD THE PROPOSED ACTION BE IMPLEMENTED. ONCE INITIATED, THESE USES WOULD CONTINUE INDEFINITELY.

Approval of the Ruby Construction mine plan would probably constitute an irreversible commitment of some common fossils. Some fossils impacted may be irretrievably lost upon completion of the mining operation, though others may be collected, and/or studied.

The major irreversible and irretrievable commitment of resources by Ruby Construction Company would be the production for consumption, including loss in mining, of about 1.48 million short tons of coal.

Since the area is small and the mining area would not be totally disturbed, the area has a high potential of being returned close to existing productivity; therefore, the only irreversible commitment would be the annual forage that could have been produced on the ten acres disturbed for five-six years. Approximately 36 acres would be permanently disturbed and irretrievably lost for forage production.

Unavoidable impacts to cultural resources (archeologic and historic) would constitute an irreversible commitment of these resources when and if the mine plan is approved. Upon completion of the mining operation, unavoidable impacts would be irretrievably committed.

Commitment of Federal coal lease D-051698 to coal development would be an irreversible commitment of aesthetic resources as related to both unavoidable and long-term minus deviations or adverse impacts. These residual impacts would for all practical purposes be irreversible, irrespective of their relative significance.

Commitment of the proposed action areas to coal development would result in irreversible commitments of recreational resources, even though some may be largely beneficial. However, destruction of unknown cultural resources would for all practical purposes be irreversible.

Chapter VIII

Alternatives to the Proposed Action

THIS CHAPTER PRESENTS THE ENVIRONMENTAL IMPACTS OF ALL REASONABLE ALTERNATIVES TO RUBY CONSTRUCTION COMPANY'S PROPOSED ACTION, INCLUDING NO ACTION.

Reject Mining Plan

Rejection of the Ruby Construction mining plan would result in no environmental impact on the leased lands, and they would continue in their present condition, or be modified by the surface owner to meet other uses, as determined. Ruby Construction Company could submit a new mining plan, challenge the rejection, or abandon, at least temporarily, development of the lease.

Ruby Construction Company has no holdings of State or privately owned coal near the Federal lease, so if no plan were acceptable, no mining would occur. This would result in a loss of energy potential, a loss to the State and county of taxes, and a loss to the State of its share of Federal royalty revenue distributed in accordance with the Mineral Leasing Act.

Require Modification of Mining Plan

Some of the impacts identified and discussed in Chapter V could be avoided if the mining plan were modified to require use of one or more alternatives discussed hereafter. In addition special stipulations could be added to the plan to mitigate some secondary effects of mining. Such conditions must be reasonable and acceptable to the lessee, or they could result in the lessee not developing the coal resource.

Different Mining Methods

SURFACE MINING

Substitution of surface mining appears to be a viable alternative to underground mining. Much of the coal seam is overlain by shallow overburden that would appear conducive to surface mining. Substitution of this method would result in more initial disturbance of the land surface; the impact on topography would be extensive, as the entire appearance and shape of the surface would be altered. Approximately 125 to 140 acres would be disturbed if strip mining took place. The additional acreage is required for roads, topsoil stockpiling areas, and an overburden storage area for the initial or boxcut. As is described in Chapter II, the primary vegetative types that would be destroyed would be mountain shrub and sagebrush. The giant wildrye (*Elymus cinereus*) along the northern boundary of the lease would also be destroyed, as would the aspen community. Wildlife and domestic livestock would be temporarily displaced from the lease area. As is described in Chapter II, about 36 AUMs (Animal Unit Month) would be lost. Erosion could be expected to be a greater problem should strip mining methods be employed rather than underground methods. The aesthetic impact of surface mining operations would be magnified since all activity would be in the open. However, because the area is topographically screened from all but approximately one mile of County road 53, visual impacts would not be significant. Noise and air pollution would be greatly magnified by blasting and operation of various machines. However, the area would not be subject to subsidence problems that might occur on the lease area at the time of mining, or in the future as a result of underground mining.

Effective rehabilitation of the land surface following surface mining would require several years before the area could be restored to a condition comparable to the original state. As is discussed in Chapter II, revegetation capabilities of the soil on the lease area are fair to poor due to excess slope.

Use of surface mining methods would also increase the recovery of available coal in place, as approximately 90 percent extraction could be expected using surface mining methods, while underground methods will recover 60-70 percent. Strip mining of the Rice seam would result in the recovery of approximately 1,153,800 tons and the loss of only 128,200 tons of coal. Use of underground methods will result in the loss of approximately 450,000 tons of Rice seam coal. The three-foot thick seam underlying the Rice seam could also be extracted if strip methods were employed. Approximately 476,000 tons of the 529,000 ton total reserve of this seam could be extracted. Strip mining would therefore allow extraction of approximately 800,000 tons that will be lost with underground methods. The Sun seam, should it exist under the lease area, could probably not be extracted by strip methods as the interburden thickness is too great. Another favorable result of strip mining as opposed to underground mining would be the decreased possibility of fire due to spontaneous combustion in the coal left unmined.

An increase in mine safety could be expected with surface mining techniques, as indicated by the fatal accident rates in 1972 of 0.42/million tons mined underground, compared to 0.07/million tons mined by surface methods. A lower incidence of nonfatal accidents could be expected as well, with the elimination of roof and rib falls, fires, explosions, and problems related to dust inhalation (black lung disease).

Different Production Ratio

Any change in production rate, either up or down, would alter the rate of intensity of environmental impacts discussed previously in this statement. If a reduction in proposed production rate were required, it could create a further shortage of coal for the domestic market in northwest Colorado and for other users. A reduction would prolong the time until final abandonment and restoration is complete, lessen employment at the mine, lessen annual tax and royalty returns to the Federal, State, and county governments from this lease, and lessen chances of the company creating an economically viable operation.

If the company were required to increase production above the level proposed, it would increase the intensity and severity of impacts described elsewhere in the statement, decrease the length of time for mining, increase annual tax and royalty returns from this lease, and necessitate acquisition of additional mining equipment, as the company's expected production from the current planned equipment fleet is already at the maximum capacity.

Different Reclamation Objectives

Alternate land uses for the disturbed areas are discussed in Chapter IX of the Regional Analysis. All reclamation objectives could apply to the area disturbed by the Ruby Construction Mine, but most would be very limited and impractical. Return to grazing land for livestock and wildlife appears to be the most viable objective.

Transportation

RAIL ALONE

Since both Ruby Construction and Peabody Coal have mines on a line only a short distance south of their coals' destination at the Hayden power plant, the construction of a spur to the existing spur at the power plant might be an excellent joint venture. The route of the rail line might easily parallel the existing roadway, and would probably have much less impact in the long run than repeated passage over Routt County 53 by diesel trucks.

A rail line has the advantage of being able to rapidly handle large volumes of coal (as could be stockpiled by Ruby Construction at the Sun Mine). Since Ruby Construction plans may include some stockpiling at the Hayden power plant, stockpiling of coal to the level that would use a 46-car, 100-ton capacity train every few days would be an attractive alternative. Since Ruby Construction company would only input one unit train every six days (at a production level of 750 tons/day), scheduling with Peabody Coal trains further north on the line would not be difficult. The existence of such a rail line would have the added advantage of eliminating the truck transfer and tipple point at the Hayden power plant. Use of unit trains would also simplify scheduling problems with D&RGWRR.

Although the mining venture by the Ruby Construction Company alone would not necessarily justify the capital outlay for constructing a rail line, a joint venture with Peabody Coal might be practical; this possibility is worthy of investigation.

HIGHWAY ALONE

Since two-thirds of the production of the Sun Mine is planned to be shipped out of the northwestern Colorado area, use of highways alone would mean long distance movement of heavy coal trucks; this would result in unacceptable degradation of highways in the area.

SLURRY PIPELINE

A slurry pipeline, as discussed in Chapter IX of the Regional Analysis, is also an alternative to truck transport of coal. It is an excellent method for moving large volumes of coal. Since the distance to the railhead is only about 11 miles, no extra pumping stations would be necessary along the route, and a buried pipeline would have little long-term impact. The preparation plants at either end of the short pipeline would be an impact, but certainly no greater than those surrounding repeated truck trips over Routt County Road 53. The acquisition and disposal of water used in such a pipeline could be a problem.

Another disadvantage of this transportation method is the high potential for freezeup in northwestern Colorado during the long, cold winters. Operational failures are difficult to detect and correct in this area, especially during the winter. During all seasons the probability of a pipeline break or leakage always exists. As the line would cross underneath many small streams, there is a high potential for damaging spillage, with resulting water and land pollution. Any spillage or leakage into water courses would result in damage to aquatic life, aesthetics, and recreation values.

The relatively small volume of coal to be hauled (about 167,000 tons/yr) might not justify the construction of such a high-speed method of coal transport over an 11-mile distance. However if this alternative were to be adopted on a large scale for regional coal transport, Ruby Construction might consider a cooperative venture with other coal companies for exporting its coal over short and long distances.

Engineering and resource problems for such a pipeline need to be investigated; they might prove prohibitive. From an environmental impact point of view this alternative to truck transport is worthy of investigation.

Conveyor belt

Belt conveyors can be used as an alternative to rail or truck transport of coal. Expertise is sufficiently advanced to assure technically sound construction of single or multiple flight belt conveyors for coal transport. Belt conveyors offer great design flexibility and economy in instances like this, where distance and quantity requirements are well known and are expected to remain relatively fixed (at about 167,000 tons/year).

In general, conveyor system construction would cause impacts similar to railroad construction. Long-distance belt conveyors have never been constructed. An eleven-mile belt could probably be considered long-distance and would probably require extensive design work. A belt conveyor would be subject to belt lift by wind and would create quantities of coal dust downwind. To decrease dusting, the entire length of the system would be necessarily hooded or guarded against wind. This would add to the visibility of the structure and increase the impact on wildlife and aesthetics of the area. Electric motors are normally used to power the belts. They would be located at frequent intervals along the lines, requiring service roads, electric transmission lines, and other service facilities. Engineering problems associated with a conveyor belt system may be prohibitive, but this alternative also merits study; as with a rail line, the possibility of a cooperative venture with Peabody Coal could also be considered.

PEABODY
COAL COMPANY

Mine and Reclamation Plan

TABLE OF CONTENTS
FOR
PEABODY'S SENECA 2-W
MINE

Chapter I
Description of the Proposed Action

THIS CHAPTER IS A DETAILED DESCRIPTION OF PEABODY COAL COMPANY'S PROPOSAL TO MINE AND RECLAIM FEDERAL COAL LANDS IN ROUTT COUNTY, COLORADO. THE CHAPTER IS DEVELOPED BY DESCRIBING THE STAGES OF IMPLEMENTATION OF THE COMPANY'S PROPOSAL. THESE ACTIONS ARE USED IN CHAPTER III TO IDENTIFY AND ANALYZE IMPACTS. THE FEDERAL ACTIONS THAT WOULD BE REQUIRED ARE DESCRIBED ON AN AGENCY-BY-AGENCY BASIS AND OTHER DEVELOPMENTS IN THE AREA OF THE PROPOSED ACTION ARE DESCRIBED TO THE EXTENT THAT THEY MAY CONFLICT WITH OR COMPLEMENT THE PROPOSAL.

The action before the Federal government with respect to Peabody Coal Company is review and approval of their mining and reclamation plan on Federal coal leases Colorado 081251 and Colorado 081258 (see Figure PI-1).

The Applicant's Proposal

On March 20, 1974, Peabody Coal Company submitted a mining and reclamation plan to the Office of the Area Mining Supervisor of the U.S. Geological Survey (USGS), to expand their coal mining operation in Routt County, Colorado. This planned mine expansion resulted from the contractual commitments of Peabody with Colorado-Ute Electric Association and the Salt River Project Agricultural Improvement and Power District to supply power to an additional unit of the Hayden Station coal-fired electric generating plant now under construction. Planned production would increase from the current 600,000 tons/year to 1,500,000 tons/year. The proposed expansion, as outlined in this plan, was to take place from an area designated as 2-W (Area C of Figure PI-2) encompassing Federal coal leases C-081251 and C-081258. A detailed Environmental Impact Report for the area encompassed in these leases was prepared by Peabody Coal and filed with the Area Mining Supervisor on February 25, 1975. The USGS determined that implementation of the Peabody mine plan would be a major Federal action significantly affecting the quality of the human environment. Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA), an Environmental Statement is therefore required for approval of the plan. Refer to Chapter I of the Regional Analysis for a detailed description of the Federal procedures required for approval of the plan.

An amended mine plan was submitted to the Area Mining Supervisor on July 22, 1975. This plan changed the timing for initiating mining operations on the 2-W area from 1975 to 1980; no other changes in the plan of March 20, 1974, for the 2-W area were made in this amended plan. However, the amended plan included mine sequence maps for proposed expansion into two additional areas not previously identified in the March 20, 1974 plan:

1. The Yoast area (Area B of Figure PI-2) encompassing Federal coal lease Colorado 0114093 and contiguous competitive lease application Colorado 22786; and

2. An expansion area located east of Peabody's present Seneca 2 Mine (Area A of Figure PI-2) encompassing mostly State and private lands, as well as a 125-acre competitive lease application tract (Colorado 19885) requested by the company.

An analysis of Peabody's Yoast area is not undertaken in this Final Environmental Statement because sufficient baseline environmental data are not available to enable the Department of the Interior to analyze the proposed mine plan pursuant to NEPA's requirements, and because the proposed action lies outside the 15-year time frame of this ES (mining is not scheduled to begin on the Yoast area until 1995). The Department's environmental assessment work, required prior to mine plan and leasing approval, will be conducted at such time as adequate baseline data for coal lease C-0114093 and competitive lease application C-22786 are available.

Because sufficient baseline environmental data are not available to enable the Department of the Interior to analyze Peabody Coal Company's proposed action of leasing and mine plan approval on the area encompassed by competitive coal lease application C-19885 pursuant to the requirements of NEPA, no analysis of the area encompassed by this lease application is undertaken in this Final ES. However, it should be noted that the Craig District Office of the BLM analyzed the applicant's proposed action to lease alone in an Environmental Analysis Record (EAR) completed on January 6, 1976 (010-6-65), and determined that issuance of coal lease application C-19885 would not constitute a major Federal action significantly affecting the quality of the environment, according to NEPA, Section 102(2)(c). Therefore, an ES is not required for lease issuance.

Background and History

Seneca Coals Ltd., a joint venture between Peabody Coal Company and Western Utility Coal Company, with Peabody designated as operator, began operation of the Seneca Mine in 1964. Coal was mined from an area east of Hayden, Routt County, Colorado, and north of U.S. Highway 40 (Area D, Figure PI-2), to supply coal to unit 1 of the Hayden Station power plant operated by Colorado-Ute Electric Association and the Salt River Project Agricultural Improvement and Power District. Unit 1 of the Hayden Station began operation in 1965; Peabody has been under

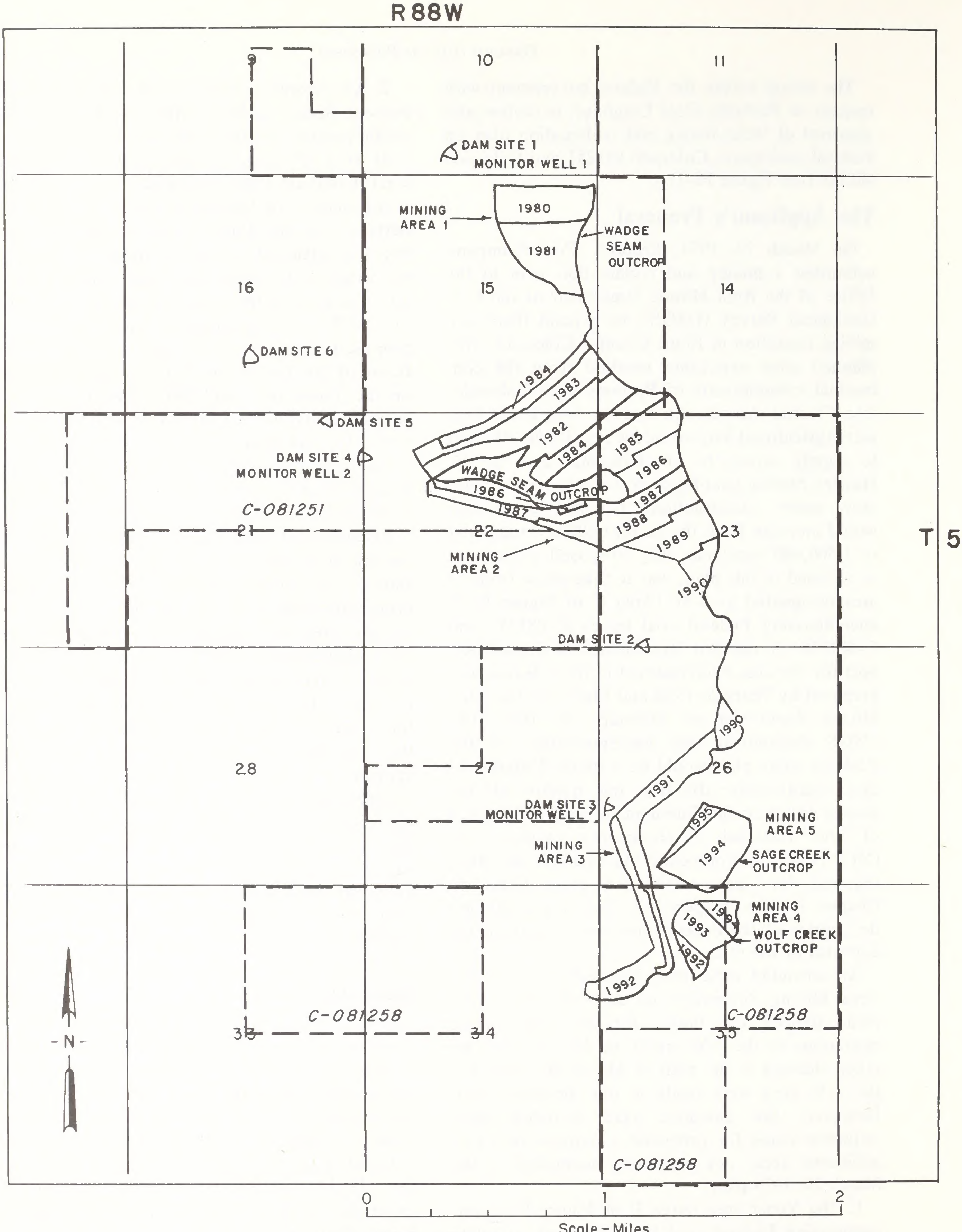
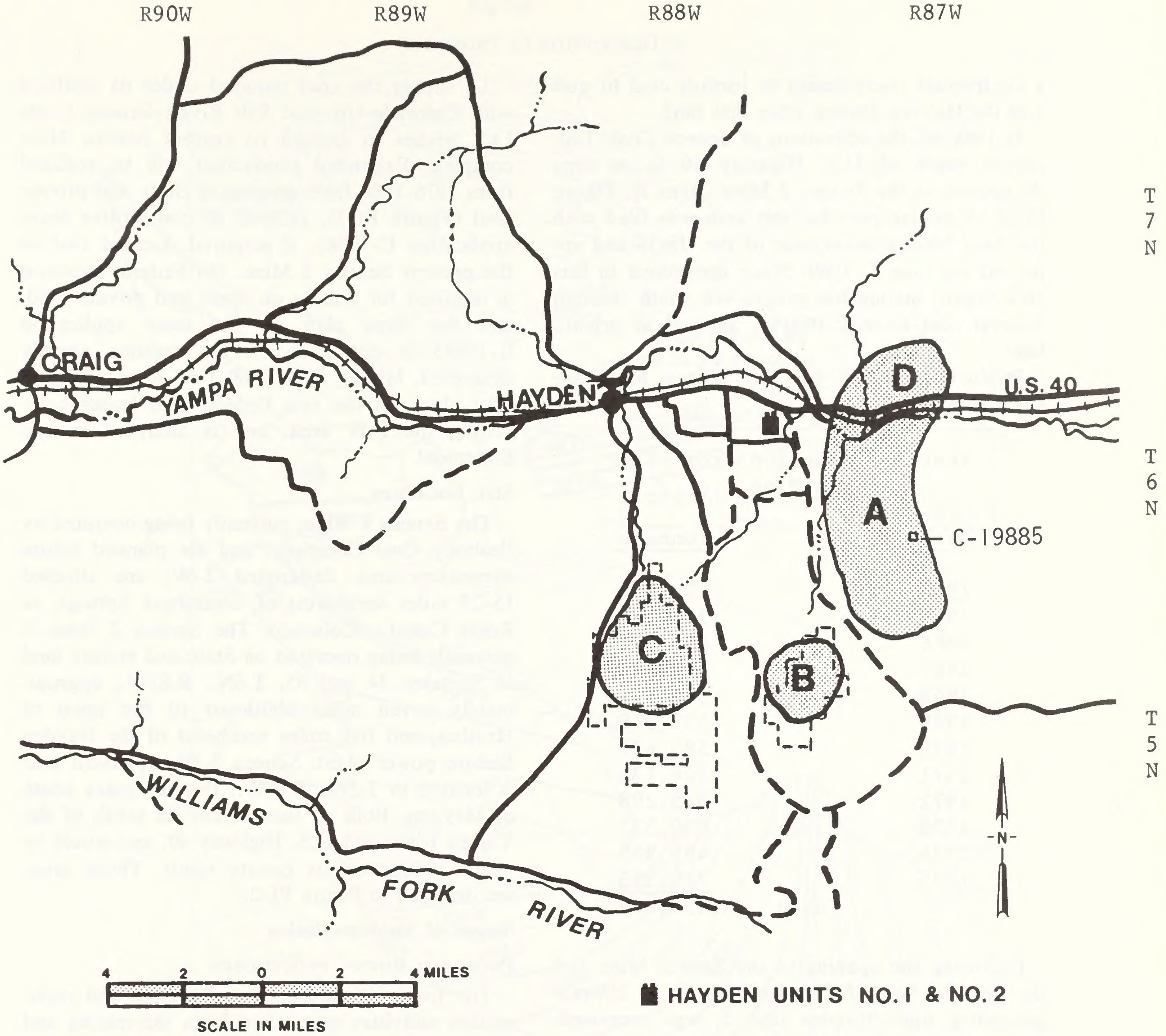


FIGURE PI- 1

Mine sequence map for Peabody's Seneca 2-W operation.



		Strip	Underground	
A	Seneca Coal Ltd.	15	20	Existing Seneca 2
B	Peabody Coal Co.	7	0	Yoast Area
C	United Electric	12	0	Seneca 2-W
D	Reclaimed Area			Original Seneca Mine

FIGURE PI- 2

Dedicated coal reserves (millions of tons).

a contractual commitment to furnish coal to unit 1 of the Hayden Station since that time.

In 1968-69, the operations of Seneca Coals Ltd. moved south of U.S. Highway 40 to an area designated as the Seneca 2 Mine (Area A, Figure PI-2). A mining plan for this area was filed with the Area Mining Supervisor of the USGS and approved on June 5, 1969. Since operations in this area began, mining has progressed south through Federal coal lease C-088199, as well as private land.

Production figures for the Seneca Mine are given below:

Yearly Production From Seneca Mine

Year	Tonnage
1964	36,858
1965	359,532
1966	493,972
1967	597,240
1968	589,974
1969	533,948
1970	583,637
1971	544,135
1972	575,298
1973	630,377
1974	496,985
1975	710,313
Total	6,152,269

Following the opening of the Seneca Mine and the construction of Hayden unit 1, a 250-mw generating unit—Hayden unit 2, was proposed. Peabody Coal Company committed itself to supply the fuel requirements of both units by a revised coal supply agreement in 1965, as updated by an amended revised coal supply agreement in 1971. Colorado-Ute Electric Association and Salt River Project Agricultural Improvement and Power District completed a detailed environmental study of Hayden unit 2 in June 1971. The Rural Electrification Administration, as lead agency, prepared an Environmental Impact Statement for Hayden unit 2 as required by NEPA (42 U.S.C., Section 4321, et. seq.), which was filed with the Council on Environmental Quality on February 4, 1972. Unit 2 was completed in mid-1976 and went into commercial operation in September 1976.

To supply the coal required under its contract with Colorado-Ute and Salt River, Seneca Coals Ltd. wishes to expand its current Seneca Mine complex. Expanded production will be realized from 1976-1980 from an area of State and private land (Figure PI-3), as well as competitive lease application C-19885, if acquired, located east of the present Seneca 2 Mine. No Federal approval is required for mining on State and private land, and the mine plan on the lease application C-19885 is not analyzed for reasons already described. Mining from 1980-1995 is proposed to take place on the two Federal coal leases comprising the 2-W area, and is analyzed in this Statement.

Site location

The Seneca 2 Mine, currently being operated by Peabody Coal Company, and the planned future expansion area designated 2-W, are situated 15-25 miles southwest of Steamboat Springs, in Routt County, Colorado. The Seneca 2 Mine is currently being operated on State and private land in Sections 34 and 35, T.6N., R.87W., approximately seven miles southeast of the town of Hayden, and five miles southeast of the Hayden Station power plant. Seneca 2-W expansion area is located in T.5N., R.88W., five-ten miles south of Hayden. Both of these areas lie south of the Yampa River and U.S. Highway 40, and would be visible from various county roads. These areas are depicted in Figure PI-2.

Stages of Implementation

Proposed mining procedures

The following description of mining and reclamation activities was taken from the mining and reclamation plan submitted by Peabody Coal Company.

The present mining operation at Seneca 2 Mine, located in T.6N., R.87W., on private and State land, would continue southeasterly through 1996. Peabody's expansion is taking place initially from a State lease located directly east of the Seneca 2 Mine. Mining at this site would progress by late 1976 to a Federal lease tract for which Peabody has made application. The lease application tract, if acquired, and the adjacent State land would be mined out by late 1979. At that time the equipment would be transported to the Seneca 2-W area in T.5N., R.88W. Mining would progress southeasterly through Federal coal leases C-081251 and C-081258. All mining would be con-

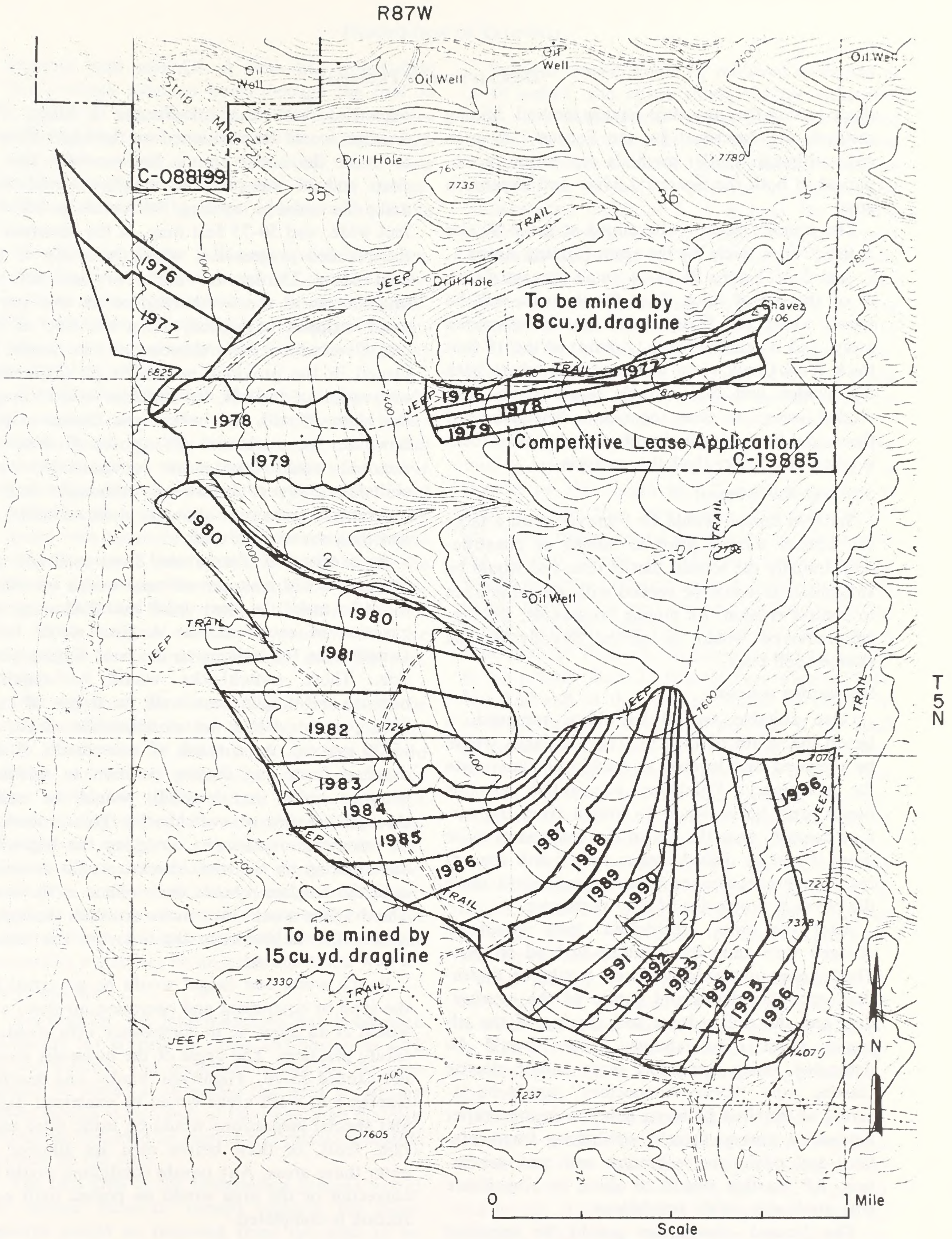


FIGURE PI-3

Mine sequence map for Peabody's Seneca 2 operation and eastern expansion area, including competitive lease application C-19885.

ducted using the area strip mining method. Mining methods are described for the Seneca 2-W area only, although similar methods are currently employed at both the Seneca 2 Mine and expansion area.

The primary seam to be mined at the 2-W site is the 12-foot thick Wadge seam (Mining Areas 1, 2, and 3 of Figure PI-1). A small acreage (Area 5) of the 4-foot thick Sage Creek seam will be mined where the Wadge seam has been eroded away, and a small acreage (Area 4) of the 18-foot thick Wolf Creek seam will be mined where both the Wadge and Sage Creek seams have been eroded away. A more complete description of these coal beds and the interburden between them is given in Chapter II of this analysis.

Soil material removal

Suitable topsoil would be removed with a large self-loading scraper prior to mining or construction. Initially the topsoil that is removed would be stockpiled; it would be seeded with annual grasses to control erosion. As mining progresses, the topsoil removed would be placed directly on the graded spoil piles.

Overburden removal

Once suitable topsoil has been removed, a bench the width of the cut (100-120 feet), would be prepared and leveled to readily accommodate the machinery. Following preparation of this bench, drill holes would be drilled from the surface down to near the top of the coal seam; these holes would be drilled with a rotary drill according to a predetermined pattern, dependent upon the physical properties of the overburden.

After the holes are drilled, they would be charged with ammonium nitrate-fuel oil mixture. The amount of explosive used would be dependent upon the depth and nature of the overburden, and the drill pattern and spacing of the adjacent holes. The charged holes would be detonated, using detonating fuses and/or electric blasting caps. "Delay connectors" would be inserted as required between holes to insure proper detonation timing, thereby optimizing fragmentation, and minimizing vibration and dust generation. All blasting would be done in accordance with applicable safety regulations.

The blasted overburden would be removed using a dragline equipped with an 18-cubic-yard bucket and a 215-foot boom, that was recently assembled for use in the 2-W area and the initial expansion area east of Seneca 2 Mine. The dragline would be positioned on the highwall area to make the initial cut on the recovery line or deep end of the pit. The dragline would then make the initial pit opening 100-feet deep, 100-120 feet wide, and 50-75 feet long, in the direction of the planned progression, which is up-dip of the coal seam. During the initial or box cut the dragline places the overburden on an area previously stripped of topsoil, along the side of the cut. Overburden from subsequent cuts would be placed in the previous mined-out pit. Following excavation of the cut, the dragline would "drag" the highwall with the bucket and chains to pull down any loose material left exposed. Overburden removal would take place continuously, three shifts/day, seven days/week, although shallow overburden areas may allow for reduced shifts, or less than seven days/week.

As overburden is excavated from each cut, the dragline would make an advance bench on which to sit to make the next uphill cut. Following excavation of each cut, the dragline would build switchbacks for walking to the next digging position. These switchbacks would be required because the dragline can walk on slopes of only 8-10 percent, while the mountainside slopes at 15-20 percent. As a result all movements of the dragline from one digging position to another, whether uphill or downhill, would be made through a series of switchbacks. This procedure of removing overburden, dragging the highwall, and walking up the switchbacks, would continue until the dragline reaches the cropline of the coal. The dragline would then move downhill through a series of switchbacks to the recovery line where a new cut is started.

Bench width and height would be governed by the type of equipment and operation involved and would at all times be in compliance with standard safety practices. The angle of the highwalls would not exceed 55-70 . Highwalls, banks, and benches sloping into work areas would be examined daily, and special inspections would be made after each rain, frost, or thaw before men are allowed to enter these areas. Any unsafe conditions would be corrected or the area would be posted until correction is completed.

Coal removal

Following removal of the overburden, a bulldozer would clean the surface of the coal of extraneous rock material. A coal drill would then drill 4–6-inch diameter holes through the coal on a pattern of approximately 15×20 feet. The holes drilled in the coal seam would be charged with ammonium nitrate, and detonated to develop minor fracture planes that allow digging and extraction of the coal by power shovels with relative ease.

Coal loading at the 2-W area would be accomplished with an electric shovel of 8-yard capacity, assisted when necessary by a front-end loader. The loading shovel would begin loading at the low or deep end (recovery line) of the pit and progress up the pit (up-dip).

Coal haulage, because of the steep dip, would be one-way down the dip. Empty coal trucks would travel up the mountain, on roads that would not exceed seven percent, to a point above the loading shovel. The trucks would then travel down the pit to the loading point, and would be loaded with approximately 25 tons of run-of-mine coal; they would then travel down the pit to the nearest exit point. Haulage would be over company-constructed haul roads to County Road 53, on which the coal would be conveyed to the Colorado-Ute generating station near Hayden, Colorado.

All coal from the Seneca 2-W Mine would be loaded and hauled during the eight-hour daytime shift. Production or maintenance problems could require coal to be occasionally loaded on extra or later shifts. The traffic pattern in the mine area would be governed by standard traffic rules. Equipment would be operated at speeds consistent with conditions such as grade, clearance, visibility, traffic load, and type of equipment used. A water truck would sprinkle the haulage roads to control dust so the field of vision of the operators would not be impaired.

Reclamation

Historically, the leasehold area has been used primarily for grazing by cattle and sheep, as well as for wildlife. The reclamation plan for the area would be aimed at returning this area to grazing when mining is finished; at the same time the plan would be designed to protect and establish wildlife habitat on the area.

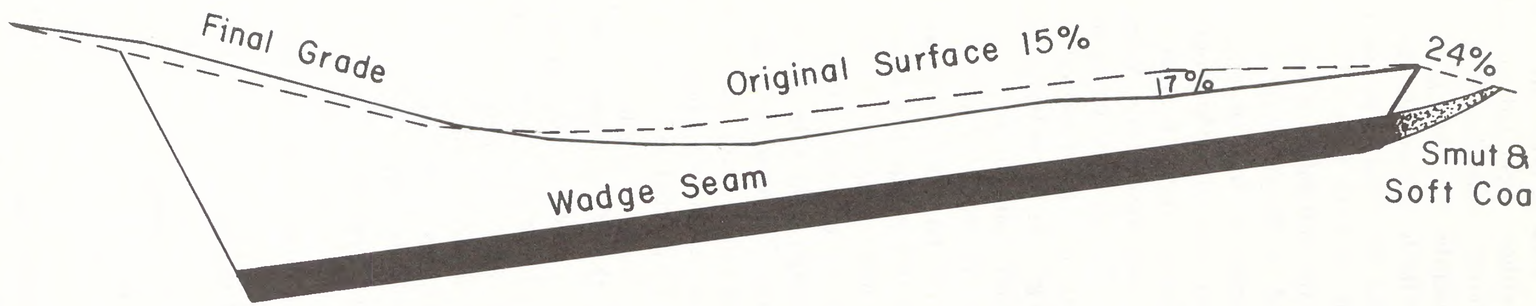
The first step in the reclamation process would be topsoil removal; topsoil suitable for plant growth would be removed from the area to be mined using a large self-loading scraper.

Suitable topsoil would be removed to depths of 8–18 inches, and either stockpiled for redistribution, or redistributed immediately on graded spoils. As topsoil depths vary throughout the mining area, where available, greater depths would be removed as needed to achieve an approximate redistributed depth of 8–18 inches. The criteria used to determine the suitability of topsoil would be those described in BLM Manual 7312-Soils (1/4/74). Past experience has proven that the brown-colored upper strata provides good growing conditions, and efforts would be made to return it to the top of the cast overburden. Where insufficient topsoil exists for adequate cover this strata would be used. Any stockpiled topsoil would be seeded with annual grasses to control erosion.

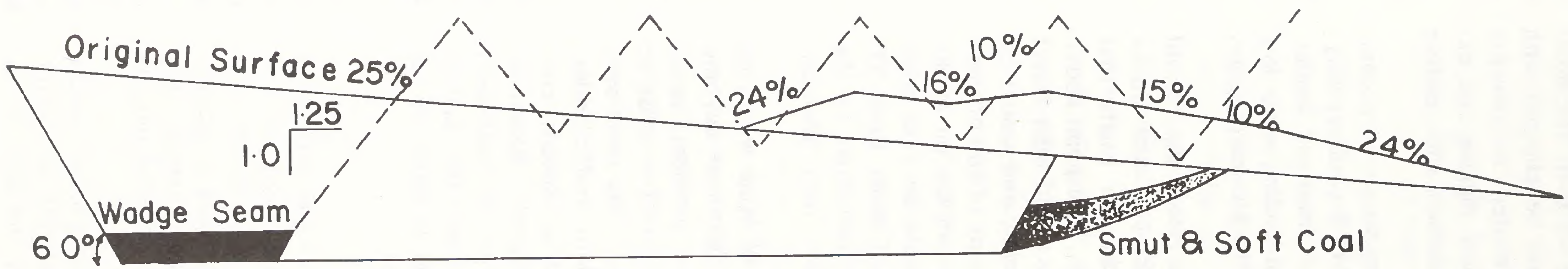
Grading of the spoil would begin as soon as the coal is loaded from the third pit and stripping is started on the fourth pit. Thereafter grading is kept no more than two spoils behind the active pit. Spoil ridges would be graded to blend with the natural terrain of adjacent areas. Grading would be done primarily with a bulldozer, which would operate for two 7½ hour shifts/day during spring, summer, and fall. Except for the box-cut spoil and the final pit, all slopes would be graded to no greater than 25 percent (see Figure PI-4). The highwall of the final pit would be sloped to an angle no greater than 50 percent. If the final pit would be used as a reservoir, the surface near the water's edge would be graded to a slope that can be traversed by man and animals. The outslope of box-cut spoils and the highwall side of spoils would be graded to approximately 33 percent. Grading would be on the contour to minimize erosion. On slopes exceeding 200 feet in length, a surface manipulation practice, such as gouging, would be utilized to induce infiltration and impede runoff.

After grading and topsoil replacing procedures are completed, soil analysis would be performed to determine if any soil amendments are necessary. The soil test would include pH, calcium, magnesium, phosphorus (both P_1 and P_2), potassium, and nitrogen.

Once spoils are graded and topsoiled, the area would be seeded. On areas with slopes less than 25 percent, farm equipment would be utilized, and seeding done in the fall. After the area is graded and proper slopes attained, the surface would be dragged. The area would then be disked to prepare a suitable seedbed; seed would be dis-



Typical section parallel to pits



Typical section perpendicular to pits

FIGURE PI-4

Grading diagram, Seneca 2-W Mine.

tributed with a seeder and immediately covered with a harrow. The operation would be accomplished in one trip by using a tractor large enough to pull a disk, seeder, and harrow in one operation. All surfaces greater than 25 percent would be aerially seeded in the spring; seeding for quick vegetative cover would be timely to control erosion. Berg and Barrau (1973) have established continuing vegetation studies on existing Seneca spoils. On the basis of their research data, a review of relevant literature, past reclamation experience, and similarities between soils at Seneca 2-W and those of Seneca and Seneca 2, the following species of legumes and grasses would be planted in a standardized mixture.

	Lb./acre
Crested wheatgrass (*Agropyron cristatum*)	2
Pubescent wheatgrass (*Agropyron trachycaulum*)	2
Intermediate wheatgrass (*Agropyron intermedium*)	3
Bromegrass (*Bromus inermis leyss*)	4
Fescue-tall (*Festuca* spp.)	2
Orchard grass (*Dactylis glomerata*)	2
Alfalfa - Cody or vernal (*Medicago sativa*)	7
Yellow sweet clover (*Melilotus officinalis*)	2
White sweet clover (*Melilotus alba*)	1
Total seeding rate:	25

In addition to these grasses and legumes, a variety of trees and shrubs would be planted by hand in depressions and valleys that provide a suitable micro-climate conducive to shrub and tree growth. They would also be planted on the highwall sides of spoils and on the outslopes of boxcut spoils. The areas planted with shrub and tree species would constitute approximately 15 percent of the disturbed area. These shrubs and trees would include the following species:

Russian olive	(*Elaeagnus angustifolia*)
Golden willow	(*Salix* spp.)
Tamarisk	(*Tamarix* spp.)
Serviceberry	(*Amelanchier alnifolia*)
Hansen rose	(*Rosa* spp.)
Chokecherry	(*Prunus virginiana*)
Chinese elm	(*Ulmus parvifolia*)
Pea shrub	(*Caragana* spp.)

The list of species to be planted might be further modified as more information is received from ongoing research in the area. Cicer milkvetch (*Astragalus cicer*), for example, has shown promise in species adaptation trials.

Following seeding, the area would be fenced to exclude sheep and cattle until vegetation is established. Control of the reclaimed surface would be retained by Peabody Coal Company for at least three years following reclamation to assure proper revegetation.

Throughout the preoperational and mining phases at Seneca 2-W, efforts would be made to preserve the nature and quality of the existing surface water drainage system. A system of siltation dams would be erected on the water courses draining the area to prevent any increase in the sediment load in the mine-area streams due to preoperational construction activities or mining operations (Figure PI-5). Sediment dams would be designed to handle a "50-year" flood. To prevent excess sedimentation from erosion of the dam itself, it would be vegetated as soon after construction as possible. Sedimentation ponds would be cleaned of collected sediment as necessary by draining the pond and removing the sediment; removed sediment would be redistributed on graded spoil areas; it is expected to be suitable topsoiling material in texture and composition. In no case would spoil material be cast into Sage Creek drainage area.

Culverts would be used wherever natural stream beds are crossed to minimize increased sediment load. Where channelization of the existing streambed would be necessary, as in the narrow, lower-segment of Hubberson Gulch, runoff effects would have been anticipated, and sediment dams constructed just below the channels. None of the channelization would increase the overall grade of the streambeds. Flow-energy dissipators, such as boulders, would be placed in the stream channel.

Since the mine area is near the crest of the drainage, the only water expected to collect in the pit would result from precipitation falling directly into the pit, limited runoff from upslope, and seepage from perched water above the pit area. Water would run to the low end of the pit where it would be pumped out for use in watering roads, irrigation, etc. Water from the pits not otherwise utilized would be pumped over the highwall into the settling ponds.

Air pollution in a mining operation of this type would be mainly the result of dust from haulage roads; fugitive dust would be controlled by watering the roads.

Road cuts would be no steeper than 1.5-1, and fills would have a slope of 2-1 or flatter. The drainage ditches next to the haul roads would be constructed with a 15-inch-wide bottom. Insofar

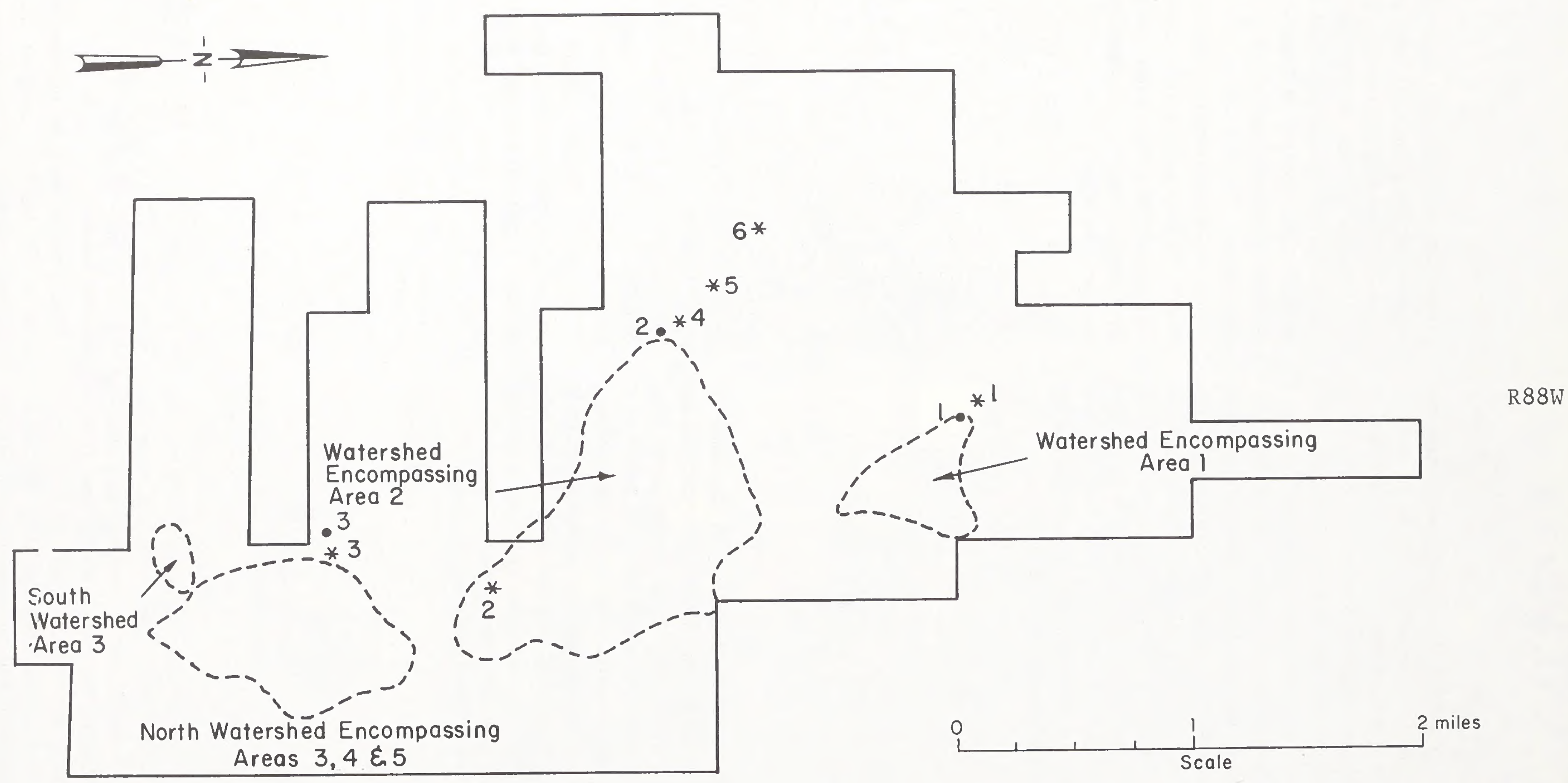


FIGURE PI-5

Surface drainage of individual mining area dam sites (*) and monitor wells (•) at Seneca 2-W Mine.

as possible, roads would be constructed from late May to September. After each segment of road is built, shoulders would be covered with topsoil and seeded as part of the reclamation program.

After mining of the area is completed, the face of the coal seam in the final highwalls would be covered by decreasing the angle of highwalls. The pit voids would act as both impoundments to catch and store water, and as settling basins. The sediment dams would be preserved to catch runoff. Wastes that accumulate at the mine, such as scraps of metal or wood, would be hauled to the open pit for burial.

When mining in the area is complete, stripping equipment would be removed, and dozers would complete necessary grading prior to seeding and planting. All roads which would not be required or requested to be left open would be reclaimed by regrading the slope of road beds, topsoiling, and seeding. Surface structures would be removed; then the area would be cleaned, graded, and seeded.

SURFACE FACILITIES

Roads

The proposed haul road system for the Seneca 2-W Mine is shown in Figure PI-6. Haulage would be on County Road 53 from the mine site to the Hayden power plant. The main haul road has already been constructed from County Road 53 in Dry Creek up to the future dragline construction area in Section 21, a distance of approximately 1½ miles. This road is within the boundary of coal lease C-081251. Haul roads would also be constructed to the northern end of the lease area in Section 15, where mining is scheduled to begin in 1980. As mining progresses roads would be extended to the new pit areas. Eventually main haulage roads would total 19,200 feet in length, and secondary haul roads necessary to mine the entire area would total 40,000 feet in length.

Main haulage roads would have a finished top width of 50 feet. All haulage roads would have an all-weather gravel surface consisting of approximately six inches of gravel topping. Whenever haulage would require utilization of county roads, these county roads would be widened and resurfaced after obtaining the necessary permit or approval from the County Road Committee. All construction would be in accordance with specifications designated by the Board of County Commissioners.

Haulage roads leading from the pit to the surface would be arranged to provide one-way traffic whenever possible, particularly if the road is on a steep grade. If this would not be practical, the road would be constructed wide enough to accommodate free passage of trucks at all points, or definite turnouts and waiting points would be designated.

Dust control measures would be undertaken where dust significantly reduces visibility of equipment operators; water trucks would sprinkle the haulage roads to control dust.

Power

Power for the Seneca 2-W area would be provided by Yampa Valley Electric Association. A 69-kv transmission line would furnish power for the mining machines and related material-handling equipment. The line would run from an existing powerline in the E ½ Sec. 14, T.5N., R.87W. to the proposed Seneca 2-W substation, to be built in the SE ¼ NW ¼ Sec. 23, T.5N., R.88W. This powerline would require no Federal action, except for that portion lying on Federal coal lease C-081258, as it would be constructed entirely on State and private land. Power from the substation to the mining machines would be supplied by cables laid on the ground. The line and substation are shown in Figure PI-6.

Office and shop

The surface facility at the Seneca 2-W Mine site would consist of a single metal building, 40'x80', located in Section 21. This building would house a shop, garage, and office facilities. No coal storage or preparation facility would be required, as the coal would be transported directly to the Hayden power station.

Mining, loading, and reclamation equipment

In order for Seneca Coals, Ltd., to expand operations, additional mining, loading, and reclamation equipment was required. A new dragline, equipped with an 18-cubic-yard bucket and a 215-foot boom, was purchased for overburden removal. A loading shovel, overburden drill, coal drill, coal haulers, and caterpillar tractors were also purchased for this expansion project.

Mining sequence

The present mining operation at Seneca 2, pictured in Figure PI-7, will continue to supply unit 1 of the Hayden power plant. Mine sequence plans for Seneca 2 have been developed through

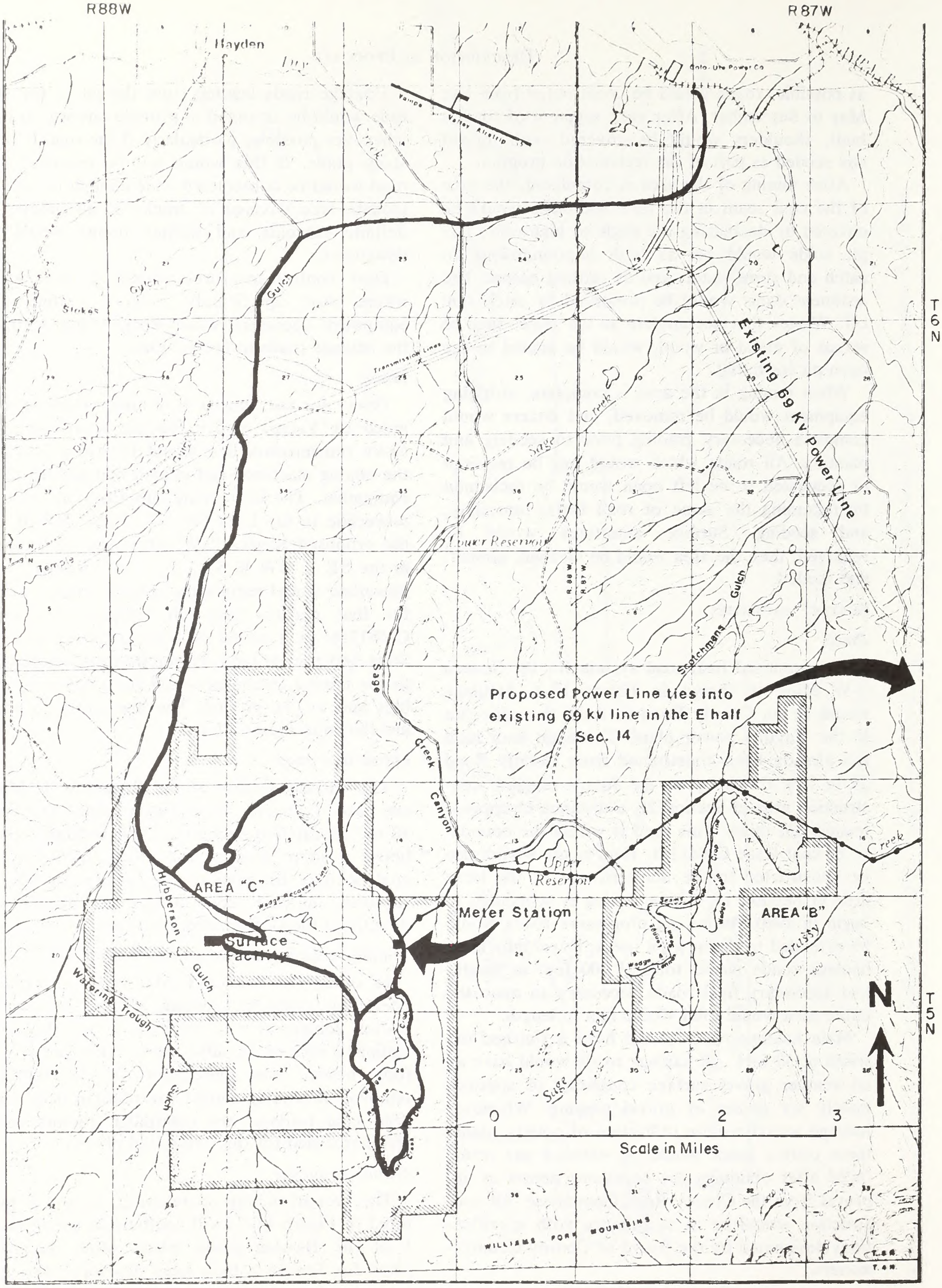


FIGURE PI-6

Haul road (————) and power line (—•—•—•—) for Seneca 2-W.

FIGURE PI-7

Aerial photo of Peabody's Seneca 2 Mine showing dip-line method of mining.

1996. All mining from this operation through 1996 will be conducted on State and private land. It would not be anticipated that the company would return to Federal lease C-088199 from which coal was mined to supply the Hayden station in the past, until the company would begin an underground operation sometime after the year 2000. The mining sequence for this area is shown in Figure PI-3.

The additional 900,000 tons of coal/year used to fuel unit 2 of the Hayden power plant would be supplied from a new mining operation. With the erection of a new dragline in late 1975, the company initiated mining operations east of the present Seneca Mine in the northeast ¼ of Sec. 2, T.5N., R.87W. Pits will progress in a southerly direction on a State lease, supplying the additional fuel requirements to Hayden unit 2. In late 1976, the pits will have progressed to a 125-acre tract of Federal coal for which Peabody has made a competitive lease application. Mining would be initiated on this tract in the latter part of 1976, provided the company is successful in its acquisition. The competitive lease application area and the adjacent State land would be completely mined out in the latter part of 1979; at this time the dragline and other large equipment would be disassembled and transported to the Seneca 2-W area where they would be reassembled. The mining sequence for this area is shown in Figure PI-3.

Mining would begin in the 2-W area on Federal lease C-081251 in January 1980, as soon as the reassembled dragline became operational. The dragline would be walked from its construction area in Section 21, T.5N., R.88W., to the top of the ridge in the southwest quarter of Section 14. The dragline would then be walked north along the ridge to the northeast quarter of Section 15. Mining would begin in the northernmost portion of Section 15, with the pits opened up at the recovery line of 100 feet, and progress up the hill in a west-to-east direction to the outcrop at the top of the hill. This dip-line form of mining has proven to be the most safe, practical, and economical method for the geologic conditions that prevail at 2-W, where the coal seam pitches at 24 percent, and the mountainside slopes at 18-20 percent. Mining would progress in a southeasterly direction through Sections 15, 22, 23, 26, and 35, as shown in Figure PI-1. Approximately 33 acres would be disturbed per year at the 2-W Mine. A maximum of 57 acres would be disturbed at any one time. At a production rate of 900,000 tons of coal/year, the economically strippable Wadge seam reserves on the two Federal leases would be completely extracted in 12 years. In 1992 the dragline would finish the last pit in the Wadge seam in Section 35, and would then be walked a short distance to the east, to the recovery line of the Wolf Creek Seam. Approximately 40 acres of Wolf Creek seam would be recovered. Mining would then progress to the Sage Creek seam, which outcrops immediately north in Section 26. Sufficient reserves of strippable Wolf Creek and Sage Creek coal exist to maintain production for three years.

In the early part of 1995, strippable coal reserves in the 2-W area would be exhausted. At this time, the equipment would be moved to the Yoast area in T.5N., R.87W., provided necessary approvals are gained.

Transportation and marketing

All of the coal produced at the Seneca Mines is consumed by the Hayden power plant located near Hayden, Colorado. Transportation from the mine areas to the power plant is by truck on company-constructed roads and existing county roads.

Relationship to Other Developments in Immediate Area

There is one other operator actively mining coal in the vicinity of Seneca Coal's Mines. Energy Fuels Corporation's 1 and 2 strip mines are located approximately eight miles southeast of Seneca 2 Mine and 13 miles southeast of the 2-W expansion area. Peabody's expansion plans would have no effect on Energy Fuels Mines as they serve different markets, utilize different means of coal transportation, and are separated by some distance.

Ruby Construction Company plans to open a small underground mine soon, to be located four miles southwest of the Seneca 2-W area. Ruby Construction would transport a portion of their coal over County Road 53 to a rail-loading facility to be constructed near the Hayden power plant, and would pass along the west side of the Seneca 2-W Mine. As this road would also be used by Peabody for transportation of their coal to the Hayden power plant, increased traffic volume could be expected. Peabody intends to improve this county road prior to initiation of truck haulage at 2—W.

Several companies and individuals have indicated their intent to begin coal mining operations in the near future. Thomas Woodward holds a Colorado State coal mining lease which is divided into two parts, one of which is located six miles north of the present Seneca 2 Mine, and the other four miles northeast of the mine. Plans are to acquire enough additional land to constitute a logical mining unit and then begin operations. Paul Coupey holds a Colorado State coal lease located five miles northeast of the Seneca 2 operation, and plans to begin surface mining operations soon. Bill's Coal Company holds a State lease located 6-12 miles north of the Seneca 2 Mine. Plans are to initiate exploration work during the summer of 1975 with eventual operation of a mine.

Coal Fuels Corporation has made application to the BLM for a competitive lease located directly west of Peabody's Federal lease C-088199 and the Seneca 2 Mine complex. If it is acquired, the company plans to open a large underground mine. Merchants Petroleum Company holds a large acreage of fee land located 6-9 miles northeast of the Seneca 2 Mine; it plans to open a mine as soon as a joint venture partner can be found. Mapco, Inc., holds a large State lease located directly east of the Seneca 2 expansion area. Mapco's plans for this lease are not known at this time, but development could occur in the next few years. American Electric Power holds Federal coal lease C-012894 located eight miles west of the Seneca 2-W Mine. The company plans to open an underground mine provided additional reserves can be acquired. Seneca Coals' continued operation and expansion should have little effect on these proposed developments.

A 69-kv Yampa Valley Electric Association transmission line currently passes through Peabody's Federal lease C-088199 and the Seneca 2 area, supplying power for the mine operation. A 69-kv transmission line to serve the 2-W Mine has been proposed from an existing line in Section 14, T.5N., R.87W.; this line would cross private and State lands. Neither of these lines would be expected to affect future mining operations.

Chapter II
Description of the Environment

THE FOLLOWING SECTION DESCRIBES THE PHYSICAL, BIOLOGICAL, AND CULTURAL RESOURCE VALUES WHICH CONSTITUTE THE SITE-SPECIFIC ENVIRONMENT IN WHICH PEABODY COAL COMPANY PROPOSES TO DEVELOP FEDERAL COAL. THE DESCRIPTION FOCUSES ON ENVIRONMENTAL DETAILS MOST LIKELY AFFECTED BY PEABODY COAL COMPANY'S PROPOSED ACTION, DESCRIBED IN CHAPTER I, AND ALTERNATIVES WHICH ARE DESCRIBED IN CHAPTER VIII. ALTERATIONS OF THESE EXISTING RESOURCE VALUES WOULD RESULT FROM THE IMPLEMENTATION OF THE COMPANY'S PROPOSAL.

Non-living Components

Geologic and Geographic Setting

TOPOGRAPHY

The Seneca 2-W (Area C) proposed mine site is on the northeastern slopes of Williams Fork Mountains. Dry, Sage, and Grassy Creeks, tributaries of Yampa River, drain this general area. Relief is generally moderate.

Area C is on the upper part of a west-facing slope (15-30 percent) of a northerly-trending ridge. Hubberson Gulch and Dry Creek flow at its lower west end. On the east, other smaller ridge lines separate the steep east escarpment of this main ridge from Sage Creek.

STRATIGRAPHY

Stratigraphic formations present in the area of the site include: the Mancos Shale, Iles and Williams Fork Formations of Mesaverde Group, and the Lewis Shale, all of Late Cretaceous age (Figure PII-1). Smaller units present are the Trout Creek Sandstone Member of the Iles Formation forming the top of that formation, and the Twentymile Sandstone Member of the Williams Fork Formation, lying about 450 feet below the top of the formation. The geology is more fully described in U.S. Geological Survey (USGS) Bulletin 1027 (Bass, Eby, and Campbell 1955).

Unnamed units in the area include minor alluvial deposits of the present streams, slope wash materials, minor rock falls, particularly from the Trout Creek and Twentymile Sandstone Members, and minor slump and landslide deposits. These deposits range in thickness from about five to thirty feet. Alluvial and slope wash deposits are mainly of silt, sand, and fine gravels.

The Iles and Williams Fork Formations are the only coal-bearing units in or near the proposed mine site. They consist of interbedded sandstone and shale with several coal beds and some clay beds. The Trout Creek and Twentymile Sandstone Members, which are about 100-200 feet thick, are convenient marker beds because the principal mined coal beds lie between them. Most of the sandstones are hard, platy to medium-bedded, and fine-grained; some are calcareous. Coal beds not included in Peabody's mine plan lie at the west edge of the Seneca 2-W site. The thickest of these is the Fish Creek coal (Bass, Eby, and Campbell 1955); it lies above the Twentymile Sandstone Member (see Figure PII-1). Where one or more of these coal beds crop out along the west side of Dry Creek they have been burned over much of their extent and mined at a few other places by underground methods. Of these beds, Bass, Eby, and Campbell state:

> A coal bed 3 feet or less in thickness crops out at many places along Fish Creek in the southeastern part of T.5N., R.87W. The Dry Creek bed, which is 10 feet thick and about 400 feet above the Twentymile sandstone member, is worked by several mines on Dry Creek in T.5N., R.88W.; and a 4½-foot bed, 240 feet below the Dry Creek bed, was formerly mined. Several other coal beds in the group are reported to have been prospected and penetrated by drill holes on Dry Creek many years ago, but they were not exposed at the time of the field investigation for this report.

STRUCTURE

The Seneca 2-W (Area C) site lies on the west flank of the Sage Creek anticline. Beds dip north-northwest in Section 15 at about 12°-14°. Along the south line of Sections 14, 15, and 16, the strike of the beds changes abruptly, so the dip is southwestward at about 7°-14° in Sections 22 and 23 (Bass, Eby, and Campbell 1955).

No faults have been mapped in the Seneca 2-W site area. However, an east-trending north-facing scarp across the middle of Section 22 has the appearance of a fault scarp, and may indicate a fault. It is noteworthy that the abrupt bend of the rocks at the south line of Section 15 occurs at this locality; thus the abrupt bend may indicate a fault, at least at depth, rather than a fold, as depicted on the cited map.

GEOMORPHOLOGY

The ridge occupied by the Seneca 2-W (Area C) proposed mine site is essentially a large cuesta with a steep short escarpment on the east, and a long and more gentle dip slope on the west (Figure PII-2). Coal is being stripped on a similar cuesta at the present Seneca 2 Mine of Peabody Coal Company (Figure PII-3). Streams flowing down the dip slope at Area C have formed small to fairly deep valleys. One of the deeper valleys, in N½ Section 20, has eroded through the Wadge coal bed; it lies parallel to, and north of, an east-trending scarp that is partly capped by the Twentymile Sandstone Member. As indicated in the section on Structure, this may be a fault-line scarp. Some landslide scars and hummocky deposits occur on the dip slope, probably resulting from sliding along bedding planes. Roger Colton of the USGS has mapped several such areas, in NE¼, N½ SE¼, and NE¼ SW¼ Section 3, S½ Section 10, S½ Section 15, and N½ Section 22, all

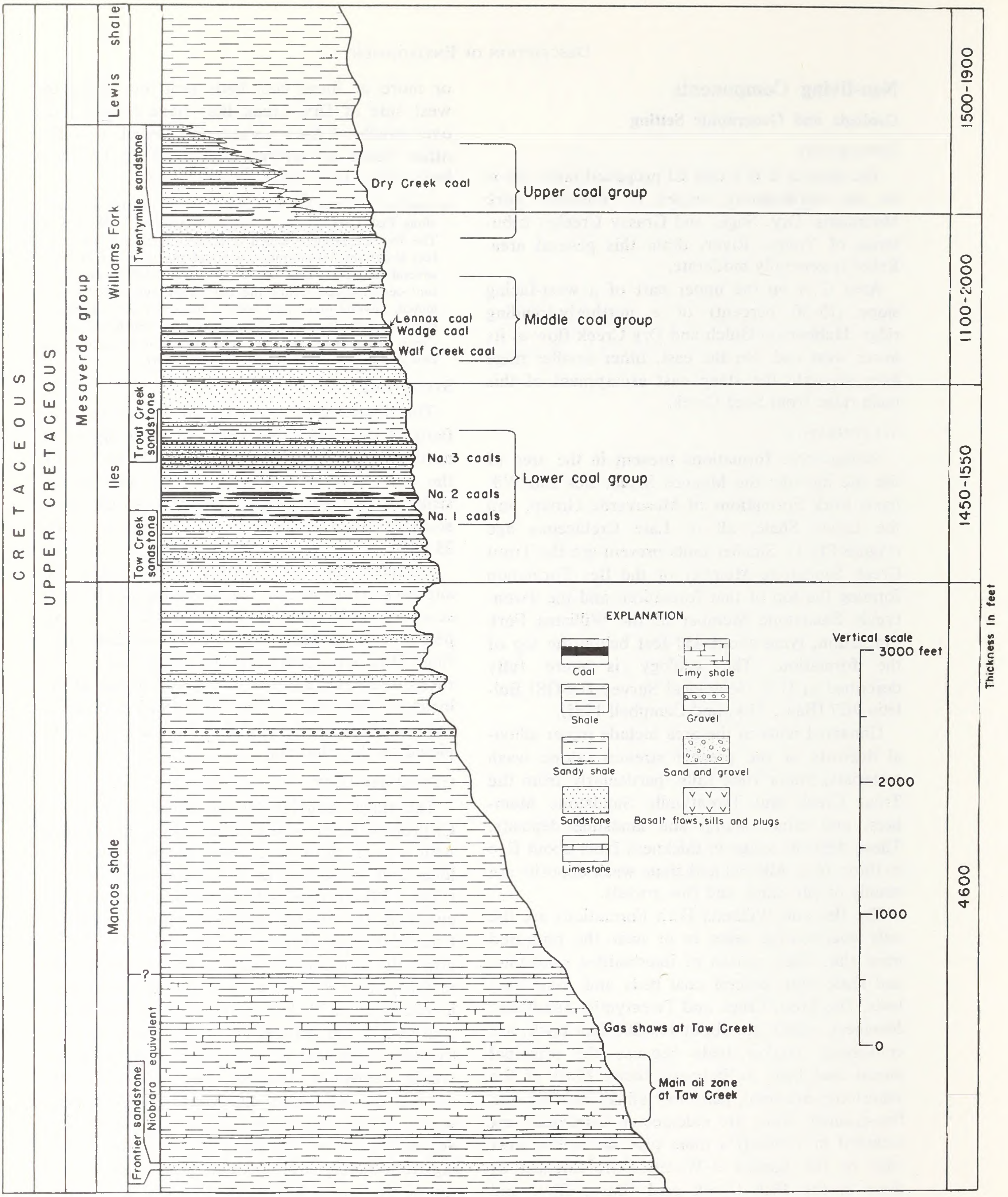


FIGURE PII-1

Stratigraphic units, including coal beds, in and near the sites of Peabody Coal Company's Seneca 2-W.

SOURCE: U.S.Geological Survey Bulletin 1027.

FIGURE PII-2

Aerial oblique photograph looking north at Peabody's Seneca 2-W proposed mine site (Kwi, Iles Formation and Kwf, Williams Fork Formation).

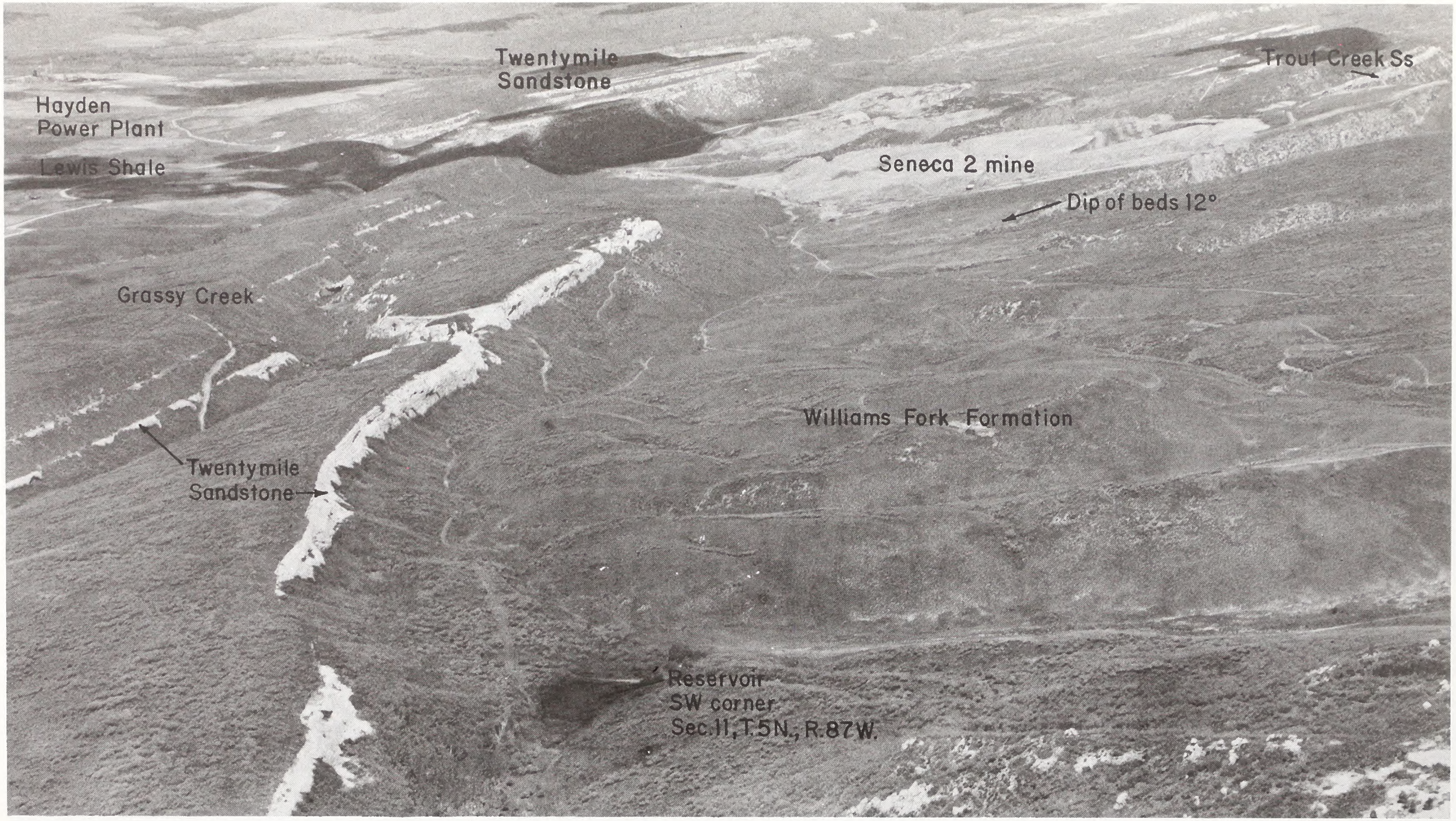


FIGURE PII-3

Aerial oblique photograph, looking north at Peabody Coal Company's Seneca 2 Mine area.

in T.5N., R.88W. (see Figure PI-6). Those in Sections 3 and 15 are the most prominent. Section 22 has the only known such feature where mining is to take place; in S½ NW¼ NE¼ there are slump features at the base of the Wadge coal bed, and these are of quite recent origin.

PALEONTOLOGY

The coal-bearing Iles and Williams Fork Formations, overlain in places by the Lewis Shale (see Geologic Map, Appendix A), are known to contain fossils. Ammonites and other marine fossils are known to occur in the Lewis Shale, and both the Williams Fork and Iles Formations contain fossil leaves, ammonites, and inoceramus clams (within interbedded shales). There is also a possibility of vertebrate fossil remains in the Iles Formation (see Ruby Construction, Chapter II, Paleontology) due to evidence of dinosaur footprints in coal beds nearby.

No specific surface exposures for fossils have been reported on the lease areas; however, no paleontology field survey has been completed for the proposed action area.

Mineral Resources

OIL AND GAS

No important deposits of economic materials other than coal are known or believed to occur on the proposed mine sites. The Sage Creek and North Sage Creek fields, which produce oil and gas from the lower part of the Mancos Shale, are along the crest of the Sage Creek anticline about one mile east of the Seneca 2-W site. There could be some oil or gas entrapped by stratigraphic control, but such targets in the area are not now well enough defined to encourage exploration.

COAL

The principal coal bed of interest at the mine site is the Wadge; others are the Wolf and Sage Creek beds; all are low-sulfur bituminous beds in the Williams Fork Formation.

These coal beds are described by the company as follows: the Wadge coal bed averages 12 feet in thickness, has an average ash content of eight percent, average sulfur content of 0.50 percent, and an average Btu/lb. of 12,250 (all percentages on a dry basis). These are the averages of 40 core samples. The Wadge bed is about 400 feet above the base of the Williams Fork Formation. The Wolf Creek coal bed lies about 150 feet below the Wadge; (on seven drill holes, however, an average interval of 168 feet was found by the present study). The Wolf Creek seam averages 9.45 percent ash, 0.58 percent sulfur, and 10,285 Btu/lb. The Sage Creek seam averages 8.25 percent ash, 0.62 percent sulfur, and 10,950 Btu/lb.

Three persistent and one lenticular coal bed were found in several of 133 core holes tested in the Seneca 2-W area. An approximate average thickness of coal beds and non-coal intervals from these holes is as follows:

Lenticular coal bed	0-4 feet	
Non-coal interval		40-58 feet
Wadge coal bed	11.5	
Non-coal interval		50-60
Sage Creek coal bed	4.2	
Non-coal interval		95-105
Wolf Creek coal bed	18.6	
Total	36.3 feet coal in 240 feet	

The company's thickness figure of 12 feet for the Wadge may be more accurate than the 11.5 feet estimated here. The Wolf Creek bed is one 17- to 18-foot bed in some holes, but in others splits into two or more beds, typically a 6.3-foot bed, 3.5 to 6.5 feet above a 10- to 14.5-foot bed. The thickness given for the Wolf Creek coal bed, shown above, includes overlying and underlying coal beds that are at least two feet thick, and lie within ten feet of the Wolf Creek, above or below. The Sage Creek seam will be recovered in an area where the Wadge seam has been eroded away and the Wolf Creek in an area where both the Wadge and Sage Creek seams have been eroded away.

The lenticular seam which occurs above the Wadge seam (generally termed the Lennox seam) is quite variable in thickness over the 2-W area. Lab analyses in the record files of the Area Mining Supervisor's office show that the Lennox seam averages 1.7% sulfur over the entire 2-W area. This is too high a sulfur content to be acceptable for use at the Hayden Station power plant. However, it may be possible to blend the Lennox seam where it exists in economically minable quantities with the underlying Wadge seam to furnish a useable product. The company has not indicated whether or not they intend to recover this seam at 2-W where it is economically feasible to do so; however, the Lennox seam is currently being recovered, where it exists in economically minable quantities, at the Seneca 2 Mine and then blended with the Wadge seam for delivery to the Hayden Station.

The report by Bass, Eby, and Campbell (1955) contains additional information on coal beds near

Peabody's proposed mine site. In S½ SE¼ Sec. 35, T.6N., R.88W., they measured the Wolf Creek bed at 11 feet 5 inches, and provided an analysis, Lab. No. 2032 (see Table PII-1). Close to this site a coal bed was measured at 6 feet 10 inches. Two miles north of the Seneca 2-W site a 5-foot coal bed, and 35 feet higher an 11-foot bed, were found.

Near Area B, Bass, Eby, and Campbell (1955) had several points of coal observations. At the Lindholm Mine, NW¼ NE¼ Sec. 30, T.5N., R.87W., located in the southwest corner of Area B, they measured a coal bed in the "middle coal group", apparently near the Wadge coal bed, at 6 feet 8 inches and obtained an analysis, Lab. No. 94195 (see Table PII-1). At the southeast corner of Area B, in SW¼ Section 16, T.5N., R.87W., they record a thickness of 12 feet for the Wadge and more than 8 feet 6 inches for the Wolf Creek.

The Wolf Creek bed presumably is the stratigraphically lowest coal that the company intends to work, and apparently the lowest economically workable coal bed of the Williams Fork Formation. Other coal beds are present in the underlying Iles Formation, below the Trout Creek Sandstone Member. Little data are available regarding the coal beds of the Iles Formation in or near Area C. About 1½ miles southeast of Area B, Bass, Eby, and Campbell (1955) record a 9-foot coal bed in the Iles. In S½ NE¼ Sec. 11, T.5N., R.88W., they report a coal mine working 10.6 feet of coal containing 2.7 feet of non-coal material, also in the Iles. Coal beds of the Iles Formation in the general area between Oak Creek and Hayden Gulch are discussed by Bass, Eby, and Campbell (1955), and there are probably one to three workable beds in Peabody's operating area. However, these would have to be mined underground.

Approximate gross quantity of coal in the Seneca 2-W areas may be determined as follows:

Wadge bed:
12.0 feet thick × 1,742 tons = 20,904 tons/acre
Sage Creek bed:
4.2 feet thick × 1,742 tons = 7,316 tons/acre
Wolf Creek bed:
18.6 feet thick × 1,742 tons = 32,401 tons/acre.

The company, in a letter of March 18, 1974, to the Area Mining Supervisor of the U.S. Geological Survey, stated an initial goal of 850,000 tons per year (from the Wadge coal bed) in the Seneca 2-W area. This output requires an annually mined reserve of 944,000 tons, if a ten percent loss is assumed, and indicates that about 33 acres will be disturbed annually.

Water Resources

GROUND WATER

The area to be mined extends for about 3½ miles north-south along a ridge that lies between Dry Creek drainage to the west and Sage Creek drainage to the east. A map of the proposed Seneca 2-W Mine, including five separate areas, is shown in Figure PI-1. The rocks dip to the west from 10-20 degrees, and except locally in Area 2, the dip of the rocks is steeper than the slope of the land surface. A west-flowing tributary of Dry Creek breached the coal in the northern part of Section 22 and the western part of Section 23. The occurrence of water in the coal and adjacent rocks is influenced to some extent by this erosional breach in the coal. Logs of drill holes report no water in the coal in the part of Area 2 to the north of the breach in the coal, nor in Area 1. It is assumed that these areas drain to the valley that produces the breach in the coal. Giant wild rye along the crop line of the coal on the north side of the breach indicates ground water discharge from perched water in the coal.

To the east and south of the breached area in Area 2, and also in Area 3, water was encountered in many of the drill holes. It is not entirely clear why these areas are not also drained by the breach in the coal, since the crop line along the south side of the breach lies at a lower altitude than the drill holes that encounter water. However one possible explanation is the presence of minor faulting that forms a barrier between saturated coal and the crop line. The coal in Areas 4 and 5 is higher topographically than in the rest of the areas and apparently does not contain water.

Water in the coal is recharged from snowmelt and spring rains on the slopes above the area, and is discharged by upward leakage to springs and water-loving vegetation lower down on the slopes.

Water quality in the rocks is indicated by samples from three wells that were drilled by the mining company to monitor the effects of mining on the ground water. These wells were drilled in topographical low spots to the west of Areas 1, 2 and 3, and are numbered accordingly. An analysis is given for number 2 well as sample number 7 in Table PII-2. Complete analyses are not available for No. 1 and No. 3 wells; however, in October 1974 the total dissolved solids for these wells

TABLE PII-1

Analysis of Coal Near Peabody Coal Company's Proposed Mine Site

(Made at the Pittsburg laboratory of the U.S. Bureau of Mines. Form of analysis: A, as received; B, air dried; C, moisture free; D, moisture and ash free)

Mine and location	No. on map	Location in mine	Coal bed and group	Formation	Lab. no	Air-drying loss	Form of analysis	Proximate: Moisture	Proximate: Volatile matter	Proximate: Fixed carbon	Proximate: Ash	Ultimate: Sulfur	Ultimate: Hydrogen	Ultimate: Carbon	Ultimate: Nitrogen	Ultimate: Oxygen	Heating value: Calories	Heating value: Btu
Lindholm mine on Sage Creek, 9 miles southeast of Hayden, sec. 30, T. 5 N., R. 87 W.	159	Face of no. 1 left room	Middle coal group.	do	94195	3.4	A	12.3	33.6	43.0	11.1	.4	----	----	----	----	5,690	10,240
							B	9.3	34.8	44.4	11.5	.4	----	----	----	----	5,885	10,590
							C	----	38.4	48.9	12.7	.5	----	----	----	----	6,490	11,680
							D	----	44.0	56.0	----	.5	----	----	----	----	7,435	13,380
Mine on Sage Creek, near mouth of canyon, (11-ft seam), sec. 2, T. 5 N., R. 88 W.	246	Main entry, 40 feet from mine mouth.	do	do	2032	2.7	A	11.0	35.8	47.5	5.7	.5	----	----	----	----	6,315	11,370
							B	8.6	36.8	48.8	5.8	.5	----	----	----	----	6,490	11,680
							C	----	40.3	53.3	6.4	.6	----	----	----	----	7,100	12,780
							D	----	43.0	57.0	----	.6	----	----	----	----	7,580	13,640

SOURCE: U. S. Geological Survey Bulletin 1027-D

TABLE PII-2

Dissolved Solids in Selected Wells, Streams, and Mine Pits

	Consolidation Fuels Test Holes 1	2	Energy 1 Pit 3	Foidel Creek Near Tipple 4	Foidel Creek Near Foidel School 5	Energy 2 Pit 6	Monitor Well P-2 7	Seneca 2 Pit 8	Seneca 2 Shop Well 9
Calcium mg/l	37	34	410	71	140	75	64	250	200
Magnesium mg/l	21	21	180	35	71	29	77	170	77
Potassium mg/l	13	3	6	3	3	3	4	10	4
Sodium mg/l	200	190	64	19	36	44	76	160	31
Bicarbonate mg/l	710	583	217	313	305	314	518	416	557
Chloride mg/l	4	3	7	4	6	7	4	18	21
Fluoride mg/l	0.8	1.3	0.3	0.3	0.3	0.3	0.1	0.4	0.3
Sulfate mg/l	39	120	1,500	84	430	80	220	1,300	420
$NO_2 + NO_3$ as ND mg/l	0.01	0.02	18	0.05	1.4	13	0.00	5.0	0.07
Silica mg/l	9.6	16	5.4	8.8	5.3	11	14	5.8	14
TDS mg/l	677	676	2,360	380	848	462	720	2,140	1,050
Arsenic µg/l	0	0	0	2	1	0	0	0	0
Cadmium µg/l	0	0	1	0	0	1	0	1	4
Cobalt µg/l	0	0	0	0	0	1	0	0	0
Copper µg/l	0	0	3	3	4	5	0	0	250*
Iron µg/l	2,200	390	40	110	90	60	2,000	50	90
Lead µg/l	0	1	0	0	0	0	0	1	0
Manganese µg/l	80	0	20	70	110	80	50	70	17
Mercury µg/l	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0
Molybdenum µg/l	0	0	1	0	0	3	0	1	0
Nickel µg/l	2	0	9	4	2	3	1	14	0
Selenium µg/l	0	0	47*	0	3	0	0	5	4
Vanadium µg/l	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Zinc µg/l	8	10	20	10	8	4	2,200*	30	20
Conductivity	1,090	1,080	2,850	600	1,200	740	1,500	2,420	1,450
pH	7.7	7.6	7.6	7.8	8.1	7.8	6.9	7.5	7.5
SAR	6.5	6.3	0.7	0.5	0.6	1.1	1.5	1.9	0.5
Water Temperature	14.5	18.0	18.5	23.0	22.0	25.0	10.0	16.0	20.5

* Excessive value (probably due to contamination of sample).

Samples collected and analyzed by USGS, 1975 (unpublished) were 1,860 milligrams per liter, and 2,900 milligrams per liter respectively. The composition of the water from these wells is similar to the present Seneca 2 pit (sample 8 in Table PII-2). Seneca 2 pit is about 6 miles northeast of proposed Seneca 2-W Mine, in the same coal bed that would be mined in Areas 1, 2, and 3.

Surface water

Water quantity

The Seneca 2-W lease encompasses two watersheds. The largest part of the lease area and all that is to be mined by 1990 lies in the Dry Creek watershed, but there are also small portions of the Sage Creek watershed within the lease boundaries. Both of these watersheds feed into Yampa River, which in turn is a tributary to Green River. The drainage system in downstream order follows:

- Yampa River
  - Grassy Creek
  - Sage Creek
  - Watering Trough Gulch (head of Dry Creek)
    - Hubberson Gulch
  - Dry Creek

No gaging stations have been operated on Sage or Dry Creeks, so runoff and peak flow estimates were made from a regional hydrologic analysis based on USGS Water Supply Paper 1683 (Patterson and Somers 1966).

Estimates of runoff potential of the upper Dry Creek watershed above Temple Gulch have been compiled utilizing data from Station 09244300 Grassy Creek, near Mount Harris, Colorado, applying the USGS regional technique. These estimates of runoff are presented in Table PII-3.

TABLE PII-3

Preliminary Estimate of Flows for Upper Dry Creek Watershed*

Recurrence Interval (yrs)	Seasonal Peak Runoff (cfs)	Seasonal Runoff (Mar - June) (in.)	Seasonal Runoff (Mar - June) (ac-ft.)
2.33	121	.85	853
5	158	1.44	1444
10	182	1.92	1925
20	194	2.39	2396
50	230	2.96	2968

*Upper Dry Creek watershed
Area: 18.8 square miles
Elevation range: 6500 ft. to 8466 ft.
Length of channel: 8.9 mi.

A more detailed analysis of runoff patterns of the lease area was obtained by subdividing the lease into the watershed shown in Figure PI-5. The first area includes Mining Area 1 in the NE½ of Section 15 on the unnamed draw north of Hubberson Gulch. The second area includes Mining Area 2 which drains into the north fork of Hubberson Gulch. The third area includes two watersheds draining Mining Areas 3, 4, and 5 on the south fork of Hubberson Gulch. The quantity of runoff for these three areas was estimated using the empirical techniques of the Soil Conservation Service, USDA (Table PII-4). Values are included for 10, 25, 50, and 100-year six-hour rainstorms. Corresponding values for runoff from snowmelt are not included, since no snow courses exist from which the snow patterns of the area can be determined. However, as a first approximation, it appears that in an average year runoff from local snowmelt may produce a peak runoff rate equal to a six-hour, 10-25 year (1.5 inch) rainfall.

Several specific observations about these three areas are in order. The first area encompassing Mining Area 1 is vegetated primarily by sagebrush, with an area of mountain shrub and aspen in the southwest portion. This aspen and dense brush is subject to heavy snow accumulation during winters.

The area encompassing Mining Area 2 consists of a wide variety of soils and vegetation types on slopes approaching 25 percent. The heavy clay soils of this area have a relatively high runoff potential.

The third area consists of two small drainages. The northernmost of these two drainages is almost entirely covered with dense brush and aspen, whereas the southern smaller drainage area is more sparsely vegetated. In the runoff estimates in Table PII-5 the northern watershed is consistently lower, due to more dense vegetation and different soil conditions.

Table PII-4 also contains estimates of discharges at the mouth of Hubberson Gulch encompassing runoffs from Mining Areas 2, 3, 4, and 5.

Surveys were also made to determine potential runoff into individual yearly mining panels. These findings are detailed in Table PII-5. The 1982 and 1983 panels in Area 2, and the 1991 panel in Area 3 are the only panels which intercept potentially high runoff.

Water rights

A preliminary search was made of the records of Water Division No. 6, at the Water Resources Division Engineer's office in Steamboat Springs, Colorado, for water rights in the Dry Creek

TABLE PII-4

Runoff Estimates
SCS Technique for 6-Hour Storm Period

Watershed	Area	10-yr Storm 1.4 inches		25-yr Storm 1.6 inches		50-yr Storm 1.8 inches		100-yr Storm 2.0 inches	
	(sq mi)	Peak Discharge (cfs)	Total Runoff (ac-ft)	Peak Discharge (cfs)	Total Runoff (ac-ft)	Peak Discharge (cfs)	Total Runoff (ac-ft)	Peak Discharge (cfs)	Total Runoff (ac-ft)
Mining Area 1	0.16	0.1	0.01	1	0.1	2	0.3	3	0.5
Mining Area 2	1.07	16	2	19	4.6	31	7.6	46	11.1
Mining Areas 3, 4, 5 North Watershed	0.35	1/	2/	1/	2/	1/	2/	1/	2/
South Watershed	0.06	0.2	0.2	1	0.7	1	0.2	2	0.3
Hubberson Gulch	8.16	43	8	216	20.1	201	37.2	253	55.8

1/ Peak discharge less than 0.1 cfs.

2/ Total runoff less than 0.1 ac-ft.

3/ Approximations only.

TABLE PII-5

Estimated Flood Potentials of Each Panel[1/]

Mining Panel Year	Mining Area	10-yr. Storm (1.4 in.) Potential Flow into Pits Peak (cfs)	10-yr. Storm (1.4 in.) Potential Flow into Pits Volume (ac-ft)	25-yr. Storm (1.6 in.) Potential Flow into Pits Peak (cfs)	25-yr. Storm (1.6 in.) Potential Flow into Pits Volume (ac-ft)	50-yr. Storm (1.8 in.) Potential Flow into Pits Peak (cfs)	50-yr. Storm (1.8 in.) Potential Flow into Pits Volume (ac-ft)
1980	1	.6[2/]	.09	1.0	.17	1.8	.29
1981	1	.2	.03	.5	.07	.8	.14
1981	1	.1	.02	.2	.04	.3	.05
1952	2	1.5	.23	7.0	.85	14.8	2.20
1982	2	.4	.07	.9	.15	1.6	.27
1983	2	2.9	.50	4.2	.73	5.7	1.01
1982	2	1.2	.21	3.3	.30	4.1	.39
1984	2	0	0	0	0	0	0
1985	2	0	0	0	0	0	0
1986	2	0	0	0	0	0	0
1987	2	.2	.02	.7	.10	1.4	.23
1988	2	.3	.04	.08	.12	1.4	.23
1989	2	0	0[3/]	0[3/]	0[3/]	0[3/]	0[3/]
1990	2	0	0[3/]	0[3/]	0[3/]	0[3/]	0[3/]
1991	3	.5	.07	1.1	.17	1.9	.32
1991	3	0	0	0	0	0	0
1991	3	0	0	0	0	0	0
1992	4	0	0	0	0	0	0
1993	4	0	0	0	0	0	0
1993	4	0	0	0	0	0	0
1994	4	0	0	0	0	0	0
1994	5	0	0	0	0	0	0
1994	5	0	0	0	0	0	0
1994	5	0	0	0	0	0	0
1995	5	0	0	0	0	0	0

1/ All calculations assume no diversion help from overburden.

2/ 0 values indicate less than .005 acre-feet or less than .05 cfs.

3/ Assumes any inflow from previously mined areas is trapped between spoils piles.

SOURCE: Environmental Impact Report. Seneca 2-W Coals, Ltd.

drainage that may lie within the lease or be influenced by the proposed mining operations. The summary of this search is presented in Table PII-6 (Peabody Coal Company 1975). The senior rights, i.e., those including and prior to July 10, 1960, probably represent an over-appropriation of the waters of Dry Creek. Therefore, one of the senior rights indicated in Table PII-6 must be acquired, or a dependable supply from drainage into the mine pits must be obtained, to insure an adequate supply for the mining operation.

Quality of streams

An evaluation was made of water quality of Sage and Dry Creeks, the two major streams draining the lease area, by Ecological Consultants, Inc. for Peabody Coal Company (see Appendix D). Figure PII-4 shows the location of water quality sampling stations, established by Ecology Consultants, Inc. in the analysis area. In general, both streams were well oxygenated. Turbidities for both streams ranged from 0-7 Jackson Turbidity Units (JTU) at upper stream sampling sites. The pH of the two streams ranged from 8.5-8.65 (Peabody Coal Company 1975).

The amount of total dissolved solids (TDS) during both March and April samplings was slightly higher for Dry Creek than for Sage Creek due to differences in drainage basin characteristics. Both streams exhibited similar nutrient levels which were in a range capable of producing abundant algal growth. Also, alkalinity, specific conductance, and TDS increased during summer months due to concentrating factors caused by low summer stream flows (Peabody Coal Company 1975).

Trace elements in Dry and Sage Creeks were generally within acceptable limits. However, lower Dry Creek did exhibit unusually high quantities of aluminum (9,800 microg/l), manganese (610 microg/l), and iron (17,600 mg/l). Lower Sage Creek also exhibited relatively high concentrations of iron (4,300 microg/l) (Peabody Coal Company 1975). Five-day and 20-day biological oxygen demand (BOD) levels were low during March readings for both Sage and Dry Creeks. Increases in BOD levels during April are probably attributable to greater stream production and increased levels of drifting plant and animal materials. Fecal coliform levels for both Sage and Dry Creeks are well within levels established by the State of Colorado for Class A and Class B streams. Both Dry and Sage Creeks are classified under Colorado standards as being Class B streams, i.e., streams that are suitable for all purposes for which raw water is customarily used, except primary contact recreation, such as swimming and water skiing (Peabody Coal Company 1975).

Climate

Rough topography surrounding the Seneca 2-W Mine area causes significant channeling of air masses passing the region. During the evening and early morning hours, air is known to move toward lower elevations. Therefore at Seneca 2-W, air from the far eastern portion will flow into Sage Creek Canyon, but the largest portion of the air mass will move into Hubberson and Watering Trough Gulches, and then up Dry Creek Valley towards the Yampa Valley. During the afternoon hours air warmed at the surface tends to flow towards higher elevations. It is estimated that down-valley flow occurs about 50 percent of the year, and up-valley flow about 10 to 20 percent of the year. The remainder of the year, wind direction is variable. At Seneca 2-W it is estimated that afternoon wind speed will average 4-5 meters/second (mps), and evening wind speed, 2 mps (4 mph). Wind speeds greater than 10 mps (20 mph) will occur in stormy weather, approximately one percent of the time. Calm conditions can occur any time of day, but are far more frequent during the evening and early morning when air mixing is poor, and therefore potential pollution episodes most likely. Wind speeds of less than 1 mps (2 mph) are expected nearly 20 percent of the time at the Seneca 2-W Mine site.

Measurements of annual precipitation at the mine are unavailable, but historical records from the nearby town of Hayden suggest that 41 centimeters (16 inches) can be expected per year. Fifty-three days per year precipitation is greater than the detectable limit of .25 millimeters (.01 inches) at the Seneca 2-W Mine.

Similar to the entire region, the mine area is subject to large seasonal and daily temperature variations. In July, temperatures are expected to vary from 29°C (84°F) during the day to 6.7°C (44°F) at night, on the average. January extremes vary from an average of 0°C (32°F) during the day to −17°C (1.4°F) at night. The growing season is assumed to be similar to that recorded at Hayden, about 76 days.

TABLE PII-6

Results of Preliminary Search for Existing Water Rights on Dry Creek

Name	Location: Section	Location: Township	Location: Range	Quantity	Appropriation Date	Basin Rank	Remarks
Magoen Ditch	SW SE 14	6N	88W	3.00 cfs	6-24-1895	218	
J. C. Temple Ditch #2	34	6N	88W	4.17 cfs	4-25-1904	583	
J. C. Temple Ditch #2	34	6N	88W	--	4-25-1904	583	
J. C. Temple Res. #2	NW SE 9	5N	88W	86.0 ac-ft	4-25-1904	583	Appears to have been
Dry Creek Ditch	SW SW 22	6N	88W	0.50 cfs	6-07-1913	666	breeched, sediment
Dry Creek Ditch	SW SW 22	6N	88W	2.50 cfs	7-10-1960	1,239	filled reservoir on
Tabb Spring & Pipeline	NW 16	6N	88W	0.05 cfs	--	--	Seneca 2-W Lease.
Broughton Spring	SW 7	5N	88W	0.004 cfs	pending		
Marvin Barns Spring	SW 18	5N	88W	0.02 cfs	pending		
South Brock Spring	SW NW 20	6N	88W	0.011 cfs	pending		
Stock Ponds							
Sumner Hockett	NW 14	5N	88W	1.5 ac-ft	--		On Seneca 2-W Lease
Don Lorenz	NE 7	5N	88W	4.5 ac-ft	--		property in Sage Creek
Norm Smith	SE 8	5N	88W	4.5 ac-ft	--		drainage.
Frank Temple	NE 15	5N	88W	0.5 ac-ft	--		According to present mining plan, this will be removed by mining.
Wells (only those that appear to be pertinent)							
	NW NW 7	5N	88W		no decree		Appears to be on the
	NW SE 4	5N	88W		no decree		Seneca 2-W Lease.
	NW SW 23	5N	88W		no decree		

SOURCE: Environmental Impact Report. Seneca 2-W Coals, Ltd.

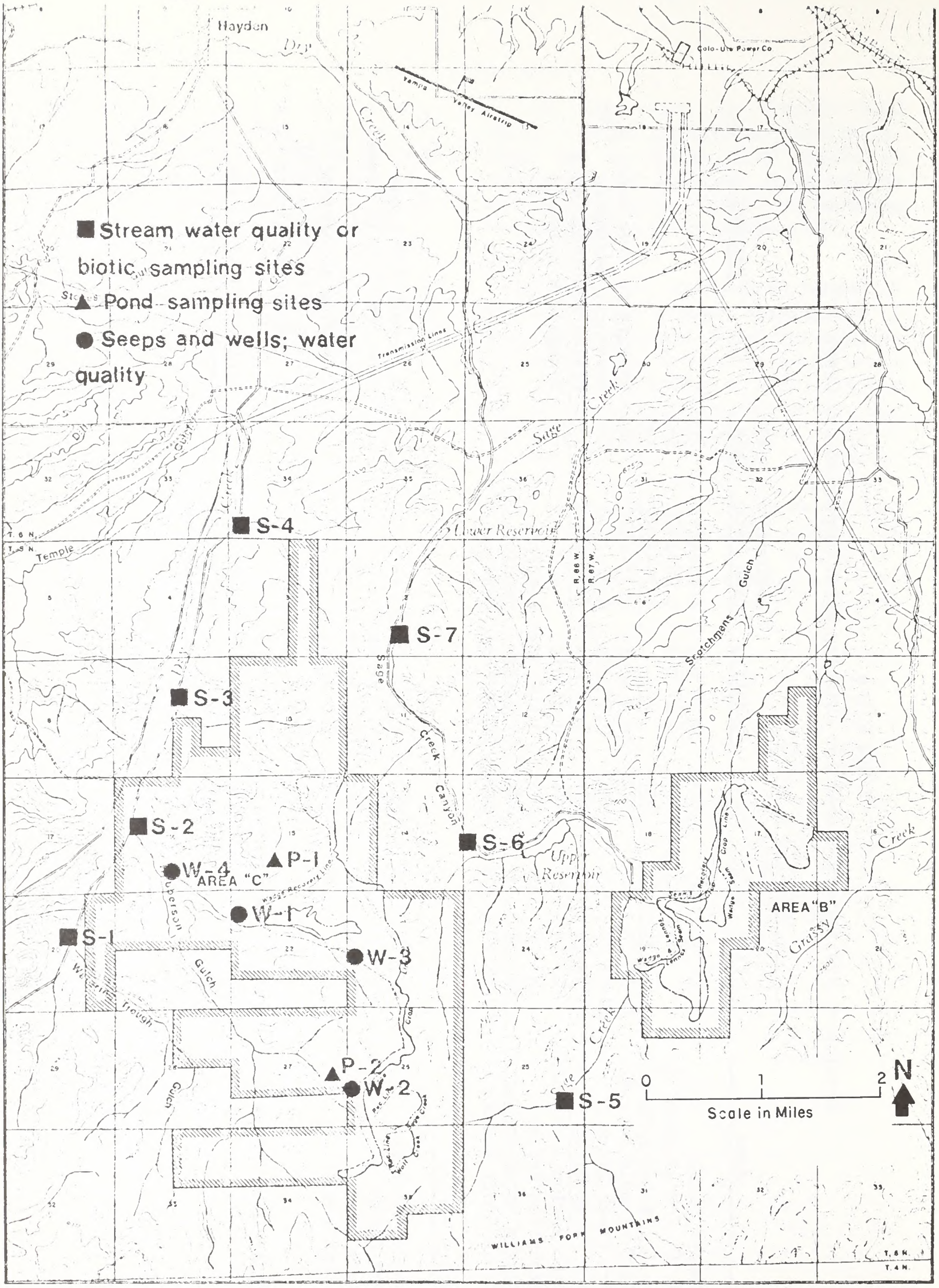


FIGURE PII-4

Water quality and biotic sampling sites.

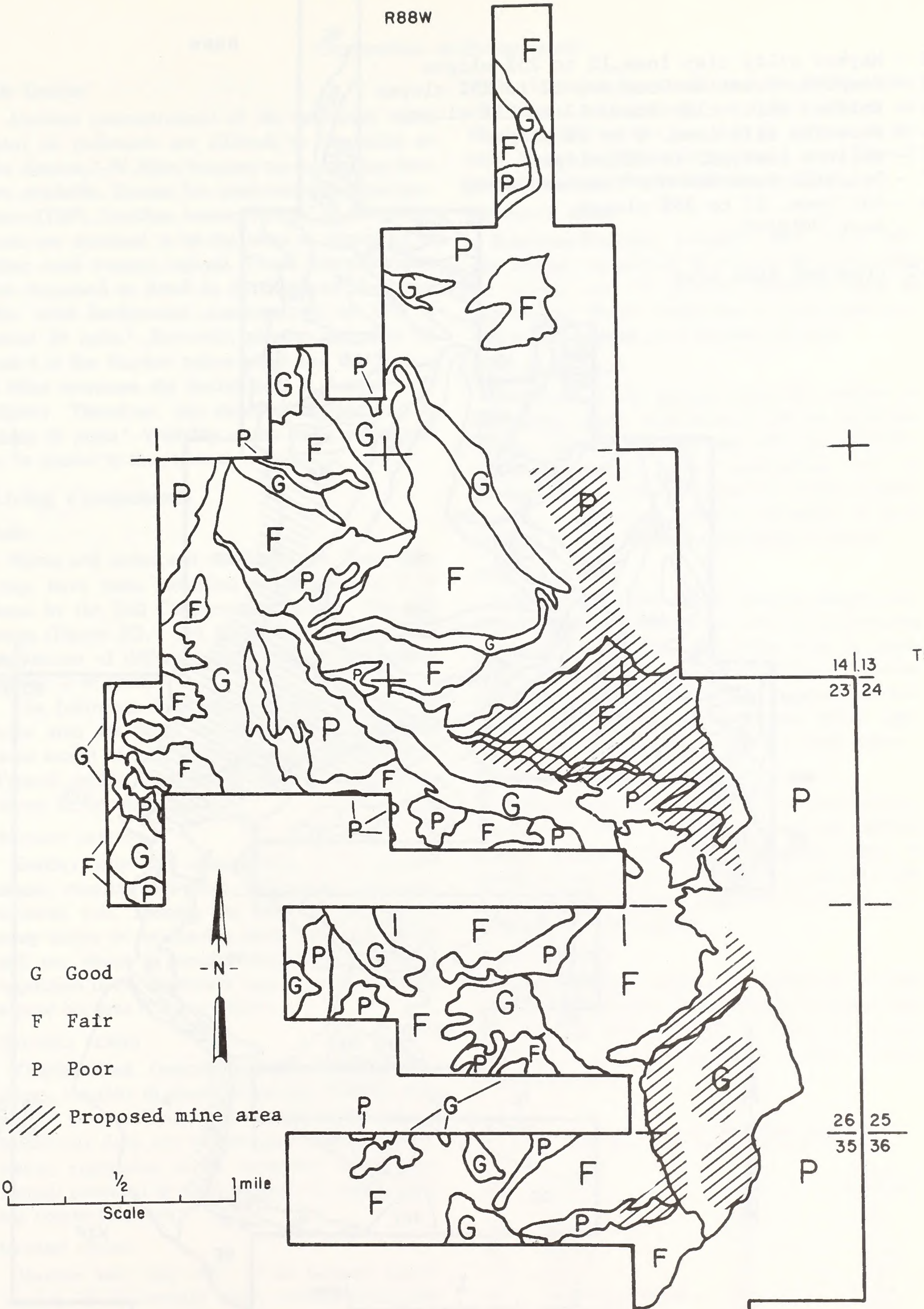


FIGURE PII-5

Relative suitability of topsoil for use in reclamation at the proposed Seneca 2-W Mine site.

4E - Haybro silty clay loam, 12 to 25% slopes
9E - Hesperus-Waterino Complex, 12 to 25% slopes
10E - Bulkley silty clay loam, 12 to 25% slopes
11A - Waterino silt loam, 0 to 3% slopes
46F - Splitro loam, 25 to 65% slopes
X2F - Delphill-Rock Outcrop Complex, steep
A - Hub loam, 12 to 25% slopes
RL - Rock Outcrop

Proposed mine area

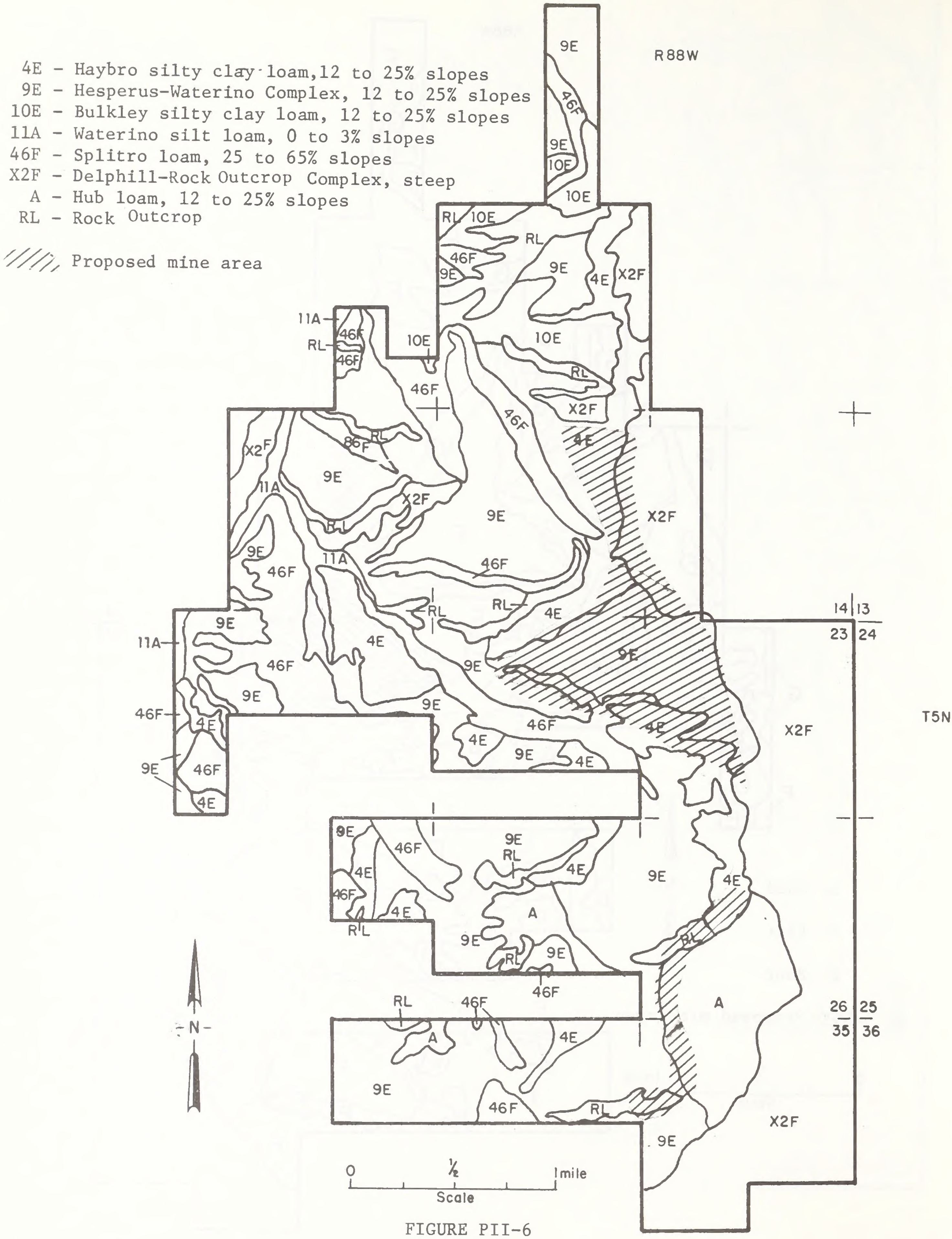


FIGURE PII-6

Soil map of the proposed Seneca 2-W Mine.

Air Quality

Ambient concentrations of the nationally regulated air pollutants are difficult to determine at the Seneca 2-W Mine because no monitoring data are available. Except for total suspended particulates (TSP), baseline concentrations of air pollutants are assumed to be the same as measured in other rural western regions. These concentrations are discussed in detail in the Regional Analysis. The rural background concentration of TSP is about 20 $\mu g/m^3$. However, present operation of unit 1 of the Hayden power plant and the Seneca 2 Mine increases the background at Seneca 2-W slightly. Therefore, the expected background is about 26 $\mu g/m^3$. Visibility at the mine is assumed to be similar to the regional visibility.

Living Components

Soils

Seven soil series and one land type, Rock Outcrop, have been identified on the Seneca 2-W lease by the Soil Conservation Service. The soil maps (Figure PII-5 and PII-6) show the location and extent of different kinds of soils located on Seneca 2-W lease.

The following descriptions of the soils in the lease area are those provided by the SCS. The areal extent of each soil is shown in Table PII-7. Typical profile descriptions for each series are shown in Appendix D.

BULKLEY SERIES

Bulkley silty clay loam (10E), 12-25 percent slopes, consists of a deep, well-drained and fine-textured soil, forming on level to moderately steep slopes of weathering shale. Included in this unit are about 5 percent Haybro soils. Native vegetation is the sagebrush type. Topsoil potential is poor because it is too clayey.

DELPHILL SERIES

Delphill-Rock Outcrop complex (X2F), steep slopes, consists of about 70 percent Delphill soils and 20 percent Rock Outcrop. Delphill soils are moderately deep and well-drained over sandstone. Native vegetation is the mountain shrub type. Topsoil potential is poor because of steep slopes and coarse fragments.

HAYBRO SERIES

Haybro silty clay (4E), 12-25 percent slopes, consists of moderately deep, well-drained, fine-textured soils on mountain slopes, forming in shale. Included are small areas of Bulkley silty clay loam, and gravelly or cobbly phases of Haybro; they occupy less than 15 percent of the unit. Native vegetation is sagebrush type. Topsoil potential is poor due to high clay content.

HESPERUS SERIES

Hesperus-Waterino complex (9E), 12-25 percent slopes, consists of 70 percent Hesperus soils on slopes, and 30 percent Waterino soils in depressions. Native vegetation is sagebrush type. Topsoil potential is poor because of slope.

HUB SERIES

Hub loam, 12-25 percent slope (A) consists of moderately deep, well-drained soil on mountain slopes, forming colluvial and alluvial materials. About 15 percent other unidentified soils of similar characteristics are included. Native vegetation is conifer type. Topsoil potential is good because of large thickness, 60 inches or more.

SPLITRO SERIES

Splitro loam (46F), 25-65 percent slopes consists of shallow, well-drained soils on north-facing mountain slopes; the underlying rock is sandstone; included are small areas of Rock Outcrop, and Routt loam, which is a deep dark-colored soil. Native vegetation is the mountain shrub type. Topsoil potential is good except for steep slopes.

WATERINO SERIES

Waterino silt loam (11A), 0-3 percent slopes, consists of deep, well-drained soil on alluvial stream terraces. Included are small areas of poorly drained soils; it is mapped in complex with Hesperus soils. Natural vegetation is bottom type. Topsoil potential is good.

ROCK OUTCROP

Rock Outcrop consists of exposures of bare rock; this land type is mapped in complex with the Delphill series. There is little or no soil material to support vegetative growth. Topsoil potential is poor.

TABLE PII-7

Estimated Areal Extent of Each Soil Mapping Unit Identified on the Soil Map for Seneca 2-W Lease

Symbol	Mapping Unit[1]	Acres	Percent Composition
4E	Haybro	945	15
9E	Hesperus-Waterino	2,739	43
10E	Bulkley	252	4
11A	Waterino	63	1.5
46F	Splitro	977	15.5
A	Hub	504	8
X2F	Delphill-Rock outcrop	410	6.5
RL	Rock outcrop	410	6.5
	Total	6,300	100.0

[1]Name shortened for convenience of the table.

Terrestrial Flora

Five primary and one secondary vegetative communities occur within the lease boundary of the Seneca 2-W Mine. The primary types are: sagebrush, mountain shrub, forbs, conifer bottom lands, and barren (Rock Outcrop); the secondary type is aspen. A more detailed description of the vegetation and the ecological requirements of these vegetative types is found in Chapter II of the Regional Analysis section of this statement. The forb type is not included in the Regional Analysis because it does not occur in large enough areas to be considered on a regional basis.

The conifer and bottom land vegetative type are present only in very limited areas, and therefore are not described extensively in this section. The approximate extent of each vegetative type is shown in Figure PII-7. The major types are described in the following paragraphs. The type designations and numbers are those used by the BLM.

Forbs, type 3

The forb vegetation type occurs as small open areas devoid of shrub cover scattered throughout the lease area; they most frequently occur on exposed shale outcrops. The vegetation cover in the forb areas is sparse, with many areas exhibiting as much as 40 percent bare ground. The quantity of plant cover decreases slightly from spring to summer, since many of the component species complete their life cycle early in the summer. The vegetation in these areas is dominated by perennial forbs, such as arnica (*Arnica* spp.), mules-ear (*Wyethia helianthoides*), locoweed (*Astragalus* spp.), and aster (*Aster* spp.). An important fraction of the cover in the springtime is contributed by ephemeral spring forbs, such as the mountain parsleys (*Cymopterus* spp. and *Pteryxia* spp.). Compared with other areas of the lease, grasses are extremely scarce, and species diversity is very low in this vegetative type. In general the existence of this vegetation type is linked with shallow silty clays or clay loams overlying shale. This type of soil provides moist soils and good growing conditions during the snowmelt in early spring, but is characterized by dry soils and rapid runoff during summer and fall. The development of perennial fibrous root systems is hindered by the high shrink-swell potential of the clays. This vegetation type covers a relatively small portion of the Seneca 2-W area.

Sagebrush, type 4

The sagebrush vegetation type is prevalent on many of the lower slopes and exposed ridgetops in the lease area. These areas of low shrubs are dominated by big sagebrush (*Artemisia tridentata*) which accounts for approximately 30 percent ground cover, and by snowberry (*Symphoricarpos* spp.) which covers as much as 15 percent of some areas. Thirty percent of the ground surface in sagebrush areas is covered by forbs; these include perennial species such as arrowleaf balsam-root (*Balsamorhiza sagittata*), locoweed, lupine (*Lupinus* spp.), clover (*Trifolium* spp.), and common spring forbs, such as mountain parsley and textile onion (*Allium textile*). Grass cover in the sagebrush type is normally low, ranging from about 3-4 percent. The sagebrush vegetation type occurs in significant proportions on the Seneca 2-W lease.

Mountain shrub, type 5

Mountain shrub is the most prevalent type of the four major vegetation types in the Seneca 2-W area. Gully bottoms, north slopes, and other slopes that have coarse soils and accumulate substantial quantities of snow, are frequently covered by mountain shrub of varying densities.

The major shrub in the mountain shrub community is snowberry, with Gambel oak (*Quercus gambelii*), and chokecherry (*Prunus virginiana*) occurring on moist sites, and serviceberry (*Amelanchier alnifolia*), occurring on both moist sites and drier slopes. The moist sites exhibit two shrub strata, with snowberry about three feet in height, while oak and chokecherry form an upper strata 10-15 feet in height. Drier sites present a single strata composed of sagebrush and snowberry two-three feet high. Forbs on these areas cover more than 15 percent of the area. These forbs consist primarily of annual species, such as starwort (*Stellaria crassifolia*), and false pimpernel (*Centunculus minimus*), and the perennial species, western yarrow (*Achillea millefolium lanulosa*), larkspur (*Delphinium* spp.), and Fendler meadow rue (*Thalictrum fendleri*). Like the sagebrush vegetation type, grasslike plants constitute a relatively minor percent of the cover in mountain shrub type, being only 5 percent of the total. Sedges (*Carex* spp.) growing around the bases of large shrubs are the primary grasslike species.

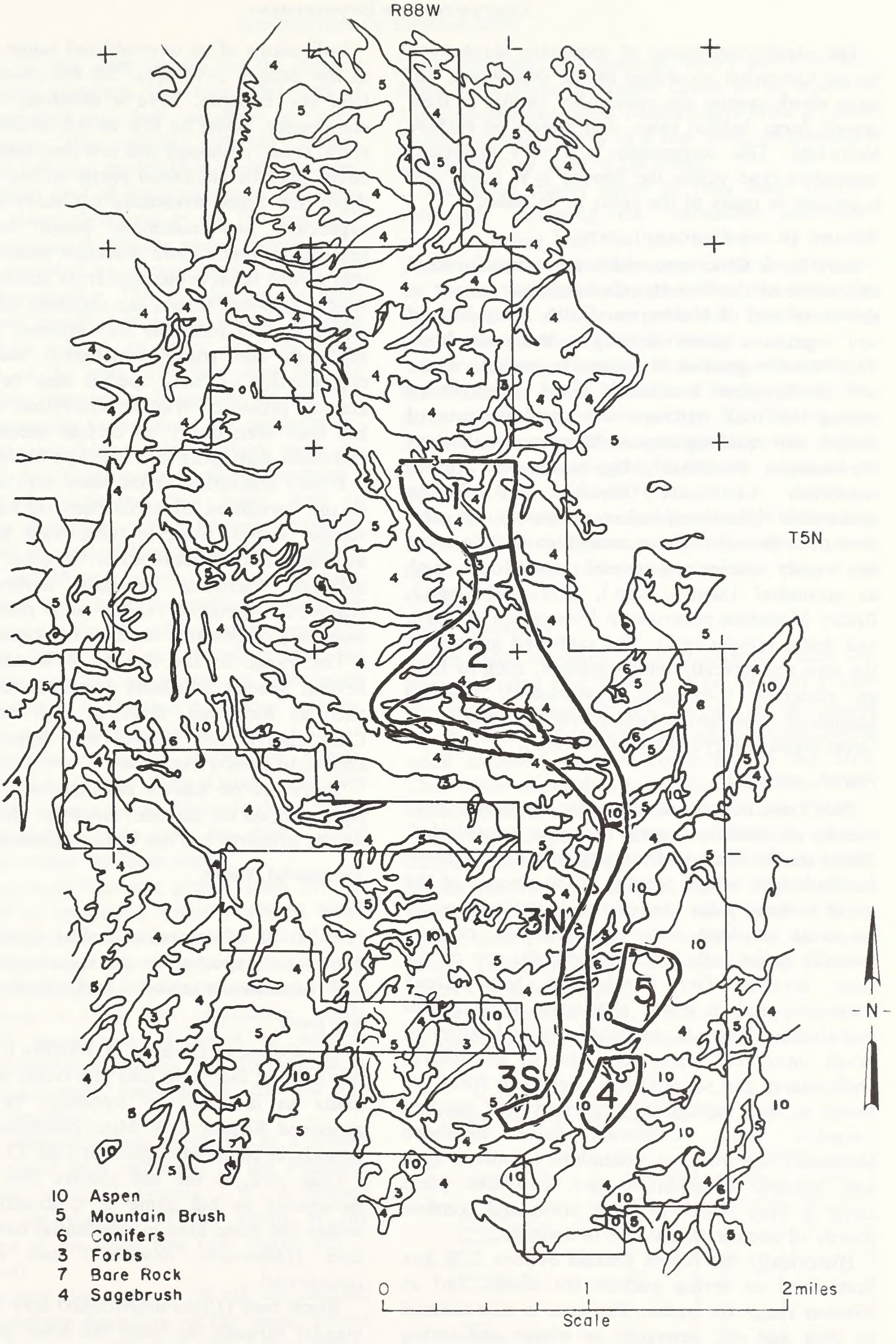


FIGURE PII-7

Vegetation types and areas to be mined.

The shrub component of mountain shrub type varies somewhat according to site conditions, but most shrub species are reasonably similar in their growth form, habitat value, and effects on surface hydrology. This community is a very important vegetative type within the Seneca 2-W lease, and is present in many of the areas to be mined.

BARREN (ROCK OUTCROP), TYPE 7

Bare Rock Outcrops, which are primarily local exposures of the Twentymile sandstone, occur in the lower end of Hubberson Gulch. Very little if any vegetation grows directly in the rock; however, some vegetation is present in pockets where soil development has taken place. Interspersed among the rock outcrops are small thickets of shrubs and quaking aspen. Mountain mahogany (*Cercocarpus montanus*), big sagebrush, fringed sagebrush (*Artemesia frigida*), and broom snakeweed (*Xanthocephalum sarothrae*) are also present in the area. These areas also include some low woody species and several showy forbs, such as groundsel (*Senecio* spp.), gilia (*Gilia* spp.), Rocky Mountain pentstemon (*Penstemon strictus*), and draba (*Draba* spp.). The scattered grasses of the area are typically bunch grasses, such as Indian ricegrass (*Oryzopsis hymenoides*), bearded bluebunch wheatgrass (*Agropyron spicatum*), and Great Basin wildrye (*Elymus cinereus*).

ASPEN, TYPE 10A

This type occurs on the lease as nearly pure stands of quaking aspen (*Populus tremuloides*). These stands consist of trees approximately 30-40 feet in height, which provide 60-80 percent of the cover in these areas. Aspen stands typically occur on areas of high snow accumulation or persistently moist soils, such as near the top of the ridge dividing Dry Creek and Sage Creek drainages, and at lower elevations along gullies and streams. There is commonly an understory of brush among the trees, consisting of snowberry, chokecherry and serviceberry. Very few forbs are found in this vegetation type; they are angelica (*Angelica* spp.), California false hellebore (*Veratrum californicum*), columbine (*Aquilegia* sp.), and larkspur (*Delphinium* sp.). Grasslike plant cover is very scarce in these areas and consists mainly of occasional patches of sedges.

Historically the region around Seneca 2-W has been used as spring pasture for sheep, and as summer range for cattle. The area is also utilized by deer and elk, primarily as winter and spring range.

Indications of an over-utilized range are present at the Seneca 2-W area. All the plant communities, for example, have a relatively small grass component, being as low as 0.2 to 3.6 percent in some areas. Although this low percentage of grass cover may be attributed partly to soil conditions, there are other evidences of heavy grazing. In sagebrush and mountain brush communities, grasses are much more abundant under the shrubs that afford them protection from grazing, whereas spaces between shrubs are occupied almost exclusively by less palatable forb species. Absence of seedlings and young bunchgrass also indicates reproduction of these species may be limited by grazing pressure. Wildlife utilization of the area has also been heavy on certain species, such as mountain mahogany and antelope bitterbush.

Heavy utilization of the lease area has resulted in the formation of terracettes on many of the steeper slopes; some of these trails have eroded as channels for runoff water. In other areas grazing and trampling by large herbivores have removed vegetative cover and contributed to sloughing of unstable sections of stream banks.

The range in the Seneca 2-W area contains several species of plants poisonous to livestock, such as locoweed, larkspur, and death camas. Chokecherry and gambel oak have also been known to poison livestock.

There are no known endangered or threatened plant species on the site; however, the vegetation on the property has not been examined in detail.

Terrestrial Fauna

WILD FAUNA

A list of all terrestrial faunal species that are known or expected to be found within Seneca 2-W boundary is included in Appendix D.

Big game

The Colorado Division of Wildlife (Colo. DOW) has divided the State into 126 Game Management Units as indicated in Appendix D. Peabody's proposed Seneca 2-W Mine operation is located entirely in Game Management Unit 13.

Only two of the ten species that have been designated as big game in Colorado are found within the lease area in substantial numbers: mule deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*).

Black bear (*Ursus americanus*) may occasionally wander through the lease but none are known to inhabit the area on a regular basis.

Mule deer. A few deer remain on the Seneca 2-W lease area yearlong. However, this area is generally regarded as deer summer or intermediate range; this would indicate spring, summer, and fall use, probably including fawning activity. A great deal of deer movement has been recorded to lower elevations in the fall and back to higher elevations during the spring months.

Cover is provided by a combination of brush, trees, and topography. This is adequate to meet deer's summer needs, but during winter, average snow depth is enough to force most of these animals out of the area. The few deer that do remain within the lease boundary during the winter are generally found along the southern exposures or the windblown ridges, where snow accumulation is less than on the northern exposure.

Studies have indicated that mule deer in northwestern Colorado utilize browse yearlong, with about 80 percent of their spring diet made up of browse, and 20 percent of forbs and grasses. It is expected that these percentages should be relatively accurate for the subject area. Some important deer foods that are found within the proposed mine area are big sagebrush, snowberry (*Symphoricarpos* sp.), Gambel oak, cho' cherry, serviceberry, and mountain mahogany.

Ponds, stocktanks, snow, Hubberson Creek, Watering Trough Creek, Sage Creek, and Dry Creek provide water sources for mule deer. These areas appear sufficient to meet the deer's water requirements within the lease area.

Populations may fluctuate greatly from year to year as well as seasonally within the year. Mule deer population estimates are based on average numbers. Mule deer summer populations have been estimated at about 7 deer/square mile. This would indicate a total deer population within Seneca 2-W lease area of about 65 animals through summer peak months, and 10 to 20 mule deer per square mile, respectively, for low and high winter densities.

Elk. Elk utilize the area primarily as a winter range and spend their summers in the Flattops, several miles south of Seneca 2-W. A limited number of elk summer in the aspen at the southern end of the lease area (see Figure PII-7, Flora section).

During winter the majority of elk are located along the northern boundary of the lease, unless there has been an exceptionally heavy snow. When this happens the elk are forced off the lease property, and generally move down to Williams Fork River or Willow Creek areas, south of the proposed mine area. Utilization of browse varies from extremely heavy in a few areas, to generally moderate over most of the lease.

The same plants listed as deer food provide food for wintering elk. Mountain mahogany receives heavy elk use and appears to be the preferred browse in the area. Cover is provided by brush, topography, and trees, especially the aspen groves. Water is provided by the same sources as mentioned for mule deer.

Elk wintering densities have been increasing in the Williams Fork Mountains in the past two-three seasons. A few years ago 200-300 elk normally wintered in these mountains; in the winter of 1974-75 approximately 2,400 elk wintered in this same area (Colo. DOW).

Population estimates for Seneca 2-W Mine site indicate about 6 elk/square mile. This would result in about 55 elk inhabiting the site during an average winter.

Small mammals

The most common small mammal within the proposed mine area appears to be the deer mouse (*Peromyscus maniculatus*). This species accounted for 76 percent of the total animals captured during small mammal surveys conducted in the area. They were primarily found within the bare rock, mountain shrub, and forb sites (see Table PII-8).

The least chipmunk (*Eutamias minimus*) also inhabits most of Seneca 2-W lease area. Least chipmunks inhabit every habitat type within the lease area except perhaps the forb sites; greatest population densities appear to be located in aspen groves (see Appendix D for relationship of other species to habitat types).

During recent studies, greatest species diversity of small mammals was recorded within the aspen

TABLE PII-8

Results of NACSM Trapping at the Three Small Mammal Sites
Near Hayden, in 1971 and 1972
(Taken from the Environment Report Seneca 2-W, Seneca Coals Ltd)

Species	Number Captured					
	Brush Site		Sage Site		Prestripping Site	
June	1971	1972	1971	1972	1971	1972
Redbacked vole	3	0	0	0	0	0
Long-tailed vole	10	4	0	3	0	0
Jumping mouse	0	4	0	0	2	0
September						
Redbacked vole	13	0	0	0	0	0
Long-tailed vole	12	5	0	0	1	0
November[1]						
Shrew	1	-	0	-	2	-
Redbacked vole	11	-	0	-	0	-
Long-tailed	2	-	0	-	0	-

[1]There were no November 1972 samples.

vegetation type; forb sites registered lowest diversity. Highest animal density was recorded in rocky outcrops; the sagebrush type provided lowest mammal densities. Rabbit and hare numbers have been reported as very low the past few years; this is the case for almost all of northwestern Colorado. No furbearer harvest information is presently available from the proposed mine area.

Game birds

Waterfowl are occasionally seen along Sage and Dry Creeks and on scattered ponds within the proposed mine area. However, ducks do not appear to use Seneca 2-W lease area to any significant degree for either nesting or feeding.

Blue grouse (*Dendragapus obscurus*) have been observed on the lease site, most often in the northern portion; population status or trend is not known for this species within the subject area. However, on a few occasions broods have been seen on the lease site, indicating that nesting and brood raising takes place on the property.

Mourning dove (*Zenaidura macroura*) are summer visitors to the proposed mine site. These birds nest and raise their young here, then move south before the onset of cold weather.

Both the sage grouse (*Centrocercus urophasianus*) and sharp-tailed grouse (*Pedioecetes phasianellus*) inhabit the lower elevations north of Seneca 2-W. Neither of these two species have been reported within the lease boundary, but there is a good chance that a few sage grouse use portions of this area seasonally.

Other birds

Many bird species occur within Seneca 2-W lease area (see Appendix D for relationship between species and the habitat types).

Habitation of Seneca 2-W by individual species of birds tends to be associated with vegetation types. The mountain shrub habitat supports a large number of birds, with as many as 24 different species being observed in this habitat.

Although distribution of the sagebrush vegetation type is nearly as extensive as that of the mountain shrub, the diversity of bird species is considerably lower in this habitat, with only 10 different species being observed.

Amphibians and reptiles

Only a limited amount of information is presently available concerning species of this group of wildlife. No studies are known to have been conducted in the area of Seneca 2-W lease specifically to gain information on the herpitofauna. All information collected in reference to these species was attained opportunistically while conducting other field activities; for these reasons the species list in Appendix D is probably not complete.

Terrestrial invertebrates

No information is currently available concerning the use of the subject area by species of this segment of terrestrial fauna.

Domestic fauna

The land within Seneca 2-W lease boundary is used by livestock primarily from late spring to early fall, about May to October.

At the present time, there are nine livestock operators within the lease area (see Figure PII-8). Both cattle and sheep are used to stock this range. Three landowners are stocking with all cattle, five all sheep, and one stocks both sheep and cattle.

Based on records and knowledge of the area, the ability of the vegetation to support domestic animals is broken down as follows: 3 acres/AUM (Animal Unit Month) in aspen, 5 acres/AUM in mountain shrub, 5.75 acres/AUM in sagebrush, and 6 acres/AUM for forb vegetation type. Approximately 195 AUMs are represented within the area proposed to be mined.

Livestock water is provided by numerous wells, ponds, and reservoirs, and Hubberson, Water Trough, and Dry Creeks. Both water quality and distribution appear adequate for present livestock use.

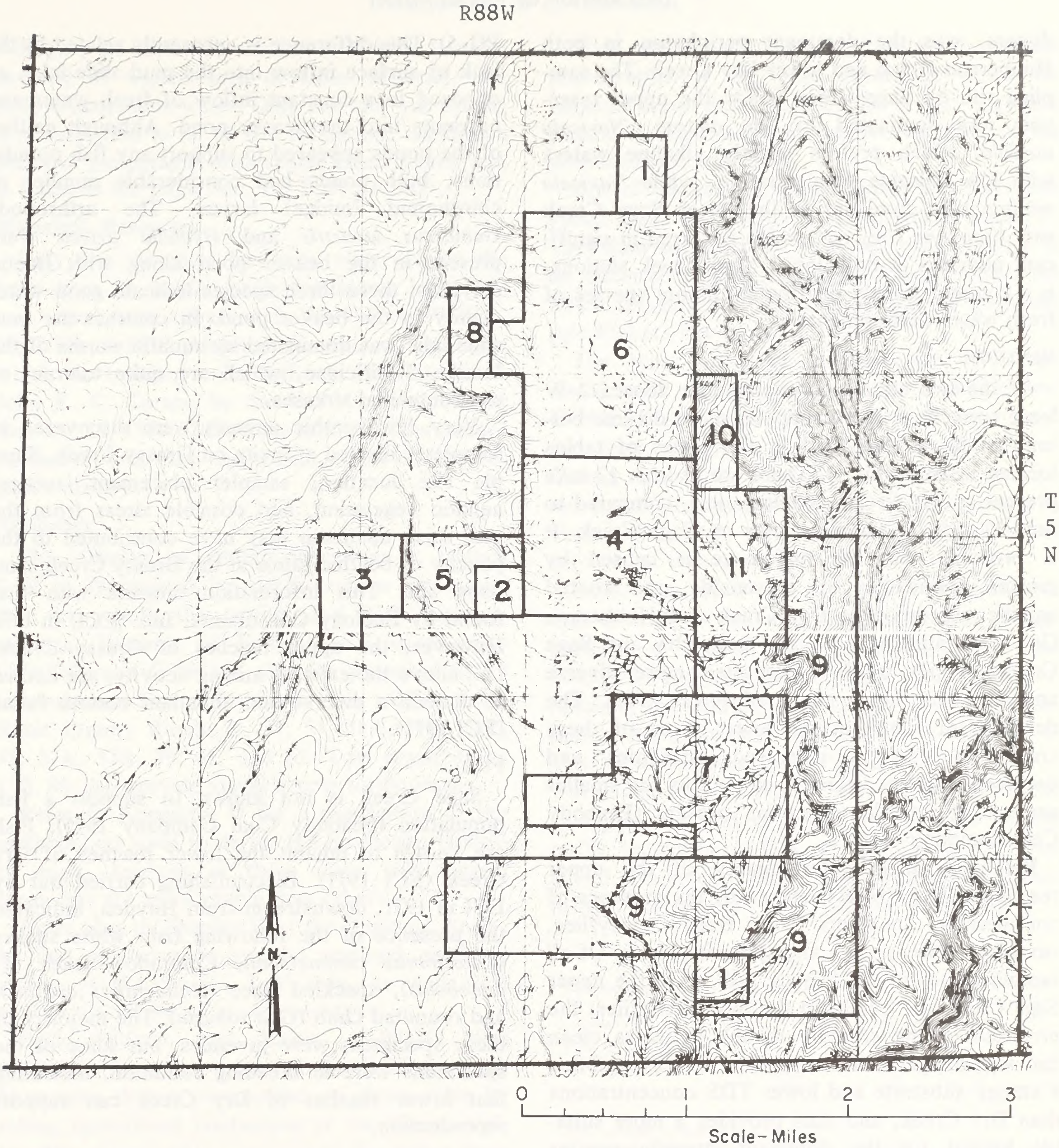
Aquatic Biology

Riparian vegetation

Riparian (i.e., streamside) vegetation must be generally categorized as good, consisting of a wide variety of species and growth levels. Riparian vegetation includes a diversity of sedges, rushes, forbs, and grasses. In addition, the banks of Sage and Dry Creeks are characterized in many areas by the presence of sagebrush, aspen, willows, and mountain shrub.

Periphyton

Periphyton taken from streams were dominated by diatoms. In Dry and upper Sage Creeks, the dominant diatom is *Syndra minuscala*, which prefers cool, fresh water. *Surirella patella*, another



1. Federal (BLM)
2. Peabody Coal Co.
3. Stanley Preece
4. Fay Sellers Temple et. al.
5. Erma Fisk
6. Bogle Farms
7. A.W.Fredrick
8. Harvey Green
9. James Papoulas
10. Ralph Flanders
11. Jack and Betty Carson

FIGURE PII-8

Landownership as of July 1975.

diatom, was the dominant periphyton in both Hubberson Gulch and lower Dry Creek. The sampling site on Sage Creek below the upper reservoir was dominated by the diatom, *Navicala uiridula*, which prefers slightly alkaline waters with low chloride concentration, while *Navicala minima* was dominant at the lower Sage Creek site. *Fragilana virescens*, which occurred in significant numbers at both lower Sage Creek stations, is a common widely distributed diatom species of fresh water environments.

Benthos

Of the two streams bordering the Seneca 2-W lease area, Dry Creek supports more diverse bottom fauna, as indicated in the series of tables located in Appendix D. There are at least 17 taxa present at Dry Creek sampling sites, compared to only 11 taxa in sampling sites on Sage Creek. It is probable that the difference is caused by greater abundance of streamside and rooted aquatic vegetation at Dry Creek and Hubberson Gulch sampling stations. On both Dry and Sage Creeks, upper reaches supported more diverse and abundant fauna than did lower areas. The decrease of fauna in the lower areas of these creeks is due to increased turbidities and decreased current velocity, as well as the smaller amount of aquatic vegetation present (Peabody Coal Company 1975).

Relatively high water quality of the upper reaches of Dry Creek is shown by the presence of considerable numbers of Baetic mayflies, stoneflies (Plecoptera), and sphaeriid clams. Of all sampling sites in the Seneca 2-W area, the upper Sage Creek site exhibited the most stoneflies; the presence of the stonefly nymph indicates clean and well-oxygenated water. Sage Creek exhibited a stoney substrate and lower TDS concentrations than Dry Creek, and thus provides a more suitable habitat for the dominant stonefly species (*Isoperla patricia*). Buffalo gnat larvae of the family Simulidae, which require stoney substrates and well-oxygenated water low in suspended solids, were numerous at most of Dry and Sage Creeks stations. Studies of benthic animals in ponds on the lease area show that fewer taxa are present in ponds than in streams, due primarily to habitat restrictions in these ponds. The natural lake occurring in Section 15 of the lease above the prehistoric mud slide contained less taxa than did the upper beaver pond in Section 27 (see Figure PII-5). This difference is apparently related to the lack of surface inflow into the mud slide lake, as opposed to a constant inflow of fresh water and nutrients into the beaver pond. Although neither of the ponds appeared to support any fish populations, both ponds had considerable number of chironomid (midge) larvae. The arthropods *Gamarrus lacustris* and *Hyalella azteca* were present in the beaver pond along with Baetid mayflies; these three species indicate good water quality in the beaver pond. In contrast the mud slide lake was dominated by aquatic worms of the family, Tubificidae, which are quite tolerant of environmental stresses.

Very few benthic animals were discovered in samples collected at a site on Grassy Creek. Sample site location, sampler placement, meager aquatic vegetation, and possible stress from the coal mine upstream may have contributed to the paucity of benthic fauna at the Grassy Creek sampling site. This information concurs with that found by Ecology Consultants, Inc. (ECI) in 1971. However, the upper reaches of Grassy Creek, i.e., above the existing mining activity, are known to contain a diverse and abundant bottom fauna (ECI 1971).

Fish

Sage Creek is not known to support a fish population (Peabody Coal Company 1975). Fish are known to inhabit the lower reaches of Dry Creek (ECI 1971). Electrofishing carried out by ECI in 1971, downstream from Hayden, indicated the presence of the following fish: white sucker (*Catostomus commersoni*), Colorado sucker (*C. discobolus*), speckled dace (*Rhinichthys osculus*), and roundtail chub (*Gila robusta*). The majority of these specimens were juveniles, but some of the specimens were in breeding condition, indicating that lower reaches of Dry Creek can support reproduction.

Cultural Components

Archeological Resources

Dr. David Breternitz, University of Colorado, completed a reconnaissance survey of the Seneca 2-W Mine lease on May 29, 1974. The methodology used involved two approaches. Initially, roads throughout the mine area were traversed to survey the region as a whole. Secondly, sectors which appeared most likely to contain sites, based on previous experience, were systematically traversed afoot.

Paucity of sites was attributed to three factors: severity of winter, lack of stone material, and lack of accessible water. Only one site was found; it is suspected to be of Ute affiliation, contains a series of pictographs with sparse lithic debris, and is found in the NE¼ Sec. 16, T.5N., R.88W.

Historical Resources

Only one structure has been observed on the lease area. A small, badly-weathered log cabin and corral were observed in the NW¼ SW Sec. 23, T.5N., R.88W. Although the tract of land upon which the building is located was first deeded to John K. C. Carson by the U.S. Government on October 22, 1924, these structural remains cannot be linked with any significant event in the region's history.

Aesthetics

The visibility of mining operations at Seneca 2-W is determined by public access routes—in this area, both the county and U.S. highway systems. Portions of Federal coal lease areas C-081251 and C-081258 plus the proposed 69-kv transmission line right-of-way are visible from Routt County Roads 27, 37, 51, 51A, 51B, 51C, 53, 57A, 57B, 59, 61, and 65. Two segments of U.S. 40 also provide visual access to the leases.

Refer to Appendix D for a description of the methodology used to derive the landscape visibility maps. Analysis of these maps will suggest areas that are more visible than others.

Refer also to Chapter II of the Regional Analysis for a discussion of the regional aesthetic setting of the Seneca 2-W area, as well as a general discussion of visual resources.

Both Federal coal leases, C-081251 and C-081258, lie in a portion of the Williams Fork Mountains that is surrounded on three sides by rolling agricultural landscapes of the Yampa Valley. This topographic exposure to the valley floor has increased the subject leases' visibility relative to adjacent areas of the Williams Fork Mountains.

Five landscape visibility maps have been prepared for the area (see Figure PII-9 for a map index). Two, at a scale of one inch/mile (Figures PII-10 and PII-11), show most viewshed sequences on the rolling valley floor that provide views to the subject lease areas. Three larger-scale detailed insets (Figures PII-12, PII-13, and PII-14) have been prepared to illustrate landscape visibility in the area of the proposed action.

Five additional figures, (PII-15-19) contain photographs of the more significant views obtainable from the area's public roads; they are helpful in illustrating the relative visibility of the proposed action areas.

One of the most sensitive foreground landscape visual units lies along Routt County Road 27. Viewshed sequence YZ provides visual access to an enclosed rolling landscape through which the 69-kv transmission line right-of-way is proposed (see Figures PII-14 and PII-16).

The most sensitive middleground landscape visual units on Federal coal leases C-081251 and C-081258 (see Figure PI-1) can be viewed from viewshed sequences AB, BC, IJ, and MN on County Road 53. This is because they occupy closer middleground landscapes and, especially as viewed from AC, have a greater angle of exposure to the viewer.

About five miles east of Craig, a one-mile section of U.S. 40 provides visual access to a large portion of Federal coal leases C-081251 and C-081258, fourteen miles distant. To avoid complicating the landscape visibility maps, classification of the many units visible from this section of U.S. 40 was omitted from Figure PII-13.

Average daily traffic (ADT) volumes from the Colorado Division of Highways indicate overall traffic increases on U.S. 40 (see Chapter III, Regional Analysis). Compounded annually, increases in ADT for the past nine years are as follows:

Sampling Segment	Sampling Year	ADT	Average Annual Increase (%)
U.S. 40 five miles east of Craig:	1965	1950	1965-1970 =-2.44
	1970	1750	1970-1974 = 8.22
	1974	2400	(9 yr. time frame = 2.33)
U.S. 40 east of Hayden on viewshed sequence CD:	1965	1800	1965-1970 = 1.09
	1970	1900	1970-1974 = 3.14
	1974	2150	(9 yr. time frame = 1.99)

These traffic counts can be used as indicators of the relative viewing use levels. No census data are available for county roads.

Recreation

Refer to Chapter II of the Regional Analysis for a discussion of the regional recreation environment.

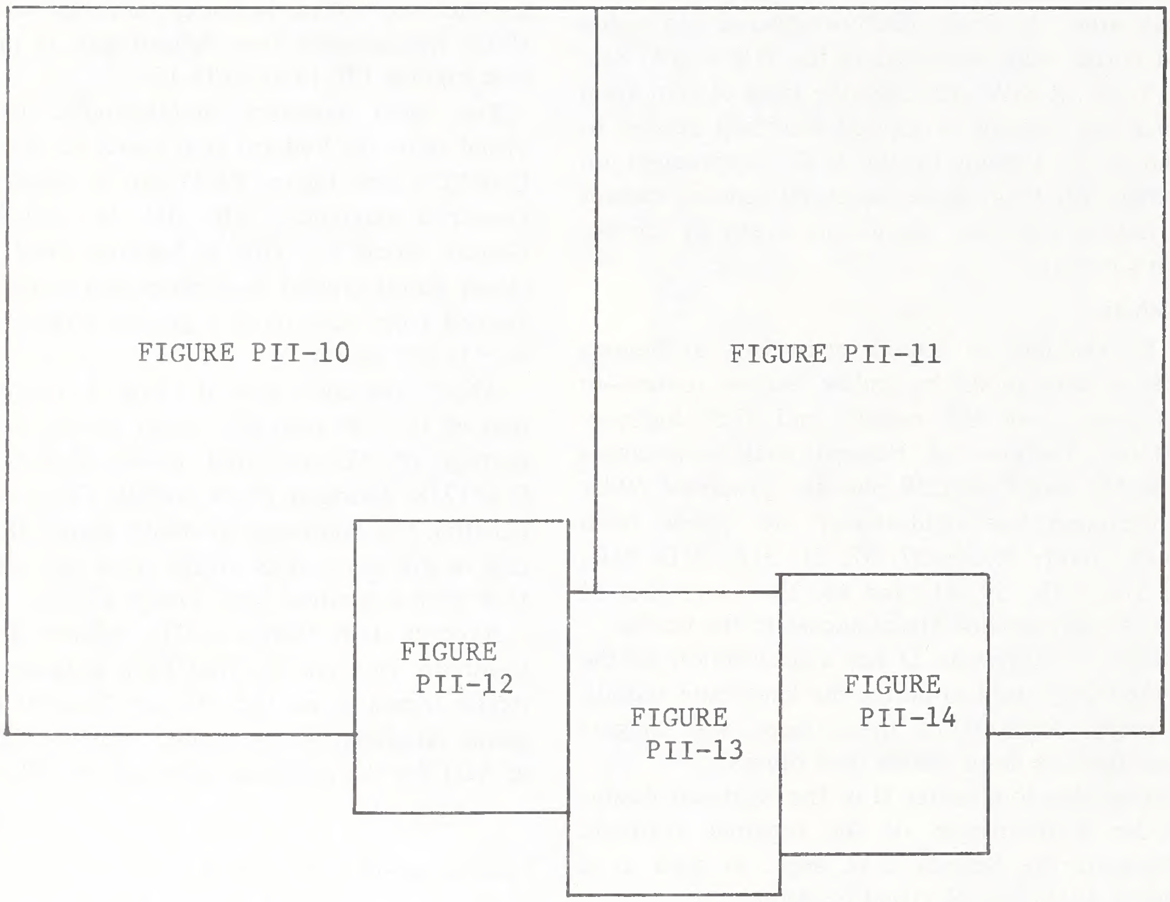
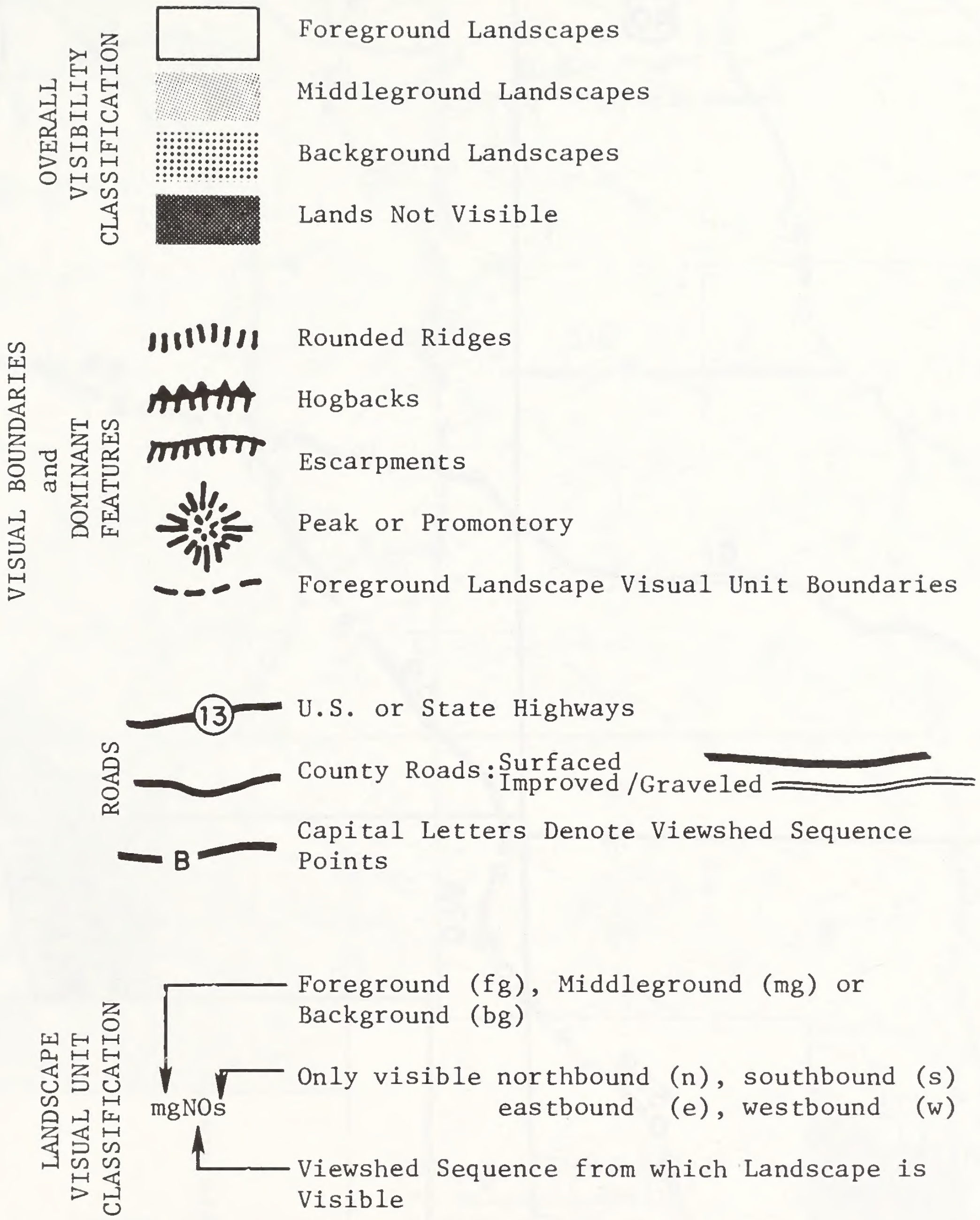


FIGURE PII-9

Index of landscape visibility maps for Seneca 2-W area.



Legend for landscape visibility maps.

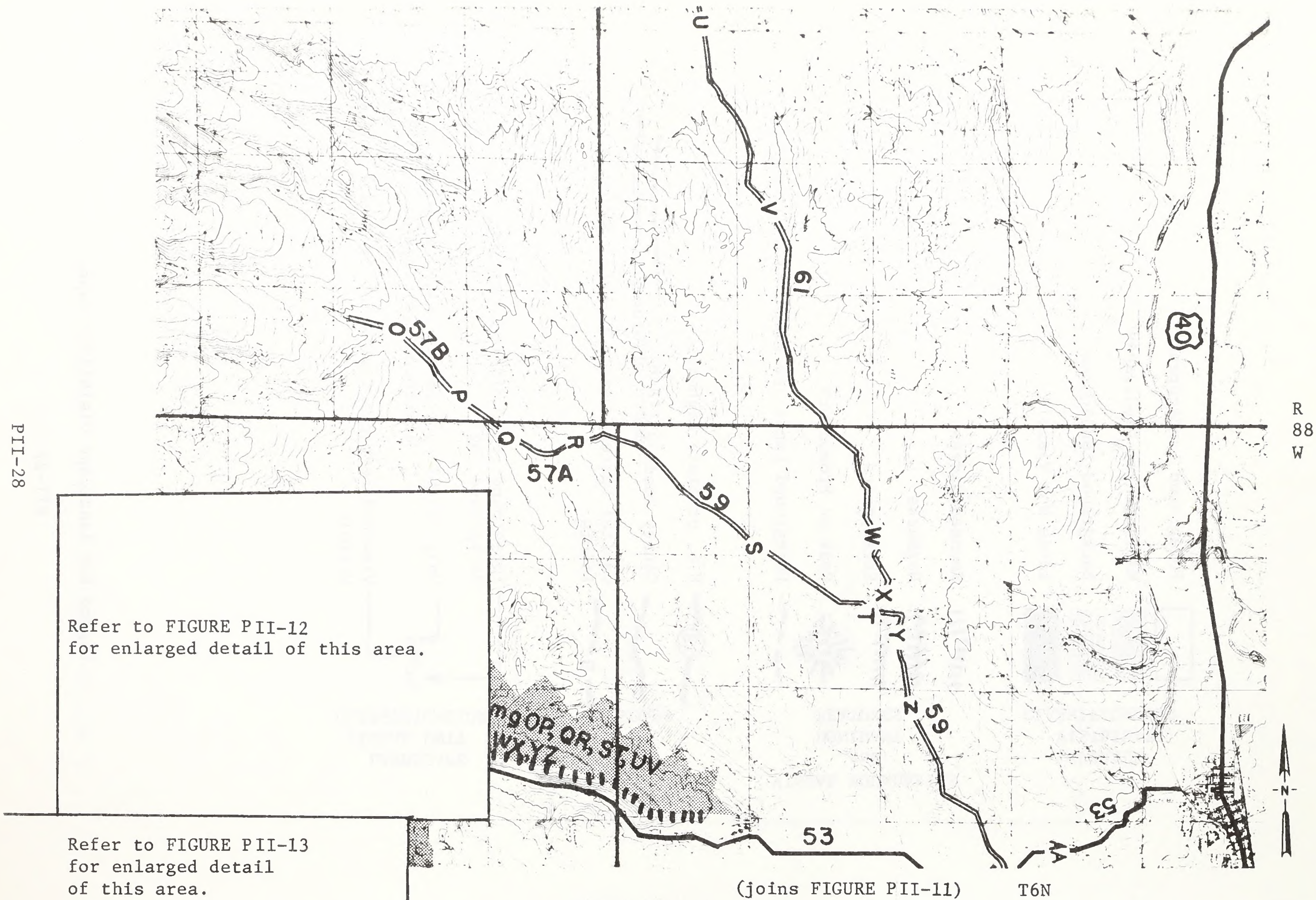


FIGURE PII-10

Landscape visibility map of Seneca 2-W area.

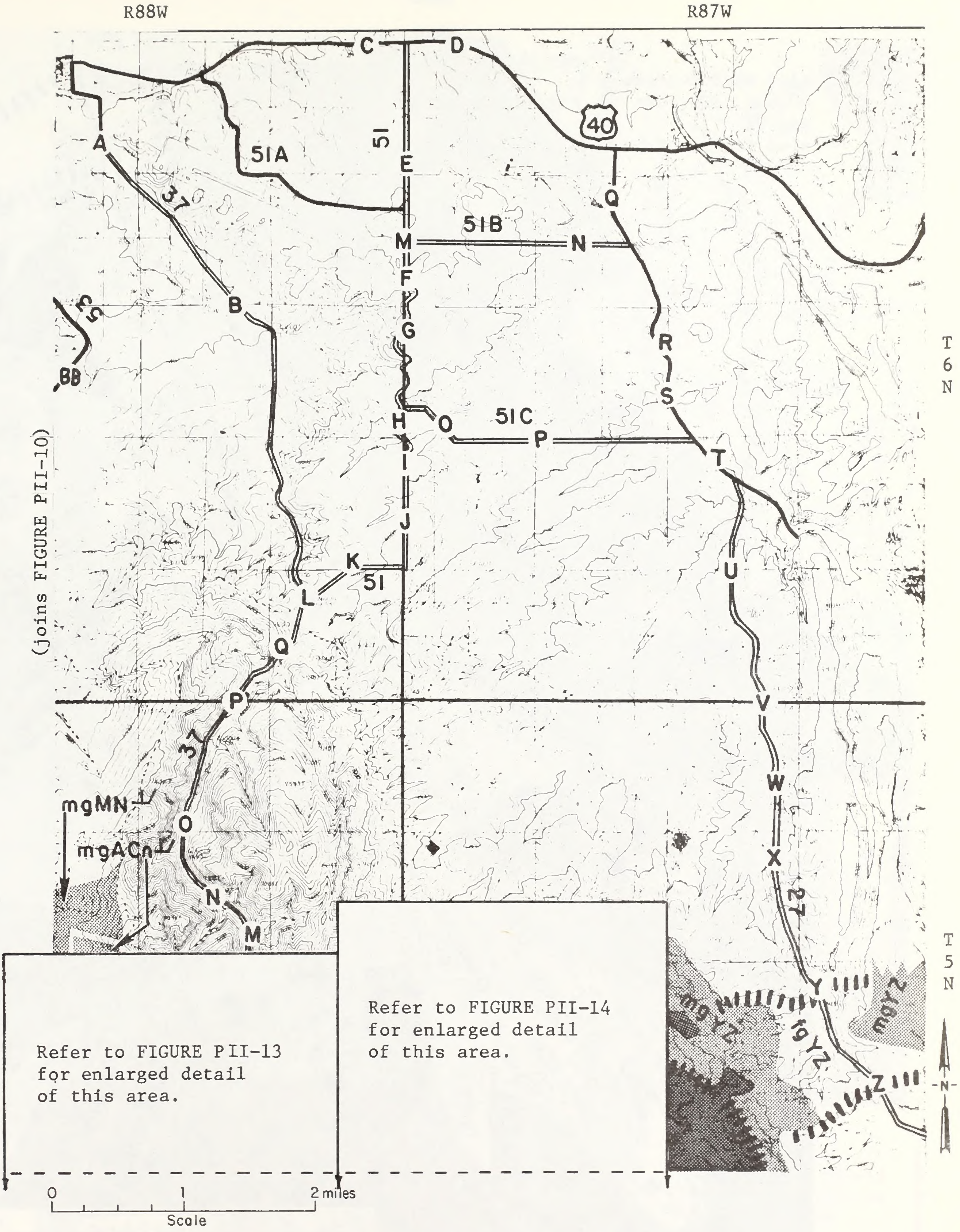


FIGURE PII-11

Landscape visibility map of Seneca 2-W area.

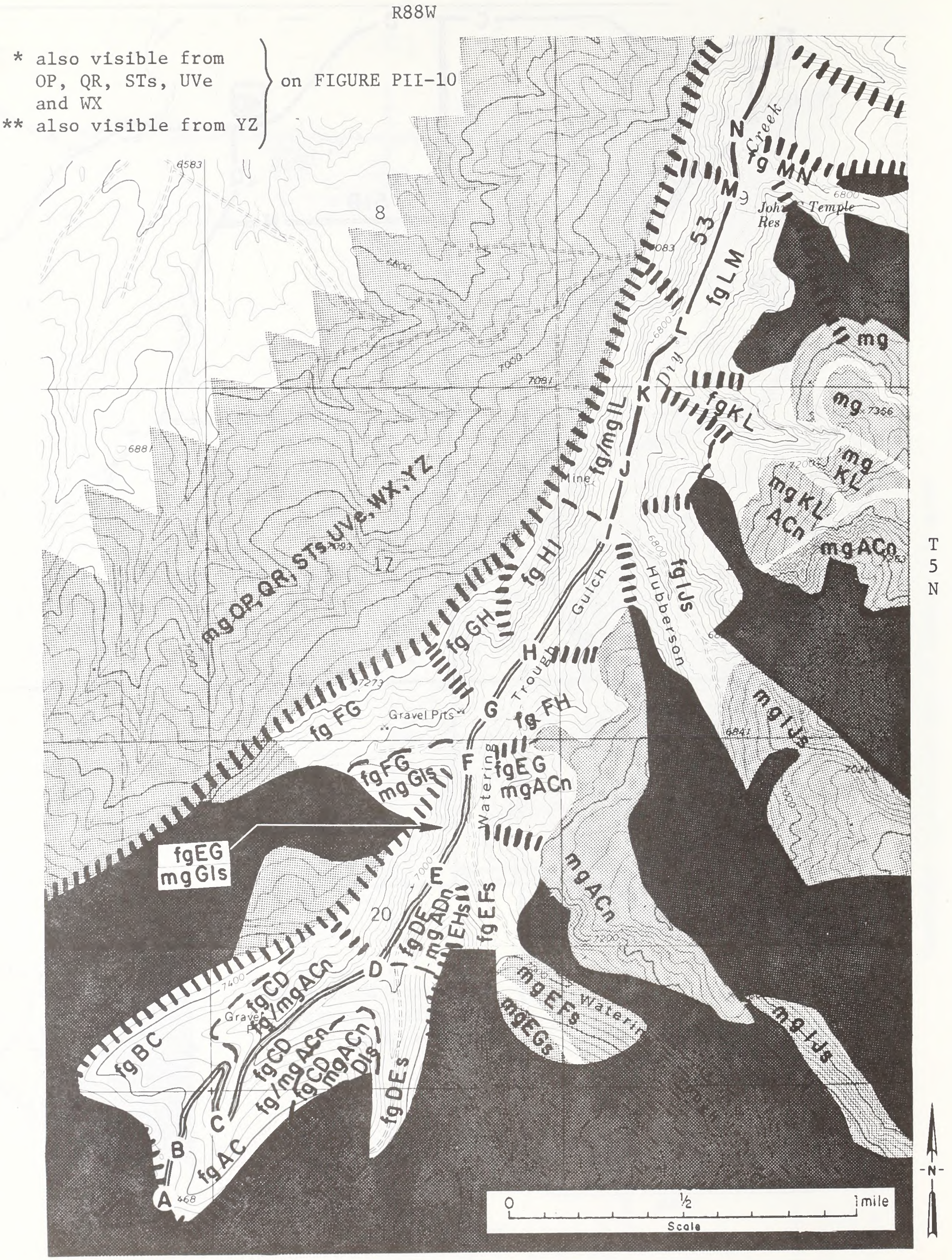


FIGURE PII-12

Landscape visibility map of Seneca 2-W area.

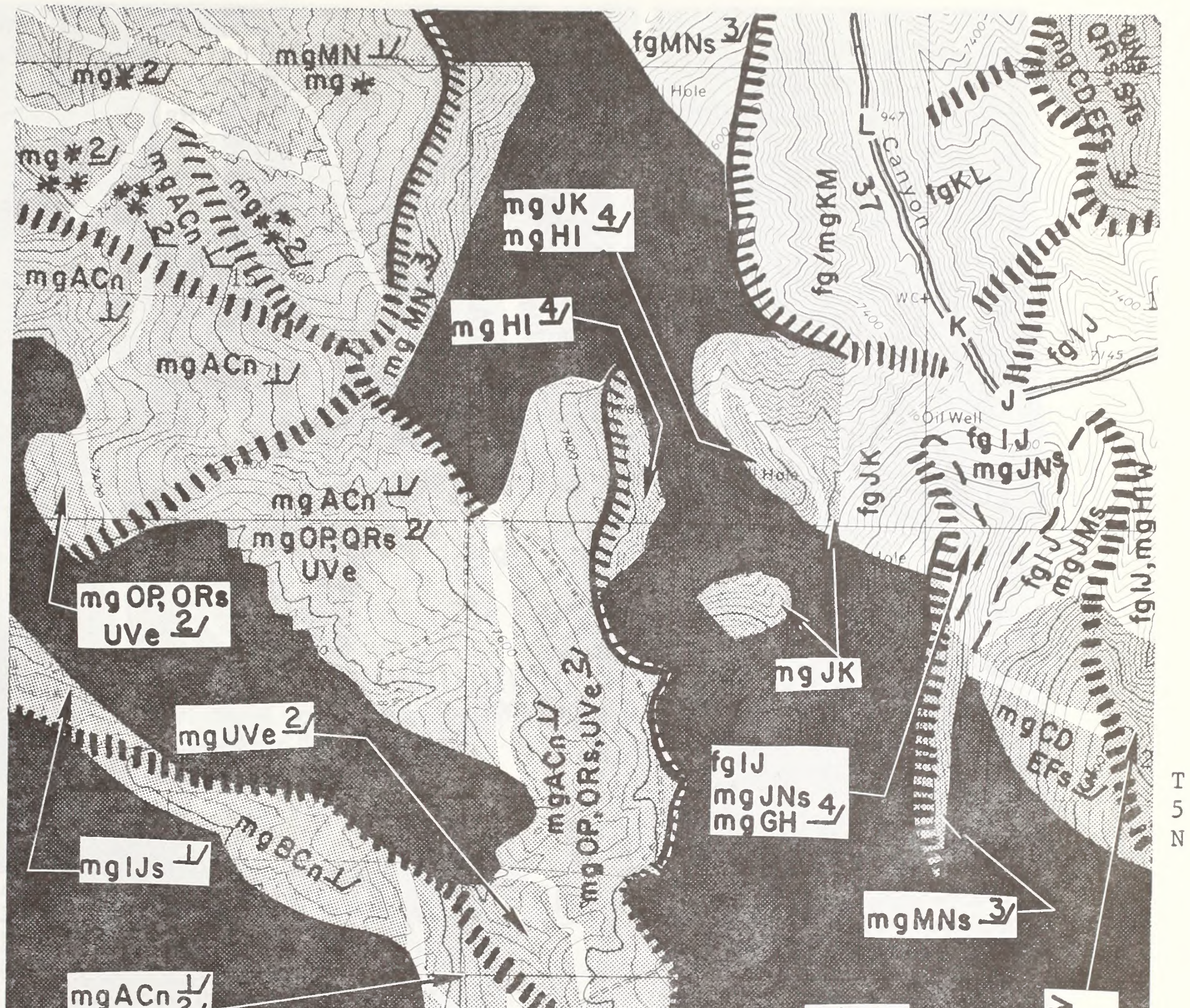


FIGURE PII-13

Landscape visibility map of Seneca 2-W area.

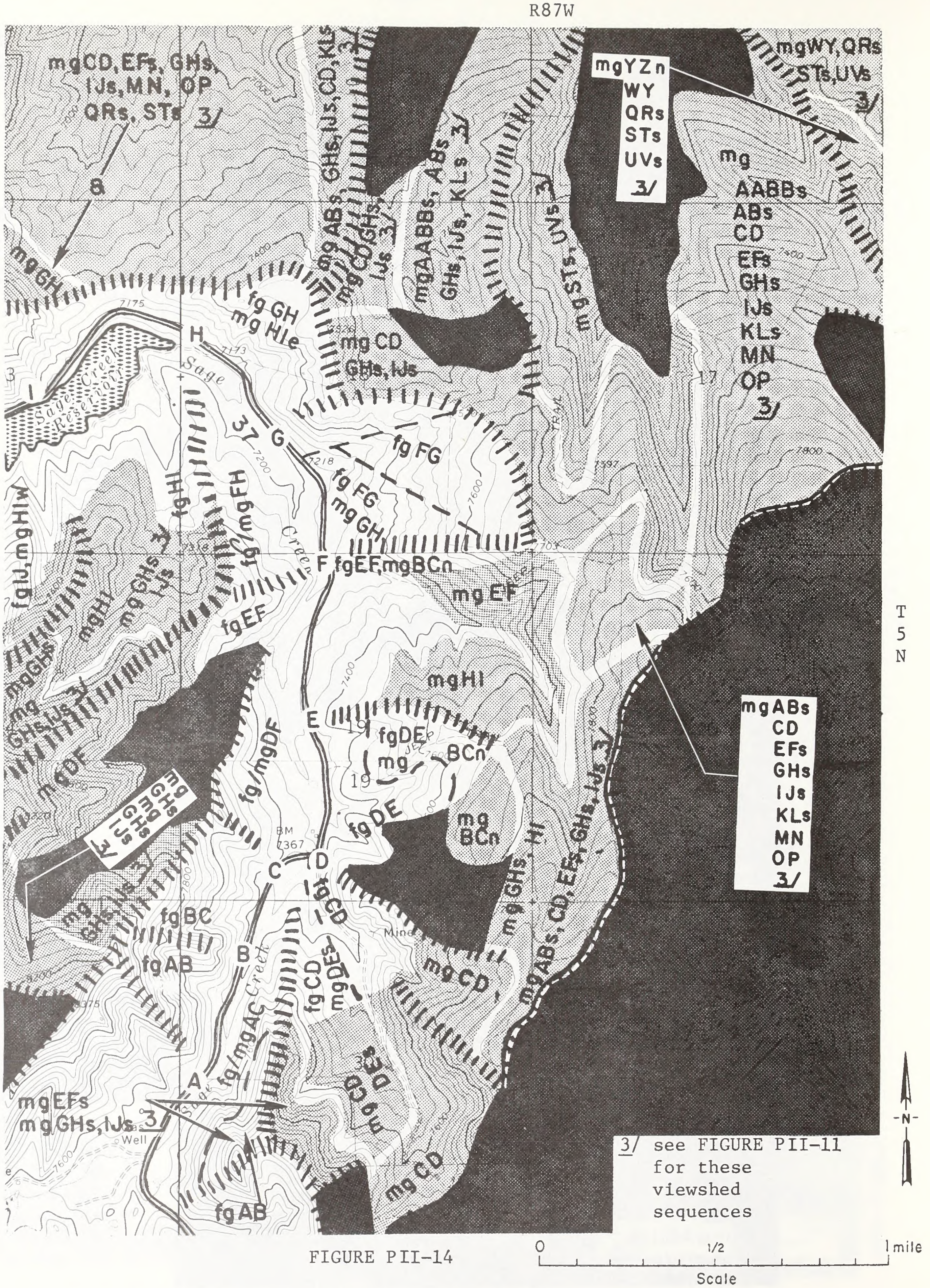


FIGURE PII-14

Landscape visibility map of Seneca 2-W area.

FIGURE PII-15

Sage Creek Reservoir provides a feature landscape for motorists on viewshed sequences HI and IJ, County Road 37. Attention is focused in this direction; landscape units opposite the reservoir would be traversed by the 69-kv Seneca 2-W tranmission line.

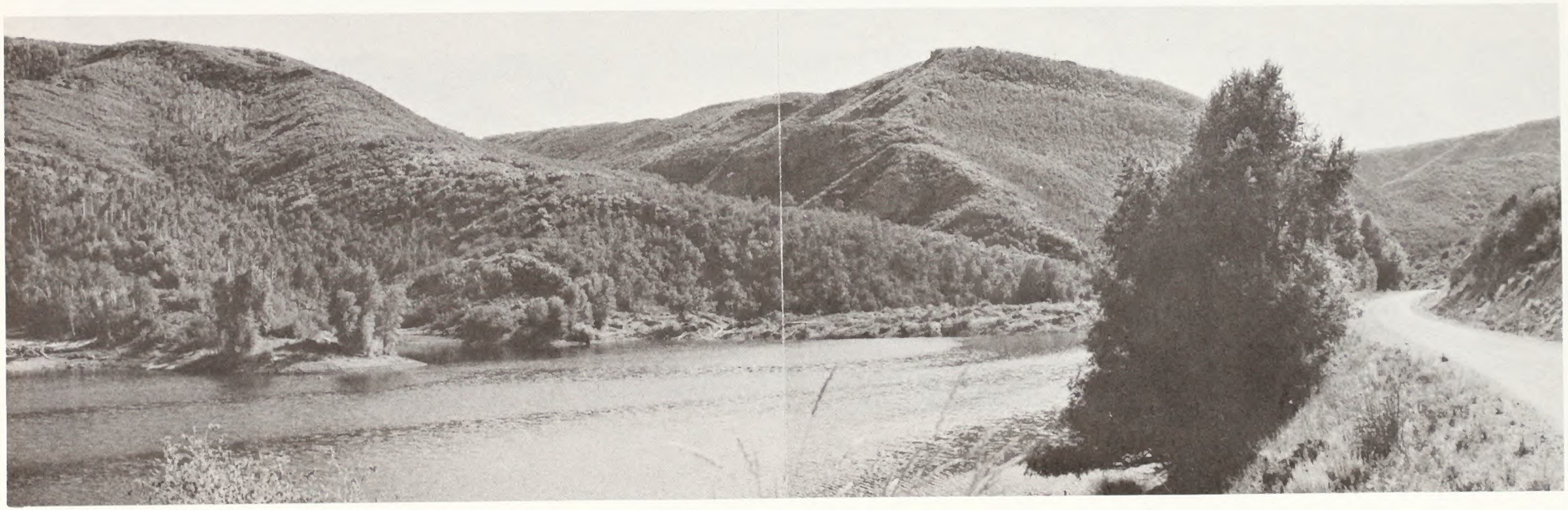


FIGURE PII-16

Viewshed sequence YZ on County Road 27 provides views into an enclosed landscape traversed by the 69-kv transmission line alinement. Note the county gravel pit visible in the lower photo.

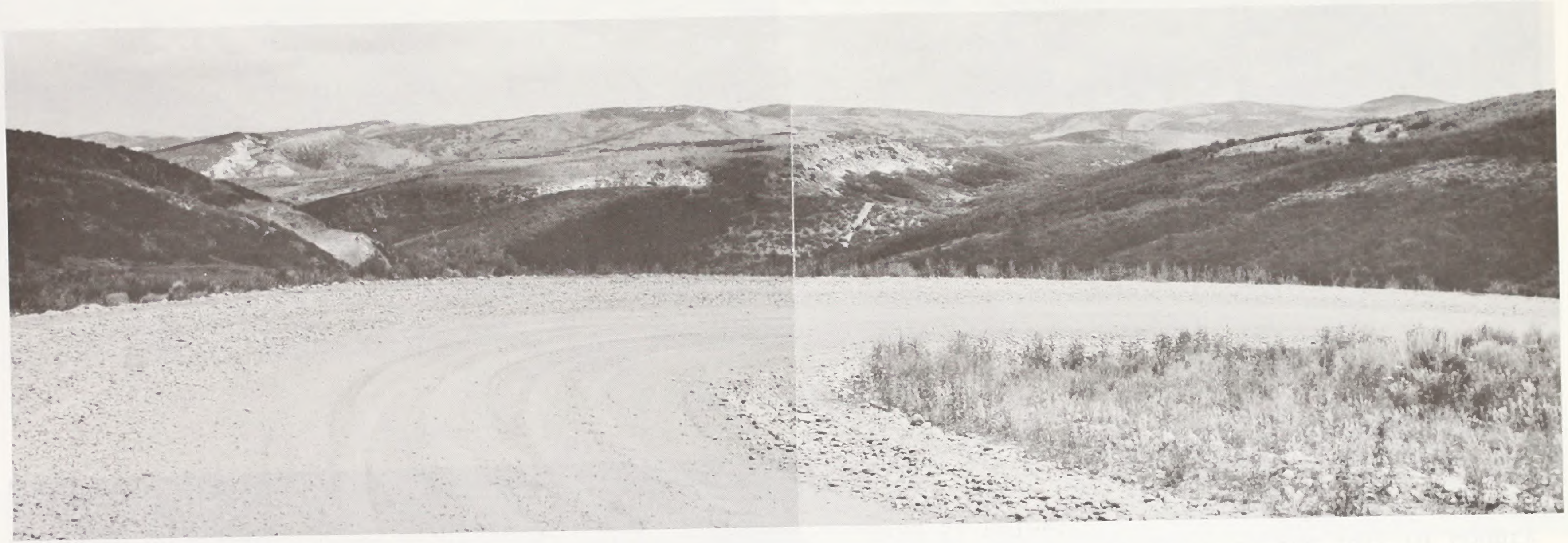


FIGURE PII-17

Viewshed sequence BC, immediately above the switchback on County Road 53, provides the largest scale and most extensive views of proposed surface mining operations on Federal coal leases C-081251 and C-081258.

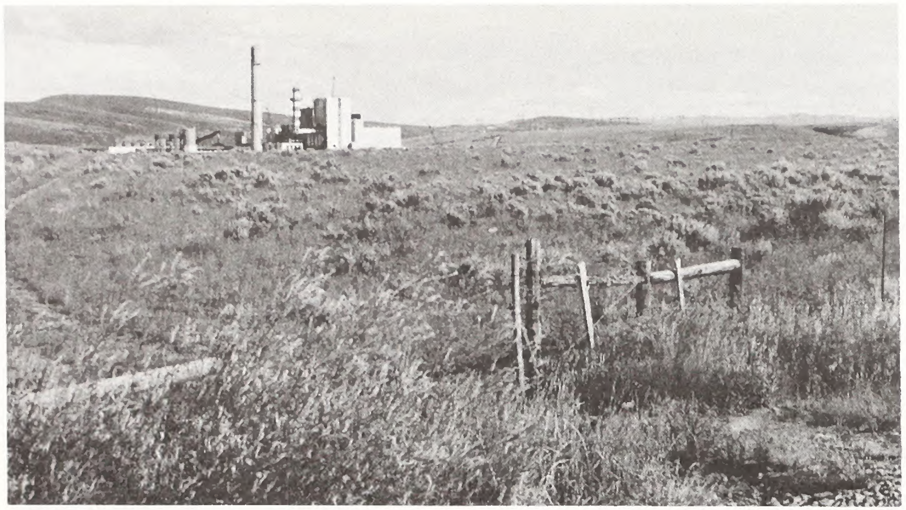
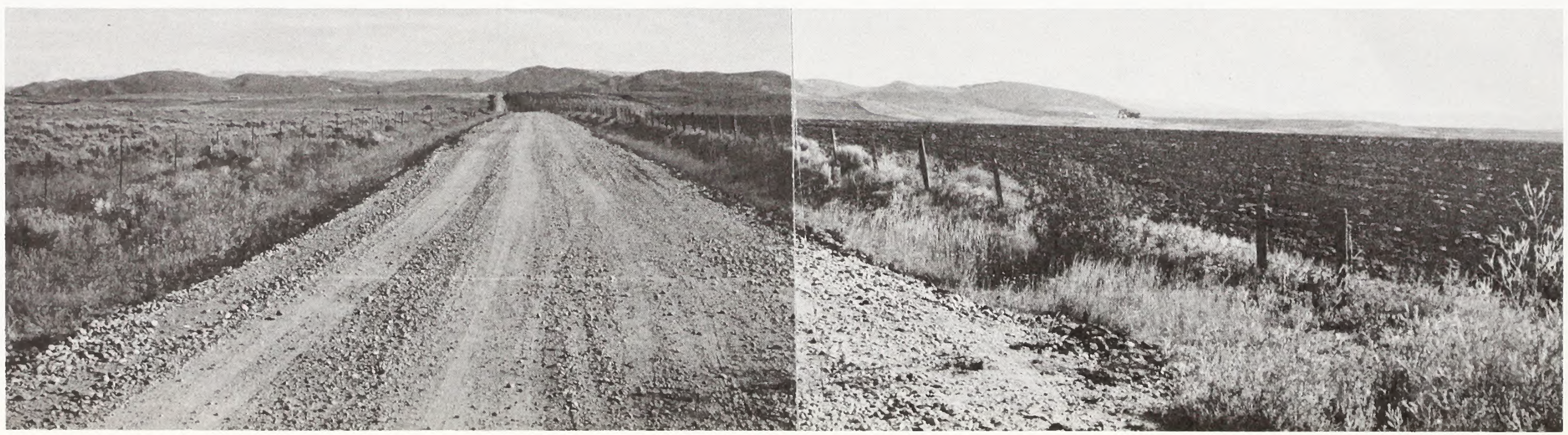


FIGURE PII-18

Viewshed sequence CD on U.S. 40 provides this panoramic view of the Hayden power plant (left) and proposed surface mining on Federal coal lease C-0114093 (visible to the left of County Road 51 below).



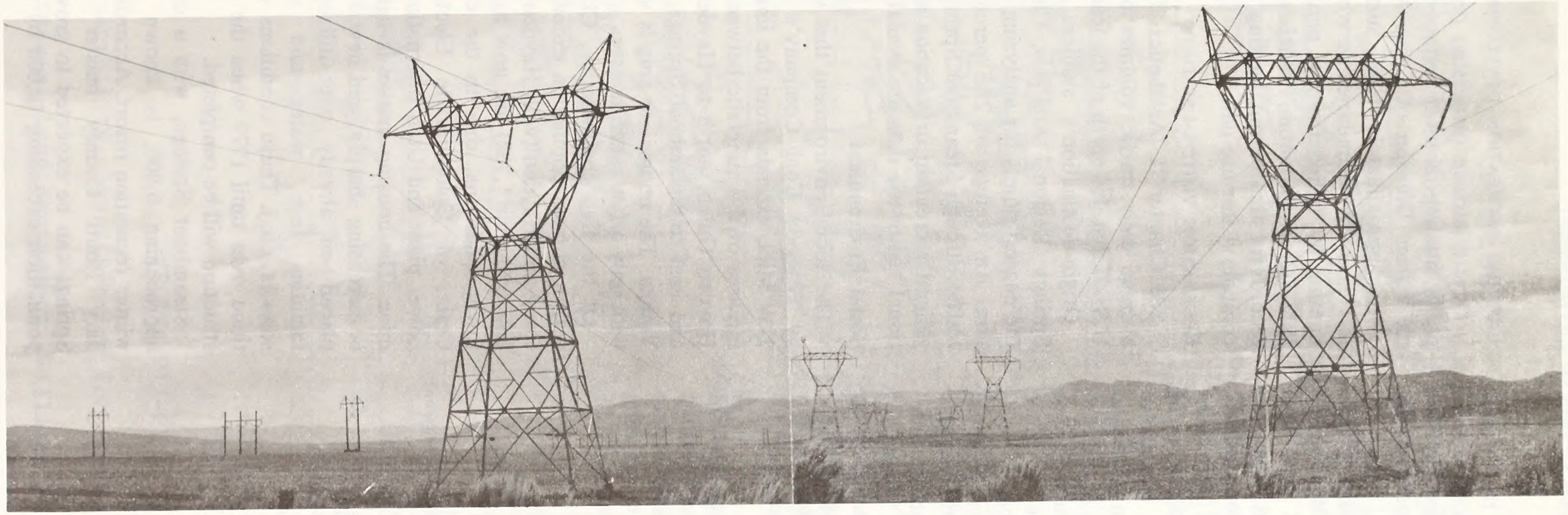


FIGURE PII-19

Viewshed sequence MN on County Road 51 B provides this view of the transmission line corridor south of the Hayden power plant. Portions of Federal coal lease C-0114093 are visible near the center of this panorama beyond the corridor.

Resources

Big game concentrations during the winter occur on both Seneca 2-W Federal coal leases; C-081251 and C-081258. However, none lie close enough to public access routes to constitute significant wildlife viewing opportunities.

Though no sharptail grouse nor sage grouse strutting areas occur on either of the lease areas, four sharptail dancing grounds and one sage grouse strutting ground lie in adjacent areas, indicating their relative probability of occurrence. Legal public access from County Road 37 is maintained to one unit of approximately 880 acres of national resource lands lying adjacent to Federal coal leases C-081251 and C-081258. An additional 200 acres of national resource lands lie in two isolated tracts within both lease area boundaries. See Chapter II, Terrestrial Fauna, for a more complete description of wildlife resources.

No fisheries occur in either lease area. Potential for significant fishing opportunities occurs in Sage Creek Reservoir; however, private surface acreage surrounding the reservoir, and denial of public access, prevents stocking of the reservoir by the Colo. DOW. Presently the reservoir supports no fisheries (Colo. DOW 1975). See Chapter II, Aquatic Fauna, for a more complete description of the fisheries resource.

Figure PII-20 displays the relative inherent capabilities of the various land units surrounding the proposed mine areas to attract and sustain recreation use; this rating pertains to existing resources and does not imply management (BLM 1974).

Recreation Capability Classification

Legend for Figure PII-20

I. Capability Classes:

(Capability to attract and to accommodate recreation)

Class 1 - Very high; intensive activities
2 - High; intensive activities
3 - Moderately high; intensive activities
4 - Moderate; dispersed activities
5 - Moderately low; dispersed activities
6 - Low; dispersed activities
7 - Very low; dispersed activities

II. Sub-Classes:

(Recreation resources)

A - angling
E - interesting vegetation
M - small water bodies
O - viewing upland wildlife
P - agricultural interest
Q - topographic - landscape variety
R - rock formations
W - waterfowl viewing
XS - snowmobiling

Existing recreation developments

Private surface ownership prevents guaranteed public hunting on most surface acreage. The Boggle Farms Division of Cross Mountain Ranches owns approximately 1,360 surface acres within the lease area boundaries on which they allow fee hunting by selling trespass permits (Colo. DOW, 1975, Cross Mountain Ranches, Inc., 1975). No records of this permit hunting are maintained to compile visitor use data.

Recreation visitor-use data

See Chapter II, Aesthetics, for an analysis of average daily traffic volumes on that portion of U.S. 40 that lies north of the lease areas.

Origin-destination studies for Steamboat Springs (Regional Analysis, Chapter II) provide the nearest points for analyzing motorist composition. An average of 29.5 percent of all U.S. 40 traffic through Steamboat Springs was engaged in general recreation or vacation activities; no additional visitor-use data are available.

Social Environment

The social environment that would be affected by Peabody Coal Company's proposed Seneca 2-W Mine extends from the immediate surrounding area of the mine site between Sage Creek and Hayden Gulch, north to Hayden, west to Craig, and east to Steamboat Springs, Oak Creek, and Yampa. The immediate area is sparsely populated with only a few ranch houses.

Of the five communities, Craig is the largest with a current population exceeding 10,000. Both Craig and Hayden (with Hayden's current population of about 1,700) are now experiencing boomtown conditions, due to the construction, near Craig, of Colorado-Ute Electric Association's power plant and Utah International's surface coal mine. The housing market is tight; the crime rate is increasing sharply; and new demands are being placed on already over-utilized social support facilities (e.g., water and sewer treatment, schools, etc.). These conditions will probably continue over until 1979 when the power plant construction will be completed.

Steamboat Springs, with a current population approaching 6,000, is known principally as a winter recreation resort. According to the preliminary Routt County master plan, Steamboat Springs can be expected to grow to a permanent population exceeding 10,000 by the mid-1980s, as

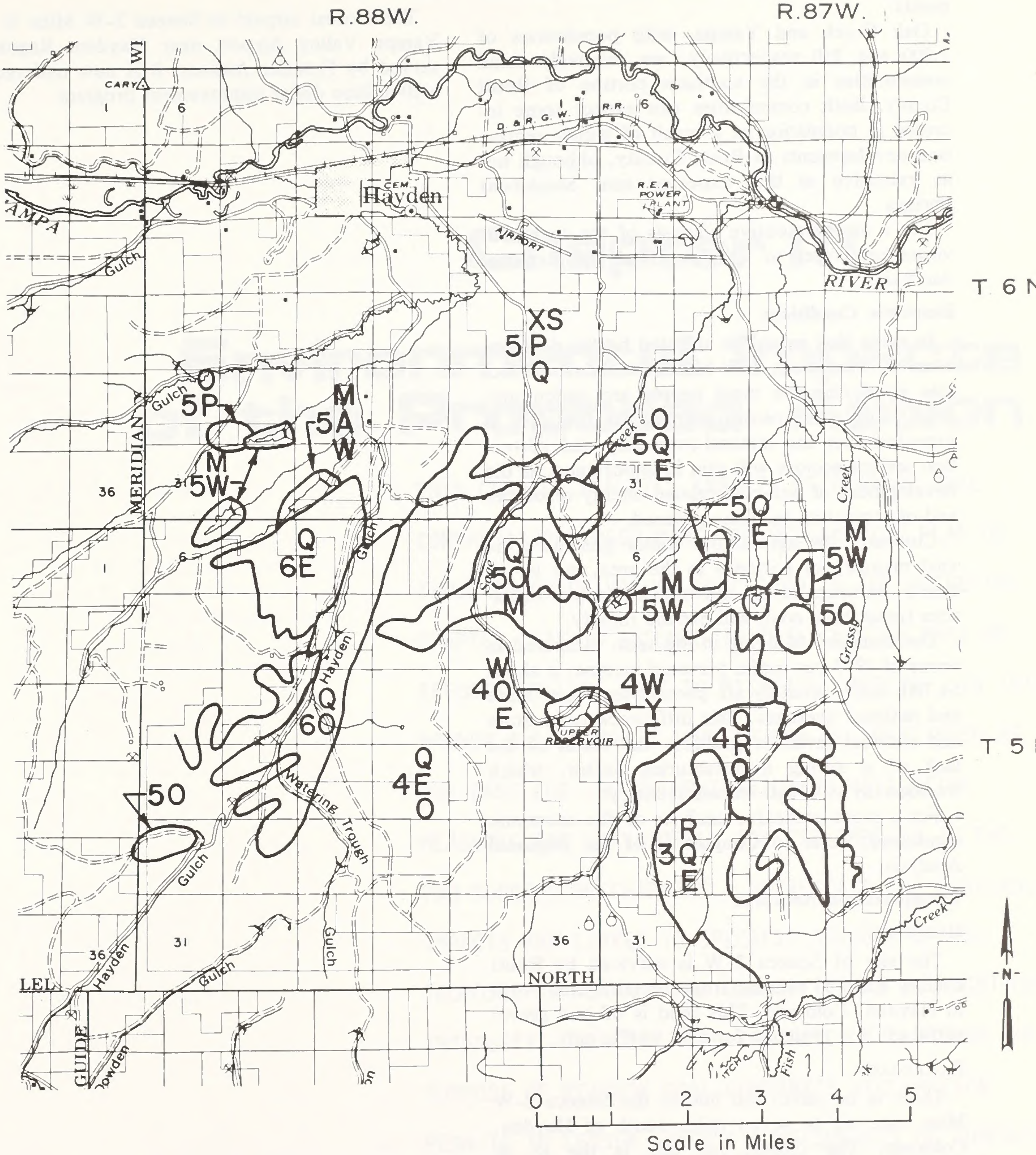


FIGURE PII-20

Recreation capability classification for the Seneca 2-W Mine area.

SOURCE: Bureau of Land Management, Williams Fork URA, 1974

a result of additional winter recreation developments.

Oak Creek and Yampa, with populations of 1,200 and 350 respectively, are relatively small communities in the southern portion of Routt County. Both communities can expect some increase in population as a result of winter recreation developments in Routt County, although not as extensive as that expected near Steamboat Springs.

For a more extensive analysis of the social environment, refer to Chapter II of the Regional Analysis.

Economic Conditions

In areas that would be affected by the development of the Seneca 2-W Mine, the industrial sectors employing the most people are agriculture, retail trade, and construction. In the future, it is expected that the mineral-extracting and recreation service sectors will gain in importance, as the development of non-coal related energy resources and of recreation facilities proceed.

Currently the agricultural sector generates the vast majority of earnings in the area, but in the future, earnings in the minerals extractive industries (other than coal) will expand rapidly.

The standard of living in the area, measured in terms of 1973 per capita personal income, is about $4,700, approximately six percent less than State and national averages. This difference from State and national levels is probably the result of the lack of a strong manufacturing sector, which traditionally is a high income industry.

For a more extensive analysis of the economic conditions, refer to Chapter II of the Regional Analysis.

Transportation Networks

Highways

The site of Seneca 2-W is serviced by Routt County Road 53 running from the mine area north to Hayden, Colorado. This road is oil and gravel surfaced; it is designed for light traffic only.

Railroads

There is no direct rail line to the Seneca 2-W Mine site, six to seven miles south of Hayden, Colorado. The closest rail line is the D. & R.G.W.-Craig branch line which passes through Hayden. It is a single track line in the process of being equipped with centralized traffic control, to be completed in 1976.

Airlines

The closest airport to Seneca 2-W Mine is the Yampa Valley Airport near Hayden. Regularly served by Frontier Airlines, it is now undergoing a 10-million dollar improvement program.

Chapter III

Environmental Impacts of the Proposed Action

THIS CHAPTER ANALYZES IMPACTS OF PEABODY COAL COMPANY'S PROPOSED MINE AND RECLAMATION PLAN ON THOSE RESOURCE VALUES DESCRIBED IN THE PRECEDING CHAPTER. IT IS ASSUMED IN THIS CHAPTER THAT NO EFFORTS WILL BE MADE TO MITIGATE IMPACTS. IN THIS MANNER ALL PROBABLE IMPACTS CAN BE IDENTIFIED AS THE BASE FOR THE DETERMINATION OF MITIGATING MEASURES AND UNAVOIDABLE ADVERSE IMPACTS IN THE TWO SUCCEEDING CHAPTERS. WHERE DATA ARE AVAILABLE, IMPACTS ARE LINKED TO SPECIFIC ASPECTS OF THE PROPOSED ACTION AND ARE QUANTIFIED AS TO MAGNITUDE, INTENSITY, DURATION, AND INCIDENCE. ALTHOUGH THE PURPOSE OF PEABODY COAL COMPANY'S RECLAMATION PLAN IS TO LESSEN ADVERSE CONSEQUENCES OF SURFACE DISTURBANCE, THE IMPACTS RESULTING FROM IMPLEMENTATION OF THEIR PLAN ARE ADDRESSED IN THIS CHAPTER.

Non-living Components

Geologic and Geographic Setting

If implemented, the proposed plan would result in an active open-pit mine at Seneca 2-W site for 15 years (1980-1995). This would mean that the attendant high walls, ramps, access roads, spoil piles, and linear pits would gradually replace the natural slopes of the ridges.

Exhibit XXII of the company's reclamation report shows that parts of the reclaimed area would be higher than the present surface, and that the maximum slope on the reclaimed area would be 24 percent. Exhibit XXI shows that elevations would be increased as much as 25-30 feet in some places. A list of "assorted notes" by Peabody for the Seneca 2-W area mentions that "Final pit to result in a lake after covering exposed coal seam," presumably in each of the sub-areas of mining. These exhibits also indicate the company assumes "a soil swell factor of 22% for the overburden." With a recovered thickness of about 11 feet for the Wadge coal bed, and 60-80 feet of overburden in the sub-areas, the final surface would be raised an average of about two to seven feet. Ultimate landforms would be expected to have a slight bulging to rolling appearance on the mountainside.

The first area scheduled for mining is NE ¼ Sec. 15; the initial cut is to be made along the line between Sections 10 and 15 with the spoils cast northward onto the natural surface, and subsequent spoils into each previous cut. This would result in a new low north-facing west-sloping spur on the ridge, along the south line SE ¼ Sec. 10, T.5N., R.88W. (see Figure PI-4), a rolling west-sloping topography in NE ¼ Sec. 15, T.5N., R.88W. (see Figure PI-6), and a relatively steep (50%) northeast-facing bank into an artificial lake where a small intermittent gully now exists.

Other sub-areas of Seneca 2-W project area would be similar in topographic and landform alterations to those described above. The relatively deep intermittent stream valley in S ½ N ½ Sec. 22 T.5N., R.88W. (see Figure PI-4) would be filled, and an artificial portion of this drainage presumably would be constructed.

Paleontology

Adverse impacts to fossils would occur if they are destroyed in the coal mining operation. Given the overall character of the stratigraphic section, it is likely that at least some fossil destruction would result. Beneficial impacts would occur if unearthed fossils were collected and studied. Potential for adverse impacts to fossils is only moderate, compared to other areas within the study region.

Mineral Resources—Coal

A beneficial effect of the Seneca 2-W mining plan would be the recovery of more coal than would be possible by underground methods. However, present strip-mining methods still assume about ten percent loss of coal in mining. Also, the company has not indicated that it would recover any coal from the 0-4 foot thick bed that lies 40-58 feet above the Wadge coal bed. In the area of operations on the Wadge bed these two factors would cause a loss of about three-feet-thickness of coal, which equals about 5,400 tons/acre, or 216,000 tons/40 acres.

Below the Wadge bed, the Sage Creek and Wolf Creek beds, taken as a whole with regard to stripping ratios, would be within strippable depths on the 10:1 ratio basis, when the Wadge and its overburden would have been removed, and before the overburden would have been replaced. The opportunity to strip mine the Sage Creek and Wolf Creek beds, with the attendant greater recovery ratio from stripping than from underground mining, would be lost after the Wadge overburden has been replaced.

Water Resources

Ground water

Principal impact on ground water would be the removal of the coal in places where it constitutes an aquifer. Ground water pumped from the mine would cause some pollution of streams.

In Areas 1, 4, and 5 and in the part of Area 2 north of the breach in the coal (see Figure PI-5) there would be no effect on the saturated zone which constitutes the main ground water body. The coal in this area is naturally drained and contains only local perched water. Some perched water, plus runoff and leachate from the spoils would accumulate in the bottom of the pit and probably would need to be pumped out during at least part of the year. The amount of water pumped from pits in these areas rarely would average more than 50 gpm. All or part of the water that accumulates in the pits might move down-dip through the coal and associated sandstones to natural points of discharge between the pits and Dry Creek. Very little of this water could be expected to move beyond these natural points of discharge.

Parts of Area 2 and Area 3 to the east and south of the breach in the coal are saturated with ground water. In places this water is under sufficient head to flow at the surface where the coal has been penetrated by test holes. Mining in these areas would release a substantial amount of ground water. The rate at which this water would drain from the rocks is not predictable; however, it is not likely to exceed 200 gpm, and is more likely to be half that amount. Shot holes at the Seneca 2 Mine sometimes encounter saturated rock a short distance up-slope from the pit. This indicates that drainage of the rock could be relatively slow depending on local conditions.

Mining in Areas 2 and 3 would destroy one spring and two wells in the mined area, and may reduce or stop the flow of a well downslope from the mined area. As in the other areas, water might move down-dip from the pits to natural points of discharge, but very little of this water could be expected to move past nearby natural points of discharge.

As both mines would be in the same coal bed, the chemical quality of the water in the pits at Seneca 2-W would be expected to be similar to the water in the present Seneca 2 pit (see Appendix D). This water can be used by livestock and wildlife and would present no danger to the land animals of the area. The undiluted water from the pits probably would not be suitable for irrigation of many crops, and it could be toxic to some aquatic life; (for a detailed survey of water criteria see McKee and Wolf, 1963). The largest discharge from the pits would occur during the spring runoff when dilution by natural flow would be the greatest. When the spring runoff is low the discharge from the pits can be expected to be correspondingly low; hence the amount of dilution would be about the same. During the summer all the water would be used for dust control and there would be no discharge to the streams.

Surface water

Opening and operating Seneca 2-W would cause changes in runoff pattern. Construction of haul roads and surface facilities during the preoperational phase would require making cuts through some steepwalled, narrow sections of Hubberson Gulch. During this construction in the narrow sections of the gulch it would be necessary to channelize segments of the streambed. This impact on the runoff pattern of the area would not be accompanied by an increase in streambed grade. Mining in the area would impact surface-water runoff in three principal ways: (1) the swell of overburden would permit the spoils to absorb more water than before; (2) there would be changes in runoff pattern since spoils would present different contours than were present in the area before mining; and (3) increase in runoff potential would occur as a result of removal of vegetation in the active mining area, and a change of vegetative species would occur in reclaimed areas.

The net result of mine operation would be a decrease in runoff due to increased absorption by mine spoils and surface drainage into mine pits. However, some increase in flow would occur from road surfaces, access roads, haul roads, and exploration trails, and the gains may offset the losses.

Much of the ground water encountered in the proposed mining operation would accumulate in pits and occasionally may have to be pumped out. Ground water would typically be higher in dissolved solids than surface water in the analysis area. Dissolved solids measurements for streams in the analysis area generally average over 500 mg/l. (Detailed tables for each ground water sampling station are in Appendix D.) Pumpage from mine areas may equal the flow in Dry Creek at times, about 100 gpm, as the most severe condition that will occur. Under these conditions, the flow in Dry Creek may be 1000 mg/l, and mine water may be 2400 mg/l, with the combined water averaging out to 1700 mg/l. This could have an adverse effect on some benthic organisms in Dry Creek.

Air Quality

Emission sources

In order to determine potential changes in air quality due to operation of the proposed Seneca 2-W Mine, emissions from all facets of the mining operation must be determined. These emissions must then be interpreted in terms of the ambient pollutant concentrations they produce in the air.

Four general sources of atmospheric emissions would be created by the proposed development. These sources emit both total suspended particulates and fugitive dust in the air; this distinction is made in Appendix D.

The four sources of air pollutants at the mine site are: (1) mining, (2) vehicle emissions, (3) roads, and (4) coal fires. These are discussed in detail in the Regional Analysis, Chapter III.

Based on current regulations, the only significant pollutant generated by the first source, mining, would be suspended particulates which result from fugitive dust. Emissions estimates from materials handling in mining have been developed for topsoil, overburden, and coal separately, but with the same methodology. All the operations of removing the material from the ground, transport, piling, and redistribution have been combined into a single emission calculation using estimates developed from other studies of fugitive dust. Detailed calculations and references are given in Appendix D.

Estimates of the quantities of material to be moved (Appendix D) were taken from the Seneca 2-W Environmental Impact Report (1975). In the years 1980 through 1990, an estimated 900,000 tons of coal would be mined per year, necessitating removal of 7,100,000 tons of overburden and 143,000 tons of topsoil each year. Emissions estimates for this quantity of materials handling is shown in Table PIII-1 as controlled and uncontrolled emissions.

Table PIII-1 lists within-mine and off-mine emissions from vehicles separately. Because of the relatively long haulage distance to the Hayden power Plant, the off-mine emissions dominate the totals. Automobile emissions were calculated by assuming one round trip from Hayden/employee.

Another possible source of emissions related to mining would be the spontaneous ignition of coal fires in overburden piles and exposed coal seams. If a fire occurs, clouds of smoke containing suspended particulates, carbon monoxide, nitrogen oxides, sulfur oxides, hydrogen sulfide, and hydrocarbons could result. Estimates of frequency or quantity of emissions cannot be made. However, if a fire occurs, the emissions might be substantial.

The calculated estimates of emissions rates are realistic approximations of the complex interaction of variables that affect dispersal of particulate material. Uncertainties (two standard deviations) are estimated to be on the order of a factor of two. All of the rates are given as yearly averages, even though it is recognized that all the activities are not continuous.

RESULTANT AIR QUALITY

Particulates

An atmospheric diffusion model has been applied to estimate the impact of emissions near the mine site. The methods used and consequent results are discussed in Appendix D.

The uncertainty in the calculated total suspended particulate concentrations can be approximated; it is estimated that the modeled concentrations are correct within a factor of three. This uncertainty could be reduced only by much more detailed, and preferably measured, emissions and meteorological data.

Table PIII-2 is a compilation of Federal and State ambient air quality standards, existing background concentrations, and diffusion model predictions. As shown in Table PIII-2 and Figure PIII-1, the decrease in concentration with distance would be rapid. Concentrations (including the background of 26 $\mu g/m^3$) would exceed the annual Federal secondary standard (60) out to nearly 1 kilometer (0.6 miles) from the center of the disturbed area, and Colorado standard (45) for a distance of 1.5 kilometers (10.9 miles). Concentrations in other than the down-valley direction would be lower by at least 50 percent.

Meteorological circumstances resulting in the largest predicted 24-hour total suspended particulate concentrations are those which contributed most to the annual average, the existence of stable conditions. It has been assumed that stable conditions with a wind speed of one meter/second persist for at least eight hours. This could occur in any direction, but is most likely to the northeast. The meteorological information available indicates that concentrations on the order of those in Table PIII-1 would occur between 10 to 30 days/year. The predicted concentrations shown in Table PIII-2 are below the Federal secondary and State standards at distances greater than 500 meters (0.3 miles) from the mine center. EPA non-degradation guidelines for Class II area values might be exceeded in the prevailing downwind direction for distances of 2 km (1.2 miles), annual average, and 2.5 km (1.6 miles), 24-hour average.

Gaseous pollutants

Vehicle emissions would be the only source of gaseous air pollutants at the mine. Federal and State regulations limit ambient air concentrations

TABLE PIII-1

Seneca 2-W Mine Air Pollutant Emissions

(Metric Tons per Year)*

Source	Air Pollutant	Uncontrolled		Controlled	
Mining Materials					
Handling:					
Topsoil	Suspended Particulates	2.2		2.0	
Overburden	Suspended Particulates	150		140	
Coal	Suspended Particulates	20		18	
		Within Mine		Off Mine	
		Cars	Trucks	Cars	Trucks
Vehicle Exhaust	Suspended Particulates	0.015	0.11	0.12	1.0
	Hydrocarbons	0.18	0.31	1.4	2.8
	Carbon Monoxide	0.97	0.48	7.8	17
	Nitrogen Oxides	0.14	3.1	1.1	28
	Sulfur Oxides	0.0036	0.22	0.029	2.0
Fugitive Dust from Off Mine Roads	Suspended Particulates	220		150	

* 1 metric ton = 1.1016 short tons

TABLE PIII-2

Air Quality in the Vicinity of the Proposed Seneca 2-W Mine

Predicted Worst Case Concentrations ($\mu g/m^3$) from Sources at the Mine

Pollutant	Averaging Time	Ambient Air Quality Standards: Federal Pri	Federal Sec	State	Existing Ambient Air Quality	Distance from Mine (km)	Maximum Predicted Concentrations	Predicted Plus Background Concentrations
Total Suspended Particulates	Annual	75	60	45	26	0.5	79	110
						2	9.4	35
	24 Hour	260	150	150	26	0.5	150	180
						2	41	67
Sulfur Dioxide	Annual	80	-	-	15	0.5	0.076	15
						2	0.012	15
	24 Hour	365	-	15	15	0.5	0.21	15
						2	0.057	15
	3 Hour	-	1,300	-	15	0.5	0.63	15
						2	0.17	15
Carbon Monoxide	8 Hour	10,000	10,000	-	400	0.5	4.1	400
						2	1.1	400
	1 Hour	40,000	40,000	-	400	0.5	7.1	410
						2	1.9	400
Non Methane Hydrocarbons	3 Hour	160	160	-	50	0.5	1.4	51
						2	0.38	50
Nitrogen Oxides	Annual	100	100	-	15	0.5	1.1	16
						2	0.17	15

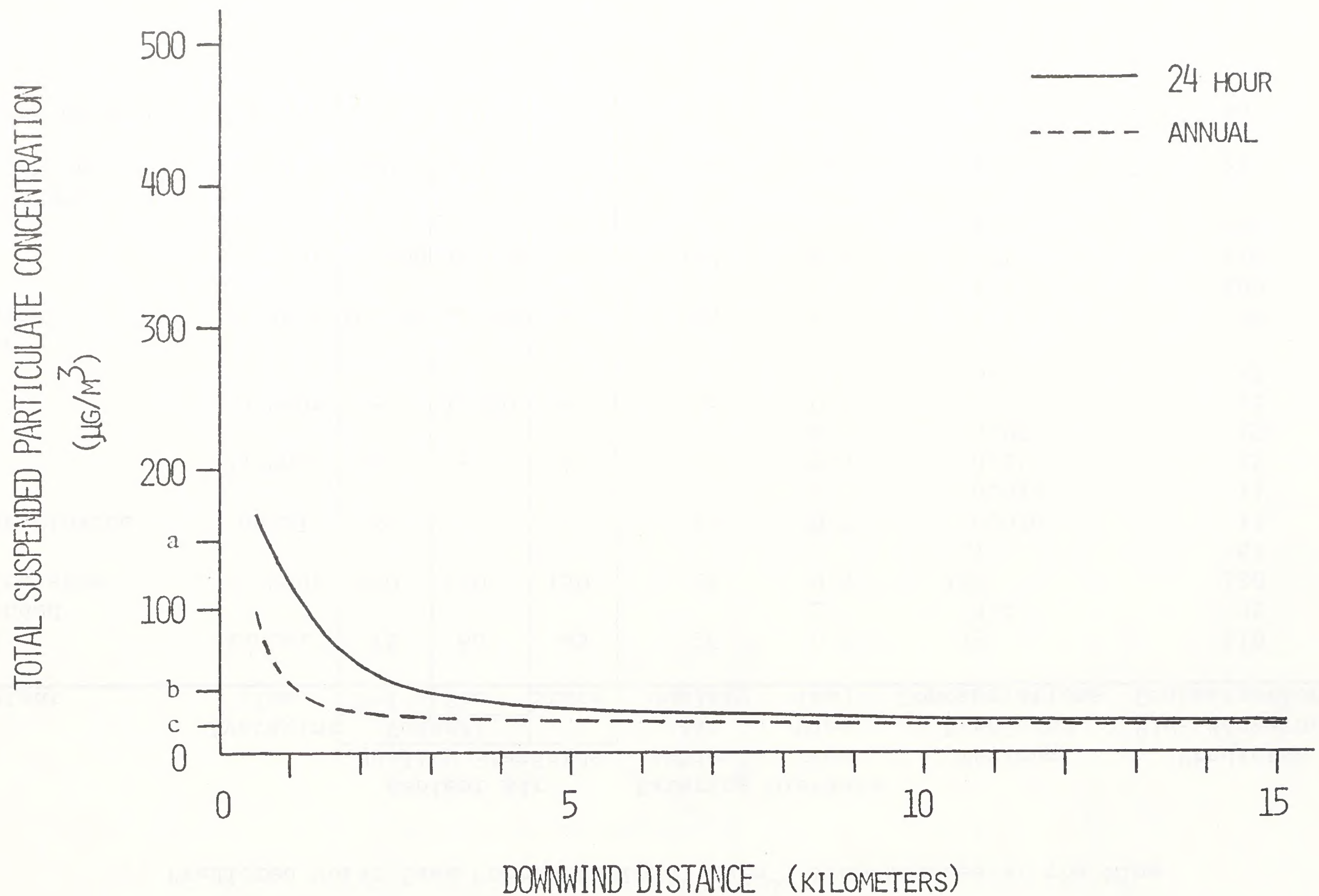


FIGURE PIII-1

Maximum down valley suspended particulate concentrations as a function of downwind distance from the center of the proposed Seneca 2-W Mine. (a, 24-hour state standard; b, annual state standard; c, baseline concentration) of the pollutants: carbon monoxide, hydrocarbons, nitrogen oxides, oxidants, and sulfur oxides. Of these, all but oxidants are emitted from vehicles.

Emission estimates were made separately for off-mine and within-mine vehicles in order to facilitate impact assessment. Results of modeling within-mine vehicle exhausts are given in Table PIII-2. As in the particulate case, the Predicted concentrations decrease rapidly with distance from the mine. Emissions from diesel and gasoline vehicles have been added together in the consideration of the mine as an area source. Applicable air quality standards and existing background concentrations are also listed in Table PIII-2.

The within-mine vehicles are assumed in the model to be spread out over the entire disturbed area. In comparison, the off-mine vehicle emissions would occur along the road system. They constitute a source ten times larger, as indicated in Table PIII-1. Ambient concentrations have not been modeled because of the lack of detailed input, as discussed earlier, but general estimates can be made by using approximation techniques from EPA, 1974. For carbon monoxide, at a distance of 100 meters (300 feet) from the road, with a wind blowing along and slightly across the road, the maximum one-hour concentrations would be about 40 $\mu g/m^3$. This is a rough approximation, but it allows a comparison to Table PIII-2, where carbon monoxide concentrations of 7 $\mu g/m^3$ are predicted as resulting from within-mine vehicles. Compared to the standards, these levels are insignificant.

Table PIII-1 includes the emission estimates separately for automobile and mine haulage trucks. The most significant difference would be in the contributions of nitrogen oxides; trucks would be expected to emit about 95 percent of the total. Annual concentrations cannot be estimated by the approximation techniques used above, but would also be expected to be insignificant.

Visibility

The addition of particulates into the atmosphere around the mine, either directly as suspended particulate emissions, or indirectly as a result of chemical reactions of gaseous pollutants, would reduce the visibility in the area. It was shown in the previous section that the gaseous contribution would be expected to be minimal. The minimum visibility on an otherwise clear day would be on the order of 40 kilometers (25 miles).

Living Components

Soils

Impacts on soils would result from' the disturbance of 540 acres by the Seneca 2-W Mine operation, 296 acres by haul roads, and 134 acres by other associated activities. Table PIII-3 shows soil disturbance by periods during the life of the mine.

TABLE PIII-3

Soil Disturbance

Activity	Period	Acres
Mining	1980 - 1985	252
	1986 - 1990	195
	1991 - 1995	93
Haul Roads		296
Surface Facilities		3
Box Cut Spoils and Stockpiles		131
	Total	970

Soils would be affected during preoperational activities at Seneca 2-W by the road-building activity of the area. Due to the instability of soils in the area, road cuts could cause some slumping. Construction of roads and surface facilities would also remove vegetation, which could lead to both wind and water erosion of soils. Both of these impacts might be of moderate proportion, and the overall impact could be mitigated by careful road cut design techniques, and by prompt revegetation of disturbed areas along the roads and surface areas.

Operation of the mine would also entail removal of vegetation. Resultant soil erosion would be short-term, since the topsoil would be removed and stockpiled. Removal of soils for stockpiling would have a secondary impact: surface and subsurface horizons of the soil would be mixed. The degree of impact from horizon mixing would depend on differences in nutrient levels and texture between horizons.

There might be some loss of topsoil from stockpiles, due to water and wind erosion. Any long-term storage of soils could also affect nutrient loss and a decline in the number of micro-organisms; however, these soils would not be stored that long. Another impact of moderate importance during the reclamation process would be compaction of soils by the shaping and spreading equipment. Where spoils have been reshaped and topsoil replaced, soil erosion may be extensive until permanent vegetation is established.

Peabody sampled and analyzed the overburden on portions of the Seneca 2-W lease area (Appendix D, Soils). Analyses of various layers of drill holes 42-C, 43-C, 125-C, 217-C, 286-C, and 311-C indicate that concentrations of high salts occur throughout most of the mining area. Of 14 holes sampled, three (43-C, 217-C, 286-C) have more than one layer of high salt material (Appendix D, Soils). The cores that show the highest concentration and greatest extent of salts all encounter the Lennox coal seam, and the high salt material is in the overburden above the Lennox coal. This high salt material, mostly shale, appears to be in concentrations that would be detrimental to plant growth if placed in the rooting zone on reshaped spoils. Four of the whole overburden cores were ground and analyzed to simulate the manner in which a dragline mixes the overburden (Appendix D, Soils). One of the four cores (217-C) showed a salt concentration that could be detrimental to plant growth. However, the core holes that had the highest salts were not analyzed as a whole core.

Most of the surface soils on the mining area (Figure PII-5) have a poor to fair potential for use as topsoil to replace on reshaped spoils. Most of these materials are rated fair to poor because permeability is very slow, and if replaced on steep slopes and left unprotected it would be subject to erosion and would not allow moisture to infiltrate for plant growth, thus decreasing reclamation potential. These individual core hole analyses also show that much of the surface soil material in the mining area is poor quality topsoil because it is a very heavy clay, and also that some of this surface material (core hole 286-C) has a high salt content.

Reclamation could have two positive impacts on the soils of the area: good soils would be more evenly distributed, and when good topsoil is found in large deposits, it might be redistributed over those areas that initially had poor quality topsoil. This could result in better vegetative growth, which would have a second favorable impact of reducing surface erosion.

The mining operation would cause vegetation removal and soil disturbance on approximately 55-60 acres/year. Vegetation removal from these acreages each year would increase erosion hazard.

Terrestrial Flora

The most significant impact to vegetation would be total removal of the existing vegetative ecosystems by various mining operations. During the fifteen-year life of the Seneca 2-W Mine, vegetation would be destroyed on approximately 970 acres. Vegetation would be affected as shown in Table PIII-4.

TABLE PIII-4

Vegetation Types, and Amount to be Disturbed by Activity (Acres)

Activity	Vegetative Type					Total
	Forbs	Sagebrush	Mtn. Shrub	Aspen	Cropland	
Mining (1980-1985)	33	140	66	13	-	252
Mining (1985-1990)	-	130	55	10	-	195
Mining (1991-1995)	-	28	11	54	-	93
Boxcut spoils and topsoil stockpiles	9	59	34	29	-	131
Haul roads	12	83	95	56	50	296
Surface facilities	-	2	1	-	-	3
Total	54	442	262	162	50	970

Vegetation loss would begin with construction of roads and surface facilities. Road construction activity would alter the surface drainage pattern, and surface water that would normally run downhill might be diverted by road construction. This might cause vegetation downslope from the roads to receive less moisture than prior to road construction; this change might cause some localized alterations in vegetative patterns. Sufficient information is not available to predict the extent of this impact. Construction of surface facilities would occur outside the mining area, and would be void of vegetation during the life of the mine.

There would also be some removal and disturbance of vegetation along the route of the 69-kv powerline; vegetation would be cleared in areas where vegetative height exceeds 10-15 feet. The access road accompanying the powerline would also involve a removal of vegetation; placement of powerpoles would result in a total loss of approximately one-half acre of vegetation in mountain shrub and sagebrush vegetation types.

Population increase associated with the Seneca 2-W Mine would disturb an estimated 17 acres by 1990. Vegetative types disturbed are not determinable since the exact location of population increase is not known.

The mining operation itself would produce the largest vegetative impact. The first disturbance of vegetation in the operation would result from stockpiling topsoil, and placement of the boxcut spoils on undisturbed land; this would amount to approximately 131 acres throughout the life of the mine. The mature mining operation would leave approximately 57 acres totally disturbed at any given time before revegetation begins. Total removal of vegetation from these acreages each year would have a secondary effect on surrounding vegetation. Once vegetation is removed from mining areas and is unavailable to herbivors, vegetation on adjacent undisturbed areas might be subjected to increased utilization. The magnitude of this impact would depend on the importance of the area for wildlife forage, and the amount of overstocking of domestic livestock.

A secondary impact would be invasion of weedy species due to destruction of native vegetation. Weedy species such as Russian thistle (*Salsola kali*) would compete with revegetation attempts, thereby decreasing chances of permanent vegetative establishment. If weedy species are not controlled, their competition with seedlings would be a significant impact to revegetation efforts.

Areas to be mined that are covered by the forb type (Figure PII-7 and Table PIII-4) would probably be the most difficult to restore, because the very fine-textured soils are highly susceptible to water erosion if used as resurfacing material. Also, a commercial seed source is not available for the plant species of this site.

If topsoil is replaced on reshaped spoils and a vegetative cover is not established quickly, it is very likely that the topsoil would erode extensively, thus decreasing reclamation potential.

Peabody plans to use alfalfa in their revegetation program. In the past alfalfa has been utilized in Peabody's reclamation efforts, and has been found to dominate the revegetated area (Berg and Barrau 1973). Alfalfa provides an excellent soil stabilizer; however, it tends to create a vegetative stand with very little variety for at least ten years. It is the current theory that stability of a plant community is a function of its species diversity, and that succession in an ecosystem is described as a progression toward higher diversity (Kormondy 1969). Diversity produces stability because there is less likelihood that any major shift or loss of one component would adversely affect the entire system. It is evident from the increasing need of pesticides in agricultural croplands that most monocultures do not produce self-sustaining stable vegetation. Because of the relatively small area being disturbed at the Seneca 2-W Mine site, this diversity concept would not constitute a major impact. Stewart (1974) found that micro-organism activity increased on revegetated mine spoils in southeastern Montana as species diversity increased.

The length of impact of vegetation loss would depend upon the success of reclamation. Since Peabody plans to return only a few native species, loss of native vegetation would be quite lengthy, depending on the rate and ability of native species to invade the area. Some small areas due to soil texture, toxicity, or other factors might be impossible to revegetate, making loss of vegetation a permanent impact. Since current reclamation methods have only been utilized for a few years, sufficient information is not available to predict the amount of time needed for native species' invasion, or the extent of areas unable to revegetate. In some years climatic conditions might prevent revegetation attempts, extending impacts of vegetative loss. Even on areas revegetated, a ten percent loss in productivity has been projected.

The total destruction of native vegetation from an area would result in the following impacts on the vegetative ecosystem:

1. Loss of above- and below-ground primary productivity,
2. Loss of a diverse vegetation capable of withstanding climate extremes and utilizing precipitation and sunlight throughout the growing season,
3. Loss of present vegetative successional stage, and set back to a very juvenile stage,
4. Loss of a natural seed source, necessary for ecological succession and stability,
5. Loss of nutrient cycling systems that utilize the soil, plants, micro-organisms, and physical forces to cycle nutrients from the soil to forms usable by plants. These systems are essential for self-sustaining vegetation growth, and may be the greatest limiting factor to establishing self-sustaining plant ecosystems on mine spoils,
6. Loss of soil stability and erosion prevention by roots and shoots of vegetation.

The proposed haul road to the Hayden power plant would remove approximately 50 acres in grain production. Since the road would probably not be reclaimed in the foreseeable future, if ever, a permanent reduction of 1,500 bushels of wheat every other year would be anticipated. This is assuming the common practice of summer fallow every other year and a yield of 30 bushels/acre.

It is improbable that existing vegetative ecosystems could be returned to strip-mined land in the 15-year time-frame of this statement; current reclamation practices have not been utilized long enough to determine whether a significant number of native plant species can be established on reshaped-topsoiled spoils. Therefore, the greatest impact to the vegetation resource would be the complete loss of existing stable plant ecosystems on approximately 970 acres, and a permanent loss of vegetation on about 300 acres. The second most significant impact would be the projected ten percent loss in production on revegetated spoils. Though seasonal peak production is not expected to decrease appreciably on most sites, species diversity will probably decrease by 75 percent. The tree, shrub, and forb components of herbage production will probably decrease by at least 75 percent, and the grass component increase by about the same amount.

Terrestrial Fauna

WILD FAUNA

Development of Seneca 2-W Mine, as covered in this statement, would result in several adverse impacts on a variety of wildlife species.

Three major categories will be covered in this section: the mining operation, construction of support facilities, and reclamation activities. Each of these actions would impact terrestrial fauna in its own particular way.

Mining operation

The major segments of a strip mining operation, as related to terrestrial fauna are: exploration, removal of vegetation, removal of topsoil, removal of overburden, and extraction of coal. The first three segments create the most significant impacts on wildlife.

During the exploration phase of the operation, paths would be cut through existing vegetation and pad locations would be cleared. Drilling operations would then take place. Most of the exploration drilling has already been completed on the Seneca 2-W site.

Destruction of vegetation creates impacts on the fauna by reducing available nesting cover, escape cover, and food, reducing the area's capability to maintain present numbers. Faunal species most affected would depend upon the vegetation type being disturbed (see Appendix D).

Noise resulting from the drilling operation and movement of equipment would create a short-term impact on faunal species in close proximity to the work area. Noise would create a degree of anxiety in animals; the degree would depend on the species, their closeness to the operation, and its duration. Those animals that are mobile enough, such as coyote, fox, deer, and most birds would likely leave the area, at least temporarily. Those animals that cannot flee would probably retreat into dens, brush, and under rocks.

Some animal deaths would be expected from this phase of the mining operation from vehicle-animal collisions and den or nest destruction or disturbance. Unplugged core sample holes would create a hazard to small mammals, amphibians, reptiles, and invertebrates, and could affect larger animals, such as deer and elk.

Removal of all vegetation would be the first step in recovery of the coal. Loss of this vegetation would result in a loss of food and cover required by terrestrial fauna. The disruption of the mined portion of the ecosystem would be total (see Appendix D for species affected by habitat type).

A combination of the loss of vegetation and removal of productive topsoil would leave the mined area void of most animal life. This impact would be exerted on most forms of terrestrial wildlife, from soil mites to deer and elk.

Topsoil removed from initial cuts would be temporarily stockpiled; this stockpiled material would cover an additional 131 acres of vegetation, resulting in a further loss of habitat values and animals.

Major impacts resulting from the removal of overburden and coal would be the creation of the highwall and prolonging of the time the area would be disturbed, increasing the disruption of normal animal movements and increasing the danger to individual animals.

Additional impacts on the existing ecosystem would result from dumping overburden into areas that have not been previously disturbed. This action would cause a direct loss of life of nesting birds, rodents, amphibians, and reptiles. Covering up vegetation would result in a further reduction in food and cover. Some beneficial impacts would result from this action: rock slides would provide habitat for rock wrens, yellow-bellied marmots, and many reptiles and invertebrates.

Total loss of wildlife habitat resulting from the mining operation would be in a constant state of progression across the lease area, from north to south. Table PIII-4 indicates the proposed acreages that would be stripped between 1980 and 1995. An estimated total of 540 acres would be strip mined by this operation.

There would be a one year time lag from the removal of topsoil to the beginning of revegetation efforts on any given unit of land. This would mean that, due to mining, approximately 57 acres of land would be lost to all wildlife at any given time during the life of this operation. All previously mined areas would be in some stage of reclamation, and therefore would be providing some wildlife habitat value. Habitat destroyed to provide for the increase in human population, would account for a loss of about 17 acres.

Less mobile animals such as many reptiles, invertebrates, and small mammals would not be able to flee and would be destroyed. Larger and more mobile species, such as deer, elk, coyote, grouse, and other birds would be able to move onto adjacent lands. All or most of these relocated animals would probably be lost, as explained in the Regional Analysis portion of this report.

The entire 970 acres that is proposed to be disturbed by 1995 provides habitat for deer and elk. Using the same population estimates that were presented in the Existing Environment section, habitat capable of supporting approximately 11 deer and 9 elk at any given point in time would be destroyed. These animal numbers represent a permanent loss from the herds unless reclamation programs could restore the mined areas to an equal or greater carrying capacity than that which is presently available.

Impacts on bear would be expected to be insignificant because of the low densities of this species within the region and the low indices of use they have indicated for the subject area.

The most significant impact on rabbits and hares would be the loss of food and escape cover during the mining operation; populations would decline in the limited area that has been denuded of vegetation.

Potential impacts to bats are not known, although it is expected that these species would be forced to relocate.

In all probability, the increase in human activity and the noise associated with the mining operations would cause some wildlife such as coyotes, fox, and many birds to leave the working area prior to actual habitat destruction. An increase in vehicle-animal collisions is also associated with human expected activity increase.

Access is not expected to be granted to the public for hunting. This practice could eventually result in improper population management of game species, such as deer, elk, and rabbits.

Water quality is not expected to be affected to any major degree. However, water quantity would be affected by the loss of a pond in the northern portion of Seneca 2-W lease. This impact would result in removing this area from potential use by waterfowl and other birds, amphibians, some insects, and many mammals.

Loss of vegetation on the proposed mine site would reduce its ability to sustain many animals including such species as deer, elk, mourning dove, and blue grouse.

A reduction in raptor nesting would possibly result from the increase in human activity and the potential loss of adequate nesting sites.

Because of a lack of knowledge of the amphibian and reptile species present, little can be said as to the impacts on this segment of the terrestrial fauna. Most species of this group are not mobile enough to escape destruction from the mining equipment. Some species, such as rattlesnakes, would be killed by miners and recreationists in and around the actual mined areas.

Little is known of the species composition of terrestrial invertebrates; therefore, nothing specific can be said about the impacts upon them. Numbers would certainly decline in the mined areas until rehabilitation begins, but to what extent is uncertain.

Support facilities

This category includes roads, buildings, and powerlines. The proposed roads are indicated in Figure PI-6. The access road into Seneca 2-W has already been constructed; however, the cuts and slopes created by this road have not been revegetated. Runoff from these areas could impact water quality in Dry Creek, and additional roads would also cause this same type of impact until the cuts and fills have been stabilized.

All roads would be constructed within the lease area except that portion of the haul road that would extend from Routt County Road 53 to the Hayden power plant, approximately 5.1 miles; it has been rerouted to minimize potential impacts on the greater sandhill crane (*Grus canadensis*) dancing grounds, indicated on Figure PIII-2, and

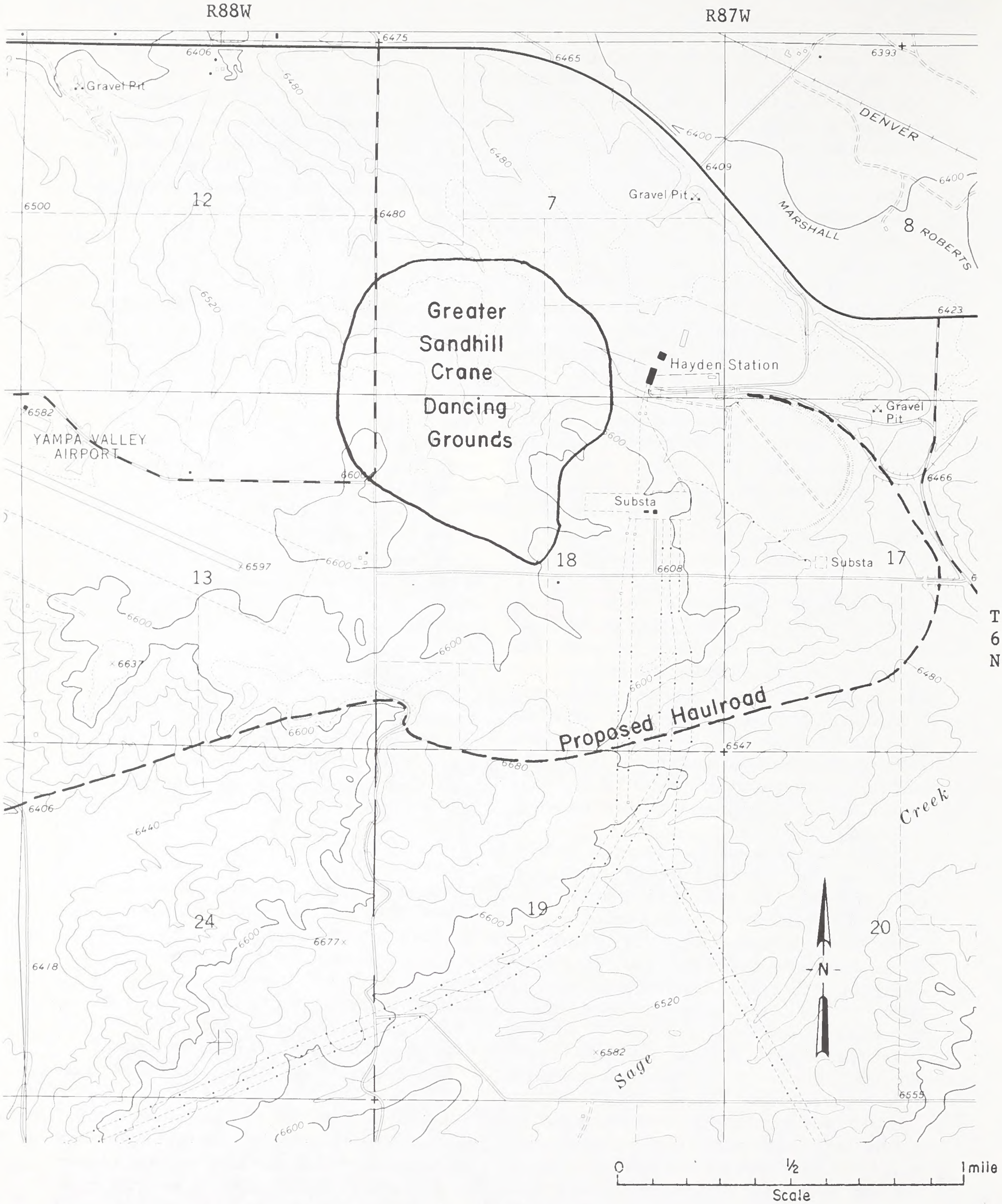


FIGURE PIII- 2

Greater sandhill crane dancing grounds.

would create minimal impacts in wildlife, because most of the road would be constructed on already disturbed agricultural lands. Approximately 60 acres would be converted for use as a haul road.

Nine miles of road would be constructed within Seneca 2-W lease, resulting in a total of 236 acres disturbed. About 83 acres of disturbance would be in sagebrush type and 95 acres in mountain shrub type (See Table PIII-4).

As currently planned, all shops, offices, and maintenance buildings would be constructed in previously disturbed areas (see Figure PI-6). No additional habitat destruction would be expected for this type of facility. All areas used for these structures are considered as permanent losses to wildlife, with the possible exception of house mice, English sparrows, and other rodents and birds that choose to live in and around man's dwellings.

A 69-kv powerline would be installed from an existing line that lies 6.5 miles east of the mine site. A substation would be constructed at Seneca 2-W (see Figure PI-6). The average distance between 69-kv power poles is normally 500 feet, dependent on wire size and terrain. Approximately 180 power poles would be required for this line, and each pole requires an area of 50 square feet cleared of all vegetation. This would result in the loss of 9,000 square feet of vegetation, mostly sagebrush and mountain shrub, and associated reduction in wildlife.

Powerlines often create a hazard; birds are killed when they collide with the wires. The extent of this impact on the region's avifauna is unknown, but it would be expected to be minimal.

Reclamation

The Seneca 2-W plan is aimed at returning this area to livestock grazing when mining is finished. However, Peabody intends to plant trees and shrubs, primarily in depressions that provide a suitable micro-climate; approximately 15 percent of the disturbed area would be planted to these types of vegetation. For additional information see the Terrestrial Flora portion of this site specific report. The result of returning only 15 percent of the disturbed area to trees and shrubs would select for those wildlife species associated with grasslands, rather than those species associated with shrub and wooded vegetation.

Rodent numbers would be expected to increase, rapidly paralleling revegetation programs; abnormally high rodent populations would be expected as tender and succulent vegetation becomes available to them. Seed-eating birds and rodents would also be expected to cause some loss in the planted seeds, reducing revegetation potential.

Species composition and densities of these rodents would vary, dependent on the plant species used in revegetation and the successional stage of reclamation. Because of Peabody's revegetation plans, it is unlikely that the species composition would return to its exact pre-mined status. High rodent numbers are expected to attract a larger than normal number of predators: coyotes, fox, snakes, and raptors.

All revegetated areas would be fenced to exclude sheep and cattle until vegetation is established. Depending on the type of fence used and the fence location, animals could become entangled, with a resulting loss of life. Present animal movements may also be disrupted or significantly altered by the location of the fences.

A combination of human activity, mine highwall, and proposed fences would probably affect animal movements within and through the region. These actions could reduce or prevent elk movement into winter range west of the mine. According to the Colorado Division of Wildlife (Colo. DOW), this could be a favorable impact, because present elk management would benefit by keeping these animals east of Seneca 2-W lease.

Response of all terrestrial fauna to reclamation would be related to the floral species, composition, and density used during this phase of the action. Jackrabbit populations would be expected to recover in areas where herbaceous cover has become successfully established. Cottontails would not be expected to respond to revegetation efforts to a significant degree until brush was replaced. Mourning doves prefer to feed in weedy fields, so if revegetated areas are invaded by seed-producing weeds, overall dove use would increase. The degree of invertebrate recovery from impacts of the mining operation would depend entirely on the vegetal species composition and success of the revegetation program.

DOMESTIC FAUNA

All livestock would be removed from areas to be mined prior to the actual beginning of work; therefore, no livestock would be expected to be lost as a direct result of these activities.

About 540 acres would be totally lost to livestock at Seneca 2-W Mine as a result of office and maintenance building construction, overburden stockpiles, haul roads, and the ongoing mine activity. The resulting loss of AUMs would vary, depending on the vegetation type that is being cleared each year. All previously mined areas would be in some stage of reclamation and might or might not be available for livestock use. All revegetated areas would be fenced to exclude livestock use until the vegetation is established, probably two or three growing seasons. Therefore, losses of AUMs on a year by year basis could vary from 90-180, depending on the type of vegetation disturbed during that year.

It is Peabody's current plan to return this area to grazing use when the mining is finished. At the same time wildlife values would be protected, and wildlife shrub and tree habitat re-established to a limited degree within the area. Approximately 85 percent of all mined areas would be seeded to a grassland type, and about 15 percent would be planted to trees and shrubs; this would impact the domestic animals by altering the area's overall carrying capacity.

Table PIII-5 indicates that approximately 540 acres representing 110 AUMs would be mined between 1980 and. 1995. As currently planned, about 460 acres would be reseeded to grasses, and 80 acres to trees and shrubs (see Table PIII-6). By subtracting the AUM values in Table PIII-5 from those in Table PIII-6, a net increase of 101 livestock AUMs is predicted when all revegetated areas would have been returned to livestock production. This does not take into account the predicted ten percent loss in productivity resulting from soil disturbances, which would reduce this increase.

TABLE PIII-5

Carrying Capacities and Loss of Animal Unit Months by Vegetation Types From 1980 to 1995

Vegetation Type	Carrying Capacity in Acres/AUM	Acres Disturbed	Total AUMs Lost
Aspen	3.00	162	54
Mountain Shrub	5.00	262	53
Sagebrush	5.75	442	77
Forbs	6.00	54	6
Total		970	193

TABLE PIII-6

Carrying Capacities of Revegetated Areas at the End of the Life of the Mine, After 1995

Vegetation Type	Carrying Capacity in Acres/AUM	Acres Revegetated	Total AUMs Restored
Mountain Shrub	5.00	224	45
Grassland	3.00	746	249
Total		970	294

Aquatic Biology

As detailed in the discussion on surface water hydrology, the primary impact upon water quality during preoperational mining phases would be due to increased sediment loads. This increased sediment load would affect the aquatic ecosystem by decreasing diversity and abundance of benthic fauna and periphyton found in the system. This could generate local effects on the aquatic ecosystem. The fish population in Dry Creek would not be affected because it occurs only near the mouth of the stream.

Any appreciable increase in sediment load would probably silt-in the beaver ponds in Section 27 on the lease area in just a few years (Peabody Coal Company 1975). This in turn would cause the beaver to move, leaving the dams to deteriorate; this decay could lead to significant sediment increase in downstream areas, as sediment stored behind the dams would likely wash downstream. Surface water hydrology of the area would further be affected since there would be a loss of a natural regulation on the flow of streams if the dams were to break. It should be emphasized that these secondary impacts would take place through a series of events extending over a considerable period of time.

The increase in total dissolved solids in streams resulting from pumping of ground water from the pits into local drainages could adversely impact the aquatic ecosystem, especially during periods of low flow when total dissolved solid values increase naturally. Many of the primary sources of food for the aquatic community, especially benthic macroinvertebrates, are extremely sensitive to changes in water quality. Even a slight sudden increase in TDS could drastically alter the biological community of a stream by changing the nature of benthic population.

Any channelization or diversions from natural water courses in the analysis area during proposed mining activity would significantly impact local aquatic ecosystems. Channelization would change stream flow characteristics, thus altering makeup of the aquatic community. For instance, an increased stream flow resulting from an increased stream gradient, would result in the establishment of a benthic population consisting of organisms which could securely fasten themselves to the stream substrate. Also stream diversions or channelizations could deplete the stream flow completely downstream from the construction activity, producing total dessication of the stream-bed and death of many aquatic organisms. Complete rehabilitation of an affected stream would require several years.

Cultural Components

Archeological Resources

Total projected acreage disturbance at the Seneca 2-W Mine for 1980 is 34 acres. An additional 218 acres would be disturbed by 1985 and another 195 acres by 1990. Because Dr. Breternitz's analysis of the study area was a reconnaissance survey, unknown sites could be destroyed by mining operations. The identified pictograph site might be subject to vandalism and pothunting by mine employees, as would other presently unknown cultural sites. As a measure of this potential, projected mine employment would reach 44 by 1980 and remain constant through 1990.

Although there is a paucity of detailed archeologic base inventory data, the area has low suitability for habitation, relative to the region. Notwithstanding this fact, seasonal transients have left archeological evidence of their presence in similar areas of the region. As a result, a moderately low possibility for experiencing adverse impacts exists.

Historical Resources

The log cabin in NW ¼, SW ¼, Sec. 23, T.5N., R.88W. would be directly displaced by surface mining operations in 1989 (see Figure PI-1). Because no intensive cultural resource survey has been completed yet, potential vandalism and pothunting could impact presently unknown historic features.

Although no intensive historic inventory has been completed, given the regional history, there would be potential for moderate adverse impact, which would be of only local significance.

Aesthetics

Refer to Appendix D for a discussion of procedures to use in analyzing the landscape visibility maps.

The proposed 69-kv transmission line, color-dominant and strongly line-dominant, would significantly impact the natural landscape. These deviations would be most obvious in the foreground landscapes visible from County Roads 37 (viewshed sequences F-K) and 27 (viewshed sequence YZ). Right-of-way clearings, reflective conductors, and the towers themselves would contrast sharply with the rolling form of the characteristic landscape. These impacts would be most adverse adjacent to Sage Creek Reservoir, as natural landscape variety focuses attention towards the reservoir (see Figures PII-13, PII-14, and PII-15).

Less adverse impacts would result where the transmission line right-of-way traverses landscapes visible at middleground distances. The proposed routing crosses woodland mountainsides east of Sage Creek Reservoir that are viewed repeatedly from the adjacent Yampa Valley (see Figure PII-14). Elements of the transmission line itself would be less visible in these landscapes, but right-of-way clearing and access road construction would produce significant line-dominant minus deviations.

The 69-kv substation, proposed in the SE ¼, SW ¼, Sec. 23, would be visible on the ridgetop from four viewshed sequences (see Figure PII-13). Color and form dominance of this structure would constitute a minus deviation from the characteristic landscape of the ridgetop.

Initial mining operations on Federal coal leases C-081251 and C-081258, scheduled to begin in 1980, would be visible in middleground landscapes (see Figure PII-13). At least a portion of the ongoing mining operation would be visible from 1980 until 1994. Haulroads adjacent to the proposed mining areas would also be visible, though those at lower elevations would be screened from view by natural topography.

The dragline, spoil piles, and ongoing mining would result in strong minus deviations because their line (especially on ridgetops), form, color, and texture (before reclamation) do not borrow from the characteristic landscape. Barren cut and fill slopes along the proposed haul roads would also impact the visual landscape, especially where they traverse steep slopes.

Within the stripping areas, spoil piles would produce a repetitious pattern of sharply angular ridges that are minus deviations in these landscapes. The active pit and adjacent highwall would introduce additional linear form foreign to the characteristic landscape.

At both lease areas, potential exists for mining too close to adjacent escarpments, which could result in dumping mine spoils over these escarpments. The resulting barren talus slopes would assume a vertical triangular form foreign to the characteristic landscape. Potential impact areas can be viewed from viewshed sequences HI, JK, and MN on County Road 37 (see Figure RIII-1, Regional Analysis).

The proposed mine offices and surface facilities could be viewed briefly by southbound travelers on viewshed sequence IJ, County Road 53. Form and color dominance of these structures might produce minus deviations from the characteristic rolling surface of the natural terrain.

If vegetation that is cleared during road construction, or cleared in connection with the mining operation itself, is scattered adjacent to the disturbed areas, or if it is piled and burned, it would produce an aesthetically unconforming landscape of forest litter.

Disposal of refuse and waste from the mining operation could also produce an undesirable landscape of litter if it is not visually screened and properly maintained.

Road, blasting, and coal dust, as well as exhaust emissions would create short-lived landscapes foreign to the environment; these would also be minus deviations from the characteristic landscape.

The overall aesthetic experience at the Seneca 2-W Mine area would also be adversely impacted. Notwithstanding the subjective nature of mood-atmosphere values, the proposed action might adversely impact the area's inherent capability to kindle feelings of isolation, solitude, or respect for nature by disturbing the landscape's natural integrity. This would be especially true adjacent to Sage Creek Reservoir, or at other areas with great landscape variety, or that provide panoramic views, as along the ridgetops. Conversely the mining action might reveal the complexity and massiveness of nature's grandeur that is now hidden, resulting in a beneficial impact upon the area's mood-atmosphere values.

Aesthetic impacts in terms of numbers viewing visible areas would increase commensurate with traffic volume increases (see Chapter II).

Adverse aesthetic impact would have moderately high significance, viewed in a regional context, because topographic exposure of the mining area and associated rights-of-way (the powerline and haul road) to the adjacent Yampa Valley is extensive.

Recreation

Surface mine operations on Federal coal leases C-081251 and C-081258 would temporarily displace big game species from the lease areas and adjacent areas, due to transmission line construction. These displacements would diminish big game viewing opportunities.

Runoff from unstabilized areas on adjacent access and haul roads would result in increased downstream sedimentation. This change could adversely impact downstream fishing capabilities of the Yampa River.

Unknown archeological sites might be destroyed by mining operations and thereby lose their inherent capability to attract and accommodate recreation use, irrespective of existing public access deficiencies. This loss could occur through actual destruction of the resource by mining itself, either by direct removal, by off-site influences (such as seismic damage from blasting), or through vandalism and pot hunting by mine employees. As an index of this potential, total mine employees at Seneca 2-W would number 44 in 1980; that number is projected to remain constant.

Proposed initial highway haulage would create driving hazards for tourists and sight-seers in the form of heavier truck traffic, rocks thrown from dual wheels, and small pieces of coal falling from traveling trucks.

The addition of roads, trails, and stripped areas could beneficially impact the area's capability to attract and support off-road-vehicle (ORV) use. This would be determined ultimately by the relative success of surface mine reclamation efforts, and management decisions that either allow or deny recreational access.

Beneficial impacts would also include increases in rockhounding capabilities, as overburden removal would expose interesting and collectible rocks and fossils.

Greater capabilities for geologic and industrial interpretation would be other beneficial impacts of the proposed action. Through providing public access to vantage points, potentials for informing the visiting public of the physical and economic conditions conducive to strip mine development at Seneca 2-W could be realized. This potential could be developed by erecting signs, distributing interpretive-educational brochures, and by guided tours.

On-site adverse and beneficial impacts have only moderately low local significance. However, potential for off-site impacts, such as those to downstream fisheries, would be moderately significant on a regional basis.

Social Environment

Table PIII-7 presents the population impact by county and community of the development of Seneca 2-W Mine; it also indicates the expected new school enrollment by county. These data were generated by the gravity-employment multiplier model described in Chapter II of the Regional Analysis, Future Social Environment Without the Proposed Action. They represent incremental increases over and above the base scenario presented in the same section of the Regional Analysis.

TABLE PIII-7

Population Impact of Seneca 2-W Mine Development

	1980	1985	1990
Direct Employment at 2-W	44	44	44
Moffat County Total	59	63	64
Craig	59	63	64
Routt County Total	102	106	109
Hayden	26	29	30
Oak Creek	12	13	13
Steamboat Springs	57	58	58
Yampa	8	8	8
Total New Population	161	169	173
New School Enrollment:			
Moffat County	10	12	14
Routt County	19	21	23
Total	29	33	37

Requirements for new social support facilities including housing, medical and allied health care, education, water and sewage treatment, fire protection, and law enforcement are functions of increases in population. Table PIII-7 indicates that development of Seneca 2-W Mine would induce a relatively small increase in population; therefore, impacts on existing social support facilities would be relatively minimal. It is the cumulative impact of several new developments that generates significant new requirements for social support facilities; these requirements are addressed in depth in Chapter III of the Regional Analysis.

The mine is expected to cause an increase in population of about 170 by 1990. Most residential and community facility needs would be met by Hayden, Steamboat Springs, and Craig. Approximately 17 additional acres would be needed for expected community needs. Small housing subdivisions or additional mobile home parks would be expected in or adjacent to these communities, but none between the mine and Hayden.

There have been no expressions of local attitudes specifically oriented toward the development of Seneca 2-W Mine. Rather, attitudes are directed toward the subject of regional and community growth in general, and are therefore examined in Chapter III of the Regional Analysis.

For an extensive analysis of regional impacts, mitigations, and unavoidable adverse effects to which the development of the Seneca 2-W Mine would contribute, refer to the appropriate sections of the Regional Analysis.

Economic Conditions

Table PIII-8 presents the economic impact of development of Seneca 2-W Mine in terms of employment and earnings. These data were generated by the gravity-employment multiplier model described in Chapter II of the Regional Analysis, Future Economic Environment Without the Proposed Action. These data represent the incremental impact over and above the base scenario described in the same section. Note that in each of the benchmark years, the greatest induced employment and earnings impacts from Seneca 2-W Mine development would fall in Routt County.

No adverse economic impacts would be expected to be associated with the development of the Seneca 2-W Mine, because both the direct and induced employment and earnings would be relatively small compared to the economic base of the region.

TABLE PIII-8

Economic Impact of Seneca 2-W Mine Development

	1980	1985	1990
Direct Employment at 2-W	44	44	44
Induced Employment			
Moffat County	11	11	13
Routt County	20	20	21
Total	31	31	34
Direct Earnings 1/	985	1100	1234
Induced Earnings 1/			
Moffat County	104	116	167
Routt County	202	206	267
Total 1/	306	322	434

1/ Thousands of 1974 constant dollars

Transportation Networks

HIGHWAYS

All coal produced by Seneca 2-W Mine (900,000 tons/year) would be used to fire the new Colorado-Ute Hayden Station unit 2, a 250-mw generating unit which began commercial operation in September, 1976. The coal would be transported by truck in approximately 25-ton loads; this would amount to 144 truck loads/day, 250 days/year. This hauling would be concentrated within an 8-hour daytime shift, giving one loaded truck every 3.3 minutes (with returning empty trucks equally as often). This traffic would have to interact with traffic from the Ruby Construction Company's Sun Mine, located slightly to the south. This mine would be transporting about 167,000 tons of coal/year over the same road, bringing the total to 1,067,000 tons/year, raising daily truck traffic to 174 truck trips each way.

The road to be used is Routt County Road 53. A five-mile-long stretch of the road would be used from a point about seven miles south of Hayden, Colorado, at the Seneca 2-W Mine, to a point about two miles south of Hayden, where a specially constructed haul road would leave County Road 53, branching east and then north to terminate at the Hayden power station (see Figures PI-6 and PIII-2 for this route). County Road 53 is an unimproved, two-lane, surfaced (but not paved), light vehicle road. Without extensive improvements such as resurfacing and widening, the road would not stand excessive use without failure.

Increases in accident rates along County Road 53 could also be expected from frequent coal truck traffic along this road; such increases would be difficult to quantify due to the present light traffic over the road. The interaction of Peabody trucks with those of Ruby Construction Company could cause traffic problems or accidents, especially at the Peabody access point to Routt County 53.

Noise levels would also increase significantly due to the coal hauling activities on Routt County 53. Exact levels of such a noise increase have not been quantified for these remote areas.

RAILROADS

Since all coal produced by the Seneca 2-W Mine would be hauled by truck to the Hayden Power Plant, no rail facilities would be used.

Some increases in rail traffic due to equipment hauling for the new mining operation might be anticipated, but since Denver and Rio Grande Western Railroad has a branch line into Hayden, Colorado, any incoming materials could be received there. Trucking of such material into the mine area via Routt County 53 from the railhead at Hayden would be practical. Impacts due to rail traffic should thus be minimal.

AIRLINES

The only real effect that the initiation of Peabody Coal's mining and trucking operations would have is increased passenger loads into the Yampa Valley Airport at Hayden. This airport is now undergoing an expansion, and any increases due to Seneca 2-W would be easily absorbed by the improved airport facility.

Chapter IV

Mitigating Measures

THIS CHAPTER PRESENTS MEASURES THAT WOULD LESSEN OR ELIMINATE THE ADVERSE IMPACTS OF PEABODY COAL COMPANY'S PROPOSED ACTION. THESE MEASURES ARE DISCUSSED IN THREE CATEGORIES: THOSE INCLUDED IN PEABODY COAL COMPANY'S PROPOSAL, THOSE REQUIRED BY LAW OR REGULATION, AND THOSE MEASURES THAT WOULD BE APPLIED AS SPECIAL CLAUSES OR STIPULATIONS TO LEASES OR PERMITS. IN EACH OF THESE CATEGORIES, MEASURES ARE PRESENTED BY IMPACTED ENVIRONMENTAL COMPONENT. BECAUSE SOME MEASURES LESSEN IMPACTS TO MORE THAN ONE RESOURCE, SOME REPETITION OF MITIGATIONS IS UNAVOIDABLE. ALL MEASURES ARE ASSESSED AS TO THEIR PROBABILITY OF IMPLEMENTATION AND/OR SUCCESS. MITIGATING MEASURES ARE PRESENTED AND ANALYZED AS PROCEDURES THAT WOULD BE REQUIRED IF THE PROPOSED ACTION IS APPROVED.

these unavoidable adverse impacts depend on visual exposure of the landscape unit in which they occur. All of these could be seen only from a one-half mile segment of County Road 53 which has a relatively low volume of local resident traffic. The scale of the proposed Ruby Construction operation compared to adjacent landscapes would be very small, commensurate with unavoidable adverse aesthetic impacts.

Destruction of recreation capabilities of unknown cultural resources could not be totally avoided. The relative values of this unavoidable adverse impact is small because of existing access limitations and availability of other similar recreation opportunities in the region. As no public surface having legal public access would be involved, only the private landowner would be immediately affected. The nature of the unknown cultural resource would determine whether significant public values are also present.

All road hazards caused by the increased volume of heavy truck and other mine-related traffic between the Ruby Construction area and Hayden would be unavoidable. Adverse impacts would include these increased traffic hazards to motorists on County Road 53, and increased road deterioration from increased traffic volumes.

Measures Included in the Applicant's Proposal

Geologic and Geographic Setting

In a letter of July 30, 1975, to the Bureau of Land Management from Mr. Alten F. Grandt, Director of Land Use and Reclamation of Peabody Coal Company, the following statement is made with regard to the Seneca 2-W mining:

> Internal spoil ridges will be graded to a rolling contour, with no slope to exceed 25%, superimposed on the natural slope of the area. The objective of the grading pattern is to maximize infiltration of runoff and precipitation. "Gouging" or other soil manipulations will be used to attain this end.
>
> The outslope of box-cut spoils and the highwall side of spoils will be graded to approximately 33%. Residual highwalls will be reduced to about 50% slope. If water collects in the final cut, the highwall slope will be reduced at the water level to a lesser slope to permit safe access by man and animal.

Water Resources and Aquatic Biology

Haul roads and other necessary roads would be stabilized with gravel or an equivalent material to minimize sediment loading of streams due to high erodibility of lease area soils. In addition, all haul and access roads would be protected from erosion by means of riprapping where needed. The impact of road building would be mitigated by the use of culverts at all stream crossings.

A monitoring program would be instituted to detect impacts on aquatic environmental components which would allow early correction of undesirable impacts. This would include both water quality monitoring in the affected drainages and regular periodic examination of biotic communities in these ecosystems, especially benthic organisms.

Throughout the preoperational and mining phases at Seneca 2-W, efforts would be made to preserve the nature and quality of the existing surface water drainage system. A system of siltation dams would be erected on the water courses draining the area, to control any increased sediment load in the mine-area streams due to preoperational construction activities or mining operations. Sediment dams would be designed to handle a "50-year" flood. To prevent excess sedimentation from erosion of the dam itself, they would be vegetated as soon after construction as possible. Sedimentation ponds would be cleaned of collected sediment by draining the pond and removing the sediment with a front-end loader; removed sediment would be redistributed on graded spoil areas; it would be expected to be suitable topsoiling material in texture and composition.

Culverts would be used wherever natural stream beds are crossed to minimize increased sediment load. Where channelization of the existing streambed is necessary, as in the narrow, lower-segment of Hubberson Gulch, runoff effects have been anticipated, and sediment dams would be constructed just below the channels. None of the channelization would increase the overall grade of the streambeds. Flow-energy dissipators, such as boulders, would be placed in the stream channel.

Since the mine area is near the crest of the drainage, the only water expected to collect in the pit would result from precipitation falling directly into the pit, limited runoff from upslope, and seepage from perched water above the pit area. It would run to the low end of the pit where it would be pumped for watering roads, irrigation, etc. Water from the pits not otherwise utilized would be pumped over the highwall into settling ponds.

Air Quality

The primary air quality impact expected from operation of the Seneca Mine is from fugitive dust emissions. Predicted levels of total suspended particulate (TSP) may exceed State annual and 24-hour standards in the immediate vicinity of the active mine.

Three preventive fugitive dust control measures are included in the applicant's proposal: continuous monitoring, watering of exposed areas, and revegetation.

An air quality monitoring program will be set up in order to determine background levels of TSP. The program will be continuous throughout operation of the mine. Data will be used to determine the success of abatement programs.

Application of water to exposed areas such as storage piles and dirt roads will prevent fine particles from becoming airborne; watering is only as efficient as the success in keeping disturbed material wet.

A major mitigative measure for the control of fugitive dust is reclamation of the mine surfaces. As mining proceeds, reclaimed areas are expected to cease to be sources of fugitive dust. Reclamation includes grading, vegetation planting, and other landscaping.

Soils and Terrestrial Flora

Historically, the leasehold area has been used for grazing cattle and sheep. The reclamation plan for the area would be aimed at returning this area to grazing use when mining is finished and at the same time protecting and establishing wildlife habitat in the area. The loss of existing vegetation would be mitigated to the extent that this plan is successful.

The first step in the reclamation process would be topsoil removal; topsoil suitable for plant growth would be removed from the area to be mined using a large self-loading scraper. Suitable topsoil would be removed to depths of 8-18 inches, and either stockpiled for redistribution, or redistributed immediately on graded spoils. As topsoil depths vary throughout the mining area, where it is available greater depths would be removed as needed, to achieve an approximate redistributed depth of 8-18 inches. The criteria used to determine the suitability of topsoil would be those described in BLM Manual 7312-Soils (1/4/74). Immediate replacement of topsoil is most desirable where grazing land is proposed, because some native plant species and microorganisms would be transplanted live, thus speeding reclamation of the mined area. Any stockpiled topsoil would be seeded with annual grasses to control erosion and compete against invading weed species.

Past experience has proven that the brown-colored upper strata provides [illegible] growing conditions, and efforts would be made to return this to the top of the cast overburden, where insufficient topsoil exists for adequate cover this strata will be used. This material would provide a useable growth media for deep-rooting plants and speed the soil-building process because of its fragmentation.

Grading of the spoil would begin as soon as the coal is loaded from the third pit and stripping is started on the fourth. Thereafter, grading would be kept no more than two spoils behind the active pit. By keeping the grading procedure as close to the active pit as possible, the length of vegetation loss would be lessened. Except for the box cut spoil, and the final pit, all slopes would be graded to no greater than 25 percent, and the highwall of the final pit would be sloped to an angle no greater than 50 percent. Grading of the spoils to these angles would increase revegetation potential. The out slope of box cut spoils and the highwall side of spoils would be graded to approximately 33 percent. Grading would be on the contour to induce water infiltration into the spoils. On slopes exceeding 200 feet in length, a surface manipulation practice, such as gouging, will be utilized to induce infiltration and impede runoff.

After grading and topsoil replacing procedures are completed, soil analysis would be performed to determine if any soil amendments would be necessary. The soil test would include pH, calcium, magnesium, phosphorus (both P_1 and P_2), potassium, and nitrogen.

Once spoils are graded and topsoiled, the area would be seeded. On areas with slopes less than 25 percent, farm equipment would be utilized, and seeding done in the fall. After the area is graded and proper slopes attained, the surface would be dragged. The area would then be disced to prepare a suitable seedbed; seed would be distributed with a seeder and immediately covered with a harrow. The operation would be accomplished in one trip by using a tractor large enough to pull a disc, seeder, and harrow in one operation. All surfaces greater than 25 percent would be aerially seeded in the spring; seeding for quick vegetative cover would be timely to control erosion. Berg and Barrau (1973) have done vegetation studies on existing Seneca spoils. On the basis of their research data, a review of relevant literature, past reclamation experience, and similarities between soils at Seneca 2-W and those of Seneca and Seneca 2, the following species of legumes and grasses would be planted in a standardized mixture.

	Lb./acre
Crested wheatgrass (*Agropyron cristatum*)	2
Pubescent wheatgrass (*Agropyron trachycaulum*)	2
Intermediate wheatgrass (*Agropyron intermedium*)	3
Bromegrass (*Bromus inermis leyss*)	4
Fescue-tall (*Festuca* spp.)	2
Orchard grass (*Dactylis glomerata*)	2
Alfalfa - Cody or vernal (*Medicago sativa*)	7
Yellow sweet clover (*Melilotus officinalis*)	2
White sweet clover (*Melilotus alba*)	1
Total seeding rate:	25

In addition to these grasses and legumes, a variety of trees and shrubs would be planted by hand in depressions and valleys that provide a suitable micro-climate. They would also be planted on highwall sides of spoils and on outslopes of boxcut spoils. Areas planted with shrub and tree species would be approximately 15 percent of the disturbed area. These shrubs and trees include the following species:

Russian olive	(*Elaeagnus angustifolia*)
Golden willow	(*Salix* spp.)
Tamarisk	(*Tamarix* spp.)
Serviceberry	(*Amelanchier alnifolia*)
Hansen rose	(*Rosa* spp.)
Chokecherry	(*Prunus virginiana*)
Chinese elm	(*Ulmus parvifolia*)
Pea shrub	(*Caragana* spp.)

The list of species to be planted may be further modified as more information is received from ongoing research in the area. Cicer milkvetch (*Astragalus cicer*) for example, has shown promise in species adaptation trials.

Following seeding, the area would be fenced to exclude sheep and cattle until vegetation is established. Control of the reclaimed surface would be retained by Peabody Coal Company for at least three years following reclamation to assure proper revegetation.

Insofar as possible, roads in the mining area would be constructed from late May to September. After each segment of road is built, shoulders would be covered with topsoil and seeded as part of the reclamation program.

When mining in the area is complete, stripping equipment would be removed and dozers would complete necessary grading prior to seeding and planting. All roads not required or requested to be preserved, would be reclaimed by regrading the slope of road beds, topsoiling, and seeding. Surface structures would be removed, and the area would be cleaned, graded, and seeded.

Fugitive dust would be controlled by watering the roads.

Terrestrial Fauna

To mitigate impacts on livestock and wildlife, Peabody's reclamation plan would be aimed at returning this area to livestock grazing use, and at the same time protect and establish wildlife habitat. A minimum of 15 percent of the reclaimed area would be planted to trees and shrubs. All spoil areas, unused haul roads, and other disturbed areas would be revegetated to reduce the impact on terrestrial fauna resulting from habitat disturbances. Peabody has chosen to maintain a daytime hauling schedule which would help mitigate the potential impact of vehicle-animal collisions. Peabody would continue ongoing wildlife monitoring programs in an effort to provide additional information to assist in mitigating wildlife impacts. Reclaimed spoil areas would be adequately fenced to exclude livestock use until a vegetal cover is re-established. Haul roads would be located and constructed to avoid harassment of any endangered species.

Aesthetics

Mine spoils would be graded at least three spoil ridges behind the active pit in the mature operation. Grading would blend the spoils with natural terrain adjacent to the mining area; this would mitigate the strongly form and line-dominant minus deviations inherent in the spoil piles. Establishment of vegetation to mitigate visual impacts of color and texture-dominant minus deviations would occur approximately three years after spoil pile leveling and seeding.

Planting of trees and shrubs in depressions, on the outslopes of box cut spoils, and on final highwalls after they have been backsloped, would help to increase landscape variety and avoid large grassy areas that do not conform with the characteristics of the adjacent landscape.

Construction of siltation dams would help mitigate potential aesthetic impacts downstream, due to a buildup of floating debris, scum, and silt.

Fugitive dust would be controlled by spraying water; however, it should be noted that this type of control is only approximately 30 percent efficient.

Backsloping road cuts and fills and establishing vegetation on them would help mitigate the strong line and form-dominant nature of these minus deviations. However, if species similar to those on immediately adjacent terrain are not used, there would be deviations from the characteristic landscape in terms of texture and color.

Disposal of mine wastes at the active open pit would help maintain a litter-free landscape, though provision must be made to control wind-blown trash, etc., both at the open pit and at the collection area.

Recreation

Peabody Coal plans to initiate reclamation plans immediately upon opening of the mine (see Terrestrial Flora section of this chapter); grading of spoil piles, construction of siltation dams, and revegetation of both would significantly reduce downstream mine-caused siltation. This would help maintain downstream fishing capabilities.

Transportation Networks

Peabody Coal Company plans to use crushed scoria to resurface Routt County Road 53 and their newly constructed haul road, northeast into the Hayden power plant. The amount of such material would be sufficient to keep these roadways adequately surfaced for the life of the mine;

this resurfacing would be accompanied by widening of the road for coal traffic. These measures would have a significant effect in reducing possible accidents along this stretch. The surfacing of the specially constructed haul road off Routt County 53 would also be done with this same material to make it the same caliber of road as the improved stretch of County 53; the scoria would be mined by Peabody from a local area in Routt County for maintaining the surfacing of the roadway for the life of the mine. One possible area not yet contracted for is at the end of the ridge between Sage Creek and Dry Creek.

The path of the haul road, which goes to a point located southeast of the Hayden power plant and then runs northwest to the plant, was chosen to avoid the traditional dancing ground of the greater sandhill crane, an endangered subspecies in Colorado. This area is located directly to the west of the Hayden power plant.

Measures Required by Law or Regulation

Laws and regulations pertaining to development of the proposed Seneca 2-W Mine grant the Secretary of the Interior, the Environmental Protection Agency, and the Colorado Department of Natural Resources authority to impose measures that would mitigate adverse impacts on the natural and human environment; see Chapter IV of the Regional Analysis for more details.

The Routt County Regional Planning Commission on July 3, 1975 approved a zoning change from Agriculture and Forestry Zone District to Mining Zone District for the area to be mined within the next three years at Seneca 2-W Mine. This zone change was approved contingent to the following conditions:

(1) County Road 27 being widened to three lanes prior to hauling coal, (2) topsoil being replaced, (3) land being returned to the approximate original contour, (4) land being reseeded, fenced to protect vegetation, and revegetated, and (5) any water impoundments that could be developed to store good quality water being included in Peabody's reclamation plan.

Geologic and Geographic Setting

In accordance with 30 CFR 211.40(a)(3), proper grading, terracing, and other reclamation measures would minimize the possibility of erosion, landslide, mud flow, slump, and similar degradational processes. Stripping would be at or near the crest of the main mountain ridge in Sections 14, 23, 26 and 35, T.5N., R.88W. (see Figure PI-6). The company has stated in the letter of July 20, 1975 that "In no case is spoil to be cast over any ridge into Sage Creek drainage area". However, placing spoils at the crest of the ridge could allow sediment to be washed into the drainage. It could also allow mudslides, landslides, or slumps into the drainage area; this would not be permitted.

Paleontology

Measures provided for in the 1906 Antiquities Act and 43 CFR 6010.2(a) and (b)(2), when implemented would provide protection for fossils which are of actual and real scientific significance. This would be accomplished by requiring the lessee to conduct an on-the-ground intensive survey to ascertain the possible occurrence of dinosaur or other significant vertebrate fossil remains. The mine operator is also required to prevent or minimize damage to known or suspected significant paleontological resources pursuant to 43 CFR Subpart 3041.2-2(d).

See the Regional Analysis for a more detailed description of how such surveys would be implemented.

Water Resources and Aquatic Biology

In accordance with 30 CFR 211.40(a)(7), when it is necessary to pump water from one of the pits, pumping would be conducted to minimize the impact on the stream. The procedure would be to pump small quantities of water over a long period of time, rather than large quantities over short periods of time. This would allow the stream to dilute the flow so there would be no large variations in the water quality downstream.

The amount of disturbed, unreclaimed surface area exposed at any particular time would be minimized in order to avoid dramatic increases in erosion and stream sedimentation. All overburden and topsoil spoil piles would be placed in the mining area in a manner that would minimize the potential for increased sediment loading in streams. Channelization of watercourses would be avoided where possible, especially where streambed gradient would be increased, in order to avoid streambed scour.

Since ash from Seneca 2-W coal burned at Hayden Station would probably be buried at moderate-shallow depths in Seneca 2 Mine spoils, extra care would be exerted in the ash disposal area to prevent erosion. Overgrazing or other misuse of this area following reclamation could lead to rill and gully formation severe enough to reach the ash and deposit it into Grassy Creek, and eventually into Yampa River.

Two wells and a spring would be destroyed in the area because of the mining operations; if it is deemed desirable these water sources would be replaced (30 CFR 211.40(a)(7)). Road construction would best be done in summer and late fall when runoff would be negligible (30 CFR 211.40(a)(11)).

The sum of all of the various mitigating measures would reduce the sediment yield from the reclaimed mine spoils by about 90 percent for a total annual reduction of 400 tons. The mitigation measures would reduce the sediment produced from road construction by about 80 percent for a total reduction of 1,090 tons.

The Colorado Department of Health, the agency that has primary responsibility for water pollution control in the study region, has published a booklet (1974) describing standards included in the Water Quality Control Act of 1973, consistent with the goals and policies of the Federal Water Pollution Control Act amendments of 1972. These standards cover water quality with respect to sludge, debris, toxic materials, and other materials undesirable for aquatic life. The Colorado Department of Health, Water Quality Control Commission, adopted rules as of August 21, 1975 that require discharge permits and present effluent limits for BOD_5, suspended solids, fecal coliform, residual chlorine, pH, and oil and grease. These are fully described in Chapter IV of the Regional Analysis, along with sampling techniques and analysis standards necessary to obtain a required permit for waste water discharge into any and all surface or subsurface waters in the State.

Air Quality

Total suspended particles (TSP) represent the only major source of air quality degradation at the Seneca Mine. Emissions of particulate matter are regulated by Federal and Colorado Law. Regulation No. 1, Emission Control Regulations for Particulates, Smokes, and Sulfur Oxides for the State of Colorado, Section II.D. Fugitive Dust, prohibits mining operations without a permit that specifies fugitive dust control measures. Many of the control measures suggested in Regulation No. 1 are already included in the applicant's proposal.

One additional measure which should be included is sequential blasting to reduce the amounts of unconfined particulate matter. The function of blasting, the break-up of material so that it can be moved, can be accomplished without the production of a large fraction of very small particles by proper sequencing and control of amounts of explosive.

The U.S. Department of Interior, BLM, also has coal mining operating regulations (CFR 43, part 3040) which require applicants to detail strategies for controlling air pollution emissions. Revegetation is an important part of this regulation. Revegetation and land reclamation can be 100 percent effective in the long-term. Short-term measures which must be specified by applicants include the size and timing of blasting and mechanisms for prevention of fires. The efficiency of these controls is difficult to assess.

Soils and Terrestrial Flora

The Routt County Regional Planning Commission on July 3, 1975, approved a zoning change from Agriculture and Forestry Zone District to Mining Zone District for the area to be mined within the next three years at Seneca 2-W Mine. This zone change was approved contingent to the following conditions: topsoil being replaced, and land being returned to the approximate original contour. Compliance with these requirements of the zoning change would lessen the impact of the mining operations on the soils of the lease area.

The Endangered Species Act of 1973 provides for the conservation, to the extent possible, of plant species facing extinction. If species in this category were found on the Seneca 2-W lease their protection would be provided for by the enforcement of this act. Because species in these categories are not easily identified, it is very likely that they would go unnoticed, and therefore unprotected.

43 CFR Subpart 3041.2-2(b)(1) and 30 CFR 211.40(a)(1) require that the operator reclaim affected lands pursuant to his approved plan, as contemporaneously as practicable with operations, to a condition capable of supporting all uses which such lands were capable of supporting prior to mining. Compliance with this regulation would keep to a minimum the amount of area void of vegetation (thus subject to erosion) at any given time.

30 CFR 211.10(c)(2) assures that baseline climatic, soils, vegetation, wildlife, and current land use information would be collected prior to mining, and would then be utilized to determine the best land use or uses after mining, and the best

ways of achieving the chosen uses. These data would provide the best basis to evaluate the success of reclamation on any given area.

30 CFR 211.10(c)(6)(xii) requires that a mine plan include logs and analysis of overburden samples of each stratum from a number of drill holes sufficient to obtain a representative sample of the overburden overlying the coal, and the stratum immediately below the coal to be mined, and that each stratum be analyzed for the following: nitrogen, phosphorus, potassium, pH, specific conductance, exchangeable sodium percentage, sodium absorption râtio, texture, sulphates, and soil-moisture holding capacity. This regulation requires that these analyses be used to determine which materials would be buried and which materials are suitable for placement near the surface for favorable propagation of vegetation. Compliance with this regulation and 30 CFR 211.40(a)(2), requiring grading methods that ensure stability and cover all acid-forming or toxic materials, would create a subsoil medium suitable for plant growth. To comply with this regulation the high salt overburden material above the Lennox coal seam identified in Chapter III would be buried below the plant rooting zone. The non-toxic sandy strata immediately above the Wadge seam would be placed over the high salt material before topsoil is replaced. Also, the high salt material above the Lennox seam would not be placed in close proximity to the proposed lake.

30 CFR 211.40(a)(4), 43 CFR Subpart 3041.2-2(f)(4) and the Colorado Mined Land Reclamation Act (H.B. 1065) require that topsoil be removed separately for replacement on backfill areas, and if not so utilized immediately, that it be segregated from other soil material. If such topsoil is not replaced on a reshaped area within a time short enough to avoid deterioration of the topsoil, vegetative cover or other means would be employed so that the topsoil is preserved from wind and water erosion, remains free of any contamination by other acid or toxic material, is protected from establishment of noxious weeds, and is in a usable condition for sustaining vegetation when restored during reclamation. Therefore, topsoil stockpiles would not be placed in areas of water accumulation. Also, after disturbed areas have been regraded, and topsoil replaced, if equipment has compacted the soil so that root and moisture penetration would be restricted, and thus the topsoil not in a condition for sustaining vegetation, the area would be chiseled or ripped in a manner to loosen the soil.

To assure that topsoil be in the best condition to sustain vegetation, every effort would be made to remove topsoil from areas to be mined, and replace it directly on reshaped spoils, thereby transplanting some native species live, retaining a degree of soil structure, and allowing the existing micro-organism population to continue functioning. Also, for the topsoil to be in the best condition for sustaining vegetation, it would be replaced in the spring or fall so the area can be seeded immediately to perennial vegetation to protect against erosion and weed invasion. If topsoil cannot be replaced immediately and is stockpiled for periods longer than a year it would be seeded with perennial species to avoid deterioration of the topsoil.

30 CFR 211.40(a)(2) and 43 CFR 3041.2-2(f)(2) require that spoil reshaping restore the approximate original contour, and 30 CFR requires the operator to establish a vegetative cover native to the area. To comply with this regulation, spoil shaping and replacement of the topsoil would be designed to create various microclimatic conditions that are characteristic of the differences in soils and exposure that produce the diversity in the existing vegetation. On areas to be returned to wildlife habitat (native vegetation) seed mixtures would be varied according to microclimatic conditions produced by the shaping process. Also, to the extent possible, native trees and shrubs would be transplanted from unmined areas to reshaped areas to decrease the impact of native vegetation loss. Mature tree and shrub transplanting and bare root stock transplanting would be done in areas of most favorable soil moisture conditions produced by shaping and topsoil replacement operations, and to steep areas to provide soil stability.

30 CFR 211.40(a)(13)(i) requires the operator to establish on regraded spoils and all other affected lands a diverse vegetative cover native to the area and capable of regeneration and plant succession, at least equal in density and permanence to the natural vegetation; therefore, to minimize the loss of existing vegetation the seedings on disturbed areas would include as many native species as possible with the addition of introduced species that have proved successful locally in stabilizing disturbed areas. Also, to assure that reclamation, and thus successful revegetation, is accomplished as contemporaneously as practicable, where final

grading creates surfaces amenable to farm equipment, seeding would be done by a rangeland drill or suitable equipment that will bury the seed at a constant depth on rough terrain, and thus increase vegetation establishment. To assure vegetative growth all seedings of perennials would be confined to late fall and early spring.

30 CFR 211.40(a)(3) requires that the operator shall stabilize and protect all surface areas, including spoil piles, affected by the coal mining and reclamation operation, to effectively control slides and erosion. Therefore, all road cuts and fills would be seeded as soon as possible following construction to minimize erosion. If construction is finished in the spring or fall, perennial vegetation would be seeded; otherwise, an annual grass would be seeded to provide temporary erosion control and compete with invading weed species. Also to control erosion in areas of extremely adverse soil moisture conditions or very steep slopes, a mulching practice, such as straw or hydromulch, would be used. To comply with this regulation where slopes are greater than 33 percent, or replaced topsoil is rated poor because of a high clay content, a surface manipulation practice would be implemented to impede runoff and induce infiltration, thereby controlling erosion and increasing revegetation attempts.

To assure establishment of permanent vegetation (30 CFR 211.40(a)(13)(i)), after replacement topsoil fertility levels would be determined and fertilizer applied, with rates and composition dependent upon the requirements of the plant species being seeded. If fertility levels are too low for seedling establishment, fertilizer would be applied shortly after seedling emergence, unless seeded in early fall, in which case it would be applied in early spring following seeding. If soil fertility levels are adequate for seedling establishment but not for sustained growth, fertilizer would be applied in the early spring of the second growing season. Where soil fertility rates are very low and plant growth is deficient, a maintenance fertilization program would be implemented until the soil system is self-maintaining.

30 CFR 211.62(b) requires that revegetated areas be evaluated by the Area Mining Supervisor to determine whether satisfactory vegetative growth is being established, or whether additional revegetation efforts should be ordered. Therefore, if climatic or soil conditions are such that revegetation attempts fail on the affected area, the area would be recovered with suitable topsoil and/or reseeded until vegetation is established. As mining proceeds on the Seneca 2-W lease, if adverse soil conditions prevent revegetation, the areas would be recovered with topsoil from the panels to be mined from 1993-95. This area has the best quality and the deepest (up to 55 feet), topsoil, and because it is the last area to be mined, there may be sufficient surplus to this material to be used on areas where existing topsoil is deficient.

30 CFR 211.40(a)(14)(ii) requires that revegetated areas would be fenced to regulate public access and protect the area from uncontrolled livestock grazing. Therefore, all revegetated areas would be fenced immediately after seeding, and grazing would not be allowed until the third growing season, and would then not be allowed during the spring or early summer when plants are growing rapidly.

Implementation of all of the measures in this section would greatly increase reclamation potential; however, because strip mining creates large changes in the plant growth medium, and because current reclamation practices have not been utilized for a long enough period of time to adequately access their ability to return mined lands to the composition or production levels of existing plant communities, a ten percent decrease in production has been projected.

30 CFR 211.1(d)(1)(ii) requires that all current mine plans, such as Seneca 2-W, will be resubmitted on or before November 17, 1977 and must comply with all of the provisions in 30 CFR 211. Compliance with this regulation will provide additional baseline data which, when received may indicate a need for additional mitigating measures.

Terrestrial Fauna

Colorado law makes it unlawful to harass, in any way, species listed as endangered by the State. Critical habitat for greater sandhill crane is located in the Hayden area. Peabody's coordination with the Colo. DOW would help mitigate any adverse impact on this and perhaps other species.

In accordance with CFR 30.211.40(a)(6), all core holes would be filled with a mud or cement substance to mitigate loss or damage to all animals.

To reduce the impact of the proposed haul road on wildlife and their habitat, CFR 3041.2-2(e)(11) and CFR 30.211.40(a)(11), states that the operator shall design all roads and powerlines in a manner that will minimize damage to fish and wildlife habitat. This would require the operator to use all cut material in road construction as fill, or haul excess material away and deposit it on existing spoil piles, rather than pushing the excess off the side of the road, and increasing the amount of disturbed vegetation.

In accordance with CFR 211.4(d), the operator shall take such action as may be needed to minimize adverse impacts upon fish and wildlife. To accomplish this goal it would be necessary to seed all disturbed roadsides as soon as possible after completion of the road construction.

By complying with CFR 211.40(a)(7), some impacts on the aquatic ecosystem, and thereby on a segment of the food web of the area's terrestrial wildlife, would be mitigated. This reference states that the operator shall utilize the best practicable commercially available technology to minimize disturbance of the prevailing quality, quantity, and flow of water in surface water systems.

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In accordance with CFR 211.40(a)(14) and CFR 3041.2-2(a)(14), the operator shall regulate vehicle traffic, wildlife and livestock grazing in all areas of active operations, including lands undergoing reclamation, in order to protect wildlife and livestock from hazards associated with such operations, and to protect revegetated areas from unplanned and uncontrolled grazing. This would require fencing of all work and reclamation areas to exclude wildlife and livestock.

Archeological Resources

Legislative backing for protection of archeological resources comes from a variety of legislation. The Regional Analysis contains a detailed accounting of how these regulations would be implemented.

The 1906 Federal Antiquities Act (P.L. 59-209; 34 Stat. 225) makes it illegal to damage, destroy, appropriate, or excavate any historic or prehistoric object; to help enforce these provisions, issuance of antiquities permits to qualified professionals for purposes of conducting surveys, testing, and excavation on Federal lands is also required. Authorization for the Secretary of the Interior to maintain the National Register of Historic Places is given by the 1966 Historic Preservation Act (P.L. 89-665; 80 Stat. 915); the Advisory Council on Historic Preservation is also established by the Act. All Federal actions affecting existing or proposed National Register Properties must be reviewed by the Advisory Council (according to Section 106 of the Act). The National Environmental Policy Act of 1969 (NEPA) (P.L. 91-190) also identifies the Federal Government's continuing responsibility to preserve important historic and cultural aspects of our national heritage. Establishment of the Federal Government in a leadership role of preserving, restoring, and maintaining cultural resources was accomplished by Executive Order 11593, 1970 (36 FR 8921). Most recent Federal legislation is the Archeological and Historical Data Conservation Act of 1974 (P.L. 93-291) which requires protection of cultural resources affected by any Federal or federally licensed construction project. These provisions would be implemented by requiring intensive cultural resource surveys that not only identify all sites, but also evaluate their significance.

Additional legislative backing is provided for protection of cultural resources in 43 CFR, Subpart 3041.2-2(d), which directs Peabody to take action to protect known and suspected cultural resources identified by the required intensive surveys. This would be accomplished by constructing fenced exclosures, interpretive signing, etc. as apestablished by this Act. All Federal actions affecting existing or proposed National Register Properties must be reviewed by the Advisory Council pursuant to Section 106 of the Act.

Cultural resources were given additional protection through establishment of the Federal government's leadership role in preserving, restoring, and maintaining cultural resources by Executive Order 11593, 1970 (36 F.R. 8921). Specifically required is consultation with the Advisory Council on Historic Preservation to assure that Federal actions would contribute to preservation and enhancement of non-federally owned sites and structures of historical, architectural, or archeological significance. Section 2(b) specifically requires the Department to exercise caution to assure that any federally owned property potentially eligible for inclusion on the National Register is not inadvertently damaged or destroyed.

Most recent legislation granting protection to cultural resources is contained in the Archeological Conservation Act of 1974 (P.L. 93-291; 88 Stat. 174) which specifically directs the Department to conduct, or cause to be conducted, surveys to prevent the loss of significant historical or archeological data that might be caused as a result of any federally licensed project. The act further requires the lessee, by extension, to analyze, recover, and preserve significant specimens and to publish the results.

Protection of cultural resources on State-owned lands is provided by the Colorado State Antiquities Act of 1973 (H.B. 1569), which is largely a parallel form of the 1906 Federal Act. The State of Colorado reserves to itself title to all antiquities lying on State-owned land. In addition, the State requires State antiquities permits for survey and study on State-owned lands, and grants or denys permits for investigating, collecting, and studying cultural resources thereon.

The National Environmental Policy Act of 1969 (P.L. 91-190) also identifies the Federal government's continuing responsibility to preserve important historic and cultural aspects of our national heritage.

Title 43 CFR, Subpart 2801.1-5(a) and 2801.1-5(h), Rights-of-Way; Terms and Conditions, also requires that cultural resources be identified and protected in right-of-way construction. The foregoing Federal and State laws are applicable to coal-related projects for which the rights-of-way would be approved, and include other regulations necessary to render such rights-of-way approvals compatible with the public interest. The foregoing regulations are therefore required to be adhered to and enforced as conditions upon which right-of-way approval would be granted.

Additional legislative backing is provided for protection of cultural resources in 43 CFR, Subpart 3041. Sec. 3041.2-2(d) directs the applicant to take action to protect known and suspected cultural resources. These would be identified by the required intensive surveys.

Title 43 CFR, Subpart 2801.1-5(a) and 2801.1-5(h), Rights-of-way; Terms and Conditions also requires that cultural resources be identified and protected in right-of-way construction. The above Federal and State laws are applicable to coal-related projects for which rights-of-way would be approved, and include other regulations necessary to render such rights-of-way approvals compatible with the public interest. The foregoing regulations are therefore required to be adhered to and enforced as conditions upon which right-of-way approval would be granted.

The foregoing legal provisions would be implemented by requiring intensive cultural resource surveys on all areas subject to terrain alteration, to be completed by the lessee. The survey would include:

1. An archival search of archeological records, survey-evaluation documents, and site files concerning the nature and extent of the area's cultural resources,

2. Interviews with local collectors and informants,

3. The actual on-the-ground intensive survey, with evaluations of National Register significance and recommendations for further study, testing, and/or excavation,

4. Subsequent testing and excavation of significant sites potentially impacted,

5. Recommendations, on a location-specific basis, as to whether or not a qualified archeologist needs to be present during mining or other alteration.

The lessee would then be responsible for nominating significant sites to the National Register of Historic Places through the State Historic Preservation Officer (SHPO). Thereafter, and prior to initiation of any terrain-altering activities, at the discretion of the BLM and in conjunction on all disturbed lands is required by 43 CFR Subpart 3041.2-2(f)(13)(i); this would help mitigate visual impacts on denuded areas. This is also provided for in 30 CFR Part 211.40(a)(13)(i). Part 1-f, Section 34-32-116, of the Colorado Mined Land Reclamation Act (H.B. 1065) also directs the establishment of a self-sustaining long-term vegetative cover. These revegetation efforts would begin as soon as possible following cessation of surface-disturbing activities. Adverse visual impacts would be rendered less harsh by arranging plantings and seedings in an irregular pattern.

All proposed mine offices, shop-warehouses, and other buildings would be built as low-profile as possible. They would also be painted a non-reflective warm green, brown, or buff color that borrows from adjacent landscape colors. Screening and loadout facilities would be similarly painted; silver-colored metallic finishes would be avoided. Transmission line support structures, if wooden, would be penta-treated if they cross foreground or middleground landscapes; however, creosote-treated poles would not be used due to their dark color. If steel lattice towers are used, they would be finished in a non-reflective olive drab or other earth-tone to avoid harsh line dominance produced by glare. Also non-reflective or non-specular conductors would be used throughout the length of the line, because most of the route is visible from several public roads.

Peabody would also maintain a litter-free landscape by screening refuse disposal and storage areas, and by regularly disposing of discarded equipment, waste, and litter. 43 CFR Subpart 3041.2-2(f)(8) requires Peabody Coal to dispose of rubbish to prevent air pollution. Section 34-32-116, Part 1-e of the Colorado Mined Land Reclamation Act (H.B. 1065) directs refuse disposal in a manner that would control unsightliness.

Also part 1-i, Section 34-32-116, of the Colorado Mined Land Reclamation Act requires that off-site areas be protected from slides or other damage due to mining or reclamation. Implementation of this constraint would prevent the dumping of mine spoils over steep slopes or escarpments, and the resultant form-dominant visual intrusions.

Regulation No. 1, Emission Control Regulations for Particulates, Smokes, and Sulphur Oxides for the State of Colorado, Section II-D, Fugitive Dust (Colorado, 1971), prohibits mining operations from occurring without a permit that specifies fugitive dust control measures. Implementation of these measures would reduce potential for atmospheric haze. In addition, 43 CFR 3041.2-2(f)(11) requires Peabody Coal to construct and maintain all roads and other utility access facilities in a manner that would minimize, control, or prevent fugitive dust. Regular sprinkling with water, or oiling would be required to control dust on all haul and access roads; such dust control measures are approximately 30 percent efficient.

The Colorado Department of Health's water quality standards (1974) provide regulations consistent with the provisions of the Federal Water Pollution Control Act amendments of 1972. Enforcement of this legislation would prevent the proposed mining operation from contributing floating debris, scum, and discoloration to the Yampa River or other downstream waters.

Impacts to mood-atmosphere values caused by increased noise levels can be partially mitigated by implementing the provisions of Colorado Senate Bill 197 (1971) which establishes maximum permissible noise levels and abatement procedures. Federal noise pollution guidelines are outlined in P.L. 91-604, The Clean Air Act, Section 401—Noise Pollution and Abatement Act of 1970. The Office of Noise Abatement and Control, established by this Act, provides for enforcement of the guidelines contained in the Act. Enforcement of these laws would achieve the lowering of noise levels adjacent to Seneca 2-W and the Yoast area.

These regulations and legislative enactments would be effective only to the extent that they are enforceable, that the standards set forth are indeed enforced, and that these minimum standards are actually effective in reducing the impacts. The probability of all of these actually being enforced on the ground is something less than 100 percent, as evidenced by impacts presently occurring from similar ongoing operations in the region. Also, 43 CFR 3041 and 30 CFR 211 do not apply to that portion of the 69-kv powerline that lies outside the lease area; that portion is therefore subject to less restrictions, especially because there is no assurance that non-reflective conductors would be used.

Recreation

Title 43 CFR Subpart 3041.2-2(f)(1) and 30 CFR Part 211.40(a)(1) requires Peabody Coal Company to reclaim the affected lands as soon after disturbance as possible, to a condition at least as capable of attracting and sustaining recreation use as now exists. These regulations require recognition of recreation resource values identified in this analysis. The subsequent application of several mitigating measures is also needed to comply with these as well as other applicable Federal and State laws and regulations.

Water quality standards established by the Colorado Department of Health (1974) provide regulations that would be used to mitigate impacts to recreation resources. All State waters are thereby required to be free of substances or conditions toxic to plant, animal, or aquatic life, that produce undesirable aquatic life, and that impart any undesirable taste to fish flesh or make fish inedible. 43 CFR Subpart 3041.2-2(f)(7) further requires Peabody Coal to minimize, control, or prevent disturbances of the prevailing quality of surface water. Subpart 3041.2-2(a)(5)(iv) prevents impoundments from adversely affecting downstream water quality. This is also affirmed by 30 CFR Part 211.40(a)(5)(iv). More specifically, Subpart 3041.2-2(f)(11) directs the mine operator to design, construct, and maintain all roads, rights-of-way, and attendant facilities in a manner that will prevent damage to fish or wildlife or their habitat. Implementation of these regulations would prohibit mine-caused damage to the recreational potential of downstream fisheries in the Yampa River and adjoining tributaries.

The Colorado Mined Land Reclamation Act (H.B. 1065) contains several provisions for mitigating recreation impacts. Section 92-13-6 describes the duties of mine operators. Part 1-f directs the disposal of refuse in a manner that would control deleterious effects. Enforcement of this regulation would prohibit actions which would indirectly impact downstream recreational fishing potential.

Earth mounding and shaping techniques would be employed to increase recreational opportunities on mined-over areas. Within the basic rolling vegetative type, waterways and ponds would be constructed to increase aesthetic attractiveness and wildlife viewing opportunities. Mounding and shaping would create more ecologic niches and additional cover, and subsequently more wildlife viewing opportunities. 43 CFR Subpart 3041.2-2(a)(5)(iii) requires the operator to ensure that water impoundments and retention dams would provide adequate safety and access for reasonably anticipated recreational water users. This is also provided for by 30 CFR Part 211.40(a)(5)(iii).

The mine operator would allow the public to use lands owned by him for recreational purposes except in areas where he determines such use to be hazardous or objectionable; Section 34-32-116, Part 1-j, of the 1973 Colorado Mined Land Reclamation Act contains these provisions in accordance with Article Four of Chapter 62, Colorado Revised Statutes, 1963. 43 CFR Subpart 3041.2-2(f)(14) requires Peabody Coal Company to allow public access to and upon Federal lands within Federal coal leases C-081258 and C-0114093 unless such access would unduly interfere with his authorized use. However, public access is also to be regulated to protect the public from hazards. Coal Mining Operating Regulations in 30 CFR Part 211.40(a)(14) also requires this access to be provided and regulated. Implementing these regulations would increase the supply of available recreation lands and help meet the increasing regional demand for recreation resources and facilities.

The recreational value of archaeological and historical resources would be mitigated as outlined under those headings in Chapter IV.

The degree to which these legislative enactments would be successful in mitigating impacts would be dependent upon their actual on-the-ground enforcement. Based upon past observations of similar coal mining operations, enforcement of current laws have not been complete in mitigating applicable impacts.

Transportation Networks

The measures applicable to transportation considerations are covered in detail in Chapter IV of the Regional Analysis. Peabody Coal Company has stated its intentions to meet all such stipulations in its transportation plans (e.g. use of Routt County 53 and the coal haul road to be constructed).

Measures to be Included if Authorization is Granted

Monitoring of water quality in Dry Creek upstream and downstream from the mined area would identify the significance of added dissolved solids attributable to leaching of mine spoils. If mitigating measures were indicated, the most effective method would be to reduce infiltration through the spoil by encouraging prompt revegetation that includes deep-rooted, woody plants.

Terrestrial Fauna

Existing roads would be used whenever possible to reduce vegetation disturbance. All disturbed areas, such as temporary roads and exploration drill pads, would be reclaimed as soon as possible to mitigate habitat losses.

All non-essential off-road-vehicle use would be prohibited to reduce the impacts on vegetation and soil productivity that would result from this type of activity.

All pad areas and roads created during the installation of the 69-kv powerline would be reseeded as soon as possible after the powerline's construction. Vegetation between the power poles would not be disturbed unless absolutely necessary.

The operator would reclaim affected lands to a condition capable of supporting all practicable uses, which such lands were capable of supporting, immediately prior to any exploration or mining.

Ponds and stocktanks would be created on reclaimed spoils as soon as possible to mitigate potential water losses to the terrestrial fauna.

To mitigate expected alteration of the existing ecosystem due to the proposed revegetation plan, it would be necessary to make every effort to return mined areas to existing soil and vegetal condition. Microenvironments, macroenvironments, slopes, and aspects would closely approximate existing conditions to reduce long-lasting impacts on terrestrial fauna; (for more information on this approach, see the mitigations proposed under Soils and Terrestrial Flora Sections).

High rodent populations expected to utilize revegetated areas would reduce natural capabilities to quickly establish a self-sustaining floral cover; to mitigate this impact it would be necessary to control these rodents.

All topsoil that would be stored would be placed within sagebrush vegetation type to avoid disturbing the mountain shrub habitat type. After the initial cuts have been made, all new stockpiled soil would be located on spoil piles so no additional areas will be disturbed.

Peabody should work closely with the Colorado DOW to insure that game populations within the lease area are managed in accordance with regional plans; access for proper game harvesting would be encouraged.

Recreation

Speeds of haul trucks traveling on the unsurfaced portion of County Road 53 would be reduced to avoid throwing rocks into on-coming sightseeing and recreational traffic, and to maintain overall highway safety.

Transportation Networks

A traffic control device, such as a flashing light or other traffic light, would be placed at the access point to Routt County 53 of Seneca 2-W, to mitigate unfavorable interactions with Ruby Construction Company trucks and with other increased traffic volumes on County 53.

Chapter V

Adverse Impacts Which Cannot Be Avoided

THIS CHAPTER PRESENTS THE RESIDUAL ADVERSE IMPACTS OF PEABODY COAL COMPANY'S PROPOSED ACTION THAT WOULD REMAIN AFTER APPLICATION OF THE MITIGATING MEASURES DISCUSSED IN THE PRECEDING CHAPTER. THE FOLLOWING DISCUSSION COMPLETES THE ANALYSIS EQUATION: IMPACTS MINUS MITIGATIONS EQUALS ADVERSE IMPACTS WHICH CANNOT BE AVOIDED.

Adverse environmental impacts which cannot be avoided would include alteration of the surface from its present natural contours to a mixture of natural and man-made forms. Higher rates of erosion could be expected from reclaimed areas than from the remainder of the mountainside.

Impacts to all fossils would be difficult to mitigate; some would most certainly be destroyed, given the nature of the stratigraphic section.

The unavoidable loss of coal in this operation, if estimated at ten percent of the 12-foot-thick Wadge bed, would be about 2,160 tons per acre. Figures provided by the company, and experience at the Seneca Mine, project loss at 8.15 percent and 1,742 tons of coal per acre, which would amount to loss of about 1,700 tons per acre. In the area where the Sage Creek seam is to be mined the projected loss is approximately 570 tons per acre, assuming a loss of 8.15 percent and 1,742 tons per acre. In the area where the Wolf Creek seam is to be recovered, the loss is projected to be approximately 2,550 tons/acre, assuming a loss of 8.15 percent, 1,742 tons per acre, and an average thickness of 18 feet.

Strip mining would disrupt the natural ground water recharge system, destroying the springs and reducing the natural ground water flow to the streams. Water supplied by the springs could be replaced by the use of wells, but the reduction of normal ground water flow into the streams could not be avoided. This reduction in flow would be small in volume and not likely to have any serious consequences. The impact on the water quality in the stream could be only partially mitigated by steady, rather than intermittent, pumping from the mine pits.

The unmitigated sediment yield from the proposed mine would be about 40 tons per year, and the unmitigated sediment yield from the haul road would be about 270 tons per year. These unavoidable additions should not significantly impact aquatic communities within the boundaries of the analysis area, except during peak runoff of spring snowmelt and severe summer thunderstorms. During these peak runoff periods, local aquatic communities could be significantly impacted by the increased accumulation of silt in critical habitat areas and the loss of individual organisms. This temporary increase in sediment could also permanently affect the aquatic ecosystem by decreasing the diversity and abundance of its benthic fauna and periphyton components.

Air quality during mining operations would be degraded in terms of all the presently regulated pollutants: suspended particulates, carbon monoxide, oxidants, sulfur dioxide, nitrogen oxides, and hydrocarbons. Mining could not be performed without air pollutant emissions from vehicles and generation of fugitive dust. Visibility in the vicinity of the mine would also be decreased. Estimates indicate that total suspended particulate regulations would be exceeded near the mine. No other degradation in excess of standards would be expected.

Soil disturbance (see Table PV-1) and loss of productivity would be unavoidable.

TABLE PV-1

Acres of Soil Disturbance Associated with Peabody's Proposed Mining Operations

Years	Seneca 2-W
1969-79	96
1980-85	470
1986-90	311
1991-95	93

On the area to be mined, partial alteration of all soil horizons, parent material, and soil characteristics which have developed over long periods of geologic time could not be avoided. Present soil biota and soil-forming processes would be altered in a negative manner. Once mining is completed and the area reclaimed, soil development would have to start again. As an end result, new soils would be formed with characteristics unlike those existing prior to mining, and the soil disturbance would lower the natural soil productivity of the area approximately ten percent. Approximately 1,000 acres of existing vegetation would be unavoidably destroyed during the 15-year life of the Seneca 2-W Mine. Vegetation would be permanently removed on approximately 315 acres. The existing stage of plant succession would be unavoidably lost when vegetation is removed. Return to native vegetation would depend upon the speed and success of reclamation efforts, and natural invasion. Since Peabody plans to use only a few native species, return to native vegetation would depend almost entirely on natural succession, and would be slow at best. The soil and microclimatic conditions produced after mining could be very different from existing conditions, thus making it impossible to establish and sustain native vegetation. If replacement of topsoil does not encourage invasion of native plants, loss of existing vegetation would be an unavoidable impact. Even on areas successfully revegetated, a 10 percent reduction in productivity has been projected. The most obvious change in vegetation on reclaimed lands would be an estimated 75 percent decrease in the tree and shrub components. Removal of approximately 50 acres in grain production caused by the haul road to the power plant would be unavoidable.

Heavy equipment noise would create an unavoidable impact on most wildlife species; however, it may benefit some animals by driving them away before they are killed. Probability of vehicle-animal collisions would increase with an increase in human activity, and cannot be avoided without construction of fences and passes, over or under existing roads. Traffic on the proposed road would not be expected to be heavy enough to justify this action at the present time. Removal of vegetation, topsoil, and overburden would be an unavoidable impact and a permanent loss to the existing ecosystem. Nest and den destruction cannot be avoided. Habitat components and exact faunal species composition ratios would not be expected to return to their present status. Loss of small mammals, reptiles, amphibians, young unfledged birds, and invertebrates that are not mobile enough to escape from the mining progression could not be mitigated without trapping and transporting animals out of the mine area. Displacement of more mobile species of wildlife such as deer, elk, coyote, fox, and fledged birds from the mining area cannot be mitigated; all or most of these relocated animals would probably be lost. Expected increases in rodent population during the revegetation program would almost certainly result in a corresponding but time-lagged increase in the numbers of coyotes, fox, snakes, and raptors. Off-site loss of habitat for a variety of wildlife species due to the population increase related to the mine's construction and operation would be unavoidable. There would be a short-term loss of livestock food for the long-term establishment of a self-sustaining floral community resulting from fencing revegetated areas.

Presently unknown subsurface archeological sites could be subject to damage by vandalism and pothunting; the significance of this impact is unquantifiable, as it would depend upon the nature of the unknown resource. Other impacts would also result from salvage excavation, as well as unnecessary excavation of significant archeological sites.

Historical features would also be subject to impacts from vandalism and pothunting.

Given the foregoing mitigating measures, the net residual of adverse impacts should be significantly reduced. However, several visually incongruous elements, or minus deviations, would not be mitigated; the proposed surface-mining operations would unmistakably alter the characteristic landscape on a long-term basis. Adverse aesthetic impacts from haul road construction would not be mitigated until they are abandoned and reclaimed. Impacts of all surface disturbances would remain until revegetation has occurred. Negative impacts resulting from the strip mining operation itself would remain prior to reclamation: approximately 57 acres at any one time. Following reclamation, minus deviations of form, color, and texture would only be mitigated as vegetation is successfully re-established. All aesthetic impacts due to dust and noise levels could not be totally mitigated; size of the area, adverse winds, nature of overburden blasting, and coal loading procedures all make total dust control unfeasible.

Adverse impacts on the area's mood-atmosphere qualities would remain unmitigated for the life of the mine. Relative values of these unavoidable adverse impacts depend on the visual exposure of the landscape visual units in which they occur. Travelers from other regions within the State as well as out-of-state visitors have visual access to Federal coal leases C-081251 and C-081258 from U.S. Highway 40. Impacts visible from U.S. 40 would be viewed by more travelers, and would therefore be most significant. The scale of the proposed coal mining operations at Seneca 2-W would be moderately large; compared to adjacent landscapes, they occupy a relatively small area but can be seen often. The degree to which unavoidable adverse impacts affect viewers would be commensurate with this exposure. Although realinement of that portion of the proposed powerline lying west of Federal coal lease C-0114093 would avoid visual encroachment upon the immediate foreground landscape of Sage Creek Reservoir, the Department cannot ensure this will happen, because this portion of the route lies outside the scope of the Federal action. These adverse impacts therefore also would not be avoided.

Destruction of recreational capabilities of unknown subsurface cultural resources could not be totally avoided. Adverse impacts to wildlife viewing opportunities would remain until cessation of surface mining operations and subsequent reclamation efforts become successful. The relative values of these unavoidable adverse impacts is moderate because of existing access to, and availability of, other similar recreation opportunities in the region. Other adverse recreational impacts would include increased traffic hazards to motorists on the haul road.

The use of Routt County 53 could be expected to have some unavoidable impacts on the environment surrounding the road corridor. Noise levels would go up from greatly increased use of the road by diesel trucks. Some degree of increase in road accidents would be unavoidable, as would some deterioration of Routt County 53.

Chapter VI

Relationship Between Short-Term Uses and Long-Term Productivity of the Environment

THIS CHAPTER DISCUSSES THE EXTENT OF LONG-TERM IMPAIRMENT OR ENHANCEMENT OF RESOURCE VALUES THAT WOULD OCCUR, GIVEN THE SHORT-TERM USES OF THE ENVIRONMENT PROPOSED IN PEABODY COAL COMPANY'S MINE AND RECLAMATION PLAN. IN THIS ANALYSIS OF TRADE-OFFS OVER TIME AND TRADE-OFFS AMONG RESOURCE VALUES, SHORT-TERM REFERS TO THAT PERIOD WHEN SUBSTANTIVE PARTS OF PEABODY COAL COMPANY'S PROPOSED ACTION TAKE PLACE. LONG-TERM IS THAT PERIOD IN WHICH SUBSEQUENT IMPACTS, BOTH ADVERSE AND BENEFICIAL, STILL AFFECT THE ENVIRONMENT.

Unavoidable paleontological impacts would be experienced in the short-term during the mine's operation. After completion of the mining operation, no further impacts would occur. Options for future use of these subsurface resources would be foreclosed. However, the operation itself could disclose knowledge of fossils heretofore unknown: this would create options for future generations to benefit from the newly-found resources.

Short-term use of the coal resources at the Seneca 2-W Mine would result from mining methods that lose about ten percent of the mined bed(s). Nearby overlying and underlying beds of coal, which are considered by the operators to be too thin to recover economically, would be lost. The lenticular (0-4 feet thick) bed 40-58 feet above the Wadge would be only partially recovered by the proposed mining methods.

The aquatic environment would be disturbed by the proposed mining activity. Water quality would be degraded through an increase in sediment loading and total dissolved solids throughout the life of the project. Aquatic organisms would be displaced for as long as the mining activity continues and some organisms would be harmed or killed during the initial adjustment period. Some small intermittent drainages would be destroyed as a result of the proposed mining activity, resulting in alterations to local runoff patterns. In addition some aquatic habitat would be lost due to the mining development in the area, in particular road construction across the local perennial streams.

Air pollution resulting from the mine would be a short-term phenomenon; that is, it would occur only during active mining. Air pollution from vehicle exhausts, and fugitive dust after mining is complete, would also depend on the subsequent use of the land. Access to the properties involved would have been established. Lack of complete reclamation, specifically vegetative cover and erosion protection, could cause blowing dust to be a continual problem.

Mining on Peabody Seneca 2-W leases would result in the introduction of new roads, buildings, powerlines, and heavy equipment into an area not now appreciably changed from its natural state, except by an electrical transmission line, a county road, and the attendant structures associated with grazing and farming activities. As the coal is mined, and associated activities are developed, the vegetation, soil, and overburden would be removed and the affected acreage would be lost to livestock grazing, wildlife use, and recreation for a period of about two-four years. At maximum production, approximately 60 acres would be disturbed by mining each year, with an equal number of acres undergoing grading and planting. At any one time the total area disturbed would be about 230 acres. Since initial reclamation of a particular area is estimated to lag about three years behind mining, wildlife use and livestock grazing would be displaced for at least that period of time. It is estimated that the total productive capacity of the land would be reduced 10 percent over present levels even if revegetation is successful. Vegetation would be permanently destroyed on approximately 315 acres due to permanent facilities, roads, and population increases.

Short-term use of the subject area would entail the complete destruction of all habitat values presently existing in those areas that are to be mined, as well as the acreages involved in all road, powerline, and mine construction. In addition to these totally impacted areas, wildlife inhabiting adjacent lands would receive lesser impact from dust, noise, and human or vehicular activity. The lease area is relatively undisturbed at the present time, so its change in use would cause a significant change in the degree of wildlife use. Short-term use of Seneca 2-W lease area by all species of wildlife would be lessened; the degree of reduced use would depend on the ability of the species involved to adapt. Long-term productivity would be expected to be reduced, because loss in soil productivity and disruption of vegetal cover would lower the area's ability to attract and sustain wildlife. Long-term productivity for those species associated with grasslands would increase within the lease area; those species associated with sagebrush, shrubs, and trees would decline (see Appendix D).

Short-term use of the lease area would be completely restricted for livestock; the mine area would be fenced to exclude use by domestic fauna. Long-term productivity would be increased; present proposals are to turn 75 percent of the mined areas into grasslands, primarily for livestock grazing.

Archeological values may be impacted during the short-run by actual surface disturbance. Potential for vandalism would also be experienced largely in the short-term. Options for future use of cultural resources would be foreclosed by the degree of unavoidable impact from the mining operation. However, required intensive cultural surveys would reveal presently unknown values and create options for future generations to benefit from the newly-found resources.

Unavoidable impacts upon historical resources would occur only in the short-term. Once mining operations cease, the potential for vandalism of historic features would return to its present state.

After 2002, long-term unavoidable impacts on the area's aesthetics would still remain, though they would be less significant than short-term impacts. However, long-term impacts would be partially mitigated with the passage of time.

Short-term use of the area would result in several beneficial impacts to recreation resources; after 2002, most of this recreational productivity would remain. Increased off-road vehicle use potential may improve recreation capabilities on a long-term basis. Success in reclamation concurrent with ongoing mining operation would maintain increased rockhounding and geologic-industrial interpretive capabilities. However, Peabody would ultimately determine whether such recreation users would be granted access to the mine area.

The action before the Federal government with respect to W. R. Grace and Company is threefold:

1. Review and approval of the mining and reclamation plan for the proposed Colowyo surface mine on Grace's Federal coal lease Denver 034365 (see Figure GI-1);

2. Review of the mine plan on competitive lease application tract Colorado 22839 (Figure GI-2) requested by Grace, with the action being approval for leasing and subsequent approval of the mine plan; and

3. Approval of a right-of-way application fo- an access national resource lands (Figure GI-3).

The Applicant's Proposal

In July, 1974, W. R. Grace and Company filed a comprehensive draft environmental im- -ct assessment for a proposed open-pit coal mi with the Office of the Area Mining Supervisor, U.S. Geological Survey (USGS). This report included baseline environmental data as well as a description of the mining plan contemplated for application on Grace's Federal coal lease. The USGS determined that implementation of the Grace Mine plan would be a major Federal action significantly affecting the quality of the human environment. Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969, an Environmental Statement (ES) is therefore required for approval of the plan. Refer to Chapter I of the Regional Analysis for a detailed description of the Federal procedures required for approval of the plan.

Since July of 1974 an additional drilling program has been conducted on the Grace property. Analysis of this newly acquired data enabled the company to formulate a new mine plan, wherein the number of seams to be extracted by surface mining techniques has been expanded from four, under the original plan, to eight; estimated recoverable reserves subsequently increased over four times, from 35.5 million to 165 million tons.

The modified mining plan, reflecting the method devised for surface mining the upper eight seams, was filed with the Area Mining Supervisor on April 30, 1975; this followed the April 24, 1975, release of a Socio-economic and Environmental Land Use Summary prepared for W. R. Grace and Company by VTN. The mine plan covers the proposed mining operations for a 30-year period. The plan outlines the acreage in Federal lease D-034365 to be mined during this time period.

Also included in the mine plan is an area, located in Section 11, T.3N., R.93W., that lies outside the present lease boundary. This area, designated as Tract A, contains Federally-owned coal that lies contiguous to Federal lease D-034365, and can be mined as a logical extension of the Colowyo Mine. W. R. Grace and Company has submitted an application for a competitive lease (C-22839) for this tract. The tract has been included in the Bureau of Land Management's Williams Fork Management Framework Plan (MFP) as an identified coal lease offering (See Chapter I of the Regional Analysis and Appendix D for a detailed description of the planning process). Because the tract is part of the applicant's mine plan proposal and because the applicant has submitted adequate baseline environmental data to enable the Department of the Interior to analyze the mine plan (and proposed lease offering) pursuant to NEPA's requirements, the tract is analyzed for lease issuance and subsequent mine plan approval. However, mine plan approval cannot occur until after the lease is issued. It should also be emphasized that there is no guarantee that this lease will, in fact, be offered at auction, nor that W. R. Grace will be the successful bidder, should it be offered. W. R. Grace and Company has no expressed right to acquire the tract.

The company has submitted maps and legal descriptions of three additional unleased Federal coal tracts, designated as B, C, and D, contiguous to coal lease D-034365 (Figure GI-2). Grace has mad pplication for competitive lease for these three tracts as well (C-22836, C-22838, and C-22837); if acquired, they would be mined as an integral part of the proposed Colowyo surface mine, but they are not part of the current 30-year mine plan. Because these applications were not included as a specific part of the applicant's mine plan; because sufficient environmental data are not available to enable the Department to analyze the leasing action pursuant to NEPA's requirements; and because mining on these tracts appears to be outside the time frame of this statement, no site-specific analysis of the areas encompassed by these lease applications will be undertaken; however, actions on these areas are analyzed in the Regional Analysis as part of the cumulative regional action.

Notwithstanding the analyses accomplished in this ES, further on-the-ground investigations, en-

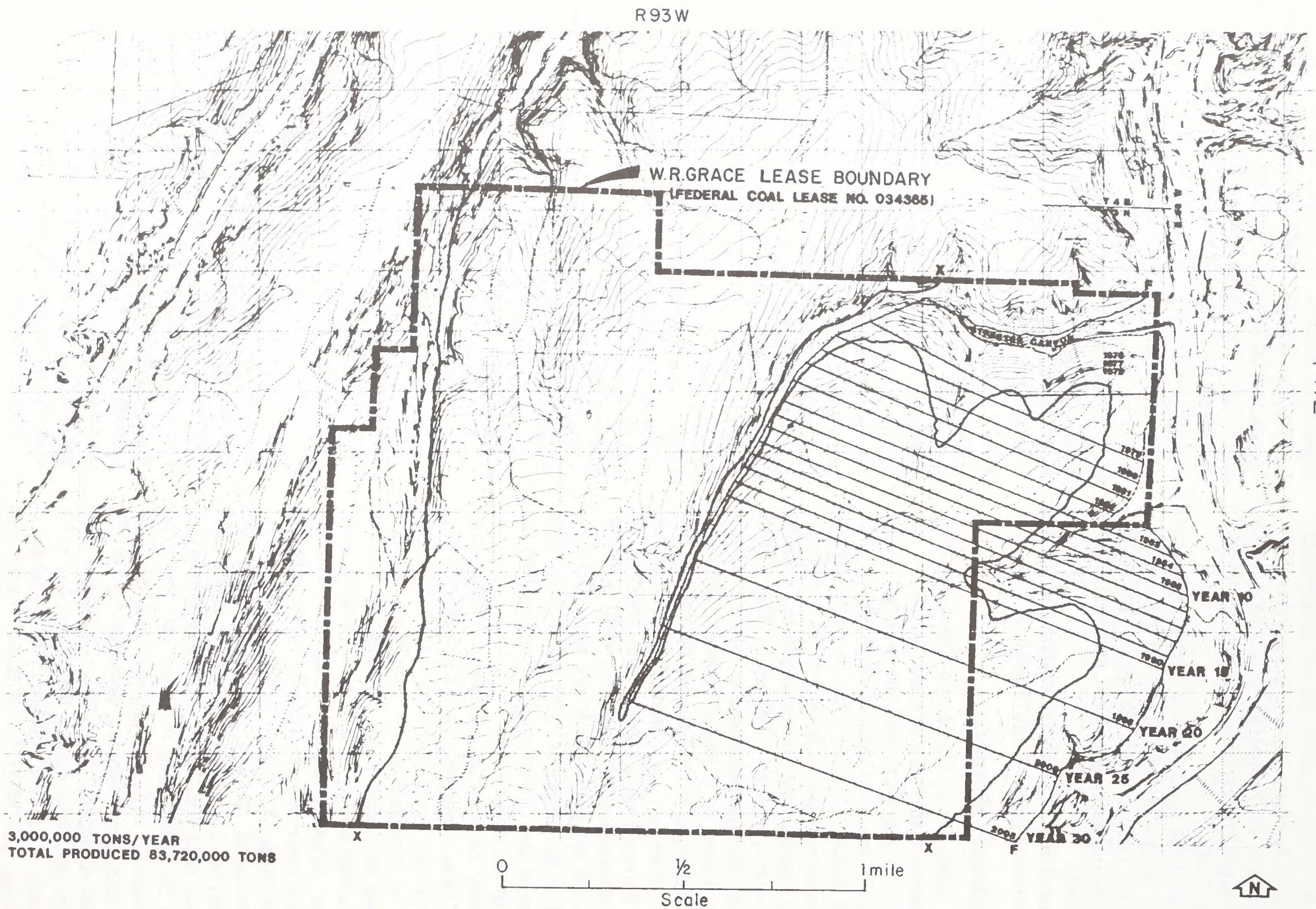


FIGURE GI- 1

30 year mine plan for Colowyo Mine.

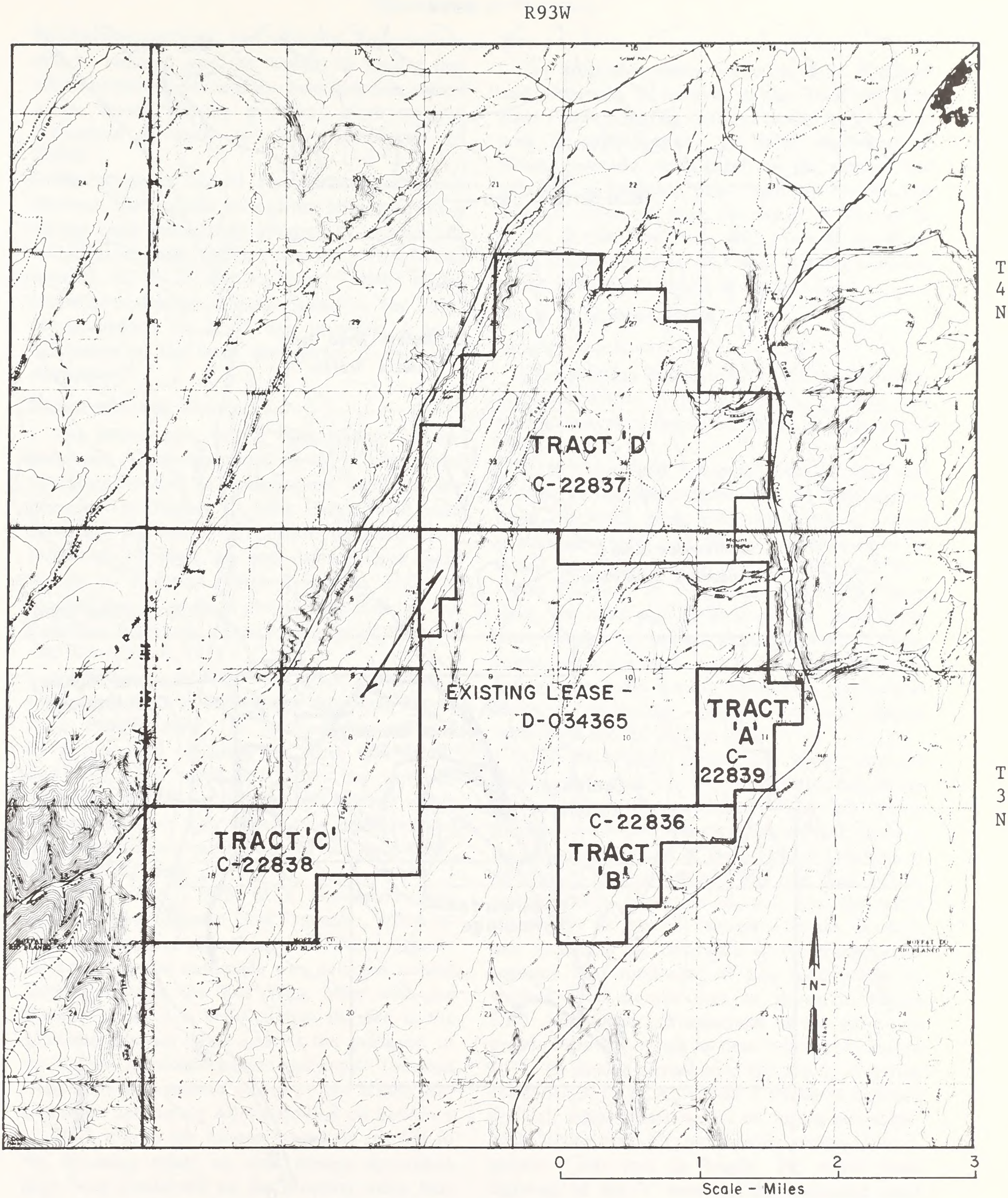


FIGURE GI- 2

Competitive lease application tracts requested by W.R.Grace.

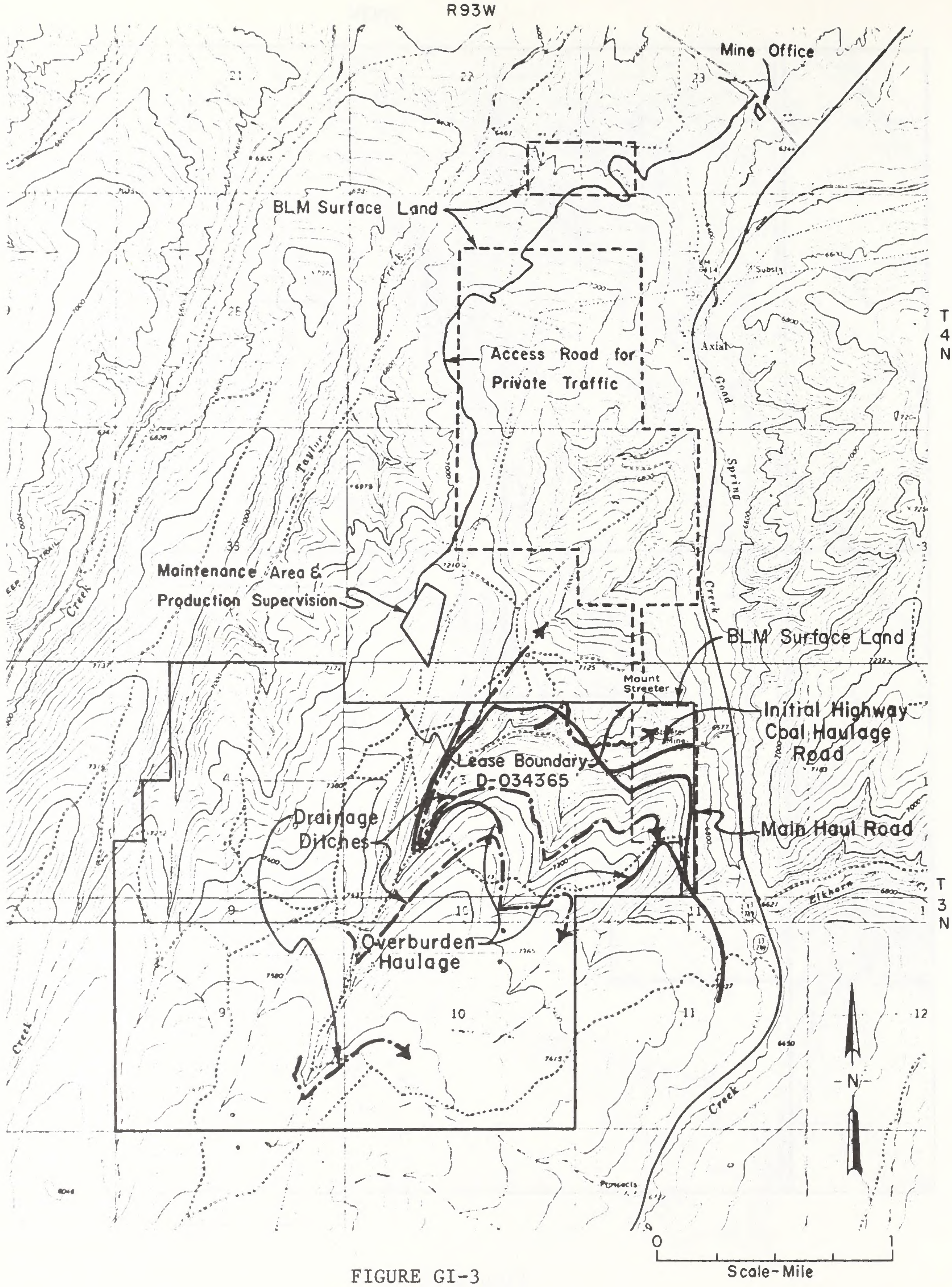


FIGURE GI-3

W.R.Grace-Colowyo Mine, map of surface facilities.

vironmental analyses, and technical examinations will be required prior to leasing, to ensure that lease stipulations, should the leasing action indeed occur, would provide necessary environmental safeguards pursuant to the requirements of NEPA.

The proposed access road crossing national resource lands would ascend the large prominent hillside lying immediately adjacent to and west of the Axial townsite, passing through parts of Sections 22, 23, 26, 27, and 34, T.4N., R.93W., to the proposed maintenance facility location. The right-of-way applied for is 100 feet in width. A legal description of the lands applied for is shown in Appendix D.

Background and History

The project site has a long history of underground mining operations. In 1914 Collum Coal Company opened an underground mine on the property. On October 25, 1924, Federal coal lease D-034365 was issued to Clifford G. Phelan. On December 31, 1945, the lease was assigned from Phelan to Colowyo Coal Company; Colowyo changed the name from the Collum Mine to the Red Wing Mine, and operated as a small producer until December 1, 1973.

In addition to the Red Wing Mine, there was a second underground mine in the same area known as the Streeter Mine. The Streeter Mine operated on private land adjoining the north side of the Red Wing Mine until 1951, when the workings collapsed. In 1952, a fire was discovered within the closed mine; it is believed to have resulted from spontaneous combustion of the coal seam, and is still burning.

On December 1, 1973, W. R. Grace and Company acquired Colowyo Coal Company, which included assignment of coal lease D-034365. Shortly thereafter carbon monoxide was detected behind seals connecting the Red Wing Mine with the Streeter Mine. It is believed that the fire in the adjoining Streeter Mine caused the presence of the carbon monoxide behind the seals. The Red Wing Mine was ordered closed by the Mining Enforcement and Safety Administration on February 12, 1974, due to the dangers posed by the fire in the adjoining mine; no coal mining operations have been conducted on the property since that time. Figure GI-4 shows the location of the closed Red Wing Mine.

SITE LOCATION

The proposed mining operation of W. R. Grace and Company is located in the Danforth Hills Coal Field of Moffat County, Colorado. The mine area is approximately 25 miles southwest of Craig, Colorado, immediately to the west of and adjacent to Colorado State Highway 13-789. The area of proposed mine operations is located in T.3N., R.93W., 6th P.M., with some of the attendant facilities located in T.4N., R.93W. Location of the mine site is shown in Figure GI-5.

Stages of Implementation

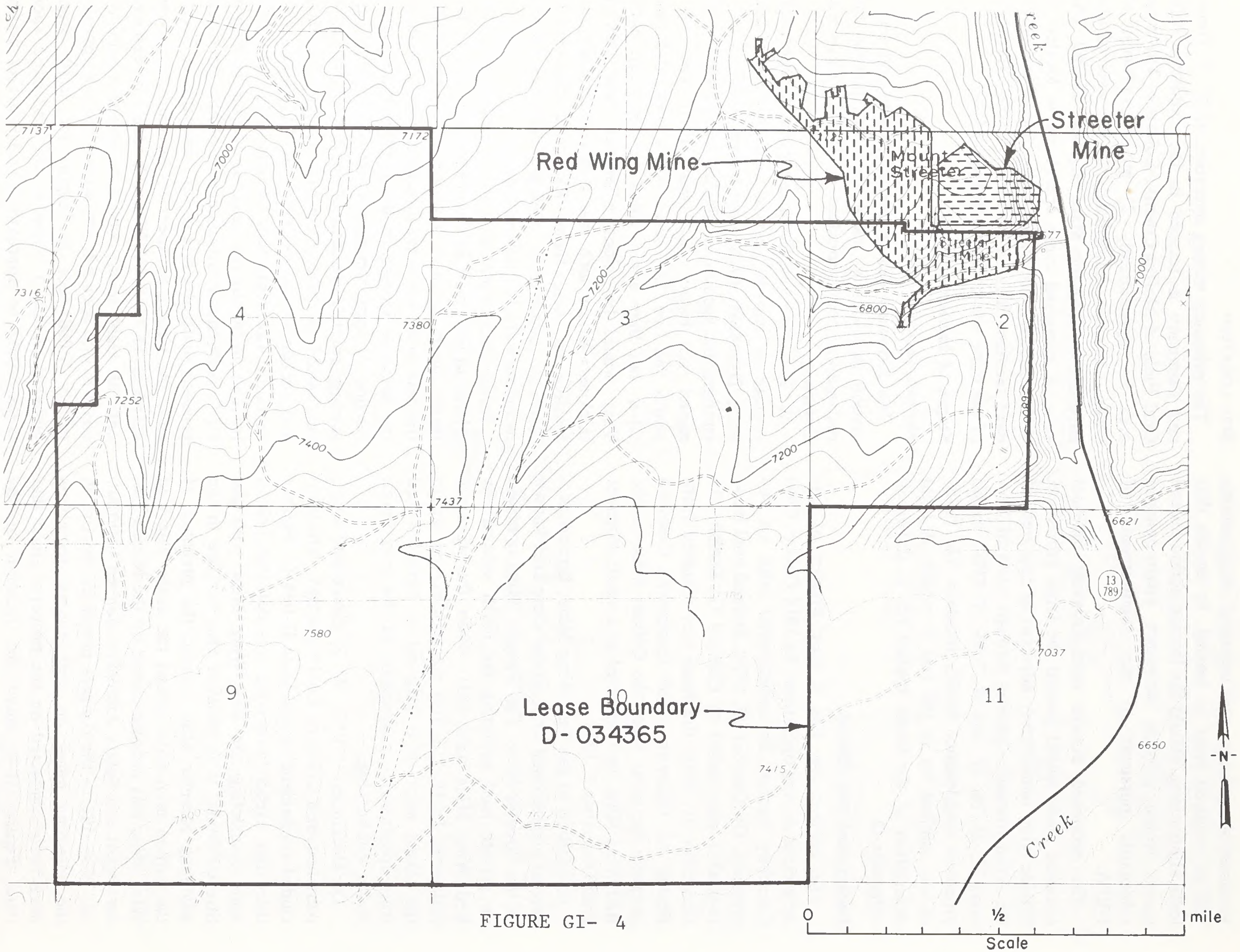
MINING PROCEDURES

The following description of mining and reclamation activities is taken from the mining and reclamation plan submitted by W. R. Grace and Company.

W. R. Grace and Company plans to open and operate an open-pit surface mine on Federal coal lease D-034365. Eight coal seams within a total stratigraphic section of 390 feet are planned to be mined (see Figure GI-6 and GII-3). Two "Y" seams and two "A" seams are shown on Figure GI-6, but they are counted as one seam each. They would be mined whenever their varying thickness is not such that it is economically unfeasible to mine them. Estimated recoverable reserves employing open-pit surface mining techniques are 165 million tons.

Initial excavation would take place near the middle of Section 2 in the northeast corner of the lease along Streeter Canyon. The pit would traverse in an east-west direction along F seam to the drainage located in the northeast portion of Section 3, approximately 4,000 feet west of the starting point. A portion of spoil from the initial cut would be placed Streeter Canyon, leveled, and reclaimed (as described in the Reclamation section). The remainder of this spoil would be trucked to a storage area as shown in Figure GI-7. Subsequent advancement of the pit would proceed south at a rate of time indicated in Figure GI-1. As mining advances to the south, overlying seams E, D, C, B, A, X, and Y would be exposed until all eight seams would be mined simultaneously in one open pit; pits would average approximately 7,000 feet in length. Pit width from highwall of the Y seam to the reclaimed spoil areas would be approximately 1,900 feet during the mature operation (see Figures GI-6 and GI-8).

R93W



T3N

FIGURE GI- 4

Extent of underground workings of abandoned Red Wing and Streeter Mines.

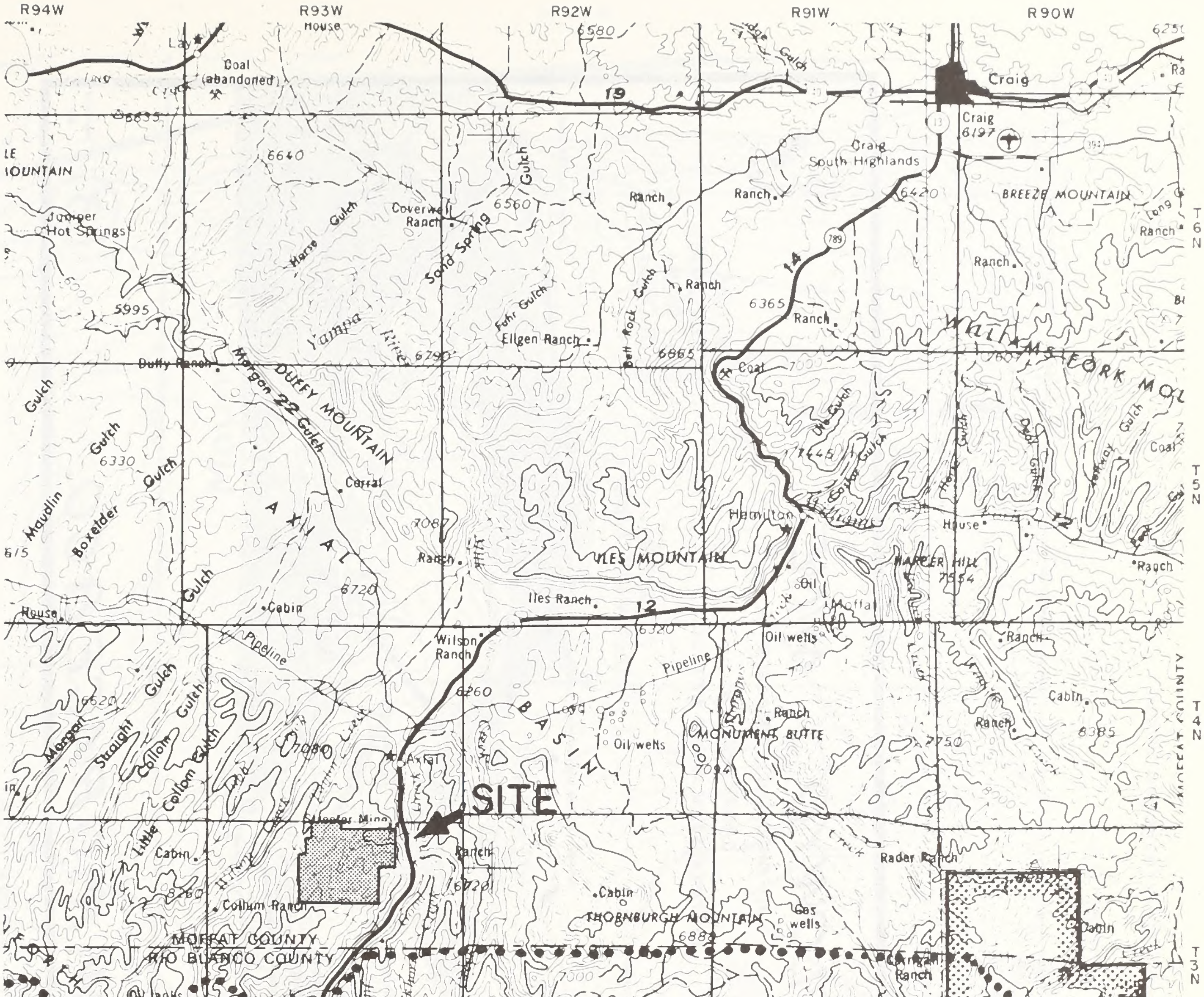


FIGURE GI- 5

Location of Colowyo Mine site.

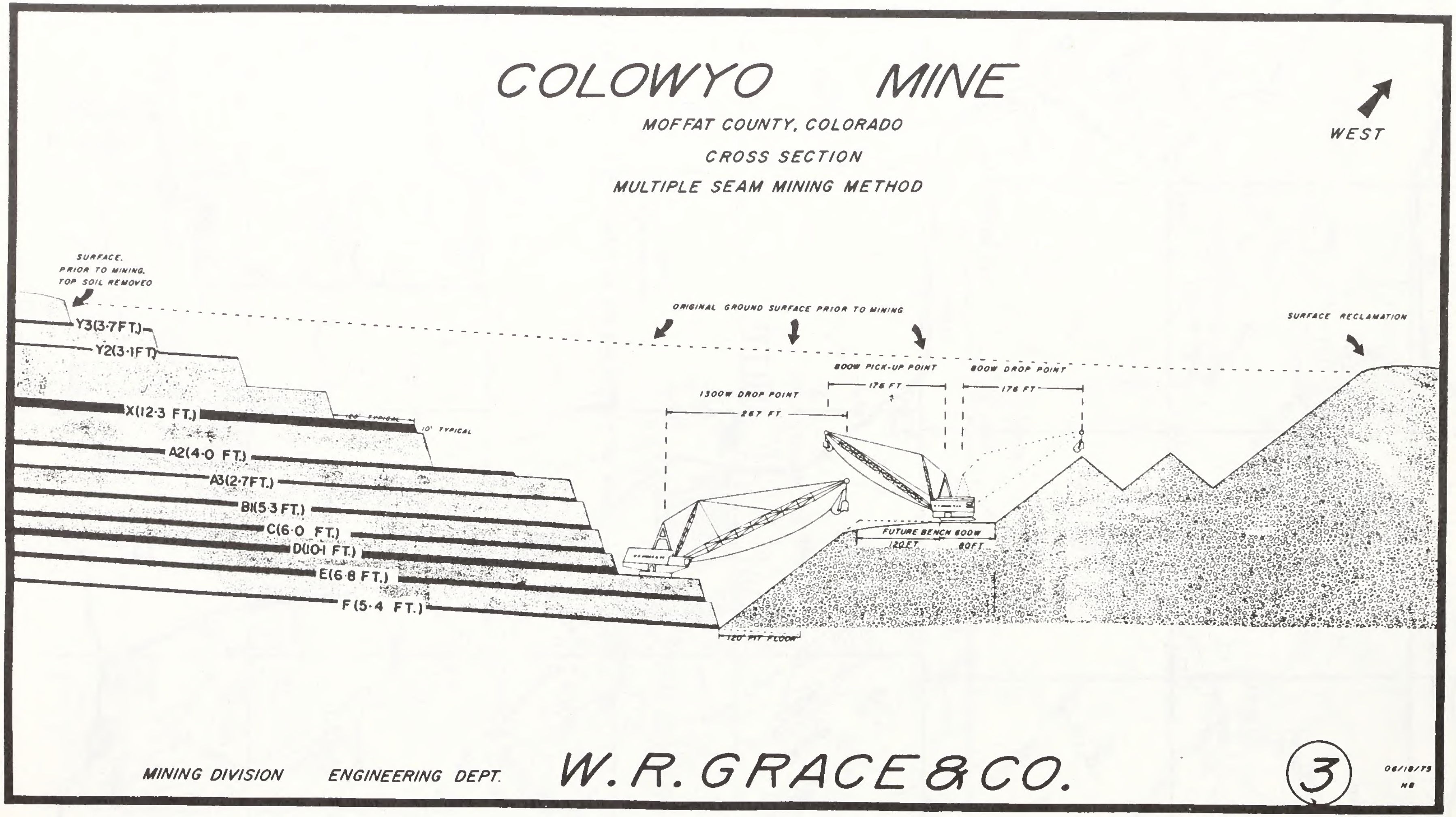


FIGURE GI-6

Multiple seam mining method.

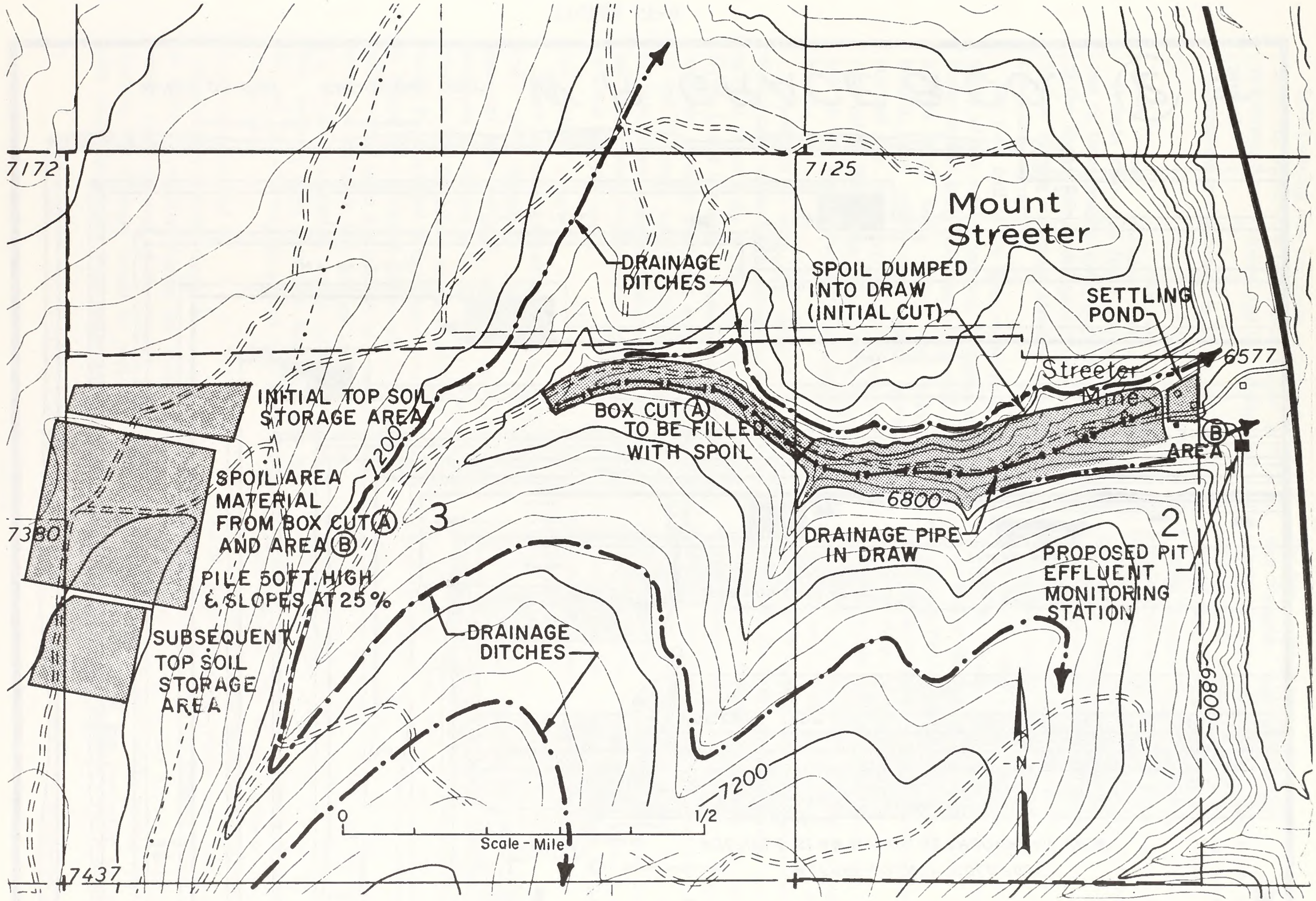


FIGURE GI-7

Spoil and topsoil stockpile area.

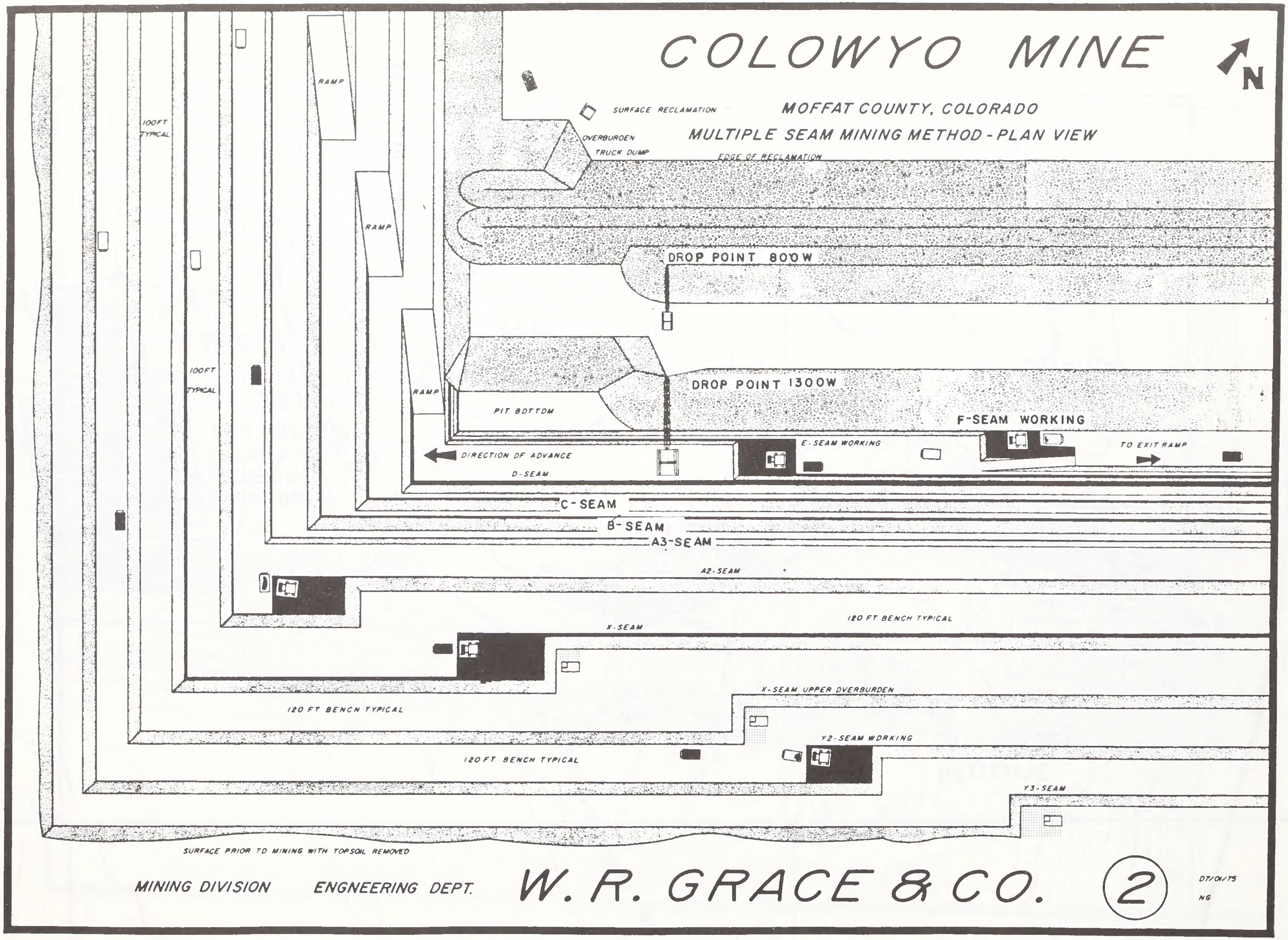


FIGURE GI-8

Multiple seam mining method.

Initial mining was originally scheduled for early 1976, but would now take place as soon as NEPA requirements are fulfilled and the mining plan approved.

Estimated production rates are as follows: First year—620,000 tons; second year—90,000 tons; third year—1,200,000 tons; fourth and succeeding years—3,000,000 tons.

Present plans call for a continuing production rate of three million tons/year for the remainder of the 30-year life of the mine; this would be subject to change as future physical and economic conditions warrant.

The west half of the lease would be the second phase of the mine operation. Stripping ratios are higher in this half, and exploratory drilling has indicated large areas where coal seams have burned, and other areas where seams have pinched out. However, W. R. Grace and Company might file a mine plan for extraction of the coal in this portion of the lease sometime in the future.

In addition to strip coal available in the top eight seams of the lease, several additional seams of coal underlie the F seam. At least four seams, G, H, I, and J, would be minable by underground methods. Streeter Mine was apparently located in G and H seams, and the Red Wing Mine in the G seam. Grace might sometime in the future submit mining plans for an underground mine in one or more of these seams.

Soil material removal

Where topsoil is developed and deemed physically and chemically suitable, it would be removed with scrapers, graders, and other appropriate equipment prior to mining or construction. During the initial mining operations, topsoil would be stockpiled in designated areas, as shown in Figure GI-7. Topsoil that would be retained in such holding areas for periods of a year or more would be seeded to help prevent erosion. As mining progresses, topsoil would be taken directly from the area to be disturbed, hauled around the pit, and spread over the graded spoil behind the mining area.

Overburden removal

Overburden removal would be accomplished in the following manner: during the initial phase of mining, after removal of the topsoil, overburden overlying the F seam would be prepared. Blast holes would be drilled with rotary drill units to the top of the F seam. Hole spacings and diameters would vary according to overburden thickness and characteristics. The holes would be loaded with ANFO and detonated sequentially with electric caps, primacord, and primers.

Shot material would be leveled and a bench prepared for the dragline by caterpillar bulldozers. The overburden would then be stripped with a 28-cubic-yard dragline equipped with a 195-foot boom. The dragline would work from a bench located west and upslope of the shot; broken overburden would be dug and cast to an area north of the shot. Initial overburden would be placed into Streeter Canyon, as the F seam outcrops within 200 feet of the canyon floor; this initial cut would be 120-150 feet in width. A portion of this spoil would be rehandled and trucked to an area west of the pit (Figure GI-7).

Mining would progress west along the outcrop of F seam to the canyon located approximately 4,000 feet west of the starting point. The dragline would then be walked back to the area immediately south of the first cut, and the next cut would be started. As F bench progresses, the next four seams encountered (E, D, C, and B,) would be treated in the same manner in sequence. Topsoil would be removed and transferred to a storage site, overburden drilled, shot, stripped, and cast by the dragline to an area north of the pit or into the mined-out pits. During the first two years of operation five seams would be exposed and mined in the pit.

The second stage of operations, as originally scheduled, would begin in mid-1977 with the delivery of another dragline. This dragline would be equipped with a 40-cubic-yard bucket and a 285-foot boom. Upon delivery and construction, it would be walked to the highwall to replace the smaller dragline. Overburden material overlying five seams, A through E, would then be stripped with the 40-yard dragline. The 28-yard dragline would be relocated in the spoil area on the north side of the pit and would rehandle excess overburden material. The 40-yard dragline does not have a sufficient dumping radius to prevent overburden from the lower seams from covering the exposed coal. The 28-yard dragline would therefore be used to pick up this excess material and redeposit it further north of the mining operation. Plan and end views of this procedure are shown in Figures GI-8 and GI-9.

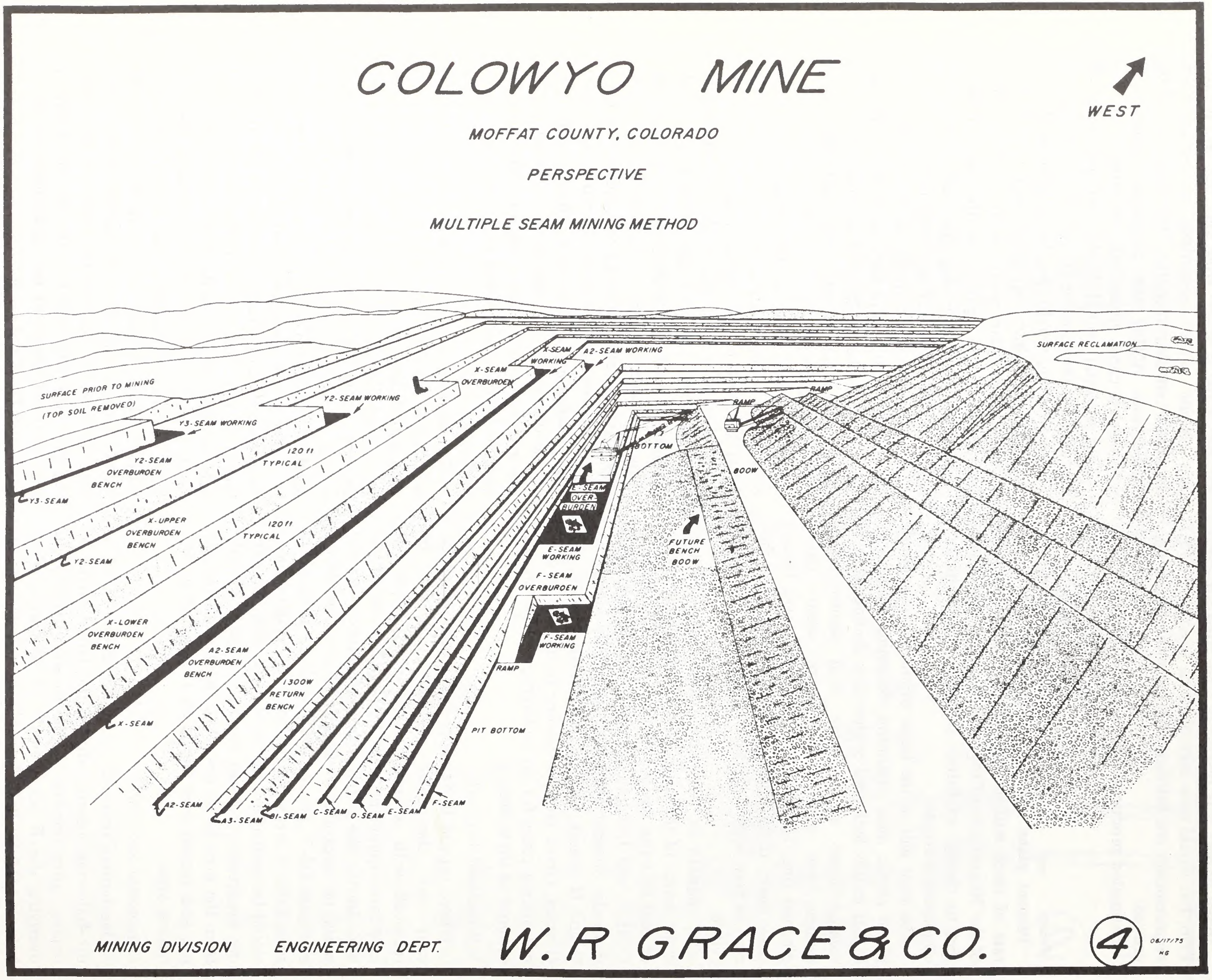


FIGURE GI-9

Multiple seam mining method.

When X and Y seams are uncovered (early in 1979) and all eight coal seams exposed, the mature pit would be in the configuration shown in Figures GI-8 and GI-9. Sometime thereafter the overburden would be of a quantity and depth that would preclude continuing in the above described manner. At this stage, a 22-cubic-yard power shovel, heretofore used for coal loading, would be re-equipped with a 15-cubic-yard dipper, and would be used for loading the overburden above the Y, X, and F seams. In this truck and shovel operation, 170-ton off-highway rock trucks would haul overburden material to the spoil area at the north side of the pit for final backfill. Great flexibility would be gained using the truck and shovel method of mining on the X and Y seams, as overburden removal could be accomplished either east or west, and the resultant material could be trucked to the spoil area and dumped precisely where it would be required for completion of the backfill process. This integration of dragline stripping and truck-and-shovel operation would be ideally suited for extraction of the eight coal seams, from both an economic and reclamation standpoint.

Coal removal

Coal removal methods would vary somewhat, as would overburden removal methods and procedures, as the mine advances from stage one through stage two. During the first stage of operations, coal would be loaded, following drilling and shooting, with the 22-cubic-yard power shovel or with front-end loaders into highway type trucks. The trucks would haul the coal via State Highway 13 to the temporary load-out facilities near Craig.

As the pit reaches maturity, originally scheduled to occur in the latter part of 1977 or early 1978, it is anticipated that construction of the rail-line from Craig to an area north of the mine would be completed. When the rail line, crushing units, and loading facilities would be operational, the company's 170-ton off-highway trucks would be employed for transportation of the coal from the mine to the loadout site. Late in the third or fourth year of operation, the power shovel would be engaged in loading rock overburden in the truck and shovel operation, and all coal loading would be accomplished with front-end loaders. During the second phase of operations, coal loading could take place from two or more seams simultaneously, as the dragline operation in the lower seams and the truck and shovel operation of the upper two seams, could proceed independently of one another.

RECLAMATION

It is the intention of W. R. Grace and Company that their surface mined lands would be returned to a condition at least as good as that which now exists, and that they would be suitable for wildlife habitat and domestic livestock grazing. At this time Grace is still discussing alternatives to a number of reclamation approaches to achieve their land use goal. As more information is gathered from the various ongoing environmental and engineering studies, or as new technologies develop, the reclamation plan will be modified.

W. R. Grace has initiated a four-year revegetation study, July, 1975, to determine the suitability and practicality of utilizing shrub species native to the Colowyo Mine site. This program will simulate the disturbance that would result from surface mining. All existing vegetation will be removed from the plots, and the top one-inch of soil will be removed to reduce weed infestation. Then all remaining topsoil will be removed and subsequently redistributed over test plots. A variety of experiments will be conducted to determine which plants and what methods are most suited for revegetation. One is designed to test the adaptability of established shrubs to be transplanted, while another will determine the potential for natural re-introduction of nitrogen into the topsoil material.

Since the design and purpose of the revegetation study is to re-establish native browse vegetation, wildlife studies are in progress to supplement the revegetation tests. The amount of big game utilization per plant species is currently being measured on the Colowyo Mine site. This information will be used to determine the percentage of each species that should be planted to provide suitable wildlife habitat. Small mammal studies are also in progress to determine the potential problems that may exist from rodent grazing. Habitat improvement projects are already underway to improve big game habitat prior to mining, in an effort to provide use areas for displaced animals when mining operations would begin.

Reclamation of the mine would begin immediately with start-up of operations. Vegetation would be removed and shredded, although its usefulness has not yet been determined. A number of approaches are under consideration: the shredded vegetation might be mixed with the topsoil and left to decay; it might be windrowed and burned and the ashes later mixed with the stored topsoil; or the material might be composted for use as a mulch when revegetation begins. Each of these approaches has a number of inherent problems. Direct mixing of plant materials with the topsoil might tie up nutrients in the decomposition process which are essential to soil development and plant establishment; seeds of undesirable species might also be introduced into the topsoil material. Burning might volatilize many nutrients, while composting might take too long, or prove too uneconomical for reclamation goals. It is the intention of W. R. Grace and Company to investigate each of these alternatives and perhaps carry out additional tests on revegetation test plots.

After vegetation removal, topsoil would be removed by scrapers or other suitable equipment and stored in long mounded terraces outside the mine area. This would be a continuing process prior to overburden removal. Storage piles would be contoured and seeded with legumes and wheatgrasses to abate erosion, and to blend with existing surrounding topography. As the mining sequence allows, some topsoil, on removal, might be placed directly onto surfaces readied by backfilling and grading. The surface would be ripped prior to topsoil replacement to relieve compaction.

During the first period of mining, spoil piles would be leveled by bulldozers as desired elevations are reached. In the mature pit, trucks would transport broken overburden material into the north edge of the pit and dump it into the voids between the piles. Final grading of the spoils would also be accomplished by bulldozers.

Broken rock material from initial cuts would be cast into piles on the bottom of Streeter Canyon. As the first piles accumulate in height, they would be graded from time to time to attain a configuration less than the angle of repose, but not more than 25 percent grade (Figure GI-10). Terraces would be made along the pile slopes to impede surface water runoff, and contour furrows placed at the toes to capture any sediment. As first mining proceeds westerly up the canyon, the F seam does not outcrop at the western end (according to drilling data.) At that time it might be necessary to make a box cut. Spoil from the box cut would be trucked to the approximate area of the topsoil storage piles, contoured, terraced, and seeded to achieve stabilization, until such time as spoil could be utilized for backfill. Diversion ditches would be constructed along the north slope of Streeter Canyon to carry surface water around the operating area and discharge it into the natural drainages outside the area. An appropriate conduit would be placed along the bottom of Streeter Canyon, on grade to the west end of the box cut, prior to initial casting of spoils, to concentrate any surface water higher up the canyon, and allow preservation of the present drainage elevation. Spoil would be placed over the conduit from the initial cuts and the conduit left in place permanently (see Figures GI-7 and GI-10).

Backfilling, grading, topsoil replacement, and seeding would begin twelve-eighteen months after opening of the initial cut, depending upon weather conditions. In the mature operation, reclamation work would be concurrent with mining; approximately 45 acres of new land would be disturbed annually, and an equal number reclaimed each year. The topography of the reclaimed surface south of Streeter Canyon itself would reasonably conform to the existing slopes, being feathered into the contiguous natural surface, with concave and convex surfaces designed to recreate a variety of micro-environments. The recontoured surface would be covered with up to 18" of the stored topdressing material; this depth would depend on the requirements of the plant species being used for revegetation. The covered surface would then be roughened by discing, harrowing, chiseling, or combinations thereof, to increase infiltration of rainfall and prevent erosion. A rangeland drill would be used to plant legumes and grasses to provide initial cover and stabilization while the shrubs gain establishment. All reclaimed areas would be adequately fenced to prevent wildlife or domestic grazing until vegetation is sufficiently established. W. R. Grace and Company also plans to retain a rehabilitation specialist to insure success of the reclamation; it is the intention of the company to implement judicious land management to insure high productivity for both domestic livestock and wildlife after mining.

To insure early plant cover and slope stabilization, native and introduced grasses would be seeded. A list of these species and the recommended mixture adapted to the mine site area of Moffat County, utilizing information from the Soil

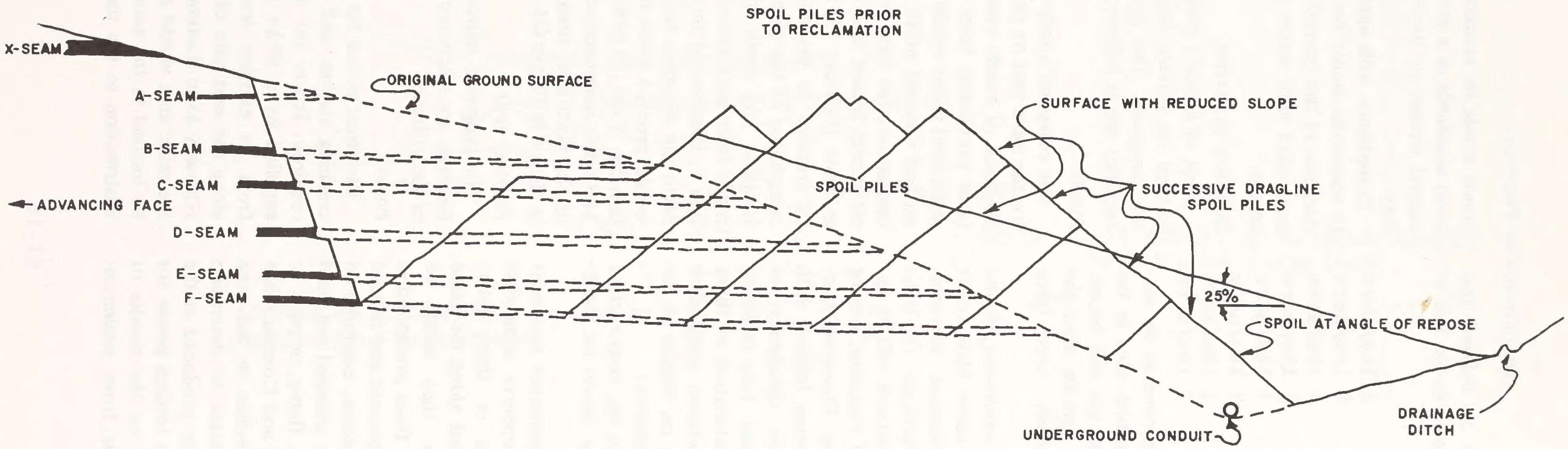


FIGURE GI-10

Schematic diagram of overburden to be dumped into Streeter Canyon after grading of the original spoils, looking west.

Conservation Service, is given as follows (no specific seed mixture is proposed yet for use at the Colowyo Mine area):

Kentucky bluegrass	2 lbs/acre
Manchar bromegrass	4 lbs/acre
Intermediate wheatgrass	4 lbs/acre
Pubescent wheatgrass	3 lbs/acre
Western wheatgrass	3 lbs/acre
Slender wheatgrass	3 lbs/acre
Bluebunch wheatgrass	3 lbs/acre
Yellow sweetclover	2 lbs/acre

The species in this list have proven to be successful for revegetation of disturbed sites in the Axial Basin area. However, this list will be expanded to include more native species after the results of the revegetation study have been analyzed.

To insure the successful establishment of the grass species recommended for initial plant cover and plant stabilization, a balanced nitrogen, phosphorus, and potassium fertilizer (N-P-K) would be used. Rates of 50-75 lb/acre will be applied depending on a number of variables, one of which is soil moisture conditions. Plans might include applications prior to planting (mixing with the topdressing), after seedling emergence or transplanting, applying slow and fast releasing forms (urea-nitrogen), or a combination of these techniques. Best methods of fertilizer application would be employed, depending on results of the revegetation test studies now underway.

All cuts and fills produced in the construction of haul roads and access roads would be stabilized by revegetation.

A main ditch would be constructed east-west across the east half of the property somewhat below highest elevation. Two or three intermediate ditches would be located along the same directions at lower elevations; they would be designed to carry runoff water from precipitation downslope and eastward to its present and natural drainage area. Water accumulations, encountered in the open pit areas would be pumped out, and carried by conduit, either ditch, flume, or pipe, to settlement ponds. W. R. Grace and Company has been participating in water studies in the area with Federal government agencies to determine quantities and qualities of water produced at the mine site. Specifications of the settling ponds for effective use would be based on the results of those studies. Discharge water from settlement ponds would be monitored for chemical and sediment standards at a point prior to release into the natural stream or drainage, and treated if necessary.

Compliance with applicable air and water quality standards would be maintained throughout the duration of the operation. Fugitive dust would be controlled with water spray distributed by water trucks.

Surface facilities

Most of Grace's proposed surface facilities are located on private land owned or controlled by the company. The company's proposed surface facilities are as follows:

Roads

The company's proposed haul roads are located for the most part on privately-owned surface land. Portions of roads crossing federally-owned land have previously been identified in Figure GI-3. Main haul roads would exit from both ends of the pit and proceed north. During the initial stage of operations, the haul roads from each side of the pit would funnel into Streeter Canyon, and then to State Highway 13, over which the coal would be trucked to the railhead at Craig. Following completion of the planned spur track and loading facilities just north of the mine area, the haul roads from each side of the pit would join in Section 3, then would proceed north through Section 34 to the dumping facility. The main access road would proceed from the mine office site in Section 23, T.4N., R.93W., through Sections 27 and 34 to the maintenance facilities. A cross-section of the main haul road on the east end of the pit is shown in Figure GI-11.

Railroad spur

The proposed railroad spur and related loadout facilities are discussed in the site specific analysis of the railroad.

Power

Electrical power for the draglines, shovel, shop, crushing station, and loading facilities would be required. Power for mining equipment would be supplied by a 69-kv transmission line extending from an existing transmission line that passes along the east side of the lease, paralleling State Highway 13 in Sections 2 and 11. The line serving the mine area would pass through a substation to be located in the southeastern part of Section 2. Distribution to the mine area would be by over-

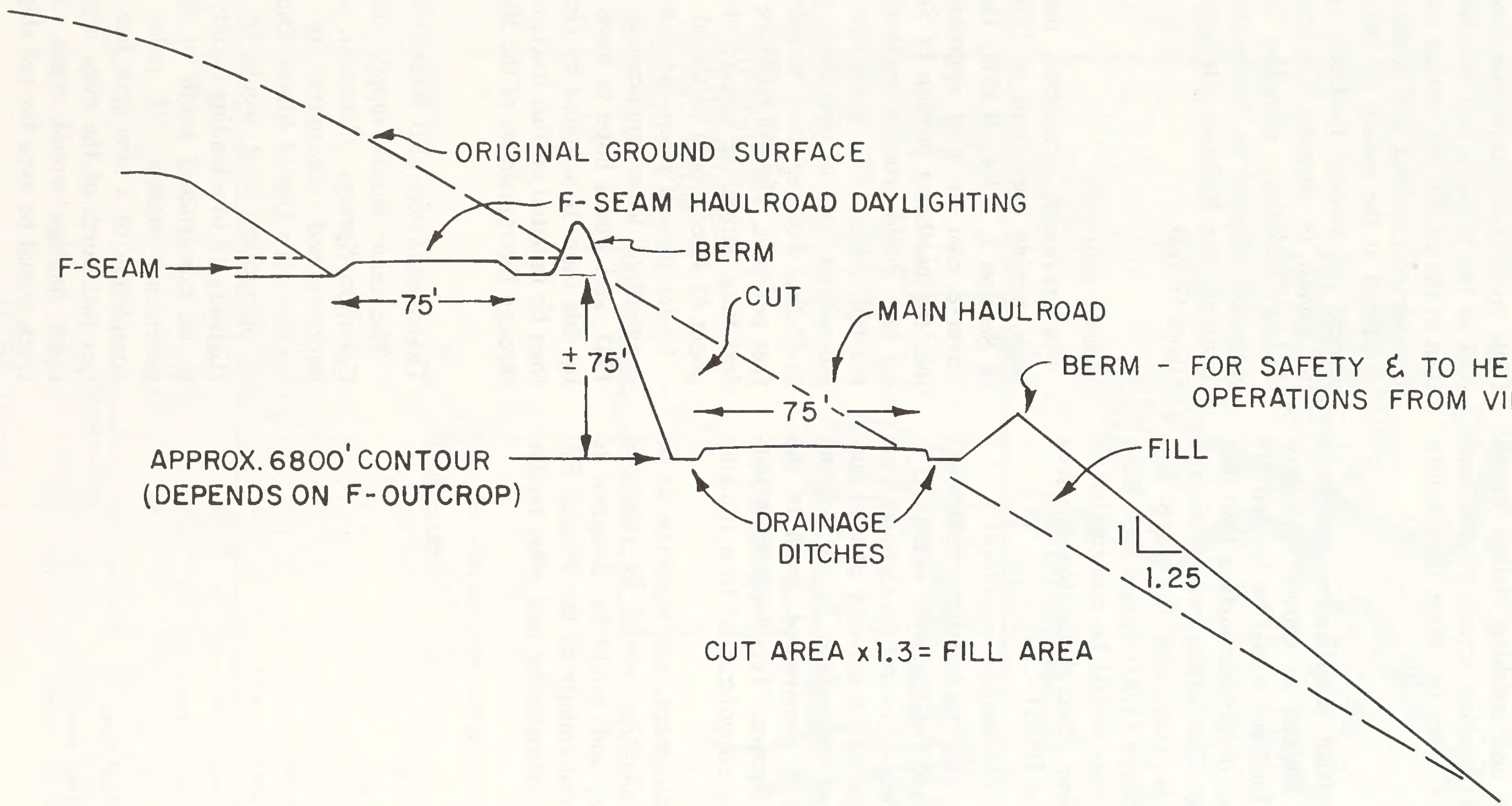


FIGURE GI-11

Proposed haul road showing average disturbance along the east side of the Colowyo Mine.

head line to portable substations, thence by trailing cables to in-pit equipment. This line, shown in Figure GI-12, would be located on privately owned surface acreage that is held by Grace. No Federal action is involved on that portion of the powerline lying outside the lease area. Power for the loading facilities and crushing station would be supplied by a line running across private land in Sections 3 and 34 from the mine distribution line.

Office and shop

The access road, office, shop, and maintenance facilities would be located as shown in Figure GI-12. All of these facilities would be located off the Federal coal lease on private surface land that is owned by Grace. The office would occupy 6,000 square feet in area, and the shop and warehouse would occupy 11,000 square feet. Both the shop and warehouse would be constructed in the 218,000 square foot (5-acre) maintenance area (see Figures GI-3 and GI-12).

Mining, loading and reclamation equipment

Mining, loading, and reclamation equipment that would be required for the mine operation is listed below. In addition several on-highway coal trucks would be required for delivery of coal during the first stage of operations, to the loading facility planned to be constructed south of the Yampa Generating Station. This haulage is currently planned to be subcontracted to a trucking company.

All machinery, equipment, and materials to be employed in the operation would be equipped with safety devices, and would be designed to comply with the requirements of the Mining Enforcement Safety Administration and other regulatory agencies.

W. R. Grace Colowyo Mine Major Equipment List

Mining Equipment	Number of Units
Overburden Drill B-E 45R	1
Overburden Drill IR, T-4	2
Coal Drill	1
Cable Tractors (Farm Type)	2
Front-End Loader (D-600 15 Cu. Yd.)	4
Off-Highway Rock Trucks (170 Tons)	7
Off-Highway Coal Trucks (170 Tons)	6
Rock Shovel (15 Cu. Yd.)	1
Dragline-28 Cu. Yd. (195' Boom)	1
Dragline-40 Cu. Yd. (285' Boom)	1
D-9H Crawler Dozer	3
D-8K Crawler Dozer	3
D-14G Grader	1
Water Trucks	1
D-824 Wheeled Dozer	1

Crushing and processing equipment

Processing of the coal would be limited to primary and secondary hammermill-type crushing which reduces the coal to a size to suit the specifications of the customer. Present plans call for a 1.5 inch maximum size of crushed coal. High speed belt conveyors would transport the coal to the primary and secondary crushers, and then to the 24,000 ton storage and loadout facility. Temporary crushing and loadout facilities would be placed at the mouth of Streeter Canyon; permanent rail loadout facilities would be placed at the mouth of Streeter Canyon; permanent rail loadout facilities, including a conveyor, are proposed adjacent to the proposed Taylor Creek tail-track (see Railroad site specific analysis and Figure GI-12).

MINING SEQUENCE

As previously described, the company would begin mining operations in 1976 near the middle of Section 2, T.3N., R.93W. The initial pit would traverse east to west approximately 4,000 feet into the northeast portion of Section 3. Succeeding pits would proceed southerly into the side of the hill. After 1977, when the mine would be in the second stage of operations and in full production, the working face would advance 250-350 feet per year. The pit might be as much as 8,000 feet long during the mature operation; each year about 45 acres would be mined.

Under present plans the company would reach competitive lease application tract C-22839 in 1983, and would hope to have acquired the tract by this time. If acquired by Grace, mining would then be initiated on this tract, and would continue through the remainder of the 30-year mine life.

TRANSPORTATION AND MARKETING

The mine would supply coal to the City of Colorado Springs, Colorado, as well as various undetermined consumers in the eastern and southeastern United States. During the first stage of operations, coal would be trucked via State Highway 13 to a loading facility presently planned to be constructed south of the Yampa Project generating station, 25 miles away. Following completion of a new spur line and loading facilities just north of the mine area, this on-highway truck haulage would cease, and the new spur track would be used for rail shipment of the coal.

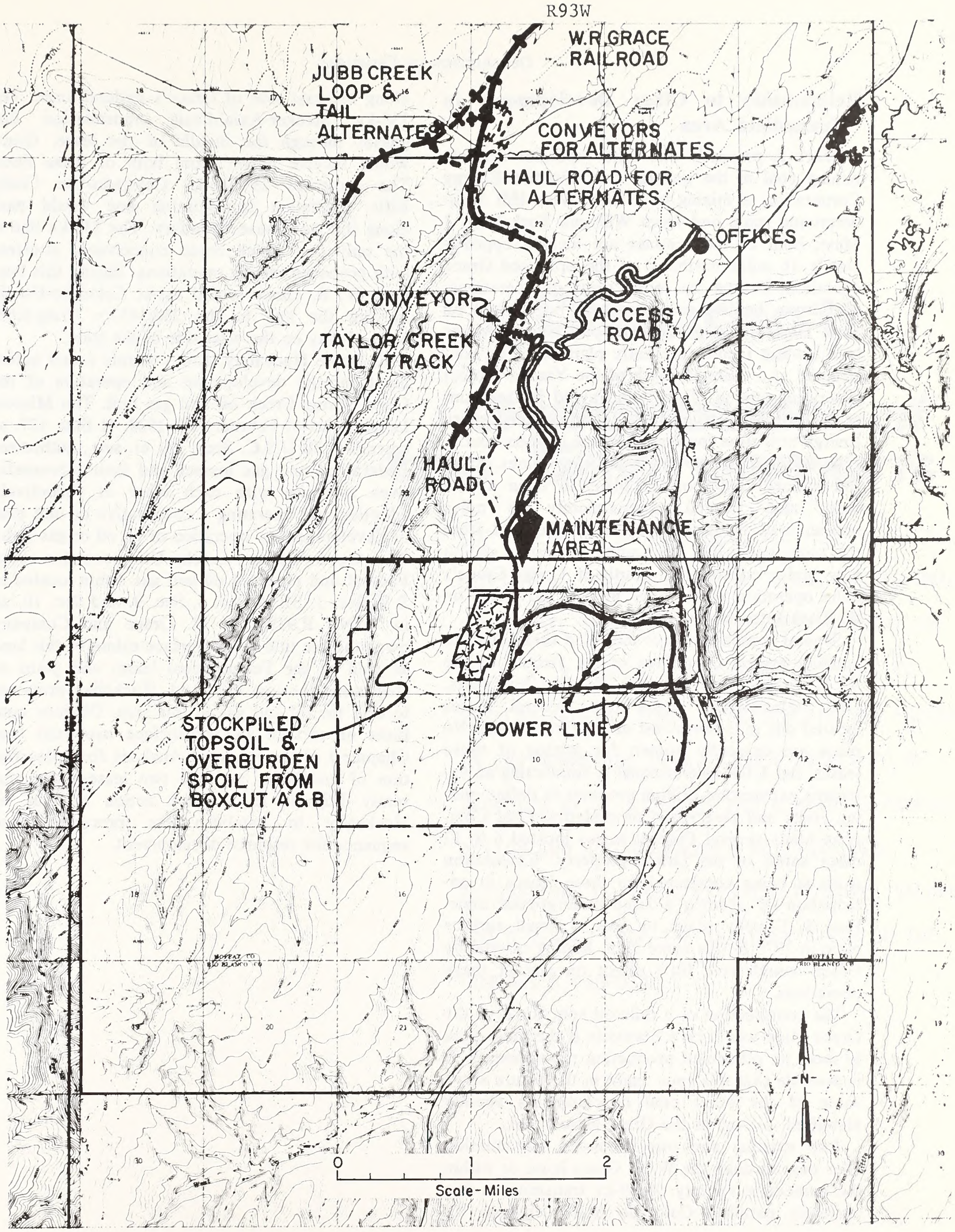


FIGURE GI-12

Proposed surface facilities and developments.

Relationship to Other Developments in Immediate Area

There is presently one other operator actively mining coal in the general area. Empire Energy Corporation is mining coal from Wise Hill 5 underground mine and from Williams Fork Strip 1 Mine; both of these mines are located approximately 16 miles northeast of the proposed Grace operation. During the initial stage of operations, coal from the Grace Mine would be trucked on State Highway 13 past the Empire Energy Mines to a loading facility presently planned to be constructed at a railhead south of the Yampa Project generating station. This would avoid further congesting the State highway to Craig, which Empire Energy now uses for truck haulage of their coal.

In addition to the two producing mines, Utah International Incorporated plans to open a new strip mine located approximately 18 miles northeast of the Grace property. The coal from this mine would fuel the Yampa generating station now under construction south of Craig. Grace's mine operation would have little or no effect on the Utah International Mine.

Several companies have indicated their intent to conduct mining operations in the vicinity of the W. R. Grace property within the next few years. Utah International holds two Federal leases located one mile northwest of the Grace lease. No plans are currently known for mining of these leases, but Utah International is conducting an extensive exploration drilling program to define mining limits and reserves. Consolidation Coal Company holds several Federal leases located 6 to 12 miles south of the Grace property. Exploration work is being conducted on these leases in anticipation of opening a large underground mine. Paul S. Coupey plans to open a small surface mine in 1976 in this same area. Mining of coal by Grace would have little effect on any of these operations.

The construction of a railroad spur to serve the Grace Mine would be a necessity if the mine were to meet its scheduled production requirements. It is possible that this spur might in the future serve some of the other coal developments already identified, as well as the Grace-mined coal.

Two existing and one proposed transmission lines pass through the W. R. Grace lease or within the immediate vicinity. A 69-kv transmission line currently parallels Colorado State Highway 13 along the east side of Grace's Federal lease. The 138-kv Meeker-Axial-Craig transmission line passes through the middle of the lease. Grace would receive power from both of these lines. The proposed 230/345-kv Colorado-Ute Craig-Rifle substation transmission line would pass along the west lease boundary. The 138-kv line is the only one which could conceivably interfere with proposed mining operations. Should this happen, W. R. Grace would assist Colorado-Ute in moving the line to the 230/345-kv Craig-Rifle right-of-way on the west side of the lease.

E. Doyle Huckabay, Ltd. controls a unit agreement for the development and operation of the Good Spring Creek oil and gas unit. The Mineral Leasing Act of February 25, 1920, 41 Stat. 437, as amended, 30 U.S.C. Secs. 181 et. seq., authorizes Federal oil and gas lessees and their representatives to unite with each other in collectively adopting and operating a cooperative or unit plan of development or operation of an oil or gas field. The Good Spring Creek Unit contains both Federal and patented oil and gas rights located in S ½ Sec. 3, SE ¼ Sec. 4, Sec. 9, and Sec. 10, all in T.3N., R.93W. W. R. Grace and Company owns the fee title to the surface estate of this land as well as the Federal coal lease, and plans to strip mine through this land. Huckabay proposes to drill for oil and gas in this area. Obvious conflicts of surface and subsurface use exist (see Chapter I of the Regional Analysis for a description of conflicts), and the two lessees are currently litigants in a court action brought by Huckabay to establish the procedure and sequence for resource development.

Chapter II

Description of the Environment

THE FOLLOWING SECTION DESCRIBES THE PHYSICAL, BIOLOGICAL, AND CULTURAL RESOURCE VALUES WHICH CONSTITUTE THE SITE-SPECIFIC ENVIRONMENT IN WHICH W. R. GRACE AND COMPANY PROPOSES TO DEVELOP FEDERAL COAL. THE DESCRIPTION FOCUSES ON ENVIRONMENTAL DETAILS MOST LIKELY TO BE AFFECTED BY W. R. GRACE AND COMPANY'S PROPOSED ACTION AND ALL REASONABLE ALTERNATIVES. ALTERATIONS OF THESE EXISTING RESOURCE VALUES WOULD RESULT FROM THE IMPLEMENTATION OF THE COMPANY'S PROPOSAL.

Non-living Components

Geologic and Geographic Setting

Topography

The site of W. R. Grace's proposed mine is on the northern slopes of Danforth Hills, and overlooks Axial Basin to the north (Figure GII-1). The site lies just west of northward-flowing Good Spring Creek. Colorado Highway 13 (789) from Craig to Meeker runs along this canyon. Most of the area is a northward-sloping upland ranging from about 7,000-7,600 feet in altitude. Most of the valleys cut into this surface are narrow, V-shaped, and about 250-500 feet deep; valley walls range in grade from 40 to 100 percent.

North of the proposed mine site, the surface is mainly two ridgelines about two miles long, trending north-northeast, bounded by Good Spring, Taylor, and Wilson Creeks. The surface on each of these ridges slopes generally down toward the north.

Stratigraphy

Except for surficial deposits, only the coal-bearing Williams Fork Formation is at the surface in the proposed mine area. The underlying Iles Formation, which also has coal beds, crops out at the northeast edge of Sections 26 and 35, and at the north end of the long ridges mentioned before, at the edge of the Axial Basin. The underlying Mancos Shale, about 5,600 feet thick, forms surface bedrock of Axial Basin (Figure GII-2).

The Williams Fork Formation consists of alternating beds of sandstone, sandy shale, carbonaceous shale, and coal beds; most beds are a few inches to a few feet thick. The formation "is characterized by thick zones of brick-red sandstone and baked shale produced by the burning of large beds of coal" (Hancock 1925). There are ten known persistent coal beds in a 392-foot stratigraphic interval in the proposed mine area. Their aggregate thickness is given by the company as 59.4 feet, and they range in thickness from about two and one-half feet to more than 14 feet, and are from 14 to 80 feet apart. According to the company, at least four deeper coal beds ranging up to 28 feet in thickness occur in a 140-foot thick interval at and below the company's Red Wing Mine.

Much of the surface of the upland area is covered by a variable thickness of residuum and soils, perhaps as much as five feet or more in thickness. Some slightly thicker alluvial deposits of silt and sand may also be present. Slopes leading down from the upland to the valley bottoms have variable thicknesses of slopewash materials. In a cut into the thick X coal bed in SW ¼, Section 2, T.3N., R.93W., 7-14 feet of slopewash lies on a fairly steep slope. This material includes discontinuous layers of sandstone fragments up to one foot thick, and individual pieces of sandstone randomly mixed with unsorted materials consisting largely of silt and sand with lesser amounts of clay.

Structure

Throughout most of the site area, beds of the Williams Fork Formation dip about three to ten degrees northerly on the flank of the Axial Basin anticline. Small subsidiary folds in the area locally modify the general northerly dip. The company report mentions linear patterns on aerial photographs that indicate either faults or joints. Three major joint trends are reported by the company; these are near-vertical to vertical, and strike about N.70° W., N.45° W., and N.30° E.

Geomorphology

Hard sandstone beds have caused narrow V-shaped stream valleys with moderately steep to precipitous slopes, a few hundred to several hundred feet high. Wilson, Taylor, and upper Streeter Creeks flow in straight narrow valleys which trend about N.30° E., the same as one of the joint trends. Wilson and Taylor Creeks in particular, may run along small straight normal faults which are part of the N.30° E. fracture set. This possibility is indicated by the slight difference in strike of the beds on opposite sides of Taylor Creek, as shown on the company's geologic map (Section 4, T.3N., R.93W.; Section 33, T.4N., R.93W.).

Overburden

The overburden consists mainly of alternating hard and soft beds of the Williams Fork Formation, as described under Stratigraphy. Surficial materials, alluvium and residuum, form a thin layer above the bedrock.

Four cross-sections by the company, in Sections 2, 3 and NW ¼ 11, T.3N., R.93W., show that overburden thickness above the top (X) main bed is mostly in the range of 100-150 feet, with a maximum of perhaps 200 feet. The overlying Y beds would be about 80-110 feet closer to the surface, but were not shown on the sections because

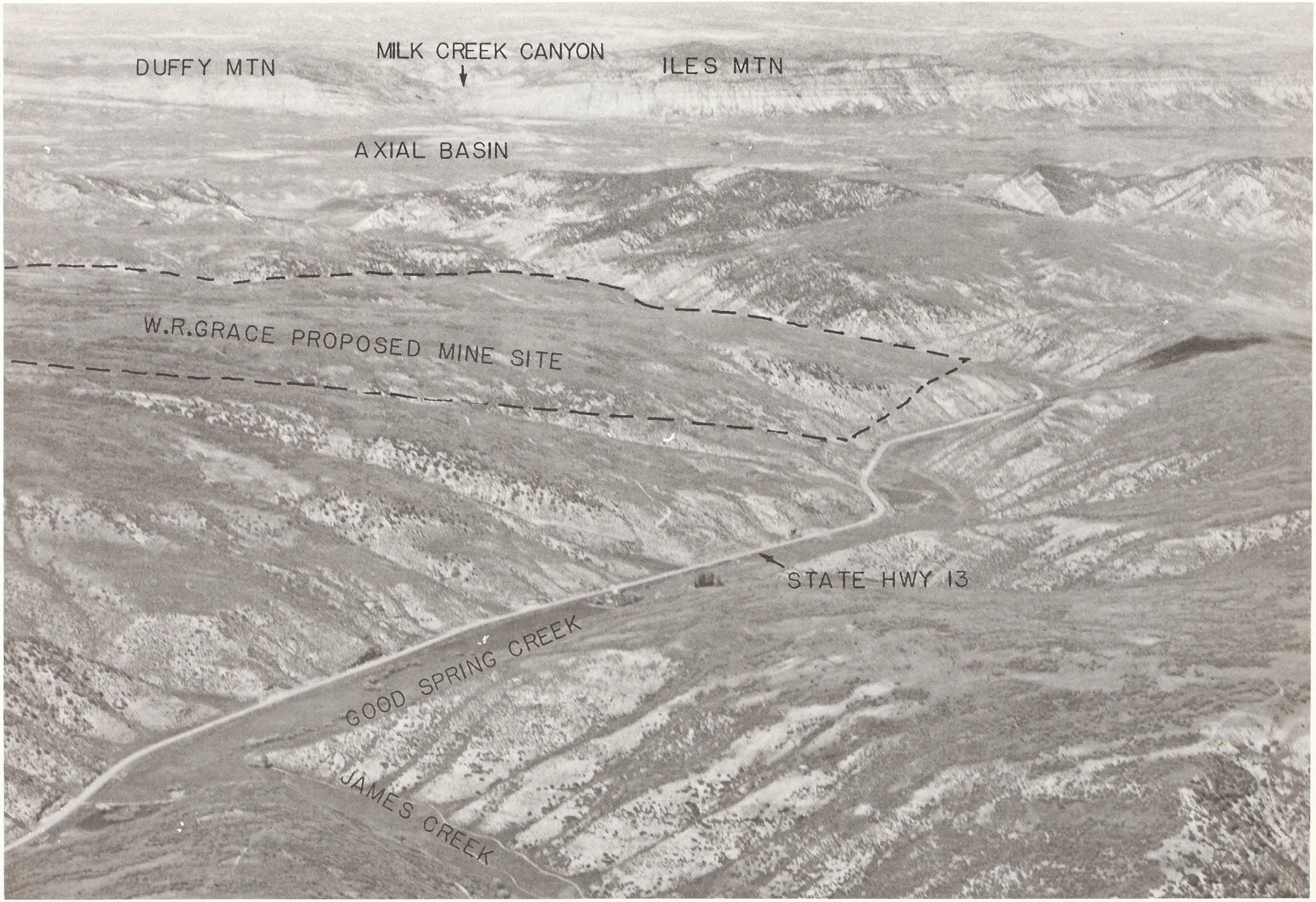


FIGURE GII-1

Aerial oblique photograph, view northeast, showing W.R.Grace Company's proposed mine site in the Danforth Hills.

ERA	PERIOD	TIME (x10^6 yrs ago)	GROUP	FORMATION	MEMBER	SUMMARY LITHOLOGIC DESCRIPTION	APPROXIMATE THICKNESS IN FEET UNIT	CUMULATIVE
MESOZOIC	Cretaceous Upper	70	Mesa Verde Group	Williams Fork Formation		Alternating sandstone, sandy ehale, carbonaceous shale, and coal beds; characterized by brick-red color.	1000	1000
			Mesa Verde Group	Iles Formation	Trout Creek SS member	Sandstone, white, fine-grained, well sorted, massive, fairly uniform in thickness.	100	1100
			Mesa Verde Group	Iles Formation		Alternating beds of massive sandstone and sandy or carbonaceous shale; light brown to white, poorly sorted, generally calcareous, grades into coal.	1300	2400
				Mancos Shale		Clay shale; soft dark-gray to drab, with lenses and interbeds of sandstone as much as 75 feet thick. Basal unit of bluish and dark-gray slaty shale and calcareous sandstone.	5600	8000
		unconformity		Dakota Sandstone (?)		Quartzitic sandstone; thinly banded greenish-gray, with pebbles at the base.	260	8260
	Jurassic Upper			Morrison Formation		Shale, limestone, chert, conglomerate lenses, and sandstone; green, greenish-gray, varicolored and maroon.	400	8660
			San Rafael Group	Curtis Formation		Shale, glauconite sandstone and thin beds of glauconitic limestone, locally oolitic, thinly-beddsd, gray.	40	8700
		unconformity	San Rafael Group	Entrada Formatiem		Sandstone; massive beds, fine-grained, sugary, light gray.	400	9100
	Triassic Upper			Chinle Formation		Calcareous shale, mudstone and a few sandstone and limestone pellet conglomerate beds.	350	9450
		unconformity		Shinarump Conglomerate		Sandstone and conglomerate interbedded, lenticular beds and steeply crossbedded, red.	50	9500
	Triassic Lower	225		Moenkopi Formation		Siltstone, shale; greenish-gray and gray, with thin red colored beds.	600	10100
PALEOZOIC	Permian	270		Phosphoria Formation		Calcareous shale to sandstone, limestone, and chert with concretions.	100	10200
	Pennsylvanian			Weber Sandstone		Calcareous sandstone; massive, light gray to buff, fine-grained.	250	10450
				Maroon Formation		Shale, sandstone, and limestone; red, interbedded.	1150	11600
				Paradox Formation		Gypsum, dark shale, yellow sandstone, red shale and siltstone; thick beds.	650	12250
		unconformity		Morgan Formation		Cherty sandstone, ehale and limestone.	1750	14000
	Mississippian			Molas (?)		Basal red shale of Morgan Formation.	50	14050
				Madison Limestone		Cherty dolomitic limestone and dolomite; light and dark gray.	430	14480
	? - ? ?	350? unconformity		Beds of undstermined age		Interbedded shale sandstons, limestone an dolomite.	200	14680
	Cambrian	570		Sawatch Quartzite		Dolomitic quartzite to quartzoss sandstone; dark to very light brown and gray, locally crossbedded.	?	?

FIGURE GII-2

Generalized stratigraphic column of rocks underlying W.R. Grace Company's proposed mine site.

SOURCE: Environmental impact report by VTN for W.R. Grace Company of "insufficient drill data". The overburden thins to zero where the X and other coal beds crop out along the valley sides. As each bed is mined, the next lower coal bed will have an overburden of approximately the thickness shown on Figure GII-3. Measurements at 28 evenly spaced points along the three cross-sections showed a total average thickness of about 320 feet to be mined, including coal beds.

Paleontology

All mining activity at the Colowyo Mine site will occur in the Williams Fork Formation of the Mesaverde Group. Many fossil imprints may be found in the coal seams, largely ammonites (flat coiled seashells), generally valuable as index fossils. However, no significant sites were located in a paleontological survey of Federal coal lease D-034365, completed by Dr. Peter Robinson of the University of Colorado Museum.

Mineral Resources

Coal

The coal beds of interest at this proposed mine site are in the Williams Fork Formation. Hancock (1925) regarded these as the principal group of coal beds. A lower group in the Iles Formation is of considerable value near Meeker, Colorado, but is represented in the vicinity of Axial Basin by a few thin beds of coal of very little economic importance.

Data from the company indicate the occurrence of ten coal beds ranging in average thickness from 2.7 to 12.3 feet (Figure GII-3). The X seam is known to be as much as 14 feet thick from one cut made in SW ¼ Section 2, T.3N., R.93W. The company regards these as eight beds of coal, as shown by their lettering (Y3 and Y2 as one bed; A2 and A3 as one bed). However, their cross-sections show these as individual beds, rather than splits from one bed, within the proposed mine area.

The company reports four deeper coal beds in the Williams Fork Formation that can be mined later by underground methods. They report that at least one of these, the bed in their now inactive underground Red Wing Mine, is 27 feet thick. Hancock (1925) shows a measured outcrop thickness of 20 feet for this bed, and also indicates another plus-20-foot bed about 60 feet lower stratigraphically. Hancock (1925) also notes a lower coal bed nearby measured at 27 feet thick, in SW ¼ NE ¼ SE ¼ Section 35, T.4N., R.93W. He believed this "bed is probably about 350 feet above the Trout Creek Sandstone".

In the absence of a single drill hole log showing the numerous coal beds of this general area, a composite stratigraphic section is shown in Figure GII-4. This figure is from Hancock's careful surface measurements (1925) and a few measurements in old mines; numbers on the right side of the column show coal bed thickness, and numbers on the left are Hancock's locality numbers, details of which may be checked in his report. Approximate stratigraphic interval of beds to be stripped and beds that may be mined underground are indicated. Hancock's figure may not show all coal beds that are present, because of the poor exposure due to slopewash, burned beds, diverse dip of the beds, and consequent difficulty of tracing beds. Also the interbed intervals may not be precise because of the difficulty in making accurate surface measurements in these folded beds.

Recoverable reserves of the coal to be mined by surface methods are stated by the company as 165 million short tons, based on a 90 percent recovery rate; approximately 18 million short tons would be lost in the mining. The four lower coal beds, which can be mined only by underground methods, form a reserve of about 200 million short tons, of which 100 million short tons would be recoverable, according to the company. The 30-year (1976-2005) plan of the company calls for production of 83,720,000 tons; with the generally accepted figure of 10 percent loss in mining, the total coal reserves committed will be about 93 million tons.

In-place resources on competitive lease application C-22839 are as follows (USGS, 1976):

Competitive Lease Application	Measured	Indicated	Total
C-22839			
Surface	19,283,634	13,270,626	32,554,260
Underground	18,036,216	17,965,134	36,001,350
TOTAL	37,319,850	31,235,760	68,555,610

NOTE: Recoverability factors have not been applied to above tonnages (i.e. estimates are of in-place tonnages).

Quality of the coal is stated by the company to be "between Bituminous, Class C and Subbituminous, Class A". Analyses of drill hole cores

Surface

Coal Bed	Thickness (feet)	Tons (millions)	BTU (per pound)	Sulfur (%)	Ash (%)	Water (%)
Y3	3.7	3.8	10,149	0.37	4.26	18.56
Y2	3.1	3.2	10,273	0.36	5.40	16.65
X	12.3	34.1	10,553	0.33	5.40	15.48
A2	4.0	7.7	10,672	0.42	4.89	15.29
A3	2.7	5.2	10,311	0.59	8.31	14.65
B1	5.3	15.3	10,780	0.39	4.6	15.09
C	6.0	20.3	10,727	0.33	4.75	14.83
D	10.1	34.2	10,626	0.34	6.27	14.45
E	6.8	23.3	10,984	0.51	4.03	14.54
F	5.4	17.9	10,903	0.57	4.86	14.21
	Total	165.0	10,705	0.4	5.16	14.91

Averages

FIGURE GII-3

Coal beds to be mined at proposed W.R. Grace strip mine.

SOURCE: W.R. Grace Company

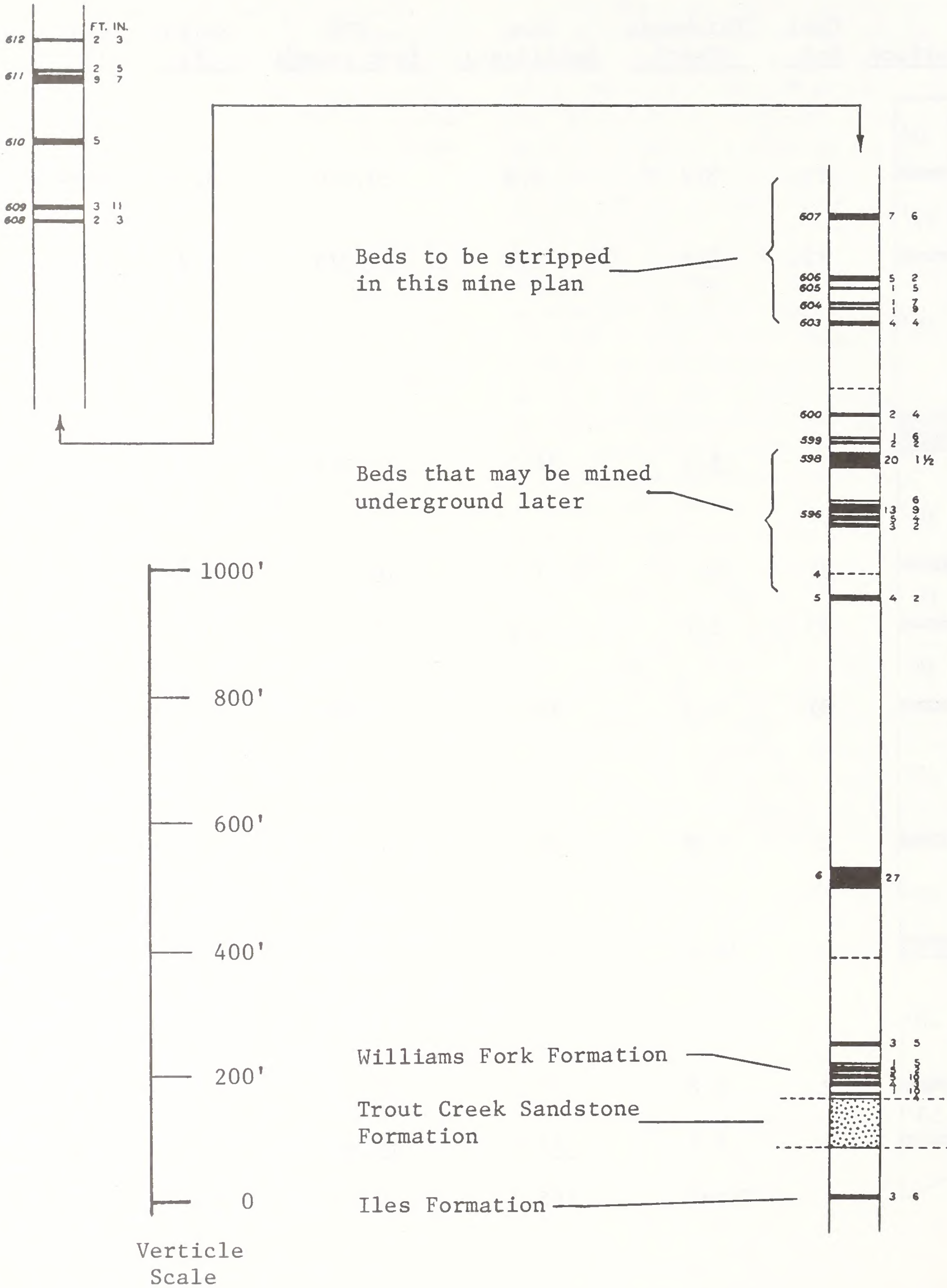


FIGURE GII-4

Stratigraphic position of coal beds at W.R. Grace proposed mine site.

SOURCE: U.S. Geological Survey Bulletin 757

taken on the property reflect the following weighted average qualities:

Btu	Ash	Sulfur	Carbon	Volatiles	Moisture
10,728	5.06%	0.4%	46.23%	33.90%	14.81%

Table GII-1 shows analyses of coal samples from the W. R. Grace proposed mine site (U.S. Geological Survey Bulletin 757).

OIL AND GAS

Except for the large coal reserves, oil and gas are the only potential mineral resources in the area of the proposed mine. Most drilling in this part of the region has been for the more easily identified targets such as structural traps. The closest fields that have produced commercial quantities of oil are on anticlinal or domal structures: Wilson Creek field about five miles to the southwest, Iles Dome oil field about six miles northeast, and Thornburgh Dome field about seven miles to the east-southeast. The immediate vicinity of the proposed mine does not seem to be favorable for oil and gas accumulations in structural traps. Possibilities do exist, however, for oil or gas accumulations in stratigraphic traps which have no surface expression to guide exploration.

None of the exploratory holes drilled in the vicinity of the proposed mine has as yet produced oil or gas in commercial quantities. These tests have been in Sections 22 and 25, T.4N., R.93W., and in Sections 4, 5, 17, 19, and 25, T.3N., R.93W. Non-production from these exploratory holes does not preclude the possibility of re-entry to holes that might be of commercial interest, if economic circumstances change sufficiently from those prevailing at the time the hole was first drilled, nor does it preclude the possibility of new exploratory holes discovering commercial quantities of oil or gas, particularly in types of traps not apparent at the surface.

Water Resources

GROUND WATER

Rocks at Colowyo Mine dip northerly toward Streeter Creek. All coal beds to be mined are truncated by the valleys of Streeter Creek on the north, and Good Spring Creek on the east. As a result these beds are all drained, except for local perching. Local perching produced some downward cascading of water in some of the test holes; however, no saturation was encountered in any of the beds that are to be mined.

Recharge takes place throughout the area, but is largely confined to the valleys of the ephemeral upland water courses such as Streeter Creek and its tributaries; most of the areas of perched water occur beneath these valleys. The perched water gradually moves downward to the main level of saturation which is probably near the level of Good Spring Creek. A small amount of perched ground water discharges into Streeter Creek. The remainder of the ground water that is recharged in the area is discharged to Good Spring Creek.

SURFACE WATER—QUANTITY AND QUALITY

Drainage and stream flow characteristics

Colowyo Mine Company property is drained by tributaries of Milk Creek which is a tributary of the Yampa River. The downstream and tributary order of the drainage system is indicated below:

Yampa River: Milk Creek, Wilson Creek
Good Spring Creek, Taylor Creek
Streeter Creek Jubb Creek.

Figure GII-5 shows the lease area and overall drainage system. The proposed lease lies between Good Spring Creek on the east and Taylor Creek on the west.

The area to be mined is drained on the west and north by an intermittent stream and its tributaries—Streeter Creek. The central portion of the area is drained by a minor tributary of Good Spring Creek, and the eastern and southern border areas drain directly to Good Spring Creek. Streeter Canyon discharges into a series of man-made ponds. Water from these ponds ultimately contributes to the total flow in Good Spring Creek by ground water return and pond system overflow.

Water supply and availability

Data for determination of mean annual runoff and peak flows of the four basins: Wilson, Taylor, and Good Spring Creeks, and Streeter Canyon, are extremely limited. The only streamflow records for these streams are from gaging stations on Wilson Creek near Axial, and Good Spring Creek at Axial, for the water year October 1974-September 1975; locations of these gages is shown in Figure GII-5. Analysis of this one year period of record indicates base flows of about 0.80 cfs and 0.60 cfs, and mean annual discharges of 2.39 cfs and 2.30 cfs, for Good Spring and Wilson Creeks respectively.

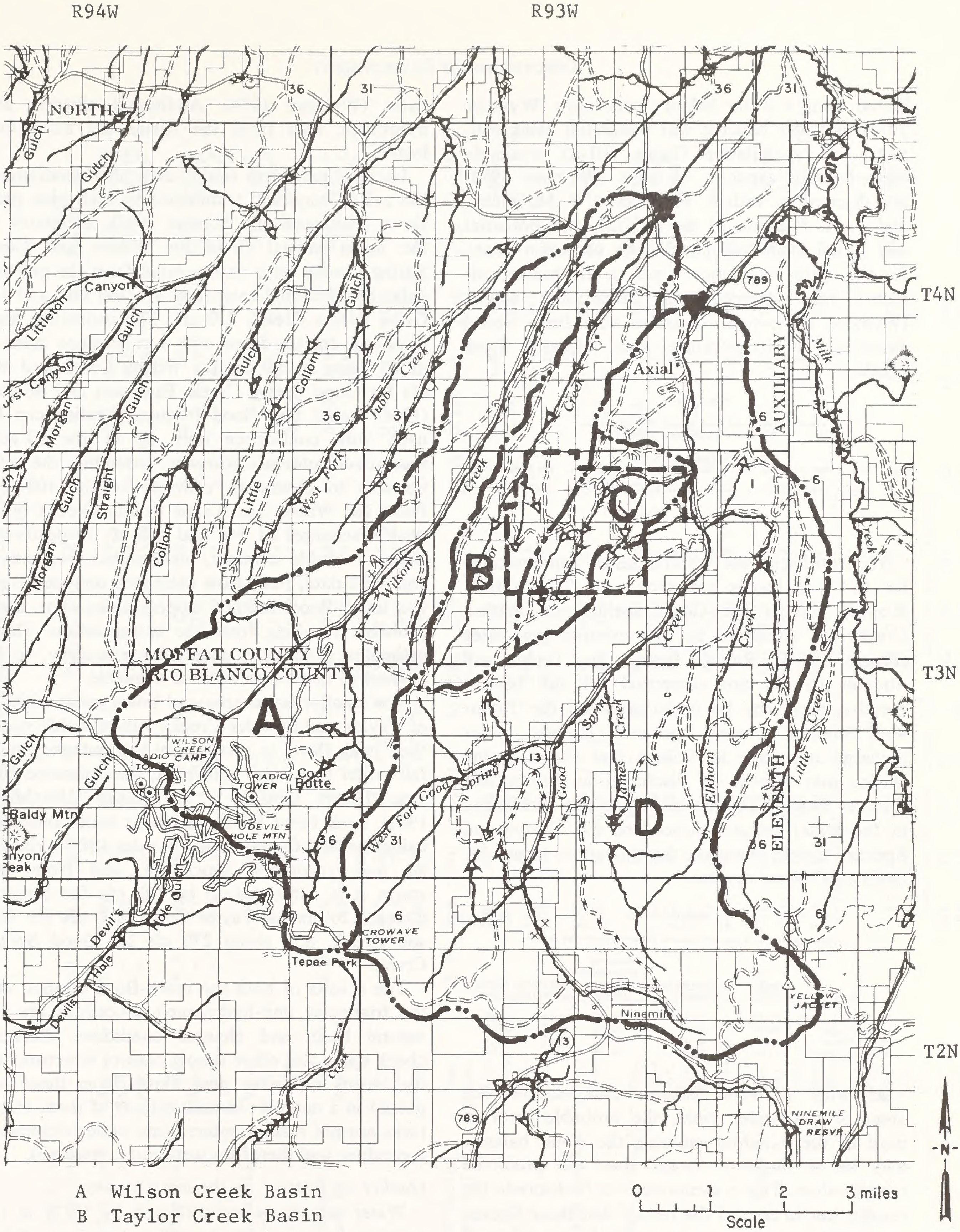
Because of the runoff data constraints, the mean annual runoff for the four basins was esti-

TABLE GII-1

Analysis of Coal Samples from W.R. Grace Proposed Mine Site

Mine	Formation	Location: Quarter	Location: Sec.	Location: T. N.	Location: R. W.	No. on map	Laboratory No.	Air-drying loss	Form of analysis	Proximate: Moisture	Proximate: Volatile matter	Proximate: Fixed carbon	Proximate: Ash	Ultimate: Sulphur	Ultimate: Hydrogen	Ultimate: Carbon	Ultimate: Nitrogen	Ultimate: Oxygen	Heating value: Calories	Heating value: British thermal units
Mount Streeter No. 10 mine (Joseph Collom).	Williams Fork.	NE.	2	3	93	598	14543	2.1	A	11.9	a40.6	45.3	2.2	0.32	------	------	------	------	6,450	11,610
									B	10.0	41.5	46.2	2.3	.33	------	------	------	------	6,590	11,860
									C	------	46.1	51.4	2.5	.36	------	------	------	------	7,325	13,180
									D	------	47.3	52.7	------	.37	------	------	------	------	7,510	13,520
Do	do	------	------	------	------	------	93309	1.8	A	10.4	38.0	49.2	2.4	.3	------	------	------	------	6,570	11,820
									B	8.8	38.7	50.1	2.4	.3	------	------	------	------	6,685	12,030
									C	------	42.4	54.9	2.7	.3	------	------	------	------	7,320	13,180
									D	------	43.5	56.5	------	.3	------	------	------	------	7,520	13,540
Do	do	------	------	------	------	------	93310	1.7	A	10.2	40.1	46.9	2.8	.3	------	------	------	------	6,570	11,830
									B	8.6	40.8	47.7	2.9	.3	------	------	------	------	6,685	12,030
									C	------	44.6	52.3	3.1	.3	------	------	------	------	7,320	13,170
									D	------	46.1	53.9	------	.3	------	------	------	------	7,550	13,590
Do. (composite of samples 93309 and 93310).	do	------	------	------	------	------	93311	1.7	A	10.6	38.5	48.4	2.5	.2	5.9	66.8	1.2	23.4	6,570	11,830
									B	9.0	39.2	49.2	2.6	.3	5.8	68.0	1.2	22.1	6,690	12,040
									C	------	43.1	54.1	2.8	.3	5.3	74.7	1.4	15.5	7,350	13,230
									D	------	44.3	55.7	------	.3	5.4	76.8	1.4	16.1	7,560	13,610

SOURCE: U.S. Geological Survey Bulletin 757



A Wilson Creek Basin
B Taylor Creek Basin
C Streeter Creek Basin
D Good Spring Creek Basin
▼ Stream gage with water samples

FIGURE GII-5

Lease area and overall drainage system.

mated using a water balance procedure (Wymore 1974). A water balance was computed using estimates of precipitation (Table GII-2), available water-holding capacity of soils (Wymore 1975, and discussions with R. F. Miller, I. S. McQueen, and F. A. Branson of the USGS), and potential and actual evapotranspiration by elevation zones for the major vegetation types in the basins, adjusted for differences in slope and aspect (Wymore 1974; solar radiation data from Grand Junction; air temperature data adjusted from Meeker).

TABLE GII-2

Mean Monthly and Mean Annual Precipitation For Meeker, Colorado, 1941-73

Precipitation, in inches

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1.17	1.07	1.39	1.65	1.47	1.45	1.43	1.92	1.29	1.52	1.14	1.39

Annual Average: 16.89

The results of the water-balance computations for the four basins are shown in Table GII-3. Run-off figures for Good Spring and Wilson Creeks are computed for the existing gage sites (Figure GII-5). Runoff figures for Taylor and Streeter Creeks are computed for the basins' mouths; they may be underestimated for Taylor and Streeter Creeks, because ground water recharge occurring in Wilson and Good Spring Basins may appear as discharge in Taylor and Streeter Basins. This possibility is not considered in the water balance procedure for Taylor and Streeter Creeks, because the procedure treats the basin as a closed system.

TABLE GII-3

Drainage-Basin Areas and Annual Water-Balance Estimates

Basin	Area (mi^2)	Precipitation (inches)	Computed Evapotranspiration (inches)	Estimated Runoff (inches)	Estimated Runoff (acre-feet)
Good Spring Creek	39.45	22.52	21.91	0.61	1,270
Wilson Creek	26.98	22.44	21.42	1.02	1,480
Taylor Creek	7.14	21.50	21.17	.33	125
Streeter Creek	2.12	21.55	21.16	.39	45

As with all water balance computations for areas of low water yield, the probable error in most of the variables entering the water balance may be as large or larger than tne predicted runoff values. This is mentioned not to discredit the results, but to remind the reader that these figures are initial estimates to be revised as additional data become available. The computed runoff figures in Table GII-3 appear to be reasonable initial estimates, and the procedure used to compute them has worked well in a hydrologically similar basin (Wymore 1974). Additional climatic and hydrologic data from the basins are being collected.

Lack of sufficient runoff data also necessitates the use of empirical techniques to determine peak flows (Patterson and Somers 1966). Estimates of the mean annual flood for Wilson and Good Spring Creeks were extrapolated from the existing data: for Wilson Creek they are 160 cfs, and for Good Spring Creek, 210 cfs. The estimated peak discharge for the flood with a recurrence interval of 50 years is 200 cfs for Wilson Creek and 400 cfs for Good Spring Creek. Patterson and Somers (1966) stated that flood frequency ratios can be used with confidence only up to the 50-year recurrence interval; however, extending the relationship to obtain an estimate of the 100-year flood for Wilson and Good Spring Creeks gives peak discharges of 340 and 440 cfs respectively. Given available climatic, topographic, vegetative, and soils data, peak flow estimates obtained from the index-flood method appear somewhat high, probably resulting from the extrapolation. These estimates must be considered preliminary, to be revised as more data become available.

The smaller basin area and lower mean altitude of Taylor and Streeter Creeks will probably cause their peak flows to result from high intensity rainfall rather than from snowmelt; the estimated 100-year 1-hour rainfall is 1.5 inches (Hershfield 1961). Peak flows for these basins were computed using the Soil Conservation Service (SCS) triangular unit-hydrograph procedure, and from this storm it is estimated to be 100 cfs for Streeter Creek, 120 cfs for Taylor Creek, 190 cfs for Wilson Creek, and about 270 cfs for Good Spring Creek.

The results of both the index-flood method and the triangular unit-hydrograph procedure are for natural basin and channel conditions. Existing check dams and other runoff control structures on the basins will alter peak flows from those expected in a natural channel; effects of these structures are not readily entered into either estimation procedure and therefore were not considered.

Quality of streams in the analysis area

Water samples were collected by VTN in the analysis area at nine sampling locations; Table GII-4 presents a complete list of the principal cations and anions for the samples. Data presented in Table GII-5 are average values for all VTN water samples which were analyzed.

TABLE GII-4

Water Quality Analysis
Colowyo Mine at Mount Streeter, Colorado

Location and Date		pH	Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	F	B	SiO_2	TDS	Alka-linity	SC
Taylor Creek I -	Aug. '74	8.4	95	52	21	5	23	475	58	13	13	0.1	0.4	750	428	740^L
	Sept.	-	49	38	10	3	1	281	90	14	0.4	-	8.2	445	230	630^L
	Oct.	-	78	54	60	5	1	257	94.4	3.9	0.1	-	8.0	513	-	800^F
Taylor Creek II -	Aug.	8.6	56	96	68	10	48	567	110	28	0.5	1.0	.91	1050	545	1125^L
	Sept.	-	37	93	71	10	1	440	250	26	0.9	-	5.7	799	361	1120^L
	Oct.	-	169	113	130	16	1	364	278	7.0	0.2	-	6.5	888	-	1350^F
Good Spring Creek I -	Sept.		85	111	40	11	1	458	390	17	0.6		8.7	1037	375	1290^L
	Oct.		107	113	226	20	1	389	378	3.5	0.3		6.5	1056		1550^F
	Ncv		121	128	32	5.3	1	281	410	4.0	1.0	0.23		1255		
Good Spring Creek II -	Aug.	8.5	110	110	48	13	42	769	130	13	.52	0.30	1.4	1260	700	1190^L
	Sept.		85	122	52	11	1	506	440	19	0.7		7.6	1109	415	1380^L
	Oct.		113	132	88	10	1	390	456	3.7	0.5		6.6	1073		1600^F
	Nov.		118	124	48	7.2	1	333	497	4.0	0.4	0.24	1	1010		
	Dec.		93	71	111	5	1	470	333	122	1.5			1012		
	Jan.		104	150	60	7.6	36	446	600	8.5	0.6		0.72	840	482	
Good Spring Creek III -	Aug.	8.5	100	140	64	17	45	854	190	14	0.59	0.25	1.3	1440	775	1410^L
	Sept.							--None--								
	Oct.		100	148	116	10	1	437	467	4.7	0.4		6.6	1220		1800^F
	Nov.		129	131	49	7.2	1	356	407	4.3	1.5	0.24	1	1173		
	Dec.		112	126	44	6.7	1	571	560	17	1.3		11.7	1129		
	Jan		106	153	62	8.3	32	472	620	6.0	0.9		1.1	1040	504	
Wilson Creek I -	Oct.		100	76	180	12	1	394	467	25.9	0.4		10.1	975		1330^F
	Nov.		112	53	113	3.1	1	318	136	24	1.0	0.14	1	835		
Wilson Creek II -	Aug.	8.4	90	64	120	11	26	580	85	120	0.6	0.15	1.6	1130	515	1340^L
	Sept.		73	54	108	9	1	395	160	116	0.5		9.4	876	324	1280^L
	Oct.		113	88	180	8	1	336	222	30	0.5		9.1	1108		1800^F
	Nov.		124	77	132	10	1		223	29.1	0.9	0.19		2021		
	Dec.		93	71	111	5	1	470	333	122	1.5			1012		
	Jan.		102	98	126	7	0		450	8.5	0.9		2.2	920	1280	
Wilson Creek III -	Aug.	8.5	78	88	150	12	36	647	120	140	0.6	0.15	0.9	1320	590	1530^L
	Sept.		85	87	148	10	1	425	300	146	0.5		7.0	1135	348	1640^L
	Oct.		82	113	188	5	1	426	378	35.4	0.4		8.3	1295		2050^F (1600^L)
	Nov.		119	113	158	7	1	322	325	34.6	1.4	0.24		808		
	Dec.		Taylor Creek Dry -- Wilson III same as Composite													
Composite	Aug.							--No Data--								
	Sept.		61	87	145	10	1	425	250	156	0.5		6.6	1079	348	1570^L
	Oct.		75	116	180	4	1	390	422	35.1	0.4		8.0	1326		2100^F (1580^L)
	Nov.		Same as Wilson Creek III -- Taylor not flowing													
	Dec.		101	90	127	6	1	542	426	138	1.0		13.4	1092		
	Jan.		98	119	137	8	20	426	493	11.0	0.8		0.6	960	466	

SOURCE: Modified Mining Plan, Colowyo Coal Mine, Colowyo Coal Company, April 30, 1975.

L,F Laboratory or field valves

TABLE GII-5

Average Concentrations All Samples

Location	pH	Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	F	B	SiO_2	TDS	Hardness $CaCO_3$	SC
Taylor Creek I	8.4	74	48	30	4.3	23	338	81	10.3	4.5	0.1	5.5	569	329	723
II	8.6	87	101	90	13.0	48	457	213	20.3	0.5	1.0	4.4	912	302	1198
Good Spring Creek I	-	104	117	99	12.1	1	376	393	8.2	0.6	0.23	7.6	1116	375	
II	8.5	107	107	47	7.6	39	430	378	9.1	0.5	0.37	4.2	1067	532	
III	8.5	109	140	67	9.8	38	538	449	10.0	0.9	0.25	4.5	1200	640	
Wilson Creek I		106	64	146	7.6	1	356	91	25.0	0.7	0.14	5.6	905		
II	8.4	100	75	130	8.3	26	445	246	83.4	0.8	0.17	5.6	1179	706	
III 1/	8.5	94	102	151	8.0	28	465	340	98.0	0.8	0.21	5.9	1102	468	
Composite I 2/		68	102	162	7.0	1	408	383	95.5	0.4		7.3	1053	348	

1/ Includes Dec. and Jan. of composite since Taylor Creek not flowing.
2/ Sept. and Oct. only.

SOURCE: Modified Mining Plan, Colowyo Coal Mine, Colowyo Coal Company, April 30, 1975.

General water types found in streams in the analysis area can be assessed from the average values in Table GII-5. They are (Grace 1975):

Location		Water Type
Taylor Creek	I	Ca - HCO_3
	II	Mg - HCO_3
Good Spring Creek	I	Mg - SO_4, HCO_3
	II	Mg, Ca - HCO_3, SO_4
	III	Mg - HCO_3, SO_4
Wilson Creek	I	Na - HCO_3
	II	Na - HCO_3, SO_4
	III	Na - HCO_3, SO_4
Composite	I	Na - HCO_3, SO_4

These water types may be summarized as typical calcium (Ca) or magnesium (Mg) bicarbonate (HCO_3) near the headwaters of the streams, with a gradual exchange of calcium and magnesium for sodium (Na) in a downstream direction. Concentration of sulfate (SO_4) also becomes more dominant in the downstream reaches. These samples were taken during the time of year when the water occurring in the streams is largely the result of base flow and would most nearly resemble rock chemistry.

Figure GII-6 (Grace 1975) is a graphical representation of the change in water chemistry with time for three of the VTN sampling stations. The only consistent relationship among the three stations is the SO_4 ion concentration which tends to increase throughout the period of record. Several other generalities are apparent from the graphs in Figure GII-6. These are:

HCO_3—Begins dropping August-November, increases to December, and decreases to January;
SO_4—Generally increases August-January;
NA—Fairly constant with some increase August-October, slight decline to December, and increasing in January;
TDS—(Total Dissolved Solids) increase from upstream to downstream.

Most drinking water standards in the conterminous United States conform to standards established by the U.S. Public Health Service (1962). These same quality criteria are adhered to by the Colorado Department of Health. Comparison of these limits to the concentrations listed on Table GII-5 reveals that water at all stations in the analysis area exceeds these recommended limits at one time or another in one or more constituents.

Water sampled during this period was exceedingly hard when compared to the fact that a total hardness of 100-150 will deposit much scale. Sample calculations use the data in Table GII-5 and the following formula:

Total hardness = sum epm (estimated parts/million) of Ca, Mg, Fe, and Mn × 50; the following total hardness was calculated:

Taylor Creek	I	384
Wilson Creek	I	526
	II	558
Good Springs Creek	I	742
	II	712
	III	846

Water quality data for the analysis area have also been collected by a USGS study team which is evaluating effects of existing coal developments on drainage systems in the EIS region. Two water quality stations were established by this team at surface water locations near Colowyo Coal Company properties (VTN 1975). Investigations of this type are concerned with evaluating potential for the occurrence of extensive acid mine drainage formation in Colorado waters. Water quality data collected in the analysis area thus far are not indicative of acidic discharge.

Analyses of water from sites on Taylor, Wilson, Good Spring, and Streeter Creeks, made at U.S. Geological Survey's central laboratory in Salt Lake City, Utah, indicate nearly equal proportions of calcium, magnesium, bicarbonate, and sulfate, when expressed in milli- equivalents/liter. At Streeter Canyon and especially at Wilson Creek, sodium and chloride are also present in significant concentrations. The most abundant trace metals in surface waters are copper, iron, lead, and zinc. Arsenic, cadmium, molybdenum, nickel, and selenium are present in small amounts. In the nine samples analyzed, dissolved-solids concentration ranged from about 500-1,100 milligrams/liter (Hofstra et al 1975).

Water and related land resource problems in the analysis area

The Colorado Land Use Commission has classified the general region of the property as contributing a low yield of dissolved and suspended sediments to the overall stream system (VTN 1975). Of all streams in the area, Wilson Creek exhibits the greatest amount of erosion. Less riparian vegetation is found on the slopes adjacent to this stream system than along the other drainages in the analysis area. The heaviest ero-

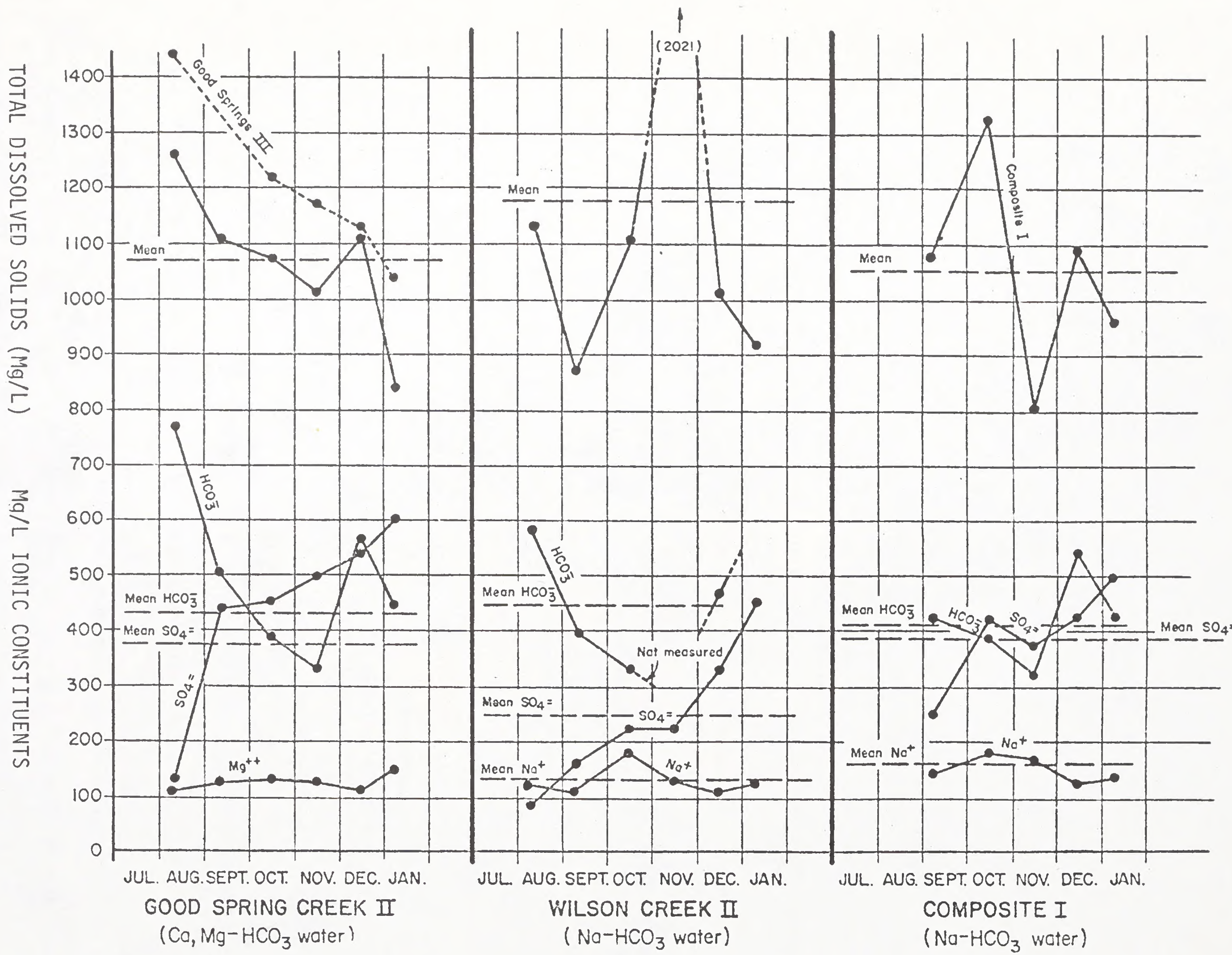


FIGURE GII-6

Selected ion concentrations and TDS.

sion of Wilson Creek is confined to particular sections of the stream channel. A dramatic cyclical pattern of deposition, erosion, and further deposition is observed along the course of this stream adjacent to the analysis area (Grace 1975).

There are several small man-made impoundments which affect the stream flow in the proposed mining area. These reservoirs have a capacity of less than one-half acre-foot and are used to provide normal water supplies for livestock. Four of the stock ponds, two on Taylor Creek and two near the headwaters of Streeter Canyon, exceed one acre-foot capacity.

Access road construction on the 4.1 square miles of property currently earmarked for mining development has resulted in alterations to traditional flow patterns at various points along the drainage courses of Streeter and Taylor Creeks. During spring runoff, ephemeral springs and creeks are often seen flowing along and across unpaved road surfaces, resulting in accelerated erosion and higher downstream turbidities.

The two existing underground mines, Red Wing and Streeter, do not affect water resources. Both have been closed due to a fire in the coal seam and the associated production of carbon monoxide gas in the mine workings.

Climate

Several deep canyons within the mine lease boundary influence climatic conditions. Rough topography of the mine area causes significant channeling of air masses passing the region. During the evening and early morning hours, air is known to move toward lower elevations. Therefore at the Colowyo Mine, air from the far western portion will flow into Taylor Creek Canyon, but the largest portion of the air mass will move into Streeter Canyon, and then up Good Spring Creek Valley toward Yampa Valley. During the afternoon hours when the sun heats the earth's surface, air tends to flow towards higher elevations.

Up-valley flow occurs less frequently in rough terrain than down-valley flow because of its dependence on strong solar heating. This restriction on the frequency of up-valley flow is assumed to apply to the Colowyo Mine site. It is estimated that down-valley flow occurs about 50 percent of the year, and up-valley flow about 10-20 percent of the year.

Average hourly wind speed varies with the time of day. At the Colowyo Mine it is estimated that afternoon wind speed will average five meters per second (mps) (10 mph), and evening wind speed will average two mps (4 mph).

Wind speeds greater than 10 mps (20 mph) will occur during stormy weather, approximately three percent of the time. Calm conditions can occur any time of day, but are more frequent during the evening and early morning. Wind speeds of less than one mps (two mph) are expected nearly 20 percent of the time at the Colowyo Mine site.

Measurements of annual precipitation at the mine are unavailable, but historical records from the nearby towns of Meeker and Hamilton indicate that about 46 centimeters (18 inches) can be expected per year. It is estimated that 80 days/year precipitation is greater than the detectable limit of .25 millimeters (0.01 inches) at the Colowyo Mine.

The mine area is subject to large seasonal and daily temperature variations. In July, temperatures are expected to vary from 30° C (86° F) during the day, to 6.7° C (44° F) at night on the average. January extremes vary from an average of 1.1° C (34° F) during the day, to -15° C (5° F) at night. The growing season is assumed to be similar to that recorded at Meeker, or about 90 days.

Air Quality

Ambient concentrations of the nationally regulated air pollutants are difficult to determine at the Colowyo Mine because no monitoring data are available. Therefore baseline concentrations of air pollutants are assumed to be the same as measured in other rural western regions. These concentrations are discussed in the Regional Analysis Air Quality section of this Environmental Impact Statement. Visibility at the mine is also assumed to be similar to the regional visibility.

Living Components

Soils

There are three broad landforms on which the soils have formed that were recognized in the W. R. Grace lease site. These are soils that developed on: (1) narrow to broad, gently sloping to rolling ridgetops, (2) moderately steep to steep sideslopes, and (3) in the nearly level to gently sloping concave narrow stream valleys.

The location of typical soil profiles (numbers 1 through 9) are shown on the soil map for each major land classification unit mapped at the study site (Figure GII-7); chemical and physical data from each profile are presented in Table GII-6. Because of the limited soil survey work by USDA-SCS in the area, only a generalized attempt was made to establish the taxonomic units for the soils. It was determined that most of the soils are in the order Mollisols and the sub-order Borolls. Soils on steep south slopes are in the order Entisols and in the sub-order Orthents.

Soils in the W. R. Grace lease are naturally calcareous. They have developed zones of lime accumulations but do not have a definite calcic horizon. Calcium carbonate veins are present in lower parts of most soil profiles. The reaction to dilute hydrochloric (HCL) acid ranged from slight to violent; reaction usually became greater with depth.

The pH values at 25° C on a 1:5 dilution ranged from 7.0-8.8. Electrical conductivity indicated most soils were only slightly saline with most readings generally below one millimohs/centimeter (Table GII-6).

Soil inventory

A detailed land unit capability map was prepared by the Bureau of Reclamation. The inventory includes only those portions of the mine plan that lie in Sections 2, 3, and the N ½ of Section 10, T.3N., R.93W. This land unit capability map was made to determine location, extent, and quality of surface soils, and to characterize overburden materials as to reclamation potential. Surface soils were delineated into units based on potential for topsoil and its distinguishing characteristics.

During the study, four major land unit capability classes were identified, described, delineated, and indicated by the use of Roman Numerals II, III, IV and VI (Figure GII-7).

Surface soils are also designated into a soil map symbol or number as established by the BLM for the State of Colorado. The major soil units were assigned the numbers 6020, 6030, 6040, and 6060, with variations within these major units being numbered consecutively as 6021 or 6022 etc., for each of the major variations within the mapping units (Figure GII-7).

The area in the mine plan that lies outside of lease D-034365 consists of soils within Soil Association 59 (see Regional Analysis, Chapter IV).

Description of mapping units

Land unit capability II

The majority of soils in this unit have developed from residual material. Typical soil profiles describing the important soil characteristics are listed hereafter and also in Table GII-6.

Mapping Unit 6020 consists principally of the deep (over 60 inches) valley-filling loamy materials in the narrow stream bottoms of the area. They consist of dark-colored alluvium with a dominant loam to clay texture. They are somewhat stratified with small layers of coarse material consisting of water-worn sandstone rock fragment or gravel-moving watertable at 23 feet. Topsoil potential is more than 60 inches thick and is rated good. Mapping unit 6021 is 36-60 inches deep. It is slightly calcareous with a strong to moderate structural development. It is saline and has a loam surface layer and a clay subsoil.

Topography for much of this land unit is rolling ridgetop with slopes of .5-15 percent. Aspect or exposure is usually north-northeast along the ridges sloping from the high hills to the south. The topsoil is about 10 inches thick and is rated fair to good. Subsoil is too clayey. Vegetation is predominantly sagebrush (*Artemsia tridentata*) with an understory of native grasses and forbs.

Land unit capability III

Mapping units in the series 6030 are shallow to moderately deep (12-36 inches), slight to medium calcareous, and in some cases have strong structure development. Slopes average 5-15 percent, but range from 0-35 percent. They are confined mostly to hill ridge-tops and western exposed side-slopes. Surface textures are usually loams and the subsoil includes clay loam and clay; they are nonsaline.

Soils that have developed under scrub oak (*Quercus gambelii*) on west faces have textures that include loam and sandy loam. These surface soils are trapped wind deposits from higher ridgetops.

Vegetative cover on the northwest-facing slopes is predominantly mountain shrub vegetative type with stands of quaking aspen (*Populus tremuloides*) at the head of draws in small moist depressions. Usually there is a good understory of native grasses in these heavy brush areas.

The ridgetops on the northeast-facing slopes are predominantly big sagebrush, a few sparsely scat-

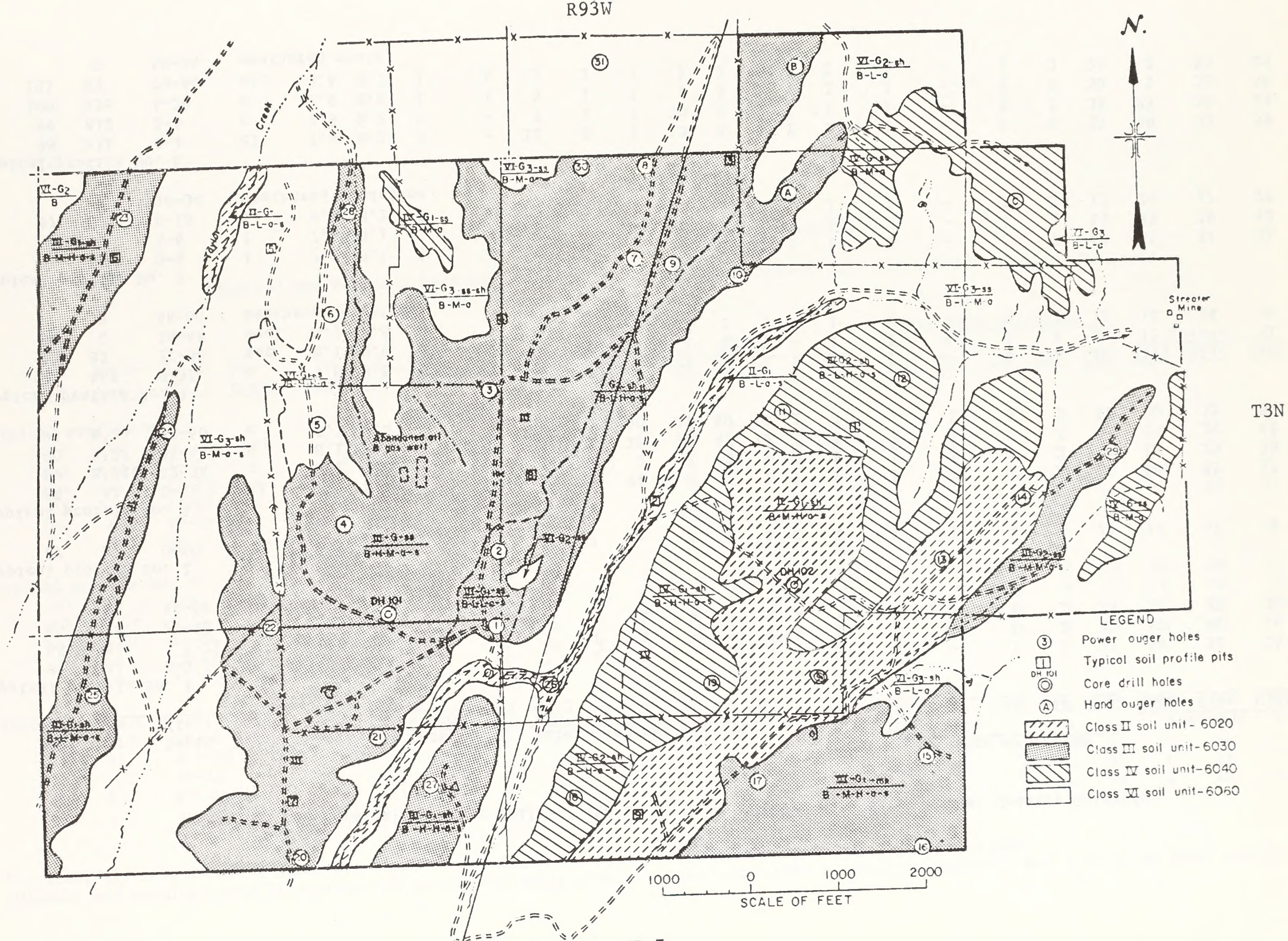


FIGURE GII-7

Soil unit classification map - Taylor Creek site.

TABLE GII-6

Chemical and Physical Data for Soils of the W. R. Grace Colowyo Mine Site, Moffat County, Colorado

Lab. No.	Hori- zon	Depth (In.)	Tex- ture*	pH Rate	Extract pH	Extract EXCIO3	Saturation Extract (me/l) CO_3	HCO_3	Cl	SO_4	Ca	Mg	Na	P	SAR	Exchange me/100 gm Tot. Na	Sol. Na	ES	ESP	CEC	Percent Sand	Silt	Clay
Typical profile No. 1																							
84	A1	0-3.5	l	6.6	8.1	1	-	7	1	1	5	3	1	1	1	1	-	1	1	27	34	31	24
85	B1	3.5-21	l	6.6	8.5	1	1	5	1	1	3	2	1	1	1	1	-	1	1	27	42	42	16
86	B2t	21-46	cl	6.5	8.4	1	1	3	1	1	2	1	1	-	1	1	-	1	1	26	24	27	37
	R	46-60	weathered shale																				
Typical profile No. 2																							
87	A	0-60	l	6.9	8.4	1	-	3	1	-	2	1	1	1	1	1	1	1	1	25	27	47	26
Typical profile No. 3																							
88	A1	0-12	sl	7.0	8.2	1	-	6	1	96	4	2	1	1	1	1	-	1	2	11	58	25	17
89	B'21t	12-34	c	8.2	8.6	1	1	4	1	2	2	3	2	1	1	1	1	1	2	34	13	29	58
90	B'22	34-48	c	8.1	8.3	5	1	5	1	76	26	47	11	1	2	2	1	1	2	68	14	38	48
91	B'23	48-60	c	8.3	8.4	5	1	5	1	60	12	40	16	1	3	2	1	1	3	33	10	35	55
Typical profile No. 4																							
92	A&B	0-32	c	7.8	8.6	1	1	3	1	1	3	2	1	1	1	1	-	1	1	29	13	41	46
93	B2	32-36	sec	8.1	8.6	1	1	3	1	1	2	1	1	-	1	1	-	1	1	24	12	47	41
94	C	36-48	secl	8.3	8.6	1	1	3	1	1	2	2	1	-	1	1	-	1	1	16	16	54	30
	R	46-60	weathered mudstone																				
Typical profile No. 5																							
95	A1	0-4	l	7.6	8.1	1	-	8	1	1	9	1	1	1	1	1	-	1	2	15	45	34	31
96	C1	4-6	l	7.8	8.1	1	-	5	1	1	6	1	1	1	1	1	-	1	2	14	29	39	42
97	C2	6-16	l	8.0	8.3	1	1	3	1	1	3	1	1	1	1	1	-	1	2	12	26	27	27
	R	16-34	weathered sandstone																				
Typical profile No. 6																							
98	A11	0-2	cl	7.4	8.2	2	-	12	3	4	13	4	1	1	1	1	-	1	1	31	28	33	39
99	A12	2-4	c	7.5	8.2	1	-	9	1	3	10	4	1	1	1	1	-	1	1	31	23	34	43
100	B2t	4-28	c	7.9	8.6	1	1	3	1	1	2	2	1	-	1	1	-	1	2	30	8	36	56
101	B3	28-60	sic	8.4	8.7	1	1	3	1	1	1	2	3	1	2	1	-	1	3	24	7	50	43
	R	60-84	weathered shale																				

TABLE GII-6 (cont'd)

Chemical and Physical Data for Soils of the W. R. Grace Colowyo Mine Site, Moffat County, Colorado

Lab.	Hori-	Depth	Tex-	pH	Extract		Saturation Extract (me/l)									Exchange me/100 gm					Percent		
No.	zon	(In.)	ture*	Rate	pH	EXClO3	CO_3	HCO_3	Cl	SO_4	Ca	Mg	Na	P	SAR	Tot. Na	Sol. Na	ES	ESP	CEC	Sand	Silt	Clay
Typical profile No. 7																							
102	A11	0-2	cl	7.6	8.2	1	-	12	1	2	12	2	1	1	1	1	1	1	2	24	35	28	37
103	A12	2-11	c	7.4	8.1	1	-	6	1	2	5	2	1	1	1	1	1	1	1	27	27	31	41
104	B2t	11-23	c	7.7	8.2	1	-	3	1	1	2	1	1	1	1	1	1	1	2	29	8	35	57
105	B3	23-29	c	7.9	8.4	1	1	3	1	1	3	2	1	1	1	1	1	1	2	21	10	41	27
106	C	29-36	l	8.3	8.5	1	1	3	1	1	2	3	1	1	1	1	1	1	3	15	26	47	27
	R	36	fractured sandstone																				
Typical profile No. 8																							
107	A1	0-5	l	6.8	8.2	1	-	9	1	2	4	5	1	1	1	1	1	1	2	21	39	36	25
108	B21t	5-16	c	7.2	8.7	1	2	6	1	2	2	5	5	1	2	1	1	1	2	35	21	24	35
109	B22t	16-22	c	8.1	8.6	3	1	4	1	31	5	13	19	1	6	4	2	3	7	38	12	29	59
110	C	22-37	c	8.1	8.3	10	-	4	8	144	24	75	56	1	9	7	4	3	6	52	13	40	47
	R	37-60	weathered shale																				
Typical profile No. 9																							
111	A1	0-2.5	sil	7.0	8.0	1	0	6	1	4	6	2	1	1	1	1	-	1	1	27	21	54	25
112	B1	2.5-10	sicl	6.8	8.2	1	-	8	1	2	7	3	1	1	1	1	-	1	1	27	18	47	35
113	B2t	10-22	c	7.3	8.6	1	1	4	1	1	2	2	1	1	1	1	1	1	1	45	14	34	51
114	B31	22-40	c	7.9	8.2	1	-	3	1	1	2	1	1	-	1	1	-	1	1	35	6	37	57
115	B32	40-48	sic	8.1	8.2	1	-	3	-	1	1	2	1	-	1	1	-	1	2	28	8	48	44
	R	48-60	weathered shale																				

*c, clay; cl, clay loam; l, loam; sl, sandy loam; sic, silty clay; sicl, silty clay loam; sil, silt loam.
Chemical and Physical data is rounded off to nearest whole number. Data indicated by number 1 generally has a value of less than 1.

tered clumps of serviceberry (*Amelanchier utahensis*), and a fairly good understory of native grasses.

Topsoil potential is about 12-36 inches thick and is rated good. There may be some areas that are saline and very shallow.

Land unit capability IV

Mapping units in the series 6040 are very shallow (less than 12 inches). In most instances, the soil is slightly calcareous. Soil structure is weak or subangular, blocky, and nonsaline. Surface textures are loam and clay loam, and the subsurface is clay or weathered shales and sandstone. Slopes are from 15-30 percent and usually have a considerable amount of surface rock exposed. Surface rock fragments are weathered sandstone and shales. In this unit some of the soils are colluvial.

Vegetative cover on this unit is predominantly big sagebrush which shows signs of poor growth because of soil conditions. There are also sparsely scattered clumps of Utah serviceberry and Utah juniper (*Juniperus osteosperma*), with some stands of native grasses as understory.

Topsoil potential is poor due to very shallow depth, coarse fragments, excess slope, and rock outcrops.

Land unit capability VI

Mapping units in the series 6060 are mostly eroded, exposing bedrock as ledges and cliffs of sandstone, mudstone, or shale; slopes exceed 60 percent.

Surface texture of these very shallow soils ranges from sandy loam to clay loam and is nonsaline. Soil development is weak, and with shallow soils and steep slopes it is susceptible to wind and water erosion.

Vegetative cover for this unit is sparsely scattered juniper, with scattered native grasses growing in and out of rock crevices. Where bedrock is exposed there is no vegetative cover. Topsoil potential is poor due to excess slope, lack of soil material, coarse fragments, and excess rock outcrop.

Terrestrial Flora

Three primary and two secondary vegetative communities exist within the lease boundary of the Colowyo Mine. Primary types are sagebrush, mountain shrub, and pinyon-juniper, with the secondary types consisting of aspen woodlands and river bottom. A more detailed description of vegetation and ecological requirements of these vegetative types is found in Chapter II of the Regional Analysis section of this statement. The approximate extent of the five vegetative types is shown on Figure GII-8. Type designations and numbers are those used by the BLM.

SAGEBRUSH, TYPE 4

The sagebrush communities are characterized by almost complete dominance of big sagebrush (*Artemesia tridentata*). The growth form of this community is characterized by scattered shrubs of medium height, rarely exceeding four feet. Numerous areas of bare ground exist with various grasses and forbs comprising the understory. The most abundant grass is western wheatgrass (*Agropyron smithii*), and the most common forb is lupine (*Lupinus* spp.). On every location in the area where soil moisture retention becomes limiting to the other landscape components, this sagebrush community develops. In this type snowberry (*Symphoricarpos oreophilus*) occurs locally within the sage where exposure or moisture retention is favorable.

MOUNTAIN SHRUB, TYPE 5

Areas of mountain shrub community are dominated by varying densities of Gambel's oak (Quercus gambelii) and serviceberry (*Amelanchier alnifolia*). The shrubs of this community range in height from three-twelve feet. Typically oaks grow in large clumps with zones of sagebrush or grasses existing between the denser oak and serviceberry stands. Within this community snowberry is the most common associated shrub. Numerous forbs and grasses occur in varying densities throughout this community, including Kentucky bluegrass (Poa pratensis), Idaho fescue (*Festuca idahoensis*), and yarrow (*Achillea lanulosa*).

PINYON-JUNIPER, TYPE 9

The pinyon-juniper woodlands are dominated by pinyon (*Pinus edulis*) and juniper (*Juniperus osteosperma*). This community is limited at the Colowyo site to the area around Mount Streeter and the bluffs along Good Springs Creek. In these locations, pinyon is very widely scattered or absent entirely, leaving the woodlands dominated by juniper. Trees seldom exceed 15 feet in height and the canopy of the forest is rarely closed. Sagebrush is a conspicuous member of this plant association, and the most prominent grass is bluebunch wheatgrass (*Agropyron spicatum*).

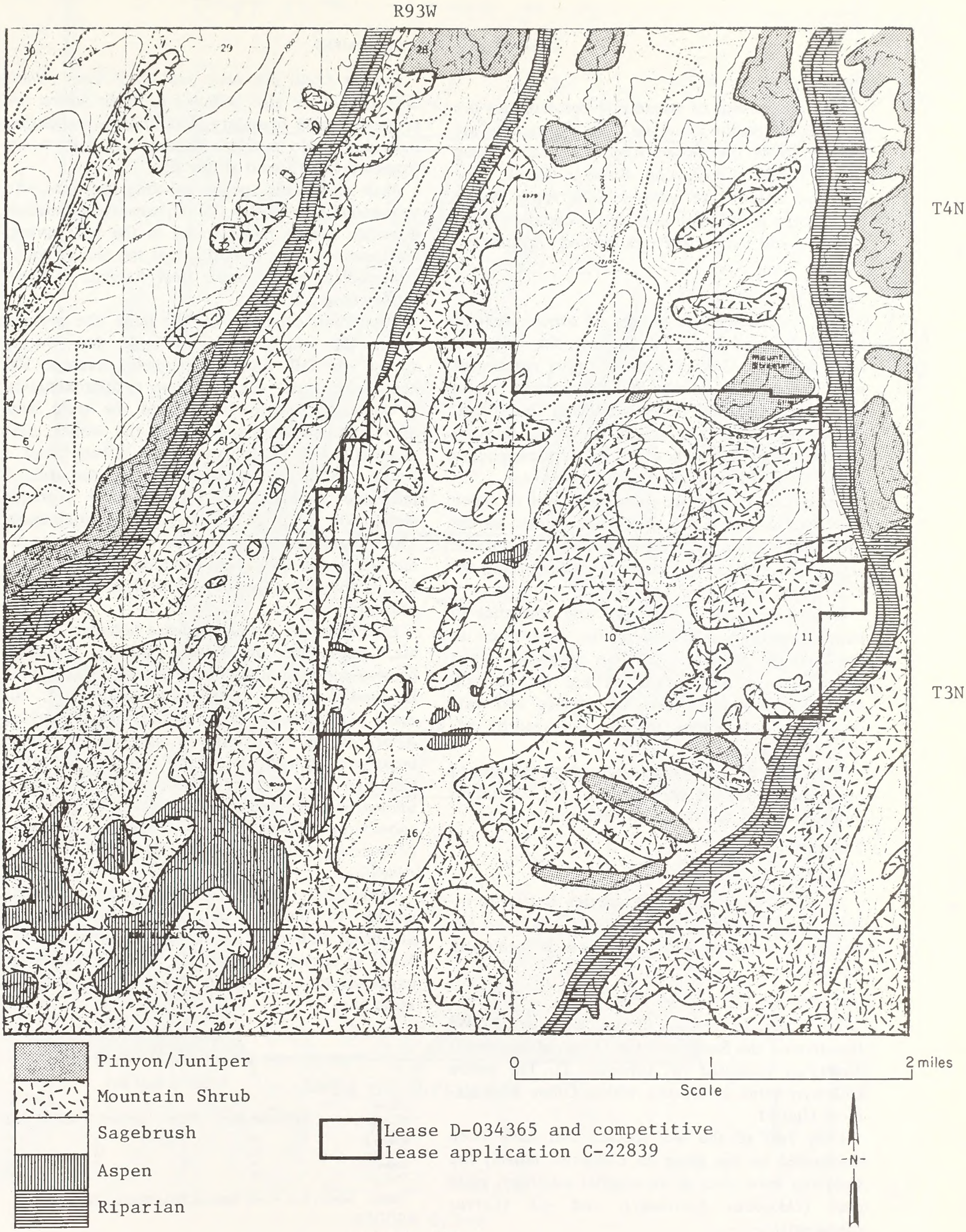


FIGURE GII-8

Vegetative map of W.R. Grace Colowyo Mine area.

RIVERBOTTOM, TYPE 20a

The riverbottom or streamside communities are very limited on the mine site. This community occurs north of the closed Red Wing Mine along Good Springs Creek and Streeter Creek. The dominant species are willows (*Salix* spp.), rushes (*Juncus* spp.), sedges (*Carex* spp.), cattails (*Typha latifolia*), and narrowleaf cottonwood (*Populus detoides*).

ASPEN, TYPE 10A

This type occurs as groves of aspen (*Populus tremuloides*) and is very limited on the Colowyo Mine property. Groves occur in upper reaches of various ephemeral creeks and in locations where meltwaters continue to flow later in the spring. Snowberry commonly occurs as an understory shrub in these stands, and serviceberry commonly occurs around the periphery of the groves.

Grasses and forbs are more prevalent in aspen type than in any of the other communities on the site, with Kentucky bluegrass the most dominant grass, and yarrow and dandelion (*Taraxacum officinale*) the most dominant forbs.

Grazing appears to have had and continues to have a profound influence on the ecosystems at the Colowyo Mine site; all five vegetation types show signs of overgrazing. These include soil trampling, low production of grasses and vast quantities of droppings; the area is grazed by cattle, deer, and elk.

There are no known endangered or threatened plant species on the site; however the vegetation on the property has not been analyzed in detail.

Terrestrial Fauna

WILD FAUNA

A table listing all wildlife species known to inhabit the Colowyo Mine site, as well as those expected to be found within the area, is located in Appendix D.

Big game

The Colorado Division of Wildlife (Colo. DOW) has divided the State into 126 Game Management Units, as indicated in Appendix D. The entire Colowyo Mine is located within Game Management Unit 11.

Only two of the ten species that have been designated as big game in Colorado inhabit the Colowyo lease area in substantial numbers: mule deer (*Odocoilus hemionus*), and elk (*Cervus canadensis*).

Cougar (*Felis concolor*) and black bear (*Ursus americanus*) are also believed to occur within the proposed mine boundary, but only as wandering individuals. No resident animals are known, or expected to be found at this site.

Mule deer. This species inhabits the mine site year-round (see Figure GII-9); greatest population densities appear to be found in the fall, spring, and summer. This indicates that the site provides intermediate and summer deer habitat, and use for fawning activity.

Population estimates on the mine site average about 150 widely scattered mule deer during spring and fall. Summer estimates average 100 head, with winter numbers down to approximately 50 animals. Apparently most of the mule deer move off the mine site during the winter, east along Highway 13, and west along Wilson Creek.

The overall deer population within the area of influence indicated on Figure GII-9 averages about 600 head in winter, and approximately 250-300 animals during the rest of the year. As indicated by the spring and summer population estimates, some deer fawning takes place on the mine property.

Deer numbers within the lease boundary fluctuate, depending on several factors including browse condition and climate. Browse plants were in good condition in the summer of 1975, but many plants showed signs of past heavy use (see Appendix D). Some browse plants known to be important as mule deer food that are found on Colowyo Mine site are serviceberry (*Amelanchier utahensis*), Gambel's oak (*Quercus gambelii*), snowberry (*Symphoricarpos utahensis*), big sage (*Artemesia tridentata*), and bitterbush (*Purshia tridentata*).

Researchers in areas of northwestern Colorado similar to the W. R. Grace property have identified mule deer use of vegetation by class of food, as shown in Table GII-7. These results are expected to be close to those of the Colowyo Mine site.

TABLE GII-7

Food Utilized by Mule Deer in Northwestern Colorado

Season of use	Percent of Total Diet: Shrubs and Trees	Forbs	Grass and Grasslike	Total
Winter	97	2	1	100
Spring	79	9	12	100
Summer	94	6	0	100
Fall	97	3	0	100

SOURCE: Kufeld, R.C. et al, Foods of Rocky Mountain Mule Deer

R93W

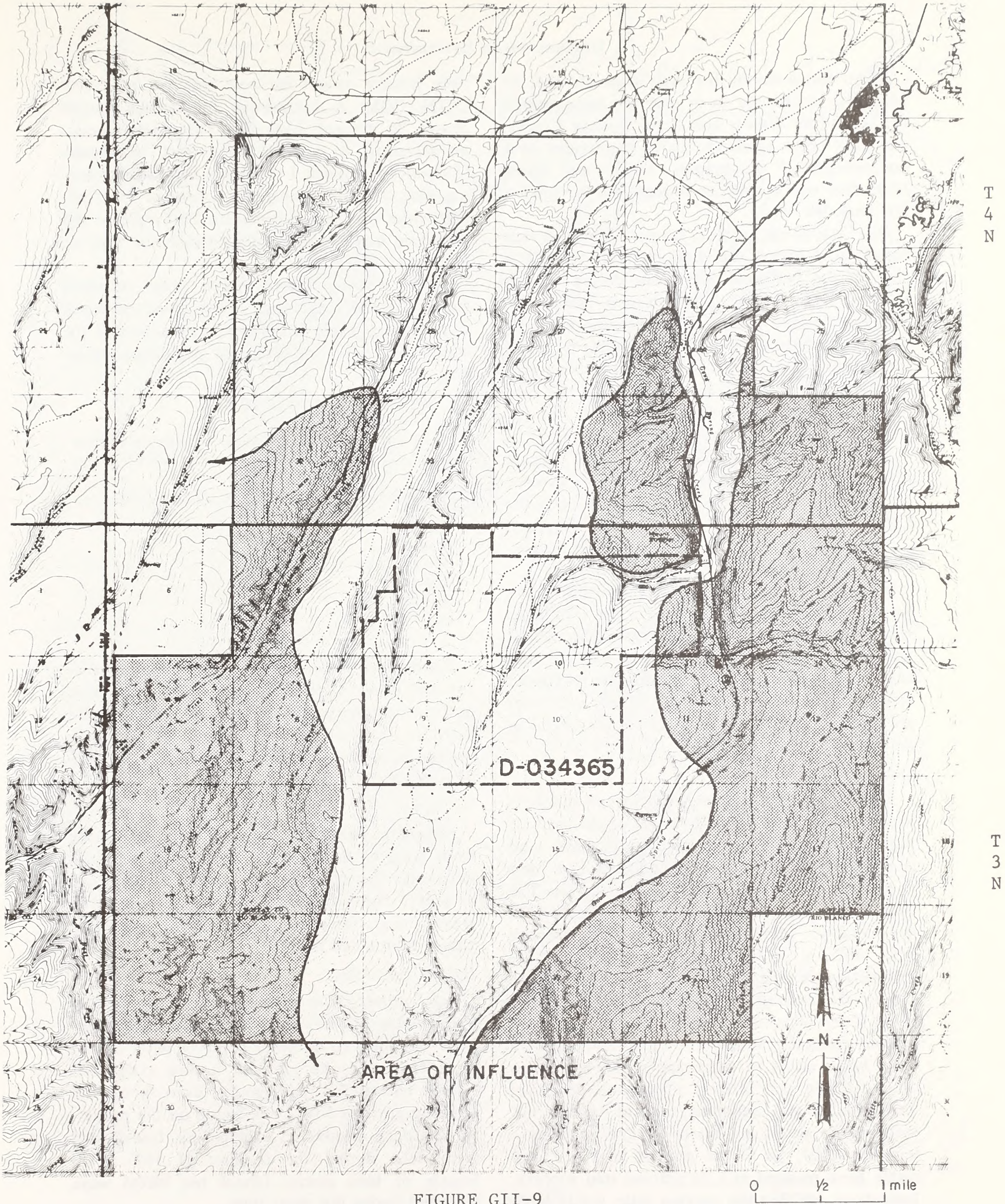


FIGURE GII-9

W.R. Grace Colowyo Mine area and winter habitat preferred by mule deer (shaded area).

Water requirements for mule deer are met by numerous stocktanks on or near the mine property, as well as Wilson and Good Springs Creeks, and snow when available. Cover is provided by a combination of topography, brush, and trees. Mule deer rely heavily on topography for protection from the wind.

Elk. Overall elk numbers do not appear to vary significantly during the year, although there is a shift in the preferred use areas during various seasons. Elk winter concentration areas are shown in Figure GII-10. Several cow elk with calves have been seen in the southwestern part of Colowyo Mine property, indicating a calving area within or just south of the site. An elk calf crop of about 18 percent was estimated for the immediate vicinity of the mine during the spring of 1975 (VTN 1975). Population estimates indicate about 50 elk wintering on the lease, with another 100 animals in close proximity possibly using the Colowyo Mine property occasionally. Approximately 70 elk have been seen utilizing the area indicated in Figure GII-10 as an elk calving site.

Information concerning the plants used by elk for food within the mine site is not available. However it is expected that these elk subsist primarily on browse during winter and late fall, and on grass and some forbs during the remainder of the year (see Figure GII-11). Water and cover are provided by the same sources as described in the mule deer section.

Small mammals

For the past several years lagamorph numbers have been extremely low over all of this part of the State; because of these low numbers and similar periodic population fluctuations it is hard to get an accurate estimate of their numbers. The Colo. DOW has estimated jackrabbit densities at the Colowyo Mine area at 4.0 animals/square mile; this is down from an estimated 9.7 animals/square mile, calculated before the decline. Cottontail densities are currently estimated at about 10.0 rabbits/square mile.

Small mammal censusing is being conducted by VTN in an effort to determine probable species diversification and relative population densities. These studies are continuing; present data are not sufficient to determine these population parameters. However, up to the present time 552 trap nights have resulted in a 54 percent trap success. Indications are that the success ratio would have been greater except for cold weather and snow (VTN 1975). A breakdown of animals caught shows 96 percent were deer mice (*Peromyscus maniculatus*); 2 percent were least chipmunks (*Eutamias minimus*); 1 percent was western jumping mice (*Lapus princeps*); and 1 percent was montane voles (*Microtus montanus*). Trap success did not seem to be influenced by vegetation type or exposure (VTN 1975).

Many wildlife species have been recorded within the site boundaries; many more are listed as probables. Table GII-8 lists some mammals for which the DOW has estimated population densities.

TABLE GII-8

Population Density Estimates for Mammals from the Area around Colowyo Mine (DOW)

Species	Density per square mile
Beaver	6.1
Weasel	0.5
Striped skunk	2.0
Coyote	0.1
Bobcat	0.3
Red fox	0.1

Beaver (*Castor canadensis*) are found along Wilson and Taylor Creeks; however none are present in the area proposed for mining. The other species listed in Table GII-8 are probably found within the site boundary, but (as indicated) all population densities are relatively low.

Waterfowl

Adequate waterfowl nesting cover is lacking from most of the Colowyo stocktanks, reducing the probability of waterfowl nesting on the mine property. The subject area probably receives its greatest waterfowl use during spring migration, mainly March and April.

Upland gamebirds

Sage grouse (*Centrocercus urophasianus*) and blue grouse (*Dendragapus obscurus*) utilize portions of Colowyo Mine site during parts of the year. The mine site provides nesting and brood rearing habitat for sage grouse, even though no strutting grounds have been found on the property. Fourteen broods averaging four birds/brood were seen during the summer of 1975. Two broods of blue grouse (about ten birds) were recorded during this same time.

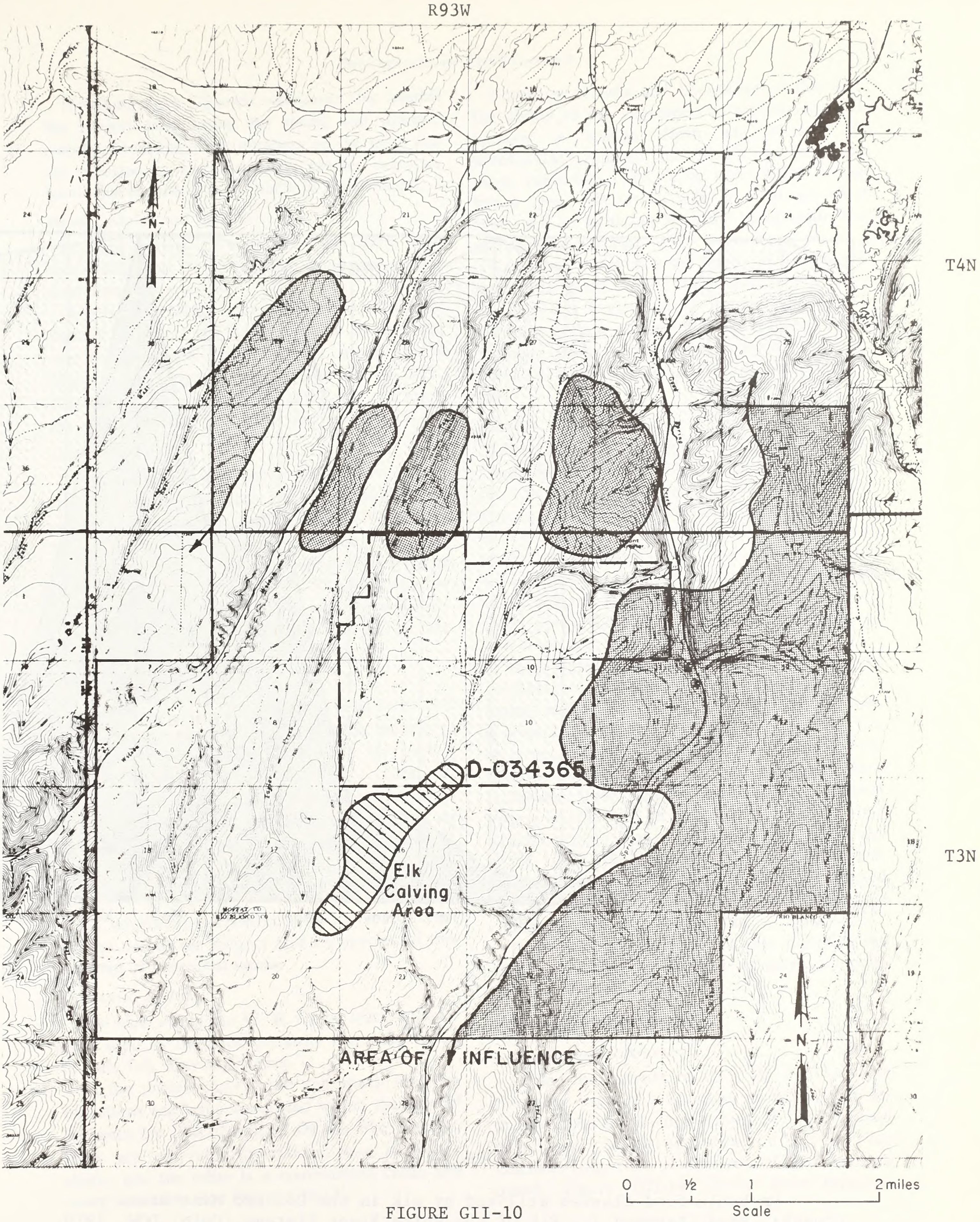


FIGURE GII-10

W.R. Grace Colowyo Mine area and winter habitat preferred by elk (shaded area).

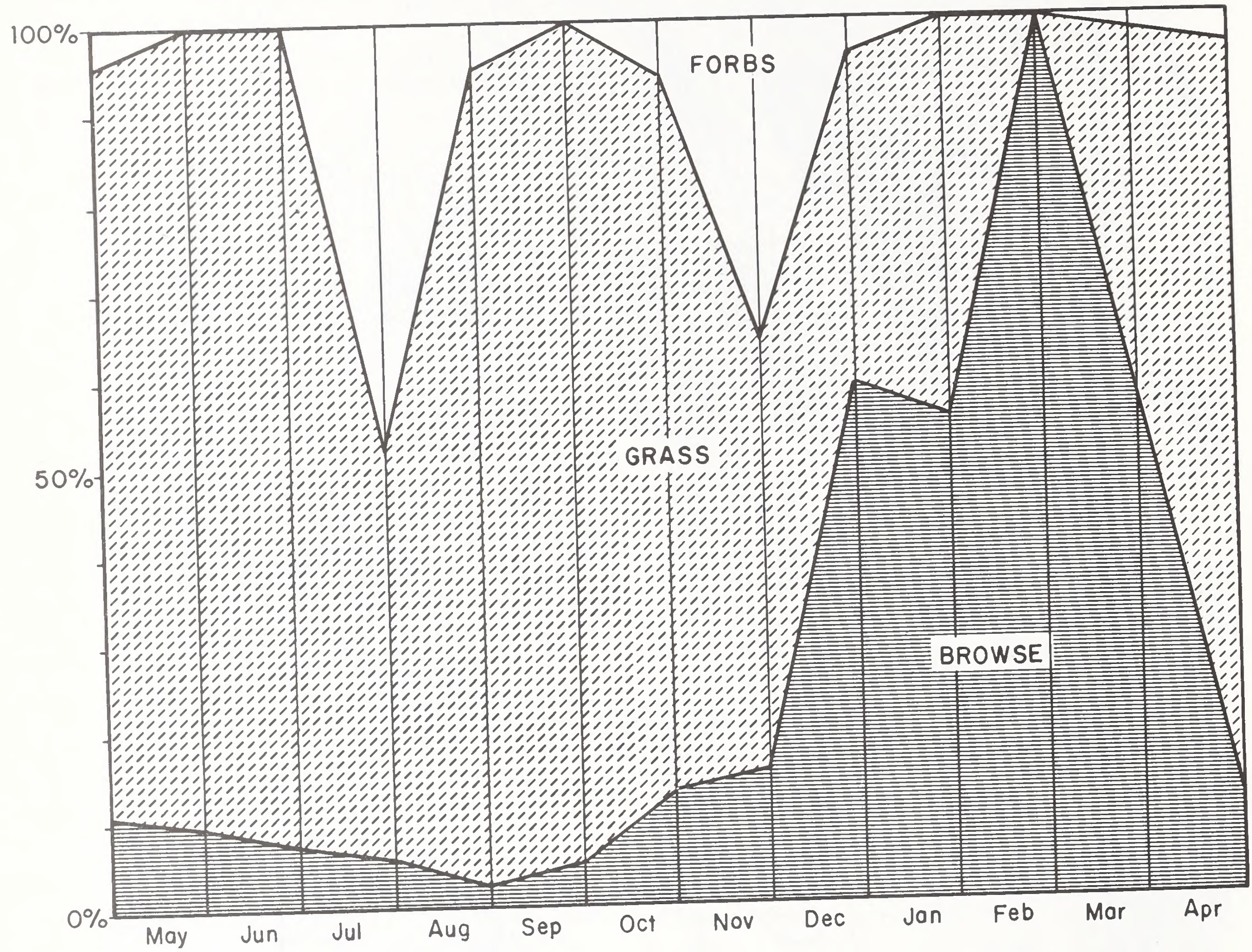


FIGURE GII-11

Probable food classes utilized by elk in the Colowyo Mine area.
SOURCE: Boyd, Raymond J., Elk of the White River Plateau, Colo. DOW, 1970.

Mourning dove (*Zenaida macroura*) also inhabit the subject area during the spring and summer months. Mourning dove numbers on the mine site are reported as low; however, greater densities have been recorded to the north in Axial Basin.

Hawks, eagles and falcons

A great variety of raptorial birds have been seen within the Colowyo Mine boundary, as indicated in Appendix D.

A peregrine falcon (*Falco peregrinus*) has been sighted in almost the same location in the past two summers (see Figure GII-12), on the north edge of the proposed mined area (VTN 1975). This falcon probably uses the mine site as a hunting range; the duration of this use is unknown.

Other birds

A variety of non-game birds have been recorded within the lease area, and many more are listed as probables. A table in Appendix D ties the use areas the birds prefer to vegetative types.

A bird transect has been established in Section 4 of R.93W., T.3N., by the U.S. Fish and Wildlife Service. It will be used to monitor the avifuna's response to habitat disturbance caused by the proposed mine operation.

Amphibians and reptiles

Few species of this group have been identified as occurring within the proposed mine boundary. No specific information is available for habitat values for these animals; however, based on habitat preferences indicated by certain species in other similar localities, those amphibians or reptiles indicated in the species list in Appendix D possibly inhabit the mine site.

Terrestrial invertebrates

No information is currently available concerning the use of the subject area by species of this segment of terrestrial fauna.

DOMESTIC FAUNA

The land within the W. R. Grace lease boundary is used by livestock primarily from late spring to early fall, May to October.

At the present time cattle and sheep ranching operations are being conducted within the area of influence by five operators. Of the five ranches, three are all cattle operations; one is totally sheep; and the other is a combination cattle and sheep operation (see Figure GII-13).

Based on records and knowledge of this area, the ability of the vegetation to support domestic animals is broken down as follows: 27.5 acres/AUM (Animal Unit Month) in pinyon-juniper vegetation type, seven acres/AUM in sage brush type, 5.5 acres/AUM in mountain shrub type, and 3.5 acres/AUM in the bottomlands that are used for grazing.

Livestock water is provided by Wilson Creek, numerous ponds, and stocktanks in the area. Streeter and Taylor Creeks normally flow water during a portion of the time that livestock are in the area. Both quality and quantity of water distribution appears adequate for present livestock use.

Aquatic Biology

The Colo. DOW classifies Taylor, Wilson, and Good Spring Creeks as non-fisheries; however it must be assumed that these streams maintain fish populations. The species likely to be present in the analysis area are black bullheads, creek chubs, flannelmouth and white suckers, and several species belonging to the family Cyprinidae (e.g., fathead minnow, red shiner). In addition Good Spring Creek probably contains some rainbow trout.

Axial Basin Reservoir is located three miles northeast of the analysis area on Good Spring Creek, just above its confluence with Milk Creek; it covers approximately 20 surface acres and has an average depth of ten feet. The reservoir contains 80 percent rainbow trout, ten percent black bullheads, three percent sunfish, three percent yellow perch, two percent channel catfish, two percent crappie, and a few largemouth bass (Colo. DOW 1972). The lake is stocked regularly with catchables by the Colo. DOW, and natural reproduction of the warm water species present is common.

There is no information available regarding the nature of the benthic fauna or periphyton populations in the analysis area.

Cultural Components

Archeological Resources

During the summer of 1975, W. R. Grace and Company initiated a literature search and an intensive cultural resource survey of the proposed mine area. Under the direction of Dr. Joe Lischka, University of Colorado, three sites were found. Figure GII-14 shows their locations

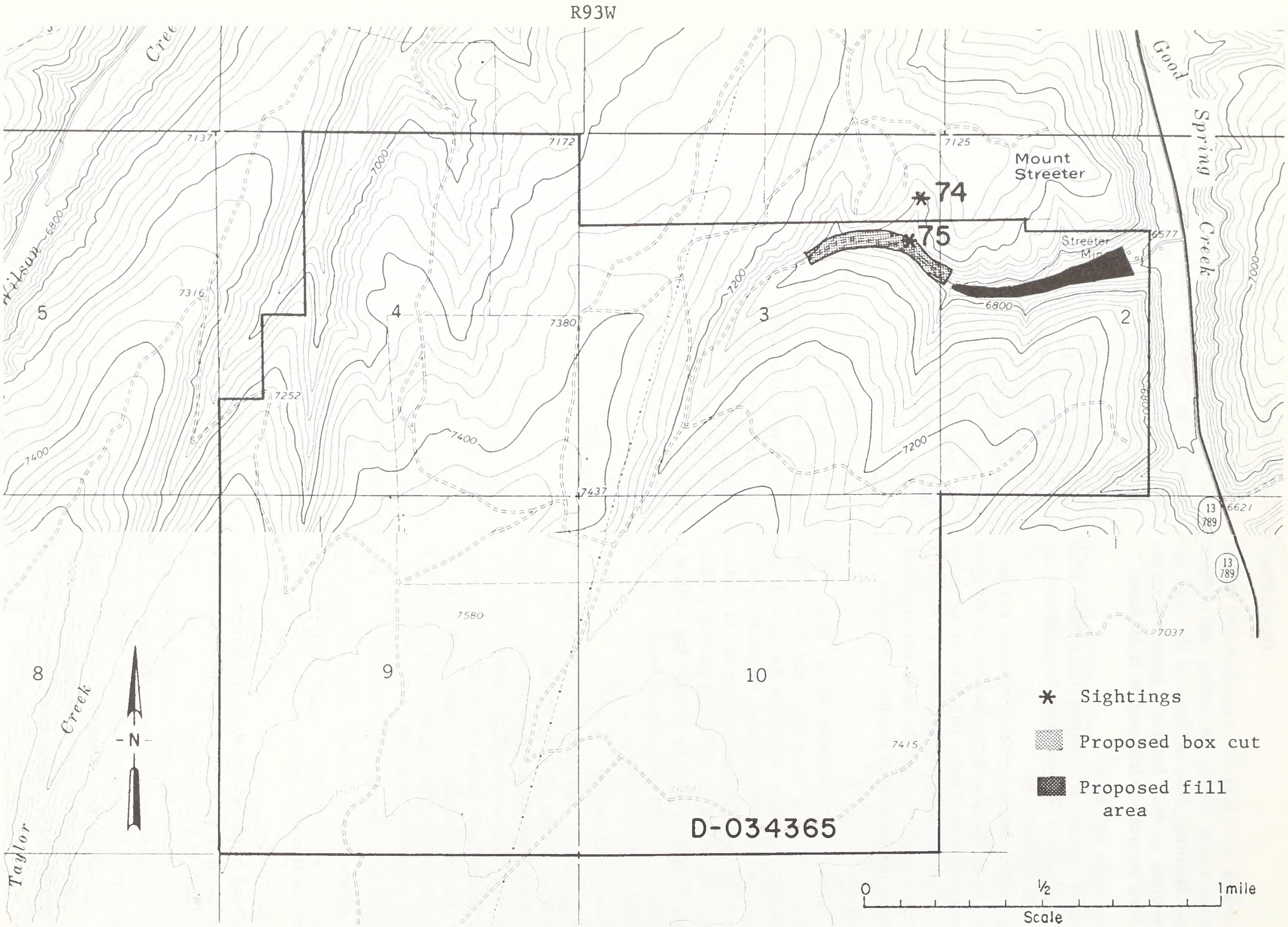
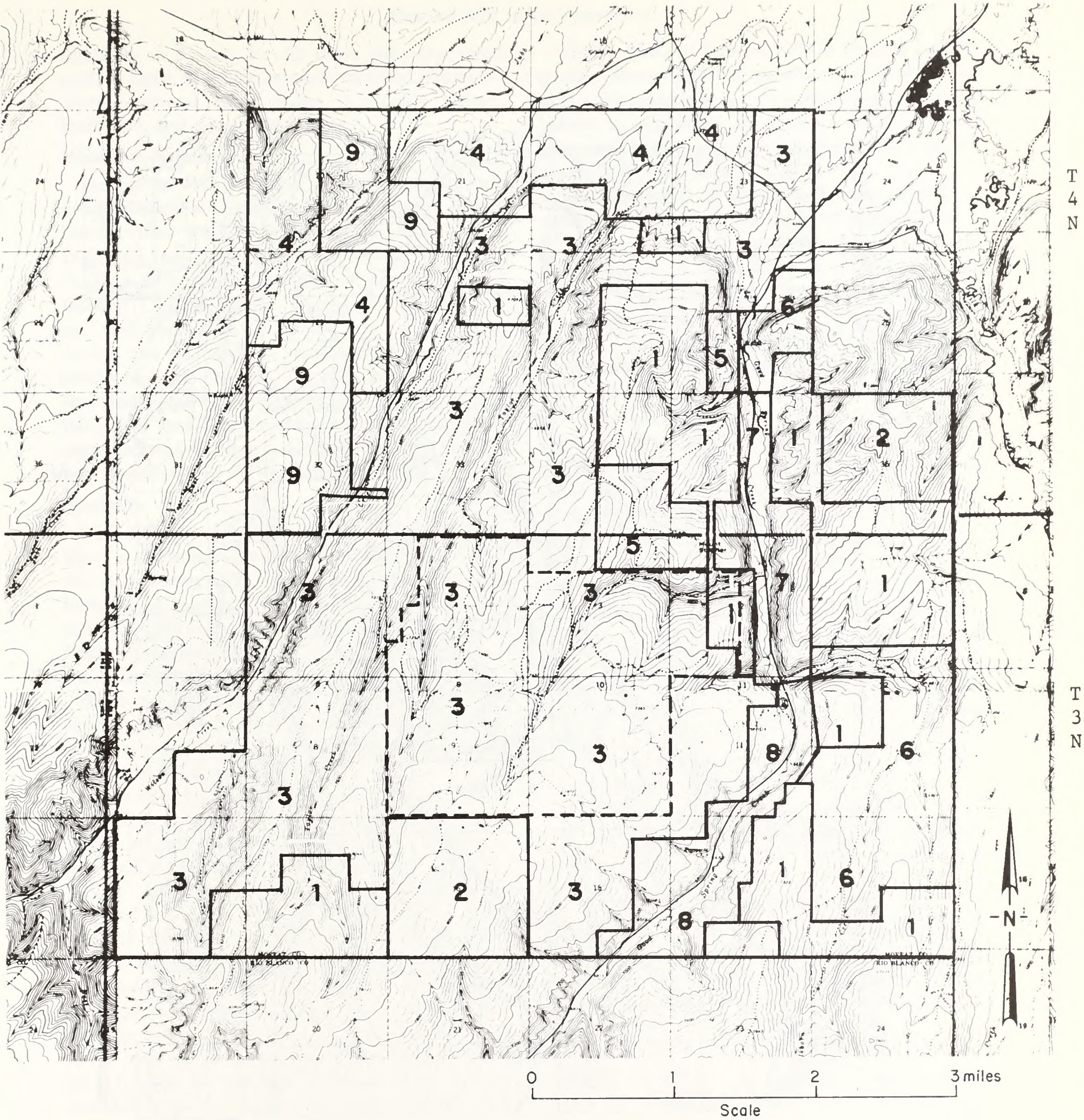


FIGURE GII-12

Peregrine falcon sightings in Streeter Canyon.

R93W



C - Cattle   S - Sheep

1. Federal (BLM) C&S
2. Colorado (State) C&S
3. W.R. Grace - C
4. Gossard - C
5. Leander - C
6. Kourlis - S
7. Streeter Coal
8. Durham - C&S
9. Fitzer - Utah Int.

FIGURE GII-13

Landownership as of June 1975.

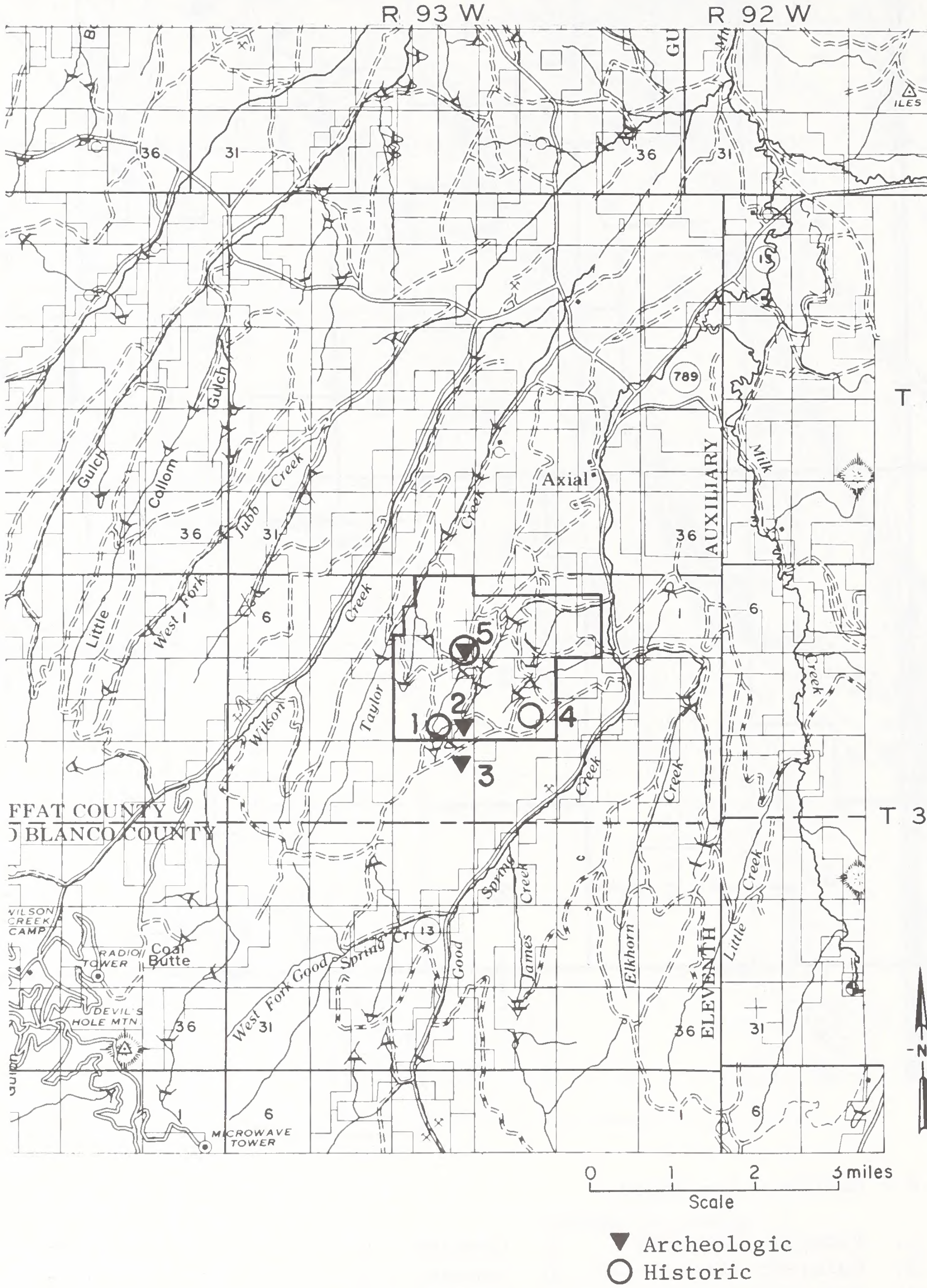


FIGURE GII-14

Cultural resources adjacent to proposed Colowyo Mine site.

(numbers 2, 3, and 5). All three sites contained surface finds of lithic materials (worked stone) including several chert flakes, projectile points, knife tips, and a sandstone mano.

Historical Resources

During the 1975 intensive cultural resource survey, historical resources were also located. Three historic sites were found on Federal coal lease D-034365 (see Figure GII-14, numbers 1, 4, and 5). One is a small log house at the bottom of Streeter Canyon with a collapsed roof (No. 1); age and history of the house are unknown. A second site contains six small sandstone piles of unknown origin (No. 4); five piles are about three feet thick and twice as long; the sixth is about thirty feet long. The third site merely contains an assortment of tin cans and glass (No. 5). Testing was recommended on the latter two sites.

Aesthetics

Visibility of mining operations at the Colowyo Mine is determined by public access routes — in this area, both county and State highway systems. Portions of Federal lease D-034365 and of adjacent facility construction areas are visible from Moffat County Roads 17, 32, and 51 as well as from Colorado Highway 13.

Refer to Appendix D for a description of the methodology used to derive landscape visibility maps. Analysis of these maps will suggest areas that are more visible than others.

Refer also to Chapter II of the Regional Analysis for a discussion of the regional aesthetic setting of the proposed Colowyo Mine as well as a general discussion of visual resources.

Four landscape visibility maps have been prepared for the area of the Colowyo Mine. At a scale of one inch per mile, Figure GII-15 illustrates landscape visibility for the general area. Two additional maps of greater detail were prepared to illustrate landscape visibility more accurately on lease D-034365 (Figure GII-16), and in the area of the proposed access road (Figure GII-17). Due to the large number of necessary viewshed sequence points, the alphabetical lettering of viewshed sequences was repeated twice beginning on Moffat County Road 32. To avoid confusing viewshed sequences having the same alphabetical lettering, note that views between viewshed sequence points A through P on Colorado 13 are confined to the immediate landscape of Good Spring Creek.

Eight additional figures, GII-19 through GII-26, contain photographs of the more significant views obtainable from the area's public roads; they are helpful in illustrating the relative visibility of the proposed action area. An index of these photographs appears in Figure GII-18.

The most visually sensitive portions of Federal coal lease D-034365 are those foreground landscape visual units lying adjacent to Colorado Highway 13 (see Figure GII-16). This landscape consists of a small grassy floodplain contained on either side by steeply rising scrub oak hillsides. Largely undisturbed natural terrain occupies foreground units visible from viewshed sequence points H through M. However viewshed sequence MN provides access into Streeter Canyon where mine facilities from the old Red Wing Mine have produced minus deviations (visual intrusions); other visual impacts have resulted from dozer work that was done to extinguish underground fires at the old Streeter Mine (see Figure GII-22).

Lease area D-034365 also contains four less visible middleground landscape visual units that are visible from Colorado 13, viewshed sequence points J through O. Other middleground visual units on D-034365 may be viewed at greater distances from Moffat County 51 and 17 as well as from Colorado 131. Largely natural rolling sagebrush and woodland types occupy these visual units, though exploration trails and roads are also discernible in the middleground.

Landscape visibility maps for the area of the proposed mine office and access road are found in Figure GII-17. The more sensitive foreground landscape visual units contain combinations of flat meadow and range lands, rolling sagebrush hills, steeper pinyon-juniper hillsides, and rimrock escarpments as well as man-made features. Powerlines and buildings at the Axial Townsite and adjacent ranches are minus deviations that create strong line and color dominance.

Landscape visual units that define Axial Basin's southern perimeter are the most visible units within the Basin. The hillside to be traversed by the Colowyo Mine access road is visible from seven viewshed sequences, which increases its visual sensitivity. The hillside to contain the access road presently contains a 138-kv transmission line and an unimproved trail. Though the trail is largely unnoticable, the strongly line-dominant powerline is a minus deviation.

LEGEND
for
LANDSCAPE VISIBILITY MAPS

OVERALL VISIBILITY CLASSIFICATION

- Foreground Landscapes
- Middleground Landscapes
- Background Landscapes
- Lands Not Visible

VISUAL BOUNDARIES and DOMINANT FEATURES

- Rounded Ridges
- Hogbacks
- Escarpments
- Peak or Promontory
- Foreground Landscape Visual Unit Boundaries

ROADS

- 13 — U.S. or State Highways
- County Roads: Surfaced / Improved /Graveled
- B — Capital Letters Denote Viewshed Sequence Points

LANDSCAPE VISUAL UNIT CLASSIFICATION

mgNOs

- Foreground (fg), Middleground (mg) or Background (bg)
- Only visible northbound (n), southbound (s) eastbound (e), westbound (w)
- Viewshed Sequence from which Landscape is Visible

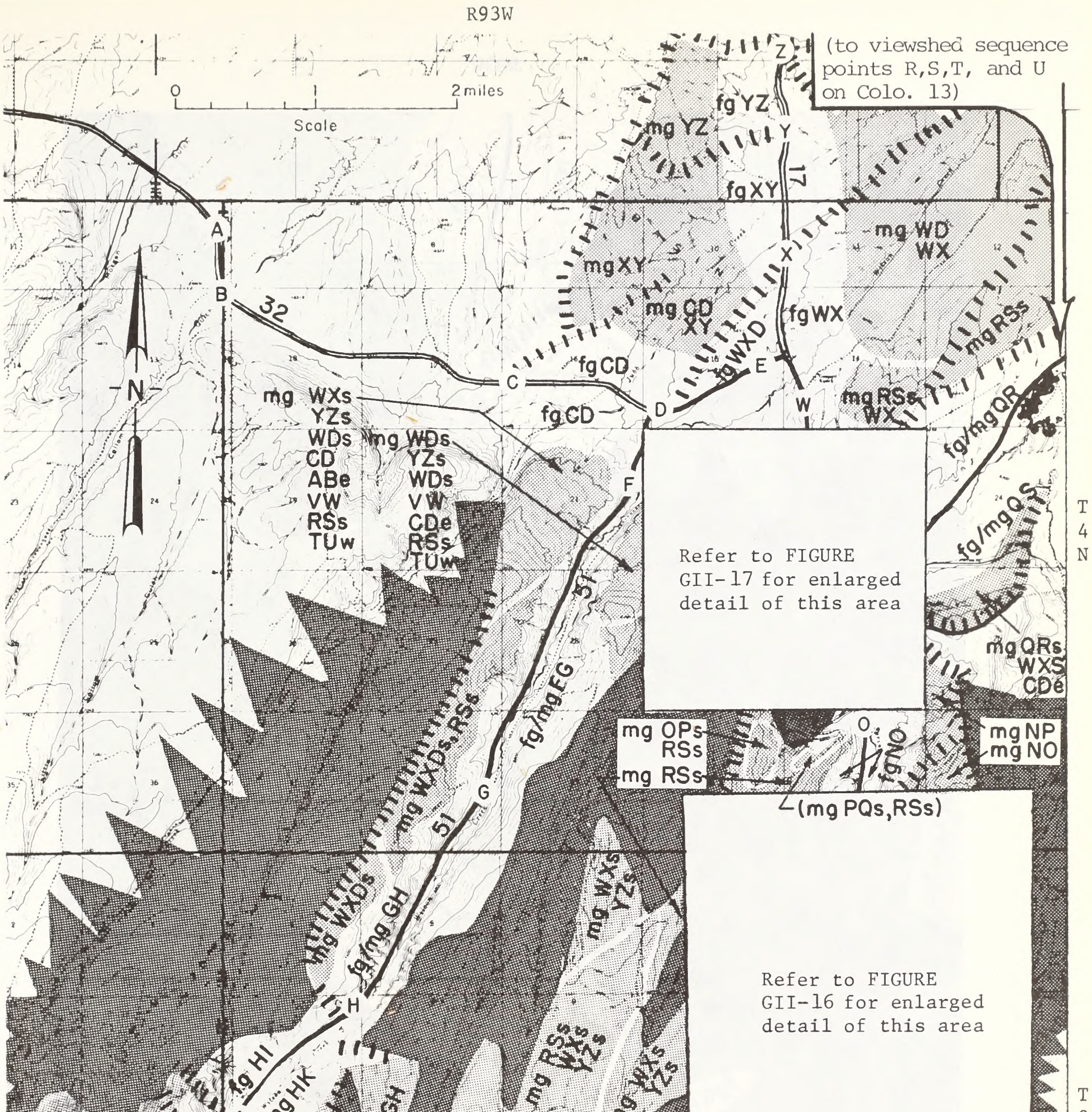
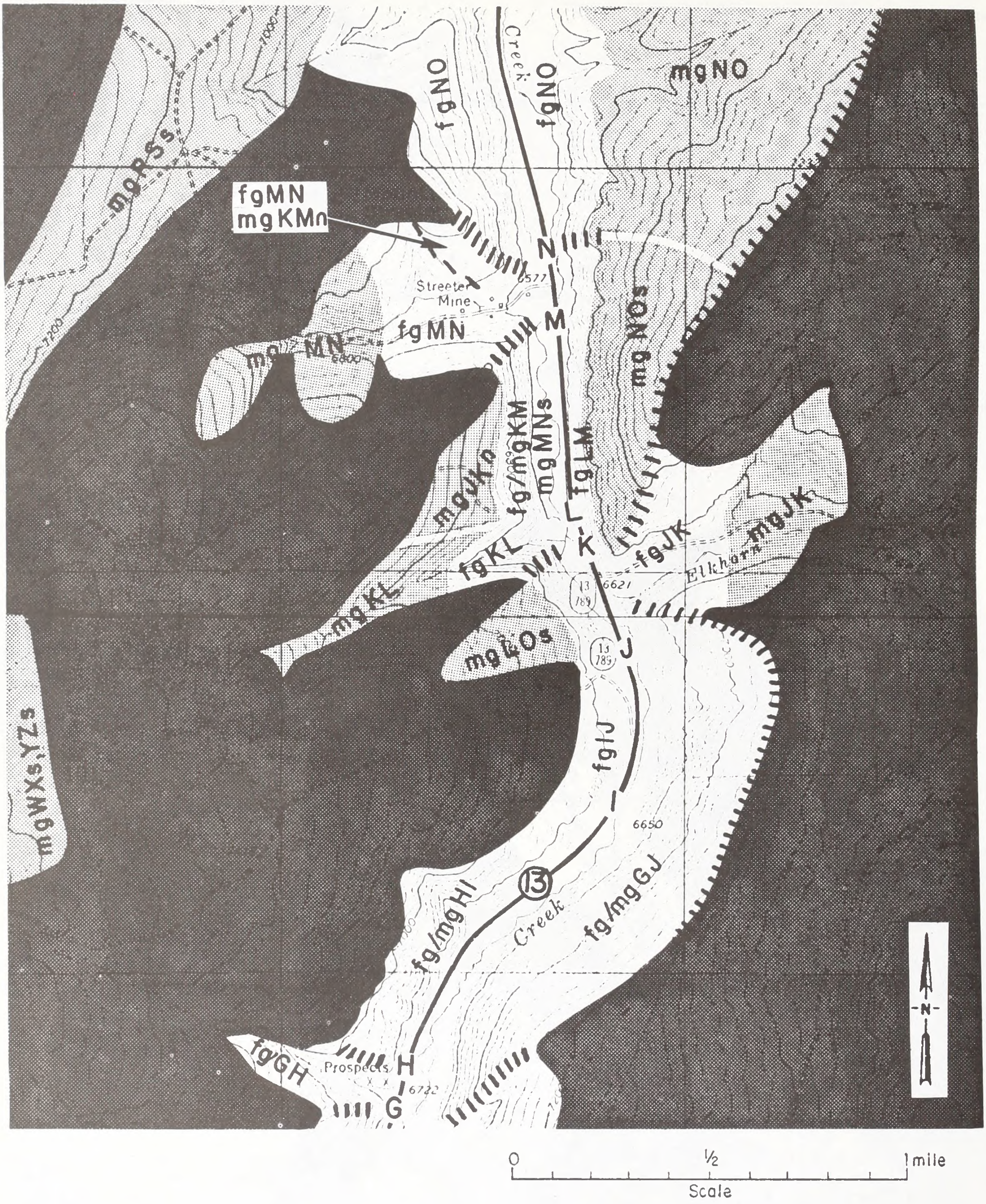


FIGURE GII-15
Landscape visibility map for W.R. Grace Colowyo Mine.

R93W

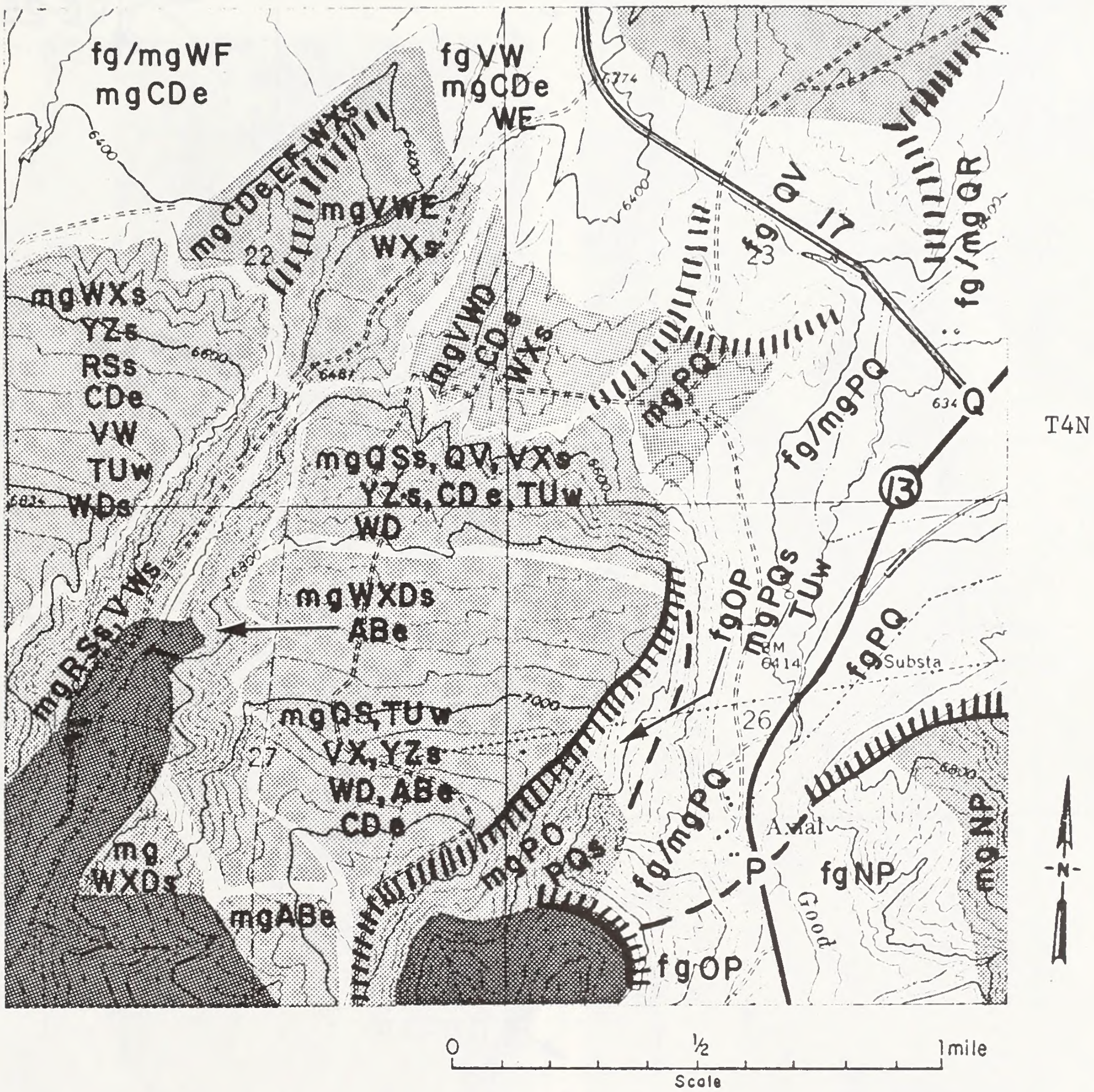


T3N

FIGURE GII-16

Landscape visibility map for W.R. Grace Colowyo Mine.

R93W



T4N

FIGURE GII-17

Landscape visibility map for W.R. Grace Colowyo Mine.

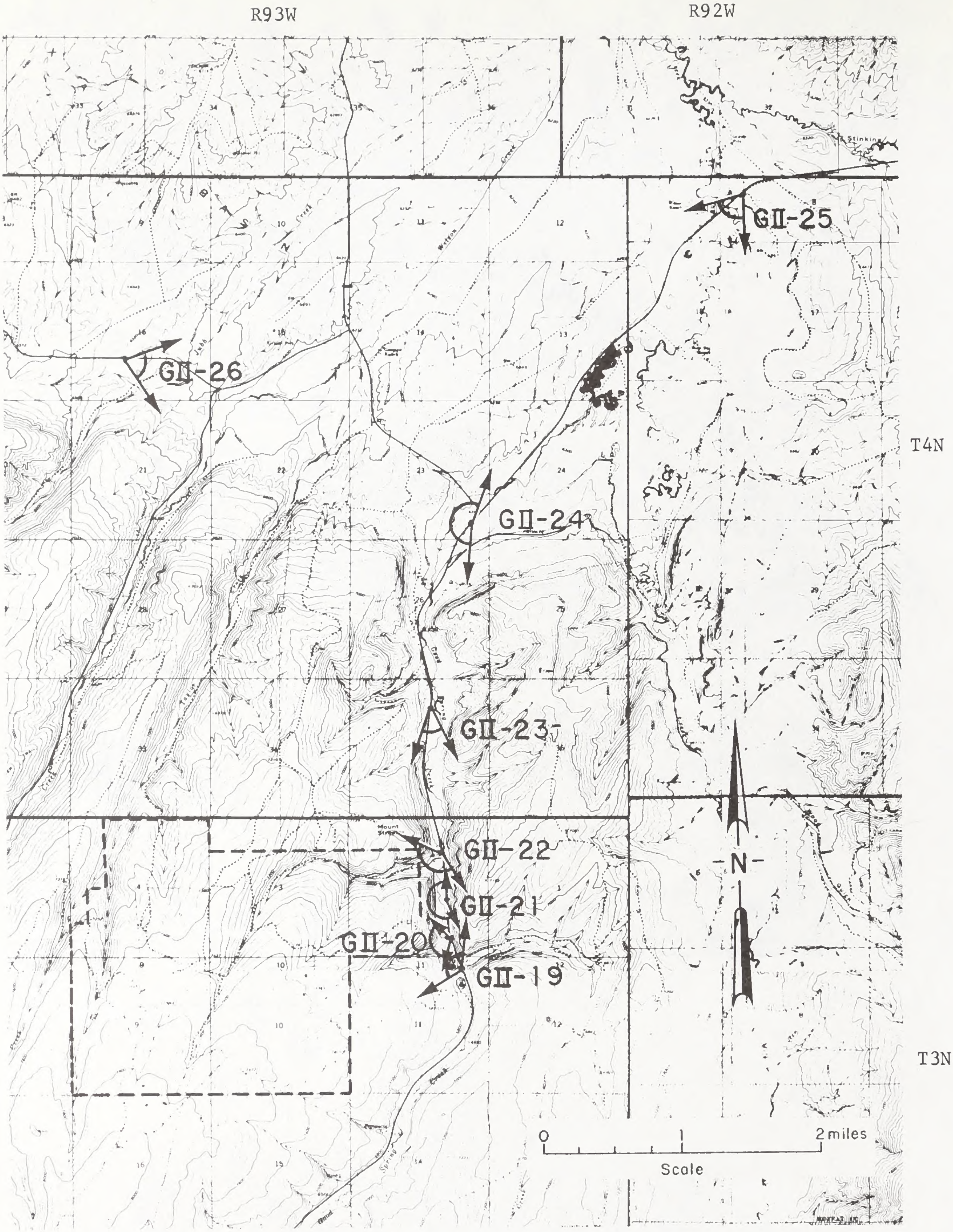


FIGURE GII-18

Locations of photo points and direction of view of FIGURES GII-20 through GII-27.

FIGURE GII-19

Northbound motorists on Colorado 13 would be able to view surface mining operations at middleground distances and at a low angle from viewshed sequence JK (see lower photo sequence).

FIGURE GII-20

Viewshed sequence KL on Colorado 13 provides views into the narrow draw which the proposed 69-kv transmission line alinement would traverse; the right-hand portion of the upper photo shows the proposed substation location in the foreground landscape.

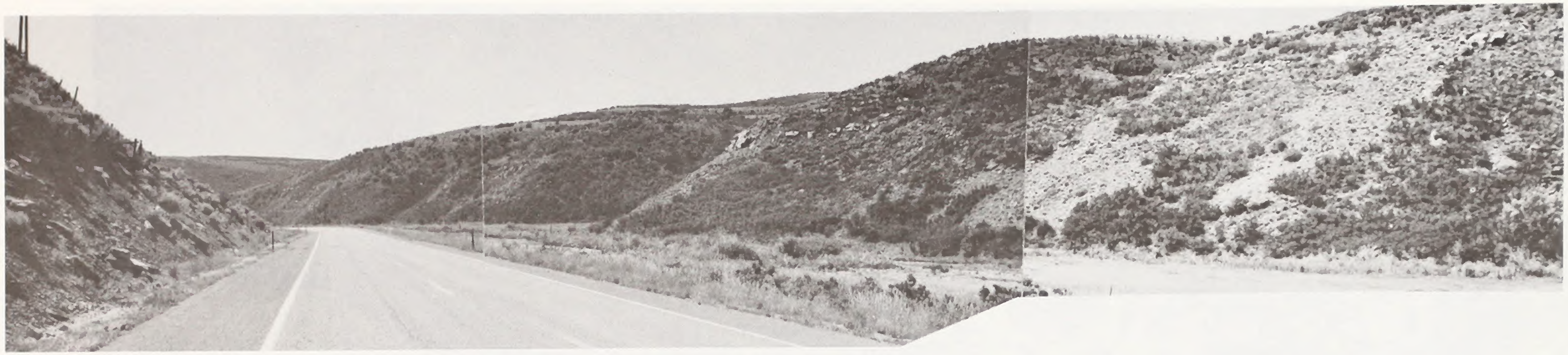


FIGURE GII-21

This six-photo sequence illustrates the landscape visible to the west of Colorado 13 from view-shed sequence LM. Proposed surface mining operations would be viewed only on the landscape unit visible on the left-hand side of the top photo sequence. The proposed haul road would parallel the highway at the crest of this foreground hillside; portions of it would be visible on the horizon. Cottonwood trees adjacent to the present Colowyo Mine access road are visible on the extreme right-hand side of the lower photo sequence.

FIGURE GII-22

Viewshed sequence MN on Colorado 13 provides foreground and middleground views into Streeter Canyon; surface mining operations would be visible here as well as to the south (see left end of upper photo sequence).

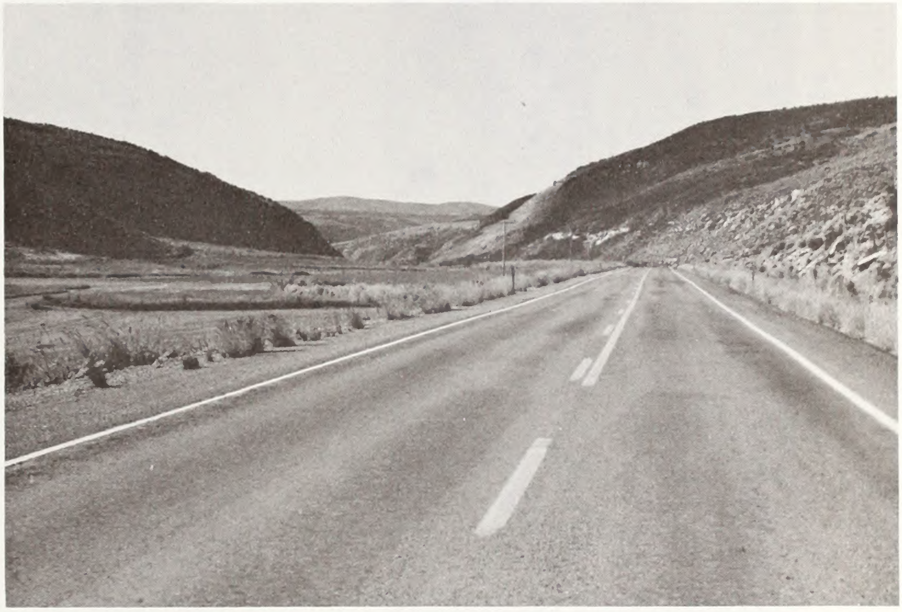


FIGURE GII-23

Southbound motorists on Colorado 13 can first view proposed surface mining operations from viewshed sequence NO (see sagebrush-covered ridge in center of photo).

FIGURE GII-24

From viewshed sequence PQ on Colorado 13, the viewer can see the proposed Colowyo Mine access road alinement and mine office facility location to the west.

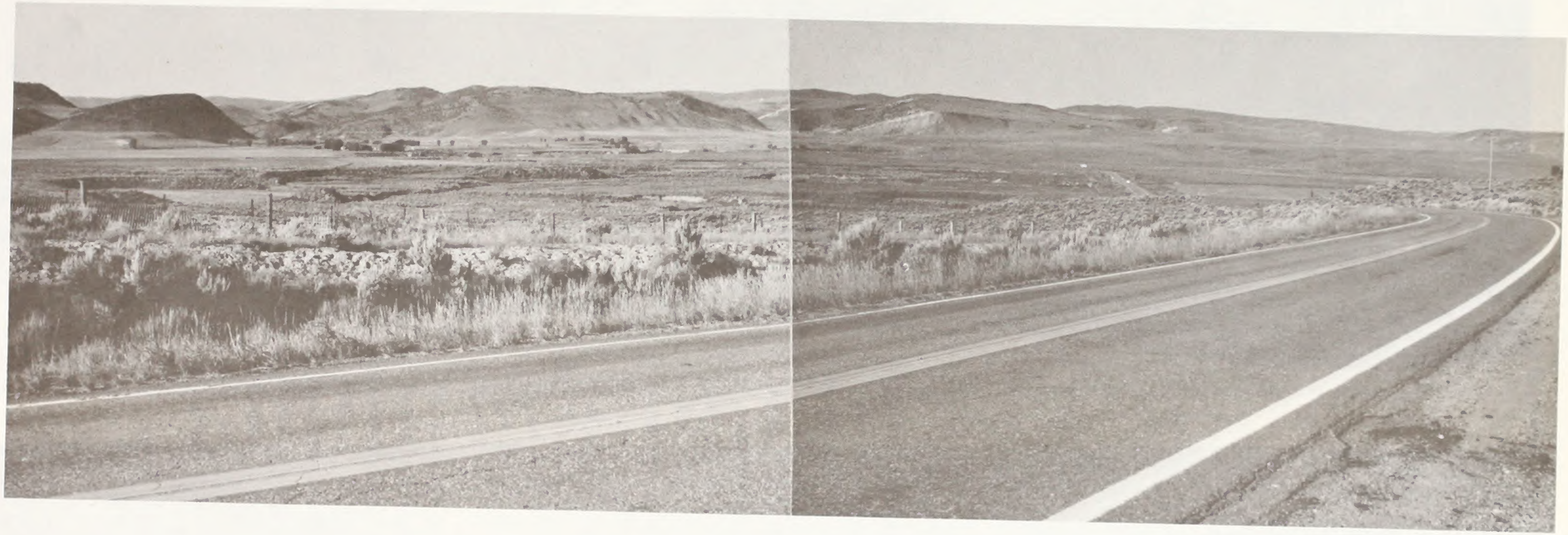


FIGURE GII-25

The proposed mine access road would be visible on the hillside just right of photo center as seen from viewshed sequence RS on Colorado 13; no proposed surface mining could be seen from this road segment.

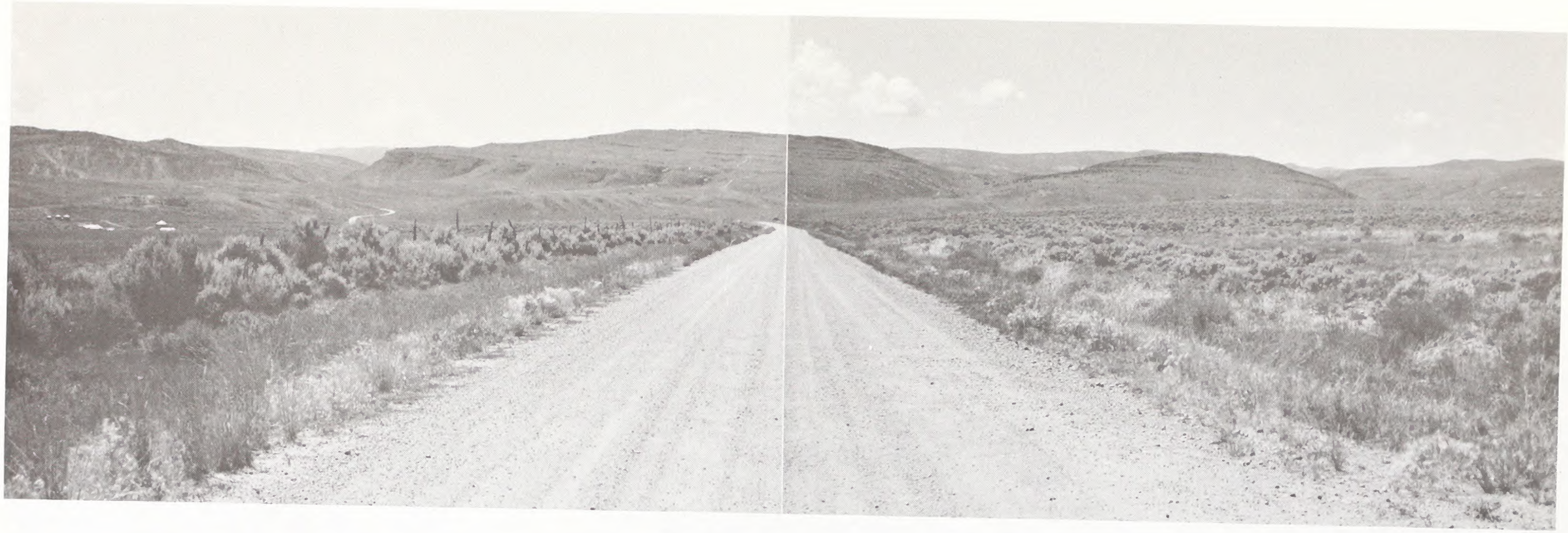


FIGURE GII-26

Two different views show the units containing the proposed access road, loadout facilities and conveyor area; the upper photo faces south from viewshed sequence WX on County Road 17; the lower photo faces east from sequence CD on County Road 32.

Views from Moffat County Road 55 near Government Bridge (south of Lay, Colorado) reveal background landscape visual units on these same exposed hillsides above Axial, and on the upper reaches of lease D-034365, some 14 miles distant. Therefore these viewshed sequences and corresponding landscape visual units were not mapped. However, these viewpoints lie in the area of the proposed Juniper Reservoir which indicates visibility to potential reservoir users.

Visual analyses were made only from surfaced or improved and graveled county roads.

Traffic volume data are available only for Colorado 13 (see Chapter II, Regional Analysis). Sampling for 1974 indicated an average daily traffic (ADT) volume of 730 vehicles. This reflects an average annual increase of 14.2 percent since 1970, compared to only a 2.5 percent increase for the five-year period preceding 1970.

Recreation

Refer to Chapter II of the Regional Analysis for a discussion of the regional recreation environment.

Resources

Though no big game concentrations occur on Federal coal lease D-034365, the area does offer winter viewing opportunities for deer, especially on the open southerly-exposed sagebrush slopes (see Chapter II, Aesthetics, for areas visible from public roads). Dense mountain shrub cover largely precludes distant wildlife viewing at higher elevations.

Private surface ownership prevents guaranteed public hunting on the mine site, although 80 acres of national resource lands lie within the lease boundaries. No private recreation operations occur on the site. See Chapter II, Terrestrial Fauna, for a more complete description of wildlife resources.

No fisheries occur on the mine area, though significant fisheries do occur downstream (Regional Analysis Chapter II). Axial Basin Reservoir and Milk Creek have a moderately low fishing capability (Bureau of Land Management 1974). See Chapter II, Aquatic Biology, for a description of fisheries.

Figure GII-27 displays relative inherent capabilities of the various land units surrounding the proposed mine area to attract and sustain recreation use. This rating pertains to existing resources and does not imply management.

Recreation Capability Classification
Legend for Figure GII-27

I. Capability Classes:
(Capability to attract and to accommodate recreation)

Class 1 - Very high; intensive activities
2 - High; intensive activities
3 - Moderately high; intensive activities
4 - Moderate; dispersed activities
5 - Moderately low; dispersed activities
6 - Low; dispersed activities
7 - Very low; dispersed activities

II. Sub-Classes:
(Recreation resources)

A - angling
E - interesting vegetation
K - organized camping
M - small water bodies
O - viewing upland wildlife
P - agricultural interest
Q - topographic - landscape variety
R - rock formations
V - panoramic view
W - waterfowl viewing
XS - snowmobiling

Existing recreation developments

No private nor public recreation developments lie on the proposed mine area. Axial Basin Reservoir lies about five miles north on Colorado 13 and is cooperatively managed by Moffat County in conjunction with the local 4-H group (Regional Analysis, Chapter II).

The Regional Analysis references a 6,370 acre big game hunting area immediately north of the Colowyo Mine area (number 19 under the Private Recreation section). This operation has been purchased by W. R. Grace and Company and leased back for ranching; a determination has not been made as to whether or not hunting will be permitted in the future.

Recreation visitor-use data

Average daily traffic (ADT) volumes from the Colorado Division of Highways indicate traffic increases on that portion of Colorado Highway 13 running adjacent to the lease area as shown below, compounded annually. Data is from the nearest sampling station about three miles south of the present entrance to Federal lease area D-034365:

Sampling year	ADT	Average annual increase (%)	
1965	380		
		2.50	
1970	430		7.52
		14.15	
1974	730		

R93W R92W

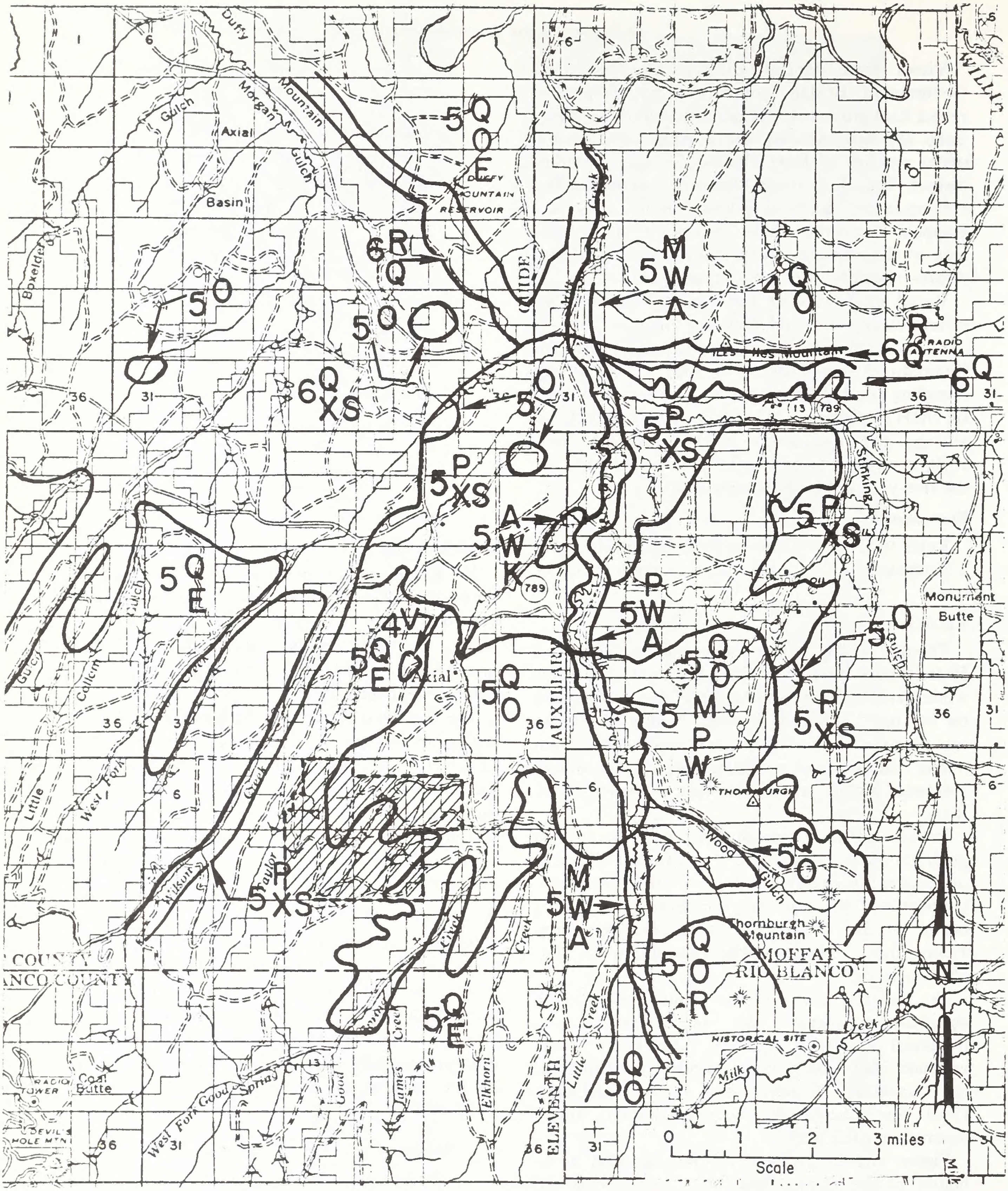


FIGURE GII-27

Recreation capability classification for the W.R. Grace Colowyo Mine area.

SOURCE: Bureau of Land Management, Williams Fork URA, 1974

Average annual increase for the 1970-1974 period is nearly sixfold that of the 1965-1970 period. Origin-destination studies for Rifle and Steamboat Springs (Regional Analysis, Chapter II) provide the nearest points for analyzing composition of motorists. Forty-two percent of all traffic traveling Colorado Highway 13 north of Rifle, and an average of 29.5 percent of all U.S. 40 traffic through Steamboat Springs were engaged in general recreation or vacation activities. No additional visitor-use data are available.

Social Environment

The social environment that would be affected by W. R. Grace and Company's proposed Colowyo Mine extends from the immediate, sparsely populated area of Axial Basin north and east to Craig and Hayden, and south to Meeker. The Axial Basin is a ranching area with fewer than ten ranch houses, while the community of Axial has only three residences.

Of the three other communities, Craig is the largest with a current population exceeding 10,000. Both Craig and Hayden (Hayden's current population is about 1,700), are experiencing boom town conditions now, due to the construction of Colorado-Ute Electric Association's power plant and Utah International's surface coal mine. The housing market is tight; the crime rate is increasing sharply; and new demands are being placed on already over-utilized social support facilities (e.g., water and sewer treatment, schools, etc.). These conditions will probably continue until 1979 when the power plant construction will be completed.

Meeker, with a current population of about 1,800, is also encountering some growth problems, as a result of preliminary development of oil shale resources in the Piceance Basin. Housing shortages, increased crime, and increased demands for social support facilities will continue in the future, as oil shale development reaches commercial stages.

For a more extensive analysis of the social environment, refer to Chapter II of the Regional Analysis.

Economic Conditions

In the area that will be affected by the development of the Colowyo Mine, the industrial sectors employing the most people are agriculture, retail trade, and construction. In the future it is expected that the mineral-extracting sectors will gain importance as the development of non-coal related energy resources proceeds. Currently the agricultural sector generates the vast majority of earnings in the area, but in the future, earnings in the minerals extractive industries (other than coal) will expand rapidly.

The standard of living in the area, measured in terms of 1973 per capita personal income, is about $4,700, approximately six percent less than State and national averages. This difference from State and national levels is probably the result of the lack of a strong manufacturing sector which traditionally is a high income industry.

For a more extensive analysis of economic conditions, refer to Chapter II of the Regional Analysis.

Transportation Networks

Highways

At the present time, the general area of the W. R. Grace Colowyo Mine site near Axial, Colorado, is served by Colorado Highway 13 running south from Craig, Colorado.

Colorado 13 has been improved for use in hauling coal between the site of the existing Empire Energy Mine near Hamilton and Craig; south of this point, the road has not been improved. There are three bridges which also have not been strengthened for heavy loads. These bridges include the Milk Creek bridge eight miles south of Hamilton (no posted weight limit), the Stinking Gulch Bridge, 5-5½ miles south of Hamilton (39-ton gross weight), and another unnamed bridge 6-6½ miles south of Hamilton (33-ton gross weight).

Highway 13 is a two-lane paved road throughout its length. This road, where not significantly improved, is basically designed as a light vehicle road. Highway 13 passes just east of the W. R. Grace Mine site at Axial.

Railroads

There are no existing rail lines into the area of the W. R. Grace Axial Mine site. The closest rail facility that can be considered existing is a planned D&RGW railroad spur (to a Colorado-Ute power plant site) running southwest of Craig, Colorado. Contracts have been let for this planned construction; it will connect with the existing D&RGW branch line running east from Craig, Colorado.

AIRLINES

The closest airport to the W. R. Grace Mine site is the Craig airport, which has somewhat limited services. Another close airport is the Yampa Valley Airport east of Hayden, Colorado. It is regularly served by Frontier Airlines and is now undergoing a 10-million dollar improvement program.

Chapter III

Environmental Impacts of the Proposed Action

THIS CHAPTER ANALYZES IMPACTS OF W. R. GRACE & COMPANY'S PROPOSED MINE AND RECLAMATION PLAN ON THOSE RESOURCE VALUES DESCRIBED IN THE PRECEDING CHAPTER. IT IS ASSUMED IN THIS CHAPTER THAT NO EFFORTS WILL BE MADE TO MITIGATE IMPACTS. IN THIS MANNER ALL PROBABLE IMPACTS CAN BE IDENTIFIED AS THE BASE FOR THE DETERMINATION OF MITIGATING MEASURES AND UNAVOIDABLE ADVERSE IMPACTS IN THE TWO SUCCEEDING CHAPTERS. WHERE DATA ARE AVAILABLE, IMPACTS ARE LINKED TO SPECIFIC ASPECTS OF THE PROPOSED ACTION AND ARE QUANTIFIED AS TO MAGNITUDE, INTENSITY, DURATION, AND INCIDENCE. ALTHOUGH THE PURPOSE OF W. R. GRACE & COMPANY'S RECLAMATION PLAN IS TO LESSEN ADVERSE CONSEQUENCES OF SURFACE DISTURBANCE, THE IMPACTS RESULTING FROM IMPLEMENTATION OF THEIR PLAN ARE ADDRESSED IN THIS CHAPTER.

Non-living Components

Geologic and Geographic Setting

TOPOGRAPHY

The proposed mine would gradually replace the natural valley, slopes, and upland. At the end of the 30-year mining period this process would result in a more subdued, gently sloping landform. Streeter Creek's lower valley would become slightly shallower, retain its steep north side, but have a more gently sloping south side. Other natural drainages on the present mine site would be obliterated and replaced by man-made drainages where necessary.

Although the company plans to return the mine site to its approximate original contour, the present northward slope of the surface in S ½ NW ¼ and N ½ SW ¼ Section 2, and S ½ NE ¼ and N ½ SE ¼ Section 3 is too steep for thick spoil fills. The present surface grade ranges from 20 to 60 percent, with a maximum of 100 percent. No figures are available for the amount of expansion as the naturally layered bedrock is converted to mine spoil containing large fragments of randomly oriented rock. However, if compared to poorly sorted natural gravels that contain large amounts of sand, silt, and clay, the spoil probably would expand about 15 percent.

Thus:	268 ft.	(average thickness of original overburden)
	+40 ft.	(15% expansion)
	308 ft.	(average thickness of final fill)
	320 ft.	(average original total thickness including coal)
	-308 ft.	(average final thickness)
	12 ft.	(average lowering of altitude of surface)

If this estimate is accurate, the volume of material returned to the mine site would be within 96 percent of the original volume, and the approximate original topography may be reconstructed, although the physical character of Streeter Canyon would be changed by partial filling.

Indications from the company's maps are that mining would continue far enough east in Sections 2 and 11 that when the spoil is replaced on the hills overlooking Good Spring Creek and State Highway 13 it would form a higher hill. This could lead to such problems as erosion, mudflows, or landslides, if these materials become saturated with water during periods of very high rainfall or rapid snowmelt.

Company maps show drainage ditches along the contour, and uphill from the mine, to protect it from surface water during snowmelt or rainfall. However, these ditches are shown ending short of the natural drainageways into which they are to conduct runoff waters, particularly the draw that empties into Good Spring Creek in S ½ Section 2. This could lead to gulley erosion downhill from the end of the ditch, and sedimentation below, with the formation of small alluvial fans in some places.

POSSIBLE GEOLOGIC HAZARD

The mining as proposed may be subject to a geologic hazard along the north side of Streeter Canyon. Mining is to begin at the foot of the canyon wall, and the steep slope apparently is particularly favorable for slumps and landslides. Such slope failures could disrupt mining and facilities and be a hazard to mine workers. Although the company reports that drill records indicate the dip of the bedrock in the area is ten degrees or less toward the north, a preliminary map based on surface exposures includes some steeper dips probably measured on slumped material. Field observations by team members indicated slightly hummocky landforms, and other suggestions that the north slope of Streeter Canyon has been unstable in the past.

PALEONTOLOGY

Adverse impacts to the human-interest value of fossils would occur if they are destroyed in the coal mining operation. Given the area's lithologic character, it is likely that at least some fossil destruction would occur. Beneficial impacts would occur if unearthed fossils were collected and studied. Potential impacts in this area are expected to be no more significant than would occur in adjacent areas with similar development. This stratigraphic section is moderately likely to yield significant fossils, compared to other areas in the study region.

Mineral Resources

The mining plan submitted by W. R. Grace calls for 30 years of mining on the eastern half of Federal coal lease D-034365, but does not indicate any mining on the western half. Presumably no development would take place for some time in the western half of this tract, which includes most of Sections 4 and 9, T.3N., R.93W. By the company's figures, this portion includes about 72,000,000 tons of strippable coal reserves.

A beneficial impact of the proposed plan would be the recovery of more coal than would be possible by underground mining. Using the generally accepted rates of 90 percent recovery for stripping, and 50 percent by underground mining methods, and an original reserves figure of 93,000,000 short tons, an estimated 37,200,000 short tons would be produced that would have been lost by underground mining. Coal reserves of the region would be reduced by about 93,200,000 tons during the recovery of 83,700,000 tons from the proposed mine.

Potential impacts of conflicts between development of coal, and exploration and/or development of oil and gas, depend on comparisons of specific details of actual proposed activities. The nature of development of an oil and gas unit area precludes definitive plans at the outset, because plans evolve as successful or unsuccessful exploration continues. Potential impacts can include matters of access, routes for utility and transportation facilities (powerlines, pipelines, haulage roads, etc.), as well as direct conflicts between mining operations and drill holes, which could result in some unrecovered resources. Rarely if ever is extraction of both types of resources precluded on technologic grounds, either sequentially, or virtually simultaneously. A current conflict between development of coal and exploration for oil and gas at the proposed site of the W. R. Grace and Company's mine is pending court action. Identification of specific impacts on mineral resources and related surface facilities would be speculative prior to resolution of the case.

Water Resources

GROUND WATER

Ground water would not be expected to accumulate in the mine spoils replaced over the mined-out part of the area; however, the spoils placed in the valley of Streeter Creek would be at a lower altitude and could become saturated. Saturated spoils could become unstable and slide toward the valley of Good Spring Creek.

SURFACE WATER

The principal impacts on surface water are destruction of natural water courses, and an average annual production of an estimated 350 tons of sediment from rehabilitated areas, and 560 tons from access and haul roads.

The discussion presented in Chapter II on surface water involves the entire drainage system which would affect the lease area; this discussion is necessary to indicate the availability of water. Actual mining operation for the period 1976-1990 will be in the northeast quarter of the lease area according to the latest mining plan. Mining impacts would be confined to Streeter Canyon, those tributaries of Good Spring Creek which drain the central and east central portions of the area, and those areas which contribute directly to Good Spring Creek; principal impacts to surface drainage would be the destruction of natural water courses.

Due to the nature of the mine plan, any sediment that is generated from the mine spoils would be deposited in the mine pit. Rehabilitated areas would yield about 350 tons of sediment per year from the average of 45 acres of land disturbed each year, and from land that has been revegetated but still is subject to accelerated erosion. The coal haulage road to be constructed at the top of the west canyon wall of Good Spring Creek probably has the potential for contributing more sediment to Good Spring Creek than actual coal excavation. The road would start about eight-tenths of a mile south of the south edge of the mouth of Streeter Canyon. At the mouth of the canyon the road turns west up the Canyon, to a point where a "U" turn can be made to continue downward at an allowable grade. Runoff that flows down fill embankments, down side slopes of cuts, and through borrow pits will cause movement of sediment. Considerable material will be moved during and immediately following construction, but will decrease as soil conditions stabilize. The 83 acres disturbed by the haul road would be expected to yield about 400 tons of sediment, and the 32 acres disturbed by the mine access road would be expected to yield about 160 tons annually.

Because the area to be mined lies above the main water table in the area, the overburden material is expected to be largely, if not entirely, oxidized. As a result, the amount of leaching from the spoils is expected to be low and far lower than in areas where mining extends below the water table.

Air Quality

EMISSIONS

Five general sources of atmospheric emissions will be created by the proposed development at the Colowyo Mine.

The five sources of air pollutants at the mine are: (1) mining, (2) processing, (3) vehicle emissions, (4) roads, and (5) coal fires. These are discussed in detail in the Regional Analysis. Based on current regulations, the only significant pollutant generated by the first source, mining, would be suspended particulates which result from fugitive dust. Emissions estimates from materials handling in mining have been developed for topsoil, overburden, and coal separately, but with the same methodology. All the operations of removing the material from the ground, transport, piling, and redistribution, have been combined into a single emission calculation using estimates developed from other studies of fugitive dust. Detailed calculations and references are given in Appendix D.

Estimates of the quantities of material to be moved (Appendix D) were taken from the Draft Environmental Impact Statement Colowyo Mine (1974). In the years 1980-1990, an estimated 3,000,000 tons of coal will be mined per year, necessitating removal of 26,900,000 tons of overburden, and 388,300 metric tons of topsoil each year. Emissions estimates for this quantity of materials handling is shown in Table GIII-1 as controlled and uncontrolled emissions.

Uncertainties in emissions (two standard deviations) are estimated to be on the order of a factor of two. All of the rates are given as yearly averages, even though it is recognized that all the activities are not continuous. As an operation of mining, blasting has not been included in the previously described emission calculations.

Process emissions of suspended particulates involve fugitive dust emitted from coal preparation for delivery, and fine particulate matter emitted directly to the atmosphere from control device exhausts. Emission totals for processing are given in Table GIII-1.

At the mine, there would be vehicle exhaust emissions from heavy diesel mine equipment, haulage trucks, and gasoline-powered cars and trucks. Table GIII-1 lists within-mine and off-mine emissions from vehicles separately. Because of the relatively large haulage distance to the railhead, the off-mine emissions dominate the totals. Automobile emissions were calculated as outlined in Appendix D.

Another possible source of emissions related to mining would be the spontaneous or accidental ignition of coal fires in overburden piles and exposed coal seams. If a fire occurs, clouds of smoke containing suspended particulates, carbon monoxide, nitrogen oxides, sulfur oxides, hydrogen sulfide, and hydrocarbons could result. Estimates of frequency or quantity of emissions at any one mine cannot be made. However, if a fire occurs the emissions might be substantial.

IMPACT ON AIR QUALITY

Particulates

In order to assess the impact of the mine on the atmospheric environment, estimates must be made of the ambient total suspended particulate concentrations resulting from the emissions specified in Table GIII-1. To do this, an atmospheric diffusion model has been applied to the mine site. The effect of local emissions are considered over long periods (annual averages), and in terms of short duration exposures (daily concentrations). The model is described in detail in Appendix D.

The uncertainty in the calculated total suspended particulate concentrations can be approximated from the combined uncertainties of the inputs, and the errors in the model itself. It is estimated that the modeled concentrations are correct within a factor of three. This uncertainty could be reduced only by much more detailed and preferably measured emissions and meteorological data.

Table GIII-2 is a compilation of Federal and State ambient air quality standards, existing background concentrations, and diffusion model predictions. For an annual average, the highest concentrations expected are those in the prevailing downwind direction during stable conditions. Air flow during these times will often be downslope from the southwest. The largest predicted annual concentration is thus at the northeast edge of the mine site.

As shown in Table GIII-2 and Figure GIII-1, the decrease in concentration with distance would be rapid. Concentrations (including the background of 20 $\mu g/m^3$) will exceed the annual Federal secondary standard (60) out to 1.8 kilometers (1.1 miles) from the center of the disturbed area, and the Colorado Standard (45) for a distance of 2.5 kilometers (1.6 miles). Concentrations in other than the down-valley direction will be lower by at least 50 percent.

Meteorological circumstances resulting in the largest predicted 24-hour total suspended particu-

TABLE GIII-1

Colowyo Mine Air Pollutant Emissions

(Metric Tons per Year)*

Source	Air Pollutant	Uncontrolled	Controlled
Mining Materials			
Handling:			
Topsoil	Suspended Particulates	5.6	5.0
Overburden	Suspended Particulates	560	500
Coal	Suspended Particulates	64	58
Process	Suspended Particulates	136	68

Source	Air Pollutant	Within Mine: Cars	Within Mine: Trucks	Off Mine: Cars	Off Mine: Trucks
Vehicle Exhaust	Suspended Particulates	0.083	0.066	0.79	4.3
	Hydrocarbons	1.06	0.19	9.5	12
	Carbon Monoxide	5.4	4.5	51	74
	Nitrogen Oxides	0.77	1.9	7.4	120
	Sulfur Oxides	0.020	0.13	0.18	8.7

* 1 metric ton = 1.1016 short tons

TABLE GIII- 2

Air Quality in the Vicinity of the Colowyo Mine

Predicted Worst Case Concentrations ($\mu g/m^3$) from Sources at the Mine

Pollutant	Averaging Time	Ambient Air Quality Standards: Federal Pri	Federal Sec	State	Existing Ambient Air Quality	Distance from Mine (km)	Maximum Predicted Concentrations	Predicted Plus Background Concentrations
Total Suspended Particulates	Annual	75	60	45	20	0.5	140	160
						2	33	53
	24 Hour	260	150	150	20	0.5	380	400
						2	160	180
Sulfur Dioxide	Annual	80	-	-	15	0.5	0.034	15
						2	0.0080	15
	24 Hour	365	-	15	15	0.5	0.093	15
						2	0.038	15
	3 Hour	-	1,300	-	15	0.5	0.28	15
						2	0.11	15
Carbon Monoxide	8 Hour	10,000	10,000	-	400	0.5	18	420
						2	7.6	410
	1 Hour	40,000	40,000	-	400	0.5	30	430
						2	13	410
Non Methane Hydrocarbons	3 Hour	160	160	-	50	0.5	2.1	52
						2	0.90	51
Nitrogen Oxides	Annual	100	100	-	15	0.5	0.60	16
						2	0.14	15

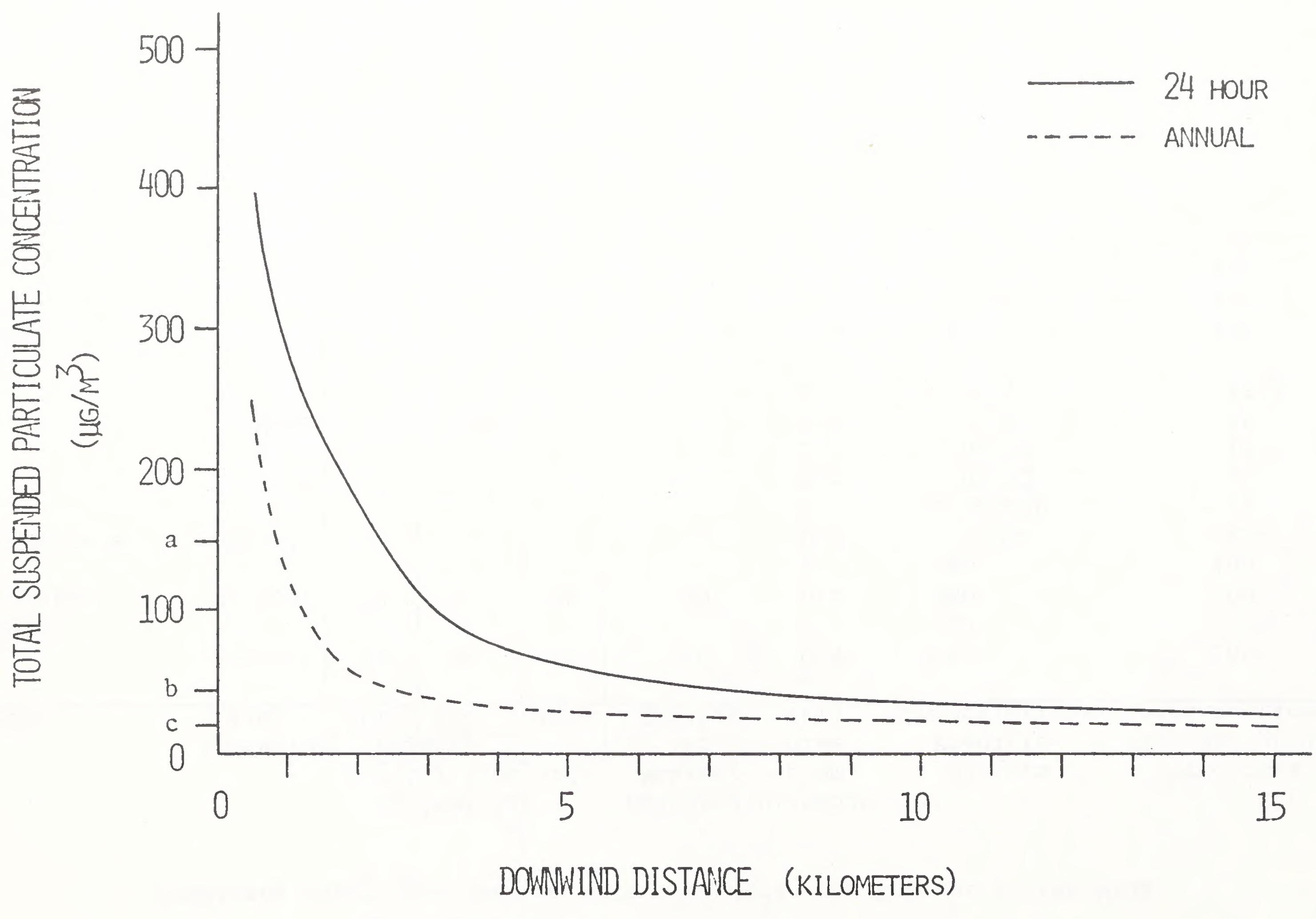


FIGURE GIII-1

Maximum down valley suspended particulate concentrations as a function of downwind distance from the Colowyo mine center. (a, 24-hour state standard; b, annual state standard; c, baseline concentration).

lates concentrations are those which contributed most to the annual average, the existence of stable conditions. It has been assumed that stable conditions with a wind speed of one meter per second (2 mph) persist for at least eight hours. This could occur in any direction but is most likely to the northeast. The meteorological information available indicates that concentrations on the order of those in Table GIII-1 will occur between 10-30 days/year. Because the emissions are concentrated, the predicted concentrations shown in Table GIII-2 are relatively large. At 500 meters (0.3 miles), the highest concentration would exceed the Federal secondary and State standards by a factor of three. The decrease of concentration with distance is also shown in Figure GIII-1.

EPA non-degradation guidelines for Class II areas will be exceeded in the prevailing downwind direction for distances of 4 km (2.5 miles), annual average, and 6 km (3.7 miles), 24-hour average.

The impacts of the two other potential sources of suspended particulates previously mentioned, blasting and fires, are difficult to assess. The cloud of dust produced by blasting is expected to be short-lived, at least compared to the averaging times of the standards (24 hours or greater), so that little contribution would be measured off the mine site. The dust produced would be created, but also initially dispersed by the force of the blast. Blasting would generally take place during the day when meteorology characteristics are most favorable for dispersing pollutants.

Coal fires would be a major source of pollutants, if neglected and allowed to burn out of control for long periods. At the immediate site, any fire could significantly contaminate the air and create a safety hazard.

Gaseous pollutants

Vehicle emissions would be the only source of gaseous air pollutants at the mine. Federal and State regulations limit ambient air concentrations of the pollutants: carbon monoxide, hydrocarbons, nitrogen oxides, oxidants, and sulfur oxides. Emission estimates were made separately for off-mine and within-mine vehicles in order to facilitate impact assessment.

Results of modeling within-mine vehicle exhausts are given in Table GIII-2. As in the particulate case, the predicted concentrations decrease rapidly with distance from the mine. Emissions from diesel and gasoline vehicles have been added together in the consideration of the mine as an area source. Applicable air quality standards and existing background concentrations are also listed in Table GIII-2.

The within-mine vehicles are assumed in the model to be spread out over the entire disturbed area. In comparison, the off-mine vehicle emissions would occur along the road system. They constitute a source 50 times larger, as indicated in Table GIII-1.

Visibility

The addition of particulates into the atmosphere around the mine, either directly as suspended particulate emissions or indirectly as a result of chemical reactions of gaseous pollutants, would reduce the visibility in the area. Gaseous contribution is expected to be minimal. Presently the average visibility range over a year is estimated at 25 kilometers (15 miles). This estimate includes such factors as cloud cover, humidity, and background pollutant concentrations. Operation of the Colowyo Mine would reduce this estimate to no less than 20 kilometers (12 miles) on an annual basis.

Living Components

Soils

Impacts on the soil by mining and associated activities would disturb about 856 acres by W. R. Grace during the period 1976 through 1990; see following tabulation.

Period	Acres Disturbed
1976-1980	415
1981-1985	201
1986-1990	240
1991-1995	211
1996-2000	218
2001-2005	214
Total	1499

Mining of the area would result in mixing together the existing soils within the mined area. The degree of soil redistribution is unknown, and would vary throughout the disturbed area. Most soil characteristics would be altered, including micro-organism populations, and other soil relationships from the existing conditions that have developed over geologic time. About three million cubic yards of topsoil would be removed and replaced.

The most recent soil survey (SCS, 1975) indicates that sufficient soil material exists to resurface the entire mined area with about 18 inches of topsoil. This would require removal of 42 to 50 inches of material from areas where suitable soil occurs. Of the area proposed for mining, about 25 percent is not overlain by material suitable for resurfacing.

In addition to soil surface acreage that would be disturbed in the mined area during the periods mentioned above, overburden would be excavated during mining operations. This could result in bringing geologic material to the surface that might be toxic to plants and animals or retard plant growth. Investigations by BLM-EMRIA to the depth of about 200 feet shows little discernible toxic materials in the soil or overburden other than low-medium levels of sodium in places. The same study shows a low-moderate accumulation of sodium salts in the contact between living soil and underlying geologic materials, especially where the contact is with shale. Areal extent is unknown, but is thought to be minor, and should have little effect mixed with other overburden materials. At the completion of mining the soil structure and its properties would be completely different from those presently existing, thus influencing moisture infiltration.

The overburden removal process would result in fine-textured (clay) soil material from the shale strata and moderately coarse-textured (fine sand) soil material from the sandstone strata. The combination of these kinds of rocks exposed to weathering would produce a wide range of soil textures in varying thickness and arrangements; the resulting soil material would be stony, and difficult to work for seedbed preparation. Soil permeability and infiltration rates near the soil surface would be reduced by compaction, when the spoil is shaped and topsoil replaced. This would increase runoff, thus adding to erosion and sedimentation. Wind action during dry periods would cause dust to be lifted into the atmosphere, adding to soil loss. As all physical, chemical, and biological systems would be disrupted to an unknown degree, overall mining action would lower overall soil productivity an estimated ten percent.

Stockpiling topsoil would degrade the physical, chemical, and biological characteristics to an unknown degree, but undoubtedly to a lower quality than now exists. Existing soils would be covered by topsoil stockpiles, and loss of production would occur on about 35 acres outside the mine area. The stockpile would be subject to erosion by wind and water, increasing soil loss and sedimentation.

Drainage ditches outside and on the area to be mined would impact soils and vegetative cover. Assuming they are 16 feet wide and have a total length of about 4.5 miles, about nine acres would be affected by a loss of vegetation and increased erosion. The result would be increased soil loss and sedimentation downstream during periods of heavy runoff, as in early spring, or during high intensity rain storms, because of concentrated runoff. Loss of riparian vegetation and deep productive soils in Streeter Canyon would be permanent.

Mine facilities constructed outside the mined area would disturb or permanently remove about 50-60 acres of soil from production.

Other off-site soil impacts would result from increased population associated with mine employment. Population increase would produce increases on recreational uses, solid waste disposal, sewage disposal, schools, and other social facilities; these would cause unquantified soil impacts such as compaction, erosion, and sedimentation.

Construction, mining equipment, off-road vehicles, etc., crossing undisturbed soil areas susceptible to compaction would impact soil permeability, water infiltration, and vegetative cover; this would increase erosion and sedimentation.

The most significant impacts to soils would be: (1) unprotected soils subjected to wind and water erosion, (2) loss of soil structure, thus decreased moisture infiltration, (3) compaction of spoils and replaced topsoil, (4) mixing of soil horizons by stockpiling, (5) loss of existing soils and creation of a very different soil complex, and (6) burial of fertile soil material. Approximately 1,500 acres at the Colowyo Mine would be subject to varying degrees of these impacts. It is impossible to predict the exact location where each impact would be most significant; however, the spoils to be placed in Streeter Canyon would be highly subject to erosion, and impacts related to reduced moisture infiltration would be most significant where clay soils are replaced on the surface of mine spoils.

Terrestrial Flora

There would be two impacts on terrestrial vegetation due to the mining operation of W. R. Grace:

1. Total and partial destruction in the mined and otherwise disturbed areas.

2. Lateral impacts on surrounding areas.

During the 30 year life of the Colowyo Mine, vegetation would be destroyed on approximately 1,500 acres. Vegetation would be affected as shown in the following table.

TABLE GIII-3

Vegetation Types, and Amount to be Disturbed by Activity (acres).

Activity	Vegetation Type: Mountain shrub	Vegetation Type: Sagebrush	Total
Mining (1976-1980)	163	32	195
Mining (1981-1985)	89	112	201
Mining (1986-1990)	118	122	240
Mining (1991-2005)	154	489	643
Access road	0	32	32
Buildings and yard	0	25	25
Topsoil stockpiles (initial years)	0	16	16
Topsoil stockpiles (subsequent years)	7	12	19
Boxcut spoil stockpile	9	36	45
Haul Road	22	61	83
Total	562	937	1,499

The acreage figure for the haul road is calculated for the Taylor Creek tail loadout facility. If the Jubb Creek tail track or loop routes are utilized, which are alternatives to the proposed rail spur (see Figure GI-12), haul road construction would destroy an additional 29 and 31 acres of sagebrush, 12 and 10 acres of mountain shrub, and 7 and 2 acres of cropland respectively.

Vegetation loss would begin with the construction of roads, drainage ditches, and surface facilities. Road and drainage ditch construction would alter the surface drainage pattern. Surface water that would normally run downhill would now be diverted to areas more convenient for discharge. This might cause some downslope areas to receive somewhat less moisture; this change in available moisture might cause some minor localized alterations in vegetative patterns. Sufficient information is not available to predict the extent of this impact, but it will likely be minimal.

The mining operation would produce the largest vegetative impact. Its first disturbance of vegetation would result from stockpiling topsoil and placing the boxcut spoils on undisturbed land; this would amount to approximately 80 acres during the 30-year mining period. The mature mining operation would mine and revegetate approximately 45 acres per year, with the pit occupying about 300 acres; total removal of vegetation from these acreages each year would have a secondary effect on surrounding vegetation. Once the vegetation is removed from the mining areas and is unavailable to herbivores, vegetation on surrounding areas may be subjected to increased utilization. Magnitude of this impact would depend on the importance of the area for wildlife forage, and the amount of overstocking of domestic livestock that takes place.

Overburden material from the initial cut would be cast into Streeter Canyon to a final proposed angle of 25 percent. This angle would increase the area of disturbance beyond that created by casting the material at the angle of repose, but would greatly increase reclamation potential of the spoil material, thereby lessening the overall impact of vegetative loss in Streeter Canyon. At the mouth, the canyon is approximately 200 feet deep; it is estimated that grading the spoils to 25 percent would raise the floor of the canyon near the mouth approximately 75 feet (Figure GIII-2).

FIGURE GIII-2—Streeter Canyon, the north edge of W. R. Grace's Colowyo Mine is shown. The hill to the left of the canyon would be mined, and original spoils cast into the canyon. Grading of the original spoil material to a 25 percent grade would raise the floor of the canyon approximately 75 feet near the mouth; current depth is about 200 feet.

Population increase associated with mine employment would remove an estimated 96 acres of vegetation by 1990, under scheduling originally proposed. Vegetative types removed are indeterminable, as location of population cannot be determined at this time. Increased recreational use by the new expanded population, especially off-road vehicle use, would affect additional vegetative types and acreages within the total study area.

A secondary impact from destruction of native vegetation would be the invasion of weedy species, such as Russian thistle (*Salsola kali*). If not controlled, their competition with seedlings would be a very significant impact to revegetation attempts, decreasing the success of permanent vegetation establishment.

At this point W. R. Grace has not developed a comprehensive seed mixture, pending the results of an extensive revegetation study on the lease site. If the current proposed mixture is not expanded, the resulting vegetation would have a very small degree of diversity. W. R. Grace is evaluating the use of alfalfa and legumes to reintroduce nitrogen into the soil system. In the past alfalfa has been utilized in reclamation efforts in the area, and has been found to dominate the revegetated area (Berg and Barrau 1973). In dominating, the alfalfa provides an excellent soil stabilizer and soil builder; however, it tends to create a vegetative stand with very little variety for at least ten years, (Berg 1975). It is current theory that the stability of a plant community is a function of its species diversity, and that succession in an ecosystem is described as a progression toward higher diversity (Kormondy 1969). Diversity produces stability because there is less likelihood that any major shift or loss of any one component will adversely affect the system as a whole. It is evident from the increasing use of pesticides in agricultural croplands that most monocultures do not produce self-sustaining stable vegetation. At this point it is difficult to predict the importance of this concept in analyzing the impact on vegetation at the Colowyo Mine, as the W. R. Grace reclamation program will not be finalized until ongoing research is complete. Also, alfalfa may not be highly competitive on topsoiled spoils. Also Stewart (1974) found that micro-organism activity increased on revegetated mine spoils in southeastern Montana as species diversity increased: micro-organism activity is very necessary for nutrient cycling and soil development processes.

Length of impact of native vegetation loss would depend upon the success of reclamation. The loss of the native vegetation might be quite long, and will depend mostly upon the rate and ability of native species to invade the area, and the extent to which trees and shrubs are transplanted from undisturbed areas to spoil areas. Some small areas, due to soil texture, toxicity, or other factors, might be impossible to revegetate, making the loss of vegetation a permanent impact. Since W. R. Grace's reclamation plan is not finalized, and current methods, mainly the shaping of spoils to approximate original contours and replacing topsoil, have only been utilized for a few years, sufficient information is not available to predict the amount of time needed for native species invasion or the extent of areas unable to revegetate. In some years climatic conditions might be such that revegetation attempts would fail, extending the impacts of vegetative loss. The loss of existing soil geomorphologic conditions, and creation of different and inconsistent soil conditions might prove native vegetation difficult or impossible to re-establish.

Total destruction of native vegetation from an area would result in the following impacts on the vegetative ecosystem:

1. Loss of above and below-ground primary productivity,
2. Loss of a diverse vegetation capable of withstanding climatic extremes and utilizing precipitation and sunlight throughout the growing season,
3. Loss of the present vegetative successional stage, and set-back to a very juvenile stage,
4. Loss of a natural seed source necessary for ecological succession and stability,
5. Loss of nutrient cycling systems that utilized the soil, plants, micro-organisms, and physical forces to cycle nutrients from the soil to forms usable by plants. These systems are essential for self-sustaining vegetation growth, and may be the greatest limiting factor to establishing self-sustaining plant ecosystems on mine soils,
6. Loss of soil stability and erosion prevention by roots and shoots of vegetation.

Young palatable vegetation produced by revegetation efforts would attract wildlife and livestock; grazing on young plants would inhibit early growth and revegetation of disturbed areas.

It is improbable that existing vegetative ecosystems could be returned to strip-mined land in the 15 year time-frame of this statement; current reclamation practices have not been utilized long enough to determine whether a significant number of native plant species can be established on reshaped-topsoiled spoils. Therefore, the greatest impact to the vegetation resource would be the complete loss of existing stable plant ecosystems on approximately 856 acres by 1990 (per the original mining schedule) and the permanent loss of vegetation on about 240 acres. The second most significant impact would be the projected ten percent decrease in production on revegetated spoils. Though seasonal peak production is not expected to decrease appreciably on most sites, species diversity will probably decrease by 75 percent. With W. R. Grace's current reclamation plan the tree, shrub, and forb components of herbage production will probably decrease by at least 75 percent, and the grass component increase by about the same amount.

Terrestrial Fauna

WILD FAUNA

Development of the Colowyo Mine, as covered in this statement, would result in several adverse impacts on a variety of wildlife species. Three major categories will be covered in this section: the mining operation, construction of support facilities, and reclamation activities. Each of these actions would impact the terrestrial fauna in its own particular way.

Mining operation

The major segments of a strip mining operation as related to terrestrial fauna, are: exploration, removal of vegetation, removal of topsoil, removal of overburden, and extraction of coal. The first three segments of this type of operation create the most significant impacts on wildlife.

During the exploration phase of the operation paths are cut through existing vegetation and pad locations are cleared. Drilling operations then take place. Most of exploration drilling has already been completed on the W. R. Grace site; however, additional exploration is expected to take place within the lease, west of the proposed mine area.

Destruction of vegetation creates impacts on fauna by reducing available nesting cover, escape cover, and food, and reducing the area's capability to maintain present animal numbers. The vegetative type being disturbed would determine the faunal species most affected (see Appendix D).

Noise resulting from drilling operation and movement of equipment would create what is expected to be a short-term impact on those faunal species in close proximity to the work area; noise will create a degree of anxiety in animals, the degree depending on the faunal species, closeness to the operation, and duration of the operation. Those animal species that are mobile enough, such as coyote, fox, deer, and most birds would likely leave the area, at least temporarily. Those species that cannot flee would probably retreat into their dens, under rocks, or into brush. Some animal deaths would be expected during this phase of the mining operation from vehicle-animal collisions, as well as from den or nest destruction. Unplugged core sample holes would create a hazard to small mammals, amphibians, reptiles, and invertebrates, and could cause larger animals, such as deer, and elk, to step into them and break a leg.

Removal of all vegetation would be the first step in the process of getting to coal. Loss of this vegetation would result in a loss of food and cover needed by terrestrial fauna; the disruption of the mined portion of the ecosystem would be total (see Appendix D for species affected by habitat type.)

A combination of vegetation loss and removal of productive topsoil would leave the mined area temporarily void of all animal life. This adverse impact would be exerted on all forms of terrestrial wildlife from soil mites to deer and elk.

Topsoil removed from initial cuts would be temporarily stockpiled west of the actual mine operation (see Figure GI-6). This stockpiled material would cover additional vegetation, primarily sagebrush, resulting in loss of habitat for sagebrush-dwelling animals (see Appendix D).

Major impacts of overburden and coal removal on wild animals would be in the creation of a highwall, and prolonging the amount of time the area would be disturbed. This highwall would create a potential hazard to animals, as well as disrupting their normal movement and migration patterns.

Additional impacts on the existing ecosystem would result from dumping overburden into Streeter Canyon. As presently planned, this overburden material is expected to completely cover the south slope of the canyon as well as the entire canyon bottom; it will also cover at least the lower 75 feet of the north slope of the canyon. This would result in the loss of all this area for wildlife use until the revegetation program has been completed; even then the area would never return to its natural or presently existing status. Some direct loss of life would result from the partial filling of Streeter Canyon; nesting birds, rodents, amphibians, reptiles, and maybe even deer would be lost.

Riparian vegetation would be lost by the dumping of spoils into Streeter Canyon, as well as the projected box cut west of the fill area (see Figure GI-5).

Total loss of wildlife habitat resulting from the mining operation would be in a constant state of progression across the lease area from north to south. Table GIII-3 indicates the proposed acreages that would be stripped between 1976-2005, under the proposed schedule. An estimated total of about 1,279 acres would be mined by this operation.

There would be a one-year time lag in the mature operation, from topsoil removal to beginning of revegetation efforts. This would mean that approximately 45 acres of land would be unavailable to all wildlife, as a direct result of mining at any given time during the life of this operation. All previously mined areas would be in some stage of reclamation, therefore providing some wildlife habitat value.

Less mobile faunal species such as many reptiles, invertebrates, and small mammals would be unable to flee and would be destroyed. The larger and more mobile species such as deer, elk, coyote, grouse, and other birds would be able to move onto adjacent lands. All or most of these relocated animals would probably be lost, as explained in the Regional Analysis portion of this report.

The entire 1,279 acres (see Table GIII-3) that is proposed to be mined by 2005 (under the 1976 starting date) provides habitat for deer and elk. Using the same population estimates that were presented in Chapter 2, habitat capable of supporting approximately 50 deer and 25 elk would be destroyed. This loss would represent a permanent reduction in the habitat's ability to sustain existing herd size and composition, unless reclamation programs could restore the mined areas to an equal or greater carrying capacity than that which is presently available.

Impacts on bear and cougar would be expected to be insignificant because of the low population densities of these two species within the region, and the low indices of use they have exhibited for the subject area. Some adjacent lands would probably also become unsuited for these species because of the close proximity of human activity.

The most significant impact on the rabbits and hares would be loss of food and escape cover during the mining operation; populations would decline in the limited area that has been denuded of vegetation. Potential impacts to bats are not known although it is expected that these species would relocate.

In all probability, increase in human activity and noise associated with the mining operations would cause some wildlife species such as coyotes, fox, and many birds to leave the working area prior to actual habitat destruction. The probability of an increase in vehicle-animal collisions would also be associated with the increase in human activity.

Access has been limited since the area was acquired by the W. R. Grace Company; additional restrictions would also be expected, thus reducing hunting pressure on big and small game species. This would allow hunting by authorized employees only. This practice could eventually result in improper population management of huntable species, such as deer, elk, and rabbits.

Additional habitat destruction might result from business and recreational use of vehicles, off the roads, on lands adjacent to the proposed mined areas. This would cause a related reduction in the use of the area by certain species of wildlife such as deer, rodents, and other herbivorous species, as carrying capacity is reduced, and nests and dens are destroyed.

Water quality would not be expected to be affected to any major degree by the mining operations; however, water quantity would be affected by the loss in availability of portions of Streeter Creek, and the eventual loss of some stock tanks as the mining operation continues. This impact would result in removing these areas from potential use by waterfowl, amphibians, insects, and many mammals; by doing so, it would reduce the area's ability to sustain a balanced ecosystem similar to the one that presently exists.

Loss of sagebrush would preclude the mine site's use by sage grouse; this loss of habitat could result in the displacement of about 60 birds. Colowyo Mine is known to be used by sage grouse for brood-rearing and probably for nesting, although no strutting grounds have been located in close proximity to the mine site. Blue grouse nesting areas would also be lost when aspen stands are destroyed.

The area's carrying capacity for mourning dove would be reduced as a result of the loss of vegetation, at least until revegetation work is completed.

A reduction in raptor nesting would possibly result from the increase in human activity and potential loss of adequate nesting sites.

Because of a lack of knowledge of the amphibian and reptile species present, little can be said as to the impacts on this segment of the terrestrial fauna; most species of this group are not mobile enough to escape destruction from mining equipment. Some species, such as rattlesnakes, would be killed by miners and recreation users in and around actual mined areas.

Little is known of the species composition of terrestrial invertebrates; therefore, nothing specific can be said about the impacts on them. Numbers would certainly decline in the mined areas until rehabilitation begins, but the extent is uncertain.

Support facilities

This category would include roads, buildings, and powerlines. Two types of roads are proposed for the mine: an access road and haul roads. The access road would extend approximately four and one-fourth miles from the mine office south to the maintenance facilities (see Figure GI-2). This road will be about 75 feet wide, and will be used for employee access and maintenance vehicles. Two major impacts would be created by this road: vegetation would be cleared from the roadway, which would result in a loss of forage, nesting cover, and escape cover. The terrestrial wildlife most affected would be those species associated with the sagebrush vegetation type (see Appendix D for an indication of the species concerned). Approximately 32 acres of sagebrush habitat would be destroyed by this road. The second major impact would be increased potential of vehicle-animal collisions; this includes big game as well as small non-game species.

The haul road, as proposed, would be constructed along the east side of the mine; during the early phase of mine operation it would be used to get the coal from the work area to Colorado State Highway 13. After the railroad spur is put into operation, haulage would be moved to loading facilities as shown in Figure GI-12. This road would result in a loss of some habitat values (see Figure GI-2). Direct loss of vegetation, nests, and dens would result from the cutting of the roadway. Additional vegetation would be lost from being covered up by cut material pushed to the side of the road (see Figure GI-11). The road will be 75 feet wide, and the area covered by the fill would vary, depending on the amount of cut material and the degree of slope. Approximately 83 acres of existing wildlife habitat would be destroyed by this road (see Table GIII-3).

The maintenance yard and office grounds would occupy about 25 acres, primarily in the sagebrush vegetation type. All areas used for these structures should be considered a permanent loss to wildlife, with the possible exception of some house mice, English sparrows, and other rodents and birds that choose to live in and around man's dwellings.

A 69-kv powerline would be installed from an existing line that lies east of the mine area (see Figure GI-12). Approximately 13,800 linear feet of new powerlines have been proposed. The average distance between power poles is normally 500 feet, although this varies, dependent upon wire size and terrain. Figuring 500 feet between poles, 28 poles would be installed; approximately 50 square feet of vegetation would have to be cleared at each pole site to make a pad for pole erection and line construction. This would total 1,400 square feet of destroyed habitat and corresponding reduction in wildlife, in addition to maintenance roads that will have to be constructed. Most of these clearings would be in oak serviceberry vegetation type, and would impact those species associated with mountain shrub type (see Appendix D).

Approximately 245 acres will be permanently removed from existing wildlife use as a result of all mine-related activities, including the off-site areas needed to accommodate the increase in human population resulting from the mine's employment and support.

Reclamation

It is W. R. Grace's current land-use plan to return their mined land to the existing usage; this would have a favorable impact on the present faunal species composition by re-establishing a similar ecosystem. The precise methodology that W. R. Grace plans to use has not been determined; therefore, it is impossible to evaluate their impacts on terrestrial fauna. All that is known is that W. R. Grace wants to return native brush and tree species to the disturbed areas in the same approximate areas and densities that they now occupy.

Rodent numbers would be expected to respond rapidly to revegetation programs; abnormally high rodent population would be expected, as the tender and succulent vegetation becomes available to them. Seed-eating birds and rodents would be expected to cause some losses in planted seeds, thus reducing the revegetation program's optimum potential. Species composition and densities of these rodents would vary, dependent on the successional stage of reclamation and the plant species used in revegetation. It is unlikely that the species composition would return to its exact premined status. High rodent numbers would be expected to attract and sustain a larger than normal number of predators, mainly coyotes, fox, snakes, and raptors.

According to the W. R. Grace modified reclamation plan, "All reclaimed areas will be adequately fenced to prevent wildlife or domestic grazing until vegetation is sufficiently established." This is understood to mean that a big game-proof fence would be installed around all revegetated areas for at least two growing seasons, and probably longer, to exclude all such areas from big game use. This exclusion time is needed to allow the vegetation to become established; however, it would also act as a barrier to normal animal movement, and direct loss of animal life might result from entanglement in these fences.

Jackrabbit populations would be expected to make a rapid recovery in areas where herbaceous cover has become successfully established. Cottontails would not be expected to respond to revegetation efforts to a significant degree until brush has been replaced.

Mourning dove prefer to feed in weedy fields. If the revegetated areas are invaded by seed-producing weeds, overall dove use would increase.

The degree of invertebrate recovery from the impacts of the mining operation would depend entirely on the vegetal species composition and success of the revegetation program.

DOMESTIC FAUNA

All livestock would be moved out of the proposed mined areas prior to the beginning of actual work; therefore no livestock would be expected to be destroyed by these activities.

Approximately 180 acres would be totally lost to livestock at any given time during the mining operation. The resulting loss of AUMs would vary from 26-33, depending on the vegetation type that is being cleared. All previously mined areas would be in some stage of reclamation. All revegetated areas would be fenced to prohibit livestock grazing for a period of at least two growing seasons. Fences along roads and around the areas being mined or reclaimed might adversely affect livestock movement to water, salt blocks, etc.

It is W. R. Grace's current land-use plan to return their mined land to the same usage as now exists; the precise methodology that they plan to use has not been determined; therefore, it is not possible to evaluate their impacts on livestock. All that is known is that W. R. Grace wants to return native brush and tree species into disturbed areas in the same approximate areas and densities that they now occupy.

Table GIII-4 indicates that approximately 1,500 acres representing 236 AUMs would be altered during the 29-year life of this mine. It is expected, because a variety of grasses would be seeded along with shrubs and trees, that the overall carrying capacity of the area for livestock would be increased at the end of the mining operation. The amount of increase cannot be estimated at this time because of the lack of information concerning revegetation plans. However, this projected increase does not take into account the ten percent loss in soil productivity, as indicated in the Terrestrial Flora Impacts Section.

TABLE GIII-4

Carrying Capacities and Loss of Animal Unit Months by Vegetation Types from 1976 to 2005

Vegetation Type	Carrying Capacity in Acres/AUM	Acres Disturbed	Total AUM's Lost
Mt. Shrub	5.50	562	102
Sagebrush	7.00	937	134
Total		1,499	236

Aquatic Biology

Proposed mining activity would impact the aquatic ecosystem in Good Spring Creek. One adverse impact would result from construction of haul roads and access roads in the area. Surface runoff from road construction areas would increase the sediment load in Good Spring Creek, if road debris were allowed to reach the creek. This increase would adversely impact the aquatic community by degradation of critical habitat areas, as well as through a loss of individual organisms from the suffocating and abrasive effects of increased siltation. These impacts would be particularly noticable within the benthic fauna and periphyton populations.

The rate of siltation in Axial Basin Reservoir would be increased by more rapid sedimentation in Good Spring Creek. Depending on the increase in sediment loading, the aquatic habitat in Axial Basin Reservoir could be eliminated in the space of several years. According to the Colorado Division of Wildlife (1972) the reservoir has an average depth of only ten feet; a significant sedimentation increase would rapidly bury the existing aquatic habitat.

Cultural Components

Archeological Resources

Under the proposed 1976 start-up date, total projected acreage disturbance for the Colowyo Mine by 1980 is 415 acres, by 1985—201 acres, by 1990—240 acres, and by 2005—643 acres. This acreage disturbance could impact presently unknown subsurface cultural resources. As an index of potential pothunting and vandalism, employment projections for the Colowyo Mine will remain constant from 1980 through 1990 at a total employment of 244. Projected impacts to known sites are shown in Table GIII-5. As per Dr. Lischka's intensive survey, none of the sites are of National Register significance.

TABLE GIII-5

Impacts to Cultural Resources

Site No. (See Figure GII-14)	Nature of Probable Impact			
	Subject to Direct Physical Displacement			Vandalism
	Mining	Roads & R/Ws	Topsoil Storage	
1 (Historic)				X (on lease but outside proposed action area)
2 (Archeologic)		X		X
3 (Archeologic)				X (off the lease)
4 (Historic)	X			X (to be mined about year 2000)
5 (Archeologic)		X	X	X
6 (Historic)		X	X	X

Given the nature of these archeological values, projected impacts would not be significant locally or regionally.

Historical Resources

Impacts to historical resources due to acreage disturbance and increased vandalism and pothunting would occur as shown above under Archeological Resources, Table GIII-5. As per the intensive cultural resource survey, none of the sites found are of National Register significance.

In terms of both local and regional history perspectives, these impacts have no special significance.

Aesthetics

The largest scale elements in the landscapes containing the proposed action would be the coal stripping area. However most impacts would result from roads and rights-of-way attendant to the proposed action itself, because they cover a larger geographic area and are relatively more permanent features. They also occupy landscape visual units that are more visible than those on the Colowyo Mine itself.

Proposed dumping of mine spoils into Streeter Canyon would result in minus deviations of form, line, color, and texture, as the resulting landform and vegetative pattern does not borrow from the characteristic landscape. Within the first three years of the stripping operation, a repetitious pattern of sharply angular ridges foreign to this otherwise undulating, steep, and irregular landscape would be visible as foreground from viewshed sequence MN (Figure GII-16). Strong line dominance of the initial highway haulage road would also be a minus deviation during the same time-frame. Intermediate crushing and loadout facilities would occupy the foreground at MN for the first three years, and would have form, line, and color that contrasts with the characteristic landscape. About two years after the mine begins, scheduled reclamation of spoils in Streeter Canyon would begin to reduce the visual impact from sharply angular spoil piles. However, the permanent haul road would remain visible in both foreground and middleground to travelers from viewshed sequence MN on Colorado 13.

Additional minus deviations in the foreground would result from extension of the east haul road across the drainage visible to the west of viewshed sequence KL, scheduled during the eighth year of mining. This section of road would be a large fill that would initially contrast sharply with the characteristic landscape.

Though most of the actual stripping operations would not be visible from public roads, portions would reveal other minus deviations at middleground distances. A significant portion of 1979-1989 stripping operations would be visible from viewshed sequences JK and KL. Because the viewing angle to these landscape visual units is small, the element of line would be a strong component of the proposed actions, in the form of silhouettes.

The east main haul road route would traverse the crest of steeply sloping hillsides immediately adjacent to Good Spring Creek at approximately the 6,800-foot contour. The main haul road would have a 75-foot cut on the uphill side; (top of this cut would be the shoulder for the "F"-seam haul road), and a high berm spoil bench would be built on the fill-slope to attempt to screen views of the mine. Barren slopes of both cut and fill banks on this road would be strongly form, color, and texture-dominant minus deviations from the characteristic landscape. Because of the viewing angle at viewshed sequence JK, a very large spoil berm would be necessary to hide the 75-foot cut as well as the mine. Resulting fills would extend down the slopes toward Good Spring Creek, creating an exceptionally large form, color, and texture-dominant visual intrusion.

Southbound travelers on viewshed sequence LO would be able to view the main haul road and mining operations directly in line with Highway 13, in an area where operations would be occurring from the eighth through the eleventh year of mining.

Only the eastern portion of the topsoil and spoil areas would be visible to southbound travelers on viewshed sequence RS. Though these would be distant middleground views, minus deviations from the characteristic landscape would yet result.

A substation proposed adjacent to viewshed sequence KL would, with the attendant 69-kv distribution line, intrude upon the characteristic natural landscape. However, most of the powerline would not be visible.

Secondary proposals would also impact the aesthetic environment of the area near Axial (Figure GII-17). The proposed mine office area would be a large scale element of the foreground picture plane at viewshed sequence QV, and to a lesser degree at sequence PQ. Form and color-dominance of these structures would cause visual intrusions, even though other buildings already lie in the general area.

The proposed access road would traverse several middleground visual units (Figure GII-17). Visible from as many as seven different viewshed sequences, this road would result in sizeable cuts and fills on a very prominent hillside. Proposed switchback construction necessary on this steep hillside would increase the road's scale, and resultant visual impacts.

Line and color-dominant loadout facilities above Taylor Creek Canyon would be visible from several viewshed sequences (see Figure GII-17). The proposed conveyor down to the actual rail loading site would be visible as middleground from County Roads 17, 32, and 51.

If vegetation cleared during road construction or mining is scattered adjacent to the disturbed area, or piled and burned, it would produce an aesthetically unconforming landscape of forest litter. Disposal of refuse and waste from the mining operation could also produce an undesirable landscape of litter, if it is not visually screened and properly maintained.

Road-blasting, coal dust, and exhaust emissions would create short-lived landscapes foreign to the environment that are also minus deviations.

The overall aesthetic experience at the Colowyo Mine area would also be adversely impacted. Notwithstanding the subjective nature of mood-atmosphere values, the proposed action might adversely impact the area's capability to kindle feelings of isolation, solitude, or a respect for nature. Beneficial impacts may also result if the operation helps to reveal more of nature's spectacular grandeur.

Aesthetic impacts in terms of numbers of potential viewers (i.e. visual sensitivity) would increase commensurately with traffic volume increases. Current average annual increases in average daily traffic on Colorado Highway 13 adjacent to the mine site are 14.2 percent.

Potential for adverse aesthetic impacts on a regional basis is moderately significant, due to the visual exposure of proposed access and transportation R/Ws to Axial Basin. Locally, the potential for adverse visual impacts to motorists on Colorado 13 is very significant.

Recreation

Surface mine operations on Federal lease D-034365 would directly remove big game species from the immediate area of operations, and from adjacent areas, due to attendant facility and linear right-of-way construction, all of which would diminish big-game viewing opportunities.

Runoff from unstabilized areas on adjacent access and haul roads could result in increased downstream sedimentation. This would adversely impact the recreation resource at Axial Basin reservoir by diminishing its capability to attract and support fishing use, though this impact would be expected to be slight.

Unknown archeological sites might be destroyed by mining operations, and therefore lose their inherent capability to attract and accommodate recreation use, irrespective of existing public access deficiencies. This loss could occur through actual destruction of the resource by mining itself, either by direct removal, by off-site influences such as seismic damage from blasting, or through vandalism and pothunting by mine employees. As an index of this potential, mine employees would number 244 at full-scale production; this level would be reached in 1979 under the applicant's proposed operating schedule.

Successful revegetation efforts on mined-over areas might result in beneficial impacts to wildlife viewing opportunities by attracting more animals than are now present, though management decisions to fence reclaimed areas would preclude these benefits.

Additional roads, trails, and stripped areas can beneficially impact the area's capability to attract and support off-road-vehicle (ORV) use; this would increase both snowmobiling and trail-bike use potential. Success in surface mine reclamation would also help determine ORV capabilities, as potential for sustaining ORV use is determined largely by surface soil quality. Management decisions at Colowyo Mine that either allow or deny recreational access prior to reclamation would determine whether such benefits will be realized.

Beneficial impacts would also include increases in rockhounding capabilities, as overburden removal would expose interesting and collectible rocks and fossils.

Greater capabilities for geologic and industrial interpretation would also occur. Though public access does not now exist, Mt. Streeter as well as other viewpoints (see Aesthetics Section) offer potential for informing the visiting public of physical and economic conditions conducive to strip mine development at Colowyo Mine area. This could be accomplished by sign construction and interpretive-educational brochure development, as well as by guided tours. Capabilities to attract this type of recreation use would also be enhanced by the relative uniqueness of this combination strip and open pit mine proposal. Potential impacts to recreation users in the form of increased highway truck travel and associated highway hazards would be significant to the region's existing tourism and sightseeing base. However, adverse impacts upon site-oriented recreation resources would have only local significance. Site-oriented beneficial impacts created by the mine itself would have regional and perhaps statewide significance, in terms of its capability to attract people's attention as an interpretive resource.

Social Environment

Table GIII-6 presents the population impact by county and community of the development of the Colowyo Mine; it also indicates expected new school enrollment by county. These data were generated by the gravity-employment multiplier model described in Chapter II of the Regional Analysis, Future Social Environment Without the Proposed Action. They represent incremental increases over and above the base scenario presented in the same section of the Regional Analysis.

Requirements for new social support facilities including housing, health care, education, water and sewage treatment, fire protection, and law enforcement are functions of increases in population. Table GIII-6 indicates that development of the Colowyo Mine would induce a relatively small increase in population; therefore, impacts on existing social support facilities would be relatively small. It is the cumulative impact of several new developments that generates significant new requirements for social support facilities; these requirements are addressed in depth in Chapter III of the Regional Analysis.

There have been no expressions of local attitudes specifically oriented toward the development of the Colowyo mine. Rather, attitudes are directed toward the subject of regional and community growth in general, and are therefore examined in the Regional Analysis.

Table GIII-6 indicates an induced population of 958 people by 1990 under the applicant's proposed operating schedule. An estimated 96 acres for additional residences and community facilities would be needed to accommodate this growth.

For an extensive analysis of the regional impacts, mitigations, and unavoidable adverse effects to which the development of the Colowyo Mine would contribute, refer to the appropriate chapters of the Regional Analysis.

TABLE GIII-6

Population Impact of Colowyo Mine Development

	1980	1985	1990
Direct Employment at Colowyo	244	244	244
New Population			
Moffat County total	561	600	613
Craig	561	600	613
Rio Blanco County total	252	263	271
Meeker	252	263	271
Routt County total	69	72	74
Hayden	69	72	74
Total	882	935	958
New School Enrollment			
Moffat County	103	117	129
Rio Blanco County	48	51	56
Routt County	13	14	15
Total	164	182	200

Economic Conditions

Table GIII-7 presents the economic impact of development of Colowyo mine in terms of employment and earnings. These data were generated by the gravity-employment multiplier model described in Chapter II of the Regional Analysis, Future Economic Environment Without the Proposed Action. These data represent the incremental impact over and above the base scenario described in the same section. Note that in each of the benchmark years, the greatest induced employment and earnings impacts from the Colowyo Mine development would fall in Moffat County.

No adverse economic impacts would be expected to be associated with the development of Colowyo Mine, because both the direct and induced employment and earnings are relatively small compared to the economic base of the region.

TABLE GIII-7

Economic Impact of Colowyo Mine Development

	1980	1985	1990
Direct Employment at Colowyo	244	244	244
Induced Employment			
Moffat County	121	132	133
Rio Blanco County	53	56	58
Routt County	14	14	14
Total	188	202	205
Direct Earnings	5461	6102	6844
Induced Earnings			
Moffat County	1219	1500	1741
Rio Blanco County	534	632	745
Routt County	144	157	177
Total	1897	2289	2663

Note: Earnings data in thousands of 1974 constant dollars.

Transportation Networks

HIGHWAYS

W. R. Grace's Colowyo Mine at Axial, Colorado, would be producing coal for a period of about two years before a planned rail line for moving coal would be completed. During this period, it is planned that coal will be moved in 30-ton capacity trucks between the mine site and a tipple point south of Craig, Colorado, via Colorado Highway 13. The mine output is expected to be 620,000 tons during the first year of operation and 900,000 tons during the second year of operation. Using a 240 day/year hauling schedule, this amounts to approximately 86 loaded truck trips/day during the first year, and 125 loaded truck trips/day in the second year of operation.

The Colorado Highway Department has stated that with the severe weather conditions to which highways such as Colorado 13 are subjected each year, heavy truck traffic such as that described above could be very detrimental to the integrity of the road surface within a comparatively short period of time. Given the right combination of moisture and frost conditions in the Spring, heavy coal-truck traffic could cause large sections of a highway such as Colorado 13 to break into pieces. Such an impact would be compounded by the increasing general and recreational use of this stretch of Colorado 13 (W. R. Grace site specific analysis, Chapter II). A breakdown in the road surface, caused by an increase in coal truck traffic, would have an extremely detrimental effect on other traffic moving over this section of Colorado 13. The Colorado State Highway Department has no plans or funds to upgrade the unimproved stretch of roadway of Colorado 13 south of Hamilton, Colorado, to accommodate the increased coal truck traffic. In addition, the weight restrictions on three bridges on Colorado 13 located south of Hamilton would be exceeded by loaded coal trucks.

The increased coal truck and mine employee vehicle traffic on State Highway 13 would increase the likelihood of auto accidents on the highway, especially at the intersection with Streeter Canyon road, where coal trucks will be entering and leaving the mine site until the railroad is completed.

RAILROADS

W. R. Grace has decided that, with a proposed output of three million tons of coal/year by 1980, a rail line from their Axial Mine to a junction with a planned D&RGW railroad spur to the Colorado-Ute power plant site south of Craig, Colorado, would be necessary. However, this is not part of the proposed action for the Colowyo Mine and is addressed in a separate analysis in this document.

Normal engineering and construction practices applied to the railroad loading and other mine facilities would prevent any potential adverse impacts to existing pipelines in the vicinity of these facilities.

AIRLINES

The only real effect that the initiation of W. R. Grace mining and railroad operations would have is increased passenger loads into the Yampa Valley Airport at Hayden. Since this airport is now undergoing a ten million dollar improvement operation, any increases due to the W. R..Grace mining plan approval should be easily absorbed by the improved airport facility. Some increased use of the limited closer facilities at Craig might also occur.

Chapter IV
Mitigating Measures

THIS CHAPTER PRESENTS MEASURES THAT WOULD LESSEN OR ELIMINATE THE ADVERSE IMPACTS OF W. R. GRACE & COMPANY'S PROPOSED ACTION. THESE MEASURES ARE DISCUSSED IN THREE CATEGORIES: THOSE INCLUDED IN W. R. GRACE & COMPANY'S PROPOSAL, THOSE REQUIRED BY LAW OR REGULATION, AND THOSE MEASURES THAT WOULD BE APPLIED AS SPECIAL CLAUSES OR STIPULATIONS TO LEASES OR PERMITS. IN EACH OF THESE CATEGORIES, MEASURES ARE PRESENTED BY IMPACTED ENVIRONMENTAL COMPONENT. BECAUSE SOME MEASURES LESSEN IMPACTS TO MORE THAN ONE RESOURCE, SOME REPETITION OF MITIGATIONS IS UNAVOIDABLE. ALL MEASURES ARE ASSESSED AS TO THEIR PROBABILITY OF IMPLEMENTATION AND/OR SUCCESS. MITIGATING MEASURES ARE PRESENTED AND ANALYZED AS PROCEDURES THAT WOULD BE REQUIRED IF THE PROPOSED ACTION IS APPROVED.

Measures Included in Applicant's Proposal

Air Quality

The primary air quality impact expected from operation of the Colowyo Mine is from fugitive dust emissions. Predicted levels of total suspended particulate (TSP) may exceed Federal and State annual and 24-hour standards in the immediate vicinity of the active mine. Three preventive fugitive dust control measures are included in the applicant's proposal: continuous monitoring, watering of exposed areas, and revegetation.

An air quality monitoring program would be set up in order to determine background levels of TSP; the program would be continuous throughout operation of the mine. Data would be used to determine the success of abatement programs.

Application of water to exposed areas such as storage piles and dirt roads would prevent fine particles from becoming airborne; watering is only as efficient as the success in keeping disturbed material wet.

Fugitive dust from process operations would be controlled by watering at transfer points, such as conveyor ends or loading stations. The placement of hoods connected to a ventilation and dust collection system over sources such as crushers and sorters would limit emissions from mechanical treatment of coal.

A major mitigative measure for the control of fugitive dust is reclamation of the mine surfaces. As mining proceeds, reclaimed areas are expected to cease to be sources of fugitive dust. Reclamation includes grading, vegetation planting, and other landscaping.

Soils and Terrestrial Flora

It is the intention of W. R. Grace and Company that their surface mined lands would be returned to a condition at least as good as that which now exists, and that they would be suitable for wildlife habitat and domestic livestock grazing. At this time Grace is still discussing alternatives to a number of reclamation approaches to achieve their proposed land use goal. As more information is gathered from the various ongoing environmental and engineering studies, or as new technologies develop, the reclamation plan would be modified.

To reduce the impact of loss of native vegetation, W. R. Grace has initiated a four-year revegetation study to determine the suitability and practicality of utilizing shrub species native to the Colowyo Mine site. This program simulates the disturbance that would result from surface mining. All existing vegetation was removed from the plots, shredded, and may be mixed with the stripped and mixed topsoils. This material was stored for one season and then redistributed over test plots. A variety of experiments are being conducted to determine which plants and what methods are most suited for revegetation. One is designed to test the adaptability of established shrubs to be transplanted, while another will determine the potential for natural reintroduction of nitrogen into the topsoil material.

Reclamation at the mine would begin immediately with start-up of operations. Vegetation would be removed and shredded, although its usefulness has not yet been determined. A number of approaches are under consideration: the shredded vegetation might be mixed with the topsoil and left to decay; it might be windrowed and burned and the ashes later mixed with the stored topsoil; or the material might be composted for use as a mulch when revegetation begins. Each of these approaches would have a number of inherent problems. Direct mixing of plant materials with the topsoil might tie-up nutrients in the decomposition process which are essential to soil development and plant establishment; seeds of undesirable species might also be introduced into the topsoil material. Burning would volitalize some nutrients, while composting might take too long or prove uneconomical to satisfy reclamation goals. It is the intention of W. R. Grace and Company to investigate each of these alternatives and carry out additional tests on the revegetation test plots.

After vegetation removal, topsoil would be removed by scrapers or other suitable equipment and stored in long mounded terraces outside the mine area. Storage piles would be contoured and seeded with legumes and wheatgrasses to abate erosion, compete with invading weed species, and blend with existing surrounding topography. As the mining sequence allows, some topsoils, upon removal, would be placed directly into surfaces readied by backfilling and grading.

Backfilling, grading, topsoil replacement, and seeding would begin as soon as possible, twelve-eighteen months after opening of the initial cut, so the area of disturbance would be kept to a minimum. In the mature operation, reclamation work would be concurrent with mining; approximately 45 acres of new land would be disturbed annually, and an equal number reclaimed each year. The topography of the reclaimed surface would reasonably conform to the existing slopes, being feathered into the contiguous natural surface, with concave and convex surfaces designed to recreate a variety of micro-environments. The recontoured surface would be covered with up to 18 inches of the stored topdressing material; this depth would depend on the requirements of the plant species being used for revegetation. The covered surface would then be roughened by discing, harrowing, chiseling, or combinations thereof to increase infiltration of rainfall and prevent erosion. A rangeland drill would be used to plant legumes and grasses to provide initial cover and stabilization while the shrubs gain establishment.

Broken rock material from initial cuts would be cast into piles on the bottom of Streeter Canyon. As the first piles accumulate in height they would be graded from time to time to attain a configuration less than the angle of repose, but not more than 25 percent grade to increase reclamation potential. Terraces would be made along the pileslopes to impede surface water runoff, and contour furrows placed at the toes to capture any sediment. As first mining proceeds westerly up the canyon, the "F" seam does not outcrop at the western end (according to drilling data). At that time, it might be necessary to make a box cut. Spoil from the box cut would be trucked to the approximate area of the topsoil storage piles, contoured, terraced, and seeded to achieve stabilization, until such time as spoil would be utilized for backfill.

To insure early plant cover and slope stabilization, native and introduced grasses would be seeded. A list of these species adapted to the mine site area of Moffat County, utilizing information from the Soil Conservation Service, is given below; the recommended mixture is also given.

Kentucky bluegrass—2 lbs/acre
Manchar bromegrass—4 lbs/acre
Intermediate wheatgrass—4 lbs/acre
Pubescent wheatgrass—3 lbs/acre
Western wheatgrass—3 lbs/acre
Slender wheatgrass—3 lbs/acre
Bluebunch wheatgrass—3 lbs/acre
Yellow sweetclover—2 lbs/acre

The species in this list have proven successful for revegetation of disturbed sites in the Axial Basin area; however, this list will be expanded to include more native species after the results of the revegetation study have been analyzed.

To insure the successful establishment of the grass species recommended for initial plant cover and plant stabilization, a balanced nitrogen, phosphorus, and potassium fertilizer (N-P-K) would be used. Rates of 50-75 lb/acre would be applied depending on a number of variables, one of which is soil moisture conditions. Fertilizers would be applied to produce the most beneficial results. Plans might include applications prior to planting (mixing with the topdressing), after seedling emergence or transplanting, applying slow and fast releasing forms (urea-nitrogen), or a combination of these techniques. Best methods of fertilizer application would be employed, depending on results of the revegetation test studies now underway.

All cuts and fills produced in the construction of haul roads and access roads would be stabilized by revegetation.

Fugitive dust would be controlled with water spray distributed by water trucks and other appropriate units where excess fugitive dust exists.

All reclaimed areas would be adequately fenced to prevent use by wildlife or domestic grazing until vegetation is sufficiently established.

Terrestrial Fauna

To mitigate the expected alterations of the existing ecosystem it would be necessary to make every effort to return disturbed areas to a state as close to existing soil and vegetal conditions as possible. W. R. Grace has indicated that it is their intention to return their surface mined lands to a condition at least as good as that which now exists.

Since the design and purpose of the revegetation study is to reestablish native browse vegetation, wildlife studies are in progress to supplement the revegetation tests. The amount of big game utilization per plant species is currently being measured. This information would be used to determine the percentage of each species that should be planted to provide suitable wildlife habitat. Small game studies are also in progress to determine the potential problems that may exist from rodent grazing; these studies are to continue. In an effort to minimize disturbances, reclamation work would be concurrent with mining; reclaimed acres would equal disturbed acres each year. All reclaimed areas would be adequately fenced to prevent wildlife utilization until the vegetation is established.

Water Resources and Aquatic Biology

A main ditch would be constructed east-west across the eastern half of the property, somewhat below the highest elevation. Two or three intermediate ditches would be located parallel to this ditch but at lower elevations; these structures would be designed to insure that runoff water from precipitation would be deposited in the natural drainage areas. This would mitigate problems with water flowing into areas other than those presently involved.

W. R. Grace and Company has been participating in water studies in the area with Federal agencies to determine quantities and qualities of water produced at the mine site. Specifications of the settling ponds for effective use will be based on the results of those studies. Discharge water from settlement ponds would be monitored at a point prior to release into the natural stream or drainage, for applicable State and Federal chemical and sediment standards, and treated if necessary.

Aesthetics

All vegetation removed by the mining operation would be shredded to be used later as a mulch, or mixed with topsoil or burned. This would prevent the unsightly appearance of scattered slash, though windrowing and burning would result in visual impacts from both the windrows and the burning of them.

Topsoil stockspoil areas would be shaped and seeded to blend with adjacent topography; their greatest impact would occur from the time they are being built until they are revegetated.

Large-scale form and line-dominant minus deviations resulting from spoil piles would remain for three years in the area of the initial mining operation; thereafter, spoil piles would be reshaped and leveled. In the mature operation the time lag from mining to the reshaping of spoil piles would be reduced to one year. Establishment of vegetation to mitigate visual impacts of color and texture-dominant minus deviations would occur approximately three years after spoil pile leveling and seeding.

All cuts and fills on access and haul roads would be revegetated and stabilized; this would help mitigate the strong line and form-dominant nature of these minus deviations. However, if species similar to those on immediately adjacent terrain are not used, there would be deviations in texture and color from the characteristic landscape.

Fugitive dust would be controlled by spraying water; it should be noted that this type of control would be only approximately 30 percent efficient.

Recreation

W. R. Grace and Company proposes to begin reclamation operations immediately after opening the mine. Reclamation would include regrading of spoils, revegetation of the spoils and road construction scars, and construction of settling ponds and diversion ditches. These actions would significantly reduce mine-caused siltation downstream. This would help maintain downstream fishing capabilities in Axial Basin Reservoir and in the Yampa River.

Measures Required by Law or Regulation

Geologic and Geographic Setting

Plans by the company for restoration of the land surface would conform to regulations to minimize sediment yield from disturbed lands, and potential hazards from spoil materials above Good Spring Creek and in Streeter Canyon (30 CFR 211.40(a)(2, 3, 5, 7, and 11). These measures would include proper placement of spoils, adequate drainage to prevent saturation of spoils in Streeter Canyon, and extension of drainage ditches uphill from mining to the middle of natural drainages.

In accordance with 30 CFR 211.4(d)(7) and 211.40(a)(3), potential failures of the north slope of Streeter Canyon would be minimized by proper placement and engineering of facilities in the canyon, and by stabilization measures on the slope such as removal of unstable near-surface materials.

Mineral Resources

Mitigating measures for potential impacts of simultaneous or sequential development of coal and exploration, and possible development of oil and gas would depend in large measure on the outcome of a pending court action. Speculation as to the result of the action would be inappropriate.

General examples of the sort of mitigating measures that might apply are discussed in Chapter I of the Regional Analysis.

Paleontology

Measures provided for in the 1906 Antiquities Act and 43 CFR 6010.2(a) and (b)(2), when implemented, would provide protection for fossils which are of actual and real scientific significance. This would be accomplished by requiring the lessee to conduct an on-the-ground intensive survey to ascertain the possible occurrence of dinosaur or other significant vertebrate fossil remains; Dr. Peter Robinson, of the University of Colorado Museum, has completed the survey. The mine operator is also required to prevent or minimize damage to known or suspected significant paleontological resources pursuant to 43 CFR, Subpart 3041, Section 3041.2-2(d).

See the Regional Analysis for a more detailed description of how such surveys would be implemented.

Water Resources and Aquatic Biology

In accordance with 30 CFR 211.40(a)(3), 5, 7 and 11), the amount of increased surface erosion and stream sedimentation in the analysis area would be minimized by measures such as: (1) all road cuts would be protected from erosion by riprapping with logs or rocks above and below the cuts, and the disturbed areas would be revegetated as quickly as possible following construction; (2) erosion from all disturbed surface areas associated with the proposed mining activity would be controlled by the design and utilization of a drainage ditch and settling pond system; (3) a sump system at the open mining pit would help keep sediment-laden waste water in the stripped area; and (4) all areas in which the surface would be disturbed as a result of the proposed action would be protected by erosion control devices (e.g., waterbars, drains) until reclamation is completed.

The Colorado Department of Health, the agency that has primary responsibility for water pollution control in the study region, has published a booklet (1974) describing standards included in the Water Quality Control Act of 1973, consistent with the goals and policies of the Federal Water Pollution Control Act Amendments of 1972. These standards cover water quality with respect to sludge, debris, toxic materials, and other materials undesirable for aquatic life. The Colorado Department of Health, Water Quality Control Commission, adopted rules as of August 21, 1975 that require discharge permits and present effluent limits for BOD_5,suspended solids, fecal coliform, residual chlorine, pH, and oil and grease. These are fully described in Chapter IV of the Regional Analysis along with sampling techniques and analysis standards necessary to obtain a required permit for waste water discharge into any and all surface or subsurface waters in the State.

The sum of these various mitigating measures would reduce the sediment yield from the reclaimed mine spoils by about 90 percent, for a total annual reduction of 315 tons. The mitigating measures would reduce the sediment produced from road construction by about 80 percent, for a total reduction of 450 tons.

Refer to the Regional Analysis for a more detailed discussion of these laws and regulations.

Air Quality

Total suspended particles (TSP) represent the only major source of air quality degradation at the Colowyo Mine. Emissions of particulate matter are regulated by Federal and Colorado Law. Regulation No. 1, Emission Control Regulations for Particulates, Smokes, and Sulfur Oxides for the State of Colorado, Section II.D. Fugitive Dust, prohibits mining operations without a permit that specifies fugitive dust control measures. Many of the control measures suggested in Regulation No. 1 are already included in the applicant's proposal.

One additional measure which would be included is sequential blasting to reduce the amounts of unconfined particulate matter. The function of blasting, the break-up of material so that it can be moved, can be accomplished without the production of a large fraction of very small particles, by proper sequencing and control of amounts of explosive.

The U.S. Department of Interior, BLM, also has coal mining operating regulations (CFR 43, part 3040) which require applicants to detail strategies for controlling air pollution emissions. Revegetation is an important part of this regulation. Revegetation and land reclamation can be 100 percent effective in the long-term. Short-term measures which must be specified by applicants include the size and timing of blasting and mechanisms for prevention of fires. The efficiency of these controls is difficult to assess.

Soils and Terrestrial Flora

The Endangered Species Act of 1973 provides for the conservation, to the extent possible, of plant species facing extinction (species for Colorado are listed in Chapter IV of the Regional Analysis). If species in this category were found on the Colowyo Mine site their protection would be provided for by enforcement of this act. Because species in this category are not common, and therefore not easily recognized, it is very likely that they would go unnoticed, and therefore unprotected.

43 CFR Subpart 3041.2-2(b)(1) and 30 CFR 211.40(a)(1) require that the operator reclaim affected lands pursuant to his approved plan, as contemporaneously as practicable with operations, to a condition capable of supporting all practicable uses which such lands were capable of supporting prior to mining. Compliance with this regulation would keep to a minimum the amount of area void of vegetation and thus subject to erosion at any given time.

30 CFR 211.10(c)(2) assures that baseline climatic, soils, vegetation, wildlife, and current land use information would be collected prior to mining, and could then be utilized to determine the best land use or uses after mining, and the best ways of achieving the chosen uses. These data would provide the best basis to evaluate the success of reclamation on any given area.

30 CFR 211.10(c)(6)(xii) requires that a mine plan include logs and analysis of overburden samples of each stratum from a number of drill holes sufficient to obtain a representative sample of the overburden overlying the coal, and the stratum immediately below the coal to be mined, and that each stratum be analyzed for the following: nitrogen, phosphorus, potassium, pH, specific conductance, exchangeable sodium percentage, sodium absorption ratio, texture, sulphates, and soil moisture-holding capacity. This regulation requires that these analyses be used to determine which materials shall be buried and which materials are suitable for placement near the surface for favorable propagation of vegetation. Compliance with this regulation and 30 CFR 211.40(a)(2), requiring grading methods that ensure stability and cover all acid-forming or toxic materials, would insure a subsoil medium suitable for plant growth. Any materials that have moderate levels of sodium salts would need to be buried at least 60 inches below the surface.

30 CFR 211.40(a)(4), 43 CFR Subpart 3041.2-2(f)(4) and the Colorado Mined Land Reclamation Act (H.B. 1065) require that topsoil be removed separately for replacement on backfill areas, and if not so utilized immediately, that it be segregated from other soil material. If such topsoil is not replaced on a reshaped area within a time short enough to avoid deterioration of the topsoil, vegetative cover or other means would be employed so that the topsoil is preserved from wind and water erosion, remains free of any contamination by other acid or toxic material, is protected from establishment of noxious weeds, and is in a usable condition for sustaining vegetation when restored during reclamation. Therefore, topsoil stockpiles would not be placed in areas of water accumulation. Also, after disturbed areas have been regraded, and topsoil replaced, if equipment has compacted the soil so that root and moisture penetration would be restricted, and thus the topsoil not in a condition for sustaining vegetation, the area would be chiseled or ripped in a manner to loosen the soil.

To assure that topsoil be in the best condition to sustain vegetation, every effort would be made to remove topsoil from areas to be mined, and replace it directly on reshaped spoils, thereby transplanting some native species live, retaining a degree of soil structure, and allowing the existing micro-organism population to continue functioning. Also, for the topsoil to be in the best condition for sustaining vegetation, it would be replaced in the spring or fall so the area would be seeded immediately to perennial vegetation to protect against erosion and weed invasion. If topsoil cannot be replaced immediately and is stockpiled for periods longer than a year it would be seeded with perennial species to avoid deterioration of the topsoil.

30 CFR 211.40(a)(2) and 43 CFR 3041.2-2(f)(2) require that spoil reshaping restore the approximate original contour, and 30 CFR requires the operator to establish a vegetative cover native to the area. To comply with this regulation, spoil shaping and replacement of the topsoil would be designed to create various microclimatic conditions that are characteristic of the differences in soils and exposure that produce the diversity in the existing vegetation. On areas to be returned to wildlife habitat (native vegetation) seed mixtures would be varied according to microclimatic conditions produced by the shaping process. Also, to

the extent possible, native trees and shrubs would be transplanted from unmined areas to reshaped areas to decrease the impact of loss of native vegetation. Mature tree and shrub transplanting and bare root stock transplanting would be done in areas of most favorable soil moisture conditions produced by shaping and topsoil replacement operations, and to steep areas to provide soil stability.

30 CFR 211.40(a)(13)(i) requires the operator to establish on regraded spoils and all other affected lands a diverse vegetative cover native to the area and capable of regeneration and plant succession, at least equal in density and permanence to the natural vegetation; therefore, to minimize the loss of existing vegetation the seedings on disturbed areas would include as many native species as possible, with the addition of introduced species that have proved successful locally in stabilizing disturbed areas. To encourage a vegetative cover equal in density and permanence to the native vegetation, fragmented material below the topsoil would be placed on top of spoil piles during the overburden removal process, if possible. This material has proven usable as a plant growth material in the area; it would provide a good growth media for deep-rooting plants, and speed the soil building process because of its fragmentation. Also, to assure that reclamation, and thus successful revegetation, is accomplished as contemporaneously as practicable, where final grading creates surfaces amenable to farm equipment, seeding would be done by a rangeland drill, or suitable equipment that would bury the seed at a constant depth on rough terrain and thus increase vegetation establishment. To assure vegetative growth all seedings of perennials would be confined to late fall and early spring.

To ensure that all affected areas be revegetated pursuant to 30 CFR 211.40(a)(13)(i), if spoil material from the original boxcut is to be stockpiled for more than five years, topsoil would be removed from the storage area before storage, replaced on the surface of the boxcut spoils, and permanently revegetated.

30 CFR 211.40(a)(3) requires that the operator shall stabilize and protect all surface areas, including spoil piles, affected by the coal mining and reclamation operation, to effectively control slides and erosion. Therefore, all road cuts and fills would be seeded as soon as possible following construction to minimize erosion. If construction is finished in the spring or fall, perennial vegetation would be seeded; otherwise an annual grass would be seeded to provide temporary erosion control and compete with invading weed species. Spoil material in Streeter Canyon would be returned to shrubs, so these deep rooting species can stabilize the spoil from slides or erosion, and mitigate the loss of existing shrub vegetation from this area. To control erosion in areas of extremely adverse soil moisture conditions or very steep slopes, a mulching practice, such as straw or hydromulch, would be used. To comply with this regulation where slopes are greater than 33 percent, or where clay soil material is replaced on spoils, a surface manipulation practice would be implemented to impede runoff and induce infiltration, thereby controlling erosion and increasing revegetation attempts.

To assure establishment of vegetation of permanence (30 CFR 211.40(a)(13)(i)), after replacement, topsoil fertility levels would be determined and fertilizer applied, with rates and composition dependent upon the requirements of the plant species being seeded. If fertility levels are too low for seedling establishment, fertilizer would be applied shortly after seedling emergence, unless seeded in early fall, in which case it would be applied in early spring following seeding. If soil fertility levels are adequate for seedling establishment but not for sustained growth, fertilizer would be applied in the early spring of the second growing season. Where soil fertility rates are very low and plant growth is deficient, a maintenance fertilization program would be implemented until the soil system is self-maintaining.

30 CFR 211.62(b) requires that revegetated areas be evaluated by the Area Mining Supervisor to determine whether satisfactory vegetative growth is being established, or whether additional revegetation efforts should be ordered. Therefore, if climatic or soil conditions are such that revegetation attempts fail on the affected area, the area would be recovered with suitable topsoil and/or reseeded until vegetation is established.

30 CFR 211.40(a)(14)(ii) requires that revegetated areas would be fenced to regulate public access and protect the area from uncontrolled livestock grazing. Therefore, all revegetated areas would be fenced immediately after seeding, and grazing would not be allowed until the third growing season, and would then not be allowed during the spring or early summer when plants are growing rapidly.

Implementation of all of the measures in this section would greatly increase reclamation potential; however, because strip mining creates large changes in the plant growth medium, and because current reclamation practices have not been utilized for a long enough period of time to adequately access their ability to return mined lands to the composition or production levels of existing plant communities, a percent decrease in production has been projected.

30 CFR 211.1(d)(1)(ii) requires that all current mine plans, such as W. R. Grace's, will be resubmitted on or before November 17, 1977, and must comply with all provisions of 30 CFR 211. Compliance with this regulation will provide additional baseline data which, when received, may indicate a need for additional mitigating measures.

Terrestrial Fauna

The Endangered Species Act of 1973 makes it unlawful to harass an endangered species in any way. Peregrine falcons have been sighted over the proposed mine site. A study would be conducted to determine the exact use and value of the proposed mine site for this endangered species before any construction is begun. Should this study determine that the mine site is used by endangered species, then W. R. Grace and Company would have to comply with the Endangered Species Act, and the requirements specified as a result of the study would be designed to protect this species and its habitat. This would help mitigate any potential harassment and subsequent dislocation of this species.

In accordance with 30 CFR, 211.40(a)(6), all core holes would be filled with a mud or cement substance to mitigate loss or injury to animals.

To reduce the impact of the proposed haul road on wildlife and their habitat, 43 CFR 3041.2-2(e)(11) and 30 CFR 211.40(a)(11), states that the operator would design all roads and powerlines in a manner that would minimize damage to fish and wildlife habitat. This would require the operator to use all cut material in road construction as fill, or haul excess material away and deposit it on existing spoil piles, rather than pushing the excess off the side of the road, and increasing the amount of disturbed vegetation.

In accordance with 30 CFR 211.4(d), the operator would take such action as may be needed to minimize adverse impacts upon fish and wildlife. To accomplish this goal it would be necessary to seed all disturbed roadsides as soon as possible after completion of the road construction.

By complying with 30 CFR 211.40(a)(7), some impacts on the aquatic ecosystem, and thereby on a segment of the food web of the area's terrestrial wildlife, would be mitigated. This reference states that the operator would utilize the best practicable commercially available technology to minimize disturbance of the prevailing quality, quantity, and flow of water in surface water systems.

In accordance with 30 CFR 211.40(a)(14) and 43 CFR 3041.2-2(a)(14), the operator would regulate vehicle traffic and wildlife and livestock grazing in all areas of active operations, including lands undergoing reclamation, in order to protect wildlife and livestock from hazards associated with such operations, and to protect revegetated areas from unplanned and uncontrolled grazing. This would require fencing of all work areas and reclamation areas to exclude wildlife and livestock.

Archeological Resources

Legislative backing for protection of archeological resources comes from a variety of legislation. The Regional Analysis contains a detailed accounting of how these regulations would be implemented.

The 1906 Federal Antiquities Act (P.L. 59-209; 34 Stat. 225) makes it illegal to damage, destroy, appropriate, or excavate any historic or prehistoric object; to help enforce these provisions, issuance of antiquities permits to qualified professionals for purposes of conducting surveys, testing, and excavation on Federal lands is required. Authorization for the Secretary of the Interior to maintain the National Register of Historic Places is given by the 1966 Historic Preservation Act (P.L. 89-665; 80 Stat. 915); the Advisory Council on Historic Preservation is also established by this Act. All Federal actions affecting existing or proposed National Register Properties must be reviewed by the Advisory Council (according to Section 106 of the Act). The National Environmental Policy Act of 1969 (P.L. 91-190) also identifies the Federal government's continuing responsibility to preserve important historic and cultural aspects of our national heritage. Establishment of the Federal government in a leadership role of preserving, restoring, and maintaining cultural resources was accomplished by Executive Order 11593, 1970 (36 F.R. 8921).

Additional legislative backing is provided for protection of cultural resources in 43 CFR, Subpart 3041. Sec. 3041.2-2(d) directs W. R. Grace and Company to take action to protect known and suspected cultural resources identified by the required intensive surveys. This would be accomplished by constructing fenced exclosures, interpretive signing, etc. as appropriate on a case-by-case basis.

These provisions would be implemented by requiring intensive cultural resource surveys on all areas subject to surface disturbance, to be completed by the lessee. An evaluation of National Register significance must be made also. If significant sites are found, W. R. Grace and Company would be responsible for nominating them to the National Register of Historic Places, and subsequently contacting the State Historic Preservation Officer (SHPO) to comply with Advisory Council review procedures concerning site protection. The surveying archeologist would also make specific recommendations, to be adhered to by W. R. Grace and Company, concerning the possible need for on-site archeological reconnaissance during mining and other surface-disturbing activities. These recommendations must be on a location-specific basis to ensure discovery, evaluation, and protection of significant sub-surface archeological resources. This has been completed for the lease area, and as a result the surveying archeologist recommended further testing of three archeological sites located by the survey. This testing, plus additional intensive surveying for all off-site rights-of-way (including access and haul roads, conveyor and transmission lines), must be completed, with all subsequent testing and evaluations, and excavation if necessary, prior to initiation of surface-disturbing activities. Most recent Federal legislation is the Archeological and Historical Data Conservation Act of 1974 (P.L. 93-291) which requires protection of cultural resources affected by any Federal or Federally-licensed construction project.

Archeological values derive their primary value from being preserved in-place; their secondary value occurs in excavation. Archeological testing or excavation stemming from intensive surveys on proposed action areas may be permitted where the site is not in imminent danger of being destroyed. This would not preserve the site's primary in-place value, and also would not allow utilization of improved archeological survey and analysis techniques in site excavation at a future date, when more sophisticated techniques could be employed. However, salvage excavation would allow for partial mitigation of adverse impacts where a site is threatened by actual physical displacement.

For all practical purposes, not all cultural values would be identified in the required survey; sites may be buried by alluvium and hidden from view. The regulations themselves would also do little to prevent theft and vandalism of cultural resources due to increased visitor use pressure.

See the Regional Analysis for a more detailed discussion of how these legal provisions would be implemented.

Historical Resources

All current antiquities legislation enumerated in the Archeological Resources Section is also applicable to protection of the area's historical resources, as are the actual mitigations.

Aesthetics

Enforcement of provisions of 43 CFR Subpart 3041.2-2(d) would ensure that W. R. Grace and Company takes visual resources identified in this statement into account in the planning, location, and construction of facilities on the proposed operation. To comply with this regulation, the following measures would be taken:

Cut and fill slopes resulting from the haul road, building pads, and parking areas would be shaped to a rounding grade that intersects adjacent terrain at a very low angle; this would help avoid creation of harsh angular forms. All mine spoils and topsoil stockpile areas would also be reshaped to a rounded and undulating, rather than geometric, form that borrows from the adjacent topography. 43 CFR Subpart 3041.2-2(f)(2) and 30 CFR Part 211.40(a)(2) further require W. R. Grace and Company to eliminate highwalls and spoil piles, restoring the approximate original contour. This requires that the overburden intended to be placed into Streeter Canyon would conform to an undulating contour; the contact of these spoils or overburden with the then undisturbed south-facing slope would be shaped to a rounding grade to avoid creation of an unnatural line-dominant feature.

In addition, implementation of 43 CFR, Subpart 3041.2-2(f)(12)(ii) would reduce visual impacts accruing to road construction because it requires all roads to be located on flatter slopes to minimize disturbance; this is also required by 30 CFR Part 211.40(a)(12)(ii). This requires that the overburden to be placed into Streeter Canyon would conform to an undulating contour; the contact of this overburden with the then-undisturbed south-facing slope would be shaped to a rounding grade to avoid creation of an unnatural line-dominant feature.

Where trees or shrubs are to be removed from road, mining facility, or right-of-way construction, or for mining itself, clearings would assume an irregular form to simulate natural openings in the vegetative cover, to be determined by the views obtainable from viewshed sequences providing the visual access (see Landscape Visibility Maps in Chapter II). When trees or shrubs are removed, they would not be piled nor lopped and scattered, but buried, or returned to the site as a chipped mulch.

Wholesale vegetation clearing within powerline rights-of-way would be prohibited; all shorter shrubs and trees would remain. In no case will the right-of-way be bladed, and no visible roads would be constructed in foreground landscapes to secure access to support structures. Access to that portion of the line traversing either foreground or middleground landscapes would not be provided for within the transmission line right-of-way. Where feasible, access would be secured by utilizing existing roads, trails, and more gentle natural terrain.

Reestablishment of a diverse vegetative cover on all disturbed lands is required by 43 CFR Subpart 3041.2-2(f)(13)(i); this would help mitigate visual impacts on denuded areas; it is also provided for in 30 CFR Part 211.40(a)(13)(i). Part 1-f, Section 34-32-116, of the Colorado Mined Land Reclamation Act (H.B. 1065) also directs the establishment of a self-sustaining long-term vegetative cover. These revegetation efforts would begin as soon as possible following cessation of surface-disturbing activities. Adverse visual impacts would be rendered less harsh by arranging plantings and seedings in an irregular pattern.

All proposed mine offices, shop-warehouses, and other buildings would be built as low-profile as possible. They would also be painted a non-reflective warm green, brown, or buff color that borrows from adjacent landscape colors. Screening, crushing, and loadout facilities, and conveyor structures would be similarly painted; silver-colored metallic finishes would be avoided.

Wooden transmission line support structures would be penta-treated where they cross foreground or middleground landscapes; however, creosote-treated poles would not be used due to their dark color. Also non-reflective or non-specular conductors would be used throughout that portion of the line visible from public roads.

W. R. Grace and Company would also maintain a litter-free landscape by screening refuse disposal and storage areas, and by regularly disposing of discarded equipment, waste, and litter. 43 CFR Subpart 3041.2-2(f)(8) requires W. R. Grace and Company to dispose of rubbish to prevent air pollution. Section 34-32-116, Part l-e of the Colorado Mined Land Reclamation Act (H.B. 1065) directs refuse disposal in a manner that would control unsightliness.

Also Part l-i, Sec. 34-32-116, of the Colorado Mined Land Reclamation Act requires that off-site areas be protected from slides or other damage due to mining or reclamation. Implementation of this constraint would prevent the dumping of mine spoils or road fill over steep slopes or escarpments, and the resultant form-dominant visual intrusions. This would prevent fill material from being dumped on steep hillsides adjacent to Good Spring Creek below the proposed haul road; all excavated material would therefore need to be hauled to the spoil area.

Regulation No. 1, Emission Control Regulations for Particulates, Smokes, and Sulphur Oxides for the State of Colorado, Section II-D, Fugitive Dust, (Colorado, 1971) prohibits mining operations from occurring without a permit that specifies fugitive dust control measures. Implementation of these measures would reduce potential for atmospheric haze. In addition, 43 CFR 3041.2-2(f)(11) requires W. R. Grace and Company to construct and maintain all roads and other utility access facilities in a manner that would minimize, control, or prevent fugitive dust. Regular sprinkling with water, or oiling, would be required to control dust on all haul and access roads; such dust control measures are approximately 30 percent efficient.

The Colorado Department of Health's water quality standards (1974) provide regulations consistent with the provisions of the Federal Water Pollution Control Act amendments of 1972. Enforcement of this legislation would prevent the proposed mining operation from contributing floating debris, scum, and discoloration to Good Spring and Taylor Creeks and the Yampa River.

Additional legislative backing is provided for protection of cultural resources in 43 CFR, Subpart 3041. Sec. 3041.2-2(d) directs W. R. Grace and Company to take action to protect known and suspected cultural resources identified by the required intensive surveys. This would be accomplished by constructing fenced exclosures, interpretive signing, etc. as appropriate on a case-by-case basis.

These provisions would be implemented by requiring intensive cultural resource surveys on all areas subject to surface disturbance, to be completed by the lessee. An evaluation of National Register significance must be made also. If significant sites are found, W. R. Grace and Company would be responsible for nominating them to the National Register of Historic Places, and subsequently contacting the State Historic Preservation Officer (SHPO) to comply with Advisory Council review procedures concerning site protection. The surveying archeologist would also make specific recommendations, to be adhered to by W. R. Grace and Company, concerning the possible need for on-site archeological reconnaissance during mining and other surface-disturbing activities. These recommendations must be on a location-specific basis to ensure discovery, evaluation, and protection of significant sub-surface archeological resources. This has been completed for the lease area, and as a result the surveying archeologist recommended further testing of three archeological sites located by the survey. This testing, plus additional intensive surveying for all off-site rights-of-way (including access and haul roads, conveyor and transmission lines), must be completed, with all subsequent testing and evaluations, and excavation if necessary, prior to initiation of surface-disturbing activities. Most recent Federal legislation is the Archeological and Historical Data Conservation Act of 1974 (P.L. 93-291) which requires protection of cultural resources affected by any Federal or Federally-licensed construction project.

Archeological values derive their primary value from being preserved in-place; their secondary value occurs in excavation. Archeological testing or excavation stemming from intensive surveys on proposed action areas may be permitted where the site is not in imminent danger of being destroyed. This would not preserve the site's primary in-place value, and also would not allow utilization of improved archeological survey and analysis techniques in site excavation at a future date, when more sophisticated techniques could be employed. However, salvage excavation would allow for partial mitigation of adverse impacts where a site is threatened by actual physical displacement.

For all practical purposes, not all cultural values would be identified in the required survey; sites may be buried by alluvium and hidden from view. The regulations themselves would also do little to prevent theft and vandalism of cultural resources due to increased visitor use pressure.

See the Regional Analysis for a more detailed discussion of how these legal provisions would be implemented.

Historical Resources

All current antiquities legislation enumerated in the Archeological Resources Section is also applicable to protection of the area's historical resources, as are the actual mitigations.

Aesthetics

Enforcement of provisions of 43 CFR Subpart 3041.2-2(d) would ensure that W. R. Grace and Company takes visual resources identified in this statement into account in the planning, location, and construction of facilities on the proposed operation. To comply with this regulation, the following measures would be taken:

Cut and fill slopes resulting from the haul road, building pads, and parking areas would be shaped to a rounding grade that intersects adjacent terrain at a very low angle; this would help avoid creation of harsh angular forms. All mine spoils and topsoil stockpile areas would also be reshaped to a rounded and undulating, rather than geometric, form that borrows from the adjacent topography. 43 CFR Subpart 3041.2-2(f)(2) and 30 CFR Part 211.40(a)(2) further require W. R. Grace and Company to eliminate highwalls and spoil piles, restoring the approximate original contour. This requires that the overburden intended to be placed into Streeter Canyon would conform to an undulating contour; the contact of these spoils or overburden with the then undisturbed south-facing slope would be shaped to a rounding grade to avoid creation of an unnatural line-dominant feature.

In addition, implementation of 43 CFR, Subpart 3041.2-2(f)(12)(ii) would reduce visual impacts accruing to road construction because it requires all roads to be located on flatter slopes to minimize disturbance; this is also required by 30 CFR Part 211.40(a)(12)(ii). This requires that the overburden to be placed into Streeter Canyon would conform to an undulating contour; the contact of this overburden with the then-undisturbed south-facing slope would be shaped to a rounding grade to avoid creation of an unnatural line-dominant feature.

Where trees or shrubs are to be removed from road, mining facility, or right-of-way construction, or for mining itself, clearings would assume an irregular form to simulate natural openings in the vegetative cover, to be determined by the views obtainable from viewshed sequences providing the visual access (see Landscape Visibility Maps in Chapter II). When trees or shrubs are removed, they would not be piled nor lopped and scattered, but buried, or returned to the site as a chipped mulch.

Wholesale vegetation clearing within powerline rights-of-way would be prohibited; all shorter shrubs and trees would remain. In no case will the right-of-way be bladed, and no visible roads would be constructed in foreground landscapes to secure access to support structures. Access to that portion of the line traversing either foreground or middleground landscapes would not be provided for within the transmission line right-of-way. Where feasible, access would be secured by utilizing existing roads, trails, and more gentle natural terrain.

Reestablishment of a diverse vegetative cover on all disturbed lands is required by 43 CFR Subpart 3041.2-2(f)(13)(i); this would help mitigate visual impacts on denuded areas; it is also provided for in 30 CFR Part 211.40(a)(13)(i). Part 1-f, Section 34-32-116, of the Colorado Mined Land Reclamation Act (H.B. 1065) also directs the establishment of a self-sustaining long-term vegetative cover. These revegetation efforts would begin as soon as possible following cessation of surface-disturbing activities. Adverse visual impacts would be rendered less harsh by arranging plantings and seedings in an irregular pattern.

All proposed mine offices, shop-warehouses, and other buildings would be built as low-profile as possible. They would also be painted a non-reflective warm green, brown, or buff color that borrows from adjacent landscape colors. Screening, crushing, and loadout facilities, and conveyor structures would be similarly painted; silver-colored metallic finishes would be avoided.

Wooden transmission line support structures would be penta-treated where they cross foreground or middleground landscapes; however, creosote-treated poles would not be used due to their dark color. Also non-reflective or non-specular conductors would be used throughout that portion of the line visible from public roads.

W. R. Grace and Company would also maintain a litter-free landscape by screening refuse disposal and storage areas, and by regularly disposing of discarded equipment, waste, and litter. 43 CFR Subpart 3041.2-2(f)(8) requires W. R. Grace and Company to dispose of rubbish to prevent air pollution. Section 34-32-116, Part l-e of the Colorado Mined Land Reclamation Act (H.B. 1065) directs refuse disposal in a manner that would control unsightliness.

Also Part l-i, Sec. 34-32-116, of the Colorado Mined Land Reclamation Act requires that off-site areas be protected from slides or other damage due to mining or reclamation. Implementation of this constraint would prevent the dumping of mine spoils or road fill over steep slopes or escarpments, and the resultant form-dominant visual intrusions. This would prevent fill material from being dumped on steep hillsides adjacent to Good Spring Creek below the proposed haul road; all excavated material would therefore need to be hauled to the spoil area.

Regulation No. 1, Emission Control Regulations for Particulates, Smokes, and Sulphur Oxides for the State of Colorado, Section II-D, Fugitive Dust, (Colorado, 1971) prohibits mining operations from occurring without a permit that specifies fugitive dust control measures. Implementation of these measures would reduce potential for atmospheric haze. In addition, 43 CFR 3041.2-2(f)(11) requires W. R. Grace and Company to construct and maintain all roads and other utility access facilities in a manner that would minimize, control, or prevent fugitive dust. Regular sprinkling with water, or oiling, would be required to control dust on all haul and access roads; such dust control measures are approximately 30 percent efficient.

The Colorado Department of Health's water quality standards (1974) provide regulations consistent with the provisions of the Federal Water Pollution Control Act amendments of 1972. Enforcement of this legislation would prevent the proposed mining operation from contributing floating debris, scum, and discoloration to Good Spring and Taylor Creeks and the Yampa River.

Impacts to mood-atmosphere values caused by increased noise levels would be partially mitigated by implementing the provisions of Colorado Senate Bill 197 (1971) which establishes maximum permissible noise levels and abatement procedures. Federal noise pollution guidelines are outlined in P.L. 91-604, The Clean Air Act, Section 401—Noise Pollution and Abatement Act of 1970. The Office of Noise Abatement and Control, established by this Act, provides for enforcement of the guidelines contained in the Act. Enforcement of these laws would achieve the lowering of noise levels adjacent to the Colowyo Mine.

These regulations and legislative enactments would be effective only to the extent that they are enforceable, that the standards set forth are enforced, and that these minimum standards are actually effective in reducing impact. The probability of all of these actually being enforced, on the ground, is something less than 100 percent, as evidenced by impacts presently occurring from similar ongoing operations in the region.

Recreation

43 CFR Subpart 3041.2-2(f)(1) and 30 CFR 211.40 Part 211.40(a)(1) requires W. R. Grace and Company to reclaim the affected lands as soon after disturbance as possible to a condition at least as capable of attracting and sustaining recreation use as now exists. These regulations require recognition of recreation resource values identified in this analysis. The subsequent application of several mitigating measures is also needed to comply with these as well as other applicable Federal and State laws and regulations.

Water quality standards established by the Colorado Department of Health (1974) provide regulations that would be used to mitigate impacts to recreation resources. All State waters are thereby required to be free of substances or conditions toxic to plant, animal, or aquatic life, that produce undesirable aquatic life, and that impart any undesirable taste to fish flesh or make fish inedible. 43 CFR Subpart 3041.2-2(f)(7) further requires W. R. Grace and Company to minimize, control, or prevent disturbances of the prevailing quality of surface water. Subpart 3041.2-2(a)(5)(iv) prevents impoundments from adversely affecting downstream water quality; this is also affirmed by 30 CFR Part 211.40(a)(5)(iv). More specifically, Subpart 3041.2-2(f)(11) directs the mine operator to design, construct, and maintain all roads, rights-of-way, and attendant facilities in a manner that would prevent damage to fish or wildlife or their habitat. All massive surface-disturbing activities would therefore be restricted from floodplains on active drainages. Implementation of these regulations would prohibit mine-caused damage to the recreational potential of downstream fisheries in Axial Basin Reservoir, Yampa River, and adjoining tributaries.

The Colorado Open Mined Land Reclamation Act (H.B. 1065) contains several provisions for mitigating recreation impacts. Section 92-13-6 describes the duties of mine operators. Part 1-f directs the disposal of refuse in a manner that would control deleterious effects. Enforcement of this regulation would prohibit actions which would indirectly impact downstream recreational fishing potential.

Earth mounding and shaping techniques would be employed to increase recreational opportunities on mined-over areas. Within the basic rolling vegetative type, waterways and ponds would be constructed to increase aesthetic attractiveness and wildlife viewing opportunities. Mounding and shaping would create more ecologic niches and additional cover, and subsequently more wildlife viewing opportunities. 43 CFR Subpart 3041.2-2(a)(5)(iii) requires the operator to ensure that water impoundments and retention dams would provide adequate safety and access for reasonably anticipated recreational water users. This is also provided for by 30 CFR Part 211.40(a)(5)(iii).

The mine operator would allow the public to use lands owned by him for recreational purposes except in areas where he determines such use to be hazardous or objectionable; Section 34-32-116, Part 1-j, of the 1973 Colorado Mined Land Reclamation Act contains these provisions in accordance with Article Four of Chapter 62, Colorado Revised Statutes, 1963. 43 CFR Subpart 3041.2-2(f)(14) requires W. R. Grace and Company to allow public access to and upon Federal lands within Federal coal lease D-034365 unless such access would unduly interfere with his authorized use. However, public access is also to be regulated to protect the public from hazards. Coal Mining Operating Regulations in 30 CFR Part 211.40(a)(14) also requires this access to be provided and regulated. Implementing these regulations would increase the supply of available recreation lands and help meet the increasing regional demand for recreation resources and facilities.

Impacts to the recreational value of archeological and historical resources would be mitigated as outlined under those headings in Chapter IV.

The degree to which these legislative enactments would be successful in mitigating impacts would be dependent upon their enforceability and actual on-the-ground enforcement. Based upon past observations of similar coal mining operations, enforcement of current laws has not been complete in mitigating applicable impacts.

See the Regional Analysis for a more detailed discussion of how these legal provisions would be implemented.

Measures to be Included if Authorization is Granted

Water Resources

Monitoring of water quality in Good Spring Creek would determine if additions of dissolved solids attributable to leaching of mine spoils would require mitigating measures. Periodic measurements of conductivity both upstream and downstream from the mouth of Streeter Canyon would constitute the monitoring program. The most effective means of reducing leaching would be to reduce infiltration through spoils by prompt revegetation that included vigorous stands of deep-rooted, woody plants to use as much infiltering surface water as possible.

Air Quality

Control of the largest source of pollutant, fugitive dust, is expected to be part of mine operations. There are several other considerations besides ambient air pollution which mandate control of fugitive emissions. The most important concern is employee health and safety.

Fugitive dust from mining operations might be a safety hazard due to impairment of worker visibility, increase in the risk of accidents, or interference with safety equipment. Another consideration of dust control is the efficiency of overburden and coal handling which is improved if the quantity of fines and the amount of airborne dust is limited.

Coal fires as a source of pollutants would be minimized by careful design of overburden piles and preventive action. Once a fire starts, only prompt, thorough fire fighting would prevent a major air pollution problem.

A major mitigative measure for the control of fugitive dust would be the reclamation of the mine surfaces. As mining proceeds, reclaimed areas would be expected to cease to be sources of fugitive dust. Reclamation would include grading, vegetation planting and other landscaping.

Other less conventional control measures are available for fugitive dust. Such practices as road paving, covering of surfaces or hooded trucks, maintaining low vehicle speeds, limiting operations during very dry periods, limiting operations at night or other times during periods of poor atmospheric dispersion, applying chemical treatments, installing barriers, and planting temporary vegetation would be utilized. However, the cost effectiveness, efficiency, and practicality of such measures has not been adequately determined.

Terrestrial Fauna

Existing roads would be used whenever possible to reduce vegetation disturbance during the exploration phase.

Topsoil removed from the initial cuts would have to be stockpiled. To mitigate the impact to the ecosystem such areas would be located where the degree of damage would be minimal. All soil would be placed within the sagebrush vegetation type to avoid disturbing mountain shrub type. After the initial cuts have been made all new stockpiled soil would be located on spoil piles so no additional areas would be disturbed.

W. R. Grace would work closely with the Colo. DOW to insure that game populations within the lease area are managed in accordance with regional plans; access for proper game harvesting should be encouraged.

All non-essential off-road-vehicle use would be prohibited to reduce impacts on vegetation and soil productivity.

Ponds and stocktanks would be created on reclaimed spoils as soon as possible to mitigate water losses caused by mining similar areas, and the covering of Streeter Creek by mine spoils.

Plant species used for revegetation of roadsides would be those that would not draw wildlife to these areas. This measure would help mitigate vehicle-animal collisions within the mine vicinity.

Spoil areas would be used whenever possible for roads to reduce the impact on undisturbed areas.

To reduce the impact of the proposed haul road on the east side of the mine, all cut material would be taken out of the area and deposited on spoil piles, rather than pushed over the side of the road. This would decrease the amount of disturbed vegetation. Spoil areas would be used whenever possible for roads, to reduce the impact on undisturbed areas.

All pad areas and roads created during the installation of the 69-kv powerline would be reseeded as soon as possible after the powerline construction. Vegetation between power poles would not be disturbed unless absolutely necessary.

High rodent populations, expected to utilize revegetated areas, wqould reduce natural capabilities to quickly establish a self-sustaining floral cover. To mitigate this impact it would be necessary to attempt to control these rodents; traps would be used, and perching structures for rodent-eating raptors would be provided in revegetated areas. A closely controlled and monitored poisoning program could be used in limited cases if all other efforts fail, and if proper authorization were obtained.

Recreation

Also at least one quarter mile of the haul road adjacent to its intersection with Colorado Highway 13 would be paved to keep trucks from tracking rocks and gravel on to the highway; this would help maintain highway safety for passing motorists. An additional northbound acceleration traffic land would be constructed on Colorado Highway 13 beginning at the haul road intersection. This would also allow coal haul trucks to discard wedged rocks from between dual wheels before entering the mainstream of traffic.

Transportation Networks

The required north-bound and south-bound acceleration lanes which are described in the Recreation section of this chapter would substantially decrease the probabilities of auto accidents at the intersection of Streeter Canyon road with State Highway 13.

Colowyo Coal Company has contracted with the State Highway Department for upgrading the three-restricted-weight bridges on Highway 13, and has contributed approximately $150 thousand to the effort, which is now underway.

Chapter V

Adverse Impacts Which Cannot Be Avoided

THIS CHAPTER PRESENTS THE RESIDUAL ADVERSE IMPACTS OF W. R. GRACE & COMPANY'S PROPOSED ACTION THAT WOULD REMAIN AFTER APPLICATION OF THE MITIGATING MEASURES DISCUSSED IN THE PRECEDING CHAPTER. THE FOLLOWING DISCUSSION COMPLETES THE ANALYSIS EQUATION: IMPACTS MINUS MITIGATIONS EQUALS ADVERSE IMPACTS WHICH CANNOT BE AVOIDED.

Replacement of a few hundred feet of natural strata with mine waste materials of broken sandstone and finer-grained rock fragments would unavoidably change the topographic, water-retaining, and erodibility characteristics of the site. Partial filling of lower Streeter Creek valley is necessary to avoid an unacceptably steep, high, south bank of spoil material.

Impacts to all fossils would be difficult to mitigate; some would most certainly be destroyed.

The proposed mining would have an unavoidable impact on coal resources in that about 93 million tons of this nonrenewable energy source would be removed. Mining methods used would result in an unavoidable loss of about 10 percent of mined coal during mining, loading, and transportation.

Unavoidable adverse impacts resulting from conflicts between coal development and oil and gas exploration and development depend on the results of a pending court action. Impacts on mineral resources could range from none, to some loss of resource recovery, or locally higher cost per unit of resource recovered, owing to special methods for extraction.

There are no significant adverse environmental effects with respect to ground water that cannot be avoided. There probably would be some unavoidable increase in dissolved solids in Good Springs Creek, due to leaching of mine spoils. The amount, after revegetation of the spoils, cannot be predicted accurately but would be small.

The unavoidable sediment yield from the mine would be about 35 tons/year, and the unavoidable sediment yield from the new roads would be about 120 tons/year. There would be some increase in sedimentation in Good Spring Creek and Axial Basin Reservoir as a result of the proposed mining activity, particularly road construction.

The air quality during mining operations would be degraded in terms of all the presently regulated pollutants: suspended particulates, carbon monoxide, oxidants, sulfur dioxide, nitrogen oxides, and hydrocarbons. Mining cannot be performed without air pollutant emissions from vehicles and the generation of fugitive dust. Visibility in the vicinity of the mine would be decreased because of mine air pollutant emissions. Estimates indicate that total suspended particulate regulations would be exceeded near the mine. No other degradation in excess of standards would be expected.

If mining proceeds at the Colowyo Mine site, soil disturbances would be unavoidable on approximately 1,500 acres (Table GV-1).

TABLE GV-1

Acres of Soil Disturbance Associated with the Proposed W. R. Grace Mining Operation

Action/Period	1976-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005
Mining	195	201	240	211	218	214
Facilities	25	-	-	-	-	-
Off-site Topsoil and Boxcut Spoil Stockpiles	80	-	-	-	-	-
Access Road	32	-	-	-	-	-
Haul Road	83	-	-	-	-	-

Soil disturbance would lower natural soil productivity of the area to some degree by compaction, mixing natural soils, and causing accelerated erosion and sedimentation.

On the area to be mined, partial alteration of all soil horizons, parent material, and soil characteristics which have developed over long periods of geologic time cannot be avoided. Present soil biota would be reduced, and soil forming processes would be stopped. Once mining is completed and the area reclaimed, soil development would have to start again. As an end result, new soils will be formed with characteristics and distributions unlike those existing prior to mining.

Approximately 1,600 acres (see Table GIII-3) of existing vegetation would be unavoidably destroyed during the 30-year life of the mine by roads, stockpiles, facilities, the mining operation itself (1,499 acres), and associated population increase (96 acres). Vegetation would be permanently removed on approximately 245 acres due to the construction of roads, permanent facilities, and population increase.

The existing stage of plant succession would be unavoidably lost when vegetation is removed. If W. R. Grace can return their mined lands to a condition suitable for wildlife habitat and livestock grazing, and utilize native species to do so, the unavoidable loss of existing vegetation would be reduced. If W. R. Grace's current seed mixture is not expanded, the loss of trees and shrubs from the existing vegetation would be unavoidable. Because reshaping and topsoiling procedures would not reproduce the distinct variations in existing soils that produce different vegetative types, even if revegetation attempts restore a diverse vegetation, distinct types will be lost.

The soil and microclimatic conditions produced after mining might be very different from existing conditions, making it impossible to establish and sustain native vegetation. On spoils where topsoil has not been replaced nor much shaping done, very little invasion of native species has taken place in 10-15 years (Appendix D, Past and Current Reclamation); if replacement of topsoil does not encourage invasion, loss of existing conditions would be an unavoidable impact. Even on areas successfully revegetated, a ten percent reduction in seasonal peak productivity has been projected.

Noise created by heavy equipment could result in an unavoidable adverse impact on most wildlife species; this might benefit some animals by driving them away from the construction areas before they are killed. The probability of vehicle-animal collisions would increase with an increase in human activity. This could not be avoided without the construction of fences and passes over or under the roads. Traffic on the proposed roads is not expected to be heavy enough to justify fencing at this time.

Nest and den destruction cannot be avoided when large tracts of vegetation are disturbed. Removal of vegetation, topsoil and overburden would be an unavoidable impact under the existing mine plan. A result of the loss of vegetation and topsoil would be a loss of the existing ecosystem; habitat components and exact faunal species composition ratios would not be returned to their present status.

Impacts on wildlife habitat resulting from dumping spoil material into Streeter Canyon could not be mitigated without changing the type of mining operation.

The one-year time lag from removal of topsoil to beginning of reclamation work would be an unavoidable impact, because reshaping could not be done in close proximity to the ongoing mine operation for safety reasons.

Loss of small mammals, reptiles, amphibians, young unfledged birds, and invertebrates that are not mobile enough to escape from the mining progression could not be mitigated without trapping and transporting animals out of the mine area. Displacement of more mobile species of wildlife such as deer, elk, coyote, fox, and fledged birds from the mining area could not be mitigated. As stated in the Regional Analysis portion of this report, all or most of these relocated animals would probably be lost.

Maintenance buildings and offices are needed on the site; therefore, loss of vegetation, representing wildlife habitat, resulting from clearing of these areas would be unavoidable, unless they can be located on spoils rather than on previously undisturbed areas.

The expected increases in rodent populations during the revegetation program would almost certainly result in a corresponding but time-lagged increase in the numbers of coyotes, fox, snakes, and raptors. Although predator control is possible at least to a limited degree, the increase in predator numbers was included in this section because they should be allowed and encouraged to use the area. Predators act to help limit rodent numbers, and this in turn would aid in the establishment of the revegetated areas sooner. Therefore, no action should be taken to mitigate the increase in predator numbers.

Fencing of revegetated areas would be necessary to protect seedling grass, forbs and shrubs, even though it would alter deer, elk, livestock and other animal species' movements. Removal of all livestock from the vicinity of the ongoing mining operation or adequate fencing would be necessary to avoid accidental loss due to equipment-animal collisions or animals falling off the highwall.

Off-site loss of habitat for a variety of wildlife species due to the population increase related to mine construction and operation would be unavoidable.

Fencing-off revegetated areas to exclude livestock grazing for a period of two growing seasons would be needed to allow new vegetation to become established. This 20-25 AUM loss in livestock forage would be an unavoidable impact. Traffic on proposed haul roads and access roads might cause unavoidable harassment or hazards to livestock.

There would be some increase in sedimentation in Good Spring Creek and Axial Basin Reservoir as a result of the proposed mining activity, particularly road construction; this increase in sedimentation would impact the aquatic ecosystem, particularly the sedentary benthic invertebrate and periphyton organisms. However, with the proper placement and utilization of settling basins around proposed construction areas, this adverse impact would not be significant.

Impacts could result from salvage excavation; both adverse and beneficial impacts could result from excavation of significant sites that is done solely for study purposes. Displacement or disturbance of known sites as identified in Chapter III (see Table GIII-5) would be unavoidable. As with archeological values, historical features could be subject to impacts from surface disturbance, vandalism, and pothunting. Displacement or disturbance of sites as identified in Chapter III would be unavoidable.

Given the mitigating measures discussed in Chapter IV, the net residual of adverse impacts should be significantly reduced; however, several visually incongruous elements or minus deviations would not be mitigated. Adverse aesthetic impacts in Streeter Canyon would not be totally mitigated; during the first two years of operation before reclamation begins, all impacts identified from dumping spoils into the canyon would remain until the spoils are revegetated. Adverse impacts from the main haul road and access road would remain until successful revegetation occurs. The strong line-dominance of the road would remain during the life of the mine. Visual impacts of that portion of the mine visible from northbound traffic on viewshed sequence JK would remain unmitigated during the life of mining operations on that area. Constructing the main haul road by cutting and hauling out excavated material would only partially mitigate impacts; the path of the road would create a line-dominant feature that cannot be totally camouflaged. In addition it would be difficult to avoid spilling some spoil below the road, regardless of the excavating equipment. Adverse visual impacts of the intermediate crushing and loadout facilities (though temporary), the mine office buildings, the substation, and the transmission line would be largely mitigated, though they would not completely borrow from the characteristic landscape. All dust and noise levels could not be totally mitigated, because total dust control is not feasible. Adverse impacts upon the area's mood-atmosphere qualities would remain unmitigated for the life of the mine. The relative value of these unavoidable adverse impacts depends on the visual exposure of the landscape visual units in which they occur. Visual access to adverse aesthetic impacts on Federal lease D-034365 from Colorado Highway 13 would be most significant due to higher traffic volumes, projected to increase. Visual impacts on county roads would be less significant. The scale of W. R. Grace's proposed coal operations compared to adjacent landscapes is relatively small; therefore the degree to which unavoidable adverse impacts affect viewers would also be proportionately small.

Destruction of recreational capabilities of unknown cultural resources could not be totally avoided. Relative magnitude of these unavoidable adverse impacts is moderately low because of existing access limitations and availability of other similar recreation opportunities in the region. It would be difficult to remove all road hazards caused by increased volume of heavy truck traffic between Colowyo Mine and the Craig railhead. Adverse impacts would include increased traffic hazards to recreation-oriented motorists on Colorado Highway 13.

Deterioration of Highway 13 between the mine site and Craig would be unavoidable, as a result of coal truck and mine employee vehicle traffic. These increases in traffic would also unavoidably increase the probabilities of auto accidents on Highway 13 between Craig and Meeker.

Chapter VI

Relationship Between Short-Term Uses and Long-Term Productivity of the Environment

THIS CHAPTER DISCUSSES THE EXTENT OF LONG-TERM IMPAIRMENT OR ENHANCEMENT OF RESOURCE VALUES THAT WOULD OCCUR, GIVEN THE SHORT-TERM USES OF THE ENVIRONMENT PROPOSED IN W. R. GRACE & COMPANY'S MINE AND RECLAMATION PLAN. IN THIS ANALYSIS OF TRADE-OFFS OVER TIME AND TRADE-OFFS AMONG RESOURCE VALUES, SHORT-TERM REFERS TO THAT PERIOD WHEN SUBSTANTIVE PARTS OF W. R. GRACE & COMPANY'S PROPOSED ACTION TAKE PLACE. LONG-TERM IS THAT PERIOD IN WHICH SUBSEQUENT IMPACTS, BOTH ADVERSE AND BENEFICIAL, STILL AFFECT THE ENVIRONMENT.

Unavoidable paleontological impacts would be experienced in the short-term during the mine's operation. After completion of the mining operation, no further impacts would occur. Options for future use of these subsurface resources would be foreclosed. However, a beneficial impact may result from the operation itself disclosing knowledge of fossils heretofore unknown; this would create options for future generations to benefit from the newly-found resources.

This plan calls for a long-term period of recovery of coal from beds as deep as 450 feet, and is thus more comprehensive in coal recovery scope than any other mining plan of the region. By the end of this period, all coal that could conceivably be recovered by surface mining would have been recovered. Use of the proposed methods, rather than underground methods, would allow a greater percentage of the coal to be recovered in a much shorter period of time.

Short-term use of the land for coal development could influence the long-term potential for exploration for oil and gas, but the specific degree of influence depends on the result of a pending court action. If resolution accommodates short-term simultaneous activities, the effect on mineral resources would reduce long-term potential for production of these resources by the amount of coal, oil, or gas recovered in the short-term. Potential long-term recovery of coal, oil, or gas still remaining after short-term recovery would not be seriously reduced. If resolution involves sequential activities, the range of possible effects on short-term and long-term productivity are wide and speculative.

The short-term use of the area's surface water resources would not have a permanent impact on the long-term productivity of the environment.

Assuming that the land surface is reclaimed and returned to an equivalent of the pre-existing vegetative cover and general contours, the air pollution resulting from the mine would be a short-term phenomena; that is, it would occur only during active mining. Air pollution from vehicle exhausts and fugitive dust, after mining is complete, would also depend on the subsequent use of the land. Access to the properties involved would have been established. Lack of complete reclamation, specifically vegetative cover and erosion protection, could cause blowing dust to be a continual problem.

Mining on the W. R. Grace lease would result in the introduction of new roads, buildings, powerlines, and heavy equipment into an area not appreciably changed from its natural state except by electrical transmission lines, a county road, and the attendant structures associated with grazing and farming activities. The lease area would be committed to coal production for a period of about 30 years, based on anticipated production levels.

As the coal is mined, overlying soil and rocks would be removed, and vegetative production from the affected soils would be lost for a period of two-four years. The short-term use of parts of the leasehold for mining would be accompanied and followed by a period of reclamation and revegetation. At maximum production, 45 acres would be disturbed by mining each year with an equal number of acres undergoing grading and planting.

It is estimated that the total productive capacity of the land would be reduced 10 percent over present levels, even if revegetation is successful. Reclamation procedures in this semiarid climate have to be tested before any final predictions can be made as to success.

The short term uses would be the total destruction of vegetation by roads, stockpiles, facilities, and the mining operation. Approximately 475 acres would be totally disturbed by mining and facilities, at any given time at maximum production. The establishment of vegetation would require at least three years, so the total area out of production at any given time would be approximately 655 acres.

Vegetation would be permanently destroyed on approximately 245 acres due to the construction of roads, permanent facilities, and population increase.

Long-term seasonal peak productivity is estimated to be ten percent less than existing conditions, and would depend on the success of W. R. Grace's final reclamation program.

Short-term use of the Colowyo Mine lease area would entail complete destruction of that portion of the ecosystem where mining would take place, as well as all areas where roads would be built, powerlines constructed, and mine buildings erected. In addition to these totally impacted areas, wildlife inhabiting adjacent lands would receive lesser impacts from dust, noise, and human or vehicular activity. The lease area is relatively undisturbed at the present time, so its change in use would cause a significant change in the degree of wildlife use. Short-term use of the subject area by all species of wildlife would be lessened; the degree of reduced use would depend on the ability of the species involved to adapt.

Long-term productivity would be expected to be reduced because loss in soil productivity and disruption of vegetal cover would lower the area's ability to attract and sustain wildlife. The degree of wildlife replacement would depend on the reclamation program's success. W. R. Grace plans to return the mined areas to a vegetation type similar to that which presently exists. This would have the effect of maintaining long-term productivity at about its present level, although it would be over 50 years before species composition and densities would be expected to approach present levels.

Short-term use of the lease area would be completely restricted from use by livestock. The lease area would be fenced to exclude use by domestic fauna during mining operations. As revegetated areas become established, livestock would be allowed to use the plots, thus temporarily increasing short-term use of the area.

Long-term productivity should return to, or near, present levels, when revegetated areas reach maturity.

The proposed mining activity would result in an increase in the consumptive use of the local water supply, due to increased domestic use by employees at the mine site and in surrounding towns. Local surface water drainage patterns would be disrupted for the life of the project.

Archeological values would be impacted during the short-run by actual surface disturbance. Potential for vandalism would also be experienced largely in the short-term. Options for future use of cultural resources would be foreclosed by the degree of unavoidable impact resulting from the mining operation. However, required intensive cultural surveys could reveal presently hidden values; this would create options for future generations to benefit from the newly-found resources.

Unavoidable impacts upon historical resources would occur only in the short-term. Once mining operations cease, the potential for vandalism and destruction of the old buildings and structures would return to its present level.

Given the foregoing mitigating measures, short-term impacts would be significantly reduced. After 2005, long-term unavoidable impacts on the area's aesthetics would still remain, though they would be less significant than short-term impacts. However, long-term impacts would be partially mitigated with the passage of time.

Short-term use of the area would result in several beneficial impacts to recreation resources (see Chapter III), and most of this recreational productivity would remain after 2005. Increased off-road vehicle use potential and additional wildlife viewing opportunities would improve recreation capabilities on a long-term basis. Success in reclamation concurrent with ongoing mining operation would maintain increased rockhounding and geologic-industrial interpretive capabilities. However, W. R. Grace and Co. would ultimately determine whether such recreation users would be granted access to the mine area.

Chapter VII

Irreversible and Irretrievable Commitments of Resources

THIS CHAPTER QUANTIFIES THOSE RESOURCES THAT WOULD BE CONSUMED AND PERMANENTLY LOST AS A RESULT OF THE IMPLEMENTATION OF W. R. GRACE & COMPANY'S PROPOSED ACTION. SUCH LOSSES ARE IRRETRIEVABLE COMMITMENTS; I.E., ONCE THESE RESOURCES ARE USED, THEY CANNOT BE REPLACED.

THIS CHAPTER ALSO OUTLINES THOSE USES OF ENVIRONMENTAL COMPONENTS THAT COULD NOT BE REVERSED SHOULD THE PROPOSED ACTION BE IMPLEMENTED. ONCE INITIATED, THESE USES WOULD CONTINUE INDEFINITELY.

Approval of the W. R. Grace Colowyo mine plan would be an irreversible commitment of fossils. Those fossils unavoidably impacted would be irretrievably lost upon completion of the mining operation.

The major irreversible and irretrievable commitment of resources by the proposed mining plan would be the production for consumption, including loss in mining, of about 93 million tons of coal in the 30-year period of 1976-2005. This was determined from the company's stated plan of producing 83,720,000 tons, and then including ten percent for loss in mining. The amount of coal, oil, or gas resources rendered irretrievable, if any, by the outcome of a pending court action concerning conflicting development and exploration ambitions is speculative. An undeterminable amount of sand, gravel, and clinker would be required for mine roads and other support facilities; these materials are available within a short distance of the proposed mine site.

The total consumptive use of the local water resource resulting from the implementation of the proposed mining activity would be negligible. The decrease in aquatic habitat in the analysis area as a result of haul and access road construction would not be significant. The primary irreversible impact resulting from the proposed mining activity would involve the increase in the rate of siltation in Axial Basin Reservoir. The life expectancy of all reservoirs is based on the rate at which silt accumulates in their basins. Once a reservoir has completely silted in, its value as a resource is lost.

Local, very small changes in climate or the atmospheric resources would result from the redistribution of the surface material at the mine. Changes in contours and surface characteristics would irreversibly alter the wind field and surface heating of the air. The air quality degradation would be reversible if reclamation is complete.

Though it is difficult to predict in detail the success of reclamation of W. R. Grace's proposed mined-over lands, returning the site to a self-sustaining ecosystem should be possible, considering existing climatic conditions and W. R. Grace's plan to replace topsoil and transplant some native shrubs and trees. However, peak seasonal productivity is projected to be ten percent less.

Wildlife resources that might be irretrievably lost include individual animals and habitats that would be destroyed. Animals and plants that would have reproduced in the affected habitats during the life of the mine might also be irretrievably lost. Most wildlife losses might be reversible if the species and habitat would not be impacted to the point that their ability to reproduce would be seriously impaired.

Annual forage production which the area could have produced would be lost during the time that mining and reclamation takes place. Production would be lost on approximately 655 acres annually; this represents an irreversible commitment of forage for livestock (approximately 105 AUMs annually), and wildlife. Approximately 245 acres would be permanently disturbed, and vegetative production would be irretrievably lost. Fertilizer utilized in the reclamation program would also be irretrievably lost. Existing soil associations would be irreversibly lost and soil structure would be irretrievably destroyed by the mining operation.

Unavoidable impacts to cultural resources would constitute an irreversible commitment of these resources when the mine plan would be approved. Upon completion of the mining operation, unavoidable impacts would be irretrievably committed.

Irreversible and irretrievable commitments of historical resources also would occur as described above in the section on archeological resources.

Commitment of Federal coal lease D-034365 to coal development would be an irreversible commitment of aesthetic resources as relates to both unavoidable and long-term minus deviations or adverse impacts. These residual impacts, for all practical purposes, would result in irretrievable resource commitments regardless of their relative significance.

Commitment of the proposed action areas to coal development would result in irreversible commitments of recreational resources, even though they might be largely beneficial. However, destruction of unknown cultural resources would be irretrievable for all practical purposes.

Chapter VIII

Alternatives to the Proposed Action

INCLUDED IN THIS CHAPTER IS A DISCUSSION OF ALL REASONABLE ALTERNATIVES TO W. R. GRACE AND COMPANY'S MINE PROPOSAL. THE IMPACTS RESULTING FROM THESE ALTERNATIVES ARE ALSO ANALYZED IN THIS CHAPTER.

Reject Mining Plan

Rejection of the W. R. Grace mining plan would result in no environmental impact on the leased land. W. R. Grace, as surface owner of the lease, could continue to use the land for livestock grazing or other land uses. Grace could submit a new mining plan, challenge the rejection, or abandon, at least temporarily, development of the lease. Should the mining plan be rejected, the development of alternate sources of energy or a reduction of energy consumption could be required.

If energy demands are to be supplied by coal, suspending development of Federal coal at the Colowyo mine site will shift impacts to other coal regions. Utilizing coal from another area, such as the Midwest, could result in some impacts in those areas similar to those which will occur in the study area if coal development is allowed. New mines would need to be opened or production expanded at existing mines. Because much of the midwest and eastern coal is of higher sulfur content than the Colowyo coal, the resulting air pollution could be worse with utilization of that coal.

A summary of the impacts of rejecting the mine plan of Colowyo Coal Company follows:

1. Electrical generating stations in Colorado Springs, Colorado, and in the midwest or south would have to find another source of low sulfur coal capable of meeting air emission requirements;

2. Revenue to Federal, State and local governments would not develop;

3. Traffic to Craig and Meeker would be reduced;

4. Adverse impacts on landform, geology, soils, etc. would not occur;

5. One of the few surface minable coal deposits in the region would not be utilized;

6. Loss of wildlife habitat and grazing area would not occur;

7. Use of ground water, electricity, and fuel oils would not occur;

8. Adverse aesthetic impacts, including dust and noise, would not occur;

9. Alterations in ground water flow and water quality would not occur;

10. Impacts on housing, schools, public utilities, community facilities, and community development would not occur.

Require Modification of Mining Plan

Some of the impacts identified and discussed in Chapter V could be avoided if the mining plan were modified to require use of one or more of the operational alternatives discussed below. In addition, special stipulations could be added to the plan to mitigate some secondary effects of the mining. Such conditions must be reasonable and, if economically unacceptable to the lessee, could result in the lessee not developing the coal resource.

Different Mining Methods

UNDERGROUND MINING

Substitution of this method of mining would result in less initial disturbance of the land surface; however, unsupported mine roofs between pillars could ultimately collapse because of the lack of structural strength in the thin overburden. The primary motivation for underground mining is that it is the most economical way to extract coal when the producing strata are located at great depths. This is not the case with several of the seams at the Colowyo Mine site; the relatively shallow overburden of 50-100 feet over the X and Y seams precludes underground mining as an economic alternative for the upper seams. In addition the thin strata interval occurring between the B, C, D, E, and F seams would preclude extraction of two or more of these seams. Underground mining would not recover as much of the coal seams as surface mining, and therefore would not be a conservation measure of a valuable energy resource.

Substitution of this method of mining would result in:

1. Less initial disturbance of the land surface,

2. Subsided land surface degraded by numerous depressions and openings,

3. Greater costs because underground is more costly than surface mining,

4. A decrease in mine safety as indicated by the fatal accident rates in 1972 of 0.42/million tons mined underground versus 0.07/million tons for strip mining,

5. Higher incidence of non-fatal accidents due to roof and rib falls, fires, explosions, and problems related to dust inhalation (black lung),

6. Recoverability of reserves reduced from a potential of 90-95 percent by surface mining to less than 50 percent by underground mining. This happens because support pillars of coal are left in

place; coal is left unmined in beds less than four feet thick; coal is left in beds over ten feet thick because of less than full height mining, and other seams are left because of the thin strata interval.

Economic conditions override underground mining alternatives at the Colowyo mine site. The cost of mining coal by surface methods is approximately two-five dollars/ton, whereas underground mining generally costs eight-fourteen dollars/ton. The difference is due primarily to labor costs, as the rate of coal production expressed in tons/man-hour is much greater for surface mining than for underground mining. Surface mining operations frequently produce more than ten times as much coal/man shift as underground mining.

CONTOUR STRIP MINING AND AUGER MINING

Contour strip mining along the various coal bed croplines, followed by auger mining, would result in a substantial reduction of land surface disturbance. However, reclamation problems with the exposed highwall and with material deposited downslope are encountered with contour mining. Highwall stability problems are created by the auger mining and subsequent subsidence; the probability of uncontrolled caving and accidents is high; steep slopes and unstable highwalls are probable.

Because auger mining cannot extend further than 200-300 feet into the highwall, the coal beyond this point would be left unmined. Only about 30-40 percent recovery of coal would be realized from that portion of the coal seams mined by augering methods; thus, contour and auger mining would not be satisfactory alternatives on Grace's leasehold.

Different Production Ratio

Any change in production rate, either up or down, would alter the rate of intensity of the environmental impacts discussed previously in this statement. If a reduction in proposed production rate were required, it could create a shortage of fuel of this quality at the power plants in the area of consumption. This would result in decreased power production when consumption is increasing, unless substitute sources of supply were obtained. A reduction would also prolong mining activity on the leasehold, prolong the time until restoration is completed, lessen employment at the mine, lessen the acreage disturbed at any one time, lessen annual tax and royalty returns to the Federal, State, and county governments from this lease, and lessen chances of the company creating an economically viable operation.

If the company was required to increase production above the level proposed, it would increase the intensity and severity of the impacts described elsewhere in the statement, decrease the length of time for mining and reclamation, increase annual tax and royalty returns from this lease, and necessitate acquisition of additional mining equipment.

The establishment of a non-uniform production rate, varying seasonally or even daily, matched to climatic conditions favorable to dust suppression, could result in a significant reduction in expected ambient suspended particulate concentrations.

Different Reclamation Objectives

Alternate land uses for the disturbed areas are discussed in the Regional Analysis. Grazing land for domestic livestock, wildlife habitat and recreation, or combinations of these, would be the objectives that would be permitted by the topography at the Colowyo Mine site.

Different Transportation Methods

TRUCK TRANSPORT

W. R. Grace has already decided on a rail line from their Axial Mine site for transport of their coal to the Craig branch of the D. & R.G.W., and has done much of the preliminary planning work. Colorado S.H. 13 will probably not stand up to even two years of heavy coal hauling at under one million tons/year. With a production of three million tons/year for the three benchmark dates of 1980, 1985, and 1990 for the mine at Axial, use of this road for more than two years for coal transport is out of the question.

SLURRY PIPELINE

A coal slurry pipeline is another alternative to use of rail or truck transport of coal. The line described in the Regional Analysis could easily handle the three million ton/year production of the W. R. Grace mine. If the slurry pipeline were used only for transport to the railhead (the distance of the proposed coal-haul rail line), no pumping stations would be needed along the right-of-way, and except for preparation stations at each end, the impacts of a buried pipeline would be small. If the pipeline were to move the coal over a long distance to market bypassing D. & R.G.W., the impacts would be considerably greater.

Consumptive use of water is the basic problem with a coal slurry pipeline. Since it takes about one ton of water to move one ton of coal, large amounts of water would have to be supplied to W. R. Grace (probably from the Axial Basin area), and subsequently disposed of at the terminus of the pipeline.

Another disadvantage of this transportation method is the high potential for freeze-up in northwestern Colorado during the long, cold winters. Operational failures are difficult to detect and correct in this area, especially during the winter. During all seasons, the probability of a pipeline break or leakage always exists. As the line would cross underneath many small streams, there is a high potential for damaging spillage with resulting water and land pollution. Any spillage or leakage into water courses would result in damage to aquatic life, aesthetics, and recreation values.

If the use of a valuable natural resource such as water is not prohibitive in this case, a slurry pipeline might be a realistic alternative for hauling coal produced at the W. R. Grace mine.

Alternative transport of coal, other than by haulage truck, would decrease vehicle exhaust emissions and road fugitive dust.

Conveyor belts

Belt conveyors can be used as an alternative to rail or truck transport of coal. Expertise is sufficiently advanced to assure technically sound construction of single or multiple flight belt conveyors. Belt conveyors offer great design flexibility and economy in instances like this, where distance and quantity requirements are well known and are expected to remain relatively fixed (at three million tons/year).

In general, conveyor system construction would cause impacts similar to railroad construction. Long distance belt conveyors have never been constructed. However, a 20-30 mile belt could probably be constructed after extensive design work.

A belt conveyor would be subject to belt lift by wind, and would create quantities of coal dust downwind; to decrease dusting, the entire length of the system would be necessarily hooded or guarded against wind. This would add to the visibility of the structure, and increase the impact on wildlife and the aesthetics of the area. Electric motors are normally used to power the belts. They would be located at frequent intervals along the lines, requiring service roads, electric transmission lines, and other service facilities.

If W. R. Grace were to use a conveyor belt system instead of a rail line, it would probably be only to the D. & R.G.W. branch line, and not over long distances to distant markets. Fairly extensive land areas would be required at the end point where the coal was to be transferred to unit trains. At this point, large surge capacity would be necessary, because the belt system would be transporting three million tons of coal/year at a relatively constant rate for subsequent movement. Unit trains would provide this capacity.

Since the impacts of a conveyor belt system are similar to rail, and since the environmental and design problems of a rail line have been considered by W. R. Grace already, a conveyor belt cannot be recommended over the rail line for coal hauling in this case. Use of unit trains from the mine site also eliminates the transfer point from conveyor belt to train at the railhead.

The decrease in vehicle exhaust emissions and road fugitive dust also applies to this alternative, insofar as truck haulage would not be used.

ENERGY FUELS CORPORATION

Mine and Reclamation Plan

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FOR
ENERGY FUELS CORPORATION
MINES

Chapter I

Description of the Proposed Action

THIS CHAPTER IS A DETAILED DESCRIPTION OF ENERGY FUELS CORPORATION'S PROPOSAL TO MINE AND RECLAIM FEDERAL COAL LANDS IN ROUTT COUNTY, COLORADO. THE CHAPTER IS DEVELOPED BY DESCRIBING THE STAGES OF IMPLEMENTATION OF THE CORPORATION'S PROPOSAL. THESE ACTIONS ARE USED IN CHAPTER III TO IDENTIFY AND ANALYZE IMPACTS. THE FEDERAL ACTIONS THAT WOULD BE REQUIRED ARE DESCRIBED ON AN AGENCY-BY-AGENCY BASIS, AND OTHER DEVELOPMENTS IN THE AREA OF THE PROPOSED ACTION ARE DESCRIBED TO THE EXTENT THAT THEY MAY CONFLICT WITH OR COMPLEMENT THE PROPOSAL.

The action before the Federal government with respect to Energy Fuels Corporation is threefold:

1. Review of the recently approved mining and reclamation plan on Energy's three issued Federal coal leases (Colorado 081330, Colorado 0128433, and Denver 052547, see Figure EI-1) with identification of any additional stipulations which may be required;

2. Review of the mine plan on two competitive lease application tracts (Colorado 20900 and Colorado 16284, see Figure EI-1) requested by Energy with the action being approval for leasing and subsequent approval of the mine plan; and

3. Approval for leasing of three competitive lease application tracts (Colorado 9968, Colorado 22677, and Colorado 22644, see Figure EI-2) which Energy has requested the government put up for auction.

The Applicant's Proposal

On November 13, 1974, Energy Fuels Corporation submitted a mining and reclamation plan to the Area Mining Supervisor of the United States Geological Survey (USGS) in Denver, Colorado, for expansion of their coal mining operations in Routt County, Colorado. A revision of this plan was filed on February 5, 1975, and a second revision was filed on April 30, 1975. This latest revision describes in detail the company's five-year operational plan on its three currently held Federal coal leases and private land, and on two competitive lease application tracts requested of the government. The plan describes in a general way the company's mining strategy for four other competitive lease application tracts as well. Finally, the plan includes the company's long-range (15-year) mine strategy and future coal lease requirements.

The mining and reclamation plan for the three issued Federal leases (C-081330, C-0128433, and D-052547) was approved on June 20, 1975, on an interim basis. Pending findings and determinations of this Environmental Statement (ES), additional stipulations may be imposed on the plan.

Five of Energy's six requested competitive lease application tracts (C-20900, C-16284, C-9968, C-22677, and C-22644) have been included in the Bureau of Land Management's Williams Fork Management Framework Plan (MFP) as identified coal lease offerings. Because Energy Fuels has proposed to mine these five tracts within the 15-year time-frame of this statement, they are analyzed for lease issuance in this statement. Further, because two of these lease application tracts (C-20900 and C-16284) were included in the company's mine plan, and because environmental data have been assembled and submitted to the ES task force, they are analyzed in conjunction with the plan on the issued leases. However, mine plan approval on the two lease applications cannot occur until after the actual leases are issued.

Notwithstanding the analysis accomplished in this ES, further on-the-ground investigations and environmental analyses and technical examinations will be required prior to leasing any of these tracts, to insure that lease stipulations, should the leasing actions indeed occur, would provide necessary environmental safeguards pursuant to the requirements of NEPA. It should also be emphasized that there is no guarantee that these leases will in fact be offered at auction, nor that Energy Fuels will be the successful bidder, should they be offered. Energy Fuels has no expressed right to acquire the tracts.

The sixth competitive lease application requested by Energy Fuels, Colorado 22676 (see Figure EI-3) has not been included in the Williams Fork MFP as an identified coal lease offering. Because sufficient baseline environmental data are not available to allow the Department of the Interior to analyze the applicant's proposed action on this tract pursuant to the requirements of NEPA, no analysis of the area encompassed by this lease application is undertaken in this ES.

Background and History

Energy Coal Company began operations at the project site in 1962 on Federal coal lease D-052547. The company began mining coal in the W ½ of Section 32, T.5N., R.86W., and progressed southeastward into Sections 8 and 9, T.4N., R.86W., on land held under coal leases D-052547 and C-081330. All operations involved surface mining methods.

Energy Coal Company was purchased by Energy Fuels Corporation on March 15, 1972. Energy Fuels has since expanded operations with the opening of two additional strip pits.

The Energy 2 Mine operation was begun in 1972 near Fish Creek in Section 25, T.5N., R.87W., on fee lands. Mining has progressed north and east toward federally owned coal. In 1970, following the issuance of a coal prospecting

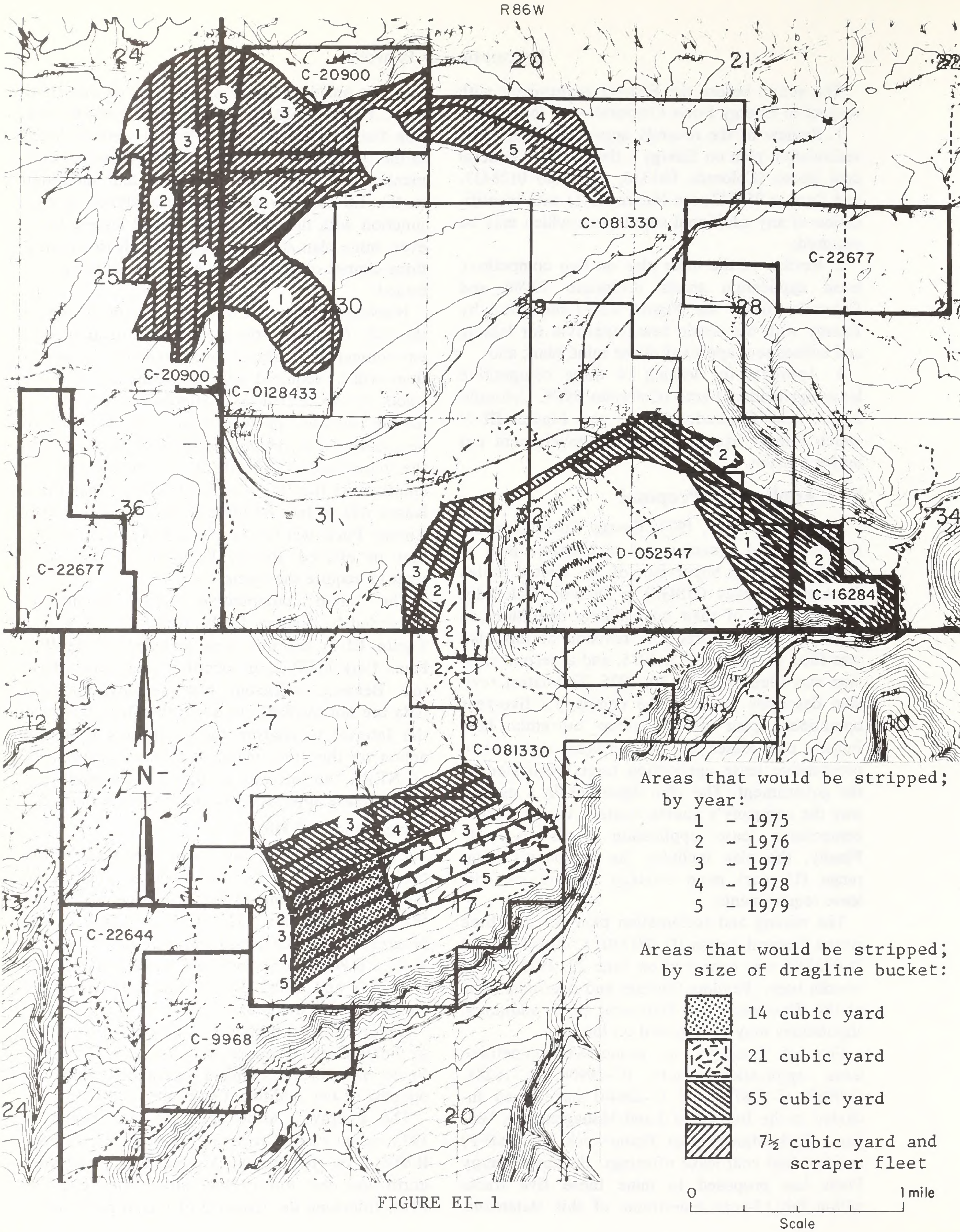


FIGURE EI-1

Mine sequence map for Energy 1 and Energy 2 Mines.

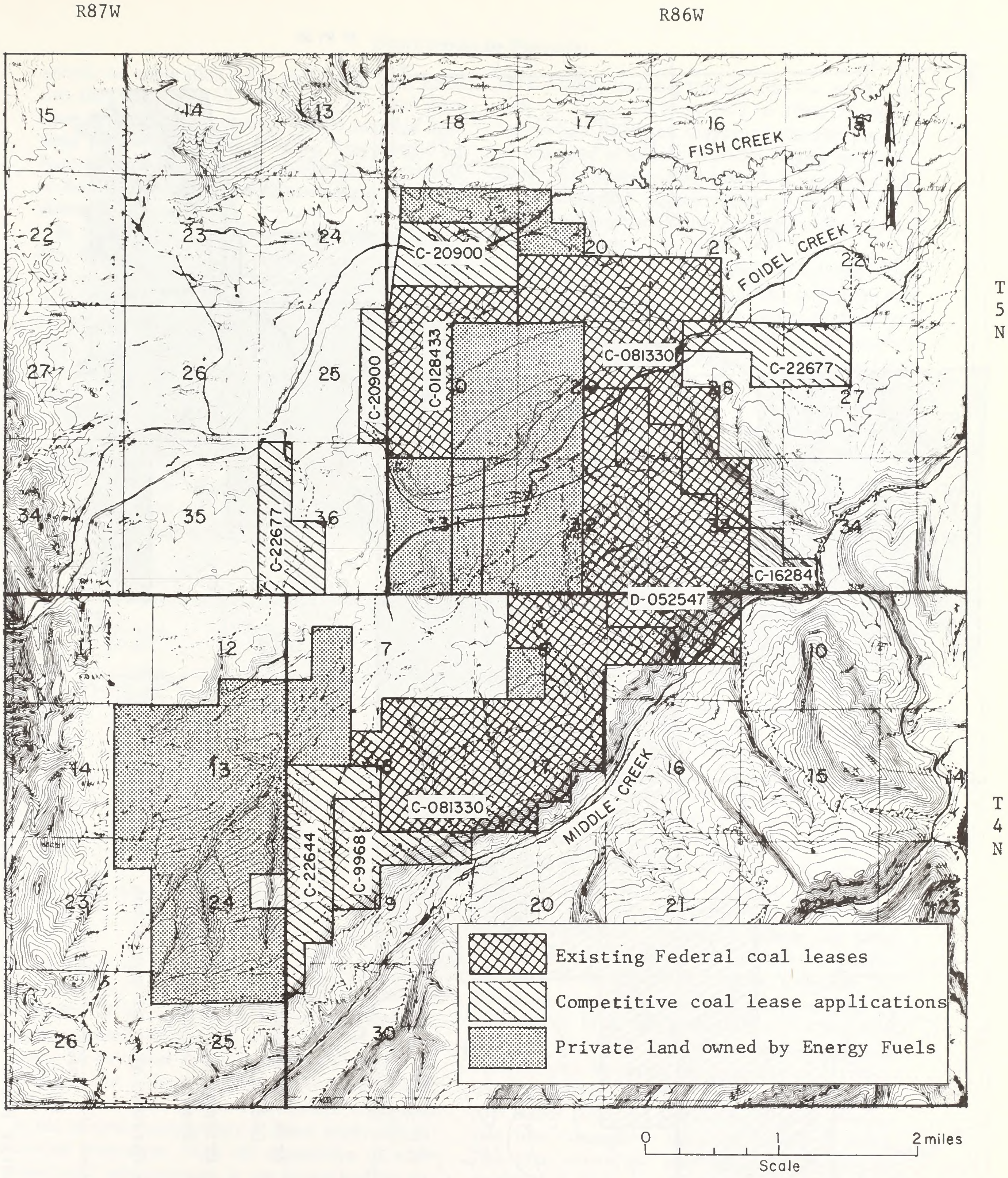


FIGURE EI-2

Energy Fuels Corporation's currently held Federal coal leases and competitive lease application tracts in the Energy 1 and Energy 2 Mine areas.

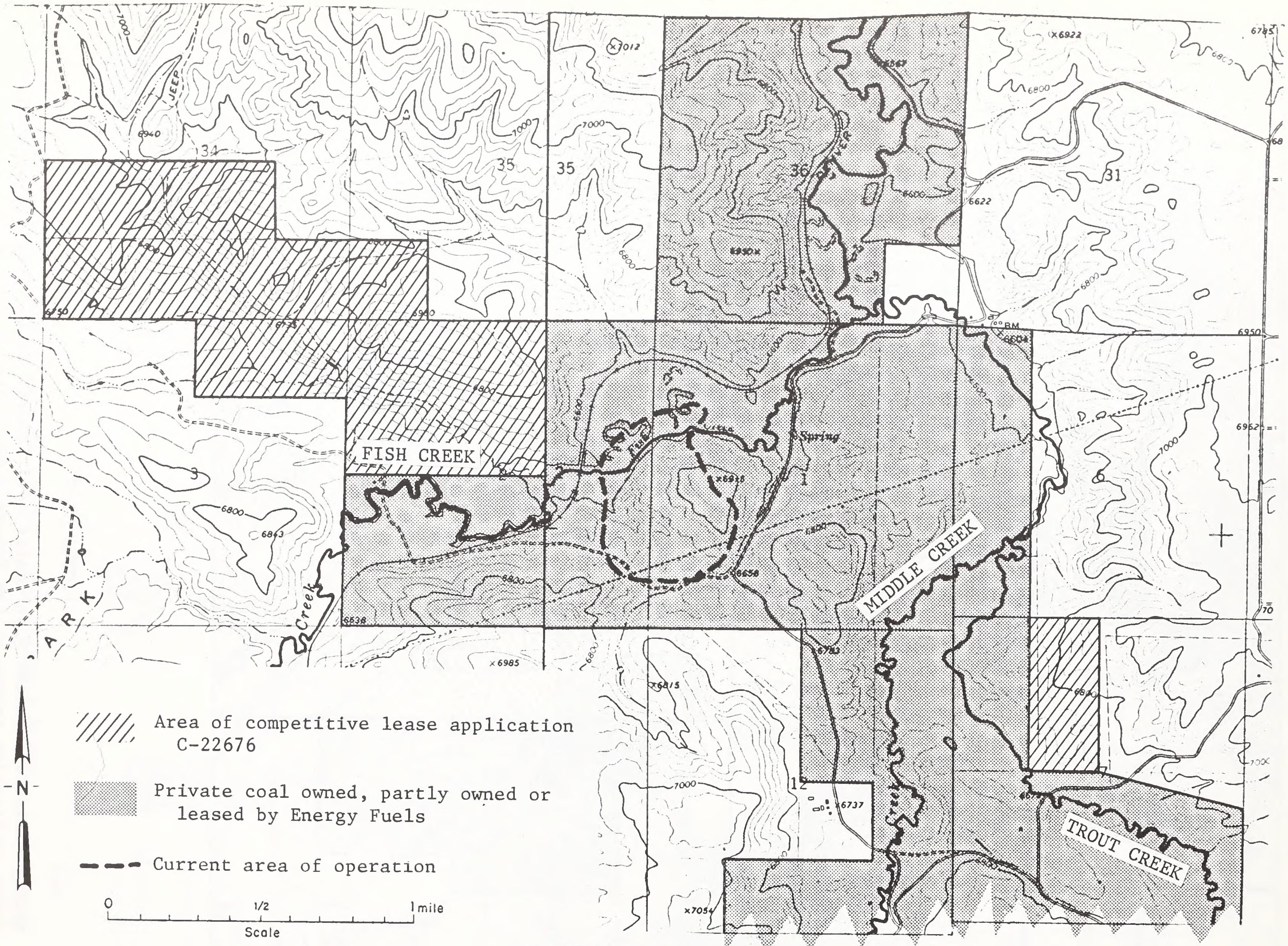


FIGURE EI-3

Energy Fuels Corporation's competitive lease application tract in the Energy 3 area.

permit, an application for a preference right lease was filed for land east of Energy 2 fee land. This lease (C-0128433), containing 474.93 acres in Sections 19 and 30, T.5N., R.86W., was granted in June 1975. Mining began in the southwest quarter of Section 30 shortly thereafter. Energy 2 Mine is shown in Figure EII-3.

In 1974, Energy Fuels began removing overburden, and in 1975 began loading and stockpiling coal at Energy 3 Mine. This new mine is located on private coal land in Sections 1 and 2, T.5N., R.86W., about seven miles northeast of Energy 1 Mine. In July 1975, following completion of new railroad load-out facilities, actual coal production began.

Mining is currently taking place at the Energy 1 Mine, the original mine begun by Energy Coal Company, on Federal lease D-052547 in Section 33, T.5N., R.86W., and private coal lands in Section 32. The mine is shown in Figure EII-2.

Yearly production figures for the Energy Mines are as follows:

Yearly Production From
Energy Fuels Corporation's Mines

Year	Energy 1 (tons)	Energy 2 (tons)	Energy 3 (tons)
1962	23,122		
1963	309,618		
1964	358,215		
1965	393,068		
1966	416,096		
1967	495,107		
1968	505,045		
1969	564,933		
1970	621,889		
1971	517,903		
1972	747,406	21,871	
1973	702,573	186,136	
1974	1,240,150	575,393	
1975	835,792	1,240,529	527,083
Total	7,730,917	2,023,929	527,083
	Total	10,281,929	

The bulk of Energy Fuels' coal production is consumed by coal-fired generating plants, and the majority of its customers are utility companies. Approximately 80 percent of the mines' current output is delivered to Public Service Company of Colorado. In addition to coal already contracted, Energy Fuels has received numerous invitations to bid on coal requirements of other utility and industrial customers. With the acquisition of additional coal sale contracts in the future and the addition of new equipment, Energy Fuels projects that total tonnage from the mines would reach five million tons/year by 1977. The company expects to maintain that tonnage rate for at least the next 15 years; so from 1977 to 1992, 75 million tons would be mined. Assuming that the majority of this coal is mined from the Wadge seam, the major coal seam in the area, it is estimated that 5,170 acres (8.1 square miles) or approximately 345 acres/year would be stripped and reclaimed by the company.

In anticipation of the expansion of operations to five million tons/year, the company has recently spent several million dollars on improvement work. Two new coal handling and loading facilities, one for the Energy 1 and 2 Mine complex, and another for Energy 3 Mine, have recently been completed. A new maintenance facility, equipped with five bays for accommodation of heavy equipment, was constructed by the company. Four miles of County Road 27 were recently moved to give access to strip coal underlying the old roadbed in the Energy 1 vicinity. Finally the company has begun to receive delivery of a new 55-yard dragline, which after construction will greatly increase stripping capacity.

Energy Fuels Corporation is presently the designated operator of three Federal coal leases. In addition, the company has made application to the Bureau of Land Management (BLM) for six competitive leases. Energy Fuels also owns or leases approximately 5,300 acres of private coal land. Copies of the three Federal leases on which Energy Fuels is mining, including their legal descriptions, are included in Appendix D.

Until June 1975, Energy 1 Mine was the only one of the three Energy Fuels mines which was operating on Federal lease lands. This mine has been operating under an approved plan of October 16, 1962. On November 13, 1974, Energy Fuels Corporation submitted a mining and reclamation plan to the office of the Area Mining Supervisor of the USGS in Denver, Colorado, for his approval. A revised mining plan was filed on February 5, 1975, and a second revision was filed on April 30, 1975. The mining and reclamation plan of April 30 covers the continuation of operations of Energy Strip 1 for five years on Federal coal leases D-052547 and C-081330, and progression into competitive lease application C-16284. This plan shows the mine generally progressing southwest in the next five years. In addition the plan covers Federal land in the Energy 2 Mine vicinity. Five year mining and reclamation plans for both recently acquired Federal coal lease

C-0128433 and competitive lease application C-20900 are described. The company's mining plans for its privately owned coal in the vicinity of Energy 1 and 2 Mines are also summarized.

As shown by the mining and reclamation plan for the five year interval from 1975 through 1979, 22 million tons of coal will be mined from approximately 1,840 acres. Detailed mine planning beyond this period is not practical at this time as the company will have depleted its economically strippable coal reserves from within current Federal coal leases and adjacent private coal lands. It would therefore be necessary for Energy Fuels to acquire additional Federal coal lands within the area for the company to remain operational. In anticipation of this, the company has made application to the Federal government for four additional competitive leases on coal acreage that lies adjacent to presently held lands. The April 30, 1975, mine plan describes these tracts and the company's general mine plans for them; because no extensive drilling has been undertaken on these tracts, detailed mine planning was not possible. Successful acquisition of these tracts by Energy Fuels at public auction would necessitate the submittal of formal exploration drilling plans and later mining and reclamation plans to the Area Mining Supervisor of the USGS. Acquisition of these lease application areas in a timely fashion would ensure that the company remains operational past 1980. Also, it is felt that a significant amount of coal in the area could be extracted by underground methods. Energy Fuels is currently developing preliminary plans for an underground operation.

Site location

Energy Fuels Corporation is presently operating three surface mines located in T.5N., R.85W., T.4, 5 and 6N., R.86W., and T.5N., R.87W. This area lies 8-12 miles northwest of Oak Creek, Routt County, Colorado, and 10-18 miles southwest of Steamboat Springs, the county seat. A railroad spur of the Denver and Rio Grande Western Railroad serves the mines from the town of Milner, west of Steamboat Springs. The three mine sites are shown in Figure EI-4.

Stages of Implementation

Proposed mining procedures

The following description of mining and reclamation activities is taken from the mining and reclamation plan submitted by Energy Fuels Corporation. The mining method will be described for Energy 1 and 2 Mines only, as Energy 3 is currently located on private lands and its single Federal competitive lease application C-22676, is not analyzed as a part of the applicant's proposal as there is inadequate baseline data to do so.

Soil material removal

The first step in the mining operation is to remove the uppermost soil material from the immediate mining area; this is accomplished with rubber-tired scrapers and/or bulldozers. At the start of operations, the topsoil is stockpiled to retain it for later distribution over the leveled spoils. This stockpiled topsoil will be graded and seeded if it is to be stored for long periods. In most cases at the Energy Mines, topsoil will be taken from directly ahead of the stripping operation and spread over the graded spoil behind the mining area.

Overburden removal

Overburden removal is accomplished in a somewhat different method at each of the two mines. At both mines, however, the first step following removal of the topsoil is drilling and shooting of a section of the overburden. Blast holes are drilled with rotary drill units on a predetermined pattern based on overburden thickness and characteristics. Commonly, an 18x18 foot pattern is used at the mines. The holes are then loaded with an ammonium nitrate-fuel oil (ANFO) mixture, primed, and detonated using primacord. After shooting, drilling begins in the next section. The size of the section that is drilled and shot depends on the method of overburden removal.

The area strip mining technique is used for overburden removal at Energy 1 Mine. Overburden is presently being stripped to 60 and 70-foot highwalls with a dragline equipped with a 14-yard bucket, and another with a 21-yard bucket, respectively. Following blasting of the overburden, the shot material is leveled and a bench is prepared for the dragline by caterpillar bulldozers. The dragline works from this bench, casting the shot material into the previous mined-out pit, or during the first or box cut, onto previously undisturbed ground. As the coal is uncovered from a particular bench by the dragline, the highwall is scaled by the bucket and is also dragged with a heavy chain attached to the bucket prior to moving to the next bench. This helps prevent loose material from falling on pit crews

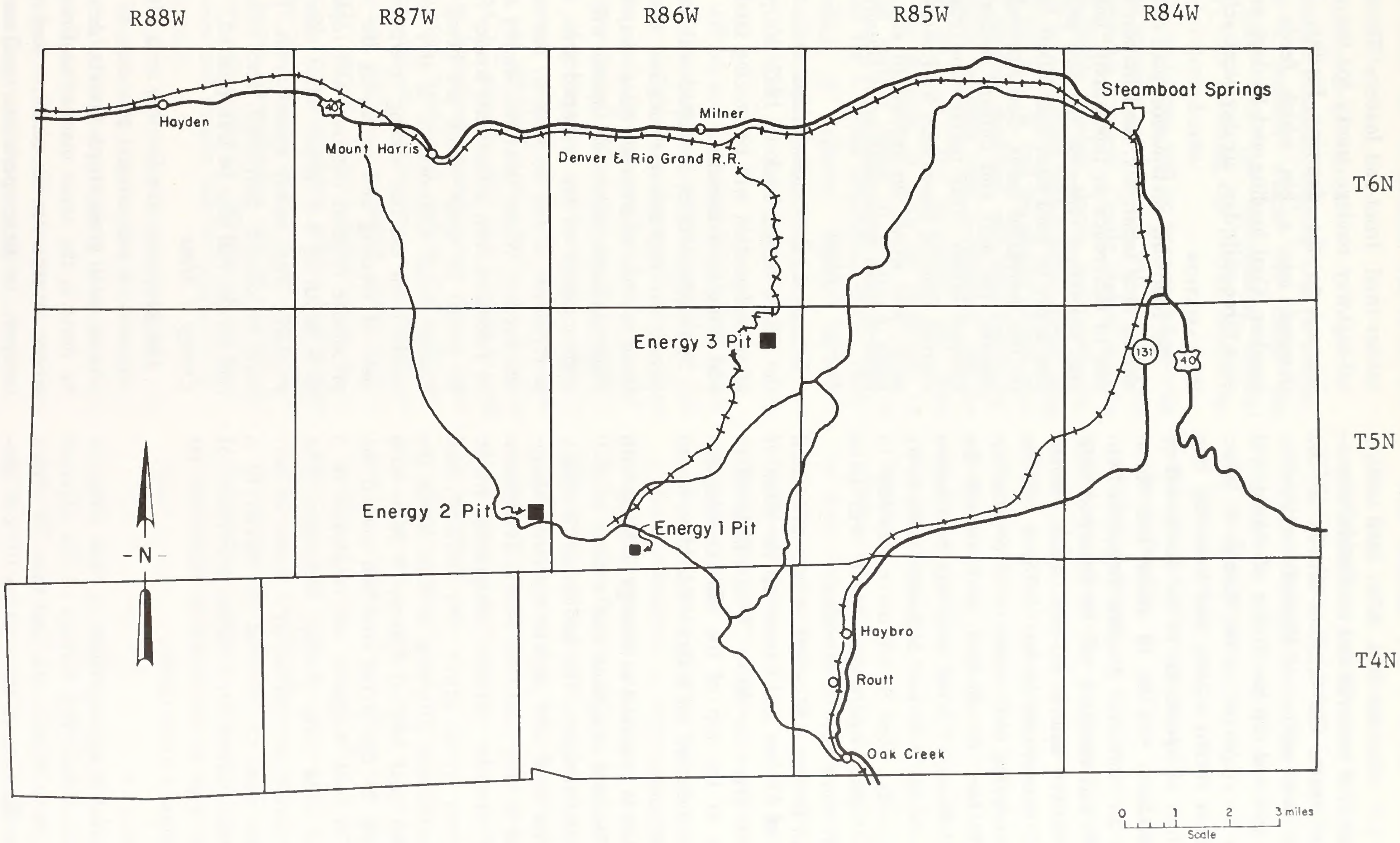


FIGURE EI-4

Location map of Energy Fuels Corporation mines.

which follow to mine the coal. After each section of shot material is removed and cast aside, exposing the coal seam, the dragline moves up the slope to the next section of blasted overburden. Both strike line and dip line forms of mining will continue to be employed at the Energy 1 Mine. Although most recent mining has been dip line form, initiation of operations to the southwest of present operations will be of strike line form. Delivery of an additional dragline began in September 1975; this machine will be equipped with a 55-yard bucket and a 325-foot boom. When erected and operational in late 1976, it will be capable of stripping coal seams to an overburden depth of 120 feet. It will first work around the perimeter of Energy 1 Mine removing overburden from the standing 60–70-foot highwall levels to its 120-foot capacity. Then it will move downdip to the other dragline operation, which will have moved to the southwest by this time.

The pits at Energy 1 Mine are at present carried on a width of 85 feet and extend up the pitch of the coal seam from the 60 or 70-foot highwall to the outcrop at the top of the hill. Overburden removal is conducted on a three shift/day, seven day/week schedule.

Overburden is removed at Energy 2 Mine with two small 7½-yard draglines and a fleet of D-9 caterpillars and scrapers. The additional flexibility of the rubber-tired and crawler-mounted equipment is used to strip coal with erratic overburden depths and irregular surface topography where dragline access would prove very difficult, and therefore inefficient. Stripping is done along the strike of the coal bed at Energy 2 Mine and progresses up the dip of the coal bed toward the east. The 7½-yard draglines are employed in a conventional area strip mining technique. The scrapers excavate overburden in a series of narrow, shallow pits. Overburden is moved to a previously undisturbed area during excavation of the first pit, and to the previous mined-out pit during subsequent excavations.

COAL REMOVAL

Coal removal is accomplished at both mines in much the same way. The surface of the exposed coal in the pit is cleaned off, and then 2¼′ holes are drilled to the base of the coal on 10′ x 5′ centers. These holes are then loaded with ANFO, and a stick of NOTRO-STARCH, and shot with primacord. Coal excavation is accomplished with rubber-tired, front-end loaders. These loaders fill off-highway haulage trucks for the one-two mile journey to the dumping facility. The coal is dumped into a bin which feeds the primary crusher. Coal loading and haulage are performed on a three-shift/day, six-day/week schedule.

RECLAMATION

The following reclamation plan deals with each mining area separately. Reclamation varies by site due to difference in topography, land use, soils, and vegetation types on the two areas. Practices that apply to both sites will follow the discussion on the individual areas. See Appendix D, Reclamation, for past and current reclamation at the Energy Mines. This reclamation plan applies to current Federal leases held by Energy Fuels Company, and would be applied to any future competitive lease application areas acquired.

Energy 1 Mine

Energy 1, the original mine area, has some of the spoils dating back to 1962. Its proposed use after reclamation will be grazing land for wildlife and domestic livestock.

Spoil piles will be reshaped with track-mounted dozers to approximate original contours, after there are two overburden piles away from the cut. Eight-eighteen inches of topsoil will be replaced with scrapers on the reshaped area. After topsoil is replaced, it will be shaped, disced, harrowed, and seeded. Where possible, shrubs and trees will be relocated with a front-end loader from areas to be mined to areas which are being revegetated. Energy Fuels Corporation is also reclaiming the spoils from the old mining operation. This consists of leveling and reshaping the spoils to approximate original contour, and replacing topsoil to a depth of 4–6 inches when excess topsoil is available from newly mined areas. The area will then be disced, harrowed, and reseeded. Trees and shrubs will also be transplanted.

Energy 2 Mine

The proposed use for this area after mining is cropland; it will consist primarily of the production of small grain crops. Overburden shaping will be done in the same manner as Energy 1 except where overburden is shallow and removed by scrapers. In these operations spoil material will be placed in its final shape by scrapers. Topsoil will be replaced, prepared, and seeded as at Energy 1 on a continual basis or from stockpiles. Time lag between stripping and reclamation will be approximately one year.

Practices utilized at all mines

To the extent possible, shaping will be accomplished in a manner which will blend the reclaimed land with the surrounding natural topography, thus lessening the overall scenic impact on the projected area.

Reshaping the slopes will be accomplished with tractors and scrapers, and topsoil will be replaced with rubber-tired scrapers. Grade stakes will be used to facilitate topsoil depth measurements. Topsoil will be smoothed with tractors using drag chains and rail ties. It will be disced or chiseled to create a suitable seed-bed, and then harrowed. The degree of leveling and roughening will be determined by use; for example, on land reclaimed for grazing, it may be desirable to roughen the surface more to create a diverse microclimate for a better vegetative cover. However, leveling of replaced topsoil on land reclaimed to farmland is very desirable and necessary to produce a favorable surface for crop production.

Seeding will be accomplished with a drill where topography is amenable to farm machinery, and seeds will be drilled to a depth of one-half to three-fourths inch. At present the following species are planted on all affected areas: intermediate wheatgrass (*Agropyron intermedium*), smooth brome (*Bromus inermis*), orchard grass (*Dactylis glomerata*), and alfalfa (*Medicago sativa*). Seeding rates of 8:4:2:2 pounds pure live seed/acre will be used; on broadcast seeded areas these rates will be doubled. Additional and/or alternate species will be utilized as site, use, and supply indicate. Seeding will be conducted preferably in fall or early spring. Where reclamation is to achieve range type conditions, native shrubs and trees will be transplanted with a front-end loader and/or by hand. Transplanting will be carried out when species are dormant. Planting of some introduced trees and shrubs will be conducted on a site specific basis.

If weeds start to invade areas reclaimed for cropland, control will be conducted by either mechanical or chemical methods, depending on the area and severity.

It is anticipated that mulch will not be required on most surfaces to be reclaimed; however, hydromulching may be used on areas with steep slopes, but these areas would be minimal.

Soil samples will be taken randomly on sites that have been reshaped and topsoiled. These samples will be submitted to the soil laboratory at Colorado State University for analysis and fertilizer recommendations. Recommended fertilizer applications will be applied in early spring following the first growing season.

Topsoil will be removed from areas to be mined and applied directly to areas to be reclaimed where feasible. It will be stockpiled when the mining sequence, or soil moisture and temperature conditions do not permit immediate placement. When it is stockpiled it will be segregated from any spoil material; furrows will be constructed at the slope toe to prevent possible water contamination. Topsoil piles will be roughened and seeded with a fast-growing plant to facilitate moisture retention, decrease erosion, and nutrient leaching.

No overburden bore holes have been sampled to date, but plans are being made to sample and analyze strata during the summer of 1975. The results of these analyses will be helpful in determining the best methods for overburden segregation if required.

All overburden shaping will be accomplished on a slope calculated to minimize erosion and sedimentation, prevent landslides, and control flooding. Contour furrows will be made at the slope toe of topsoil and overburden piles to trap sediment.

All toxic material, debris, refuse, or material constituting a fire hazard will be buried in the pits in a manner to prevent contamination of ground or surface water.

The four streams in the present mining area will be monitored; they will be sampled monthly above, below, and within the mine areas as weather permits. Any surface water generated into the pits will be pumped into evaporation ponds. This monitoring program will be used to check the possibility of downstream contamination and to comply with standards set by the Colorado Water Quality Commission.

Miscellaneous practices

Warning signs will be placed around all areas which might constitute a threat to human safety.

All reclaimed areas will be fenced with a livestock-proof fence. Reclaimed areas will be restricted to grazing until after the second growing season, at which time grazing will be permitted on a limited and regulated basis with the approval of the Open Mine Land Board's recommendation.

All appropriate governmental and private agencies will be consulted as necessary to accomplish the best possible and most economical reclamation.

Surface facilities

In order to support the mining operation and provide a marketable coal product, related auxiliary facilities and services are required; these facilities are described hereafter. All of the company's surface facilities are constructed on private surface land.

Roads

All haul roads at Energy 1 Mine are constructed on the bottom of the pit or on regraded spoils. Haul roads at Energy 2 are generally located on the bottom of the pit or across land on the up-dip side of the pit that will be mined in the future. Haul roads are watered when necessary to control fugitive dust in compliance with air pollution standards set by the Colorado Air Pollution Control Commission.

Railroad spur and coal loading

Access to coal preparation plants and markets is provided by a 12-mile spur line of the Denver and Rio Grande Western (D. & R.G.W.) railroad from Milner, Colorado. Unit-trains of specific size are gravity-loaded from the coal stockpile. The older plant near Energy 1 Mine, now infrequently used, crushes and loads directly into cars which are moved by a tugger hoist. The new loading facility serving Energy 1 and 2 Mines has a loading rate of approximately 100 tons/minute.

Power

Electric power for the mine shops, electric draglines, crushing station, and loading facilities is supplied to Energy 1 and 2 Mines from an existing 69-kv transmission line.

Crushing plants

Two 2-stage crushing and screening plants are available for use at the Energy 1 and 2 Mines. The older of these two plants has a capability of processing 500 tons of coal/hour, while the second plant, operating together with the new unit-train loading facility, is operating at rates of 1,800 tons/hour.

Crushed coal storage

A total combined storage capacity of 100,000 tons of sized coal is available at the new Energy 1 and 2 unit-train loading facility. Unit-trains of 58, 44, or 40 cars are loaded; present haulage profiles over the Rocky Mountain front range corridor limit the size of the unit-trains to 58 cars.

Office complex and maintenance facilities

The office complex, shop, and warehouse are located on private land in Sections 29 and 32, T.5N., R.86W. Administrative, payroll, and staff personnel are housed in offices near the shop. Basic mine scheduling, reclamation, and safety activities are coordinated by a resident staff. Heavy mobile equipment, such as drills, front-end loaders, haulage units, and dozers are generally taken to the newly constructed maintenance facility for servicing and repairs. Five large bays, equipped with overhead mobile and floor-mounted stationary cranes, are available to accommodate all heavy equipment taken into the shop. A warehouse building adjacent to the shop complex provides storage for operating supplies and repair parts.

Mining, loading, and reclamation equipment

Table EI-1 contains a summary of the company's current equipment fleet and equipment now on order.

TABLE EI-1

Current Equipment Fleets

Fleet	Number	Capacity
Dozers	9	--
	1	--
	5	--
	1	--
	1	--
Total Units	17	
Haulage Trucks	4	65-Ton
	8	50-Ton
	2	35-Ton
Total Units	14	
Draglines	1	21-Yard
Currently being constructed	1	55-Yard*
	1	14-Yard
	2	7 1/2-Yard
Total Units	5	
Overburden Drills	2	9-Inch
	3	7 7/8"
Total Units	5	

Fleet	Number	Capacity
Coal Drills	4	2 1/2"
Total Units	4	
Coal Loading Units	1	14-Yard
	2	10-Yard
	2	7-Yard
Total Units	5	
Road Graders	2	--
Total Units	2	
Scrapers	2	15-Yard
Total Units	2	
Water Trucks	1	--
Total Units	1	
Fuel Trucks	1	--
Total Units	1	
Lubrication Trucks	2	--
Total Units	2	

* Second on order for 1979

Mining sequence

Present mining operations will continue at the Energy 1 and 2 pits. Mining will continue north and west at the present Energy Strip 1 Mine. The

14-yard and 21-yard draglines will remove overburden to their respective depth limits of 60 and 70 feet. When the new 55-yard dragline becomes operational in late 1976, it will work around the perimeter of the Energy 1 Mine, removing overburden from the existing 60-foot to 70-foot highwall level to its capacity of 120 feet. Mining operations will also expand southwest with the 14-yard dragline opening a new boxcut in Section 17, T.4N., R.86W., as depicted in Figure EI-1. This machine will work its way across Section 17 into Section 18 where it will concentrate on removing overburden up to a 60-foot highwall during the next five years. The 21-yard dragline will follow the 14-yard dragline into Section 17 and will work in an adacent area east of the 14-yarder, cleaning up both Sections 17 and 18 to the Wadge cropline in an area where stripping depths commonly exceed 60 feet. By 1979, the present Energy Strip 1 pit in Sections 32 and 33, T.5N., R.86W. will be mined out and all mining at Energy 1 will be confined to Sections 8, 17, and 18, T.4N., R.86W. By 1980, this area will also be mined out, and operations will again need to be expanded southwest into Sections 18 and 19, T.4N., R.86W. on Federal land for which Energy Fuels has made lease application.

Mining operations at Energy 2 Mine have expanded from private land in Sections 24 and 25, T.5N., R.87W. into Federal lease land in Sections 19 and 30, T.5N., R.86W. The company has also made application for additional Federal land in Sections 25 and 19 (C-20900) to be mined, if acquired, in conjunction with currently held lands. The company has filed an application for Federal land in Sections 27 and 28, T.5N., R.86W. and Section 36, T.5N., R.86W., which, if acquired, should extend the life of the Energy 2 Mine by at least two years into the early 1980's. The mine sequence is depicted in Figure EI-1.

The April 30, 1975 mine plan describes in detail the mine method and sequencing on Energy's competitive lease applications C-16284 and C-20900 (see Figure EI-1) and describes in a general way the mining plan for competitive lease applications C-9968, C-22677, and C-22644. The five competitive lease applications and their respective acreages and tonnages are listed below. A legal description of each is shown in Appendix D.

Competitive Lease Application	Date Filed	Acreage	Reserves Strip	Reserves Underground
C-16284 1/	5-9-72	80.00	366,154	1,408,597
C-20900 2/	5-23-74	419.87	1,503,623	6,132,200
C-9968 1/	11-7-69	320.00	4,176,518	3/
C-22677	4-30-75	644.26	3/	3/
C-22644 2/	5-1-75	678.02	3/	6,179,962

1/ Total tons in place

2/ Recoverable tons

3/ No report

Competitive lease application C-20900 is located in Section 19, T.5N., R.86W. and Section 25, T.5N., R.87W. on land contiguous to present pits at Energy 2. The surface of this land is privately owned while the coal is reserved to the government. If acquired, the company plans on stripping coal from this lease area with two 7½-yard draglines, supplemented by a scraper and dozer fleet. A production schedule submitted by the company shows that a portion of the coal lying within the Section 25 parcel was proposed to be mined in 1975.

Competitive lease application C-16284 lies adjacent to Energy 1 in Sections 33 and 34, T.5N., R.86W. The surface of Section 33 is privately owned and the coal is federally owned, while both surface and coal in Section 34 is federally owned. This acreage is a continuation of the Wadge seam down a steep downwarp of the strata into the Twenty mile synclinal structure. The mine plans show how the coal in this tract would be stripped, if acquired; this action was originally scheduled to occur in 1976 and 1977, to be mined by the new 55-yard dragline. Pits would generally be along the dip of the bed. The dragline would enter the tract from coal lease D-052547 which lies adjacent to the west side of the tract. In anticipation of the leasing of this tract to Energy Fuels, the company has moved Routt County Road 27 to go around its operations; access is thereby attained for mining underlying coal to a 120-foot highwall.

The mining plans for Energy Fuels competitive lease applications C-22644 and C-22677 are described in their respective applications. Coal from these two leases, as well as C-9968, if acquired by Energy Fuels, will be mined for the most part during the period 1980-1990.

Competitive coal lease applications C-22644 and C-9968 are located in Sections 18, 19, and 30, T.4N., R.86W. on land that borders present lease C-081330. The surface of the land is privately owned and the coal federally owned. If the leases are acquired, the company will open a boxcut in Section 18 with the 14-yard dragline; mining would then progress into Section 19. A strike line form of the area strip mining method would be employed. The 14-yard dragline will be excavating overburden in coal lease C-081330 until 1980, so would not be available for stripping in the application areas until that time. Prior to the start of operations in these lease application areas, a new five year plan would be prepared.

Competitive lease application C-22677 is located in Sections 27 and 28, T.5N., R.86W., and in Section 36, T.5N., R.87W. All of the land encompassed in this application is privately owned surface and Federal coal. The areas requested to be put up for public auction are considered probable strip areas on the Fish Creek coal seam. If this area is put up for auction and Energy Fuels is the successful bidder, the company will mine the lease application areas in a similar manner to the present Energy 2 Mine.

Transportation and marketing

Coal is loaded from the storage areas directly into 40, 44, or 58-car unit-trains for shipment to market. Public Service Company of Colorado currently receives 80 percent of Energy Fuels production. Most of the remainder of Energy Fuels' scheduled production is shipped to St. Louis to Amherst Industries, Inc., a West Virginia-based marketing firm. Additional small amounts of coal are shipped elsewhere.

Relationship to Other Developments in Immediate Area

There are presently three other coal operators actively mining coal in the immediate vicinity. Pittsburg and Midway Coal Mining Company is mining coal from Edna Strip Mine located three miles east of Energy 1 Mine. Routt Mining Corporation has a small underground operation three miles south of Energy 1 Mine. Peabody Coal Company is presently mining at the Seneca 2 Mine about eight miles northwest of Energy 1. Peabody's Seneca 2-W Mine area, scheduled to begin operation in the future, is located approximately 13 miles northwest of Energy 1 Mine. These operations are little related as they serve different markets and do not lie immediately adjacent to one another. Energy Fuels and Pittsburg and Midway use separate spur trackage, but the same railroad (D. & R.G.W.), for transportation of their coal over the Rocky Mountains; however the railroad can adequately handle increased volume of traffic. Expansion of Energy Fuels' mining operations should have little effect on the other coal producers in the immediate area.

Several companies and individuals have indicated their intent to begin coal mining operations in the vicinity of Energy Fuels in the very near future or within the next few years. Thomas Woodward and Paul Coupey both plan mining operations on private land nine miles northeast of Energy 1 Mine. Mapco Incorporated owns a large State lease immediately north of the Energy 1 and 2 complex. Coal Fuels Corporation has made application for a Federal lease located five-eighth mile northwest of Energy 1 with intentions of opening a large underground mine. Energy Fuels' continued operation and expansion should have little effect on these proposed developments.

Three existing and one proposed transmission lines pass through the Energy 1 and 2 area. The 230-kv Hayden-Toponas line and the 138-kv Hayden-Oak Creek line pass through Energy Fuels competitive lease application C-22677 area. In addition the proposed 230-kv Hayden-Wolcott transmission line will pass through this corridor. A 69-kv Yampa Valley Electric Association line once passed through Energy Fuels Federal leases C-081330 and D-052547; this line was rerouted to circumvent planned expansion of the Energy 1 Mine. It is the usual procedure in areas where transmission lines and strip pits conflict to reroute the transmission line; in some instances, the utility company may be forced to compensate the mining operator for coal that is lost by failure to reroute the line.

Chapter II

Description of the Environment

THE FOLLOWING SECTION DESCRIBES THE PHYSICAL, BIOLOGICAL, AND CULTURAL RESOURCE VALUES WHICH CONSTITUTE THE SITE-SPECIFIC ENVIRONMENT IN WHICH ENERGY FUELS CORPORATION PROPOSES TO DEVELOP FEDERAL COAL. THE DESCRIPTION FOCUSES ON ENVIRONMENTAL DETAILS MOST LIKELY TO BE AFFECTED BY ENERGY FUELS CORPORATION'S PROPOSED ACTION AND ALL REASONABLE ALTERNATIVES. ALTERATIONS OF THESE EXISTING RESOURCE VALUES WOULD RESULT FROM THE IMPLEMENTATION OF THE CORPORATION'S PROPOSAL.

Non-living Components

Geologic and Geographic Setting

Topography

Energy Fuels Corporation's Number 1 surface mine occupies a long high ridge that trends northeasterly. The ridge has a steep southeast escarpment ending at Middle Creek. The northwest slope is gentle and uniform to Foidel Creek, a distance of 1.5–1.7 miles.

Energy 2 Mine is operating on the northwest foot of a gentle slope toward Fish Creek. The slope merges into the open and gently undulating upper part of Twentymile Park.

Stratigraphy

Except for surficial deposits, only the coal-bearing Mesaverde Group and overlying Lewis Shale are at the surface in the area of this report (Bass, Eby, and Campbell 1956). A brief report on stratigraphy of the Steamboat Springs area by T.G. Larson (1955) describes rocks down to Precambrian, mostly from an oil test hole at Tow Creek (sec. 18, T.6N., R.86W.). Stratigraphy is discussed in Description of the Environment, of the Regional Analysis of this Environmental Impact Statement. Figure EII-1 shows the pertinent part of the coal-bearing rocks.

The only coal-bearing strata in the area are the Iles and Williams Fork Formations of the Mesaverde Group (Figure EII-1). Only beds of the Williams Fork Formation are at the surface, except along Middle Creek (E ½ and E ½ SW ¼, Section 9; SE ¼ and SE ¼ SW ¼ Section 17; and E ½ and SE ¼ SW ¼ Section 19, T.4N., R.86W.). The Iles Formation underlies the Williams Fork. The coal currently being mined at Energy Fuels 1 Mine is the Wadge coal bed of the middle coal group, and the mined bed at Energy 2 Mine is the Fish Creek coal bed of the upper coal group, both of the Williams Fork Formation.

The Trout Creek Sandstone Member of the Iles Formation, a cliff-forming white sandstone about 100 feet thick, and the Twentymile Sandstone Member of the Williams Fork Formation, a 100-200 foot thick, white, cliff-forming sandstone unit, are prominent markers throughout this coal-bearing area.

Alluvium of Quaternary age is present mostly along the main streams; its thickness and nature are not well known; it consists mainly of sand, silt, and lesser amounts of gravel.

Structure

Energy 1 Mine is on the northwest flank of a north-northwest plunging asymmetrical anticline, the Trout Creek (formerly Oak Creek) anticline. Beds on the flank of the anticline at Energy 1 Mine dip about 15° on the average; however, they vary from about 8°-16° in dip. Another synclinal axis trends due north, about one mile west of the lease area of Energy 1 Mine, then swings northeast just outside the area of Energy 2 Mine to join the other eastern synclinal axis and continue northward as the Twentymile Park syncline. Dip of the beds in the Energy 2 Mine area is low, averaging about 3°-5°.

At the Energy 1 Mine and southwest, the northwest flank of Trout Creek anticline is broken by at least ten northwest-trending normal faults, almost all down-thrown on the southwest side. Vertical displacements range from less than one to possibly more than 50 feet. It is probable that coal mining in the area will reveal many more (Bass, Eby, and Campbell 1956). The area most affected by these faults, as far as coal mining is concerned, is in Section 8, T.4N., R.86W., where displacement is greatest and where there are either two faults creating a graben, or more than two faults and cross-fractures, with a consequent complex fracturing of coal and other rocks.

Geomorphology

Landscape character in and near the Energy mine sites results mostly from moderate folding of strata followed by differential erosion of interbedded hard and soft layers of various thicknesses. Figures EII-2 and 3 show the geology and character of the landscape.

An unpublished photogeology interpretation map by Roger B. Colton, USGS, shows possible landslide or slump areas on Energy 1 slope, particularly in Sections 8 and 18, T.4N., R.86W. These probably are mostly or entirely soil creep landforms and/or small composite landslides; they may result from water saturation of areas where bedrock is broken up by faults and fractures. This same map shows possible landslides in Energy 2 area also, around and mostly north of the common corner of Sections 19 and 30, T.5N., R.86W., and Sections 24 and 25, T.5N., R.87W.

Paleontology

The coal-bearing Iles and Williams Fork Formations, overlain in places by the Lewis Shale (see Geologic Map, Appendix A), are known to con-

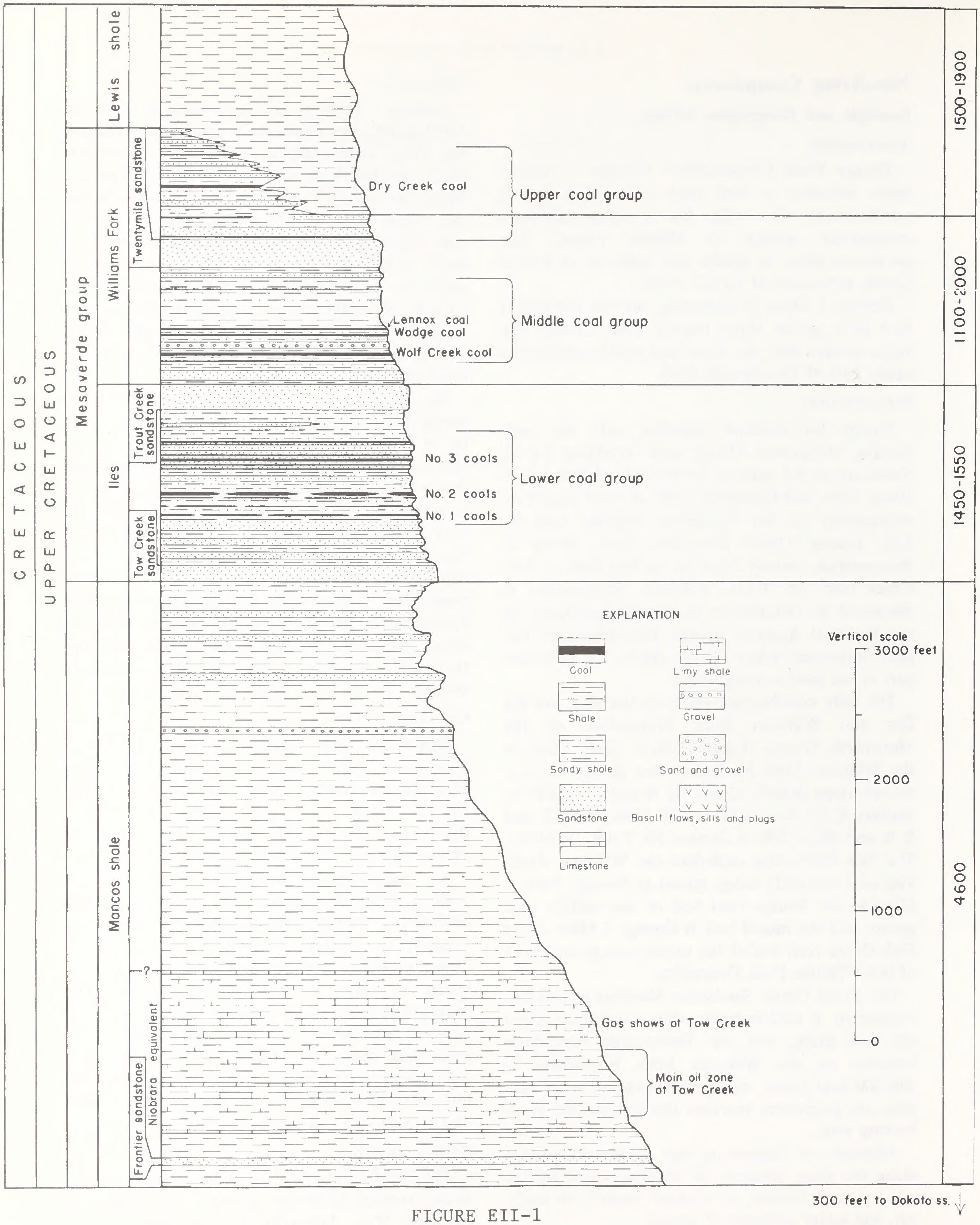


FIGURE EII-1

Coal-bearing formations in Energy 1 and 2 Mine areas.

SOURCE: U.S. Geological Survey Bulletin 1027

FIGURE EII-2

Aerial oblique photograph looking east at Energy 1 Mine area (Ki, Iles Formation; Kit, Trout Creek Sandstone Member; Kwf, Williams Fork Formation; Kwt, Twentymile Sandstone Member; M, active mining area; ms, mine spoil piles and RR, railroad).

FIGURE EII-3

Aerial oblique photograph, looking southwest, of the Energy 2 Mine area (Kwf, Williams Fork Formation; Kls, Lewis Shale; Qal, alluvium; am, abandoned meander; ms, mine spoil pile).

TABLE EII-1

Analysis of Coal Samples from Localities near Energy Fuels Corporation Mines

(Made at the Pittsburg laboratory of the U.S. Bureau of Mines. Form of analysis: A, as received; B, air dried; C, moisture free; D, moisture and ash free)

Mine and location	No. on map	Location in mine	Coal bed and group	Formation	Lab. no	Air-drying loss	Form of analysis	Proximate: Moisture	Proximate: Volatile matter	Proximate: Fixed carbon	Proximate: Ash	Ultimate: Sulfur	Ultimate: Hydrogen	Ultimate: Carbon	Ultimate: Nitrogen	Ultimate: Oxygen	Heating value: Calories	Heating value: Btu
Middle Creek mine of Frank Gould, NW¼ sec. 10, T. 4 N., R. 86 W.	46	Face of main entry, 390 ft from portal.	Wolf Creek, upper bench, middle coal group.	Williams Fork	C58119	2.7	A	7.7	40.9	45.3	6.1	.6	5.7	67.4	1.5	18.7	----	11,940
							B	5.2	42.0	46.5	6.3	.6	5.5	69.3	1.5	16.8	----	12,270
							C	----	44.3	49.0	6.7	.6	5.2	73.1	1.6	12.8	----	12,940
							D	----	47.5	52.5	----	.7	5.6	78.3	1.7	13.7	----	13,860
Do	46	do	Wolf Creek, lower bench, middle coal group.	do	C58120	2.5	A	7.8	39.4	43.9	8.9	.4	5.5	64.5	1.3	19.4	----	11,440
							B	5.4	40.4	45.0	9.2	.4	5.4	66.2	1.4	17.4	----	11,730
							C	----	42.7	47.6	9.7	.4	5.1	70.0	1.5	13.3	----	12,400
							D	----	47.3	52.7	----	.5	5.6	77.5	1.6	14.8	----	13,740
Apex mine, SW¼ sec. 22, T. 4 N., R. 86 W.	52	600 ft north, 150 ft west of portal; 25 ft in by room no. 6.	No. 2?, lower coal group.	Iles	B34464	3.5	A	7.7	36.4	50.1	5.8	.6	5.7	68.7	1.5	17.7	----	12,150
							B	4.4	37.7	51.9	6.0	.6	5.5	71.2	1.6	15.1	----	12,590
							C	----	39.4	54.4	6.2	.7	5.2	74.4	1.6	11.9	----	13,160
							D	----	42.0	58.0	----	.7	5.5	79.4	1.7	12.7	----	14,040
Greenhalgh prospect, face of drift 54 ft from portal, NE¼ sec. 32, T. 5 N., R. 86 W.	99a	Strip mine	Wadge	Williams Fork	C73282	5.6	A	10.1	35.7	48.4	5.8	.5	----	----	----	----	----	11,670
							B	4.7	37.9	51.3	6.1	.5	----	----	----	----	----	12,360
							C	----	39.7	53.9	6.4	.5	----	----	----	----	----	12,970
							D	----	42.5	57.5	----	.5	----	----	----	----	----	13,860
Greenhalgh shaft, NE¼ sec. 32, T. 5 N., R. 86 W.	99b	----	do	do	E74290	5.0	A	11.1	35.0	47.5	6.4	.5	----	----	----	----	----	11,380
							B	6.4	36.8	50.1	6.7	.5	----	----	----	----	----	11,980
							C	----	39.4	53.5	7.1	.6	----	----	----	----	----	12,800
							D	----	42.4	57.6	----	.6	----	----	----	----	----	13,790
Hutchinson mine, 6 miles southeast of Milner, SE¼ sec. 12, T. 5 N., R. 86 W.	89	10 ft from surface	Wadge, middle coal group.	do	1832	6.2	A	12.5	35.2	46.9	5.4	.42	5.83	63.25	1.43	23.63	6,135	11,050
							B	6.7	37.5	50.0	5.8	.45	5.48	67.43	1.52	19.32	6,545	11,780
							C	----	40.2	53.6	6.2	.48	5.07	72.29	1.63	14.31	7,015	12,630
							D	----	42.8	57.2	----	.51	5.41	77.08	1.74	15.26	7,480	13,460
Hutchinson mine of Tom Chergo, 6 miles southeast of Milner, NW¼NE¼ sec. 13, T. 5 N., R. 86 W.	90	----	do	do	31038	4.0	A	12.8	37.2	44.4	5.6	.43	5.77	63.26	1.49	23.46	6,130	11,030
							B	9.2	38.7	46.3	5.8	.45	5.54	65.90	1.55	20.74	6,386	11,500
							C	----	42.6	51.0	6.4	.49	4.99	72.57	1.71	13.83	7,030	12,660
							D	----	45.5	54.5	----	.52	5.33	77.54	1.83	14.78	7,515	13,530
Arthur mine (later known as Edna) of John Arthur, SW¼ sec. 24, T. 4 N., R. 86 W.	57	Face of left entry, 425 ft from mouth.	Wadge, middle coal group.	do	A34345	2.7	A	10.1	38.4	43.5	8.0	.6	5.9	63.0	1.4	21.1	6,228	11,210
							B	7.5	39.5	44.8	8.2	.7	5.7	64.7	1.5	19.2	6,400	11,520
							C	----	42.7	48.4	8.9	.7	5.3	70.0	1.6	13.5	6,922	12,460
							D	----	46.9	53.1	----	.8	5.8	76.8	1.8	14.8	7,600	13,680
Johnnie's mine, NE¼ sec. 33, T. 4 N., R. 86 W.	68	Tipple sample (5 tons)	Lower coal group	Iles	C78023	1.4	A	8.4	39.0	48.8	3.8	.5	5.8	70.1	1.5	18.3	----	12,360
							B	7.1	39.6	49.5	3.8	.5	5.8	71.1	1.5	17.3	----	12,540
							C	----	42.5	53.4	4.1	.5	5.4	76.5	1.7	11.8	----	13,490
							D	----	44.4	55.6	----	.5	5.6	79.8	1.7	12.4	----	14,070

SOURCE: USGS Bulletin 1027-D

tain fossils. Ammonites and other marine fossils occur in the Lewis Shale, and both the Williams Fork and Iles Formations contain fossil leaves, ammonites, and inoceramus clams (within interbedded shales). No specific surface exposures of fossils have been reported on the lease areas; however, no paleontology field survey has been completed for the proposed action areas.

Mineral Resources

Except for coal, no important mineral deposits are known or believed to occur on the Energy mine sites. The Energy 1 Mine is about four miles northwest of the Oak Creek oil field; this oil field is higher on the Trout Creek anticline than is the Energy 1 site. Structure does not appear favorable for oil or gas accumulation beneath any of the three Energy Fuels' mine sites. There could be oil or gas entrapment by stratigraphic control, but such targets are not now defined well enough to encourage exploration.

COAL

The mined coal bed in Energy 1 and 3 Mines is the Wadge bed of the middle coal group of the Williams Fork Formation (Figure EII-1). The mined bed in Energy 2 Mine is the Fish Creek bed of the upper coal group. Other coal beds in the Williams Fork Formation that locally may be of sufficient quality, quantity, and availability for mining are the Wolf Creek and Lennox beds. These coal beds are described in detail in the Energy Fuels Corporation's 1974-80 mine plan submitted to the USGS in November, 1974.

The Wolf Creek Seam is erratic in thickness, relatively low in Btu content (about 10,000 per pound), and below stripping depth, except perhaps in small areas southwest of the present Energy 1 Mine.

The Wadge seam is approximately 150 feet above the Wolf Creek. At Energy 1 the coal is about seven feet thick and increases to around ten feet to the southwest. Btu content of the Wadge averages about 11,200 "as received".

The Lennox coal seam, approximately 52 feet above the Wadge, is lenticular and high in sulfur. The coal is as much as 4 feet thick but usually is only 2½-3 feet thick. The 2-3 percent sulfur content is high for boiler fuel. Its Btu content is nearly 12,000 per pound.

The Fish Creek seam is about 1,500 feet above the Wadge. It is 4¼-5 feet thick. The Btu content is about 11,200. comparable to the Wadge seam.

Quality of the coal, as indicated by analyses of coal in and near the Energy Fuel Corporation mines area, is shown in Table EII- 1 The coal has been described by Bass, Eby, and Campbell (1955) as non-coking, bituminous in the middle group, and on the margin of sub-bituminous and bituminous in the upper group.

There are no detailed estimates of the reserves of coal on Energy Fuels Corporation's Federal coal leases. A report for the company, (April 30, 1975) reports on the reserves as follows:

> A detailed analysis of overburden depths, coal quality, eroded coal seams, and burnt areas has not been completed due to the lack of drilling information; however, a preliminary reserve estimate of coal occurring on lease areas 1, 2, and 3 in the Wadge and Fish Creek seams could approach 20-million tons maximum, assuming no coal voids and 90-percent mining extraction.

Calculations based on some drilling information of the company and its predecessors, and on scanty outcrop information, produced the following rough estimates of coal reserves of these two beds on parts of the company's Federal coal leases. These estimates assume the average figure of 1,800 tons per acre-foot of coal. The figures derived agree reasonably well with the 20 million ton figure (Table EII-2). An additional reserve occurs on the company's privately owned lands.

TABLE EII-2

Partial Estimate of Energy Fuels Corporation Coal Reserves

	Energy 1 Mine area. T.4N., R.86W.	
	Federal coal lease C-081330. Wadge coal bed	
Sec. 17:	440 acres. Average thickness 10.75 feet in 8 drill holes	8,510,000 tons
Sec. 18:	360 acres. Average thickness 10.9 feet in 7 drill holes	7,060,000 tons
	Energy 2 Mine area. T.5N., R.86W.	
	Federal coal lease C-081330. Fish Creek coal bed	
Sec. 20:	240 acres. Average thickness 4 feet by company estimate. . . .	1,730,000
Sec. 21:	160 acres. Average thickness 4 feet by company estimate. . . .	1,150,000

In-place resources on the five competitive lease applications included in Energy Fuels' proposal are as follows (USGS, 1976); this most recent data is in addition to that submitted by the company in their mine plan (USGS, 1976):

Competitive Lesse Application	Measured	Indicated	Inferred	Undifferentiated	Total
C-9968					
Surface				4,913,550*	4,913,550*
C-16284					
Surface	557,622	87,912			645,534
Underground	1,354,986	1,560,186	236,394		3,151,566
C-20900					
Parcel A					
Surface	552,258				552,258
Underground	14,873,922	679,212			15,553,134
Parcel B					
Surface	616,518				616,518
Underground	5,493,744				5,493,744
C-22644					
Surface				4,491,900*	4,491,900*
Underground				14,820,480	14,820,480
C-22677					
Parcel A					
Surfsce	1,093,068**	1,682,442**			2,775,510
Underground	332,946	6,144,624	6,348,024		12,825,594
Parcel B					
Surfsce	1,575,270	646,884			2,222,154
Underground	4,324,356	7,926,012			12,250,368
TOTAL	30,774,690	18,727,272	6,584,418	19,734,030	75,820,410

* An overlsp of 240 scres exists between C-9968 snd C-22644 which contains an estimated 4,491,900 tons of surface-minable coal. Precsution should be tsken not to count this coal twice.

** Surfsce-minable coal cannot be determined owing to lack of exploration data; figure shown is totsl cosl in Fish Creek coal bed, a substantisl portion of which is believed to be surface minable.

NOTE: Recoverability factors have not been applied to the above tonnages (i.e. estimates sre in-place values).

Water Resources

Ground water

At Energy 1 Mine the Wadge coal bed and associated water-bearing sandstones dip north under Foidel Creek. Ground water from the mined area is discharged by upward leakage from the coal and associated sandstones to Foidel Creek, and to an area of barren alkali-covered ground and water-loving grasses along Foidel Creek in the NW ¼ SE ¼ Section 29, T.5N., R.86W. On June 12, 1975 when measurements were made by USGS, discharge into Foidel Creek was about one-quarter-second foot or a little over 100 gallons per minute (gpm); discharge from the vegetation and evaporation from the ground surface would increase this figure. Water stands in the lower end of the Energy 1 Mine pit about 3,000 feet south and 100 feet higher than Foidel Creek. Although the water in the mine pit accumulates from both surface and ground water runoff from an area of about one square mile, the pit does not fill up nor need to be pumped; it is assumed that the water drains from the pit by natural discharge via the aforementioned path (Figure EII-4). Dissolved solids in Foidel Creek approximately doubled as the result of upward leakage into the stream. Water of similar quality and concentration to that in the mine pit would cause this change if it were discharged to the stream in the amounts that were measured. Analyses of these waters are given in Table EII-3.

The ground water discharge into and along Foidel Creek probably has increased in amount and decreased in quality as the result of mining operations. Currently, where the ground water is near the surface north of the Foidel school, salts have accumulated on the surface; a pre-mining photograph of this area does not show any salt accumulation. Chemical quality of water in Foidel Creek is not likely to be detrimental to aquatic life even during low flow conditions in late summer when upward leakage from the coal would not be diluted as much by flow of better quality water from upstream. Diversity index for aquatic insects was much the same above and below the area of discharge of poor quality water; it was low in both places probably as the result of sediment pollution resulting from road construction. Chemical quality of the water could conceivably cause a deterioration in yields from irrigated crops; however this cannot be quantified.

Spoils at Energy 2 Mine are placed downslope from the actively mined part of the area. As a result the lowest part of the mine where drainage from ground water accumulates, is upslope from the part of the mine that has been refilled with spoils (Figure EII-4). The water in this sump accumulates at a rate that requires pumping. This is done periodically, but in spring it averages about 100 gpm, roughly the same as is discharged naturally from Energy 1 Mine. Energy 2 Mine closely parallels Fish Creek, and it may be that before mining operations started, water from coal and associated sandstones discharged by upward leakage into this stream. However, spoils appear to be less permeable than unmined ground, and hence may serve as a dam to prevent movement of ground water to the stream. At Energy 1 Mine there are no spoils between the lower end of the mine and the stream.

The chemical quality of the water from Energy 2 Mine is similar to that from Energy 1 Mine, except that Energy 1 is higher in sulphate and TDS. However, the discharge of water from Energy 2 Mine into Fish Creek will have negligible effect on water quality in the stream. The amount of water pumped from the mine diminishes during the summer until there is only enough to use for

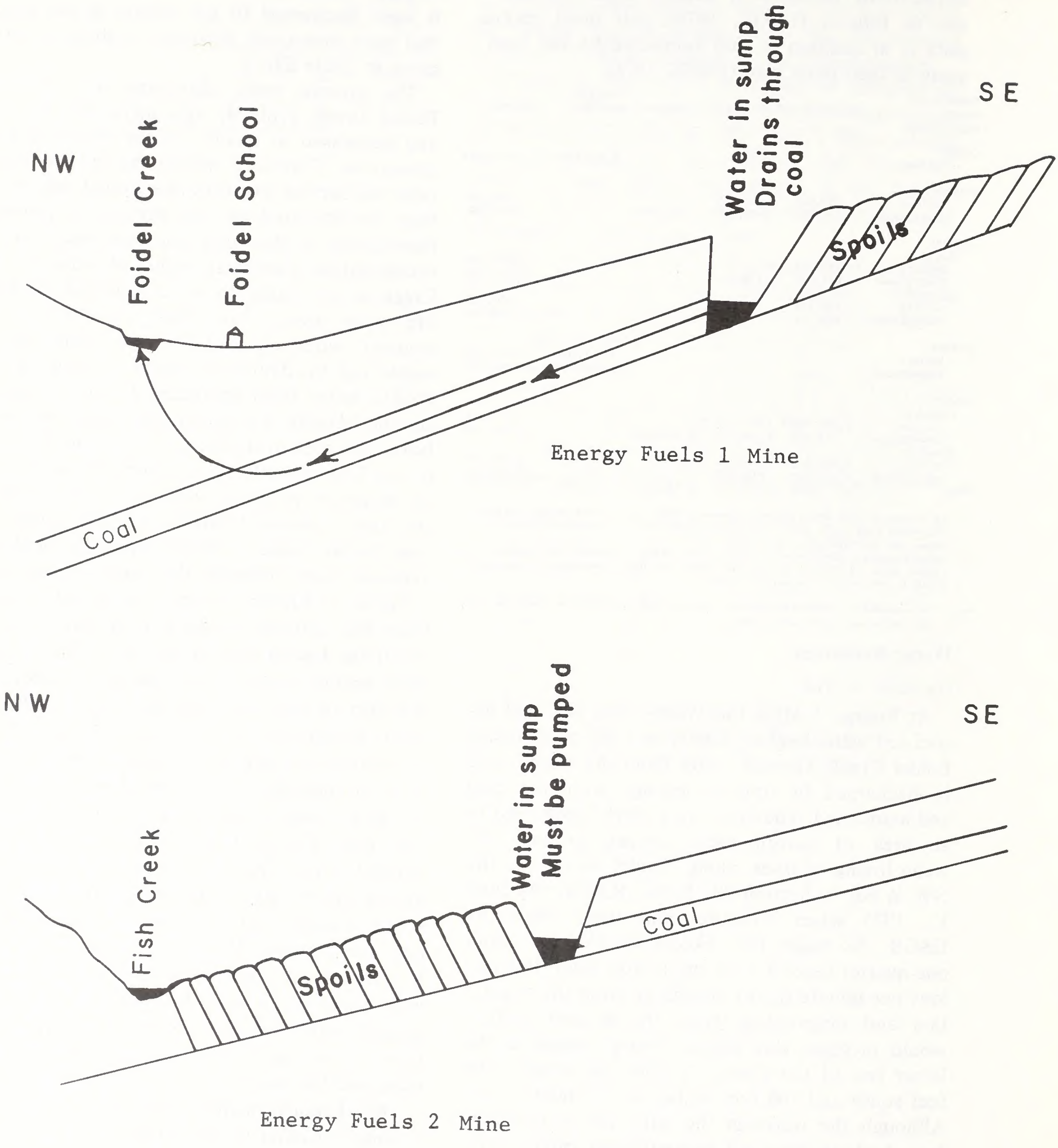


FIGURE EII-4

Hydrologic conditions at the Energy Fuels 1 and 2 Mines.

TABLE EII-3

Dissolved Solids in Selected Wells, Streams, and Mine Pits

	Consolidation Fuels Test Holes 1	2	Energy 1 Pit 3	Foidel Creek Near Tipple 4	Foidel Creek Near Foidel School 5	Energy 2 Pit 6	Monitor Well P-2 7	Seneca 2 Pit 8	Seneca 2 Shop Well 9
Calcium mg/l	37	34	410	71	140	75	64	250	200
Magnesium mg/l	21	21	180	35	71	29	77	170	77
Potassium mg/l	13	3	6	3	3	3	4	10	4
Sodium mg/l	200	190	64	19	36	44	76	160	31
Bicarbonate mg/l	710	583	217	313	305	314	518	416	557
Chloride mg/l	4	3	7	4	6	7	4	18	21
Fluoride mg/l	0.8	1.3	0.3	0.3	0.3	0.3	0.1	0.4	0.3
Sulfate mg/l	39	120	1,500	84	430	80	220	1,300	420
NO_2 + NO_3 as ND mg/l	0.01	0.02	18	0.05	1.4	13	0.00	5.0	0.07
Silica mg/l	9.6	16	5.4	8.8	5.3	11	14	5.8	14
TDS mg/l	677	676	2,360	380	848	462	720	2,140	1,050
Arsenic µg/l	0	0	0	2	1	0	0	0	0
Cadmium µg/l	0	0	1	0	0	1	0	1	4
Cobalt µg/l	0	0	0	0	0	1	0	0	0
Copper µg/l	0	0	3	3	4	5	0	0	250*
Iron µg/l	2,200	390	40	110	90	60	2,000	50	90
Lead µg/l	0	1	0	0	0	0	0	1	0
Manganese µg/l	80	0	20	70	110	80	50	70	17
Mercury µg/l	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.0
Molybdenum µg/l	0	0	1	0	0	3	0	1	0
Nickel µg/l	2	0	9	4	2	3	1	14	0
Selenium µg/l	0	0	47*	0	3	0	0	5	4
Vanadium µg/l	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Zinc µg/l	8	10	20	10	8	4	2,200*	30	20
Conductivity	1,090	1,080	2,850	600	1,200	740	1,500	2,420	1,450
pH	7.7	7.6	7.6	7.8	8.1	7.8	6.9	7.5	7.5
SAR	6.5	6.3	0.7	0.5	0.6	1.1	1.5	1.9	0.5
Water Temperature	14.5	18.0	18.5	23.0	22.0	25.0	10.0	16.0	20.5

* Excessive value (probably due to contamination of sample).

Samples collected and analyzed by USGS, 1975 (unpublished) sprinkling the haul roads; there is no discharge into Fish Creek during periods of low flow.

SURFACE WATER

Drainage and stream flow characteristics

Existing and proposed mining areas of Energy Fuels Corporation lie in the Trout Creek drainage system which heads in the panhandle area of Rio Blanco County, and flows generally north through the south-central part of Routt County to its confluence with the Yampa River near the town of Milner. Major tributaries of Trout Creek involved in the mining area are Middle Creek and Fish Creek. Foidel Creek, a tributary of Middle Creek, is also affected by existing and proposed mining operations. Figures EI-3 and 4 show the overall drainage system of Trout Creek and its tributaries. The following listing indicates the basic drainage system and tributary ranking of these major streams:

- Yampa River
  - Trout Creek
    - Middle Creek
      - Foidel Creek
    - Fish Creek

Fish and Trout Creeks generally flow continuously; during periods of low flow, ground water recharge sustains the flow. Foidel and Middle Creeks flow intermittently, according to USGS topographic maps of the area. All streams of the drainage system have small, intermittent tributaries.

Headwaters of Trout Creek are located on Mount Orno south of the mining area at an elevation of approximately 12,000 feet. Thus Trout Creek derives most of its runoff from snowmelt in June and July (Figure EII-5).

Fish Creek originates in Dunckley Flat Tops southwest of the mining property at an elevation of 10,000 feet; it too derives most of its runoff from snowmelt in May and June (Figure EII-6). The natural channel of Fish Creek lies within 100 feet of existing Energy 2 and 3 mining operations.

Monthly hydrographs (Figures EII-7 and EII-8), and yearly hydrographs (Figure EII-9) show variations in mean annual flows of both creeks.

Foidel and Middle Creeks have their sources south of the mining area at about 8,000 and 8,600 feet respectively. The streams parallel each other about two miles apart through the mining property and flow northeasterly bracketing the property (see Figure EI-2). No streamflow data are available for Foidel and Middle Creeks, but observations indicate that the streams would run briefly during snowmelt periods and heavy rains, then go dry for lack of sustaining baseflow.

Water supply and availability

Most water yield in the Trout Creek system is derived from snowmelt with about 55 percent coming in June and July. Trout and Fish Creeks contribute the major portion of total yield due to their higher headwaters and larger drainage areas. Average annual discharge at stream gaging stations on Trout Creek (1953-58) and Fish Creek (1955-70) was 19,840 and 8,910 acre-feet per year. However, these gaging stations are well upstream in the drainage pattern. The drainage area for Trout Creek at the gaging site is about 16 square miles, and for Fish Creek 34.5 square miles. The drainage area of Trout Creek above Fish Creek (including Middle Creek) is about 78 square miles, and for Fish Creek at its mouth is about 77 square miles. Thus considerably more water would be available from total drainage than is indicated at gaging stations.

Estimates of streamflow (Dames and Moore 1975) made at sites within the analysis area on September 11 , 1974 are shown in Table EII-4.

TABLE EII-4

Streamflow Estimates in Analysis Area

Stream	Location of Measuring Point	Estimated Discharge (cfs)
Trout Creek	NW1/4, NW1/4, SW1/4 Sec. 19, T5N, R85W	13
Trout Creek	NE1/4, NE1/4, NW1/4 Sec. 25, T6N, R86W	9
Fish Creek	SW1/4, SW1/4, SW1/4 Sec. 25, T5N, R87W	2
Fish Creek	NW1/4, NW1/4, NW1/4 Sec. 1, T5N, R86W	4
Foidel Creek	NW1/4, NW1/4, NW1/4 Sec. 28, T5N, R86W	1

These estimates were made by timing rate of flow over a measured distance and estimating average depth and width of stream to determine its area. Streamflow measurements on June 19, 1975, on Foidel Creek at the county road crossing in the NW ¼ SW ¼ NW ¼ Section 32, T.5N., R.86W., and below Foidel School in the NW ¼ NE ¼ SE ¼ Section 29, T.5N., R.86W., show

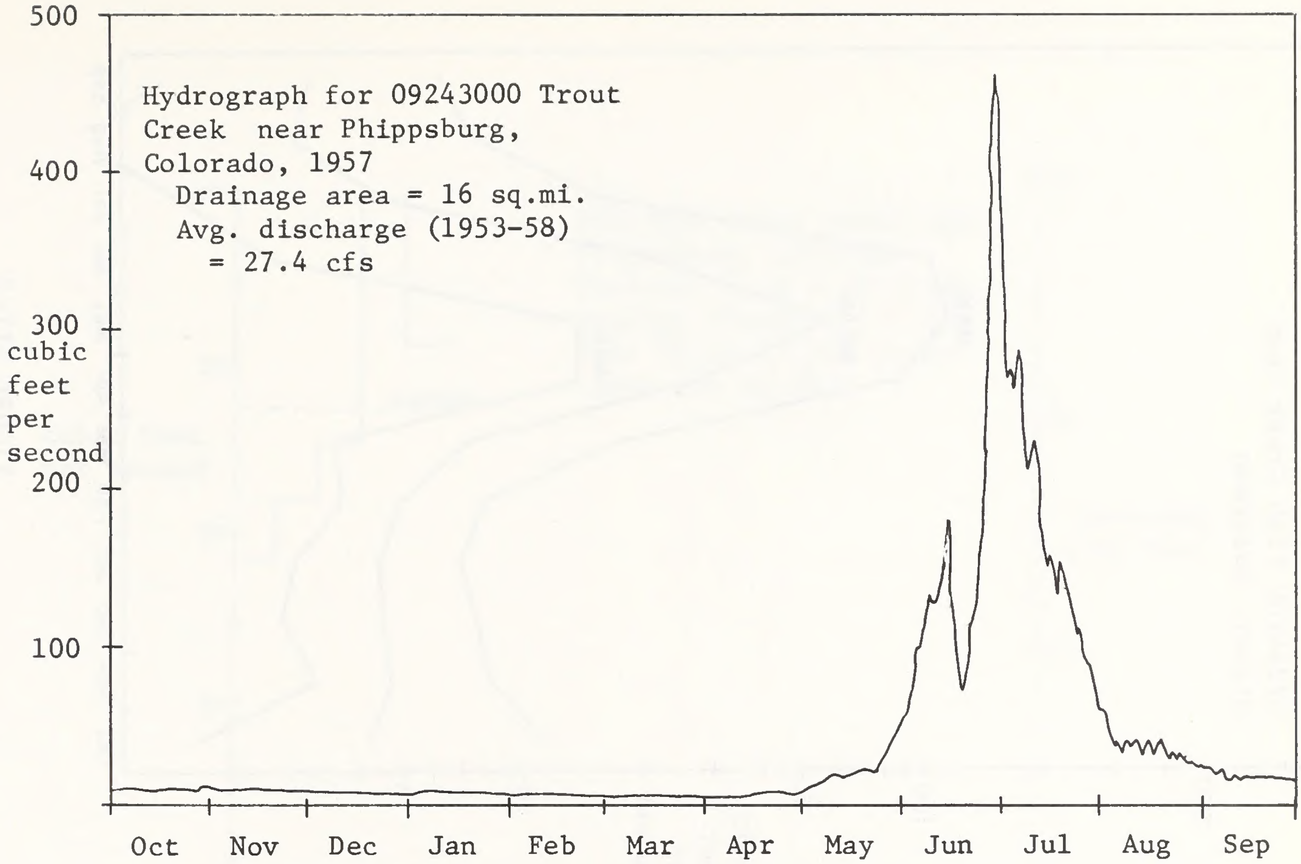


FIGURE EII-5

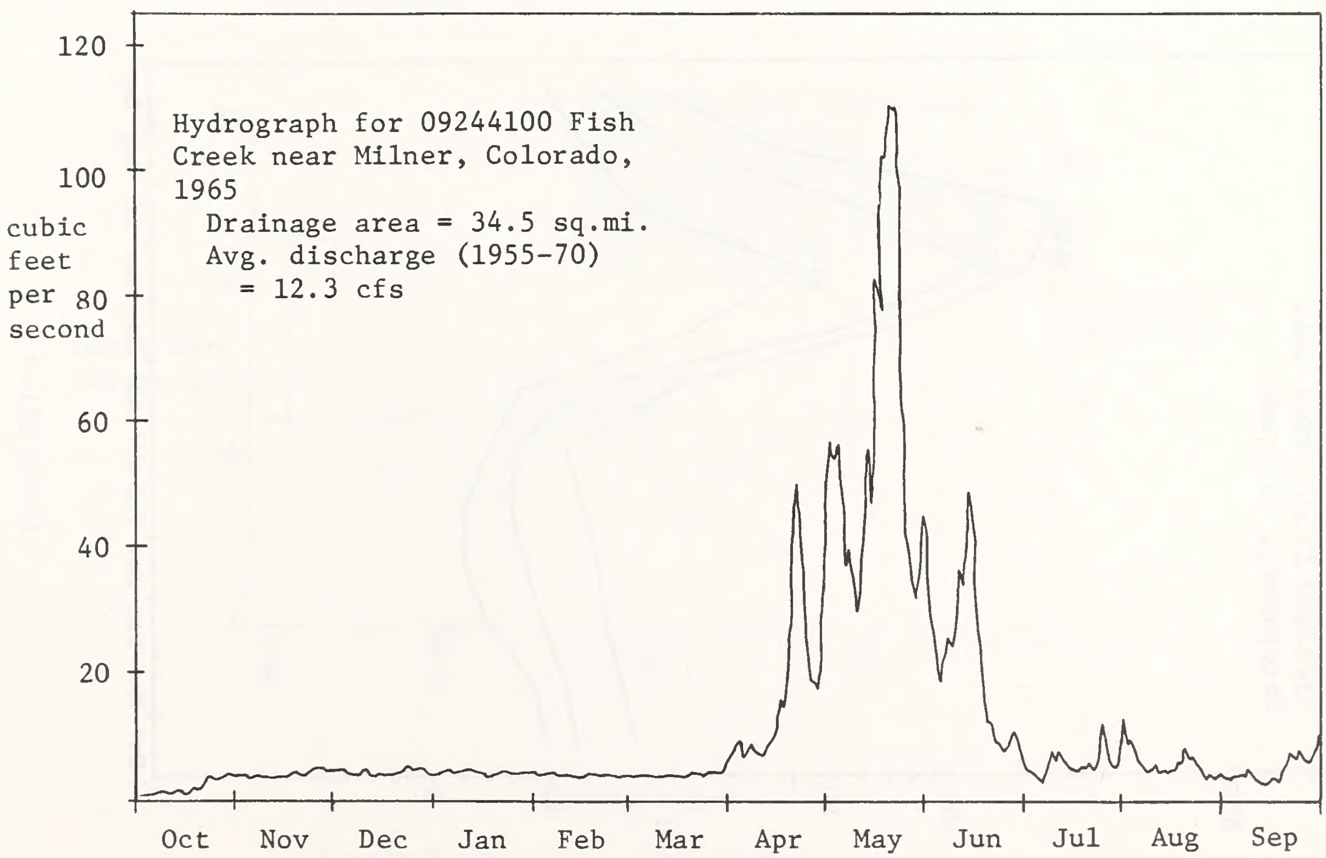


FIGURE EII-6

Typical daily hydrographs of selected streams.

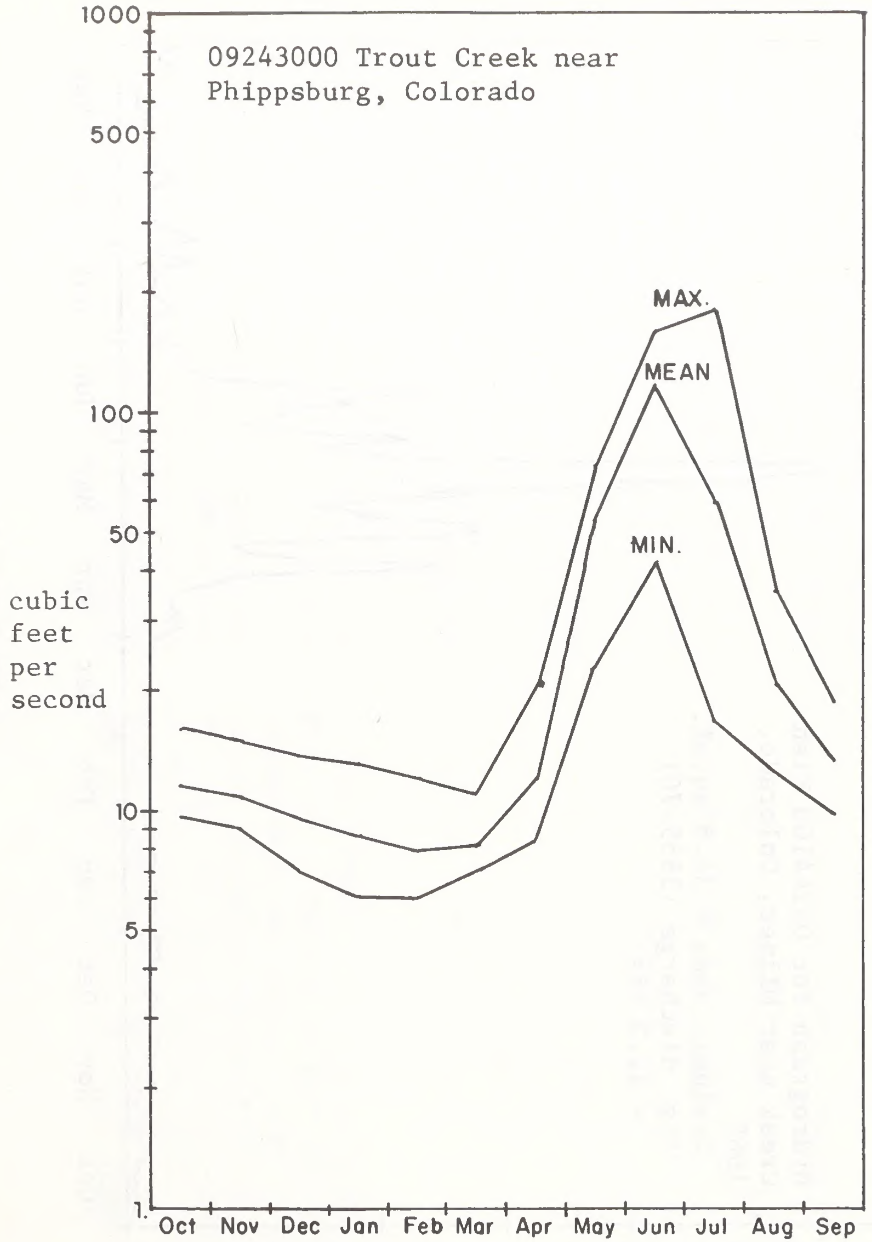


FIGURE EII-7

Monthly hydrographs of 09243000 Trout Creek near Phippsburg, Colorado.

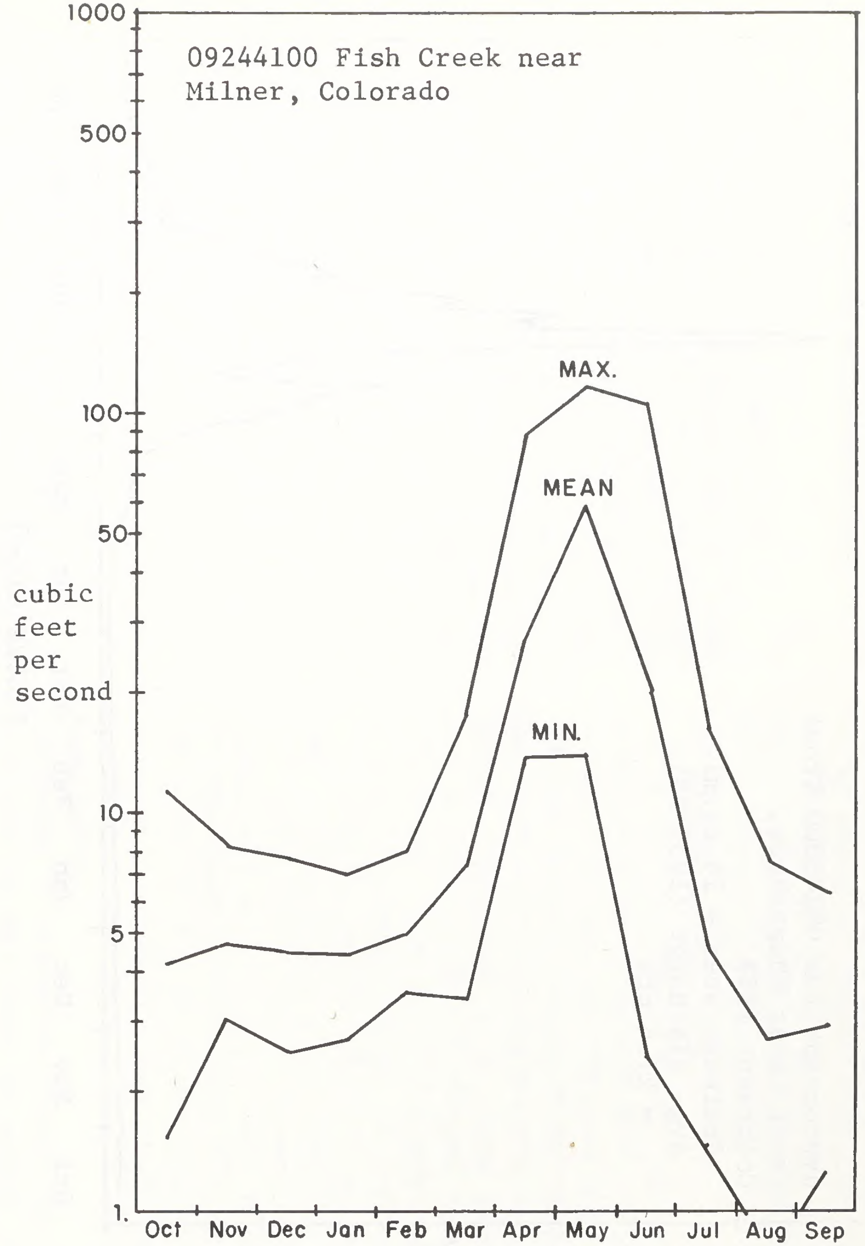
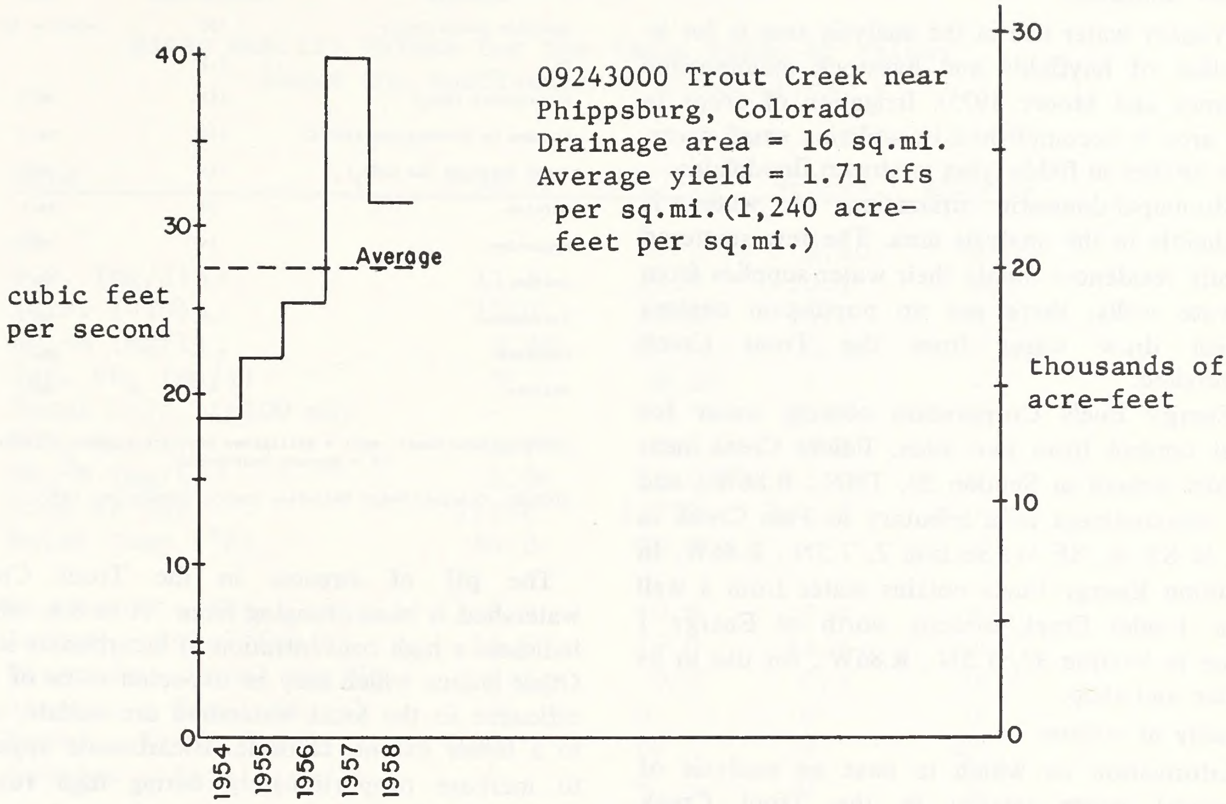


FIGURE EII-8

Monthly hydrographs of 09244100 Fish Creek near Milner, Colorado.



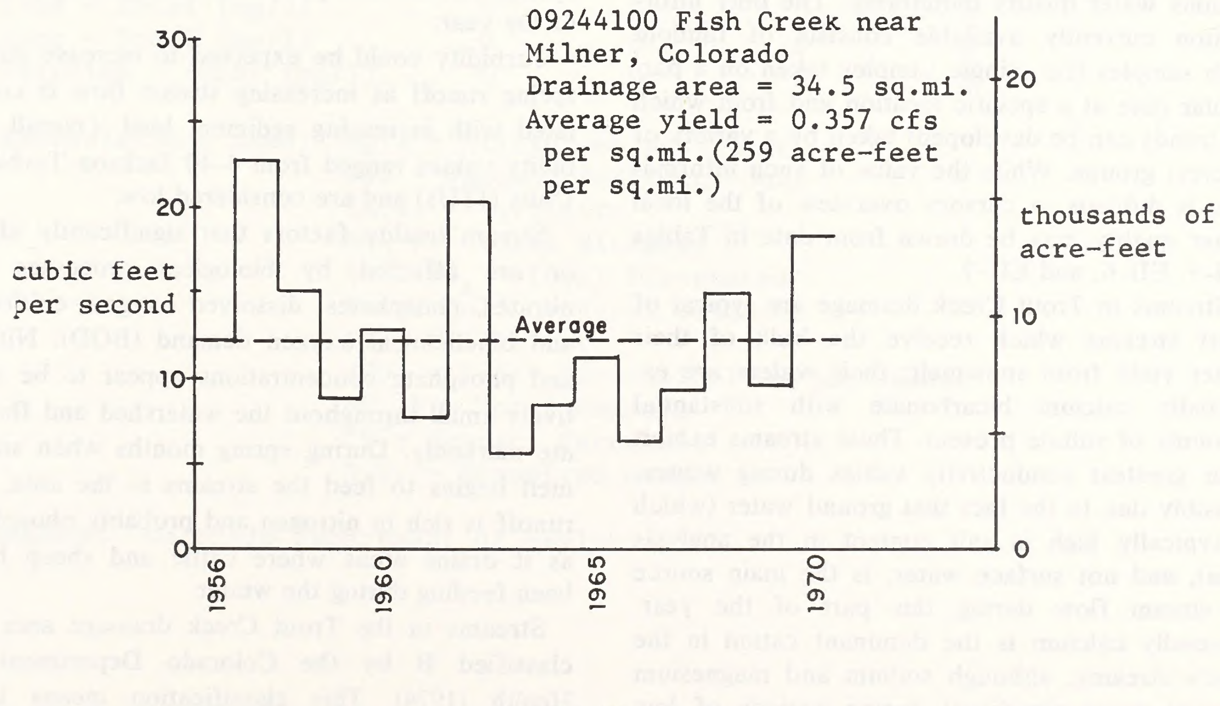


FIGURE EII-9

Yearly hydrographs of selected streams.

0.88 and 1.13 cubic feet per second (cfs) respectively; the measurements were made by EIS team personnel.

Water utilization

Primary water use in the analysis area is for irrigation of hayfields and livestock maintenance (Dames and Moore 1975). Irrigation of crops in the area is accomplished by utilizing small diversion ditches in fields lying in stream floodplains.

Municipal-domestic utilization of water is negligible in the analysis area. The few scattered family residences obtain their water supplies from private wells; there are no population centers which draw water from the Trout Creek watershed.

Energy Fuels Corporation obtains water for dust control from two sites: Foidel Creek near Foidel School in Section 29, T.5N., R.86W., and an impoundment of a tributary to Fish Creek in SE ¼ SE ¼, SE ¼, Section 2, T.5N., R.86W. In addition Energy Fuels obtains water from a well near Foidel Creek directly north of Energy 1 Mine in Section 32, T.5N., R.86W., for use in its office and shop.

Quality of streams

Information on which to base an analysis of chemical water quality in the Trout Creek watershed is limited. There has not been any continuous water quality monitoring. The only information currently available consists of random grab samples (i.e., single samples taken on a particular date at a specific location and from which no trends can be developed) taken by a variety of interest groups. While the value of such information is dubious, a cursory overview of the local water quality may be drawn from data in Tables EII-5, EII-6, and EII-7.

Streams in Trout Creek drainage are typical of most streams which receive the bulk of their water yield from snowmelt; their waters are essentially calcium bicarbonate with substantial amounts of sulfate present. These streams exhibit their greatest conductivity values during winter, possibly due to the fact that ground water (which is typically high in salt content in the analysis area), and not surface water, is the main source of stream flow during this part of the year. Generally calcium is the dominant cation in the area's streams, although sodium and magnesium become more significant during periods of low flow.

TABLE EII-5

Mean Water Quality Values for Trout Creek (Near Mouth at Milner) from 5-65 to 5-66

Parameter	Reported Value	Unit
Specific Conductivity	330	umhos at 25° C
pH	7.5	
Bicarbonate (HCO_3)	143	mg/l
Residue on Evaporation (105°C)	193	mg/l
Total Hardness (as $CaCO_3$)	145	mg/l
Calcium	35	mg/l
Magnesium	14	mg/l
Sodium	8.6	mg/l
Potassium	1.8	mg/l
Chloride	1.7	mg/l
Sulfate	43	mg/l

Abbreviations Used: mg/l = milligrams per liter; umhos = micromhos; °C = degrees Centigrade

SOURCE: Colorado Water Pollution Control Commission, 1974.

The pH of streams in the Trout Creek watershed is basic, ranging from 7.4 to 8.4, which indicates a high concentration of bicarbonate ions. Other anions which may be expected to be of significance in the local watershed are sulfate, and to a lesser extent, chloride. Bicarbonate appears to increase proportionately during high runoff periods, while sulfates are significant in early spring, but are less prevalent during other periods of the year.

Turbidity could be expected to increase during spring runoff as increasing stream flow is correlated with increasing sediment load. Overall turbidity values ranged from 4-40 Jackson Turbidity Units (JTUs) and are considered low.

Stream quality factors that significantly affect or are affected by biological processes are nitrates, phosphates, dissolved oxygen, coliforms and biochemical oxygen demand (BOD). Nitrate and phosphate concentrations appear to be relatively small throughout the watershed and fluctuate markedly. During spring months when snowmelt begins to feed the streams in the area, the runoff is rich in nitrogen and probably phosphate as it drains areas where cattle and sheep have been feeding during the winter.

Streams in the Trout Creek drainage area are classified B by the Colorado Department of Health (1974). This classification means local streams are suitable for all purposes for which

TABLE EII-6

Water Quality Values for the Yampa River at Milner
Above the Confluence of Trout Creek

Date	9-26-73	10-17-73	4-3-74	4-10-74
pH	-	-	8.40	8.30
D.O. (mg/l)	11.6	11.8	10.1	9.9
Turb. (JTU)	12.0	22.0	15.0	20.0
NO_3-N (mg/l)	0.20	0	0.35	0.35
Tot. PO_4 (mg/l)	0	0.10	-	-
Fecal Coli. (/100 ml)	-	-	220	2
BOD_5 (mg/l)	1.7	1.6	2.0	-
NH_3-N (mg/l)	0.04	0.08	0.08	0
Time of day	1,640	1,750	1,015	1,735
Water Temp (°F)	54.0	54.0	-	-
Magnesium - Total (mg/l)	8.0	10.0	5.0	13.0
Sodium - Total (mg/l)	15.0	14.0	13.0	13.0
Fluoride - Total (mg/l)	0.3	0.2	0.2	0.2
Arsenic - Total (mg/l)	0	0	0	0
Boron - Total (mg/l)	50	60	70	40
Cadmium - Total (mg/l)	0	0	0	0
Copper - Total (mg/l)	0	0	0	0
Lead - Total (mg/l)	0	0	0	0
Zinc - Total (mg/l)	0	0	0	0
Selenium - Total (mg/l)	0	0	0	0

Abbreviations used: Mg/l = Milligrams per liter
JTU = Jackson Turbidity Unit
Turb. = Turbidity
NO_3-N = Total Nitrates
Tot. PO_4 = Total Phosphates
Fecal Coli. = Fecal Coliform
Ml = Milliliter
BOD_5 = 5-day Biochemical Oxygen Demand
NH_3-N = Total Ammonia
°F = degrees Farenheit
D.O. = Dissolved Oxygen

SOURCE: Colorado Department of Health, 1975

TABLE EII-7

Water Quality at Selected Stream Sites in the Trout Creek Watershed

		Field Observations					Laboratory Determinations															
							Trace Elements, Micrograms per liter															
Section Name	Date	Turbidity	Flow Source	Temperature °C	pH	Specific Conductance, Micromhos per Centimeter at 25°C	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Iron (Fe)	Lead (Pb)	Maganese (Mn)	Mercury (Hg)	Molybdenum (Mo)	Nickel (Ni)	Selenium (Se)	Silver (Ag)	Vanadium (V)	Zinc (Zn)	Sulfate (SO_4) Milligrams per liter
Fish Creek at mouth on Trout Creek	06-09-72	ST	SM	15.5	7.4	560	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Middle Creek at mouth On Trout Creek	06-09-72	T	SM	15.0	7.2	550	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trout Creek above Middle Creek	06-09-72	T	SM	10.0	7.9	145	1	0	-	0	1	130	2	0	.0	-	3	-	0	-	30	15

Abbreviations Used: ST = Slightly Turbid; SM = Snow Melt; T = Turbid

SOURCE: Wentz 1974.

raw water is customarily used, except primary contact recreation, such as swimming and water skiing. In addition the water in Class B streams has: (1) a geometric mean of less than 10,000 total coliform groups, or 1000 fecal coliform groups per 100 milliter/sample, (2) a dissolved oxygen content of at least six milligrams/liter (mg/1), (3) a pH rating of no more than 9.0 nor less than 6.0 units, (4) a temperature which maintains a normal pattern of diurnal and seasonal fluctuations, and is not increased above 20 C (68 F) by any other than natural means, and (5) no increases in turbidity of over ten (JTUs) during any single period (Colorado Department of Health 1974). As shown in Table EII-5, the highest fecal coliform value recorded for the analysis area was 220 (probably bacterial) groups per 100 milliliters. The 5-day BOD ranged from 1.5 to 2.0 for the analysis area. These values are normal for a drainage area which is not subject to significant pollution. Water temperatures ranged from 6.5 C (44 F) to 20.5 C (69 F) on the various dates that streams in the analysis area were sampled (see Tables EII-5, EII-6, and EII-7).

Physical nature of streams

Physical quality of portions of streams in the vicinity of the existing Energy Fuels mining operations is poor. Streams in this area are meandering and have flows of less than five cfs. In addition the sediment load carried by these streams appears to be relatively high throughout the year. The Colorado Division of Wildlife (1972) rates streams in Trout Creek drainage as average or below average with respect to clarity of water and pool-riffle ratio. In addition annual water temperature regime of these streams is borderline for the cold-water species that exist there.

Physical quality of the streams in the mining area was examined by EIS personnel on June 12, 1975. Heavy sediment loading, low quality riparian (stream-bank) vegetation, and generally poor stream-bottom conditions were noted during this investigation. Very few riffle areas (areas of shallow, fast-flowing water with rocky substrate—as opposed to pools) were observed, and existing riparian vegetation offered little cover to the stream-course.

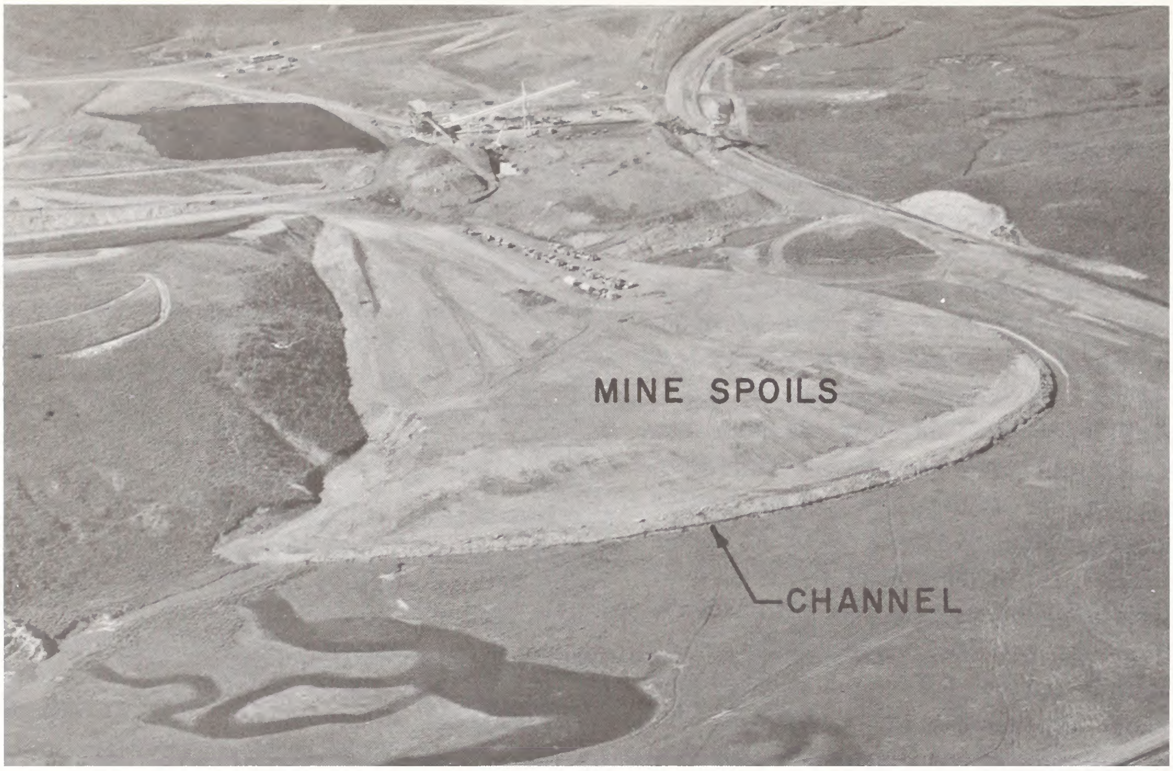
Existing water-land-resource problems as related to existing mining activities

Several areas of surface water degradation resulting from ongoing Energy Fuels mining activities were noted during field inspections of the analysis area made by EIS team personnel during the first two weeks of June 1975. Overburden removed from Energy 3 mining area was dumped across Fish Creek as it flows northeast a few hundred yards from the mine (Figure EII-10). A channel constructed by Energy Fuels diverted stream flow around the overburden pile via this ditch. The pile of overburden had not been reclaimed, and sediment load in Fish Creek increased as it flowed in direct contact with the pile. An investigation of the downstream area below the channelization project indicated that much of the stream bottom had been silted in as a result of this operation. Some deterioration of the chemical stream quality due to dissolved solids leaching out of the overburden pile into the stream was also occurring.

Energy Fuels, realizing that the rechanneling was poorly done, has reworked the area. The stream has been rechanneled in a meandering fashion, and the sides and bottom covered with river rock (Figure II-10). Also the spoil pile has been shaped to a workable angle, covered with topsoil, and seeded. The additional work on the rechanneled stream has minimized the impacts previously described and produced a much more acceptable stream, environmentally and aesthetically.

Ground water encountered during operations at Energy 1 and 2 Mines is accumulated in mining pits. Some of this water is utilized by Energy Fuels for dust control. Unutilized water at Energy 1, which is typically higher in TDS than local surface water, flows into Foidel Creek via natural underground runoff. Water in Foidel Creek below the influx of water from the mining pits was measured to be higher in TDS than water upstream from this influent.

Excess water at Energy 2 location has been pumped from pits and allowed to seek its own course over approximately 150 yards to Fish Creek. The area into which this water is pumped has been highly disturbed with earth-moving equipment, resulting in increased erosion as pit water flows toward Fish Creek. The disturbed



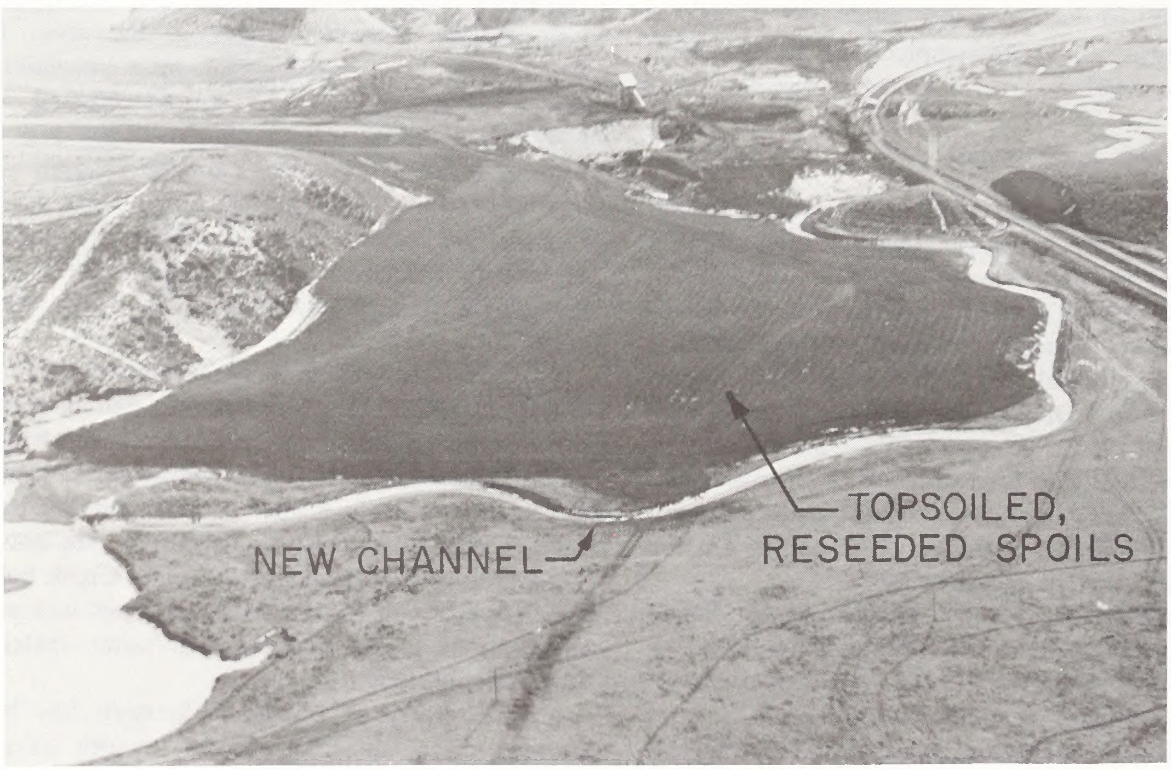


FIGURE II-10

The top photo shows the rechannelization at Energy 3 Mine in June 1975, that produced adverse environmental impacts. The bottom photo shows the additional work that has been done to lessen the impacts; the stream has been rechanneled in a meandering fashion, river rock placed on the sides and bottom, and the spoils reshaped to a more reclaimable angle, covered with topsoil, and seeded. Additional reclamation efforts illustrated in the bottom photo were completed in September, 1976.

ground and the lack of construction of a definite channel for the runoff water increases sediment load in Fish Creek in this area. Water in Energy 2 pit is also higher in TDS than water flowing in Fish Creek, and the amount of TDS in Fish Creek downstream of the influent is increased.

Construction of roads for exploration and hauling associated with existing mining activities has also increased runoff erosion and sediment loads in Trout Creek watershed. In addition unreclaimed spoil piles, which at Energy 1 and 2 operations add to sedimentation problems, were observed in Foidel and Fish Creeks.

Climate

Rough topography of the Energy Fuels Mine areas causes significant channeling of air masses passing the region. During the evening and early morning hours, air moves toward lower elevations. Therefore at Energy 1, night-time air masses are expected to move toward the Foidel Creek and then to the northeast. Similarly at Energy 2, night-time air drains down-valley to the northwest. During the afternoon hours when the sun heats the earth's surface, air tends to flow towards higher elevations. It is estimated that down-valley flow occurs about 50 percent of the year and up-valley flow 10-20 percent of the year. The remainder of the year wind direction is variable.

Average hourly wind speed varies with the time of day. Wind speeds reach average maximum values during summer afternoons and are usually associated with up-valley flow. It is estimated that afternoon wind speed will average 4 meters/second (mps) (8 mph), and evening wind speed 3 mps (6 mph). Wind speeds greater than 10 mps (20 mph) will occur during abrupt weather changes or storms, primarily during the winter and spring months. Calm conditions can occur any time of day but are far more frequent during the evening and early morning. Wind speeds of less than one mps (two mph) are expected nearly 20 percent of the time at the two sites.

Measurements of annual precipitation at the mine are unavailable, but historical records from the towns of Hayden and Yampa indicate that about 41 centimeters (16 inches) can be expected annually. It is estimated that 90 days/year precipitation is greater than the detectable limit of .25 millimeters (.01 inches) at the Energy Fuels Mines.

Similar to the entire region, the mine area is subject to large seasonal and daily temperature variations. In July, temperatures are expected to vary from 27° C (81° F) during the day to 6.7° C (44° F) at night, on the average. January extremes vary from an average of 0.0° C (32° F) during the day to −17° C (1.4° F) at night. The growing season is expected to be somewhat less than that recorded at Hayden, or about 60-70 days.

Air Quality

Ambient concentrations of the nationally regulated air pollutants are difficult to determine at the mines because no monitoring data are available. Therefore baseline concentrations of air pollutants are assumed to be the same as measured in other rural western regions. These background concentrations are discussed in the Regional Analysis Air Quality section of this Environmental Impact Statement. Visibility at the mine is also assumed to be similar to the regional visibility.

Living Components

Soils

A soil survey was prepared by the USDA-Soil Conservation Service for most of the existing Federal leases, and for all but the west part of competitive lease application (C-22677). Refer to Figure EII-11 for the soil map and mapping legend. Detailed soil series and mapping unit descriptions for Figure EII-11 follow. Typical profile descriptions for each series are shown in Appendix D, Soils.

Legend for Figure EII-11

Map Symbol	Name	Percent Slope	Reclamation Potential
4C	Abor silty clay	3 to 12	poor
4E	Abor silty clay	12 to 25	poor
X4F	Abor Moyerson complex	12 to 25	fair
10C	Bulkley silty clay loam	3 to 12	poor
10E	Bulkley silty clay loam	12 to 25	poor
10F	Bulkley silty clay loam	25 to 65	poor
50F	Cochetopa fine sandy loam	25 to 65	good
AW	Cumulic Cryaquolls	0 to 6	good
X2F	Delphill-Rock Outcrop complex	-	poor
23A	Gapo clay loam	0 to 3	poor
2VD	Routt loam	3 to 25	excellent
16D	Skylick loam	3 to 25	excellent
X8D	Splitro-Winevada complex	3 to 25	good
X8F	Splitro-Winevada complex	25 to 65	fair
2E	Work loam	12 to 25	good
99	Cryoborolls-Rock Outcrop complex		poor
2NE	Routt loam	5 to 25	good
34E	Gallatin fine sandy loam	12 to 25	excellent
34F	Gallatin fine sandy loam	-	good
9A	Hesperus fine sandy loam	0 to 3	good
101	Torriorthents - Rock Outcrop complex	-	poor
61C	Hesperus fine sandy loam	3 to 12	good
X10	Bulkley-Moyerson complex	-	poor

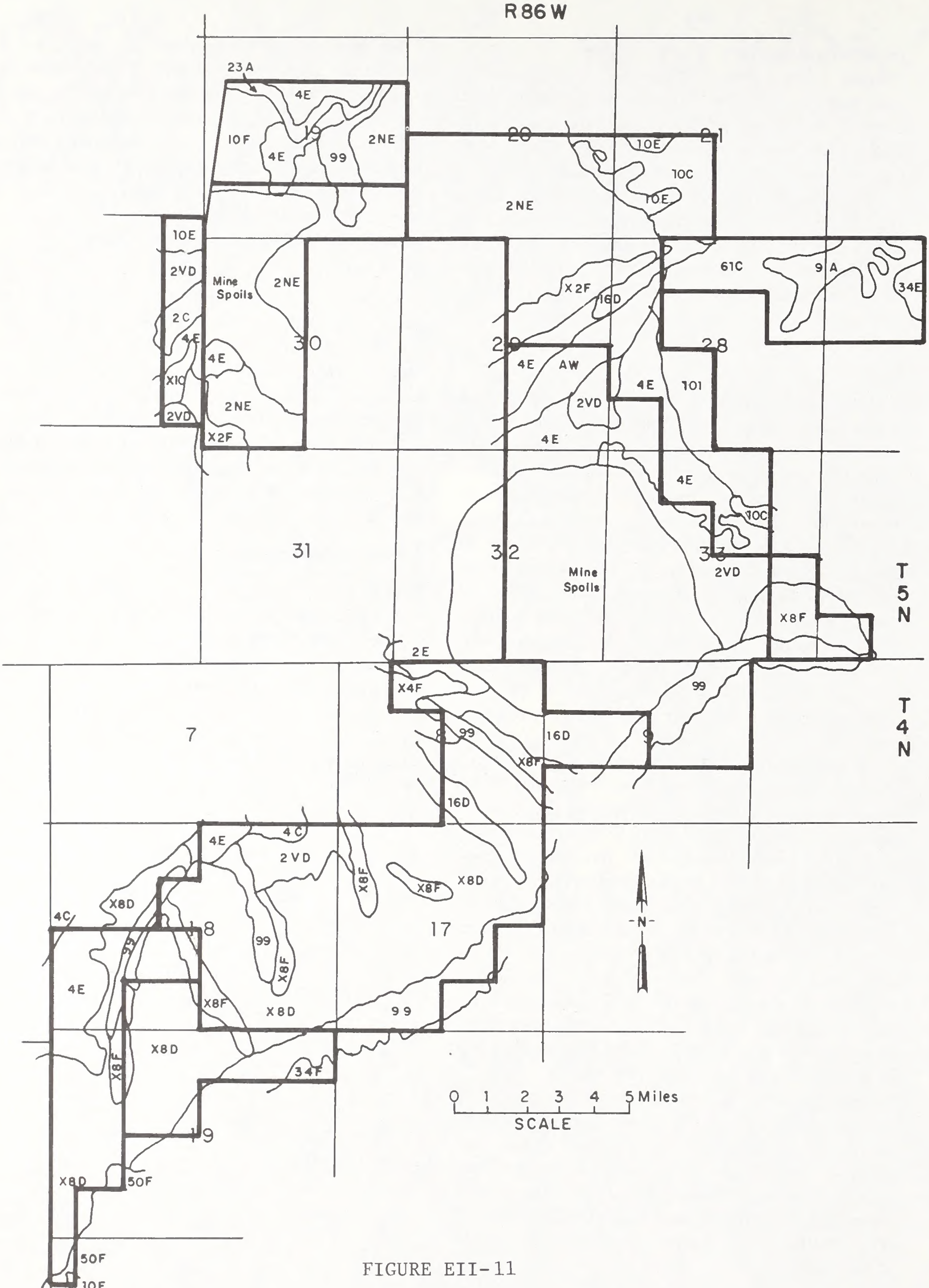


FIGURE EII-11

Soil map of the Energy Fuels 1 and 2 Mine areas.

Abor series

Soils of the Abor series are moderately deep, fine-textured, and well-drained; they form in Mancos Shale and occupy upland slopes. The soils of this series are found throughout the study area.

Sagebrush, rabbitbrush, needle grass, prairie Junegrass, and wheatgrasses are the principal native plants. Soils are productive and the level-sloping areas are suited to small grains.

Abor silty clay, 3-12 percent slopes (4C) occupies gently sloping to sloping uplands. Soils are underlain by shale at depths of 24-40 inches; it is an extensive soil. Areas are irregular in shape but large in size.

Abor silty clay, 12 to 25 percent slopes (4E) occupies moderately steep upland slopes, otherwise much like 4C.

Abor-Moyerson complex, 25-65 percent slopes (X4F) consists of about 55 percent Abor soils and 40 percent Moyerson soils. Abor soils occupy upper and lower portions of side-slopes; Moyerson soils occupy the middle section of side-slopes, ridgetops, and mounds; about 5 percent is shale outcrops. These soils have very rapid surface runoff; rill and sheet erosion are very active. These soils are used for range and wildlife.

Soils in the Moyerson series are shallow, well-drained, and fine-textured; they are forming in place on Mancos Shale. Slopes are undifferentiated.

The very dark grayish brown silty clay loam surface layer is about 5 inches thick, and has fine subangular blocky to fine granular structure. The subsoil is of the same color as the surface but is a silty clay texture.

Surface runoff on these clayey soils is very rapid, and if vegetative cover is depleted, they will erode severely.

Because the soils are so clayey, so shallow, and in a cold, dry, climatic zone, they are best suited to permanent grass. The native species are western wheatgrass, squirreltail, Sandberg bluegrass, winterfat, low rabbitbrush, buckwheat, and big sagebrush. Surface runoff on these clayey soils is very rapid, and if vegetative cover is depleted they will erode severely.

Routt series

The Routt series is deep and well-drained, forming on upland slopes in wind-blown material derived from shales and sandstones.

Routt soils have a very dark-brown loam surface layer about 22 inches thick with strong granular to moderate blocky structure. The next layer is a granular, leached, brown loam horizon about 4-12 inches thick. These soils are moderately susceptible to erosion, but are highly susceptible to slipping when saturated.

Native vegetation is principally oak brush, rose serviceberry, needle grass, Junegrass, elk sedge, and big sage; these productive soils are suited for range.

Routt loam, 3-25 percent slopes (2VD) occupies gently sloping to moderately steep upland and mountain slopes, generally above 7,000 feet elevation. It is an extensive unit and best typifies the series.

This well-drained soil has a thick, dark, granular surface layer. Natural fertility level is high for this soil; it takes water moderately slowly, but has a high water-holding capacity.

Skylick loam, 3 to 25 percent slopes (16D) has a profile similar to the Routt series, except the texture of the B2t horizon is a light clay loam.

Splitro series

The Splitro series is shallow and well-drained, forming in a mixture of loess and weathered fine grained sandstone material. Slopes are steep, generally north facing, and irregular in size and shape.

The black loam surface layer is about 9 inches thick and has fine granular structure. The 9-inch thick subsoil is a very dark-brown loam that is massive. Surface runoff on these slopes is rapid, and if the surface is not protected erosion could be severe.

Some common native species would be oak brush, serviceberry, big sagebrush, slender and western wheatgrass, needlegrasses, mountain brome, nodding brome and elk sedge.

Splitro-Winevada complex, 3 to 25 percent slopes (X8D), and Splitro-Winevada complex 25 to 65 percent slopes (X8F) are made up of about 50 percent Splitro and 30 percent Winevada, and include about 20 percent Routt soils and Rock Outcrops.

The Winevada series is similar to the Splitro except the sandstone is at a depth of 20 to 40 inches.

Bulkley series

The soils of the Bulkley series are deep, well drained, and fine textured. They are forming on level to moderately steep upland slopes in weathered material from Mancos Shale.

The dark grayish brown silty clay loam surface layer is very friable, granular, and about 4 inches thick.

Native vegetation is mainly wheatgrasses, bluegrasses, needlegrasses, and big sagebrush. The level to sloping areas are suited to cultivated crops, and yields are good.

Bulkley silty clay loam, 3 to 12 percent slopes (10C), 12 to 25 percent slopes (10E), and 25 to 65 percent slopes (10F) occupy gently sloping to steep upland areas.

This well drained soil is slowly permeable, and has very rapid surface runoff. Rilling occurs during spring snow melt. It has a high water holding capacity but gives up water slowly to plants. When the soil dries, wide deep cracks tend to form.

Cochetopa series

The Cochetopa series consists of deep, well drained soils formed from colluvium of mixed minerology. They occupy fans, footslopes, and sideslopes; slopes are 3 to 65 percent. The native vegetation is mainly aspen, oak brush, and snowberry.

In a representative profile the surface layer is very dark brown clay loam about 18 inches thick.

Cochetopa fine sandy loam, 25 to 65 percent slopes (50F) is on steep mountain slopes.

It is well drained, slowly permeable, and has a low water-holding capacity. It readily gives up its moisture to needs of the plants.

All areas mapped have a cover of aspen trees and an understory of grasses.

Delphill series

Soils in this series are moderately deep over sandstone. They occupy steep mountainsides at elevations of 6,100 to 7,100 feet.

In a representative profile the surface layer is dark grayish brown gravelly loam about 4 inches thick. Erosion hazard is high. Water-holding capacity is medium.

Delphill-Rock Outcrop Complex, steep (X2F) is on steep mountainous slopes.

Two kinds of soil make up the complex. The dominant, or about 70 percent, consists of colluvium from sandstone and shale. It is moderately deep, well-drained, and moderately permeable. Because it overlies sandstone or shale material at about 24 inches the water-holding capacity is moderate. The other soil is forming in weathered sandstone material. It is about 6 inches thick over sandstone, has rapid surface runoff and a low water-holding capacity. All of the acreage is in native range and is being used for grazing.

Gapo series

In this series are deep, poorly-drained, fine-textured soils. They are forming in level to sloping concave areas from fine textured alluvium derived principally from Mancos Shale.

The very dark grayish brown clay loam, or clay, surface layer is about 20 inches thick. The upper 2 inches is peaty. Surface runoff is rapid but internal drainage is very slow. The soils are very slowly permeable and have a fluctuating water table. They are poorly drained and calcareous.

Because of poor drainage the soil is best suited to grass. Native species are predominantly sedges, rushes, tufted hairgrass, and other water-tolerant grasses. If irrigated, the soils can be used for cropland.

Gapo clay loam, 0-3 percent slopes (23A) is on level to nearly level stream terraces. Areas mapped are generally long and narrow.

The soil is poorly drained. It is very slowly permeable, but has a high water-holding capacity. A water table keeps the soil wet most of the year, and the soil is mottled from the surface down.

Work series

The Work series consists of deep, well-drained soils that formed in material weathered from interbedded fine grained sandstone and soft shale. Soils are on upland benches and side slopes, and have slopes of 3 to 25 percent.

Work loam, 12 to 25 percent slopes (2E) occupies side slopes and rolling uplands that are moderately steep.

This soil has a high level of natural fertility. It takes water moderately slow but stores a large amount for plant use. Because of a thick, friable, surface layer there is very little surface runoff. The soil is well-drained. Plant roots and soil moisture have little difficulty in penetrating this soil.

This soil is used mostly for rangeland. However, some of it is used for production of winter wheat.

Gallatin series

The soils of this series are deep and well-drained. They are forming in moderately coarse-textured material derived from soft sandstone, but locally reworked by wind and water. Slopes are level to moderately steep.

The very dark grayish brown fine sandy loam surface layer has fine, granular structure, is very friable and is about eight inches thick. The subsoil, about 22 inches thick, has the same color and texture as the surface, but has weak, medium blocky structure. The substrata is a dark fine sandy loam.

Surface runoff is slow on all slopes and the water erosion hazard is slight. Erosion from wind is a hazard on all slopes.

The soils are located in a cold, dry, climatic zone, so are best suited to permanent grass. Native plants are bluebunch and western wheatgrass, Junegrass, squirreltail, muttongrass, and big sagebrush.

Gallatin fine sandy loam, 3 to 12 percent slopes (34C) occupies gently sloping to sloping uplands. Gallatin fine sandy loam, 12 to 25 percent slopes (34E) is like 34C except it occupies steeper slopes.

Hesperus series

These soils were deep, well-drained, and occupy upland fans and sidehill slopes. These soils formed in residuum weathered from sandstone.

The dark grayish brown fine sandy loams surface layer is about 18 inches thick, very friable, and has a weak granular structure. The subsoil is a dark yellowish brown sandy clay loam about 32 inches thick.

These soils are suited to cultivation and production of small grains. They are also suited to pasture or range use. Some native plants are wheatgrasses, needle grasses, brome, big sagebrush, and snowberry.

Hesperus fine sandy loam, 3 to 12 percent slopes (61C) occupies gently sloping uplands. Hesperus fine sandy loam, 0 to 3 percent slopes (9A), occurs on level to nearly level upland slopes. The soils are developed from deep loess.

This unit has a high natural fertility level; it has a high water holding capacity; water intake rate is moderate. Surface runoff is slow, and the erosion hazard is slight. The unit is used both as native range and non-irrigated cropland, with winter wheat being the major crop.

Miscellaneous

Cumulic Cryaquoll (AW) are located on intermittent or perennial stream terraces. The land is permanently wet because of overflow and water table conditions. Only water-tolerant plants will survive. It includes some small areas of better-drained soils suitable for pasture or hayland.

Torriorthent Rock Outcrop (101) is composed of 15-50% rock outcrop, which in this specific area is hard sandstone. The aspect is usually west-facing and the soils which range from very shallow to deep are drier, warmer, and lighter in color than soils in the X8D and X8F units.

2NE (mapping symbol) identifies a soil complex which consists of the following:

(1) 50%—Argic Pachic Cryoboroll, fine, mixed (20 to 40 inches to paralithic material); (2) 35%—Argic Pachic Cryoboroll, fine loamy, mixed (more than 40 inches to paralithic material); (3) 100%—Lithic Cryoboroll, loamy, mixed (splitro series); and (4) 5%—Rock Outcrop. Complex 2NE occupies moderately steeply sloping uplands (12-25% slopes). The deeper soils are found in swales or concave positions. The moderately deep soils occupy smoothly rounded spur ridges. The very shallow soils are found in close proximity to the rock outcrops which occur along highly eroded gullies and rills, and on ridges which have steep side slopes.

Unnamed Argic Pachic Cryoboroll (soil in complex 2NE): the soils within this series are moderately deep and well-drained. They are formed in residuum from sandy shales and occur on moderately sloping uplands.

A typical profile has a dark grayish brown loam surface about 19 inches thick. The structure is a moderate grade of granular and is friable. The subsoil which is about 15 inches thick is dark yellowish brown heavy clay loam or silty clay loam. The structure is subangular blocky and the consistence is very firm when moist.

Native vegetation is mountain big sage, Idaho fescue, serviceberry, and snowberry. These soils are suited to cultivation and production of small grains. They are also suited to pasture or range use.

The unit (99) is a complex of Cryoborolls-Rock Outcrop and is on slopes of 40 to 90 percent. It consists of about 60 to 80 percent shallow-to-deep dark colored soils, and the balance is Rock Outcrop.

Cumulic Cryaquoll (AW) are located on intermittent or perennial stream terraces. The land is permanently wet because of overflow and water table conditions. Only water-tolerant plants will survive. It includes some small areas of better drained soils suitable for pasture or hayland.

Terrestrial Flora

Four primary vegetative community types are found in the general area of the Energy Fuels mines: grassland, sagebrush, mountain shrub, and cropland; and two subtypes: aspen and mountain shrub-rock outcrop. Spoils, revegetated or not, are mapped separately.

The vegetative types have been delineated on Figure EII-12; they are described in following paragraphs, and are keyed to Figure EII-12. The ecological requirements of these general types are found in Chapter II of the Regional Analysis. Type designations and numbers are those used by the BLM.

Grassland, type 1

A few isolated stands of grassland type are found in the area; they are mostly small parks among the mountain shrub and aspen types.

The vegetation consists primarily of needlegrasses (*Stipa* spp.), bluegrasses (*Poa* spp.), and bromes (*Bromus* spp.). Many very small areas of grassland type occur along the creek bottoms, but have not been mapped separately from the surrounding vegetation in this general map.

Sagebrush, type 4

Sagebrush community occurs on all sites below the elevational range of mountain shrub community; the transition zone between the two communities is often very wide, making them difficult to separate. The sagebrush is often short in the bottom lands, and these areas support a good understory of grasses and forbs.

The dominant grasses associated with the sagebrush (*Artemesia* spp.) are: wheatgrasses (*Agropyron* spp.), bluegrasses, June grass (*Koleria cristata*), and bottle brush squirreltail (*Sitanion hystrix*); dominant forbs include: buckwheat (*Eriogonum* spp.), onion (*Allium* spp.), flebane (*Erigeron* spp.), and milkvetch (*Astragalus* spp.).

Mountain shrub, type 5

The mountain shrub community is usually found on the highest slopes and lower north-facing slopes of the area, depending on soil depth, texture, and available moisture.

This type supports many important browse species, including: Gambel oak (*Quercus gambelii*), western serviceberry (*Amelanchier alnifolia*), antelope bitterbrush (*Pursia tridentata*), big sagebrush (*Artemesia tridentata*), chokecherry (*Prunus virginia*), mountain mahogany (*Cercocarpus montanus*), and snowberry (*Symphoricarpos* spp.). (Associated species are the same as listed in Chapter II of the Regional Analysis.)

Aspen, type 10a

Aspen communities are located in the highest areas and those of best soil moisture conditions. There are only a few areas that are distinctly aspen type; most aspen is mixed with mountain shrub type.

Mountain shrub-rock outcrop, type 5a

In general this type is the same as mountain shrub community, but is found on rock outcrops in the mining area. Understory vegetation is not as dense as mountain shrub community, and much of the area is covered by bare rock.

Cropland, type 19

Croplands of the area are comprised of winter wheat, pastures, and hayland. Most of the winter wheat areas were formerly sagebrush type, located on the hillsides adjacent to creek bottoms. Production on the dryland farmed winter wheat is approximately 30 bushels/acre/year. Pasture lands are areas that have been seeded to grasses, mostly wheatgrasses (*Agropyron* spp.), and bromes, but are not productive enough, or are too rough for haying; some of these areas were formerly cultivated for winter wheat. Haylands are located in sub-irrigated creek bottoms, and have been designated (19a) on the vegetative map. The primary species seeded with the native grasses of the creek bottoms are: wheatgrasses, bromes, Timothy (*Phleum pratense*), and orchard grass (*Dactylis glomerata*).

Spoils

The areas classified as spoils are areas that have been surface mined. Some of these areas have been recently mined, shaped, topsoiled, and seeded, while some are old spoils that are unshaped and support scattered vegetation. For a more detailed description of vegetation being

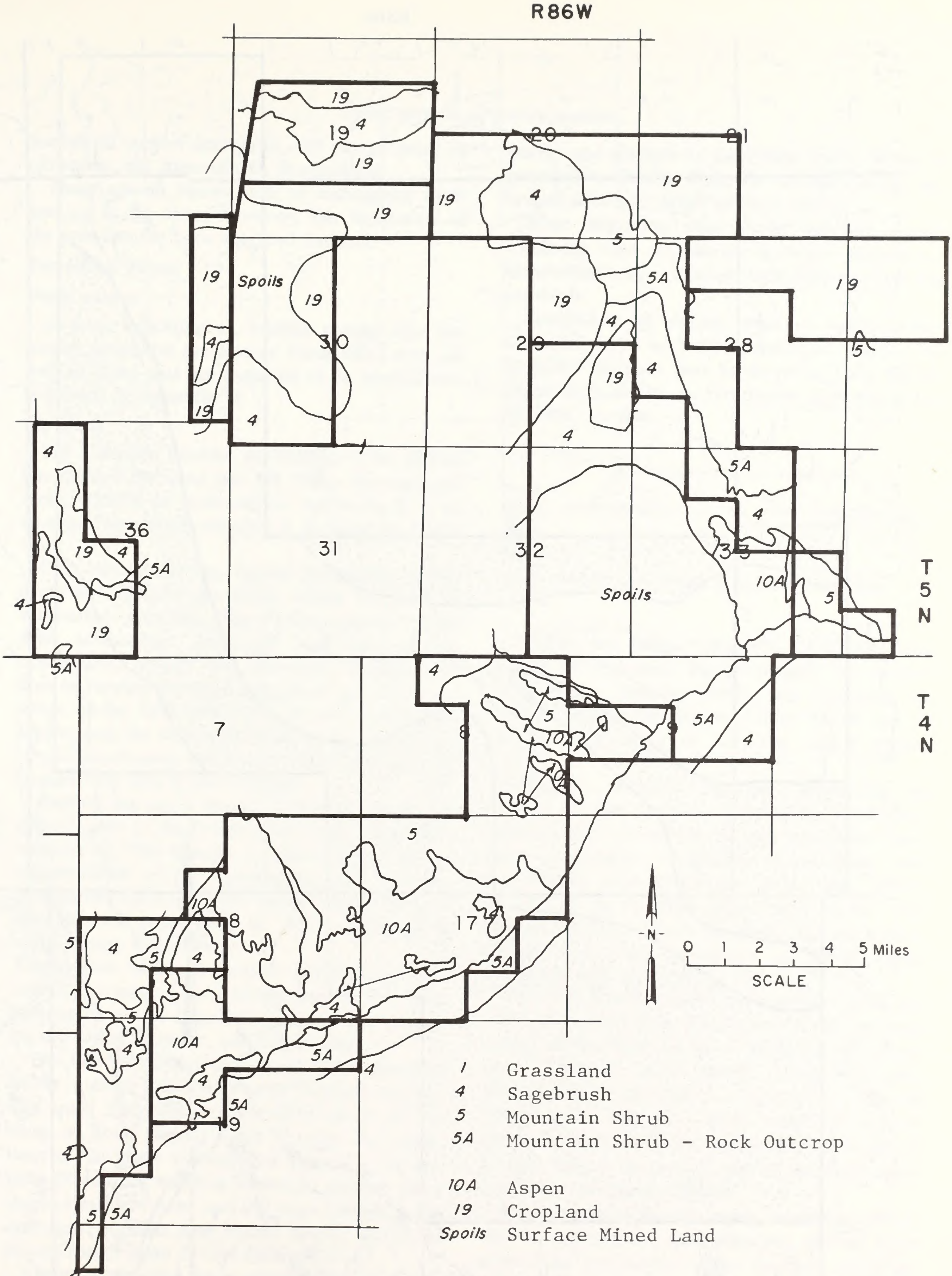


FIGURE EII-12

Vegetation map of the Energy Fuels 1 and 2 Mine areas.

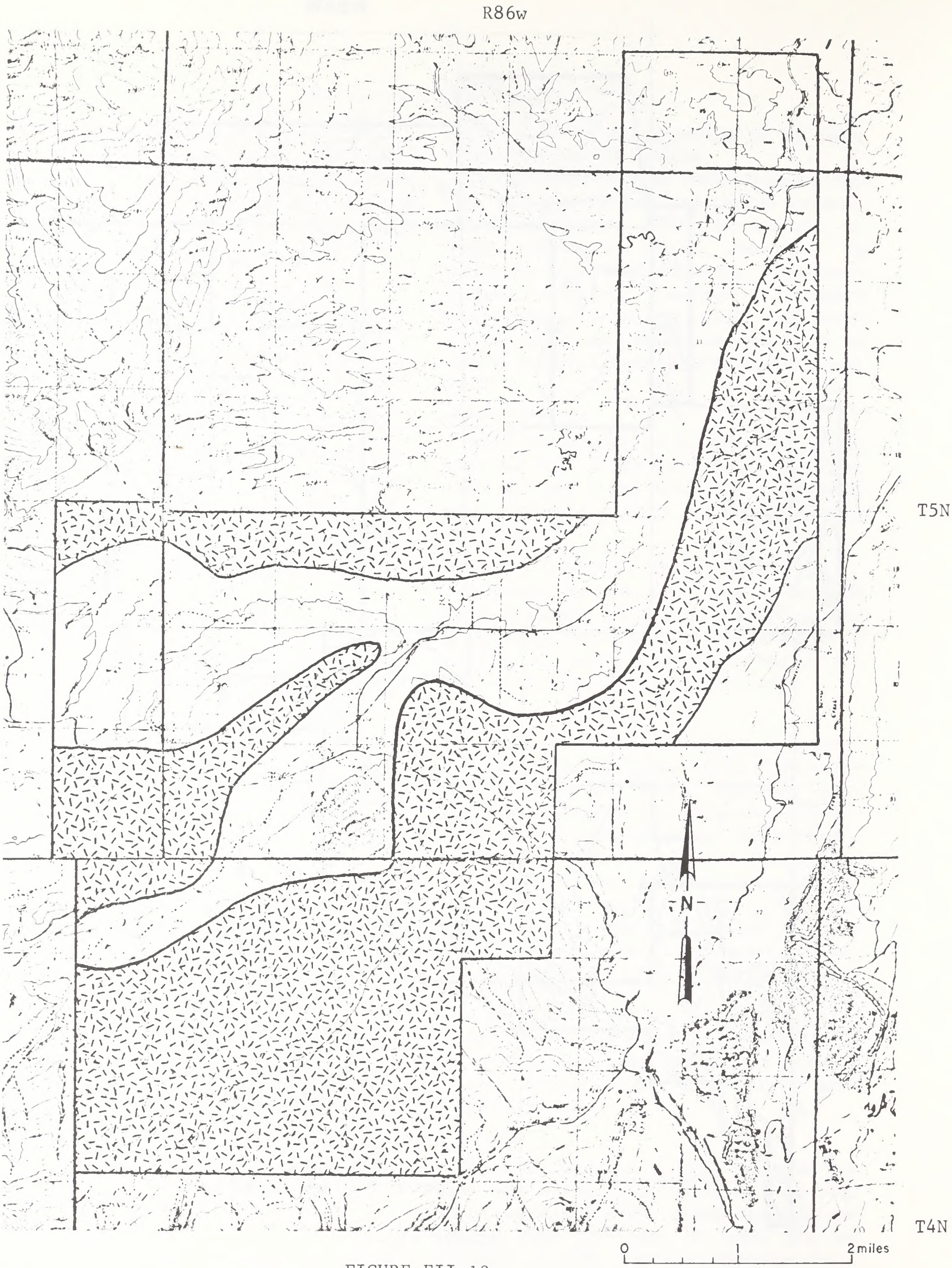


FIGURE EII-13

Preferred mule deer summer use areas (shaded).

seeded on current operations, and that growing on old spoils, see Appendix D, Reclamation.

There are no known rare or endangered plant species in the area; however, the vegetation of the area has not been analyzed in detail.

Terrestrial Fauna

Wild fauna

A table indicating all wildlife species that are known to inhabit the Energy Fuels Mine area, as well as those that are expected to be found here, is located in Appendix D.

Big game

The Colorado Division of Wildlife (Colo. DOW) has divided the state into 126 Game Management Units (GMU) as indicated in Appendix D. The Energy Fuels mine complex is included in GMU 13.

Only two of the ten species designated as big game in Colorado are found within the area in substantial numbers. These two species, mule deer (*Odocoileus hemionus*) and elk (*Cervis canadensis*), occupy the proposed development area in varying densities dependent upon the condition of the food and cover, as well as climatic factors and the degree of harassment. Black bear (*Ursus americanus*) and cougar (*Felis concolor*) are found in the area in low numbers.

Another big game species that may inhabit the subject area is the white-tailed deer (*Odocoileus virginianus*). This species is suggested as a potential inhabitant of the development area, because of reported sightings a few miles to the west and their known occurrence in similar habitats in northwestern Colorado.

Mule deer. Mule deer may be found in any portion of the subject area at any time of the year; however a greater population density occurs during the spring, summer, and fall months.

The Energy Fuels mine area provides marginal winter habitat and fair-to-good summer browse. The areas preferred by deer for summer use lie south of Routt County Road 27, with the exceptions of the butte northeast of Energy 1 (in sections 28 and 33) which is known to support some summer resident deer, and the areas bordering the drainages of Fish and Foidel Creeks north of Routt County Road 27 (see Figure EII-13).

Cover is provided by a combination of brush, aspen (*Populus* spp.), and topography, and appears to be adequate to meet the needs of the local deer. Water also appears to be of sufficient quality and quantity to meet their needs. Water is provided by Foidel, Fish, and Middle Creeks and several scattered ponds or stock tanks.

Some important deer foods that are found within the mine area are serviceberry, snowberry, bitterbrush, oak, common chokecherry, and big sagebush.

Researchers in similar areas of northwestern Colorado have identified preferred classes of foods for the mule deer as shown in Table EII-8. These study results are considered appropriate for the mine complex.

TABLE EII-8

Preferred Classes of Food for Mule Deer

	Percent of Diet			
Season	Shrubs & Trees	Forbs	Grasses & Grasslikes	Total
Winter	97	2	1	100
Spring	79	9	12	100
Summer	94	6	0	100
Fall	97	3	0	100

SOURCE: Kufeld, R.C. et al, Foods of Rocky Mountain Mule Deer

Studies are being conducted by Dames and Moore to determine the parameters for species composition, density, trend, and utilization by wildlife within the region. Tables EII-9 and 10 present the results of the first year's studies (1975).

Numbers of deer fluctuate, depending on several factors discussed previously; these fluctuations occur from year to year and within each year. Population estimates range from one deer/square mile during the severe cold winter months to seven deer/square mile in the mild summer months. These estimates indicate a fluctuating mule deer population of 38-263 head within the area indicated by Figure EII-13.

Elk. The Energy Fuels mine complex area provides good elk winter habitat and is used to some extent during these months. Wintering elk appear to concentrate along Middle Creek and Rattlesnake Butte, as well as in and around the old spoils of the Energy 1 Mine. Additional animals are also found along the buttes north and east of Foidel School. A few elk remain in these areas yearlong (see Figure EII-14).

Cover is provided by aspen, mountain shrub, and the topography; spoil piles also provide some protection from severe winter weather; cover appears to be adequate to meet the elks' needs. Water does not appear to be a limiting factor on the elk population; their water requirements are met in the form of snow, scattered ponds, stock

TABLE EII-9

Browse Evaluation of the Mountain Shrub Vegetation Type on Section 21, T.5N., R.86W. 1/

A. Browse Condition Summary

Form Class	Number of Plants: Snowberry	Big Sagebrush	Rabbitbrush	Serviceberry	Bitterbrush	Subtotal	Percent of Total
1 & 4 (light)	2	14	15	0	0	31	21%
2 & 5 (moderate)	27	17	2	22	3	71	47%
3 & 6 (heavy)	10	1	5	6	27	49	32%
Subtotal	39	32	22	28	30	Total 151	

B. Browse Trend Summary

Number of young plants	39
Number of decadent plants	12
Total	51
20 percent of Total	10.2%
Difference between young and decadent	27

C. Key area evaluation

	Points
Browse condition	10
Browse trend	15
Total	25
Adjective rating	Good

1/ SOURCE: **Baseline Environmental Report (Dames and Moore 1975).**

TABLE EII-10

Browse Evaluation of the Mountain Shrub Vegetation Type on Section 9, T.4N., R.86W. 1/

A. Browse Condition Summary

Form Class	Number of Plants: Snowberry	Big Sagebrush	Gambel Oak	Serviceberry	Subtotal	Percent of Total
1 & 4 (light)	10	12	14	5	41	32%
2 & 5 (moderate)	23	22	10	12	67	52%
3 & 6 (heavy)	8	3	2	7	20	16%
Subtotal	41	37	26	24	Total 128	

B. Browse Trend Summary

Number of young plants	16
Number of decadent plants	12
Total	28
20 percent of Total	5.6 (2.8)
Difference between young and decadent	4

C. Key area evaluation

	Points
Browse condition	10
Browse trend	10 (15)
Total	20 (25)
Adjective rating	Fair to Good

1/ **SOURCE: Baseline Environmental Report (Dames and Moore 1975).**

R86W

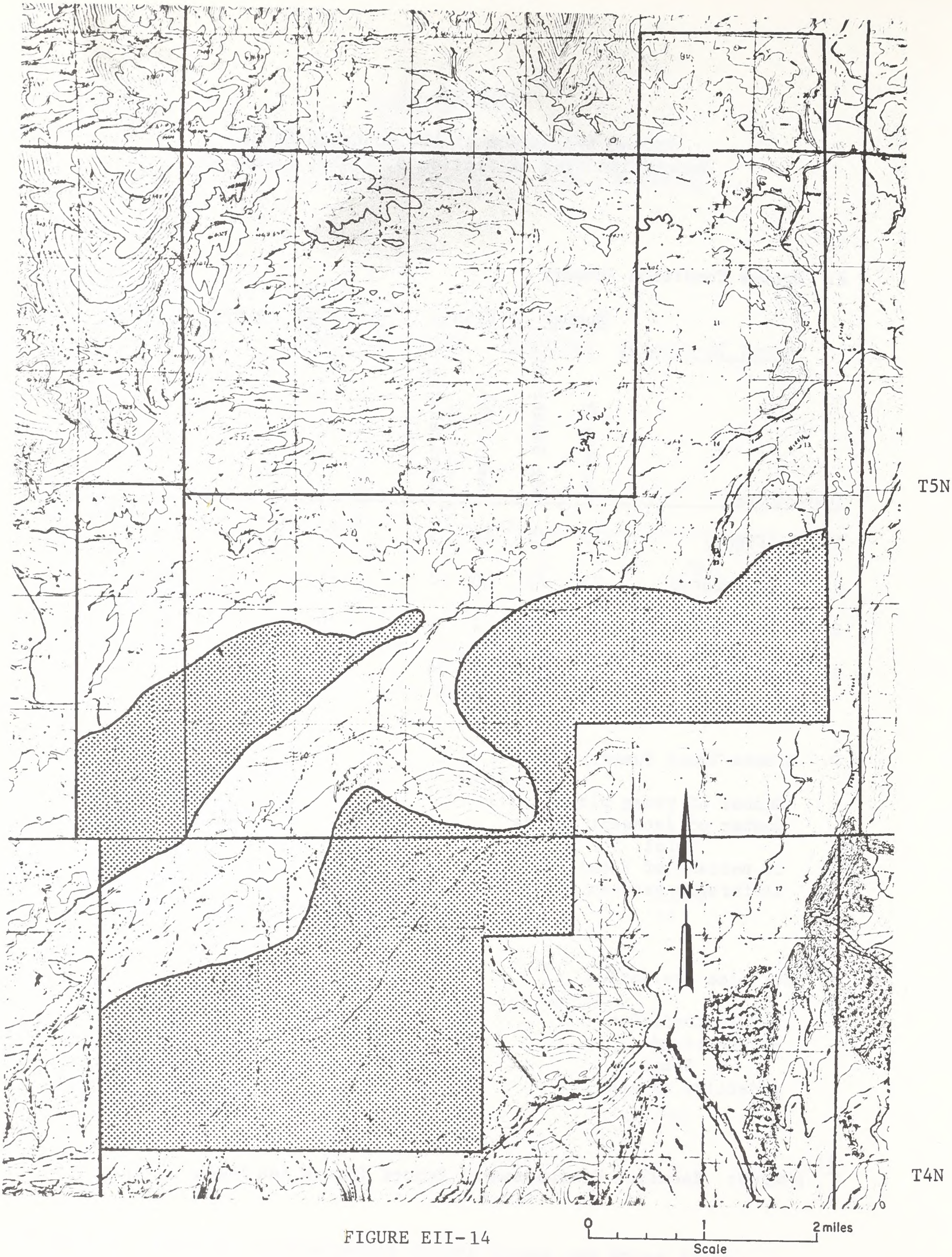


FIGURE EII-14

Preferred elk winter use areas (shaded).

tanks, and three creeks running through the area. Studies are being conducted by Dames and Moore to determine which plant species are of most importance to elk, and the condition and trend of these plants.

The Colo. DOW flew portions of northwestern Colorado to locate big game concentrations; the area around the Energy Fuels mine complex was transected in spring 1975. The results of these flights indicated a population estimated at six elk/square mile. This estimate would suggest a potential elk population within the area outlined on Figure EII-14 of 225 elk. At least 30 elk are known to use Energy 1 Mine spoils extensively (according to permanent mine workers reports).

Black bear. Little information is available concerning the use of the mine complex area by this species. The Colo. DOW indicates that bears are generally found along the southern fringe of Energy 1 lease area; they estimate five bear are located in this general area (see Figure EII-15). Based on bear habitation in other parts of northwestern Colorado the bears would be expected to remain in the brushy or forested vegetation types.

Cougar. The only cougars known to inhabit the area are found along Middle Creek south of Energy 1 (see Figure EII-15); estimates indicate two-four animals. No reports of lion predation have been reported to Colo. DOW in recent years, so it is assumed that cougar predation is not a serious problem to livestock operators. Both bear and cougars tend to avoid areas of concentrated human activity and would generally remain south of Routt County Road 27.

Small game mammals

Lagomorphs. Data are presently not available to indicate population densities or habitat conditions for species of this group of mammals. Rabbit population densities have been very low over all of northwestern Colorado for the past few years, as reported by local hide and fur dealers; preliminary studies indicate that this is true in the mine complex area.

Furbearers. Several species of furbearers have been identified within the subject area; however no population, harvest, or habitat data are presently available (see Appendix D, Terrestrial Fauna Section for species by habitat).

Mammalian predators. Cougar is listed as both predator and big game species. Other predator species that are found within this site are coyote (*Canis latrans*), bobcat (*Lynx rufus*), and red fox (*Vulpes fulva*). No specific data are available describing habitat or population parameters for these three species. Fox and coyote population trends are reported rising. Bobcat population trends in northwestern Colorado are generally stable to slightly declining.

Other mammals

A variety of rodents, insectivores, bats, and skunks is found within the subject area.

Small mammals were trapped on three consecutive nights by Dames and Moore (6-8 August 1975) using Sherman live traps. Four 12 x 12 grids (144 Sherman live traps per grid) were placed in each representative cover type, namely aspen, mountain shrub, sagebrush, and grassland. In addition to identifying, weighing, and recording the reproductive status of captured animals, vegetation at each grid site was sampled to compare mammalian diversity with cover types.

Twenty-one mammal species were recorded during the study. Aspen and mountain shrub types had the greatest species composition, with 14 and 13 species respectively. Eight species were identified in sagebrush habitat, and only two in grassland. Mountain shrub and aspen areas appear to support a more diverse mammal fauna than do sagebrush or grassland, because a greater array of microhabitats is associated with woodland growth-form and food resource. Many mammals utilize more than one community (Appendix D, Terrestrial Fauna).

All species were trapped in the aspen and mountain shrub areas, but only deer mice were trapped in sagebrush and meadow communities (Table EII-11). Since the diversity was greatest in mountain shrub followed by aspen woodlands, these communities must be considered more important habitats for small mammals than sagebrush or meadows. The diets of the six species trapped in mountain shrub type ranged from animal matter to seeds and vegetation, suggesting that not only a diverse habitat exists, but a diverse food resource base.

Unlike the woodland communities, sagebrush and meadows are more open and more restricted

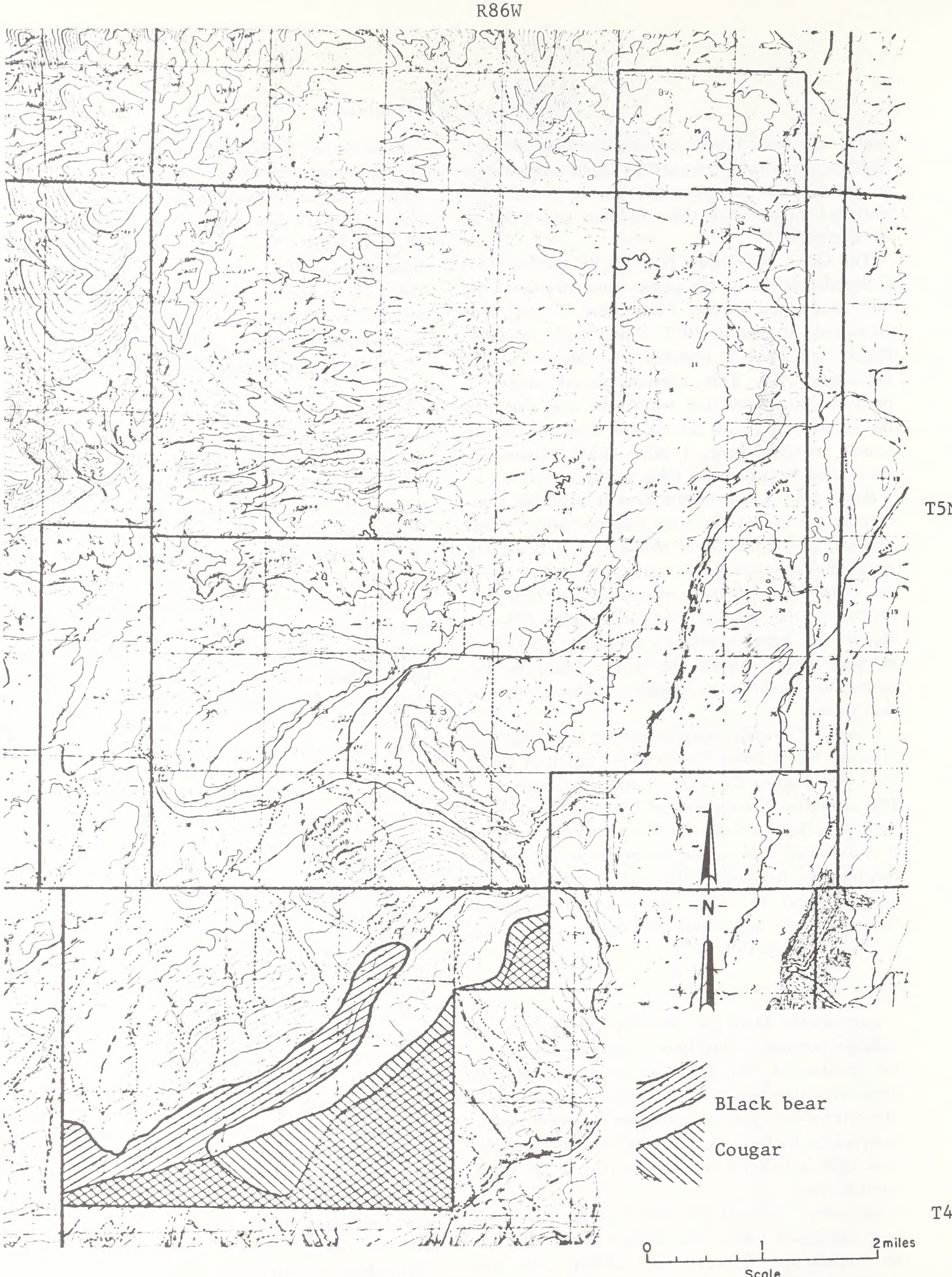


FIGURE EII-15

Black bear and cougar preferred use areas.

TABLE EII-11

Small Mammals Live-Trapped on the Four Mammal Grids - Energy Fuels Mine
August 1975

	Aspen	Oak	Sagebrush	Meadow	Total
Trap Nights	432	432	432	432	1,728
Total Species	5	6	1	1	13
Total Individuals	24	45	19	5	93
Total Biomass (gms.)	595	889	516	78	2,078
Trap Nights/Catch	18	9.6	22.7	86.4	
Percent Captures/Grid	5.6	10.4	4.4	1.2	
Density (Individuals/acre)	3.6	6.7	2.8	0.7	

Trapped Population Only

Species	Comp.	Biomass	Comp.	Biomass	Comp.	Biomass	Comp.	Biomass
Shorttail Weasel	-	-	1	56	-	-	-	-
Least Chipmunk	11	290	3	87	-	-	-	-
Deer Mouse	1	23	18	266	19	516	5	78
Boreal Redback Vole	3	96	7	176	-	-	-	-
Mountain Vole	6	141	12	252	-	-	-	-
Western Jumping Mouse	3	45	4	52	-	-	-	-

SOURCE: Dames and Moore, 1975.

in growth-form. The deer mouse, a predominantly seed-eating species although weakly omnivorous, was the only species to appear in these communities. The grasses at the meadow grid site were established through human manipulation, and the presence of deer mice and the absence of other rodents typifies the relationship between deer mice and exotic communities.

Data (Table EII-12) indicate less breeding activity occurs in aspen woodland than in the other communities. This may reflect shorter reproduction seasons at higher elevation.

TABLE EI1-12

Reproductive Status of Small Mammals Trapped on Four Grids, Energy Fuels Mine - August 1975

	Active		Inactive		
	Male	Female	Male	Female	Juvenile
Aspen					
Least Chipmunk	-	2	2	3	4
Deer Mouse	-	1	-	-	-
Boreal Redback Vole	2	-	1	-	-
Mountain Vole	1	2	-	1	2
Western Jumping Mouse	-	-	1	-	2
Oak Brush					
Shortail Weasel	-	-	-	-	1
Least Chipmunk	-	-	1	1	1
Deer Mouse	2	4	1	-	11
Boreal Redback Vole	2	2	2	1	-
Mountain Vole	1	1	1	1	8
Western Jumping Mouse	-	2	2	-	-
Sagebrush					
Deer Mouse	4	11	-	-	3
Grass					
Deer Mouse	2	1	1	-	1

SOURCE: Dames and Moore, 1975.

Waterfowl

Several species of waterfowl are known to migrate through the region, and many stop off at some ponds or creeks during this period. At least six species are known to nest within the area. Nesting densities are expected to be light and restricted to the creeks and ponds in areas that are not heavily grazed. Peak for waterfowl numbers moving through the mine complex area is probably in March or April.

Upland gamebirds

Sage grouse (*Centrocercus urophasianus*). Sage grouse have been reported mainly in the northwest portion of the site (Figure EII-16). This species is found in huntable quantities west and northwest of Energy 2. Population size has been estimated around 200 birds, with an estimated 10-20 percent (20-40 birds) located in close proximity to Energy 2 (Colo. DOW). Population condition and habitat parameters are not presently available. Bird identification transects, established by Dames and Moore, were run in the spring, summer, fall, and winter of 1975. Bird species identified during the reading of these transects were included in the species list located in Appendix D.

Sharp-tailed grouse (*Pedioecetes phasianellus*). This grouse species is known to inhabit certain areas along northern and western perimeters of the subject area. One dancing ground has been identified one mile northwest of Pinnacle Peak (Figure EII-16). No additional information is presently available.

Blue grouse (*Dendragapus obscurus*). These birds may be found scattered throughout the mine complex area, generally in aspen vegetation type. More blue grouse are known to inhabit the conifer forests south of the subject area. Population densities, habitat conditions, or season of use information are not available for blue grouse at this time.

Other birds

Very little information is available for non-game birds inhabiting this area; some of the most obvious birds have been recognized on the site. The presence of other bird species is assumed, based on a literature review conducted by Dames and Moore (1975).

Amphibians and reptiles

Very little data are available for occurrence or habitat requirements of amphibians and reptiles within this area. Some generalizations can be made based on species habitat in other localities; a species list based on this extrapolation is included in Appendix D, Terrestrial Fauna.

Terrestrial invertebrates

No information is currently available concerning the use of the subject area by species of this group.

Threatened or endangered species

No endangered or threatened species are known to inhabit or utilize the subject area (Colo. DOW). However, the peregrine falcon (*Falco peregrinus*) is a potential visitor in the mine's vicinity.

Domestic fauna

Some of the lands within the Energy Fuels lease areas are used by livestock, primarily from

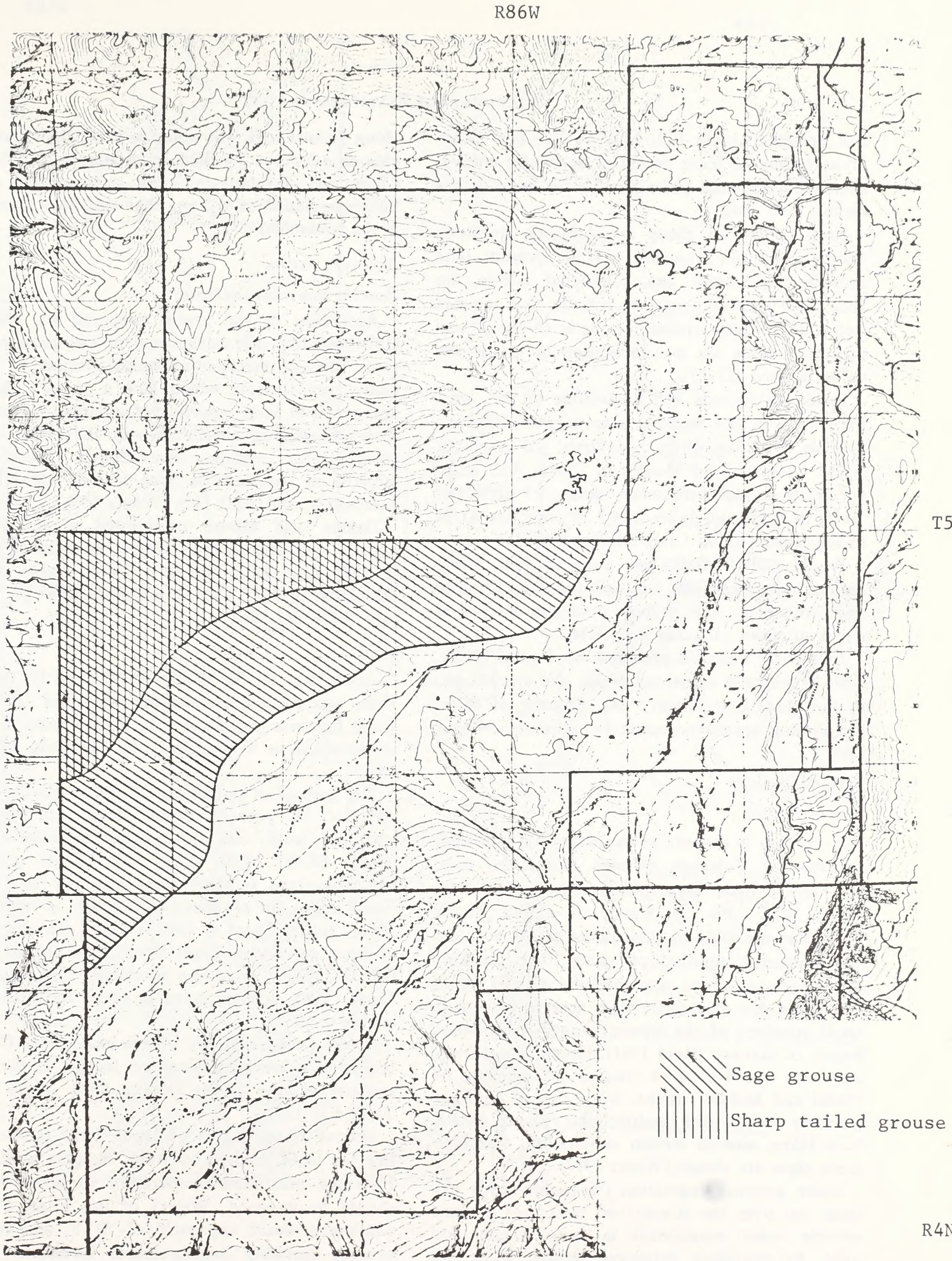


FIGURE EII-16

Sage grouse and sharp-tailed grouse preferred use areas.

late spring to early fall, May to October. Other areas within the lease boundary are under cultivation (see Terrestrial Flora Section for more details on this land use).

Both cattle and sheep are domestic livestock within the lease boundary. At the present time ranching operations are conducted within the lease area by five operators. Of the five ranches one is an all-cattle operation; one is all-sheep; and the other three are a combination of sheep and cattle (Figure EII-17).

Based on records and knowledge of this area, the ability of the vegetation to support domestic animals is broken down as follows: 4.0 acres per AUM (Animal Unit Month) in aspen, 4.25 acres per AUM in aspen-mountain shrub, 4.5 acres per AUM in mountain shrub, and 7.75 acres per AUM in sagebrush (BLM, Craig District Office).

Wheat stubble fields are used by both sheep and cattle during the late fall months, October and November, and support domestic animals at a rate of about 7.0 acres per AUM.

Livestock water is provided by Foidel Creek, Fish Creek, and numerous ponds and stock tanks in the area. Both quality and quantity of water distribution appear adequate for present livestock use.

Aquatic Biology

Aquatic flora

According to a study of the effects of acid mine drainage in Colorado (Wentz 1974), the most abundant aquatic flora (plants which spend their entire life cycle in water) in Trout Creek watershed are diatoms (unicellular plants with external cases composed of silica). The plankton (mass concentrations of unicellular plants) which serves as the principal food source for many small members of the stream ecosystems consist largely of diatoms (Reid 1961). Green filamentous algae are found in thick masses in segments of Foidel and Middle Creeks, while rooted aquatics (partially submerged multicellular plants which have taken root in stream substrates), and blue green algae are absent (Wentz 1974).

Taller growing vegetation (riparian) which extends out over the stream bed maintains a more suitable water temperature in these streams for trout, by providing extensive shaded areas, as well as increasing the natural food supply (terrestrial insects falling onto the water surface from overhanging vegetation). Riparian vegetation along Trout Creek was noted to be fair-good at locations surveyed by EIS team personnel; Trout Creek has a relatively more concentrated and taller population of willows than the other streams in the watershed.

Aquatic fauna

Benthic macroinvertebrates

According to the report prepared by Wentz (1974) mayflies and midges are the two most common benthic macroinvertebrates found in the study area (insects which lack a spinal column and spend at least a portion of nymphal stages of their life cycle in association with the stream bottom). Other aquatic invertebrates found in streams in the analysis area include stoneflies, caddisflies, and black flies (Wentz 1974).

Dames and Moore established a series of aquatic sampling stations within the subject area in 1975 (see Table EII-13). These sights were monitored in July, August, and September of 1975 (see Table EII-14).

Fish

According to the Colo. DOW (1972) Trout, Fish, and Middle Creeks are classified as cold water fisheries populated with trout. Foidel Creek is classified as a nonfishery by the Colo. DOW (1975).

The game fish population of Trout Creek consists of 80 percent brook trout, 10 percent cutthroat trout, and 10 percent rainbow trout (Colo. DOW 1972). The Colo. DOW stocks catchable-sized rainbow trout annually in Trout Creek above the proposed mining site on National Forest lands. There is some natural reproduction of trout species in Trout Creek, and the overall fish population condition is stable. The flow of Trout Creek is interrupted at some locations by beaver dams.

Studies conducted by Dames and Moore (1975) indicated a low quality sports fishery in the immediate vicinity of the Energy Fuels mines (see Table EII-15).

Overall water quality of Trout Creek is rated as fair for trout, limited by water temperatures; 70° F is the maximum temperature to which trout should be exposed. Waters of the Trout Creek watershed would approach 65°-70° F, and above average turbidity measurements (sediment load transported by stream) would occur during the late summer and early fall. The physical quality of Trout Creek may also be classified as fair to

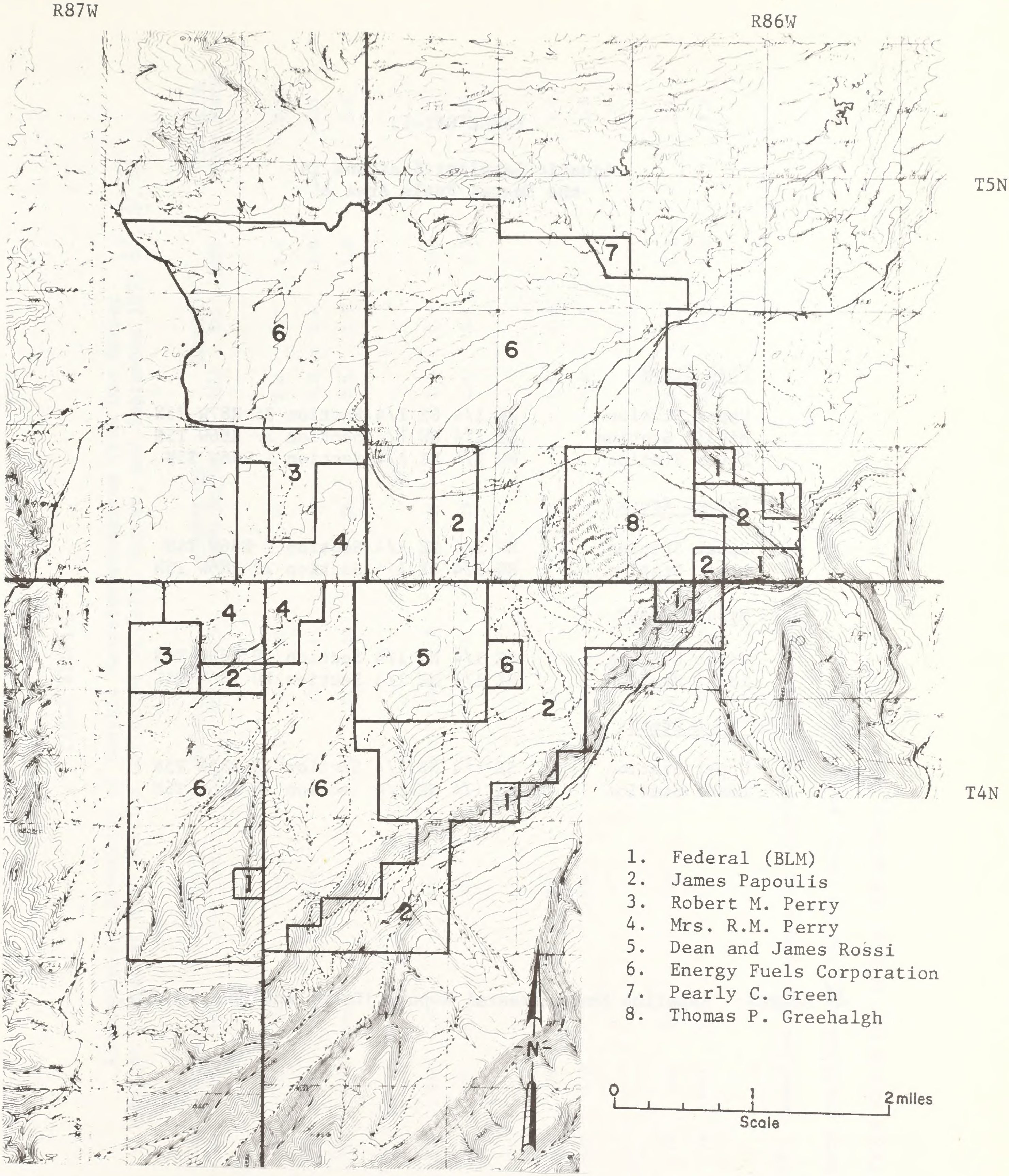


FIGURE EII-17

Landownership as of June 1975.

TABLE EII-13

Aquatic Sampling Stations in the Energy Fuels Area [1/]

Fish Creek	
Upper Station	NW 1/4 SE 1/4 Section 34 R87W T5N
Middle Station	SE 1/4 SW 1/4 Section 17 R86W T5N
Lower Station	NW 1/4 NE 1/4 Section 1 R86W T5N
Foidel Creek	
Upper Station	NW 1/4 NE 1/4 Section 7 R86W T4N
Lower Station	NW 1/4 SE 1/4 Section 29 R86W T5N
Middle Creek	
Upper Station	SE 1/4 NE 1/4 Section 19 R86W T4N
Lower Station	NE 1/4 NW 1/4 Section 10 R86W T4N
Trout Creek	
Upper Station	SE 1/4 NE 1/4 Section 18 R85W T5N
Lower Station	NW 1/4 NE 1/4 Section 36 R86W T6N

1/ SOURCE: Baseline Environmental Report (Dames and Moore 1975).

TABLE EII-14

Abundance and Diversity of Benthic Macroinvertebrates from One Surber Bottom Sample at Each Station Collected in July, August, and September 1975 1/, 2/, 3/

Station	Number of Individuals			Average For Summer Season	Number of Taxa			Average For Summer Season	Diversity			Average For Summer Season
	July	Aug	Sept		July	Aug	Sept		July	Aug	Sept	
Fish Creek												
Upper	140	307	750	399	8	12	20	13	2.0	2.7	2.7	2.5
Middle	10	998	589	532	1	15	11	9	0.0	2.7	1.8	1.5
Lower	18	2399	4058	2158	6	20	16	14	2.2	2.3	1.4	2.0
Middle Creek												
Upper	230	832	294	452	18	10	8	12	2.5	0.9	1.6	1.7
Lower	130	151	672	318	13	10	21	15	2.4	2.6	3.3	2.8
Foidel Creek												
Upper	90	1013	-	552	8	16	-	12	1.3	1.8	-	1.6
Lower	486	3170	-	1828	7	16	-	12	1.8	1.8	-	1.8
Trout Creek												
Upper	29	546	775	450	11	17	18	15	2.8	3.3	2.3	2.8
Lower	76	6082	715	2291	7	15	20	14	2.3	2.1	2.6	2.3

1/ SOURCE: Baseline Environmental Report (Dames and Moore 1975).

2/ For more detailed analysis of data, see Appendix D.

3/ See Table EII-A for station locations.

TABLE EII-15

Numbers and Kinds of Fish
Captured at Each Station in August 1975 1/ 2/

Species	Fish Creek			Foidel Creek		Middle Creek		Trout Creek	
	Upper	Middle	Lower	Upper	Lower	Upper	Lower	Upper	Lower
MINNOWS									
Shiner (*Notropis* spp.)	-	1	3	-	-	-	-	3	-
Speckled dace (*Rhinichthys osculus*)	-	41	1	-	3	-	3	54	17
Flathead minnow (*Pimephales promelas*)	-	-	4	-	-	-	-	-	-
SUCKERS									
White sucker (*Catostomus commersoni*)	-	7	2	-	5	-	21	1	4
Mountain sucker (*Catasomus platyrhyrchus*)	-	-	-	-	-	14	32	1	-
SCULPINS									
Mottled sculpin (*Cottus bairdi*)	12	-	3	-	-	-	-	22	4
TROUT									
Brooktrout (*Salvelinus fontinalis*)	-	-	-	-	-	1	-	-	-

1/ SOURCE: Baseline Environmental Report (Dames and Moore 1975).

2/ See Table EII-A for station locations.

good. The pool-riffle (critical spawning and feeding habitat for trout) ratio in Trout Creek is approximately 50-50 (50 percent pools and 50 percent riffle areas), while a 30-70 ratio is described as ideal by the Colo. DOW (1972). The natural channel of Trout Creek is meandering, with steep, undercut banks in its lower reaches south and east of the proposed mining activities.

Food supply available to the trout population in Trout Creek (primarily aquatic invertebrates) is fair in quality and quantity, and general condition of the fish in the stream is rated as fair.

There are very few non-game species to compete with trout for available habitat in Trout Creek. Non-game species which are present in the stream are white suckers, mottled sculpins, and red shiners (Everhart and Seaman 1971).

Fish Creek is populated with brook and rainbow trout in a 70-30 percent species composition ratio (Colo. DOW 1972). The stream is stocked with rainbow trout at random time intervals by the Colo. DOW, at locations above proposed mining activity. There is some natural reproduction of brook trout in Fish Creek, and overall fish population condition is stable.

Physical and chemical quality of Fish Creek is poor in the vicinity of the proposed actions. Critical limiting factors for the fish population in Fish Creek on the Energy Fuels property are: (1) water temperatures which are marginal (greater than 80° F in some stream segments during the summer and early fall; 60° F-65° F is generally considered optimum for trout), (2) more pool areas than riffle areas (65 percent pools to 35 percent riffles), (3) generally turbid water flow clarity throughout most of the year, (4) low average flow velocity, (5) widely meandering natural stream channel with steeply undercut and eroding banks, and (6) lack of an adequate food supply (macroinvertebrates) for the existing trout population. The only non-game fish species which might occur in Fish Creek are white suckers, sculpins, and red shiners.

Fisheries population of Middle Creek consists of brook and rainbow trout in a 50-50 ratio (Colo. DOW 1972). The stream is occasionally stocked with rainbow trout by the Colo. DOW at irregular time intervals, and there is some natural reproduction of brook trout in the upper reaches of the stream. The streamflow is interrupted by beaver dams at some locations. General quality of Middle Creek in the vicinity of the proposed action is poor due to: (1) marginal water temperatures for trout, (2) high turbidity of stream flow, (3) more pools than riffle areas, (4) marginal fish food supply for trout, and (5) low velocity flow and meandering stream channel (taken from Colo. DOW's Stream Rating System). Middle Creek may also be assumed to contain some suckers and sculpins.

Although Foidel Creek is considered to be a non-fishery, field observations during June 1975 by E S team personnel indicated that the stream does flow during spring runoff, and for at least a portion of the summer. It may be assumed that some members of the permanent fish population in Middle Creek migrate into Foidel Creek during these periods. Quality of the intermittent flow of Foidel Creek is poor, characterized by low velocity, high sediment loads, marginal water temperatures, lack of riffle areas, and low diversity of aquatic insects.

Cultural Components

Archeological Resources

During the summer of 1975, Dr. Alan Olson of Denver University spent five man-days conducting a reconnaissance survey of several Energy Fuels' properties. Dr. Olson's report to the Energy Fuels consultants (September 18, 1975) indicates:

> that the area is initially unsuitable for permanent occupation. However, there is the potential for seasonal utilization prior to European settlement of the region. This activity, such as hunting or gathering undoubtedly occurred, but this utilization does not produce definite concentrations of artifacts except possibly at base camps. None of these were located. The vegetative cover inhibited 100 percent coverage of the parcels, but all feasible locations for occupation were intensively surveyed for a total of five man/days.

The one-page report closes by stating:

> "The areas surveyed appear to be devoid of any archeological material."

Also during the summer of 1975, Dr. Calvin Jennings of Colorado State University completed an archeological reconnaissance survey of proposed coal lease areas for the BLM. In accordance with their contract, a sample percentage of each area was surveyed; areas having the greatest potential for site locations received the closest scrutiny. The Jennings survey disclosed six sites in the immediate proposed action areas, two of which are on tracts which were to have been surveyed by Dr. Olson. Figure EII-18 indicates the locations of the sites, and Table EII-16 indicates their nature.

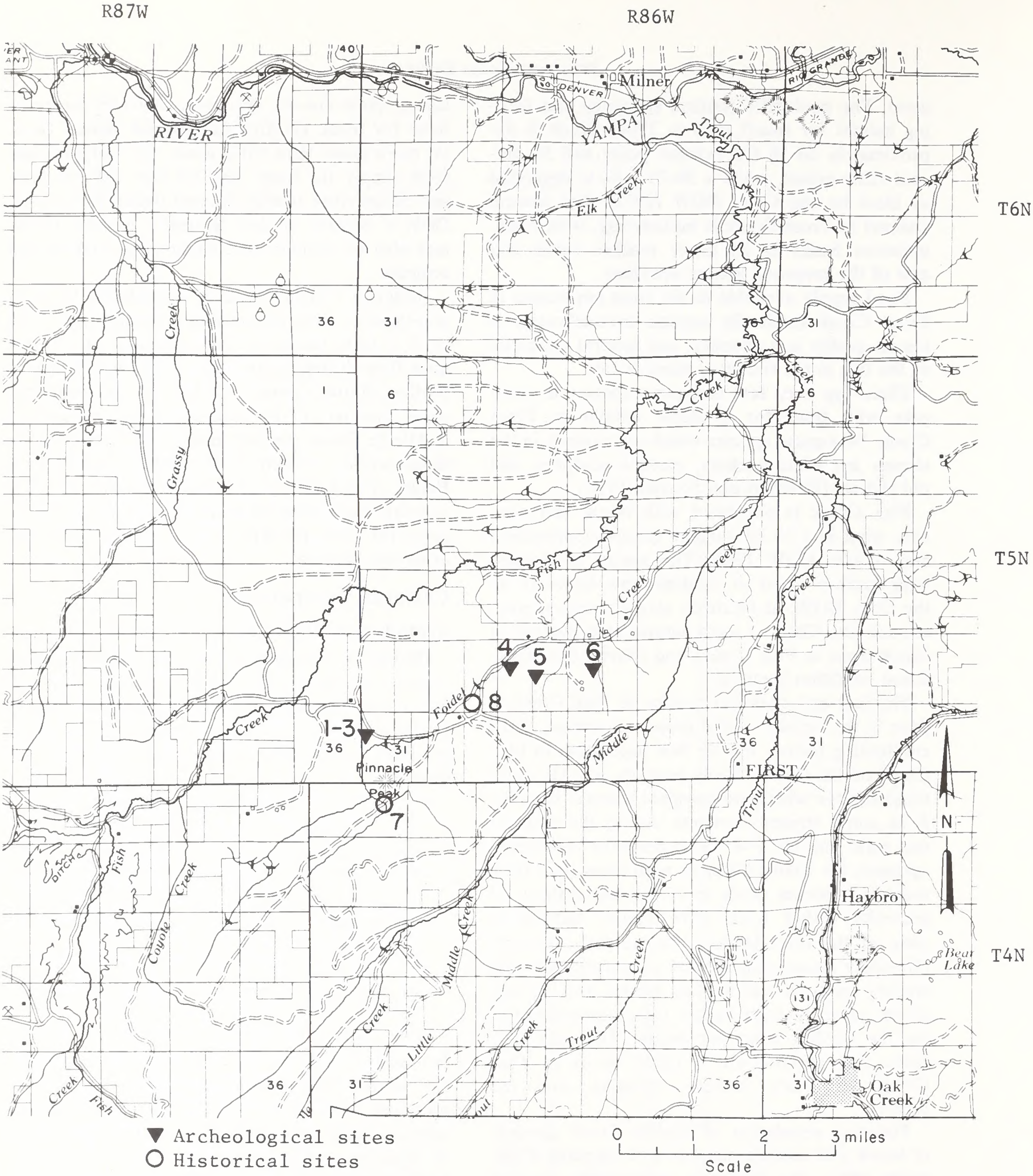


FIGURE EII-18

Cultural resources at the Energy Fuels mine areas.

TABLE EII-16

Cultural Resources at the Energy Fuels Mine Areas

Site Number	Nature of Site				Comments
	Archeologic			Historic	
	Lithic	Chipping Station	Campsite		
1			X		Site has been disturbed by a powerline and road.
2		X			Site disturbed by a dozer cut.
3	X				Road cut through site.
4			X		Site is disturbed by plowing. Recommended nomination t the National Register of Historic Places.
5			X		Site is disturbed by plowing. Recommended testing.
6			X		Site is disturbed by plowing.
7				X	3 milled lumber buildings, partially collapsing, and machinery.
8				X	Foidel School

No other cultural resources are known on or in close proximity to the three Energy Mine areas.

Historical Resources

Figure EII-18 indicates the location of the two known historic sites in the area, and Table EII-16 shows their nature. The site south of Pinnacle Peak is of relatively recent origin and is a farmstead of no special significance; land on which the structures lie was first deeded by the U.S. Government on September 19, 1911, to Samuel Handley (Routt County Assessor's Office).

Site No. seven is the old Foidel Canyon School. Routt County Assessor's office records indicate this tract of land was first deeded to Albert P. Smith from the U.S. Government on August 4, 1902. The first school building was built in either 1913 or 1914 and was one of the first schools in the area; others include the Eddy School on Trout Creek, and the Middle Creek School on Middle Creek. Being rather roughly constructed, this structure was torn down, and the present Foidel Canyon School was erected in 1925 (Mrs. Helen (Long) Light 1975). Foidel is the name of a family of early settlers who located in the canyon in 1887; Mrs. Margaret Foidel is buried on the hillside under the rimrock not far from the schoolhouse (Colorado Division of State Archives and Public Records 1975). At the request of her family, Mrs. Foidel's grave was moved in 1962 from the approximate present location of the Energy 1 shop and maintenance facilities; a Mr. Gerald Jonnes from Rockville, Indiana, moved the grave to Fort Collins, Colorado (Mr. Jack Eatherton, Energy Fuels Mine Superintendent, 1976).

Two additional graves are thought to occur in the area of Pinnacle Peak; one is thought to be that of an Indian, the other that of an early homesteader.

Aesthetics

Visibility of mining operations at Energy Fuels is determined by public access routes in this area, the county road system. Portions of both mines are visible from several county roads: 27, 31, and 33.

A landscape visibility map for both Energy 1 and 2 Mines is found in Figure EII-19. Refer to Appendix D for a description of the methodology used to derive the map. Analysis of the landscape visibility map suggests areas that are more visible than others.

Refer also to Chapter IV of the Regional Analysis for a discussion of the regional aesthetic setting of the Energy Mines areas as well as a general discussion of visual resources.

ENERGY 1

Energy 1 is confined largely to the immediate landscape of Foidel Creek downstream to the break in rimrock escarpments that lies above the Foidel School. Ten additional Figures, EII-20 through EII-29, are photographs of the more significant views from public roads at Energy 1; they are helpful in indicating the relative visibility of the proposed action area.

The most visually sensitive portion of Energy 1 is the foreground visible from viewshed sequence EG. This landscape contains all base facilities for the mine; both old and new tipples, shop, railroad siding, and transmission lines are large-scale features that dominate this landscape. They do not borrow visual dominance elements (i.e. form, line, color, and texture) from the adjacent landscape, and therefore are minus deviations (visual intrusions) from the characteristic landscape (see Regional Analysis, Chapter IV). Construction of the newly relocated Routt County Road 27 has improved visibility of the base facilities by increasing the viewing angle through elevation of the roadway.

Viewshed sequence BE provides visual access to a foreground visual unit that contains competitive lease application C-16284, and one unit of C-22677. Few deviations presently occur in this landscape (see Figure EII-23).

LEGEND
for
LANDSCAPE VISIBILITY MAPS

OVERALL VISIBILITY CLASSIFICATION

- Foreground Landscapes
- Middleground Landscapes
- Background Landscapes
- Lands Not Visible

VISUAL BOUNDARIES and DOMINANT FEATURES

- Rounded Ridges
- Hogbacks
- Escarpments
- Peak or Promontory
- Foreground Landscape Visual Unit Boundaries

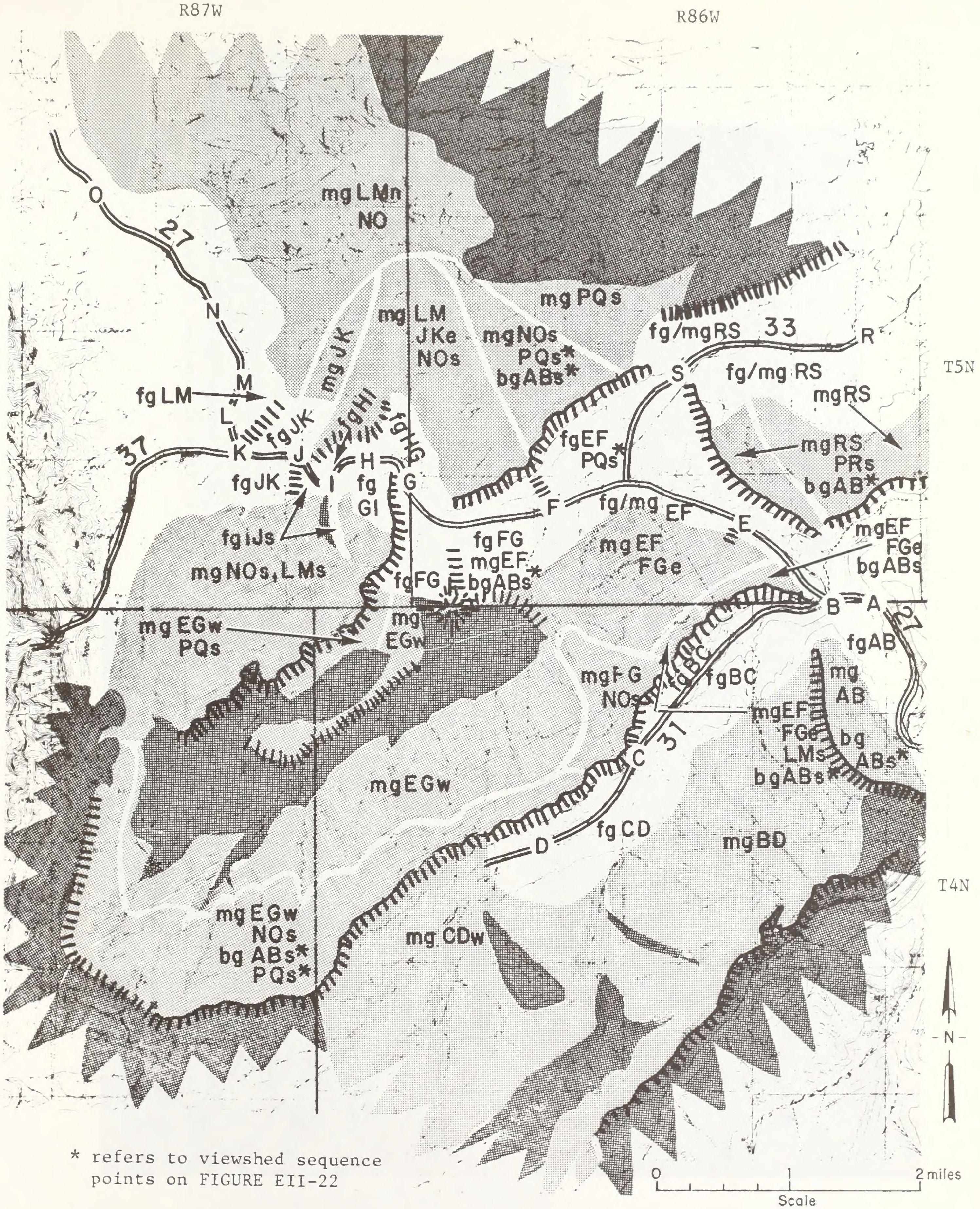
ROADS

- 13 U.S. or State Highways
- County Roads: Surfaced / Improved /Graveled
- B Capital Letters Denote Viewshed Sequence Points

LANDSCAPE VISUAL UNIT CLASSIFICATION

mgNOs

- Foreground (fg), Middleground (mg) or Background (bg)
- Only visible northbound (n), southbound (s) eastbound (e), westbound (w)
- Viewshed Sequence from which Landscape is Visible



* refers to viewshed sequence points on FIGURE EII-22

FIGURE EII-19

Landscape visibility map of Energy Fuels 1 and 2.

FIGURE EII-20

These foreground landscapes visible from viewshed sequence CD contain existing (above) as well as potential areas (below) for minus deviations. Spoils dumped over the escarpment from Energy 1 are large scale elements in this foreground landscape.

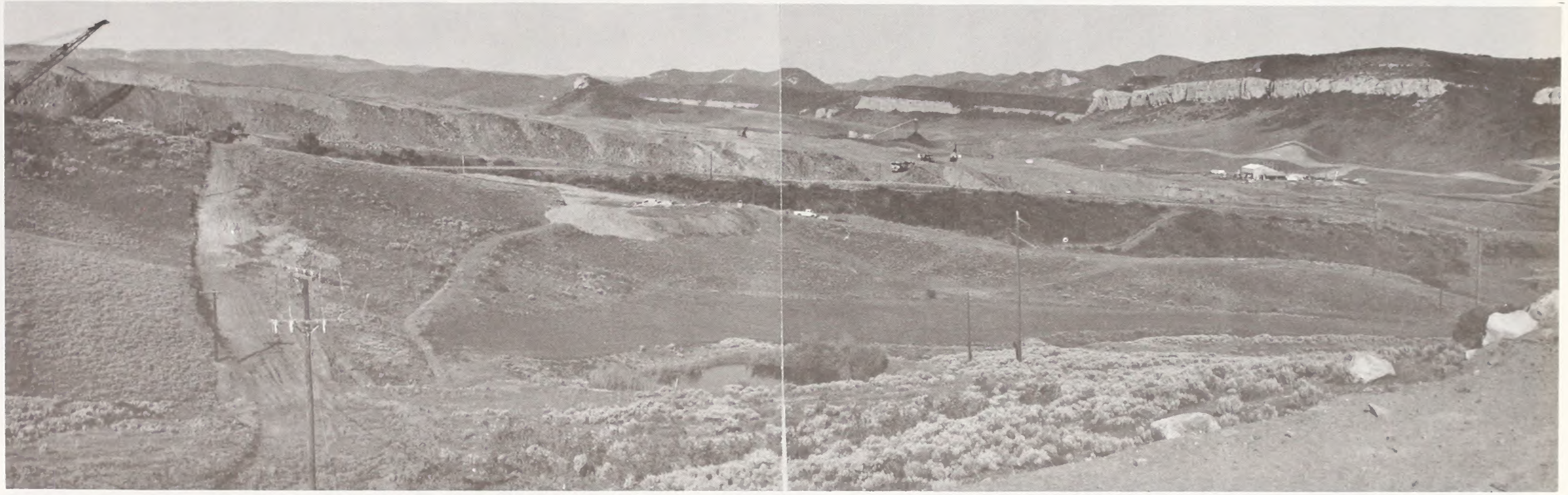


FIGURE EII-21

The entire operation at Energy 1 becomes visible immediately upon entering viewshed EF while traveling westbound on County Road 27. The newly relocated 69-kv transmission line is visible in the foreground.

FIGURE EII-22

This four-shot panorama from viewshed sequence EF shows both active pits and the old mined-over area (above), plus the area of the proposed action visible to the left of Pinnacle Peak (below). The Energy 1 shop and old tipple are visible in the foreground.

FIGURE EII-23

Visible from viewshed sequence BE, this four-shot panorama displays mixed foreground and middleground landscapes that contain portions of Competitive Lease Application C-16284 and C-22677. The recent relocation of County Road 27 has increased the viewing angle into this landscape.

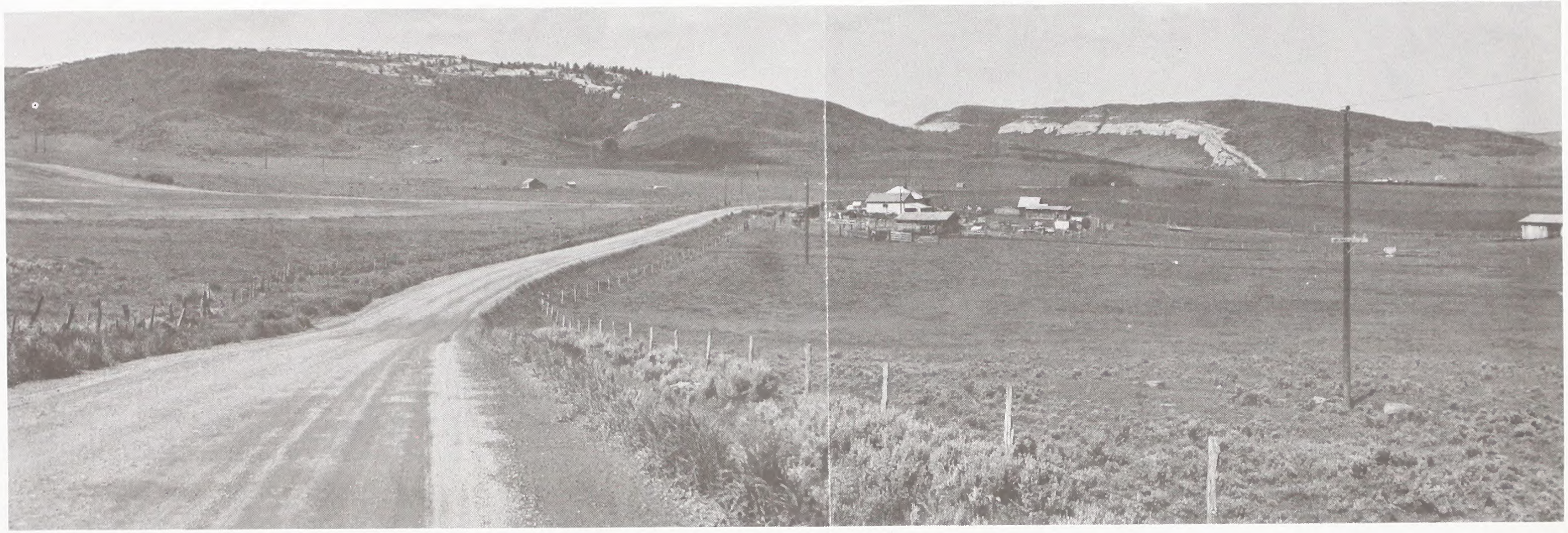


FIGURE EII-24

Southbound motorists on viewshed sequence RS, County Road 33, can view this portion of competitive lease C-22677 in the foreground landscape.

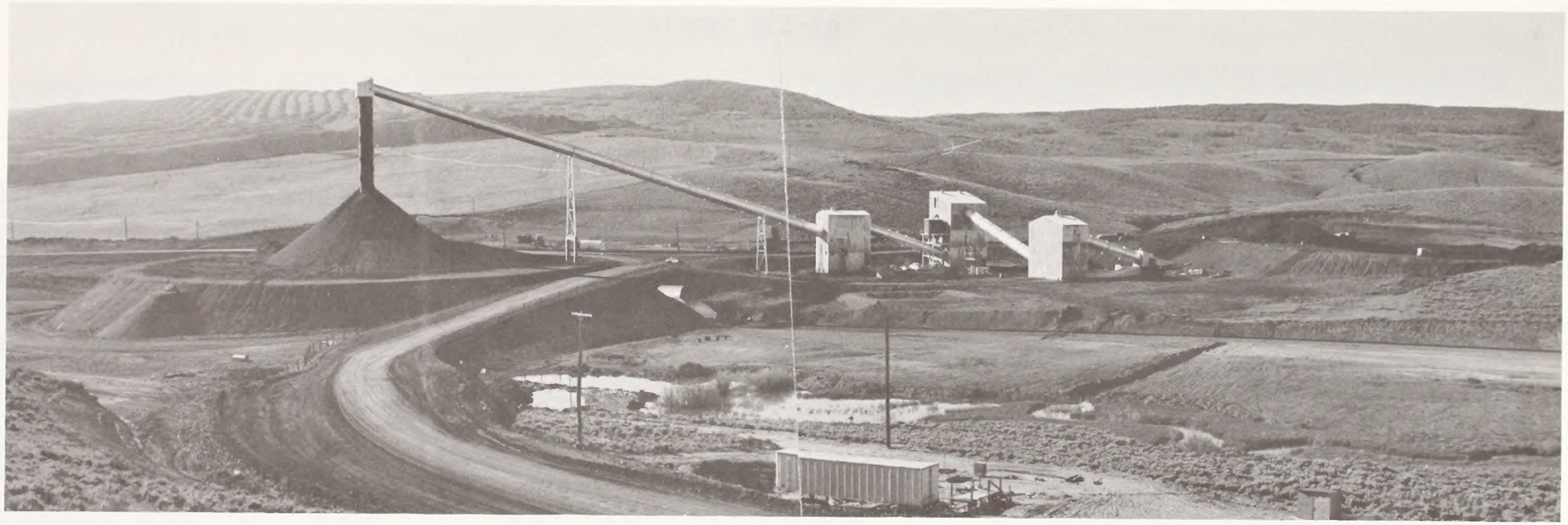


FIGURE EII-25

Visible from viewshed sequence FG, this foreground landscape is occupied by the new Energy 1 tipple and loadout facility. The existing mine is visible in the left middleground, and Federal coal lease C-081330 is visible to the right.

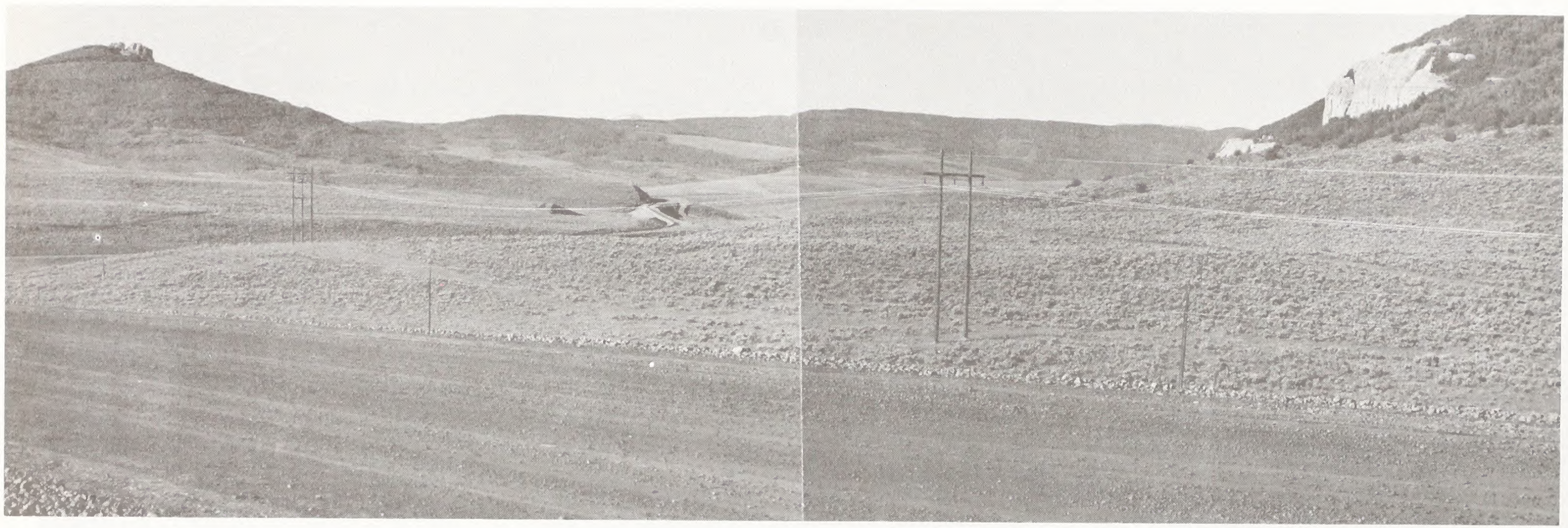


FIGURE EII-26

Immediately upon entering the Energy 1 area from the west, this view appears on viewshed sequence FG. Beyond the Energy 1 rail spur lies competitive lease applications C-22644 and C-9968.

FIGURE EII-27

This panorama may be viewed looking southwest from viewshed sequence AB, on County Road 33. Scanning from left to right, portions of Energy 1, Pinnacle Peak, portions of Energy 2 and part of competitive lease application C-22676 at the Energy 3 area occur as both middleground and background landscapes.

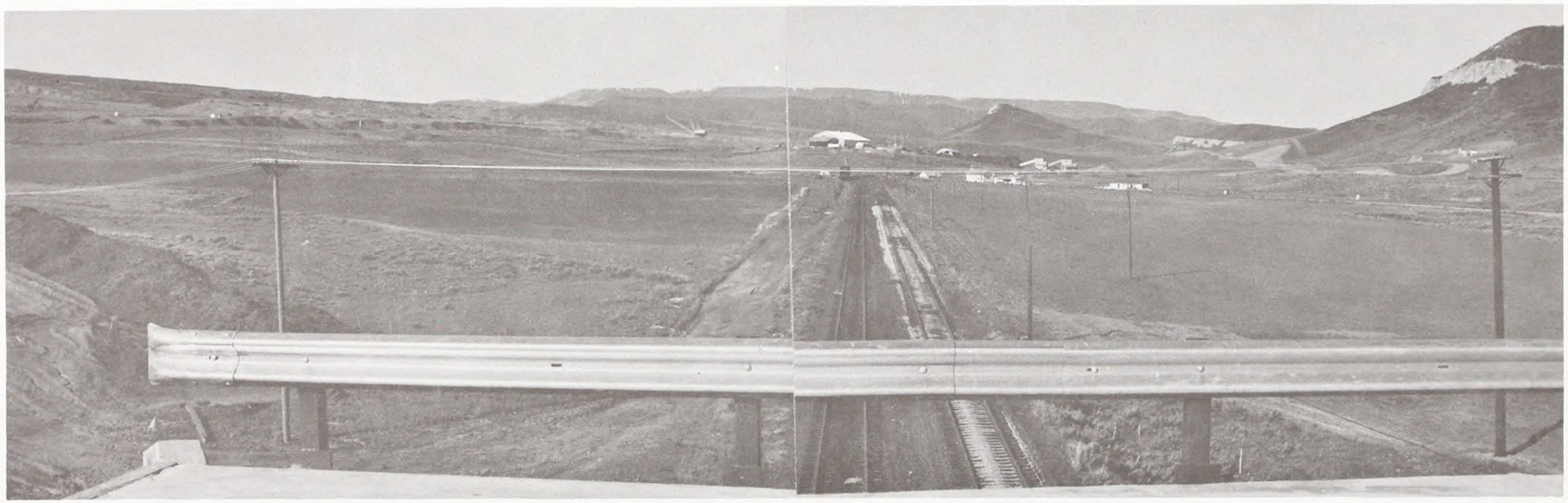


FIGURE EII-28

This axis or alinement of the railroad siding helps to focus attention on the Energy 1 shop area as viewed from the railroad overpass, viewshed sequence EF, County Road 27. Portions of competitive lease applications C-9968 and C-22644 plus Federal coal lease C-081330 are visible as middleground beyond the shop area.

FIGURE EII-29

Examples of short-lived minus deviations include blowing coal dust from the Energy 1 tipple (above) and dust clouds resulting from blasting (below), as seen from viewshed sequence FG on County Road 27.

FIGURE EII-30

This four-shot panorama scans to the east from viewshed sequence LM on County Road 27. Existing Energy 2 operations plus Federal coal lease C-0128433 and competitive lease application C-20900 are visible to the left (above and part of lower photo). Competitive lease application C-22677 lies just below the horizons on the right (below). Note the Energy 1 spoils visible at the left of the lower photo.

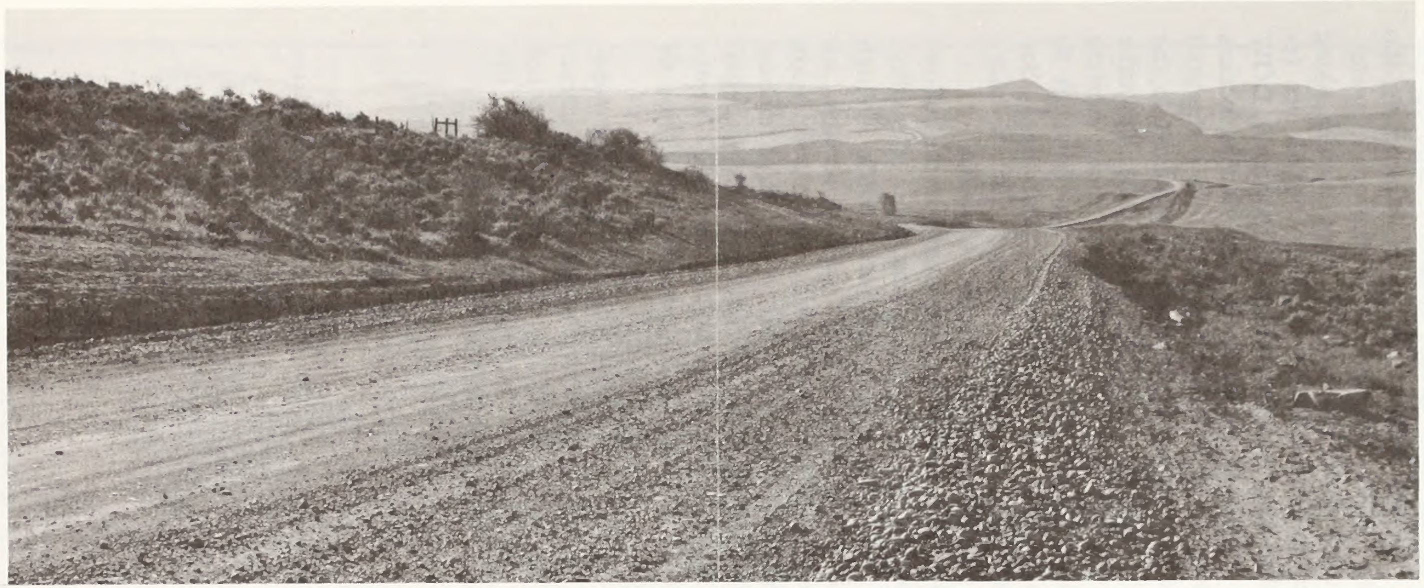


FIGURE EII-31

This four-shot panoramic landscape may be viewed by southbound motorists along County Road 27 on viewshed sequence NO. Existing mining operations at Energy 2 are visible on the left (above). Federal coal lease C-0128433 and competitive lease application C-20900 appear as light-colored grain fields above this mined-over area. Middleground landscapes to the right (below) contain portions of Federal coal lease C-081330 plus competitive lease applications C-22677, C-9968, and C-22644 (see Energy 1).

Another unit of competitive lease application C-22677 occupies the foreground landscape of viewshed sequence RS; it is intersected by two transmission lines; both are strongly line-dominant minus deviations (see Figure EII-24).

The middleground landscape at Energy 1 contains all existing overburden and coal stripping areas. Because the viewing angle is low, the size of the middleground "picture plane" is much smaller than the actual disturbed area. Mine spoils are alined perpendicular to the contour, and appear as vertical ridges which occupy much of the mined-over area. Ridgetop mining operations are strongly form and line-dominant as they are silhouetted against the sky from viewshed sequences EF and FG (see Figure EII-25).

The remaining middleground landscape, behind Pinnacle Peak and partly obscured by it, contains nearly all of existing lease C-081330, and competitive lease applications C-9968 and C-22644 (see Figure EII-26).

Energy 2

Due to a precipitous rimrock ledge on its southern perimeter, Energy 2 is only visible from viewshed sequences lying along Routt County Roads 27 and 33, not from the Energy 1 area. Figures EII-30 and EII-31 are photographs of the more significant views obtainable from public roads at Energy 2.

Most visually sensitive areas at Energy 2 are the foreground visual units that lie adjacent to viewshed sequences RS, GH, and JK. Currently only minedeout areas undergoing reclamation occupy viewshed sequences GH and JK.

Middleground landscape visual units along County Road 27 reveal the greatest portion of Energy 2 Mine. Strike-mining at this mine generally precludes viewing parallel to mine spoils, and therefore the strongly line-dominant effect of mining across contours is absent; reshaping spoils soon after mining has also helped to minimize these impacts. The greatest minus deviations at Energy 2 are due to strongly line-dominant roads, and also form and color-dominant mined-over areas.

Recreation

Refer to Chapter IV of the Regional Analysis for a discussion of the regional recreation environment.

Resources

Noteworthy wildlife viewing opportunities occur during the winter when several elk concentrate on old mine spoils, southerly exposed hillsides, rimrock ledges, and fields adjacent to the Energy 1 Mine. Seasonal concentrations of waterfowl offer additional viewing opportunities along all perennial streams in the area; beaver are reported in these same drainages (Croonquist, DOW 1975). Seasonal upland game bird viewing occurs in a sage grouse strutting ground and a sharptail grouse dancing ground, which lie adjacent to the Energy 2 Mine (Williams Fork Unit Resource Analysis, BLM 1974). One known raptor nesting area lies immediately north of and adjacent to Foidel School on the rimrock escarpment. See Chapter II, Terrestrial Fauna, for a more complete description of wildlife resources.

Good small stream fishing occurs on the following streams, listed in descending order of quality: Trout, Fish, Middle, and Foidel Creeks. Though they lie on privately-owned surface acreage, all are generally open to fishing with permission (Croonquist, DOW 1975). However, on a regional basis the latter three have only marginal capabilities to attract and sustain fishing use. See Chapter II Aquatic Biology for a complete description of fisheries.

Figure EII-32 displays relative inherent capabilities of various land units in the area to attract and sustain recreation use; this rating does not imply management but merely looks at the resources in their present condition.

Recreation Capability Classification

Legend for Figure EII-32

I. Capability Classes:

(Capability to attract and to accommodate recreation)

Class 1 - Very high; intensive activities
2 - High; intensive activities
3 - Moderately high; intensive activities
4 - Moderate; dispersed activities
5 - Moderately low; dispersed activities
6 - Low; dispersed activities
7 - Very low; dispersed activities

II. Sub-Classes:

(Recreation resources)

A - angling
E - vegetation
M - small water bodies
O - viewing upland wildlife
P - agricultural interest
Q - topographic - landscape variety
R - rock formations
V - panoramic view
W - waterfowl viewing
XO - off-road vehicle use
XS - snowmobiling
ZC - coal mines

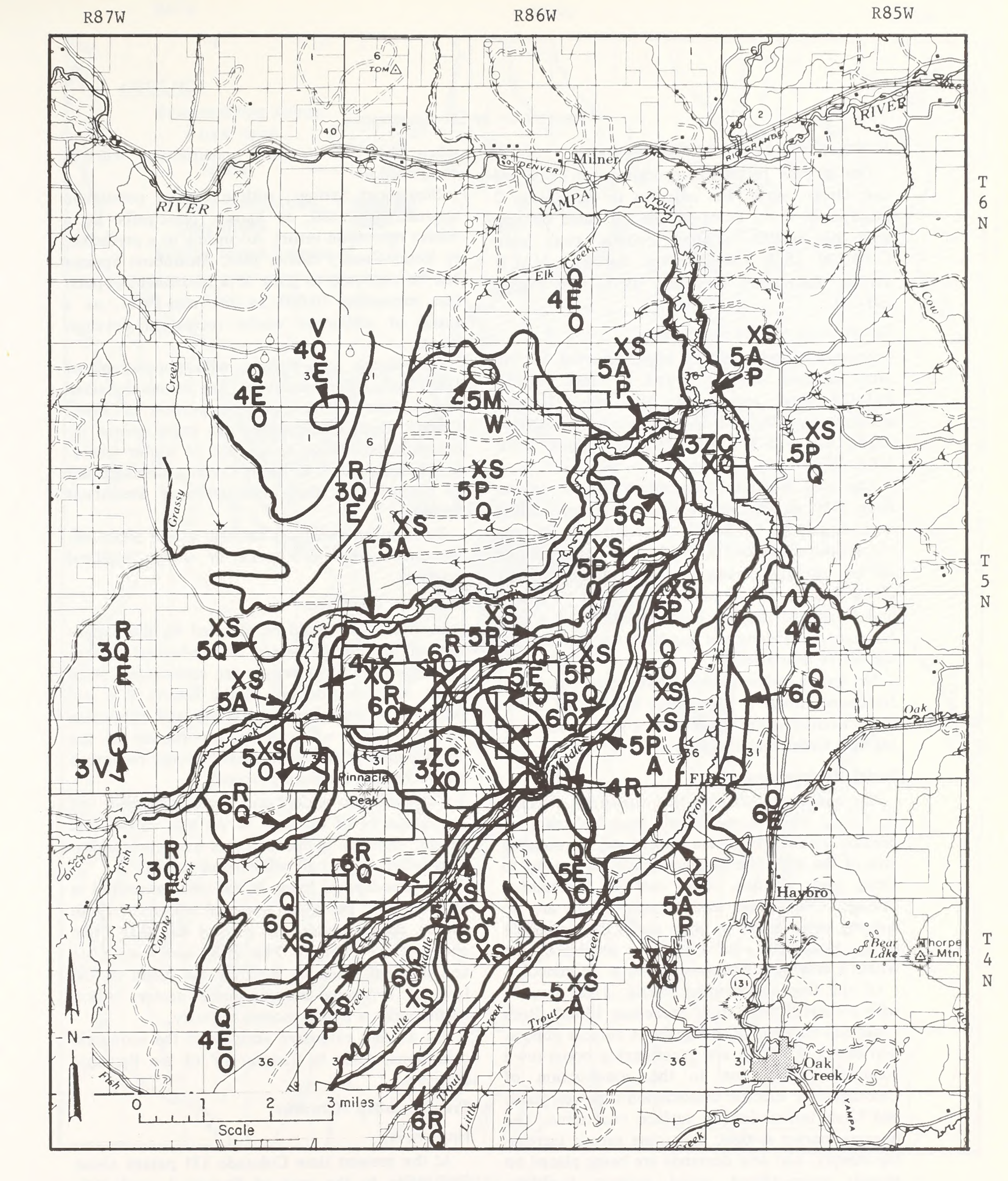


FIGURE EII-32

Recreation capability classification for the Energy Mines area.

SOURCE: BLM, Williams Fork URA, 1974

Existing recreation developments

One private recreation operation for dispersed use, Green Acres, lies adjacent to the Energy 2 Mine area. Forty acres of this big game hunting area lies within existing Federal coal lease C-081330 (Soil Conservation Service, NACD Private Recreation Inventory 1975) (see Figure EII-33).

Recreation visitor-use data

Snowmobiling use has been reported in the areas of both Energy 1 and 2 Mines (Figure EII-33). Three areas, 018, 019, and 021, contributed 50, 120, and 42,840 visits, respectively, during the 1972-73 season. (BLM, Williams Fork URA 1974).

The area Wildlife Conservation Officer reports from 5-10 snowmobiles using the Energy 1 Mine area, largely on weekends in January and February. (Croonquist, DOW 1975). An undetermined amount of sage grouse hunting occurs northwest of the Energy 2 Mine area on the Cross Mountain and Camilletti ranches (Croonquist, DOW 1975); however, no fishing use has been documented for the above four streams.

No traffic volume studies have been completed for county roads in the Energy Mines area. However, Routt County Road 27 is a major road linking Oak Creek and Hayden.

Social Environment

The social environment that would be affected by Energy Fuels Corporation's proposed mine expansion extends from the immediate surrounding area of the mine site in Twentymile Park, west to Craig and Hayden, and east to Steamboat Springs, Oak Creek, and Yampa. There are no housing subdivisions or other major developments in the immediate area. Only four residences are within a mile of any proposed area to be mined.

Of the five communities, Craig is the largest, with a current population exceeding 10,000. Both Craig and Hayden (with Hayden's current population of about 1,700), are experiencing boom-town conditions now, due to the construction of Colorado-Ute Electric Association's power plant, and Utah International's surface coal mine. The housing market is tight; the crime rate is increasing sharply; and new demands are being placed on already over-utilized social support facilities, (e.g., water and sewer treatment, schools, etc.). These conditions will probably continue until 1979 when the power plant construction will be completed.

Steamboat Springs, with a current population approaching 6,000, is known principally as a winter recreation resort. According to a preliminary Routt County master plan, Steamboat Springs can be expected to grow to a permanent population exceeding 10,000 by the mid-1980s, as a result of additional winter recreation developments.

Oak Creek and Yampa, with populations of 1,200 and 350 respectively, are relatively small communities in the southern portion of Routt County. Both communities can expect some increase in population as a result of winter recreation developments in Routt County, although not as extensive as that expected near Steamboat Springs.

For a more extensive analysis of the social environment, refer to Chapter IV of the Regional Analysis.

Economic Conditions

In areas that would be affected by the expansion of the Energy Mines, the industrial sectors employing the most people are agriculture, retail trade, and construction. In the future, it is expected that the mineral-extracting and recreation service sectors will gain in importance, as the development of non-coal related energy resources and recreation facilities proceeds.

Currently the agricultural sector generates the vast majority of earnings in the area, but in the future, earnings in the minerals extractive industries (other than coal) will expand rapidly.

The standard of living in the area, measured in terms of 1973 per capita personal income, is about $4,700, approximately six percent less than State and national averages. This difference from State and national levels is probably the result of the lack of a strong manufacturing sector, which traditionally is a high income industry.

For a more extensive analysis of the economic conditions, refer to Chapter IV of the Regional Analysis.

Transportation Networks

Highways

At the present time Colorado 131 passes about five miles to the east of Energy 1, and U.S. Highway 40 passes about the same distance north of Energy 3. These are the closest approaches of

R87W R86W R85W

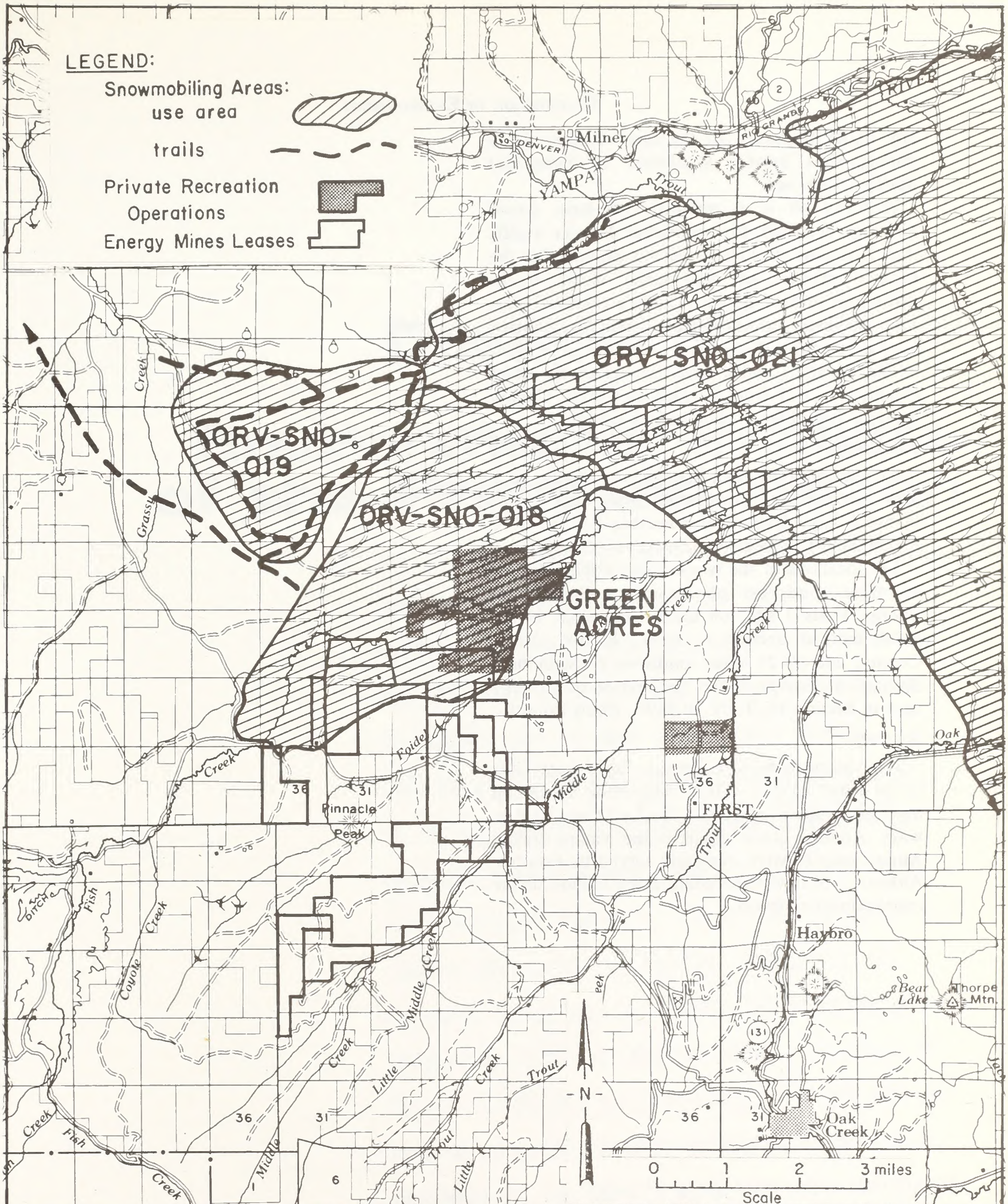


FIGURE EII-33

Visitor use and privately owned-and-operated recreational developments at the Energy Mines area.

SOURCES: Bureau of Land Management, Williams Fork URA, 1974
Soil Conservation Service, NACD Private Recreation Inventory, 1975

any major highways to the three Energy Fuels mining sites located southwest of Steamboat Springs, Colorado.

Highway 40 is a widened, two-lane, paved highway designed for somewhat heavier traffic than it is now sustaining, but not suitable for the heavy transport of coal using diesel trucks (Prosence 1975). Highway 131 is a relatively narrow, two-lane, paved highway basically designed for lightweight traffic.

The Energy 1 and 2 areas are served by Routt County Road 27 from Hayden and Routt County Road 33 from Steamboat and Oak Creek.

RAILROADS

At the present time, the Energy Fuels mine sites southwest of Steamboat Springs are served by the Energy Spur running northeast to the D. & R.G.W.R.R.-Craig branch line out of Milner.

The locations of the two existing tipples are: (1) 14 miles southwest of Steamboat Springs, at Energy Fuels 3 site, on the Energy spur, in the south half of Section 1, T.5N., R.86W., Routt County, and (2) 22 miles southwest of Steamboat Springs, at Energy 1 site, the end of the Energy spur in Section 31, T.5N., R.86W., Routt County.

AIRLINES

The closest airport to Energy Fuels mine sites is the Routt County STOL Airport at Steamboat Springs, which is served by Rocky Mountain Airways. Another close airport is the Yampa Valley Airport near Hayden, regularly served by Frontier Airlines, and now undergoing a ten million dollar improvement program.

Chapter III

Environmental Impacts of the Proposed Action

THIS CHAPTER ANALYZES IMPACTS OF ENERGY FUELS CORPORATION'S PROPOSED MINE AND RECLAMATION PLAN ON THOSE RESOURCE VALUES DESCRIBED IN THE PRECEDING CHAPTER. IT IS ASSUMED IN THIS CHAPTER THAT NO EFFORTS WILL BE MADE TO MITIGATE IMPACTS. IN THIS MANNER ALL PROBABLE IMPACTS CAN BE IDENTIFIED AS THE BASE FOR THE DETERMINATION OF MITIGATING MEASURES AND UNAVOIDABLE ADVERSE IMPACTS IN THE TWO SUCCEEDING CHAPTERS. WHERE DATA ARE AVAILABLE, IMPACTS ARE LINKED TO SPECIFIC ASPECTS OF THE PROPOSED ACTION AND ARE QUANTIFIED AS TO MAGNITUDE, INTENSITY, DURATION, AND INCIDENCE. ALTHOUGH THE PURPOSE OF ENERGY FUELS CORPORATION'S RECLAMATION PLAN IS TO LESSEN ADVERSE CONSEQUENCES OF SURFACE DISTURBANCE, THE IMPACTS RESULTING FROM IMPLEMENTATION OF THEIR PLAN ARE ADDRESSED IN THIS CHAPTER.

Non-living Components

Geologic and Geographic Setting

TOPOGRAPHY

Topography and landforms of the mined areas would be modified slightly due to removal of natural irregularities including small tributary stream valleys, and replacement with a man-made surface. The general surface at each mine would be expected to stand slightly higher because of the increase in overburden bulk resulting from breaking up the original beds of rock, moving, and dumping them.

Small intermittent streams draining the mining areas would be removed, and some alteration of the main streams may take place. Some of these streams, especially Fish Creek, are meandering streams. Man's alteration of such streams generally means straightening their courses; this shortens the course, and consequently increases the velocity, raising the possibility of erosion and downstream deposition of sediments.

Spoils from the Energy 1 Mine have been placed along the crest of the ridge, as well as on the mined gentler ridge slope. Debris from these spoils has been washed, and some has moved in small landslide, slump, or creep movements down the steep southeast slope of this ridge (Figure EIII-1). A small amount of this debris has reached the county road, and it is conceivable that larger masses of it could be carried over the road and into Middle Creek, creating problems of road maintenance and stream flow.

Following mining and reclamation in the Energy 1 area, ground water rising along known or unknown fractures into the base of the fill material could lead to slump and small mudflow actions along the toe of the fill.

PALEONTOLOGY

Adverse impacts to fossils would occur if they are destroyed in the coal mining operation. Given the overall character of the stratigraphic section, it is likely that at least some fossil destruction would occur. Beneficial impacts would occur if unearthed fossils were collected and studied. This stratigraphic section is only moderately likely to yield significant fossils when compared to other areas within the study region.

Mineral Resources

A beneficial effect of Energy Fuels Company's mining methods would be the recovery of more coal than would be possible by underground methods.

Coal resources of the region would be depleted by the sum of coal produced, plus coal lost in mining. A ten percent loss of the mined coal bed is the generally accepted figure with the mining methods used; about one foot of coal would be lost in Energy 1 Mine, or about 1,800 tons/acre. In Energy 2 Mine, ten percent would be 0.4 foot of coal lost in mining, or about 720 tons/acre.

Coal resources in thin beds above the mined beds, if disposed of with other overburden, rather than recovered during mining, would be an additional loss. The company describes the Lennox coal bed as being about 52 feet above the Wadge in Energy 1 Mine and "usually only 2½ to 3 feet thick", but ranging up to 4 feet; if not recovered, this bed's loss would mean a reduction of the coal resources by about 4,500-5,400 tons/acre.

Water Resources

GROUND WATER

Several springs and wells would be destroyed by the mining activity. Other impacts on ground water are not expected to change appreciably from those resulting from present mining activity.

The extension of mining into areas adjacent to the present Energy 1 Mine is not likely to cause any appreciable change in the present ground water flow regime to Foidel Creek. Most of the area proposed for mining is either drained by present mining activities, or never contained any ground water due to its relatively high topographic position. The entire mining operation in a proposed new mine southwest of Energy 1 Mine in Sections 17 and 18, T.4N., R.86W. (coal lease C-081330) is likely to be too high topographically to contain ground water.

Energy 2 Mine would continue to produce ground water as the mining operation extends southeast into coal lease C-0128433 and competitive lease application C-20900; the amount and quality are not likely to change. Water discharged from this mine does not cause any problems, now nor is it likely to in the future. As the mining operation moves east along Fish Creek, coal that is to be mined is exposed along the side of the valley; since the coal slopes toward this exposure, the material that is mined might be drained, and water-yielding beds might not be encountered.

The mining proposed by Energy Fuels would result in the destruction of minor aquifers that

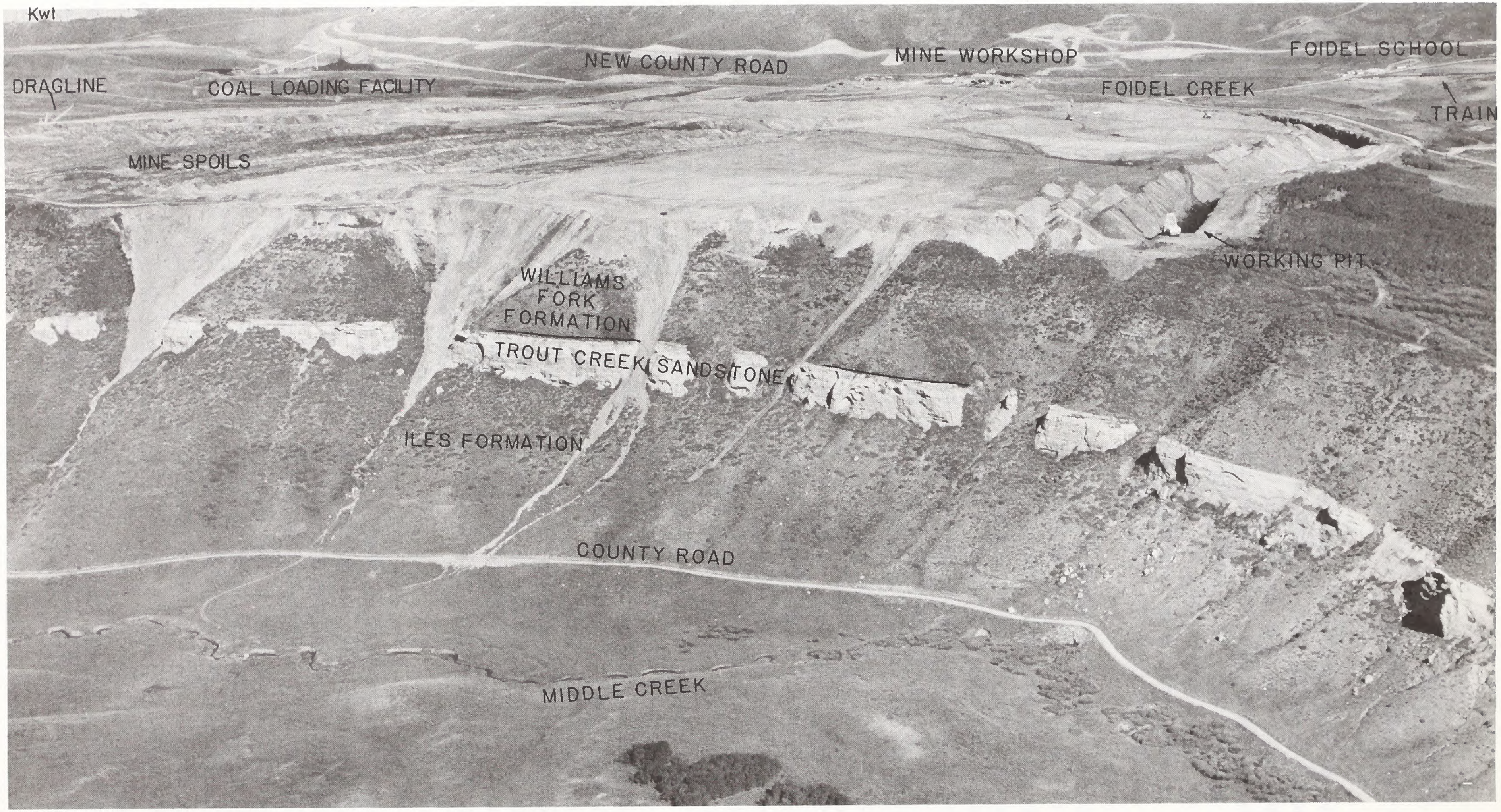


FIGURE EIII-1

Aerial oblique photograph, view north, of Energy 1 Mine area. Debris slides, from mine spoils placed at crest of ridge, have formed on steep south face of ridge. (Kwt, Twentymile Sandstone Member).

supply few wells and springs. Energy 1 Mine may destroy two springs and may cause a third spring to dry up; Energy 2 Mine may destroy three wells and three springs, depending upon the extent of the mine pits in these areas, and if some of the coal in these areas is extracted by underground methods.

SURFACE WATER

Mining activity proposed by Energy Fuels Corporation would result in 5,170 acres (8 square miles) of disturbed land in Trout Creek watershed during the next 15 years. This surface disruption would produce some increase in sediment in Fish and Foidel Creeks, and possibly in Trout and Middle Creeks as well.

Channels of any intermittent tributary streams in the proposed strip mining areas also would be destroyed; this would require establishment of new drainage patterns following mining operations and reclamation procedures at these sites.

Quality of streams

Due to the nature of the mine plans at Energy 1 and 2, any sediment that would be generated from the unshaped mine spoils would be deposited in the mine pits. Rehabilitated areas would, however, yield about 1,110 tons of sediment per year from the average 343 acres per year of disturbed land, and from land that has been revegetated, but is still subject to accelerated erosion. No new haul roads are planned, but there will be some sediment produced from existing haul roads.

An increase in sedimentation would also affect other water quality parameters. An increase in the turbidity would produce a proportionate increase in water temperature, due to the propensity of suspended sediment to absorb heat, and concurrently lower the dissolved oxygen (DO) content of the stream.

Field investigations by E S team personnel reveal possible contamination of Foidel Creek by coal dust blowing into the stream from the tipple and from passing railroad cars. Bottom material in Foidel Creek downstream of the tipple consists primarily of fine, black, organic material, which could be the product of accumulated coal dust. Continuous accumulation of coal dust in streams would increase the COD (Chemical Oxygen Demand), and reduce the DO content of the water due to oxidation of the coal.

There would be some continuing leaching of mine spoils in the area. Owing to dilution, added dissolved solids probably would not have any significant local or regional impact on the usability of water in the area. However, any addition of dissolved solids would contribute to the overall water quality problem in the Lower Colorado River.

Air Quality

EMISSION SOURCES

To determine potential changes in air quality due to operation of the proposed Energy Fuels Mines, emissions from all facets of the mining operation must be determined. These emissions must then be interpreted in terms of the ambient pollutant concentrations they produce in the air. Since there are two distinct mines: Energy 1 and 2 data and analysis will be given separately for each.

Five general sources of atmospheric emissions would be created by the proposed development at each mine: (1) mining, (2) processing, (3) roads, (4) coal fires, and (5) vehicle emissions. These are discussed in detail in the Regional Analysis.

Based on current regulations, the only significant pollutant generated by the first source, mining, would be suspended particulates which result from fugitive dust. Emissions estimates from materials handling in mining have been developed for topsoil, overburden, and coal separately, but with the same methodology. All the operations of removing the material from the ground, transport, piling, and redistribution have been combined into a single emission calculation using estimates developed from other studies of fugitive dust. Detailed calculations and references are given in Appendix D.

Estimates of the quantities of material to be moved (Appendix D) were taken from the Description of the Applicant's Proposal submitted to the BLM. In the years 1980 through 1990, an estimated 2,400,000, 1,200,000, and 1,300,000 tons of coal will be mined/year, necessitating removal of 39,600,000, 10,700,000, and 17,600,000 metric tons of overburden, and 474,000, 451,000, and 386,000 metric tons of topsoil each year for Energy 1, 2, and 3, respectively. Emissions estimates for this quantity of materials handling are shown in Table EIII-1 as controlled and uncontrolled emissions.

TABLE EIII-1

Energy Fuels 1 and 2 Mines Air Pollutant Emissions

(Metric Tons per Year)*

Source	Air Pollutant	Uncontrolled		Controlled			
Mining Materials		1	2	1	2		
Handling: Topsoil	Suspended Particulates	6.4	7.0	5.8	6.3		
Overburden	Suspended Particulates	800	220	720	200		
Coal	Suspended Particulates	51	26	46	23		
Process	Suspended Particulates	130	56	55	28		
Fugitive Dust from Off Mine Roads	Suspended Particulates	260	130	180	91		
		Within Mine				Off Mine	
		Cars		Trucks		Cars	
		1	2	1	2	1	2
Vehicle Exhaust	Suspended Particulates	0.15	0.049	0.42	0.14	1.2	0.62
	Hydrocarbons	1.18	0.58	1.2	0.40	15	7.4
	Carbon Monoxide	9.8	3.2	7.2	2.4	80	40
	Nitrogen Oxides	1.4	0.45	12	4.0	12	5.8
	Sulfur Oxides	0.027	0.012	0.85	0.28	0.30	0.15

*1 metric ton = 1.1016 short tons

These calculated estimates of emission rates are realistic approximations of the complex interaction of variables that affect dispersal of particulate material. Uncertainties (two standard deviations) are estimated to be on the order of a factor of two. All of the rates are given as yearly averages, even though it is recognized that all the activities are not continuous. As an operation of mining, blasting has not been included in the previously described emission calculations.

Process emissions of suspended particulates involve fugitive dust emitted from coal preparation for delivery, and fine particulate matter emitted directly to the atmosphere from control device exhausts. Emission totals are given in Table EIII-1 with the assumption that each mine has separate process facilities. At the mine, there would be vehicle exhaust emissions from heavy diesel mine equipment and haulage trucks, and gasoline powered cars and trucks. Emissions from haulage trucks are calculated in Appendix D. Table EIII-1 lists within-mine and off-mine emissions from vehicles separately. No haulage distance to the railhead has been assumed. The off-mine emissions dominate the totals.

Another possible source of emissions related to mining would be the spontaneous or accidental ignition of coal fires in overburden piles and exposed coal seams. If a fire occurs, clouds of smoke containing suspended particulates, carbon monoxide, nitrogen oxides, sulfur oxides, hydrogen sulfide, and hydrocarbons can result. Estimates of frequency or quantity of emissions at any one mine cannot be made. However, if a fire occurs, the emissions may be substantial.

RESULTANT AIR QUALITY

Particulates

Table EIII-1 lists five sources of suspended particulate from the mine. Vehicle emissions of particulate are usually not an air pollution problem, and are obviously insignificant in comparison to mining operations. Overburden removal, because of the large tonnages involved, would be the dominant mining source. It is assumed that the stripping would be continuous during active mining. The variations in emission rate have been averaged in the estimation of yearly emission rates, and in fact are the reason for not using shorter averaging times to specify emissions.

To assess the impact the mine would have on the atmospheric environment, estimates must be made of the ambient total suspended particulate concentrations resulting from the emissions. To do this, an atmospheric diffusion model has been applied to each mine site. The effect of local emissions are considered over long periods (annual averages), and in terms of short duration exposures (daily concentrations), in the model used here. All of the emissions shown in Table EIII-1, except fugitive dust from off-mine roads, have been added to represent a single source originating across each entire active mine site. The model is described in detail in Appendix D.

The uncertainty in the calculated total suspended particulate concentrations can be approximated; it is estimated that the modeled concentrations are correct within a factor of three. This uncertainty could be reduced only by much more detailed and preferably measured emissions and meteorological data.

Table EIII-2 is a compilation of Federal and State ambient air quality standards, existing background concentrations, and diffusion model predictions. For an annual average, the highest concentrations expected are those in the prevailing downwind direction during stable conditions. Air flow during these times will often be downslope. The largest predicted annual concentration is thus at the lowest edge of the mine site.

As shown in Table EIII-2 and Figure EIII-2, the decrease in concentration with distance would be rapid. Concentrations at Energy Fuels 1 (including the background of 20 μg/m) would exceed the Annual Federal Secondary Standard (60) out to 2 kilometers (1.2 miles) from the center of the disturbed area, and Colorado Standard (45) for a distance of 3 kilometers (1.9 miles). Concentrations in other than the down-valley direction would be lower by at least 50 percent. Concentrations due to emissions from Energy 2 would be lower even in the down-valley direction by at least 50 percent, as shown in Figure EIII-3.

Meteorological circumstances resulting in the largest predicted 24-hour total suspended particulates concentrations are those which contributed most to the annual average, the existence of stable conditions in the down-valley direction. The meteorological information available indicates that concentrations on the order of those in Table EIII-1 would occur between 10-30 days/year. Because the emissions are concentrated, the pre-

TABLE EIII-2

Air Quality in the Vicinity of the Energy Fuels Mines

Predicted Worst Case Concentrations ($\mu g/m^3$) from Sources at the Mine

Pollutant	Averaging Time	Ambient Air Quality Standards: Federal Primary	Federal Secondary	State	Existing Ambient Air Quality	Distance from Mine (km)	Maximum Predicted Concentrations 1	2	Predicted Plus Background Concentrations 1	2
Total Suspended Particulates	Annual	75	60	45	20	0.5	310	95	330	120
						2	46	14	66	34
	24 Hour	260	150	150	20	0.5	500	160	520	180
						2	210	65	230	85
Sulfur Dioxide	Annual	80	-	-	15	0.5	0.20	0.064	15	15
						2	0.046	0.015	15	15
	24 Hour	365	-	15	15	0.5	0.53	0.17	16	15
						2	0.22	0.072	15	15
	3 Hour	-	1,300	-	15	0.5	1.6	0.51	17	16
						2	0.66	0.22	16	15
Carbon Monoxide	8 Hour	10,000	10,000	-	400	0.5	44	10	440	410
						2	18	4.2	420	400
	1 Hour	40,000	40,000	-	400	0.5	74	18	470	420
						2	30	7.4	430	410
Non Methane Hydrocarbons	3 Hour	160	160	-	50	0.5	5.5	1.8	56	52
						2	2.2	0.74	52	51
Nitrogen Oxides	Annual	100	100	-	15	0.5	3.0	1.0	18	16
						2	0.70	0.23	16	15

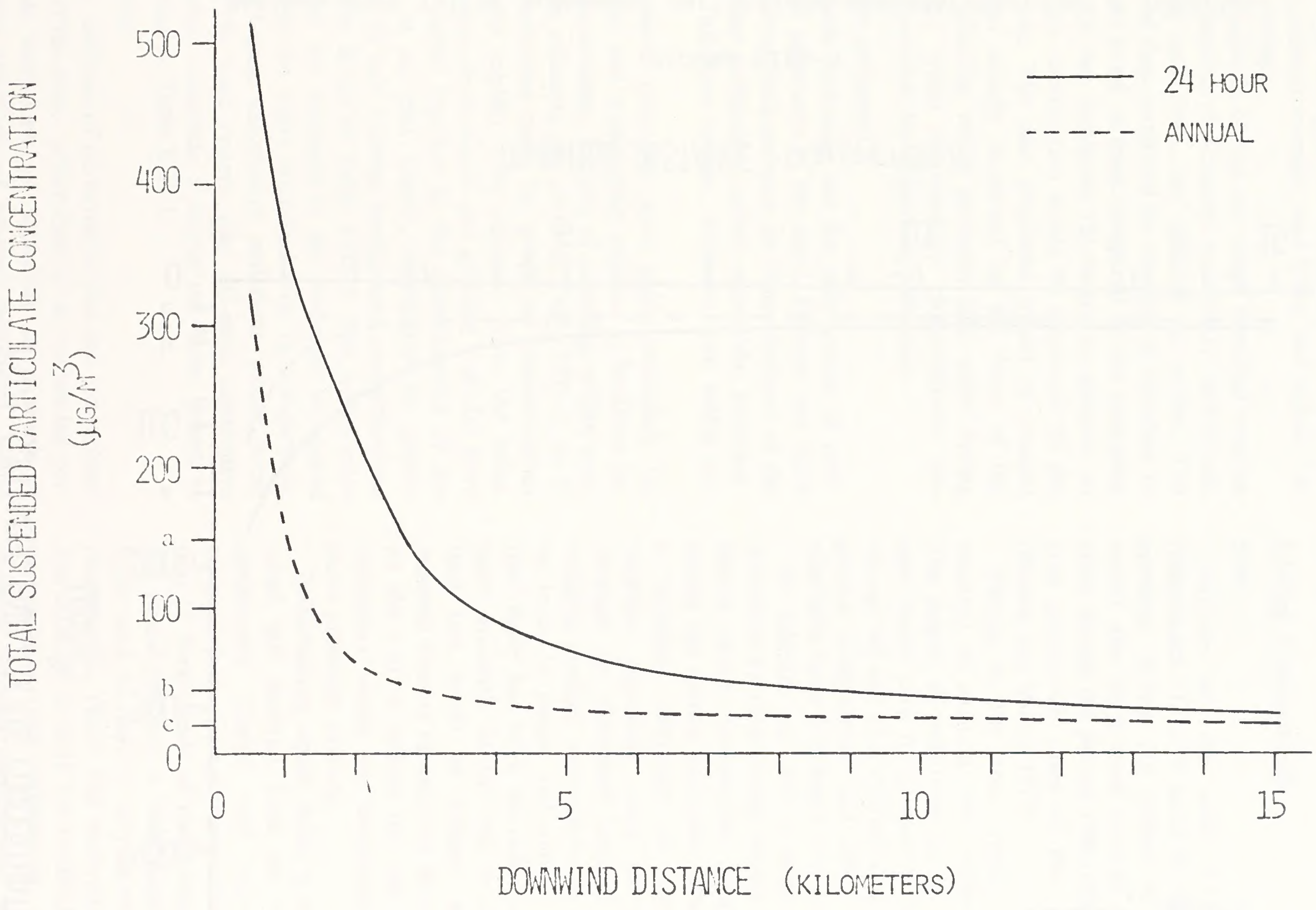


FIGURE EIII-2

Maximum down valley suspended particulate concentrations as a function of downwind distance from the Energy Fuels 1 center. (a, 24 hour State standard; b, annual State standard; c, baseline concentration).

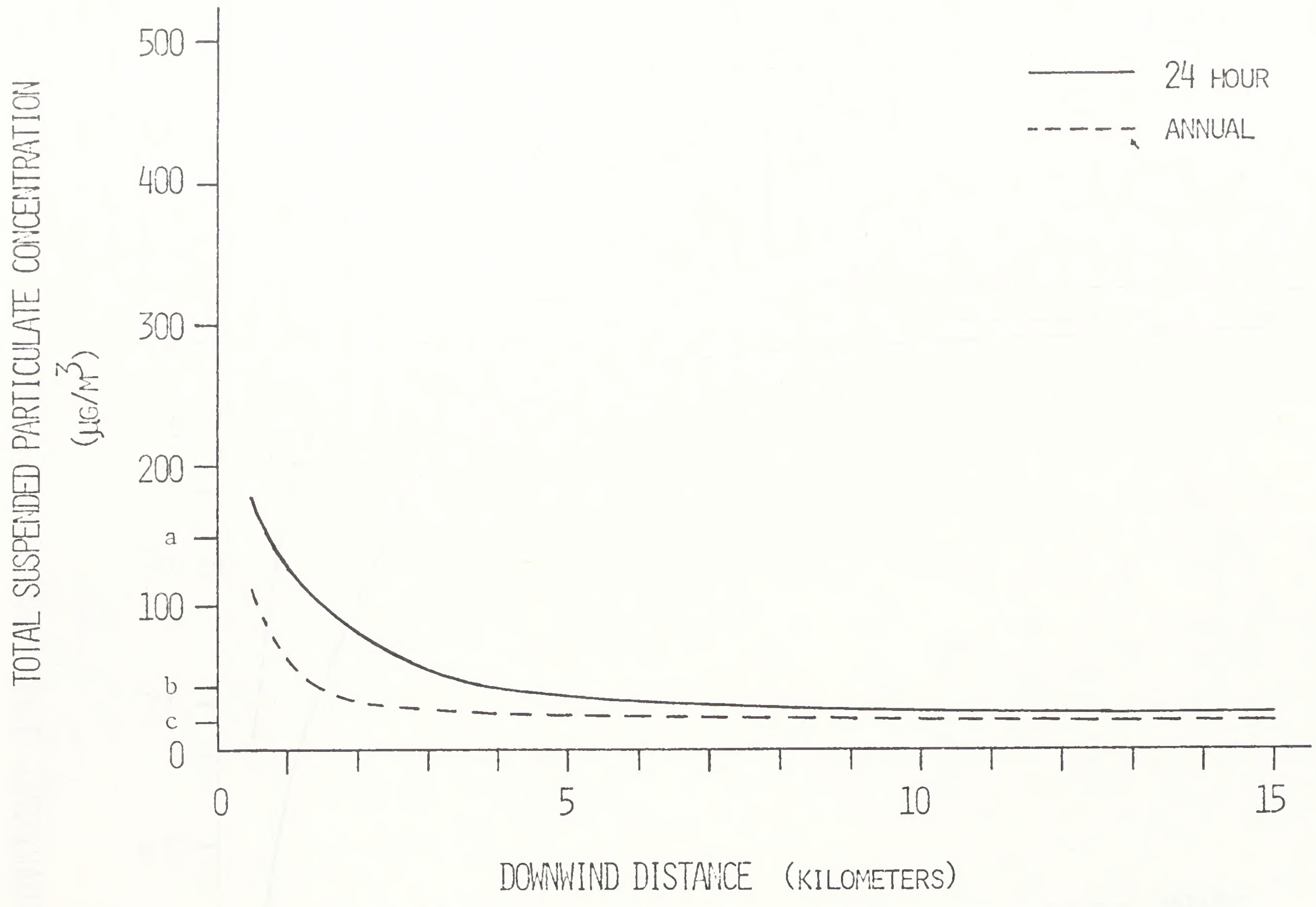


FIGURE EIII-3

Maximum down valley suspended particulate concentrations as a function of downwind distance from the Energy Fuels 2 center. (a, 24 hour State standard; b, annual State standard; c, baseline concentration).

dicted concentrations shown in Table EIII-2 are relatively large. At 500 meters (0.3 miles), the highest concentration would exceed the Federal Secondary and State Standards by a factor of three.

EPA non-degradation guidelines for Class II areas would be exceeded in the prevailing downwind direction for distances of 6 km (3.7 miles), annual average, and 8 km (4.9 miles), 24-hour average.

The impacts of the two other potential sources of suspended particulates previously mentioned, blasting and fires, 'are difficult to assess. The cloud of dust produced by blasting is expected to be short-lived, at least compared to the averaging times of the standards (24 hours or greater) so that little contribution would be measured off the mine site. The dust produced would be created but also initially dispersed by the force of the blast. Blasting would generally take place during the day when meteorology characteristics are most favorable for dispersing pollutants.

Gaseous pollutants

Vehicle emissions are the only source of gaseous air pollutants at the mine. Federal and State regulations limit ambient air concentrations of the following pollutants: carbon monoxide, hydrocarbons, nitrogen oxides, oxidants, and sulfur oxides.

Emission estimates were made separately for off-mine and within-mine vehicles to facilitate impact assessment. Results of modeling within mine vehicle exhausts are given in Table EIII-2. As in the particulate case, the predicted concentrations decrease rapidly with distance from the mine. Emissions from diesel and gasoline vehicles have been added together in the consideration of the mine as an area source. Applicable air quality standards and existing background concentrations are also listed in Table EIII-2. The within-mine vehicles are assumed in the model to be spread out over the entire disturbed area. In comparison, the off-mine automotive emissions would occur along the road system. The off-mine automotive emissions constitute a source ten times larger, as indicated in Table EIII-1.

Visibility

The addition of particulates into the atmosphere around the mine, either directly as suspended particulate emissions, or indirectly as a result of chemical reactions of gaseous pollutants, would reduce the visibility in the area. It was shown in the previous section that the gaseous contribution would be expected to be minimal. The minimum visibility on an otherwise clear day would be on the order of 25 kilometers (15 miles). Operation of the Energy Fuels Mines would reduce this estimate to no less than 20 kilometers (12 miles) on an annual basis.

Living Components

Soils

Impacts on the soils would result from disturbance of 1,840 acres by Energy Fuels Corporation during the period of 1975-79. There would also be a need to strip mine some 3,330 acres during the period 1980-1990 to meet desired coal production rates of five million tons/year (Dames and Moore 1975).

Mining of the area would result in mixing together all existing soils within the mined area. The degree of redistribution of soils is unknown and would vary from place to place. This would change all soil characteristics, and alter micro-organism composition and other soil relationships that have been developed over geologic time.

In addition to soil acreage that would be disturbed by strip mining during the periods mentioned above, overburden would be excavated during the mining operation. The result would be a complete alteration of overburden characteristics, especially water movement over and through the disturbed layer; it could result in bringing geologic material to the surface that may be toxic to plants and animals. At the present time there has been no indication of discernible toxic materials in the soil or overburden other than low levels of sodium; however, only a minimal number of analyses have been completed. At the end of mining the soil structure and its properties would be completely different from those presently existing.

Disturbances would result in mixing of fine-textured soil material from the shale strata, and moderately coarse and coarse-textured soil material from the sandstone strata. The combination of these kinds of rocks exposed to weathering would produce a wide range of soil textures from sand to clay, in varying thicknesses and arrangements. These soil materials would be stony and difficult to work for seedbed preparation. Soil permeability and infiltration rates would be reduced through compaction, when the spoil is shaped and topsoil replaced for reclamation. This would increase runoff, thus increasing erosion and sedimentation. Wind action would cause some dust to be lifted into the atmosphere, reducing air quality and adding to soil loss. As all physical, chemical, and biological systems would be disrupted to an unknown degree, overall mining action would produce an estimated ten percent lowering of overall soil productivity.

Alterations of the channels of Middle and Fish Creeks in the area of the mines would affect downstream portions of these creeks and adjoining land. Channelizing stream courses would increase flow velocities, resulting in accelerated erosion of streambeds and banks. This would increase soil loss in the immediate area as well as along the downstream channels.

Mine facilities constructed outside the mined area would disturb and permanently remove soil from production.

Additional off-site soil impacts would result from increased population associated with mine employment. This increase would generate expansion of recreation and solid waste and sewage disposal, which would cause unquantifiable soil impacts on approximately 156 acres by 1990, such as compaction, erosion, sedimentation, water consumption, and decreased soil water quality.

Construction and mining equipment crossing undisturbed soil areas susceptible to compaction would impact soil permeability, water infiltration, and vegetative cover. This would increase runoff, erosion, and sedimentation. Where spoils have been reshaped and topsoil replaced, soil erosion may be extensive until vegetation is established.

Most of the area proposed for mining on lease C-081330 and competitive lease application C-16284, and most of the area encompassed by competitive lease applications C-22644 and C-9968 contain soils that are highly productive, and would be rated good as potential topsoil material (Figure EII-12). About half of the area proposed for mining in lease D-052547, and the southeast part of lease C-081330, have soils that are rated good for topsoil, and the other half is rated poor because of high clay content.

The proposed mining areas on lease C-0128433, the northern part of lease C-081330, and competitive lease application C-20900 contain a variety of soils, about half of which are rated good and half poor for topsoil. In these areas, where good and poor soils are in close proximity, a beneficial impact could occur if those soils were mixed in the replacement process.

The most significant impacts to soils would be: (1) unprotected soils subjected to wind and water erosion, (2) loss of soil structure, thus decreased moisture infiltration, (3) compaction of spoils and replaced topsoils, (4) mixing of soil horizons, (5) loss of existing soils and creation of a very different soil complex, and (6) burial of fertile soil material. Approximately 1,840 acres at the Energy Fuels 1 and 2 Mines would be subject to varying degrees of these impacts. It is impossible to predict the exact location where each impact would be most significant, except that impacts related to reduced moisture infiltration would be most significant on Abor, Bulkley, and Gapo soils (Figure EII-12).

Terrestrial Flora

There would be two main impacts on terrestrial flora associated with the mining operations at Energy Fuels mines: (1) total and partial destruction in the mined and otherwise disturbed areas, and (2) lateral effects on surrounding areas. Energy Fuel's mine plan is only complete to 1981; during that period vegetation on approximately 1,840 acres would be destroyed at Mines 1 and 2. Vegetation would be destroyed as shown in Table EIII-3.

TABLE EIII-3

Vegetation Types, and Amount to be Disturbed (Acres)

Vegetative Type					
Sagebrush	Mtn. Shrub	Mtn. Shrub-Aspen	Aspen	Cropland	Total
880	195	85	20	660	1,840

Energy Fuels does not hold any Federal coal leases in Energy 3 area; however, approximately 80 acres of sagebrush have already been disturbed at this mine on a State lease. Also Energy Fuels anticipates that it will disturb approximately 3,330 acres from 1981-90; however, the areas that will be mined have not been delineated.

The impacts to the vegetation on competitive lease applications C-22644 and C-9968 would be the same as those on lease C-081330, mostly loss of aspen and sagebrush types.

The impacts to the various vegetation types on competitive lease applications C-20900 and C-16284 have been included with those on the lease areas because the area to be mined was delineated in the mine plan. Impacts to the western part of competitive lease application

C-22677 would be much the same as lease C-20900, as most of the area is covered by sagebrush and dry cropland. Impacts to the vegetation on the eastern part of C-22677 would be much more significant, as most of this area is covered by hayland that receives much of its moisture by sub-irrigation. If reclamation could not reestablish the sub-irrigation abilities of this land, hay production would be significantly reduced.

No additional roads would be required to obtain the coal from existing areas to be mined, but as new areas are developed, vegetation loss would begin with road construction. The mining operation itself would produce the largest impact on vegetation. The first and greatest impact to vegetation would be the total removal of vegetation prior to topsoil removal. The organic matter produced by many years of vegetative growth would be essentially lost, as all but a very small part of the existing vegetation that is removed with the topsoil in a mining operation is buried in the mine pit. The second disturbance of vegetation in the mining operation would result from stockpiling topsoil and placing boxcut spoils on undisturbed land. The mature mining operation would leave approximately 350 acres totally disturbed at any one time before revegetation begins.

Total removal of vegetation from these acreages each year would have a secondary effect on surrounding vegetation. Once vegetation is removed from the mining areas and is unavailable to herbivors, vegetation on surrounding areas may be subjected to increased utilization. The magnitude of this impact would depend upon the importance of the area as wildlife forage, and the amount of overstocking of domestic livestock that takes place.

Population increase associated with mine employment would disturb an estimated 156 acres of vegetation by 1990. Vegetative types removed are indeterminable, as the exact location of population cannot be determined at this time. This figure includes the development of social facilities (schools, shopping areas, etc.) to serve this increased population. Increased recreational use by the new expanded population, especially off-road vehicle use, would affect an indeterminable amount of additional vegetative types and acreages within the total study area.

Disturbance of areas currently used for cropland would probably be the smallest impact to vegetation, as Energy Fuels plans to replace topsoil and return these areas to cropland. However, the 660 acres of winter wheat that will be disturbed will be out of peak production for at least three years; assuming 30 bushels/acre, this represents a loss of 19,800 bushels/year. Since the fields are in summer fallow every other year, not more than two crops, or 20,600 bushels, will be the total crop loss. Because reclamation plans call for returning 400 acres more to dryland wheat than exists now, there should eventually be an increase of 12,000 bushels/growing season. Successful crops of shallow-rooted small grains would probably be easiest to re-establish on topsoiled mine spoils, especially if a fertilizer program is included. Areas of native vegetation would be the most difficult to re-establish, if not impossible.

A secondary impact due to destruction of native vegetation is invasion of weedy species such as Russian thistle (*Salsola kali*). These weedy species would compete with revegetation attempts, thereby decreasing the chances of permanent vegetation establishment. If weedy species are not controlled, their competition with seedlings would be a very significant impact to revegetation efforts.

Energy Fuels plans to use alfalfa in their revegetation program. Alfalfa has been utilized in reclamation efforts in the area in the past and has been found to dominate the revegetated area (Berg and Barrau 1973). In dominating, the alfalfa provides an excellent soil stabilizer; however it tends to create a vegetative stand with very little variety for a number of years (at least ten), and produces management problems for domestic livestock (Berg 1975). It is current theory that the stability of a plant community is a function of its species diversity, and that succession in an ecosystem is described as a progression toward higher diversity (Kormondy 1969). Diversity produces stability, because there is less likelihood that any major shift or loss of any one component would adversely affect the system as a whole. Problems created from seeding alfalfa on mine spoils may decrease, as alfalfa does not appear to be highly competitive on reshaped, topsoiled spoils. It is evident from the increasing need of pesticides in agricultural croplands that most monocultures do not produce self-sustaining stable vegetation. Also Stewart (1974) found that micro-organism activity increased on revegetated mine spoils in southeastern Montana as species diversity increased; micro-organisms are very important to nutrient cycling and soil development.

The length of the impact of total vegetation loss would depend upon the success of reclamation. Since Energy does not plan to include native species in their seed mixture, the loss of the native vegetation would be quite long, depending upon the rate and ability of native species to invade the area, and the amount of shrub and tree transplanting done by the company. Also some small areas, due to soil texture, toxicity, or other factors, might be impossible to revegetate, making the loss of vegetation a permanent impact. Since current reclamation methods have been utilized for only two years, sufficient information is not available to predict the amount of time needed for native species invasion, or the extent of areas unable to revegetate. In some years climatic conditions may be such that revegetation attempts would fail, extending the impacts of vegetative loss. Also the loss of existing soil geomorphologic conditions and creation of a different soil might prove native vegetation difficult or impossible to establish.

Young, palatable vegetation produced by revegetation efforts would attract wildlife and livestock; grazing on young plants would inhibit early growth and revegetation of disturbed areas.

The total destruction of native vegetation from an area would result in the following impacts on the vegetation ecosystem:

1. Loss of above and below ground primary productivity,
2. Loss of a diverse vegetation capable of withstanding climatic extremes, and utilizing precipitation and sunlight throughout the growing season,
3. Loss of present vegetative successional stage, and a setback to a very juvenile stage,
4. Loss of a natural seed source, very necessary for ecological succession and stability,
5. Loss of nutrient cycling systems that utilize the soil, plants, micro-organisms, and physical forces to cycle nutrients from the soil to forms usable by plants. These systems are essential for self-sustaining vegetation growth, and might be the greatest limiting factor to establishing self-sustaining plant ecosystems on mine spoils,
6. Loss of soil stability and erosion prevention by roots and shoots of vegetation.

It is improbable that existing vegetative ecosystems could be returned to strip-mined land in the 15 year time frame of this statement; current reclamation practices have not been utilized long enough to determine whether a significant number of native plant species can be established on reshaped-topsoiled spoils. Therefore, the greatest impact to the vegetation resource would be the complete loss of existing stable plant ecosystems on approximately 5,170 acres by 1990, and the permanent loss of vegetation on about 350 acres. The second most significant impact would be the projected ten percent decrease in production on revegetated spoils. Though seasonal peak production is not expected to decrease appreciably on most sites, species diversity will probably decrease by 75 percent. The tree, shrub, and forb components of herbage production will probably decrease by at least 75 percent, and the grass component increase by about the same amount.

Terrestrial Fauna

WILD FAUNA

The expansion of Energy Fuels Mine complex covered in this statement would result in several adverse impacts on a variety of wildlife species. Three major categories will be covered in this section: the mining operation, construction of support facilities, and reclamation activities. Each of these actions would impact the terrestrial fauna in its own particular way.

Mining operation

The major segments of a strip mining operation, as related to terrestrial fauna, are: exploration, removal of the vegetation, removal of the topsoil, removal of the overburden, and extraction of the coal. The first three segments of this type of operation would create the most significant impacts on wildlife.

During the exploration phase of the operation, paths would be cut through the existing vegetation and pad locations cleared; drilling operations would then take place. Destruction of the vegetation would create impacts on the fauna by reducing the available nesting cover, escape cover, and food, and reducing the area's capability to maintain present animal numbers. The faunal species that are most affected would depend upon the vegetation type that is being disturbed (Appendix D).

Noise resulting from the drilling operation and movement of equipment would create what is expected to be a short-term impact on those faunal species in close proximity to the work area; the noise could create a degree of anxiety in the animals. This degree of anxiety would depend on the faunal species, closeness to the operation, and the duration of the operation. Those animal species that are mobile enough, such as coyote, fox, deer, and most birds, would most likely leave the immediate area, at least temporarily. Those species that could not flee would probably retreat into their dens or other protective cover.

Some animal deaths would be expected from this phase of the operation from vehicle-animal collisions, and den or nest destruction, or disturbance. Unplugged core sample holes could create a hazard to small mammals, amphibians, reptiles, and invertebrates, and could result in larger animals, such as deer and elk, stepping into them and breaking a leg.

Removal of all vegetation would be the first step in the process of getting to the coal; the loss of this vegetation would result in a loss of food and cover needed by terrestrial fauna. The disruption of the mined portion of the ecosystem would be total (see Appendix D for species affected by habitat type).

A combination of vegetation loss and removal of productive topsoil would leave the mined area void of animal life; this adverse impact would be exerted on all forms of terrestrial wildlife from soil mites to deer and elk.

The major impacts of the removal of the overburden and coal would be in the creation of the highwall, and the prolonging of the amount of time that the area will be disturbed, increasing the disruption of normal animal movements and increasing the danger to individual animals.

The total loss of wildlife habitat would be in a constant state of progression across the lease area. Table EIII-3 indicates the proposed acreages that would be stripped by Mines 1 and 2 from 1975-79. An estimated 3,330 acres would be strip-mined by the Energy Fuels mining operations from 1980-90. This would make a total of about 5,170 acres that will be mined between 1975-90.

There will be a one year time lag from the removal of topsoil to the beginning of revegetation efforts; this would mean that, due to mining, approximately 350 acres of land would be totally lost to all wildlife at any given time during this 15-year period. All previously mined areas would be in some stage of reclamation, and therefore provide some wildlife habitat value.

Additional acreage would be lost to wildlife as a result of road construction, mine facilities, and the off-site loss of approximately 156 acres, due to the population increase related to the additional mine employees and support personnel. Most of the road construction and mine facility buildings are already completed for on-going mine operations. Therefore, additional losses of habitat and corresponding wildlife losses resulting from these activities would be minimal.

Less mobile faunal species such as many reptiles, invertebrates, and small mammals would not be able to flee from mine-related activities and would be destroyed. The larger and more mobile species such as deer, elk, coyote, grouse, and other birds would be able to move onto adjacent lands. All or most of these relocated animals would probably be lost, as explained in the Regional Analysis portion of this report.

The entire 5,170 acres that would be mined by 1990 provide summer deer habitat and winter elk habitat. Using the same population estimates used in Chapter II, habitat capable of supporting approximately 55 deer (estimated 21 percent of the subject area's herd), and 50 elk (out of a local population estimated at 225), would be displaced and probably eventually lost (see Figures EII-13 and EII-14). These animal numbers would represent a permanent loss out of the respective herds unless rehabilitation programs could restore the mined areas to an equal or greater carrying capacity than that which is presently available.

Impacts on bears and cougars would be expected to be significant to local populations. The degree of human activity as well as the loss of vegetal cover would probably preclude the use of the subject 5,170 acres by these species; some of the adjacent lands would probably also become unsuited for these species because of the close proximity of human activity.

The most significant impact on the rabbits and hares would be the loss of food and escape cover during the mining operation; populations would decline in the limited area that has been denuded of vegetation.

Potential impacts to bats are not known although it is expected that these species would relocate.

In all probability the increase in human activity and the noise associated with the mining operations would cause some wildlife species such as coyotes, fox, and many birds to leave the working area prior to actual habitat destruction. The probability of an increase in vehicle-animal collisions would also be associated with the increase in human activity.

The probability of legal as well as illegal hunting and trapping pressure could increase as better access becomes available, and more people come into the region.

Additional habitat destruction would likely result from business and recreational use of vehicles off the roads on lands adjacent to the proposed mined areas. This would cause a related reduction in the use of the area by certain species of wildlife such as deer, rodents, and other herbivorous species, as the carrying capacity is reduced, and nests and dens are destroyed.

Water quality has been altered in Fish Creek as a result of past Energy Fuels mining operations. Additional deterioration of this creek as well as potential damage to Middle and Foidel Creeks would be possible. This could result in making these creeks unsuitable for waterfowl, shorebirds, beaver, muskrats, amphibians, insects, and other wildlife species (see Appendix D for a list of terrestrial species associated with aquatic habitats). This loss would reduce the area's ability to sustain a balanced ecosystem similar to the existing one.

Approximately 10-20 percent of local sage grouse habitat would be altered; the expected impact would be a reduction of between 20-40 birds. Sharp-tail grouse and blue grouse would also be displaced but no population estimates are currently available for these species within the mine complex. The area's carrying capacity for mourning doves would be reduced as a result of a loss of vegetation, until rehabilitation work begins.

A reduction in raptor nesting would be possible, resulting from human activity and potential loss of adequate nesting sites; however, this loss is expected to be minimal. Noise emitted from the mining equipment and blasting would probably interfere with the raptor's hearing, thus affecting their hunting ability in close proximity to the ongoing mining operations. Some nestling gamebirds, raptors, shorebirds, and non-game song birds would probably be destroyed as a result of the mining operations, because of their lack of mobility at this point in their life cycle. Many other birds would lose their nesting or escape cover and would cease to use the subject area.

Because of a lack of knowledge of the amphibian and reptile species present, little can be said about the impacts on this segment of the terrestrial fauna. Most species of this group would not be mobile enough to escape destruction from the mining equipment; some species, such as rattlesnakes, would be killed by miners and recreationists in and around the actual mined areas.

Little is known of the species composition of terrestrial invertebrates; therefore, nothing specific can be said about the impact upon them. Numbers would certainly decline in the mined areas until rehabilitation begins, but to what extent is uncertain.

Support facilities

No additional buildings are expected to be constructed, and no additional roads or powerlines have been addressed in the mining plan, although some limited road construction could be expected. Some of the existing new roads have not been revegetated; they will continue to impact wildlife, primarily by reduction of water quality due to sediment runoff during rains and snowmelt. Existing roads also impact wildlife by presenting a vehicle-animal collision hazard. This hazard would probably increase with expanded activity in the region.

Reclamation

The current land use plan of Energy Fuels is to revegetate much of the area that is presently sagebrush, oak brush, and mountain shrub to grasslands or agricultural use. Animals that are closely associated with grasslands or domestic croplands would benefit from this change. At the same time those species that prefer the sagebrush, oak brush, or mountain shrub vegetation type would be detrimentally impacted (see Appendix D for an indication of the species involved).

Energy Fuels has indicated that "Where possible, shrubs and trees will be relocated . . ." (Energy Fuels Corporation Reclamation Plan). Exact size or configuration of these shrub or tree relocations has not yet been determined. However, since the overall plan is to return most of the disturbed areas to grassland or crops, it is assumed that the shrubs and trees would not approach the total acreage that presently exists.

Because the current revegetation plan does not call for replacement of all sagebrush, oak brush, and mountain shrub acreage, the initial decline in the deer herd would be expected to be sustained. Elk habitat, mainly the food component, might be improved as a result of the revegetation effort; this appears to be the case in the older Energy Fuels 1 Mine spoils.

All revegetated areas are to be fenced to exclude livestock grazing for at least the first two growing seasons; these fences may prevent some use by big game. If so, this would constitute an impact on deer and elk by restricting their use of the subject areas. Installation of protective fences and the mine's highwall would create a barrier to normal animal movement. The impact of the highwall would be greater on small mammals, reptiles, and amphibians than on the larger, more mobile animals, such as deer, elk, and coyotes. An additional impact would be the loss of life due to animals falling off the highwalls or getting entangled in the fences.

Based on past reclamation activities, the early stages of this project would probably support abnormally high rodent numbers. The species composition and densities of these rodents would vary, dependent upon successional stages of reclamation and the plant species used in revegetation; it is unlikely that the species composition would return to its pre-mined status. High rodent numbers are expected to attract and sustain larger than normal numbers of predators, mainly coyotes, fox, snakes, and raptors.

Jackrabbit populations would be expected to make a rapid recovery in areas where herbaceous cover has become successfully established. Cottontails and snowshoe hares would not respond to rehabilitation efforts to a significant degree until brush and tree species were replaced.

Sage grouse and blue grouse numbers would not be expected to recover because of the loss of their preferred habitat—sagebrush and aspen. Mourning dove prefer to feed in weedy fields. If the revegetated areas are invaded by seed-producing weeds, overall dove use would increase.

The degree of invertebrate recovery from the impacts of the mining operation would depend entirely on the vegetal species composition and success of the revegetation program.

DOMESTIC FAUNA

All livestock would be moved out of the proposed mine areas prior to beginning actual work; no livestock are expected to be destroyed by these activities.

Approximately 1,400 acres of land would be totally lost to livestock at any given time during the mining operation; the resulting loss of Animal Unit Months (AUMs) would vary depending on the vegetation type being cleared. All previously mined areas would be in some stage of reclamation. All revegetated areas would be fenced to prohibit livestock grazing for a period of at least two growing seasons.

Losses in AUMs, on a year by year basis, could vary from 270-139, depending on the type of vegetation disturbed. Assuming actual livestock use for four months, as many as 35-68 cattle or 175-340 sheep will be displaced.

In the current reclamation plan, Energy Fuels would reseed with a mixture of grasses and alfalfa. Alfalfa on mine spoils has caused livestock losses in other areas in northwestern Colorado. Planting this species could result in loss of animals due to bloat, when they are eventually returned to the revegetated areas.

The reclamation plan also calls for a conversion of the lands in the Energy 2 area to agricultural use; these lands would be lost to livestock grazing for most of each year.

Table EIII-4 indicates that approximately 1,840 acres, representing 275 AUMs, would be altered during the first five years of mining. Approximately 780 acres would be put into croplands; the remaining 1,060 acres would be seeded to a grassland type. By substituting carrying capacity figures used in Table EIII-5, there will be an expected net increase of 136 AUMs after all mined areas have been revegetated, and vegetation has become established. This does not take into account the ten percent loss in soil productivity, as indicated in the Terrestrial Flora Impacts Section. This still indicates a potential beneficial impact for livestock.

Aquatic Biology

Increase in sedimentation which would result from the proposed mining activities would have a severe effect on the aquatic ecosystems in the Trout Creek watershed. Surface mining methods such as those employed at Energy 3 Mine (Figure EII-10, top photo) could result in a "dead

TABLE EIII-4

Carrying Capacities and Loss of Animal Unit Months by Vegetation Types during First Five Years of the Mining Operation

Vegetation Type	Carrying Capacity in acres/AUM	Acres Disturbed	Total AUMs Lost
Aspen	4.00	20	5
Aspen - Mt. Shrub	4.25	85	20
Sagebrush	7.75	880	113
Mt. Shrub	4.50	195	43
Cropland	7.00	660	94
Total	-	1,840	275

TABLE EIII-5

Estimated Carrying Capacities of Revegetated Areas at the End of the First Five Years of Mining Operations

Vegetation Type	Carrying Capacity in acres/AUM	Acres Revegetated	Total AUMs Restored
Grassland	3.00	780	260
Cropland	7.00	1,060	151
Total	-	1,840	411

stream'' for miles below the action site. Drastic sedimentation increase resulting from disruption of natural stream channels would result in: (1) reduction of all benthic (bottom) organisms by suffocation, resulting from increased deposition of silt in the streambed, (2) silting in of all riffle areas which are critical to trout spawning and feeding, (3) elevation in water temperature and a decrease in dissolved oxygen content of the stream to an extent that would produce an intolerable environment for trout, (4) an increase in disease and suffocation in fish, due. to abrasive and clogging effects of additional sediment on their gills.

Direct alteration of the natural stream channels as a result of strip mining activity could also eliminate aquatic life in the stream at and below the site through dessication. In addition, fish present in this stream segment would either have to migrate into already occupied habitat further downstream or perish. Mining activities across a stream channel would also eliminate riparian vegetation which is critical to both local fish and wildlife populations. Critical habitat areas (spawning beds) would be permanently removed from the ecosystem. Natural flow characteristics of the stream would be changed, resulting in permanent alteration of habitats and life cycles of many members of the aquatic community; for instance, an increased stream velocity resulting in permanent alteration of habitats and life cycles of many members of the aquatic community; for instance, an increased stream velocity resulting from channelization would alter the pool-riffle ratio of the stream channel, producing corresponding shifts in trout habitat use areas. An increased stream velocity would also change the composition of the macroinvertebrate population, resulting in a preponderance of organisms which can adjust to the swift currents by permanently attaching themselves to the stream bottom.

Effects of strip mining on the aquatic community could extend throughout the downstream portion of the Trout Creek drainage. For example, fish displaced by mining activities would have to migrate downstream into already occupied habitat. Such displacement of the members of fish population could result in overpopulation of the downstream habitat (not enough available food and cover for the number of fish present), stunting (fully grown fish with extremely small bodies and large heads), or death.

Cultural Components

Archeological Resources

Total projected acreage disturbance for Energy Fuels by 1980 is 1,840 acres; by 1990 an additional 3,330 acres would be disturbed (5,170 acres total). Because Dr. Olson's analysis of the Energy Fuel's area was a reconnaissance survey, unknown sites could be destroyed by this acreage disturbance. As an indication of potential for impact due to vandalism or pothunting, projected employment figures for Energy Fuels are 137 employees by 1980, 306 by 1985, and 418 by 1990. Table EIII-6 shows the likely impact on all known sites.

TABLE EIII-6

Impacts to Cultural Resources

Site No. (see Figure EII-20)	Nature of Probable Impact: Direct Physical Displacement — Mining	Roads and R/Ws	Vandalism
1		x	x
2		x	x
3		x	x
4 1/ 2/	x	x	x
5 1/	x	x	x
6 1/	x	x	x
7		x	x
8			x

1/ On or in close proximity to competitive lease application C-22677

2/ Number four's National Register qualities would be adversely impacted by mining or disturbing the site area.

Because the Energy Fuels mine plan presently lacks specificity with respect to support facilities, roads, and rights-of-way, only the general nature of impacts can be assessed in this section.

In view of the paucity of detailed archeologic base inventory data, and given the area's suitability for at least seasonal habitation, there is a moderate likelihood that the area's archeologic resources would yield significant information concerning prehistoric occupation of the area.

Historical Resources

As the Foidel School is in an area of ongoing operations, impacts to it would not be expected in the form of direct physical displacement. However, because no intensive cultural resource survey has been completed, potential vandalism, pothunting, and outright physical displacement of unknown historical features could occur. Mining operations in the Pinnacle Peak area could adversely impact the two graves in that area (see Chapter II), depending upon their exact location.

Although no intensive base inventory of historic resources exists, there is only a moderate likelihood of encountering significant historic resources, given the area's regional history.

Aesthetics

Refer to Appendix D for a discussion of procedures to be used in analyzing the landscape visibility maps for assessment of impacts.

The largest-scale elements in the landscapes containing proposed action would be the coal-stripping areas themselves. However most impacts would result from roads and linear rights-of-way attendant to the proposed action itself, because they cover a larger geographic area, and are also relatively more permanent features.

The form of the mined areas would conflict with irregular patterns occurring naturally, though they can more easily borrow from the rectilinear agricultural pattern at Energy 2. Spoil piles would produce a repetitious form of sharply angular ridges that are minus deviations in this rolling landscape. The active pit and adjacent highwall introduce additional linear form that is foreign to this characteristic landscape. Spoils dumped over escarpments would produce barren talus slopes; their vertical triangular form would be foreign to the horizontally-oriented rectangular form of rock ledges (see Figure EIII-1).

Cuts and fills on roads and rights-of-way characteristically produce half-moon shaped scars foreign to all but adjacent rimrock escarpments. When viewed parallel to their alignment, their sharply angular contact with natural terrain fails to borrow from the adjacent rolling landscape.

Buildings, tipples, and draglines further introduce sharply angular and blocky forms into the landscape. Power transmission structures and conductors, buildings, equipment, tipples, roads, and rights-of-way would be strongly line-dominant elements foreign to this rolling landscape.

Stream rechanneling could produce strong line dominance that does not complement curving lines of hillsides and meanders. Silhouettes produced by spoil piles, transmission lines, draglines, and vegetation clearings also characteristically exhibit angular lines that are incongruous in natural landscapes.

Large mined-over areas would result in color variations, such as light-colored mineral soils, that draw attention to the mining operation. The coal visible in the active pit and barren cut-and-fill slopes would also produce color deviations from the characteristic landscape. Changes in the vegetative complex in reclamation operations could create hues markedly different from the characteristic landscape. Reflective or silver-colored tipples, transmission lines, and buildings introduce foreign colors into the landscape,́ as does brightly painted equipment.

Reclamation efforts that utilize other than native species would create textural differences from the adacent types. Spoils, road cuts, and rights-of-way that are not successfully revegetated would also appear as visual intrusions.

Road and blasting dust, coal dust, and exhaust emissions create short-lived landscapes foreign to the native surroundings. Other ephemeral landscapes that occur as minus deviations would result from increased siltation in streams.

If vegetation cleared during road construction or mining is scattered adjacent to the disturbed areas, or if it is piled and burned, it will produce an aesthetically unconforming landscape of forest litter. Disposal of refuse and waste from the mining operation could also produce an undesirable landscape of litter if it is not contained, visually screened, and properly maintained.

The foregoing discussion of minus deviations accruing to the proposed action considers the existing landscape character. It must be noted that existing coal mining operations have already produced a variety of existing minus deviations prior to those adverse impacts anticipated here (see Chapter II).

Overall aesthetic experience at Energy Mine areas would also be adversely impacted. Notwithstanding the subective nature of mood-atmosphere values, the proposed action might adversely impact the area's inherent capability to kindle feelings of isolation, solitude, or a certain respect for nature. Beneficial impacts may also result if the operation helps to reveal more of nature's spectacular grandeur.

The total adverse aesthetic impact would not be significant regionally. Local significance would be moderate because projected adverse impacts would add to and prolong the aesthetic obtrusiveness of existing mining operations.

Recreation

Adverse impacts might accrue to the area's wildlife viewing potential if critical habitat is mined or if mining operations occur in too close proximity to intolerant species' habitats. As a result, viewing opportunities at sage grouse strutting grounds and sharptail dancing grounds adjacent to Energy 2 and competitive lease application C-22677 might be lost.

When mining operations, roads, or rights-of-way occur on steep slopes, or in too close proximity to perennial streams, increased sediment loads could occur in either Fish, Foidel, Middle, or Trout Creeks. Rechanneling and relocation of drainages also might promote siltation. These changes would ultimately impact the recreation supply in terms of reducing each stream's capability to attract and support fishing use. Essentially all Energy lease applications and existing leases would have potential for causing these impacts. Incidences of increased streamside erosion at Energy 2 are witnesses to these impacts (see Figure EIII-4).

Dumping overburden over escarpments could create safety hazards for recreation visitors and sightseers on public roads below them; several large rocks already have crossed County Road 31 (see Figures EIII-1 and EII-27).

Unknown archaeological sites might be destroyed by mining operations and thereby lose their inherent capability to attract and accommodate recreation use. This loss could occur through actual destruction of the resource by mining itself, either by direct removal, or by off-site influences such as seismic damage from blasting, or through vandalism and pothunting by mine employees. As an index of vandalism potential, present mine employment is 175; projected employment by 1990 is 418.

Developments at Energy 2 might adversely impact the recreational potential of the private big game hunting area, Green Acres. However this adjacent recreation operation might actually benefit from the proposed actions through experiencing a net increase in numbers of animals, as is presently occurring adjacent to and east of Energy 2 Mine (Scott 1975).

In addition revegetation efforts on mined-over areas might result in beneficial impacts to wildlife viewing by attracting more animals; this is presently occurring with winter elk concentrations at Energy 1 spoils.

More roads, trails, and denuded slopes could also positively affect the area's capability to attract and support off-road-vehicle (ORV) use.

Other beneficial impacts might result from increases in each mine's capability to attract and sustain rockhounding use. Stripping of the overburden would uncover interesting and collectable rocks and fossils now found below the surface.

Greater capabilities for geologic and industrial interpretation would also occur. All three mines have existing public access viewpoints (see Aesthetics Section), with potential for informing the visiting public of the physical and economic conditions conducive to strip mine development on these particular sites. This could be accomplished by interpretive signing, interpretive-educational brochure development, and also by guided tours.

On-site adverse and beneficial impacts would have only moderately low significance locally. However, off-site impacts, such as those to downstream fishing capabilities, would be moderately significant on a regional basis.

Social Environment

Table EIII-7 presents population impact by county and community of the development of Energy Fuels Mines; it also indicates expected new school enrollment by county. These data were generated by the gravity-employment multiplier model described in Chapter IV of the Regional Analysis, Future Social Environment Without the Proposed Action. They represent incremental increases over and above the base scenario presented in the same section of the Regional Analysis.

Requirements for new social support facilities including housing, health care, education, water and sewage treatment, fire protection, and law enforcement are functions of increases in population. Table EIII-7 indicates that expansion of Energy Fuels Mines would induce a relatively moderate increase in population; therefore, impacts on existing social support facilities are expected to be relatively small, compared to both the existing extent of, and other future demands on, these facilities. It is the cumulative impact of several new developments that generates significant new requirement for social support facilities; these requirements are addressed in depth in Chapter V of the Regional Analysis.

Population projections show that the Energy mines would cause an increase of about 600 people in Moffat County, and 950 in Routt County by 1990. This means that approximately 60 acres will

FIGURE EIII-4

Examples of impacts to the recreational capabilities of downstream fisheries are illustrated by these sediment-producing actions at Energy 2 adjacent to Fish Creek The top photo shows rill erosion on partially reclaimed spoils (photo's lower half), plus gullying from an uncontrolled water diversion (upper half). The lower photo is a closer view of erosion from the uncontrolled water diversion.

TABLE EIII-7

Population Impacts of Energy Fuels Mine Development

	1980	1985	1990
Direct Employment at mine 1/	137	306	418
New Population			
Moffat County total	157	433	608
Craig	157	433	608
Routt County total	341	694	949
Hayden	46	117	168
Oak Creek	106	203	273
Steamboat Springs	155	307	420
Yampa	34	69	88
Total	498	1127	1557
New School Enrollment			
Moffat County	33	87	309
Routt County	69	139	189
Total	102	226	309

1/ Over and above existing employment

TABLE EIII-8

Economic Impacts of Energy Fuels Mine Development

	1980	1985	1990
Direct Employment at mine 1/	137	306	418
Induced Employment			
Moffat County	34	84	135
Routt County	67	137	186
Total	101	221	321
Direct Earnings	3066	7653	11725
Induced Earnings			
Moffat County	340	1097	1548
Routt County	686	1556	2388
Total	1026	2653	3936

Note: Earnings data in thousands of 1974 constant dollars.

1/ Over and above existing employment levels.

be needed in Moffat County for residential and community facilities. Most of these uses will be on lands in and around Craig. However there is a possibility that some new rural residences along good county access could become established. These would have to comply with local zoning and ordinances. In Routt County an additional 95 acres might be needed to accommodate the expected population growth. Most requirements will be met by Steamboat Springs, Oak Creek, and Hayden. As in Moffat County, additional rural residences may be expected closer to the mining areas. These would probably be for a portion of the actual work force at the mines. Although it is possible, it is doubtful that new communities will be built to handle the housing needs of the 418 new employees expected by 1990.

There have been no expressions of local attitudes specifically oriented toward the development of Energy Fuels Mines. Rather attitudes are directed toward the subject of regional and community growth in general and are therefore examined in the Regional Analysis.

For a more extensive analysis of the regional impacts, mitigations, and unavoidable effects to which the expansion of Energy Fuels Mines would contribute, refer to the appropriate chapters of the Regional Analysis.

Economic Conditions

Table EIII-8 presents the economic impact of development of Energy Fuels Mines in terms of employment and earnings. These data were generated by the gravity-employment multiplier model described in Chapter IV of the Regional Analysis, Future Economic Environment Without the Proposed Action. These data represent the incremental impact over and above the base scenario described in the same section. Note that in each of the benchmark years, the greatest induced employment and earnings impacts from Energy Fuels Mines development fall in Routt County.

No adverse economic impacts are expected to be associated with the development of Energy Fuels Mines because both the direct and induced employment and earnings are relatively small compared to the economic base of the region.

Transportation Networks

HIGHWAYS

Since all new coal output is to be transported via the Energy Spur, and thence via D. & R.G.W.R.R. rail lines out of the area, no impacts in the form of increased coal truck traffic due to these increased operations are expected. Since rail lines go directly into the mining areas, equipment need not be transported over the highways.

Increased use of the D. & R.G.W.R.R. Energy Spur by coal trains and increased vehicular traffic volumes would result in increased potential for auto-train collisions at two county road crossings. These grade crossings are protected by signs only, located 2 and 11 miles down Energy Spur from Milner, on Routt County roads 179 and 33, respectively. No major highways are involved; all are county roads carrying local traffic, but increased train traffic of 2-3 trains per day and expected increased auto traffic would lead to an increased hazard rating at these two crossings. This rating cannot be quantified because no historical vehicular traffic data are available for the county roads.

RAILROADS

Total production of coal is to be moved by rail through the tipples at Energy 1 and 3.

The coal would be loaded on a 280 day/year schedule using 46 or 58 (100 ton capacity) car unit trains, without helper service. This amounts to about 2 unit trains of 58 cars/day, or 2-3 unit trains of 46 cars/day, each way. The impact of this number of trains to be loaded and run over the Energy Spur would necessitate careful scheduling. Proper scheduling of traffic over the D. & R.G.W.R.R. branch line with which Energy Spur connects would also be necessary to work up to 3 coal trains/day (280 days/year) into the regional rail traffic. The actual increase would be from production of 2.0 million T/yr expected without the proposed action to 5.0 million T/yr with the action.

Noise levels could be expected to go up due to the operation of more trains over the Energy Spur from increased coal production.

AIRLINES

The only real effect that the initiation of increases in Energy Fuels mining and railroad operations could have is increased passenger loads into the Yampa Valley Airport at Hayden. Since this airport is now undergoing a ten million dollar improvement operation, any increases due to the Energy Fuels mining plan should be easily absorbed by the improved airport facility. Some increase in passenger traffic into the closer Routt

County STOL Airport (Steamboat Springs airport) could also be expected; however, services are more limited there.

Chapter IV

Mitigating Measures

THIS CHAPTER PRESENTS MEASURES THAT WOULD LESSEN OR ELIMINATE THE ADVERSE IMPACTS OF ENERGY FUELS CORPORATION'S PROPOSED ACTION. THESE MEASURES ARE DISCUSSED IN THREE CATEGORIES: THOSE INCLUDED IN ENERGY FUELS CORPORATION'S PROPOSAL, THOSE REQUIRED BY LAW OR REGULATION, AND THOSE MEASURES THAT WOULD BE APPLIED AS SPECIAL CLAUSES OR STIPULATIONS TO LEASES OR PERMITS. IN EACH OF THESE CATEGORIES, MEASURES ARE PRESENTED BY IMPACTED ENVIRONMENTAL COMPONENT. BECAUSE SOME MEASURES LESSEN IMPACTS TO MORE THAN ONE RESOURCE, SOME REPETITION OF MITIGATIONS IS UNAVOIDABLE. ALL MEASURES ARE ASSESSED AS TO THEIR PROBABILITY OF IMPLEMENTATION AND/OR SUCCESS. MITIGATING MEASURES ARE PRESENTED AND ANALYZED AS PROCEDURES THAT WOULD BE REQUIRED IF THE PROPOSED ACTION IS APPROVED.

Measures Included in the Applicant's Proposal

Water Resources

Impacts on water resources would be lessened by pumping water accumulated in the mined area into settling ponds before allowing it to enter the natural drainages.

Soils and Terrestrial Flora

The following mitigating measures included in Energy Fuels Mine reclamation plan deal with each mining area separately, followed by measures that apply to all sites.

ENERGY 1 MINE

The proposed use for this area after mining is grazing land for wildlife and domestic livestock. Spoil piles would be reshaped with track-mounted dozers to approximate original contours after there are two overburden piles separating the reclamation area from the mining cut, so areas of disturbance are kept to a minimum. Shrubs and trees would be relocated with a front-end loader, from areas to be mined to areas which are being revegetated. Energy Fuels Corporation is also reclaiming the spoils from the old mining operation; this consists of leveling and reshaping the spoils to approximate original contour, and replacing topsoil to a depth of 4-6 inches if sufficient topsoil is available in new areas. The area is then disced, harrowed, and reseeded. Trees and shrubs will also be transplanted to this area.

ENERGY 2 MINE

The proposed use for this area after mining is cropland, primarily for production of small grain crops. Overburden shaping would be done in the same manner as Energy 1, except where overburden is shallow and removed by scrapers; in these operations spoil material would be placed in its final shape by the scrapers.

PRACTICES UTILIZED AT ALL MINES

Shaping would be accomplished in a manner which would blend the reclaimed land with the surrounding natural topography as much as possible; this would allow runoff to be spread evenly over the mined area, and lessen the possibility of soil loss by water erosion. Time lag between stripping and reclamation would be approximately one year, to keep the area of disturbance to a minimum, and allow revegetation efforts to be accomplished at optimum seeding times.

Reshaping of the spoils would be accomplished with tractors and scrapers, and topsoil would be replaced with rubber-tired scrapers, so soil mixing would be minimized. Grade stakes would be used to facilitate topsoil depth measurements. Topsoil would be smoothed with tractors using drag chains and rail ties. It would be disced or chiseled to create a suitable seed-bed, and then harrowed. The degree of leveling and roughing would be determined by use; for example, on land reclaimed for grazing it might be desirable to rough the surface more to create a diverse microclimate for a better vegetative cover. However, leveling of replaced topsoil on land reclaimed to farmland would be very desirable and necessary to produce a favorable surface for crop production. Topsoil would be removed from areas to be mined, and applied directly to areas to be reclaimed, where feasible. It would be stockpiled when the mining sequence, or soil moisture and temperature conditions do not permit immediate placement. When it is stockpiled, it would be segregated from any spoil material; furrows would be constructed at the slope toe to prevent possible water contamination. Topsoil piles would be roughened and seeded with a fast-growing plant to facilitate moisture retention and decrease erosion and nutrient leaching.

Seeding to a depth of one-half to three-fourth inch would be accomplished with a drill where topography is amenable to farm machinery. At present the following species are planted on all affected areas: intermediate wheatgrass (*Agropyron intermedium*), smooth brome (*Bromus inermis*), orchard grass (*Dactylis glomerata*), and alfalfa (*Medicago sativa*). Seeding rates of 8:4:2:2 pounds pure live seed/acre would be used; on broadcast-seeded areas these rates would be doubled. Additional and/or alternate species would be utilized as site, use, and supply indicate. Seeding would be conducted preferably in fall or early spring. Where reclamation is to achieve range type conditions, native shrubs and trees would be transplanted with a front-end loader, and/or by hand when species are dormant. Planting of some introduced trees and shrubs would be conducted on a site specific basis.

It is anticipated that mulch would not be required on most surfaces to be reclaimed; hydromulching might be used on areas with steep slopes, but they would be minimal.

Experiments with wood chips and straw would be conducted on small tracts to facilitate planning for mulch on areas of adverse soil and/or moisture conditions.

Soil samples would be taken randomly on sites that have been reshaped and topsoiled. These samples would be submitted to the soil laboratory at Colorado State University for analysis and fertilizer recommendations. Recommended fertilizer would be applied in early spring following the first growing season. If weeds invade areas reclaimed for cropland, control would be conducted by either mechanical or chemical methods, depending on the area and severity.

No overburden bore holes have been sampled to date, but plans are being made to sample and analyze strata during summer, 1975. The results of these analyses would be helpful in determining the best methods for overburden segregation if required.

All overburden shaping would be accomplished on a slope calculated to minimize erosion and sedimentation, prevent landslides, and control flooding. Furrows would be contoured at the slope toe of topsoil and overburden piles to trap sediment.

All toxic material, debris, or refuse would be buried in the pits in a manner to prevent contamination of ground or surface water.

All haul roads would be watered to control fugitive dust, in compliance with air pollution standards set by the Colorado Air Pollution Control Commission, and would thus reduce the impact of fugitive dust on soils and vegetation.

All reclaimed areas would be fenced with a livestock-proof fence. These areas would be restricted to grazing until after the second growing season, at which time grazing would be permitted on a limited and regulated basis with the approval of the Open Mine Land Boards recommendation. All appropriate governmental and private agencies would be consulted as necessary to accomplish the best possible and most economical reclamation.

Terrestrial Fauna

Energy Fuels has stated that the primary use of the proposed mine site, after mining, would be for domestic livestock grazing and wildlife use. The area would be reseeded, and trees and shrubs would be transplanted. These actions would help mitigate the loss of wildlife habitat by returning a vegetal cover to the area as soon as possible.

All reclaimed areas would be fenced to exclude domestic livestock until at least after the second growing season. This would help mitigate losses of forage by allowing the reseeded and new planted areas sufficient time to establish a vegetation community that could support grazing or browse use.

Energy Fuels would continue ongoing wildlife monitoring programs to provide additional information to assist in mitigating potential wildlife impacts.

In an effort to minimize the impacts of the mine's disturbance, reclamation work would be concurrent with the mining activity; reclaimed acreages would equal disturbed acres each year.

Aquatic Biology

The four streams in the proposed mining area would be monitored monthly, as weather permits, above, below, and within the mine areas. Any surface water generated into the pits would be pumped into evaporation ponds. These two actions would help mitigate potential impacts to the aquatic ecosystem.

Historical Resources

Energy Fuels plans to ascertain the exact location of two graves near Pinnacle Peak and fence them with protective exclosures (Eatherton, 1976).

Aesthetics

Large-scale form, line, and color-dominant minus deviations would be mitigated by complete regrading of the spoils and by revegetation. In the mature operation, the reclamation operation at Energy 1 and 2 would lag two spoil ridges behind the active pit operation.

Establishment of vegetation to mitigate visual impacts of color and texture-dominant minus deviations would occur approximately three years after spoil pile leveling and seeding. Planting of trees and shrubs is proposed at Energy 1, which if successful would further enable the area to blend with the characteristic landscape. Reclamation for cropland at Energy 2 would enable the mined-over area to borrow form from the adjacent forming landscape.

All toxic material, debris, and refuse are to be buried in pits. This would help ensure the maintenance of a litter-free landscape.

All haul roads would be watered to control fugitive dust; however, it should be noted that this type of control is only approximately 30 percent efficient.

Recreation

Energy Fuels proposes to regrade all spoil piles, and subsequently to establish either grassland or cropland vegetation. This action would significantly reduce mine-caused downstream siltation, which would help maintain downstream fishing capabilities in Fish, Middle, Foidel, and Trout Creeks, as well as in the Yampa River.

Measures Required by Law, Regulation, or Stipulation in Applicant's Present Lease

Laws and regulations common to all proposed mine developments grant the Secretary of the Interior, the Environmental Protection Agency, and the Colorado Department of Natural Resources authority to impose measures that will mitigate adverse impacts on the natural and human environment; they are listed in Chapter VI of the Regional Analysis. The following mitigating measures would be required of Energy Fuels; listed first are stipulations for leases C-081330, D-052547, and C-0128433 that are currently required by the Area Mining Supervisor as a result of Energy's interim approval (see Chapter I).

1. Operations must be conducted so as not to adversely change the character or cause pollution of streams, ponds, waterholes, seeps, marshes, or damage to fish and wildlife resources. Contaminants or pollutants shall be controlled and not allowed to enter streams, springs, stock waters, or ground waters.

2. No water from stock ponds or springs shall be used without prior written consent.

3. The lessee has the responsibility for securing access rights-of-way.

4. The lessee shall be required to comply with all Federal and State mine safety laws, regulations, and standards.

5. Mine waste products should be neutralized or disposed of in such a manner that it represents no hazard to living ecosystem components.

6. Topsoil will be removed and stockpiled, and pits constructed to bury spoils and waste materials; pits will be reclaimed by spreading the stockpiled topsoil, and revegetated, to stabilize soil, to original plant species, or species acceptable to the District Manager, BLM, and Area Mining Supervisor, USGS.

7. Spoils will be contoured to a traversible condition for motorized-wheeled vehicles in all directions, covered with topsoil, and revegetated to original plant species or species acceptable to the District Manager, BLM, and Area Mining Supervisor, USGS.

8. Either rehabilitation technique in 6. or 7. will begin as soon as pits are full and will progress as the mining operation progresses. Time frame for rehabilitation will be by approval of Area Mining Supervisor, USGS, and District Manager, BLM.

9. Topsoil stockpiles will be revegetated to prevent erosion and loss, until it can be redistributed.

10. Open burning is permitted only after securing a burning permit from the Colorado Air Pollution Control Commission. A copy of such a burning permit shall be furnished to the District Manager and the Area Mining Supervisor for their approval prior to conducting any such burning.

11. All existing improvements used by the lessee, such as fences, gates, cattleguards, roads, trails, culverts, pipelines, bridges, public lands survey monuments, and water development and control structures shall be maintained in serviceable condition to the degree practicable. Damaged or destroyed improvements shall be replaced, restored, or appropriately compensated for. When it becomes absolutely necessary, and only upon prior approval of the Bureau of Land Management through the Area Mining Supervisor, the lessee may disturb a public land survey corner marker or monument. However, the lessee shall bear all costs of any surveys required to preserve the true point of the marker.

12. The lessee shall comply with any County Zoning Resolution, subdivision regulations, with approval presented in triplicate to the District Manager through the Area Mining Supervisor.

13. Prior to undertaking any ground-disturbing activities on lands covered by said lease, the lessee shall engage the services of a qualified archeologist, (and a historian, when appropriate), acceptable to the lessor to conduct a thorough and complete intensive survey of areas to be disturbed, for evidence of archeological or historic sites or materials. Said archeologist shall work under the authority of current Antiquities Act permit, applicable to the area to be investigated. Report of methods used, area surveyed, report of finding, and conclusions and recommendations shall be made to lessor.

14. The lessee shall immediately bring to the attention of the lessor any and all antiquities or other objects of historic or scientific interest, including, but not limited, to historic or prehistoric ruins, fossils, or artifacts discovered, (to be left intact until authorized to proceed by lessor).

15. Mining or exploratory operations shall not be conducted, which, in the opinion of the Area Mining Supervisor, constitute a hazard to oil and gas production, or that would unreasonably interfere with the orderly development and production of existing oil and gas leases issued for the same lands.

16. Disturbed sites other than spoil areas will be stabilized immediately following completion of any construction by revegetation techniques. Upon completion of mining operations when buildings and other constructions are removed, the area involved will be recontoured to conform with the surrounding terrain. Revegetation of these sites will be with original species, or with species acceptable by the District Manager, BLM, and Area Mining Supervisor, USGS.

17. All roads will be waterbarred to reduce erosion potential, and culverts installed in the drainages as required to mitigate on- and off-site impacts.

18. The lessee shall give full protection to all critical habitat or habitats that provide a limiting component for any species.

19. The lessee shall give seasonal protection to fawning, calving, nesting, and similar areas.

20. The lessee shall make every reasonable effort to prevent, control, or suppress any fire in the operating area. Uncontrolled fires must be reported immediately to the District Manager.

21. Drill holes, excavations, and improvements shall be conditioned at all times to prevent injury to persons, livestock, and wildlife.

22. Those areas outside the lease areas are considered unauthorized for occupancy until such time as authorized.

23. Additional stipulations may be imposed as a result of an Environmental Impact Statement that will be completed prior to final approval of the mining plan.

Geologic and Geographic Setting

Energy Fuels has stated its objective of returning the land to as near its natural configuration as possible. No specific mention was made of the small intermittent streams that originally drained the area. Proper drainage of reclaimed areas should be attained by careful planning of the reshaping of the topography in accordance with (30 CFR 211.40(a)(2)).

Where mining takes place on the gentle slope of a ridge, as in Energy 1 and 3 Mines, spoil would not be placed or piled high on the crest of the ridge. This would prevent the spoils from being carried down the steep slope as landslide, mudflow, creep, or slump materials (30 CFR 211.40(a)(3)).

Mineral Resources

Under the present mining methods, the amount of coal lost in mining could be minimized by careful recovery of coal from any lenticular or thin coal beds overlying the mined bed. Drilling should be on closely spaced centers to assure that no other bed below the lowest mined bed is within stripping distance (30 CFR 211.4(b)).

PALEONTOLOGY

Measures provided for in the 1906 Antiquities Act, and 43 CFR 6010.2(a) and (b)(2), when implemented, would provide protection for fossils which are of actual and real scientific significance. This would be accomplished by requiring the lessee to conduct an on-the-ground intensive survey to ascertain the possible occurrence of dinosaur or other significant vertebrate fossil remains. The mine operator would also be required to prevent or minimize damage to known or suspected significant paleontological resources, pursuant to 43 CFR, Subpart 3041, Section 3041.2-2(d).

See the Regional Analysis for a more detailed description of how such surveys would be implemented.

Air Quality

The major source of air quality degradation from operation of the Energy Fuels mines would be fugitive dust emissions. Emissions of particulate matter, as well as ambient air concentrations of suspended particulates, are controlled by both Federal and Colorado law.

The U.S. Department of the Interior, BLM, issued rules and regulations for coal mining (43 CFR 3040) in May 1976. These regulations and those issued at the same time by the USGS (30 CFR 211) are discussed in detail in the Regional Analysis. They require that applicants for Federal lease lands specify in detail controls to be used in blasting, prevention of fires, and wind erosion. In addition air quality monitoring would be required to insure maintenance of ambient standards.

Colorado Regulation No. 1 Section II.D, Fugitive Dust prohibits mining operations without a permit that specifies fugitive dust control measures. Several suggested control measures include: paving dirt roads, regulating vehicle speeds, and watering of exposed areas.

Paving dirt roads would be nearly 100 percent effective, and would reduce total dust emissions at the mine by about 20 percent. Watering dirt roads is expected to be about 30 percent effective, reducing total emissions by about 6 percent.

Water Resources and Aquatic Biology

The Colorado Department of Health, the agency that has primary responsibility for water pollution control in the study region, has published a booklet (1974) describing standards included in the Water Quality Control Act of 1973, consistent with the goals and policies of the Federal Water Pollution Control Act amendments of 1972. These standards cover water quality with respect to sludge, debris, toxic materials, and other materials undesirable for aquatic life. The Colorado Department of Health, Water Quality Control Commission, adopted rules as of August 21, 1975 that require discharge permits and present effluent limits for BOD, suspended solids, fecal coliform, residual chlorine, pH, and oil and grease. These are fully described in Chapter IV of the Regional Analysis, along with sampling techniques and analysis standards necessary to obtain a required permit for waste water discharge into any and all surface or subsurface waters in the State.

Soils and Terrestrial Flora

The Endangered Species Act of 1973 provides for the conservation, to the extent possible, of plant species facing extinction. If species in this category were found on the Energy Fuels lease area, their protection would be provided for by the enforcement of this act. Because species in these categories are not easily identified, it would be very likely that they would go unnoticed, and therefore unprotected.

43 CFR Subpart 3041.2-2(b)(1) and 30 CFR 211.40(a)(1) require that the operator reclaim affected lands pursuant to his approved plan, as contemporaneously as practicable with operations, to a condition capable of supporting all practicable uses which such lands were capable of supporting prior to mining. Compliance with this regulation would keep to a minimum the amount of area void of vegetation, and thus subject to erosion at any given time.

30 CFR 211.10(c)(2) assures that baseline climatic, soils, vegetation, wildlife, and current land use information would be collected prior to mining, and could then be utilized to determine the best land use or uses after mining, and the best ways of achieving the chosen uses. These data would provide the best basis to evaluate the success of reclamation on any given area.

30 CFR 211.10(c)(6)(xii) requires that a mine plan include logs and analysis of overburden samples of each stratum from a number of drill holes sufficient to obtain a representative sample of the overburden overlying the coal, and the stratum immediately below the coal to be mined, and that each stratum be analyzed for the following: nitrogen, phosphorus, potassium, pH, specific conductance, exchangeable sodium percentage, moisture-holding capacity. This regulation requires that these analyses be used to determine which materials would be buried, and which materials are suitable for placement near the surface for favorable propagation of vegetation. Compliance with this regulation and 30 CFR 211.40(a)(2), requiring grading methods that ensure stability and cover all acid-forming or toxic materials, would insure a subsoil medium suitable for plant growth.

30 CFR 211.40(a)(4), 43 CFR Subpart 3041.2-2(f)(4) and the Colorado Mined Land Reclamation Act (H.B. 1065) require that topsoil be removed separately for replacement on backfill areas, and if not so utilized immediately, that it be segregated from other soil material. If such topsoil is not replaced on a reshaped area within a time short enough to avoid deterioration of the topsoil, vegetative cover or other means would be employed so that the topsoil is preserved from wind and water erosion, remains free of any contamination by other acid or toxic material, is protected from establishment of noxious weeds, and is in a usable condition for sustaining vegetation when restored during reclamation. Therefore, topsoil stockpiles would not be placed in areas of water accumulation. Also, after disturbed areas have been regraded and topsoil replaced, if equipment has compacted the soil so that root and moisture penetration would be restricted, and thus the topsoil not in a condition for sustaining

vegetation, the area would be chiseled or ripped in a manner to loosen the soil.

To assure that topsoil be in the best condition to sustain vegetation, every effort would be made to remove topsoil from areas to be mined, and replace it directly on reshaped spoils, thereby transplanting some native species live, retaining a degree of soil structure, and allowing the existing micro-organism population to continue functioning. Also, for the topsoil to be in the best condition for sustaining vegetation, it should be replaced in the spring or fall, so the area can be seeded immediately to perennial vegetation to protect against erosion and weed invasion. If topsoil cannot be replaced immediately and is stockpiled for periods longer than a year, it would be seeded with perennial species to avoid deterioration of the topsoil.

30 CFR 211.40(a)(2) and 43 CFR 3041.2-2(f)(2) require that spoil reshaping restore the approximate original contour, and 30 CFR requires the operator to establish a vegetative cover native to the area. To comply with this regulation, spoil shaping and replacement of the topsoil would be designed to create various microclimatic conditions that are characteristic of the differences in soils and exposure that produce the diversity in the existing vegetation. On areas to be returned to wildlife habitat (native vegetation) seed mixtures would be varied according to microclimatic conditions produced by the shaping process. Energy Fuels plans to return much of the mined area to wildlife habitat; however, their current seed mixture does not contain any native species. For this land use to be obtained the seed mixture would be expanded to include more species, as many as possible native to the area. Also, to the extent possible, native trees and shrubs would be transplanted from unmined areas to reshaped areas to decrease the impact of loss of native vegetation. Mature tree and shrub transplanting and bare root stock transplanting would be done in areas of most favorable soil moisture conditions produced by shaping and topsoil replacement operations, and to steep areas to provide soil stability.

30 CFR 211.40(a)(13)(i) requires the operator to establish on regraded spoils and all other affected lands a diverse vegetative cover native to the area and capable of regeneration and plant succession, at least equal in density and permanence to the natural vegetation; therefore, to minimize the loss of existing vegetation, the seedings on disturbed areas would include as many native species as possible, with the addition of introduced species that have proved locally successful in stabilizing disturbed areas. To encourage a vegetative cover equal in density and permanence to the natural vegetation, the overburden removal process would replace the fragmented material below the topsoil to the top of the spoil piles. This material has proven useful on a plant growth material in the area, and would thus provide a useable growth media for deep-rooting plants, and speed the soil-building process because of its fragmentation. Also, to assure that reclamation, and thus successful revegetation, is accomplished as contemporaneously as practicable, where final grading creates surfaces amenable to farm equipment, seeding would be done by a rangeland drill, or suitable equipment that will bury the seed at a constant depth on rough terrain, and thus increase vegetation establishment. To assure vegetative growth all seedings of perennials would be confined to late fall and early spring, and seedings would be accomplished only after seedbed preparation.

30 CFR 211.40(a)(3) requires that the operator shall stabilize and protect all surface areas, including spoil piles, affected by the coal mining and reclamation operation, to effectively control slides and erosion. Therefore, all road cuts and fills would be seeded as soon as possible following construction, and water bars, contour furrows, and other surface manipulation practices would be used to minimize erosion. If construction is finished in the spring or fall, perennial vegetation would be seeded; otherwise, an annual grass would be seeded to provide temporary erosion control and compete with invading weed species. Also to control erosion in areas of extremely adverse soil moisture conditions or very steep slopes, a mulching practice, such as straw or hydromulch, would be used. In addition, to comply with this regulation, where slopes are greater than 33 percent, or topsoils with a high clay content are replaced, a surface manipulation practice would be implemented to impede runoff and induce infiltration, thereby controlling erosion and increasing revegetation success. Also, on areas where cropland is the proposed land use, spoils should be reshaped as flat as possible, and, if necessary, a terrace effect created to reduce erosion.

To assure establishment of vegetation of permanence (30 CFR 211.40(a)(13)(i)), after replacement, topsoil fertility levels would be determined and fertilizer applied, with rates and composition dependent upon the requirements of the plant species being seeded. If fertility levels are too low for seedling establishment, fertilizer would be applied shortly after seedling emergence, unless seeded in early fall, in which case it would be applied in early spring following seeding. If soil fertility levels are adequate for seedling establishment but not for sustained growth, fertilizer would be applied in the early spring of the second growing season. Where soil fertility rates are very low and plant growth is deficient, a maintenance fertilization program would be implemented until the soil system is self-maintaining.

30 CFR 211.62(b) requires that revegetated areas be evaluated by the Area Mining Supervisor to determine whether satisfactory vegetative growth is being established, or whether additional revegetation efforts should be ordered. Therefore, if climatic or soil conditions are such that revegetation attempts fail on the affected area, the area would be recovered with suitable topsoil and/or reseeded, until vegetation is established.

30 CFR 211.40(a)(14)(ii) requires that revegetated areas would be fenced to regulate public access and protect the area from uncontrolled livestock grazing. Therefore, all revegetated areas would be fenced immediately after seeding, and grazing should not be allowed until the third growing season, and would then not be allowed during the spring or early summer, when plants are growing rapidly.

Implementation of all of the measures in this section would greatly increase reclamation potential; however, because strip mining creates large changes in the plant growth medium, and because current reclamation practices have not been utilized for a long enough period of time to adequately access their ability to return mined lands to the composition or production levels of existing plant communities, a ten percent decrease in production has been projected.

30 CFR 211.1(a)(1)(ii) requires that all current mine plans, such as Energy Fuels', will be resubmitted on or before November 17, 1977 and must comply with all of the provisions of 30 CFR 211. Compliance with this regulation will provide additional baseline data which, when received may indicate a need for additional mitigating measures.

Terrestrial Fauna

The Endangered Species Act of 1973 makes it unlawful to harass an endangered species in any way. The possibility of peregrine falcons using the area has been addressed. Therefore, to insure that no action is taken that would interfere with this species' activities, a study could be conducted prior to any work being done. This study would identify all endangered species' habitat and use areas, or prove that endangered species do not use the subject area.

In compliance with 30 CFR, 211.40(a)(6), all core holes would be filled with a mud or cement substance to mitigate losses or damage to any faunal species.

To reduce the impact of the proposed haul road on wildlife and their habitat, 43 CFR 3041.2-(2)(e)(11) and 30 CFR 211.40(a)(11) state that the operator shall design all roads and powerlines in a manner that will minimize damage to fish and wildlife habitat. This would require the operator to use all cut material in road construction as fill, or haul excess material away and deposit it on existing spoil piles, rather than pushing the excess off the side of the road and increasing the amount of disturbed vegetation.

In accordance with 30 CFR 211.4(d), the operator shall take such action as may be needed to minimize adverse impacts upon fish and wildlife. To accomplish this goal it would be necessary to seed all disturbed roadsides as soon as possible after completion of the road construction.

By complying with 30 CFR 211.40(a)(7), some impacts on the aquatic ecosystem, and thereby on a segment of the food web of the area's terrestrial wildlife, would be mitigated. This reference states that the operator shall utilize the best practicable commercially available technology to minimize disturbance of the prevailing quality, quantity, and flow of water in surface water systems.

In accordance with 30 CFR 211.40(a)(14) and CFR 3041.2-2(a)(14) the operator shall regulate vehicle traffic, wildlife and livestock grazing in all areas of active operations, including lands undergoing reclamation, in order to protect wildlife and livestock from hazards associated with such operations, and to protect revegetated areas from unplanned and uncontrolled grazing. This would require fencing of all work areas and reclamation areas to exclude wildlife and livestock.

Archeological Resources

Legislative backing for protection of archeological resources comes from a variety of legislation. The Regional Analysis contains a detailed accounting of how these regulations would be implemented.

The 1906 Federal Antiquities Act (P.L. 59-209; 34 Stat. 225) makes it illegal to damage, destroy, appropriate, or excavate any historic or prehistoric object; to help enforce these provisions, issuance of antiquities permits to qualified professionals for purposes of conducting surveys, testing, and excavation on Federal lands is required. Authorization for the Secretary of the Interior to maintain the National Register of Historic Places is given by the 1966 Historic Preservation Act (P.L. 89-665; 80 Stat. 915); the Advisory Council on Historic Preservation is also established by the Act. All Federal actions affecting existing or proposed National Register Properties must be reviewed by the Advisory Council (according to Section 106 of the Act). The National Environmental Policy Act of 1969 (P.L. 91-190) also identifies the Federal government's continuing responsibility to preserve important historic and cultural aspects of our national heritage. Establishment of the Federal government in a leadership role of preserving, restoring, and maintaining cultural resources was accomplished by Executive Order 11593, 1970 (36 F.R. 8921). Most recent Federal legislation is the Archeological and Historical Data Conservation Act of 1974 (P.L. 93-291) which requires protection of cultural resources affected by any Federal or federally-licensed construction project.

These provisions would be implemented by requiring intensive cultural resource surveys that not only identify all sites, but also that evaluate their significance.

Additional legislative backing is provided for protection of cultural resources in 43 CFR, Subpart 3041. Section 3041.2-2(d) directs Energy Fuels to take action to protect known and suspected cultural resources identified by the required intensive surveys. This would be accomplished by constructing fenced exclosures, interpretive signing, etc., as appropriate on a case-by-case basis.

In order to identify all cultural resource values adequately to satisfy legal requirements, an intensive archeological survey must be completed by the lessee, and an evaluation of National Register significance must be made. If significant sites are found, Energy Fuels would be responsible for nominating them to the National Register of Historic Places, and subsequently contacting the State Historic Preservation Officer (SHPO) to comply with Advisory Council review procedures concerning site protection. The surveying archeologist would also make specific recommendations, to be adhered to by Energy Fuels, concerning the possible need for on-site archeological reconnaissance during mining and other surface-disturbing activities. These recommendations must be on a location-specific basis to ensure discovery, evaluation, and protection of significant sub-surface archeological resources. If significant sites are found, Energy would be responsible for nominating them to the National Register of Historic places. Dr. Olson's cultural resource study was completed as a reconnaissance survey.

To mitigate impacts to the open chipping site recommended for nomination to the National Register (see Table EII-16 and Figure EII-18), the site would be salvage-excavated, if there is no means for modification of the proposed action to preserve the site in-place. However, this would only occur after consultation with the Advisory Council. This area is not included in Energy Fuel's current six-year mine plan, but lies within competitive lease application C-22677, applied for by Energy Fuels.

Archeological values derive their primary value from being preserved in-place; their secondary value occurs in excavation. Archeological testing or excavation stemming from intensive surveys on proposed action areas may be permitted where the site is not in imminent danger of being destroyed. This would not preserve the site's primary in-place value, and also would not allow utilization of improved archeological survey and analysis techniques in site excavation, at a future date when more sophisticated techniques could be employed. However, salvage excavation would allow partial mitigation of adverse impacts where a site is threatened by actual physical displacement.

The relative probability of these measures' success would be influenced by several factors. Some sites would not be identified in the required survey if they are buried by alluvium and hidden from view. The regulations themselves would also do little to prevent theft and vandalism of cultural resources.

See the Regionl Analysis for a more detailed discussion of how these legal provisions would be implemented.

Historical Resources

All current antiquities legislation enumerated in the Archeological Resources section is also applicable to protection of the area's historical resources, as are the actual mitigations.

The Foidel Canyon School is an important feature in local history, and would therefore be nominated to the National Register of Historic Places. Irrespective of its eligibility for inclusion on the National Register, it would not be destroyed nor damaged by mining operations; Energy Fuels would protect the building by stabilization, interpretive signing, and fence exclosures as necessary, in consultation with the Advisory Council on Historic Preservation.

Aesthetics

Enforcement of provisions of 43 CFR Subpart 3041.2-2(d) would ensure that Energy takes visual resources identified in this statement into account, in the planning, location, and construction of facilities on the proposed operation. To comply with this regulation, the following measures would be taken:

Cut and fill slopes resulting from the haul road, building pads, and parking areas would be shaped to a rounding grade that intersects adjacent terrain at a very low angle; this would help avoid creation of harsh angular forms. All mine spoils and topsoil stockpile areas would also be reshaped to a rounded and undulating, rather than geometric, form that borrows from the adjacent topography. 43 CFR Subpart 3041.2-2(f)(2) and 30 CFR Part 211.40(a)(2) further require Energy to eliminate highwalls and spoil piles, restoring the approximate original contour.

In addition, implementation of 43 CFR, Subpart 3041.2-2(f)(12)(ii) would reduce visual impacts accruing to road construction, because it requires all roads to be located on flatter slopes to minimize disturbance; this is also required by 30 CFR Part 211.40(a)(12)(ii).

Where trees or shrubs are to be removed from road, mining facility, or right-of-way construction, or for mining itself, clearings would assume an irregular form to simulate natural openings in the vegetative cover to be determined by the views obtainable from viewshed sequences providing the visual access (see Landscape Visibility Maps in Chapter II). When trees or shrubs are removed, they would not be piled, lopped, nor scattered, but buried, or returned to the site as a chipped mulch.

Wholesale vegetation clearing within powerline rights-of-way would be prohibited. Where removal of taller vegetation is necessary, all shorter shrubs and trees would remain. In no case would the right-of-way be bladed, and no visible roads would be constructed in foreground landscapes to secure access to support structures. Access to that portion of the line traversing either foreground or middleground landscapes would not be provided for within the transmission line right-of-way. Where feasible, access would be secured by utilizing existing roads, trails, and natural terrain.

Reestablishment of a diverse vegetative cover on all disturbed lands is required by 43 CFR Subpart 3041.2-2(f)(13)(i); this would help mitigate visual impacts on denuded areas; it is also provided for in 30 CFR Part 211.40(a)(13)(i). Part 1-f, Section 34-32-116, of the Colorado Mined Land Reclamation Act (H.B. 1065), also directs the establishment of a self-sustaining long-term vegetative cover. These revegetation efforts would begin as soon as possible following cessation of surface-disturbing activities. Adverse visual impacts would be rendered less harsh by arranging plantings and seedings in an irregular pattern.

All proposed mine offices, shop-warehouses, and other buildings would be built as low-profile as possible. They would also be painted a non-reflective warm green, brown, or buff color that borrows from adjacent landscape colors. Screening and loadout facilities would be similarly painted; silver-colored metallic finishes would be avoided.

Transmission line support structures, if wooden, would be penta-treated if they cross foreground or middleground landscapes; however creosote-treated poles would not be used, due to their dark color. If steel lattice towers are used, they would be finished in a non-reflective olive drab or other earth-tone, to avoid harsh line dominance produced by glare. Also non-reflective or non-specular conductors would be used throughout the length of the line, because most of the route is visible from several public roads.

Energy Fuels would also maintain a litter-free landscape by screening refuse disposal and storage areas, and by regularly disposing of discarded equipment, waste, and litter. 43 CFR Subpart 3041.2-2(f)(8) requires Energy Fuels to dispose of rubbish to prevent air pollution. Section 34-32-116, Part 1-e of the Colorado Mined Land Reclamation Act (H.B. 1065), directs refuse disposal in a manner that would control unsightliness.

Also part 1-i, Section 34-32-116, of the Colorado Mined Land Reclamation Act requires that off-site areas be protected from slides, or other damage due to mining or reclamation. Implementation of this constraint would prevent the dumping of mine spoils over steep slopes or escarpments, and the resultant form-dominant visual intrusions.

Regulation No. 1, Emission Control Regulations for Particulates, Smokes, and Sulphur Oxides for the State of Colorado, Section II-D, Fugitive Dust, (Colorado, 1971) prohibits mining operations from occurring without a permit that specifies fugitive dust control measures. Implementation of these measures would reduce potential for atmospheric haze. In addition, 43 CFR 3041.2-2(f)(11) requires Energy Fuels to construct and maintain all roads and other utility access facilities in a manner that would minimize, control, or prevent fugitive dust. Regular sprinkling with water, or oiling, would be required to control dust on all haul and access roads; such dust control measures are approximately 30 percent efficient.

The Colorado Department of Health's water quality standards (1974) provide regulations consistent with the provisions of the Federal Water Pollution Control Act amendments of 1972. Enforcement of this legislation would prevent the proposed mining operation from contributing floating debris, scum, and discoloration to Trout, Fish, Middle, and Foidel Creeks or other downstream waters.

Impacts to mood-atmosphere values caused by increased noise levels can be partially mitigated by implementing the provisions of Colorado Senate Bill 197 (1971), which establishes maximum permissible noise levels and abatement procedures. Federal noise pollution guidelines are outlined in P.L. 91-604, The Clean Air Act, Section 401—Noise Pollution and Abatement Act of 1970. The Office of Noise Abatement and Control, established by this Act, provides for enforcement of the guidelines contained in the Act. Enforcement of these laws would achieve the lowering of noise levels adjacent to the Energy Mines.

These regulations and legislative enactments would be effective only to the extent that they are enforceable, that the standards set forth are indeed enforced, and that these minimum standards are actually effective in reducing impact. The probability of all of these actually being enforced, on the ground, is something less than 100 percent, as evidenced by impacts presently occurring from similar ongoing operations in the region. For example, note the existing visual intrusions at Energy 1 (Figures EII-22, 25, and 29), Energy 2 (Figure EIII-4), and Energy 3 (Figure EII-10).

Recreation

43 CFR Subpart 3041.2-2(f)(1) and 30 CFR 211.40, Part 211.40(a)(1) require Energy Fuels Company to reclaim the affected lands as soon after disturbance as possible, to a condition at least as capable of attracting and sustaining recreation use as now exists. These regulations require recognition of recreation resource values identified in this analysis. The subsequent application of several mitigating measures is also needed to comply with these as well as other applicable Federal and State laws and regulations.

Water quality standards established by the Colorado Department of Health (1974) provide regulations that can be used to mitigate impacts to recreation resources. All State waters are thereby required to be free of substances or conditions toxic to plant, animal, or aquatic life, that produce undesirable aquatic life, and that impart any undesirable taste to fish flesh or make fish inedible. 43 CFR Subpart 3041.2-2(f)(7) further requires Energy Fuels to minimize, control, or prevent disturbances of the prevailing quality of surface water. Subpart 3041.2-2(a)(5)(iv) prevents impoundments from adversely affecting downstream water quality. This is also affirmed by 30 CFR Part 211.40(a)(5)(iv). More specifically, Subpart 3041.2-2(f)(11) directs the mine operator to design, construct, and maintain all roads, rights-of- way, and attendant facilities in a manner that would prevent damage to fish or wildlife, or their habitat. All surface-disturbing activities would therefore be restricted from floodplains on active drainages. Implementation of these regulations would prohibit mine-caused damage to the recreational potential of downstream fisheries in Fish, Middle, Foidel and Trout Creeks, and in the Yampa River.

The Colorado Open Mined Land Reclamation Act (H.B. 1065) contains several provisions for mitigating recreation impacts. Section 92-13-6 describes the duties of mine operators. Part 1-f directs the disposal of refuse in a manner that would control deleterious effects. Enforcement of this regulation would prohibit actions which would indirectly impact downstream recreational fishing potential.

Earth mounding and shaping techniques would be employed to increase recreational opportunities on mined-over areas. Within the basic rolling vegetative type, waterways and ponds would be constructed to increase aesthetic attractiveness and wildlife viewing opportunities. Mounding and shaping would create more ecologic niches and additional cover, and subsequently more wildlife viewing opportunities. 43 CFR Subpart 3041.2-2(a) (5)(iii) requires the operator to ensure that water impoundments and retention dams will provide adequate safety and access for reasonably anticipated recreational water users. This is also provided for by 30 CFR Part 211.40(a)(5)(iii).

The mine operator would allow the public to use lands owned by him for recreational purposes except in areas where he determines such use to be hazardous or objectionable; Section 34-32-116, Part 1-j, of the 1973 Colorado Mined Land Reclamation Act contains these provisions in accordance with Article Four of Chapter 62, Colorado Revised Statutes, 1963. 43 CFR Subpart 3041.2-2(f)(14) requires Energy Fuels to allow public access to and upon Federal lands within Federal coal leases C-081330 (80A.), and D-052547 (40A.), and Competitive Lease Application C-16284 (80A.), unless such access would unduly interfere with his authorized use. However, public access is also to be regulated to protect the public from hazards. Coal Mining Operating Regulations in 30 CFR Part 211.40(a)(14) also require this access to be provided and regulated. Implementing these regulations would increase the supply of available recreation lands and help meet the increasing regional demand for recreation resources and facilities.

The recreational value of archeological and historical resources would be mitigated as outlined under those headings in Chapter IV.

The degree to which these legislative enactments would be successful in mitigating impacts will be dependent upon their enforceability and actual on-the-ground enforcement. Based upon past observations of similar coal mining operations, enforcement of current laws has not been complete in mitigating applicable impacts. For example see Figure EIII-5 at Energy 2.

See the Regional Analysis for a more detailed discussion of how these legal provisions would be implemented.

Measures to be Included if Authorization is Granted

Water Resources and Aquatic Biology

A buffer zone, inside of which no surface disruption or spoil deposition would be permitted, would be established on both sides of all streams which could be directly impacted by the proposed strip mining activities. This buffer zone would prevent direct alteration of natural stream channels and reduce increased sedimentation which would result from the proposed action. The extent of the buffer zone at each proposed mining site would be established by field surveys. Criteria which should be considered in determining the width of the buffer zone would be: (1) erodibility of alluvium at each location, (2) location of critical fish (e.g., spawning areas) and wildlife habitat areas, (3) nature of riparian and adjacent terrestrial vegetation, (4) local drainage patterns, and (5) existing physical and chemical quality of streams.

Measures which would decrease erosion and stream sedimentation and thereby mitigate impacts on the aquatic fauna in the proposed mining areas would be: (1) construction of basins for reduction of sediment in all water associated with the mining process before returning this water to local drainage, (2) construction of diversion ditches for returning water encountered or utilized in the mining process to local streams, (3) protection of all road cuts (including existing roads) by such means as rip-rap or buttresses, in order to minimize erosion from these areas, and (4) location of all areas to be utilized for the deposition of topsoil and overburden away from natural stream drainage areas, in order to minimize erosion potential.

Monitoring of water quality in Foidel and Fish Creeks above and below the mined areas would determine if leaching of mine spoils constituted a significant problem. If so, infiltration rates and leaching could be reduced by prompt revegetation that included vigorous stands of deep-rooted woody plants.

Air Quality

Control of the largest source of pollutant, fugitive dust, would be part of mine operations. Fugitive dust from mining operations might be a safety hazard, due to impairment of worker visibility, increase in the risk of accidents, or interference with safety equipment. Another consideration of dust control would be the efficiency of overburden and coal handling, which is improved if the quantity of fines and the amount of airborne dust is limited.

A wide variety of control measures would be possible to help prevent the generation of fugitive dust (see the list in the last section). The most common method for dust control on surfaces is the application of water to agglommerate fine particles, and thus prevent them from becoming suspended in the atmosphere. Watering is only as efficient as the success in keeping the disturbed material wet (either by wind or mechanical action). In the dry Colorado climate, this can be very difficult. Over-watering must be avoided because of the obvious safety hazards of mud on non-level surfaces. On haul roads that are semi-permanent, an additive such as a petroleum-based material would be used to form a crust that approximates the effect of paving. Water would also be applied on surfaces other than roads to dampen material about to be moved.

Fugitive dust from process operations would be controlled by watering at transfer points, such as conveyor ends or loading stations. The placement of hoods connected to a ventilation and dust collection system over sources such as crushers and sorters, would limit emissions from mechanical treatment of coal. General cleanliness and the prevention of spills would reduce the amount of fugitive dust.

Particulate matter would be forced into the atmosphere in the blasting operations, but the amount that remains airborne would be controlled sufficiently, if care is taken in the blast design. The function of blasting, the break-up of material so that it can be moved, would be accomplished without the production of a large fraction of very small particles, by proper sequencing, and control of amounts of explosive.

Coal fires as a source of pollutants would be minimized by careful design of overburden piles, and preventive action. Once a fire starts, only prompt, thorough fire fighting can prevent a major air pollution problem.

All of the gaseous pollutant emissions from the mine result from vehicle exhausts and fires. The required use of automobiles, trucks, and other heavy equipment, complying with EPA vehicle emission regulations, would be expected to be the only available control measure.

Terrestrial Fauna

To mitigate potential impacts to wildlife, all new fences within the mined areas would have to be constructed in conformance with accepted guidelines for fence construction in big game use areas.

Reseeded areas would be fenced to exclude livestock use. This, however, would not protect such areas from wildlife. To mitigate the impact on newly planted trees and shrubs additional protection would be needed until these plants become established.

To mitigate the expected alteration of the existing ecosystem due to the proposed revegetation plan, it would be necessary to make every effort to return mined areas as closely as possible to original soil and vegetal conditions. Micro- and macro-environments would be designed to closely approximate existing conditions to reduce long-lasting impacts on terrestrial fauna. (For more information on this approach see the mitigations proposed under Terrestrial Flora).

High rodent populations expected to utilize revegetated areas would reduce natural capabilities to quickly establish a self-sustaining floral cover. To mitigate this impact it would be necessary to attempt to control these rodents; traps would be used, and perching structures for rodent eating raptors would be provided in revegetated areas. A closely controlled and monitored poisoning program would be used in limited cases, if all other efforts failed and proper authorization can be obtained.

Edge effect is very important to many wildlife species. Destruction of small patches of native vegetation within the general cropland areas could be partially mitigated by returning small patches of brush, native grass, and forbs to those areas revegetated for agricultural purposes.

Future loss of elk habitat due to dumping spoils over the sides of canyons would be mitigated by prohibiting this practice.

Any new ponds created as a result of mining operations would be designed with irregular shorelines to maximize waterfowl use. If the ponds are of sufficient size, small islands would be added. Slopes and water depths would be planned to include deep and shallow waters, and variable slopes from 1:2-1:7. The ponds would be revegetated with immergent and submergent vegetation to provide both food and nesting, or escape cover for waterfowl and shorebirds.

Tree nesting birds such as some hawks, falcons, woodpeckers, and passerines would lose their nesting sites as a result of the mining operation; suitable trees or snags would be installed within reclamation areas to help mitigate these losses.

Existing roads would be used whenever possible to reduce vegetation disturbance. All non-essential off-road-vehicle use would be prohibited to reduce the impacts on vegetation and soil productivity that would result from this type of activity.

Topsoil removed from the initial cuts would have to be stockpiled. To mitigate the impact to the ecosystem, such areas should be located where a minimal degree of damage will be done.

Plant species of low palatability to big game animals should be used along roadsides, to reduce big game use of these areas, and to mitigate potential vehicle-animal collisions.

Chapter V

Adverse Impacts Which Cannot Be Avoided

THIS CHAPTER PRESENTS THE RESIDUAL ADVERSE IMPACTS OF ENERGY FUELS CORPORATION'S PROPOSED ACTION WHICH WOULD REMAIN AFTER APPLICATION OF THE MITIGATING MEASURES DISCUSSED IN THE PRECEDING CHAPTER. THE FOLLOWING DISCUSSION COMPLETES THE ANALYSIS EQUATION: IMPACTS MINUS MITIGATIONS EQUALS ADVERSE IMPACTS WHICH CANNOT BE AVOIDED.

Unavoidable Adverse Impacts

Adverse environmental effects that cannot be avoided would include alteration of the surface from present natural contours and landforms to a mixture of these natural forms and man-made forms. Man-made landforms could be subject to increased rates and modes of degradation by erosion, mudflows, landslides, and slumps, compared to the remainder of the mined areas. Replacement of natural intermittent streams with man-made drainage controls would be unavoidable in strip mining.

Impacts to all fossils would be difficult to mitigate; some would most certainly be destroyed given the nature of the stratigraphic section. Generally speaking, these losses would not be significant.

Use of very large equipment in the proposed mining plan for rapid removal of overburden and of coal, would cause an unavoidable coal loss of about ten percent. For the Energy 1 Mine area this loss would amount to about 1,800 tons/acre, and in Energy 2 Mine area about 720 tons/acre.

Sedimentation increases would not be highly significant after required mitigating measures were taken. Sediment yield from the mine operation would be about 650 tons per year. This contribution would be in addition to an existing high sediment yield resulting from unprotected agricultural lands in the immediate vicinity. Anticipated increases in total dissolved solids (TDS) resulting from the disposal of ground water from the mining process into the local streams should be negligible, if mitigating measures are adequately implemented.

The air quality during mining operations would be degraded in terms of all the presently regulated pollutants: suspended particulates, carbon monoxide, oxidants, sulfur dioxide, nitrogen oxides, and hydrocarbons. Mining could not be performed without air pollutant emissions from vehicles and the generation of fugitive dust. Visibility in the vicinity of the mine would be decreased because of mine air pollutant emissions. Estimates indicate that total suspended particulate regulations would be exceeded near the mine. No other degradation in excess of standards would be expected.

If mining proceeds at the Energy Fuels Mines, disturbance of soil cannot be avoided (Table EV-1).

Soil disturbance would lower natural soil productivity of the area to some degree by compaction, mixing natural soils and causing accelerated erosion and sedimentation. On the area

TABLE EV-1

Acres of Soil Disturbance Associated with the Energy Fuels Mining Operations

Mine/Period	1976-1980	1981-1985	1986-1990
	Acres	Acres	Acres
Energy 1, 2,	1,840	1,665*	1,665*

*Estimated Dames and Moore for all Energy Fuels Mines

to be mined, partial alteration of all soil horizons, parent material, and soil characteristics which have developed over long periods of geologic time, could not be avoided. Present soil biota and soil forming processes would be destroyed. As an end result after mining, new soils would be formed with characteristics unlike those existing prior to mining. Soil erosion that takes place before topsoiled spoils are stabilized would be unavoidable.

The total removal of existing vegetation on approximately 5,300 acres will be unavoidable if this operation continues until 1990. Vegetation would be permanently destroyed on approximately 350 acres. The existing stage of plant succession would be unavoidably lost when vegetation is removed. Energy Fuels' current reclamation plan would not ensure that any native species would be returned, and though wildlife habitat is a proposed land use at Energy 1 Mine, the reclamation plan would not encourage a return to existing wildlife habitat. In areas where native lands would be reclaimed to cropland the loss of native vegetation would be an unavoidable impact. Unless Energy Fuels' seeding mixture is expanded, return to native vegetation would depend entirely on natural succession, and would be very slow at best. The soil and microclimatic conditions produced after mining would be very different from existing conditions, making it impossible to establish and sustain native plant ecosystems. There has been very little invasion of native species on spoils where topsoil has not been replaced and shaping has not been done (Appendix D, Reclamation); if replacement of topsoil does not encourage invasion, the loss of native vegetation would be an unavoidable impact. Even on areas successfully revegetated, a ten percent loss in productivity has been projected.

A permanent loss of the existing ecosystem would result from the proposed mining operation. Habitat components and the faunal species composition ratios would not be expected to return to their present status. The impact to small mammals, reptiles, amphibians, young birds, and invertebrates that are not mobile enough to escape from the mining progression could not be mitigated without trapping and transporting animals out of the mine area. Displacement of the more mobile species of wildlife, such as deer, elk, coyote, fox, and fledged birds from the mining area could not be mitigated. As stated in the Regional Analysis portion of this report, all or most of these relocated animals would probably be lost.

The one-year time lag from the removal of topsoil to the beginning of reclamation work would be an unavoidable impact, because reshaping could not be done in close proximity to the ongoing mine operations for safety reasons.

The ongoing highwall would create an unavoidable impact on normal animal movements. It would be impossible to backslope portions of this highwall and still maintain the same type of mining operation that has been proposed. Increased human activity and noise level associated with the mining effort would impact bear, cougar, raptors, elk, and other animal use to some degree, especially close to ongoing work areas. Probability of vehicle-animal collisions would increase with an increase in human activity. This impact could not be avoided without construction of fencing or wildlife passes (over or under the existing roads); road use and animal numbers are not sufficient to justify the cost at this time. As previously stated, a loss of vegetal cover and food would result from the mining operation; therefore, the temporary loss of these habitat values to all wildlife species cannot be mitigated. The expected increase in rodent populations during the revegetation program would almost certainly result in a corresponding but time-lagged increase in the numbers of coyotes, fox, snakes, and raptors. Although predator control would be possible, at least to a limited degree, the increase in predator numbers was included in this section because they should be allowed and encouraged to use the area; the predators would act to help limit the rodent numbers; and this in turn would aid in the establishment of the revegetated area. Therefore, no action should be taken to mitigate the increase in predator numbers. Noise produced by mining equipment and the work itself would be expected to be great enough to preclude the use of the raptors' keen hearing, thereby reducing their hunting ability in close proximity to the ongoing mining operations.

Removal of all livestock from the vicinity of the ongoing mining operation would be necessary to avoid accidental loss due to equipment-animal collisions or animals falling off the highwall. Fencing of the revegetated areas to exclude livestock grazing for a period of two growing seasons would be needed to allow new vegetation to become established. This would mean a short-term loss of food for long-term establishment of a self-sustaining floral community.

If presently unknown subsurface archeological sites occur on the mine property they could be subject to damage by direct surface disturbance, and could also be subect to vandalism and pothunting. The significance of this impact is unquantifiable as it would depend upon the nature of the unknown resource. Other impacts would also result from required as well as unnecessary excavation of significant archeological sites. Except as provided for above in excavation, probable impacts identified in Table EIII-6 would, for all practical purposes, be unmitigatable, pending exact location of the area to be mined. Should competitive lease application C-22677 be granted to Energy Fuels and subsequently be mined, the National Register qualities of site number 4 (Table EII-17 and Figure EII-18) would be damaged, unless the area could be mined without any surface disturbance of the site.

Impacts upon the Foidel Canyon School might occur from theft and vandalism due to greater numbers of people in the area.

Given the foregoing mitigating measures, the net residual of adverse aesthetic impacts should be significantly reduced. However, there would be an increasing alteration of the characteristic landscape accompanying the proposed action. For all practical purposes, several visually incongruous elements or minus deviations would remain unmitigated. The visually unconforming effect of roads and rights-of-way constructed on too steep terrain would be impossible to mitigate. Earth-moving equipment simply cannot negotiate slopes that are too steep, and therefore attendant cut-and-fill slopes would remain unmitigated. Examples may include the large road fills where excess material was dumped adjacent to the county road reroute at Energy 1. Buildings and tipples can never totally blend with the adjacent terrain; painting with special colors is no panacea for camouflaging all structures, nor are any structural designs that purport to blend them with the characteristic landscape. Specific combinations of available topography and vegetation do not always allow implementation of a mitigating measure to the extent possible under ideal conditions; the result is only partial mitigation. In fact, the visibility of these residual impacts can only be reduced by constructing them so they can borrow visual dominance elements from the characteristic landscape (and become plus deviations). All dust and noise levels could be totally mitigated. The size of the area, adverse winds, the nature of overburden blasting, and coal-loading procedures all could make total dust control unfeasible. The relative values of these unavoidable adverse impacts would depend on the visual exposure of the landscape visual units in which they occur. No major U.S. or State highway provides visual access to these areas, but Frontier Airlines and Rocky Mountain Airways schedule daily flights over the Energy area at moderately low altitudes between Denver and Hayden or Craig. The scale of Energy's coal operations compared to adjacent landscapes is moderate; therefore the degree to which unavoidable adverse impacts affect viewers would be proportionate.

If surface mining occurs on that portion of competitive lease application C-22677 that lies south of Energy 2 it would directly displace sharptail grouse from their dancing grounds during the operation. Off-site impacts to the Green Acres big game hunting area, both adverse and beneficial, would remain unmitigated. Relative values of these unavoidable adverse impacts is moderately low, compared to similar available recreation opportunities in the region. Destruction of unknown subsurface cultural resources could not be totally avoided by conducting reconaissance surveys, because significant resources might lie hidden below the surface. As no public surface is involved, only the private landowner would be immediately affected.

The increase in auto-train collision hazards at the two county road—Energy railroad spur grade crossings would be unavoidable, as would the increase in auto accidents on Routt County roads 27 and 33. County road maintenance cost increases would also be unavoidable.

Chapter VI

Relationship Between Short-Term Uses and Long-Term Productivity of the Environment

THIS CHAPTER DISCUSSES THE EXTENT OF LONG-TERM IMPAIRMENT OR ENHANCEMENT OF RESOURCE VALUES THAT WOULD OCCUR, GIVEN THE SHORT-TERM USES OF THE ENVIRONMENT PROPOSED IN ENERGY FUELS CORPORATION'S MINE AND RECLAMATION PLAN. IN THIS ANALYSIS OF TRADE-OFFS OVER TIME AND TRADE-OFFS AMONG RESOURCE VALUES, SHORT-TERM REFERS TO THAT PERIOD WHEN SUBSTANTIVE PARTS OF ENERGY FUELS CORPORATION'S PROPOSED ACTION TAKE PLACE. LONG-TERM IS THAT PERIOD IN WHICH SUBSEQUENT IMPACTS, BOTH ADVERSE AND BENEFICIAL, STILL AFFECT THE ENVIRONMENT.

Unavoidable paleontological impacts would be experienced in the short-term during the mine's operation. After completion of the mining operation, no further impacts would occur. Options for future use of these subsurface resources would be foreclosed. However, a beneficial impact may result from the operation itself disclosing knowledge of fossils heretofore unknown; this would create options for future generations to benefit from the newly-found resources.

Short-term use of Energy Fuels' coal resources would result from rapid mining methods. Although allowing for rapid and possibly more economical recovery of coal, these methods generally result in the loss of about ten percent of the mined bed(s). They also result in the loss of nearby overlying and underlying beds of coal, which are considered by the operators to be too thin to recover economically, but which could perhaps be recovered by slower, more costly methods. Beds of minable coal lie below the mined (Wadge, Fish Creek) bed at depths which call for underground mining (or in-situ gasification, etc.), but these methods cannot be safely used until the strip mining with its attendant necessary blasting would be completed. Thus the large-scale rapid mining methods used here would allow an earlier start in the development of the deeper coal beds than would slower, more coal-conserving methods.

Aquatic environment would be disturbed by proposed mining activity. Water quality would be degraded through an increase in sediment loading and total dissolved solids throughout the life of the project. Aquatic organisms would be displaced for as long as the mining activity continues, and some organisms would be harmed or killed during the initial adjustment period. Some small intermittent drainages would be destroyed as a result of the proposed mining activity, resulting in alterations to local runoff patterns. After cessation of mining the environment will recover to the point that long-term productivity will not suffer as a result of the mining activity.

Assuming that the land surface would be reclaimed and returned to an equivalent of the pre-existing vegetative cover and general contours, the air pollution resulting from the mine would be a short-term phenomena; that is, it would occur only during active mining. Air pollution from vehicle exhausts and fugitive dust after mining is complete would also depend on the subsequent use of the land. Access to the properties involved will have been established. Lack of complete reclamation, specifically vegetative cover and erosion protection, could cause blowing dust to be a continual problem.

Mining by Energy Fuels will result in the introduction of new roads, buildings, powerlines, and heavy equipment into an area not appreciably changed from its natural state, except for some transportation routes and structures associated with grazing and farming activities.

The lease areas will be committed to coal production for a period of about 15 years based on anticipated production levels, during which time agricultural production would be significantly altered. Impacts arising from the short-term use of the environment would be minimized to the greatest extent practicable, with modern mining and reclamation practices. At maximum production, about 350 acres would be disturbed by mining each year, with an equal number of acres undergoing grading and planting. At any one time the total area out of production will be about 1,400 acres. The principal long-term changes will be local modification of the topography and surface drainage systems, soil loss, and reduction of productive capacity. Areas to be returned to grazing land would require at least three years for vegetation establishment; however areas returned to cropland should be usable the first year after shaping and topsoil replacement, if a fertilizer program is utilized. Areas used for roads and facilities, and areas for the population would be permanently lost, and will involve approximately 350 acres. If fertilizer is used, the long-term productivity of areas returned to cropland should approximately equal the production before mining, and a ten percent loss in production has been projected for areas returned to grazing land. The return of mined areas to productivity would depend upon the diligence of Energy Fuels Company in implementing their reclamation program.

Short-term use of the subject area would entail the complete destruction of that portion of the ecosystem where mining is to take place, as well as any areas where roads are constructed. In addition to these totally impacted areas, wildlife inhabiting adjacent lands would receive some degree of a lesser impact from dust, noise, and human or vehicular activity. Some areas adjacent to the lease area have already been mined. Therefore, the short-term effect would not be as severe as it would be if this were an undisturbed habitat. Short-term use of Energy Fuels lease area by all species of wildlife would be lessened; the degree of reduced use would depend on the ability of the species involved to adapt. Long-term productivity is expected to be reduced because loss of soil productivity and disruption of cover would reduce the area's ability to attract and sustain wildlife. The degree and direction of wildlife replacement would depend on the reclamation program's success. Plans for revegetating the area indicate that present species composition and densities would never return. Long-term production of those species associated with grasslands would increase within the lease; those species associated with sagebrush, shrubs, and trees would decline (see Appendix D).

Short-term use of the lease area would be completely restricted for livestock; the lease area would be fenced to exclude use by domestic fauna. Long-term productivity would be increased because of revegetation plans. Present proposals are to turn approximately 41 percent of the mined areas into grasslands, primarily for livestock grazing.

Archeological values may be impacted during the short-run by actual surface disturbance. Potential for vandalism would also be experienced largely in the short-term. Options for future use of cultural resources would be foreclosed by the degree of unavoidable impact from the mining operation. However required intensive cultural surveys would reveal presently unknown values and create options for future generations to benefit from the newly-found resources.

Unavoidable impacts upon historical resources would occur only in the short-term. Once mining operations cease, the potential for vandalism of the Foidel School would return to its present level.

Given the mitigating measures discussed in Chapter IV, short-term aesthetic impacts would be significantly reduced. After 1990 long-term unavoidable impacts on the area's aesthetics would still remain, though they would be less significant than short-term impacts. However, long-term impacts would be partially mitigated with the passage of time. Examples of long-term mitigations include the gradual weathering of cuts and fills and the ecological succession that establishes plant communities.

Short-term use of the area would result in several beneficial impacts to recreation resources. After 1990 much of this recreational productivity would remain. Increased off-road vehicle use and potential and additional wildlife viewing opportunities would improve recreation capabilities on a long-term basis. However success in reclamation and the ultimate cessation of mining operations would decrease rockhounding and geologic-industrial interpretive capabilities, although new mining operations in adjacent areas might be linked with successful reclamation efforts in the proposed action areas to create long-term interpretive capabilities for recreation use.

Chapter VII

Irreversible and Irretrievable Commitments of Resources

THIS CHAPTER QUANTIFIES THOSE RESOURCES THAT WOULD BE CONSUMED AND PERMANENTLY LOST AS A RESULT OF THE IMPLEMENTATION OF ENERGY FUELS CORPORATION'S PROPOSED ACTION. SUCH LOSSES ARE IRRETRIEVABLE COMMITMENTS; I.E., ONCE THESE RESOURCES ARE USED, THEY CANNOT BE REPLACED.

THIS CHAPTER ALSO OUTLINES THOSE USES OF ENVIRONMENTAL COMPONENTS THAT COULD NOT BE REVERSED SHOULD THE PROPOSED ACTION BE IMPLEMENTED. ONCE INITIATED, THESE USES WOULD CONTINUE INDEFINITELY.

Approval of the Energy Fuels mine plan would be an irreversible commitment of fossils; both beneficial and adverse impacts would become irretrievable upon completion of the mining operation.

The major irreversible and irretrievable commitment of mineral resources by the present and proposed mining activities is the production of coal for consumption, including loss in mining, of about 77 million tons of coal in the 15-year period of 1975-1990.

This commitment is distributed as follows, by millions of short tons:

TABLE EVII-1

Commitment of Coal by the Energy Fuels Corporation

Year	Produced	Loss in Mining	Total
1975	3.0	0.30	3.30
1976	3.5	0.40	3.85
1977	4.0	0.40	4.40
1978	4.5	0.50	4.95
1979	5.0	0.60	5.60
1980-1990	50.0	5.50	55.50
	70.0	7.7	77.60

An undeterminable amount of sand, gravel, and clinker will be required for mine roads and other support facilities.

There will be no significant irreversible and irretrievable commitments of water resources resulting from mining activities.

Local, very small changes in climate or the atmospheric resources would result from the redistribution of the surface material at the mine. Changes in contours and surface characteristics would irreversibly alter the wind field and surface heating of the air. The air quality degradation would be reversible if reclamation is complete.

It is difficult to predict reclamation success of Energy Fuel's mined lands. Return to a self-sustaining ecosystem should be possible, considering existing climatic conditions, and Energy Fuel's plan to replace topsoil, but productivity is projected to be ten percent less. However, existing soil profiles and vegetative ecosystems would be irretrievably lost.

Wildlife resources that might be irretrievably lost include individual animals and habitats that are destroyed. Animals and plants that would have reproduced in the affected habitats during the life of the mine might also be irretrievably lost. Most wildlife losses might be reversible if the species and habitat are not impacted to the point that their ability to reproduce is seriously impaired. The annual forage production which the area could have produced will be lost during the time that mining and reclamation takes place. Production will be lost on approximately 1,400 acres annually, i.e., 220 livestock AUMs per year; this lost production increment is an irreversible commitment of forage for livestock and wildlife. Approximately 350 acres will be permanently disturbed, and vegetative production will be irretrievably lost. Fertilizer utilized in the reclamation program will also be irretrievably lost.

Unavoidable impacts to cultural resources (archeologic and historic) would constitute an irreversible commitment of these resources when the mine plan would be approved. Upon completion of the mining operation, unavoidable impacts would be irretrievably committed, in terms of adverse impacts that cannot be avoided.

Commitment of the proposed action areas to coal development would be an irreversible commitment of aesthetic resources related to both unavoidable and long-term minus deviations. These residual impacts would be for all practical purposes irreversible.

Commitment of the proposed action areas to coal development would result in irreversible commitments of recreational resources, though they would be largely beneficial. However, destruction of sharptail grouse dancing grounds and of unknown cultural resources would be, for all practical purposes, irreversible.

Chapter VIII

Alternatives to the Proposed Action

INCLUDED IN THIS CHAPTER IS A DISCUSSION OF ALL REASONABLE ALTERNATIVES TO ENERGY FUELS CORPORATION'S MINE PROPOSAL. THE IMPACTS RESULTING FROM THESE ALTERNATIVES ARE ALSO ANALYZED IN THIS CHAPTER.

Reject Mining Plan

Because Energy Fuels has recently obtained approval of their 5-year mining plan on three currently held Federal coal leases, rejection of this plan is not possible. Possible alternatives for the 5-year plan open to the Federal government at this time are: (1) inclusion of additional stipulations to further protect the environment (identified in Chapter IV of this analysis), and (2) action on competitive lease applications C-20900 and C-16284 which were included in Energy Fuels 5-year plan, but for which approval has not been granted.

Should the Federal government decide not to put the two lease applications up for competitive bid, Energy Fuels could continue mining operations on its Federal acreage covered by the existing mine plan, and on privately owned coal in the area, with the same primary and secondary impacts as those evolving from mining the lease application areas, together with the additional Federal and private coal. The company's private coal reserves and Federal coal under the approved plan could sustain production at proposed levels for only five or six years. Should these lands not be put up for auction, no environmental impact would occur, and they would continue in their present condition or be modified by the surface owner to meet other uses. Because these lease application areas contain only a small quantity of coal, it is doubtful that another operator would find these isolated blocks economically attractive to mine at a later date. A decision to refrain from offering these applications competitively in the near future may therefore preclude their being mined.

The Federal government also has the option of whether or not to place the four additional competitive lease application areas (C-22644, C-9968, C-22676 and C-22677) requested by Energy Fuels up for bid. A decision to refrain from offering these application areas competitively may force Energy Fuels to move to another area in five to six years, following extraction of its currently held coal. Another option open to Energy Fuels would be to close the company's three mines. This would result in the loss of jobs for 175 people currently employed by the coal company; these employees might eventually obtain other jobs in the area, but many undoubtedly would be forced to seek employment outside tbe area, or remain unemployed. The number of people directly affected by the loss of jobs is significant, when the small population of the county and the low level of industrial activity are considered.

Public Service Company of Colorado would also be affected by a shutdown of the mines, as half of that utility's coal supply for power generation is obtained from Energy Fuels Corporation. Power cutbacks or shortages could occur in eastern Colorado until another source of coal was found. Electric rates could conceivably increase if the purchase price of the coal from other sources was greater than that from Energy Fuels.

If the mine closed, county and State facilities might be adversely impacted by decreased income from taxes and production royalties. Colorado has a personal income tax, a corporate income tax, and a general property tax levied by the county on mine equipment, and receives 50 percent of all production royalties from the Federal leases. Local tax revenues would be decreased as a result of a mine shutdown. Unless tax rates increased, the quality of present services would decline.

Require Modification of Mining

Some of the impacts identified and discussed as adverse impacts which cannot be avoided if the proposal is implemented, could be avoided, if the mining plan was modified to require the use of one or more of the operational alternatives discussed hereafter. In addition, special conditions could be added to the plan to mitigate some secondary effects of the mining. Such conditions must be reasonable, and if economically unacceptable to the company, could result in the company not developing the area, with the resultant impacts discussed under the heading, Reject Mining Plans.

Different Mining Methods

Underground mining

Substitution of this method of mining would result in less initial disturbance of the land surface; however, unsupported mine roofs between pillars could ultimately collapse because of lack of structural strength in the thin overburden. This would result in a partly subsided land surface degraded by numerous depressions and openings. Substitution of underground mining would also result in: (1) greater costs because underground mining is more costly than surface mining, (2) a decrease in mine safety as indicated by the fatal accident rates in 1972 of 0.42/million tons mined underground, compared to 0.07/million tons for surface mining, (3) higher incidence of non-fatal accidents due to roof and coal falls, fires, explosions, and problems related to dust inhalation (black lung disease), and (4) less coal recovery.

On Energy Fuels Federal leaseholds, much of the Fish Creek Seam would be nearly impossible to mine by underground methods because of thin overburden; the overburden depth over much of the Energy 2 area never exceeds 20 feet; this would not be enough to support the roof in an underground operation.

Some of the acreage where mining is planned for Wadge seam coal would also be impossible to mine because of shallow overburden. However the Wadge seam is generally overlain with a fairly competent roof, and where overburden depths exceed approximately 40 feet, the coal could be extracted by underground methods. Assuming the entire 6-12 foot section of the seam could be mined safely by underground methods, and that 50 percent of coal in the mined area was left in place to provide support and lessen the probability of surface subsidence, coal extracted would represent about 45 percent of available coal in place. This rate compares to the present recovery of approximately 90-95 percent of available coal by strip methods. An underground operation could still be conducted on coal reserves which lie below current economic overburden depth of stripping equipment, following extraction of the strip-mined coal.

Different Production Rate

Energy Fuels is currently contracted to supply 3.3 million tons of coal/year to its various customers. The proposed mine expansion program would increase the rate to five million tons/year by 1977.

Any change in production rate either up or down would alter the rate or intensity of the environmental impacts discussed previously in this statement. If a reduction in proposed production rate were required, it would create a shortage of fuel at the power plants in the area of consumption, resulting in decreased power production when consumption is increasing, unless substitute sources of supply were obtained. A reduction would also prolong mining activity on the leasehold, prolong the time until restoration is completed, lessen employment at the mine, lessen disturbed acreage at any one time, and lessen annual tax and royalty returns to the State and county from the Federal leases.

If the company was required to increase production above the level proposed, it would increase the intensity and severity of the impacts described elsewhere in Chapter III, decrease the length of time for mining and reclamation, and increase annual tax and royalty returns.

Different Reclamation Objectives

Alternate land uses for the disturbed areas are discussed in Chapter IX of the Regional Analysis. All reclamation objectives listed could apply to various parts of Energy Fuels' mined lands, grazing land for domestic livestock, wildlife habitat, recreation, urban and commercial development, and multiple use.

Transportation

Different Transportation of Coal

TRUCK TRANSPORT

Since a rail spur to the D. & R.G.W. line already exists from the Energy Fuels' mining sites with adequate loading facilities for the anticipated increased output, building a new roadway to the sites or modifying existing county roads for coal transport, would impose unnecessary environmental impacts in construction, modification, and use of such roadways. As has been stated in the Regional Analysis, heavy use of the existing roadways in this area by coal trucks would cause drastic degradation of these roadways.

SLURRY PIPELINE

A coal slurry pipeline would be capable of transporting the coal production from the Energy Fuels Mines in northwestern Colorado to the terminus at steel mills in Pueblo. As described in Chapter IX of the Regional Analysis, such a pipeline could easily handle the entire volume of 4.5 million tons intended for this market. The large volumes of water necessary to transport the coal in slurry form might be used in the steel mills in Pueblo, thus mitigating some of the water disposal problem.

However this would be a long pipeline, requiring pumping stations along the way, as well as preparation plants at either end. The existence and use of such a pipeline has less impacts on air quality than a rail line, but would add on impacts such as a large, consumptive water requirement.

When one considers the fact that a rail spur connecting to the D. & R.G.W. branch line already exists, with adequate transport capacity for the increased production of the Energy Fuels Mines, the extra environmental impacts of the construction and use of such a pipeline are considered unacceptable.

CONVEYOR BELTS

Belt conveyors can be used as an alternative to rail transport of coal. Expertise is sufficiently advanced to assure technically sound construction of single or multiple flight conveyors for coal transport. Long distance belt conveyors have never been built, however. A 12 mile-long belt could be considered long distance, and would probably require extensive design work.

Since the impacts of construction of a conveyor belt system would be added to an environment with an existing rail line adequate for the needed coal transport, the impacts associated with building and operating such a system, though the system may be practical, are considered unacceptable.

W. R. GRACE & COMPANY

Railroad Plan

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FOR
W. R. GRACE RAILROAD

Chapter I

Description of the Proposed Action

THIS CHAPTER IS A DETAILED DESCRIPTION OF W. R. GRACE AND COMPANY'S PROPOSAL TO CONSTRUCT A RAILROAD FROM CRAIG, COLORADO, TO AXIAL BASIN. THE CHAPTER IS DEVELOPED BY DESCRIBING THE STAGES OF IMPLEMENTATION OF THE COMPANY'S PROPOSAL. THE FEDERAL ACTIONS THAT WOULD BE REQUIRED ARE ALSO DISCUSSED IN THIS CHAPTER.

The Applicant's Proposal

Specific Action

On April 30, 1975 W. R. Grace and Company filed a tramroad right-of-way application with the Colorado State Office of the Bureau of Land Management for construction of a 25-mile railroad between Craig and Axial, Colorado. The application was given serial number C-22673 and was filed under the provisions of the act of January 21, 1895 (28 Stat. 635; U.S.C. 956). The proposed action is to approve the application through issuance of a right-of-way.

Two phases of the railroad proposal are considered in this Impact Statement: construction and operation.

The construction phase would consist of an intensive program for the development of the railroad line and pertinent facilities. This would include route selection, staking design, engineering, obtaining rights-of-way, construction of railroad bed, bridges, drainage structures, fences, etc.

The operation phase would involve those facilities required for the heavy transportation schedule of coal by unit train. Operations would include long-term maintenance and additional construction necessary for expanding functions of the railroad.

Purpose of Proposed Project

The purpose of the proposed railroad would be to transport low sulfur subbituminous coal from a planned surface mine immediately south of Axial Basin in northwestern Colorado to the Denver and Rio Grande Western (D. & R.G.W.) Railroad near Craig. The existing railroad is already a major transportation means for coal being shipped east from northwestern Colorado.

General Description of Proposed Route

A feasibility study of three routes was conducted for the applicant by Morrison-Knudsen Company, Inc. These routes are depicted on Figure GRI-1 as A, B, and C. The route preferred by the applicant is A; it is considered the proposed route in this report.

The route would join the proposed Colorado-Ute spur approximately four miles from the terminus of the existing D. & R.G.W. Railroad at Craig. At the approximate starting point of the spur's loop into the plant site, the route would extend westward along a ridge parallel to the loop, and then southwestward on a high fill, crossing over State Highway 13 via a steel girder bridge where Johnson Creek and the highway intersect. Dropping on a maximum grade of 0.8 percent, the route would parallel Highway 13 from Milepost A-1 to A-3, then flatten to a level grade and follow a bluff along the south side of Yampa River to the confluence of Yampa and Williams Fork, Rivers (A-4.3), where a steel bridge would be required across the Williams Fork. From the Williams Fork bridge, the route would continue at an elevation of 6,130 feet along the south side of the Yampa to Milk Creek (A-13.8), which would be crossed by another steel bridge.

The most extensive rock cuts on this route would occur in the Williams Fork-to-Milk Creek increment, particularly between A-7 and A-8, and again between A-13 and A-14. At A-14, the route would leave the Yampa River and follow Milk Creek southward for approximately three miles, climbing at a maximum grade of 0.91 percent, as it would extend along the west side of the canyon floor by means of moderate cuts and fills and several channel changes (at points where Milk Creek meanders in a narrow canyon). Near Milepost A-17, the route would leave Milk Creek to follow another streambed, Wilson Creek, southwestward to MP A-20. Maximum grades of 1.1 percent and many channel changes would be required along Wilson Creek, and at A-20 a large multiplate culvert would be used to take the railroad under a county road.

Right-of-way Requirements

It would be necessary to obtain rights-of-way from several private landowners as well as the Federal government and the State of Colorado. A basic right-of-way width of 100 feet, 50 feet each side of center line, or ten feet beyond construction lines, whichever is greater, was used to estimate right-of-way needs. This is the standard of Denver & Rio Grande Western Railroad (D. & R.G.W.R.R.) right-of-way. Access would have to be developed to extensive segments of the route.

The following is a tabulation of the amount of land that would be needed for right-of-way purposes.

Relationships to Other Developments in Immediate Area

There are several proposed and existing mineral developments that could be related in some way to the proposed railroad. The principal relationship would be the potential of using the railroad

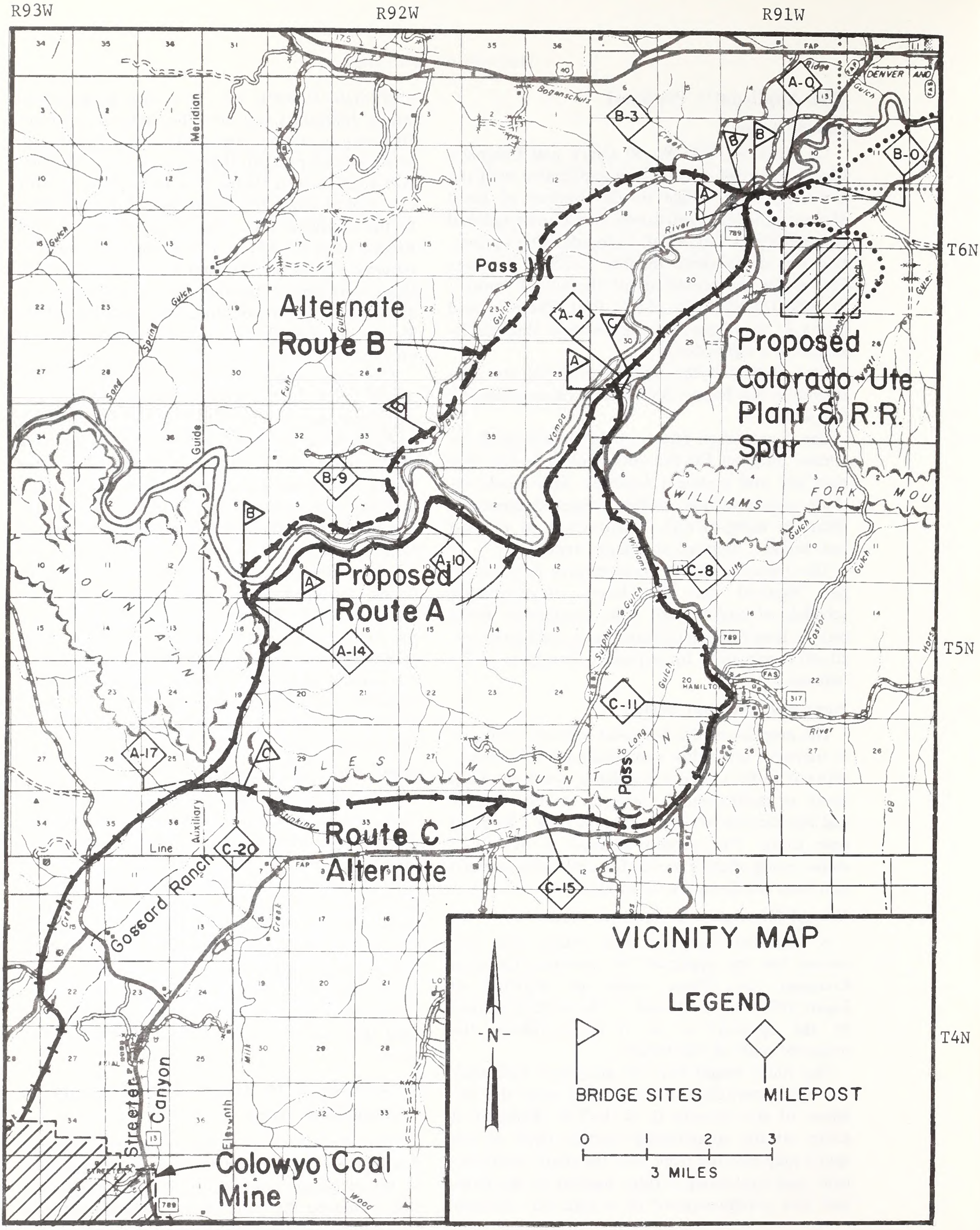


FIGURE GRI-1

Proposed and alternate routes, W.R.Grace railroad.

TABLE GRI-1

Right-of-way-Requirements

Owner	Deeded Land	Leased Land		Juniper Reservoir Withdrawal	
		U.S. Govt.	St. of Colo.	Private	Govt.
Raftopolis			5.0		5.0
Loudy	33.2		4.1	33.2	4.1
Evans			3.8		
Wilson Bros.	21.3			21.3	
Empire Energy	6.7				
Clancy	14.8				
Charchalis		29.6			29.6
Hilton	52.5	59.4		42.2	59.4
Ellgen	8.8			8.8	
Gossard	39.4				
Zamboni*	17.1			17.1	
	193.8	89.0	12.9	122.6	98.1

Minimum Total Land Requirements = 296 Acres

* Hilton lease from Zamboni

for transporting coal and other minerals to various markets outside the study area. Utah International has major coal leases immediately west of W. R. Grace in Axial Basin; estimated production from this development is three million tons per year. Consolidation Coal Company has leases approximately ten miles southwest of the terminus of the proposed railroad. With an estimated annual production of nine million tons to be transported, an additional spur to the proposed railroad could be constructed, or coal could be hauled by truck to the terminus. Empire Energy has an underground coal mine within a mile of the railroad and could use it for transport.

If the railroad would someday be extended south to Meeker and the White River, it could be used by Superior Oil Company to haul nahcolite, dawsonite, and shale oil from their proposed development; annual production of these minerals is estimated at six million tons. An extension of the railroad could possibly serve the anticipated transportation needs of Colorado oil shale lease tracts (C-a and C-b) southeast of Rangely, and Utah oil shale lease tracts (U-a and U-b) west of Rangely.

Another relationship exists between the railroad and Juniper Dam, proposed to be built on Yampa River approximately 22 miles downstream from the confluence of Milk Creek and Yampa River. The reservoir created by the Bureau of Reclamation proposal would extend upstream to the Williams Fork River. With a proposed high water level of 6,110 feet, the reservoir would influence the railroad route between Williams Fork and Milk Creek. Assuming the dam would be constructed as proposed, the railroad would be designed without conflicting with the reservoir. Maximum water elevations of the proposed reservoir have been set at 6,110 feet mean sea level (MSL) at the dam, and 6,130 feet MSL at the confluence of the Williams Fork and Yampa Rivers. These figures from the Bureau of Reclamation reflect the maximum flood stage (i.e., the delta effect). The route is designed to allow a ten-foot freeboard above the reservoir. If Juniper Dam is constructed as proposed, riprap would be required for embankment protection along portions of Yampa River; this protective measure would not be taken until dam construction is initiated. The Juniper project would also include a pumped-storage facility along the east bank of Yampa River. Further studies and correlation would have to be made with the Bureau of Reclamation to assure compatibility between the railroad and this facility.

If Juniper Reservoir is constructed by the Colorado River Water Conservation District, preliminary data suggest a high-water level of 6,125 feet without the delta effect. Some modification of plans would be required for the railroad between the Williams Fork River and Milk Creek.

Design Criteria

Alinement and Grade

Representatives of the D. & R.G.W. Railroad have indicated the following criteria for preliminary studies of a rail connection in this vicinity: maximum grade against loaded trains of 0.8 percent, maximum grade against empty trains of 1.1 percent, and maximum curvature of seven degrees. Analysis indicates that motive power required for operation into Craig from the D. & R.G.W.R.R. main line could allow a technically feasible operation over a railroad with grades somewhat greater than those set forth by the D. & R.G.W.R.R. Final design criteria would be reviewed in light of operation and maintenance studies.

Cuts and Fills

Requirements for cuts and fills would be based upon a geological reconnaissance of the routes by Morrison-Knudsen in June, 1974. In general all fills would be estimated on the basis of a 1.5:1 slope. Cut slopes would vary depending upon materials encountered from 1.5:1 in common, to a maximum of 0.25:1 under the most favorable rock conditions. The basic width of the roadbed would be 24 feet at subgrade elevation. No provision has been made for a maintenance way parallel to the roadbed. A 12-foot-wide rock ditch would be used in all rock cuts and through cuts. In addition to catching sluff, the ditch would provide some area for snow storage and would be wide enough to accommodate maintenance vehicles. Channel changes shown on the plans, principally where the route passes through Milk Creek Canyon, would be sized to accommodate 50-year flood flows, and would be estimated on the basis of 1.5:1 slopes with riprap protecting the railroad embankment.

Track

In selecting materials for use in track construction, the general principle followed would be: the material should be sufficient for 30 years service and should also be readily available from the D. & R.G.W.R.R., for ease of maintenance and availability in the event replacement or repair would be necessary.

Construction Guidelines

Construction Schedules

The railroad would require two seasons for construction. The normal construction season in the vicinity of Craig is seven months, beginning in mid-April and ending in mid-November; during this period construction generally can proceed without serious delays caused by weather. Earthwork and bridge building would begin simultaneously. In order to complete the project in two seasons it is essential that most of the grading be accomplished in the first construction season, and that bridges be ready so track laying can begin at the beginning of the second construction season. Bridge work might have to continue during the winter months in addition to the regular construction season.

Special Construction Considerations

A temporary crossing might be necessary on Milk Creek to gain access and to work on either side. Final design of the railroad might show that it would be more economical to borrow in certain areas for fill, to reduce haul distances from other places along the right-of-way. Marshy areas, particularly at the mouth of the Williams Fork, might require special construction techniques. No access exists between Williams Fork and Milk Creek, a ten-mile section. The steep bank along the Yampa River would require some special considerations in construction.

Construction Estimates

The estimate for earthwork includes handling of common and rippable materials by scrapers, and the handling of rock by drilling, blasting, front-end loading, and truck hauling. Hauls are estimated for both the scraper and truck-transported materials. In some reaches, substantial quantities could be moved by dozers alone, sidecasting without loading into scrapers or trucks. The following is a tabulation of construction estimates:

	Unit	Quantity
Clearing (based on 150' R/W)	Acres	394
Common excavation (incl. rock, borrow, emb. comp.)	Cubic Yards	1,521,700
Haul	Yard-Miles	669,600
Presplitting rock	Linear Feet	246,700
Riprap - in place	Cubic Yards	21,400
Pipe underpasses	Each	1
Relocate roads (incl. grading, drainage)	Miles	0.87
Grade crossings (incl. planking, grading, 2 cattle guards, signing)	Each	33
Fencing	Linear Feet	170,400
Revegetation (incl. seed, mulch, blowing)	Acres	55
Guard rail (for highway protection)	Linear Feet	4,500
Water for dust abatement	Million Gallons	900
Permanent RR materials	Total Feet	114,048
Ballast - in place	Total Feet	114,048
Track laying (incl. welding)	Total Feet	114,048
Turnouts	Each	2

Railroad Operation and Maintenance

Principal railroad use would be unit coal trains consisting of as many as 92 railcars having a capacity of 100 tons per car. Usually the trains would be kept together as a unit and operated solely for the purpose of transporting coal from the mine to a specific destination. As many as five locomotives, each having 3,000 horsepower, might be needed. At maximum grades of 0.8 percent against load, the speed would be about 14-15 mph., and the average speed loaded would be about 30 mph.; top speed empty would be 50 mph. Fuel consumption of each engine is 140 gallons per hour in eighth notch, and 6-7 gallons per hour at idle. Obviously 140 gallons per hour fuel consumption is a maximum figure; the realistic average figure lies somewhere between this and 6 gallons per hour.

In order to run this private spur economically, the loading facility would be designed to accommodate loading of 10,000 tons of coal in two hours. Thus, one unit train per day of 92 cars could carry Grace's estimated three million tons of coal per year in about 326 days. A four-man crew would be necessary to operate such a unit train; occasionally a five-man crew (the fifth man being a fireman) would be on the train to comply with the union agreement calling for firemen on ten percent of all trains. For the first four or five years a section crew responsible for maintaining and repairing damage to the rails would consist of five members; thereafter the section crew would have to be enlarged to some unknown figure because more maintenance would be required for the older line. It is assumed these permanent personnel would be available locally.

Reclamation

Reclamation procedures would involve the establishment of a stable, self-perpetuating, vegetative cover on the lands disturbed by railroad construction. Wherever practical, topsoil would be stored and replaced on any Lewis or Mancos Shale that is disturbed, or on any areas that expose the "C" soil horizon or other strata unsuitable for plant growth, except for steep rock faces. It is doubtful that fertilizer would be required for this operation; however, its usefulness would be evaluated during revegetation.

Seeding would occur as soon as practical after construction, and would be designed to coincide with optimum planting times, spring or fall. In some areas prone to erosion, winter wheat or another annual would be planted immediately for erosion control until the next optimum planting time when a comprehensive seeding mixture would be applied.

Hydromulching or a suitable substitute for seeding would be used on slopes steeper than 25 percent. A rangeland drill would be utilized for seeding surfaces that accommodate farm equipment. Depending on slope angles, a scarification procedure would prepare a seedbed suitable for plant growth where hard flat surfaces have been created during construction; steep surfaces of exposed rock would not be seeded.

Using the Soil Conservation Service's guidelines for revegetating disturbed areas, four seed mixtures listed below are recommended for the different ecological conditions that occur along the railroad route:

Recommendations for south facing slopes, steep, topography, and/or low rainfall

Indian Ricegrass, Bluebunch wheatgrass, Streambank wheatgrass, Russian wildrye, Needle and thread grass, Sand dropseed, Western wheatgrass, Intermediate wheatgrass, Yellow sweetclover

Recommendations for moderate moist and cold location (east facing areas)

Smooth brome, Mountain brome, Hard fescue, Western wheatgrass, Orchard grass, Bluebunch wheatgrass, Slender wheatgrass, Yellow sweetclover

Recommendations for areas in the Axial Basin

Indian ricegrass, Bluebunch wheatgrass, Western wheatgrass, Siberian wheatgrass, Green needle grass,. Sand dropseed, Streambank wheatgrass, Russian wildrye

Recommendations for Taylor Creek area

Timothy, Smooth brome, Big bluegrass, Orchard grass, Hard fescue, Western wheatgrass, Mountain brome, Bluebunch wheatgrass, Slender wheatgrass, Yellow sweetclover.

Exact composition of species in each seeding mixture would depend on slope aspect, location, and degree. Each mixture would total approximately 25 pounds of seed per acre, including a fast germinating annual (such as winter wheat or oats) to provide early competition for weed species, enhance soil stability, and provide quick establishment of green cover. In areas of high wildlife and livestock use, unpalatable species in the seeding mixture would discourage stock and wildlife activity immediately adjacent to the railbed. If various adverse climatic conditions cause failures, additional seeding would be required.

Other Protective Measures

Areas of the right-of-way that might be hazardous to wildlife or livestock, such as steep slopes or deep cuts, would be fenced. In areas where the landowner might request the right-of-way to be fenced to protect livestock, the fence would be designed to limit livestock, but not hinder deer or antelope movements. A recommended design would be the following wire spacings, starting from the ground: 16, 6, 8, and 10 inches.

Railroad construction would be modified or stopped in the spring, during the periods when sandhill cranes would be nesting in the Big Bottom area. Sage grouse strutting grounds in the vicinity of the head of Milk Creek would be located prior to railroad construction, and construction modified or stopped when grouse would be strutting. The timing of construction in the areas of sandhill crane and sage grouse activity would be coordinated with the Colorado Division of Wildlife (Colo. DOW).

Chapter II

Description of the Environment

THE FOLLOWING SECTION DESCRIBES THE PHYSICAL, BIOLOGICAL, AND CULTURAL RESOURCE VALUES WHICH CONSTITUTE THE SITE-SPECIFIC ENVIRONMENT IN WHICH W. R. GRACE AND COMPANY PROPOSES TO CONSTRUCT A RAILROAD. THE DESCRIPTION FOCUSES ON ENVIRONMENTAL DETAILS MOST LIKELY TO BE AFFECTED BY THE PROPOSAL AND ALL REASONABLE ALTERNATIVES. ALTERATIONS OF THESE EXISTING VALUES WOULD RESULT FROM THE IMPLEMENTATION OF THE COMPANY'S PROPOSAL.

Non-living Components

Geologic and Geographic Setting

Topography

The proposed route begins at about 6,260 feet altitude on a bluff overlooking the Yampa River near Craig. It continues south and southwest along the eastern bank of the river valley, dropping to 6,130 feet at the Williams Fork River junction. It then continues west and southwest at this same altitude along the steep south side of the Yampa River valley; here the Yampa is mostly confined to a narrow winding valley with high steep slopes rising from the river's edge or from the edge of a very narrow valley floor (Figure GRII-1). Hills rise 400-700 feet above the river along this stretch with slope angles of 15-40 percent, increasing locally to 100 percent. The route enters Milk Creek Canyon at an altitude of 6,130 feet and climbs to 6,210 feet in the 3-mile stretch of the canyon. It crosses Axial Basin along Wilson Creek rising to 6,340 feet at the southern terminus.

Landforms along the proposed route mostly are the result of differential erosion of hard and soft rocks that have been moderately folded.

Stratigraphy

Stratigraphic formations involved in the proposed railroad route include from oldest to youngest: Mancos Shale, Iles Formation, Williams Fork Formation, and Lewis Shale, all of Late Cretaceous age. Unnamed geologic materials include alluvial silts, sands, and gravels along the streams, gravels on terraces and upland surfaces, rock fall sandstone blocks, talus, and landslide, slump, and earthflow materials. Geology of the area has been described by Hancock (1925) and by Lauman (1965).

The Mancos Shale consists mainly of shale and a few thin, soft sandstone beds. Some beds of the Mancos are calcareous.

The Iles Formation consists of alternating beds of sandstone, shale, and some coal. Most sandstones and some shales are calcareous. The sandstones are fine to medium grained, thin to medium-bedded with a few massive beds, and most are quite resistant to erosion. The Trout Creek Sandstone Member, a massive, cliff-forming unit, is at the top of the Iles Formation.

The Williams Fork Formation consists of alternating beds of sandstone, sandy shale, and coal. The sandstone beds are mostly lenticular, very fine to medium grained, and calcareous. In some places the rock is reddened and hardened as a result of coal having burned at the outcrop. The shale generally is carbonaceous and partly calcareous. The Twentymile Sandstone Member is a distinctive white, medium-grained, calcareous, porous, massive ledge-forming sandstone unit about 870 feet below the top of the formation. The lower part of the overlying 870 feet of rocks is a sequence of sandstone, siltstone, shale, and coal beds. The sandstones are fine- to medium-grained, thin- to massive-bedded, carbonaceous, friable, and discontinuous. They are interbedded with carbonaceous, locally calcareous shales, carbonaceous siltstones, and coal beds (Lauman 1965). The uppermost part of Williams Fork Formation typically is fine- to coarse-grained material transitional into the overlying Lewis Shale.

The Lewis Shale is soft shale that underlies broad rolling areas of low relief.

Alluvium along the streams is of unknown thickness, but the feasibility study by Morrison-Knudsen Company, Inc., suggests thicknesses on the order of 20-30 feet along the Yampa and Williams Fork Rivers and Milk Creek. The alluvium consists mainly of silt and sand, with lesser amounts of clay and fine gravel.

Terrace gravels are mostly thin, probably less than 10-15 feet. They include pebbles and small cobbles of hard rock types such as granite and quartzite. The feasibility study mentions gravel pits worked by the State Highway Department in E ½ Section 21, T.6N., R.91W., and describes them as "thin and mixed with considerable silt".

Paleontology

The Mancos Shale contains predominately marine shales with littoral (of shore) sands in the upper part of the formation; ammonites, baculites, scaphites, and inoceramus clams are found in the very fossiliferous formation. Both the Williams Fork and Iles Formation contain fossil leaves, ammonites, and inoceramus clams within interbedded shales. Ammonites and other marine fossils occur in the Lewis Shale.

A considerable amount of recent alluvial material also occurs in the area of the proposed route. No specific information on its potential for fossils is available.

FIGURE GRII-1

Aerial oblique view east, showing Route A along Yampa River's steep south bank in NW ¼ Section 12, T.5N., R.92W.

Water Resources

Ground water

Ground water underlies the proposed railroad route at a depth that rarely exceeds a few tens of feet. The water is for the most part contained in relatively impermeable shales and sandstones. Only the alluvium of the Yampa and Williams Fork Rivers has moderately high permeability. The water table is recharged by precipitation throughout the area, and generally discharge is to nearby streams and/or water-loving vegetation in the valleys. Water in the shales is marginally suitable for livestock and generally unsuitable for domestic or irrigation use; water in the sandstones and alluvium is suitable for livestock and marginally suitable for domestic use or irrigation.

Surface water

Streams that might be impacted by the proposed W. R. Grace Railroad are listed below in downstream order and tributary rank:

- Yampa River
  - Johnson Gulch
  - Williams Fork River
  - Milk Creek
    - Wilson Creek
    - Taylor Creek
    - Jubb Creek

The proposed route begins about three miles southwest of Craig and runs generally southwest, crossing Johnson Gulch, Williams Fork River, thence down the Yampa River to the mouth of Milk Creek, thence up Milk Creek to the mouth of Wilson Creek. From the mouth of Wilson Creek the route follows Wilson Creek about one half mile to Jubb Creek, thence across and up the east side of Jubb Creek about three miles where the route traverses the Jubb Creek—Wilson Creek divide, crosses Wilson Creek, and then continues to Taylor Creek. At Taylor Creek the route continues about two miles upstream to a loading facility.

All major streams possibly impacted by railroad construction head at high altitudes and exhibit the same characteristics of other streams in the Yampa River system: the bulk of their runoff occurs in May and June, and their low base flow is sustained mainly by ground water. In summer months the flow of these streams is diminished by irrigation withdrawals.

Streamflow data for station 09249500 Williams Fork at Hamilton, 09250000 Milk Creek near Thornburgh, and 09251000 Yampa River near Maybell are given in Chapter II of the Regional Analysis. The estimated peak discharge for the flood with a recurrence interval of 50 years is 300 cfs for Wilson Creek, and the estimated average annual runoff for Taylor Creek is 125 acre-feet. Good Spring Creek would not be impacted by the railroad, but contributes to Milk Creek above Milk Creek Canyon. The estimated peak discharge for Good Spring Creek for the 50-year flood is 400 cfs.

No data are available for Johnson Gulch or Jubb Creek. Both are intermittent streams and probably contribute small flows as a result of snowmelt or intense rainfall.

Tables GRII-1 to GRII-2 summarize some of the general quality parameters that have been analyzed in the study area. In general, dissolved solids increase and turbidity decreases as flow decreases. Dissolved oxygen concentrations normally will decrease as temperature increases during summer, although production of oxygen by algae during warm periods can increase dissolved oxygen in the water. Nutrients such as nitrates and phosphates enter surface waters from ground water and surface runoff; they do not follow a definite seasonal pattern. Sulfate and bicarbonate show a direct relation to dissolved solids. One measure of the tolerance of a water quality system to external changes is pH stability. The Yampa River has little seasonal pH variation and is slightly alkaline, as are most western streams. Toxic elements such as arsenic, cadmium, copper, lead, silver, zinc, and selenium have been constantly below the toxic effect threshold in the Yampa River near Maybell. Arsenic, cadmium, lead and silver have not been above detection limits in any of the more than 15 samples collected at this station since 1968. Only one of 23 tests for copper, four of 34 tests for zinc, and four of 28 tests for selenium found measurable quantities. The one copper sample indicated a very high concentration and probably is an anomalous value. Other element concentrations were below the maximum criteria (EPA 1972).

Living Components

Soils

The proposed railroad right-of-way would cross several different landforms and three soil associa-

TABLE GRII-1

Water Quality of the Yampa River Near Maybell

Period of Record 1968-Present

Parameter and Unit of Measure[1]	Time Period Warm Baseflow Aug-Oct	Cold Baseflow Nov-Mar	High Flow Apr-Jul
Turbidity JTU[2]	16±18	45±81	332±401
Dissolved Solids mg/l	300±56	374±47	221±147
Temperature °F	58±9	33±2	54±10
Flow CFS	345±133	368±73	4323±3497
Nitrate mg/l	0.25±0.39	0.28±0.30	0.47±0.44
Phosphate mg/l	0.22±0.33	0.09±0.15	0.20±0.15
Bicarbonate mg/l	173±18	193±25	118±37
Sulfate mg/l	87±48	110±27	50±45
pH	8.0±0.5	7.9±0.3	7.7±0.3

[1] Values for parameters presented in this table are expressed as a mean (the first number given) and one standard deviation (the second number given).

[2] JTU = Jackson Turbidity Unit; Mg/l = milligrams per liter

SOURCE: Colorado Department of Health 1975

TABLE GRII-2

Water Quality of Wilson Creek and Good Spring Creek

(Period of Record 1974 - Present)

Parameter and Unit of Measure[3/]	Sample Location	Warm Baseflow Aug-Oct	Cold Baseflow Nov-Mar	High Flow Apr-Jul
Turbidity	Good Spring Cr.	9+10	101+132	1/
JTU[2/]	Wilson Cr.	3.5+0.7	64+74	1/
Dissolved				
Solids	Good Spring Cr.	998+156	984+204	1/
mg/l[2/]	Wilson Cr.	1448+172	1166+104	1/
Nitrate	Good Spring Cr.	1/	1/	1/
mg/l	Wilson Cr.	1/	1/	1/
Phosphate	Good Spring Cr.	0.01	0.02+	1/
mg/l	Wilson Cr.	0.01	0.02+	1/
Bicarbonate	Good Spring Cr.	435+100	545+36	1/
mg/l	Wilson Cr.	407+24	527+20	1/
Sulfate	Good Spring Cr.	234+291	425+190	1/
mg/l	Wilson Cr.	146+147	396+41	1/

Composite of data available from VTN samples stated as mean standard deviation

1/ Insufficient data at this time

2/ JTU = Jackson Turbidity Unit; Mg/l = milligrams per liter

3/ Values for parameters presented in this table are expressed as a mean (the first number given) and one standard deviation (the second number given).

SOURCE: Colorado Department of Health 1975 tions (21, 35, and 41), which are shown on the general soil map in Appendix D, Estimated Soil Properties Significant to Engineering and their Interpretation. Descriptions include soil properties, limitations, and suitabilities. Soil associations were developed because basic soil data are not available to locate or identify individual soil series occurring within the right-of-way. At the larger scale the pattern of occurrence of the soils enables the land user to identify suitabilities, limitations, and potentials of the soil for construction, rehabilitation, reclamation, and land treatment practices.

Narrative discussion of soil associations crossed by the proposed railroad gives a reasonably clear picture of the landscape and its soils, geology, climate, vegetation, and current use, and general productivity, potentials, and limitations. The proposed railroad right-of-way would cross soil associations 21, 35, and 41 as described in the Regional Analysis:

Soil association 21 occurs on uplands and in valleys and associated stream floodplains. Shrink-swell potential is high; valley soils are susceptible to flooding during spring and early summer. They are highly productive for pasture and irrigated cropland. If vegetative cover is removed, water erosion hazard is high. Soils of the uplands are less productive than of the bottom lands and are used for grazing and limited dry cropland.

Soil association 41 occurs on sloping to steep uplands and mesas. Suitability for fill material is poor because of shallow depths to bedrock. Productivity is low to medium, and use is primarily range, recreation, and wildlife habitat. Erosion potential is high when the vegetative cover is removed.

Soil association 35 occurs on the nearly level to gently sloping uplands (plains). These soils have a fair suitability for fill material and are used primarily for range, urban development, recreation, and wildlife. Erosion potential is moderate when vegetative cover is removed.

Appendix D provides additional physical and chemical data, suitabilities and limitations for construction, reclamation potential, etc, for each soil association.

Terrestrial Flora

Vegetation along the proposed railroad route is typical of vast areas of intermountain and plateau country of Colorado's western slope. Except for cultivated land, the landscape is dominated by sagebrush communities. Figure GRII-05 illustrates vegetation (and therefore land use) along the proposed route, as well as along alternate routes; vegetative types present are: sagebrush, mountain shrub, pinyon-juniper, cropland, and river bottom (riparian).

Numerous factors are responsible for the present condition and extent of plant communities; no areas exhibit pre-Caucasian conditions. Livestock grazing has had the most significant effect on composition and distribution of existing plant communities. Soils, topography, and fire also are significant in overall distribution of community types. Vegetation occurs as a mosaic rather than as a broad expanse because of these factors. No rare or endangered plant species have been identified along the proposed corridor route; however, the vegetation has not been analyzed in detail.

For discussion, plant communities are analyzed in segments; more detailed analysis of each type is presented in Chapter II of the Regional Analysis.

Segment 1: Colorado Ute Spur to Yampa/Williams Fork Junction

South of Craig the Yampa River contains substantial floodplains as much as ¼ mile wide. This zone contains riparian vegetation dominated by narrow leaf cottonwood (*Populus deltoides*) and willows (*Salix* spp.). Species within this vegetation type require readily available water throughout their growing season, and distribution is limited to the river courses. During summer, livestock are maintained in many of the floodplain pastures of this type. Depending on the width of the floodplain, riparian vegetation is found the entire length of this segment. Two other major vegetation units occur above and adjacent to the river. The effects of agriculture are evident from the "patchwork" nature of the vegetation distribution (Figure GRII-05). Relatively flat areas in the floodplain of the river are utilized for haylands, whereas some areas of rolling topography above the river have been converted to wheat fields; the more severe topography and gullies are dominated by sagebrush communities. The most conspicuous species in the sagebrush communities is big sagebrush (*Artemesia tridentata*). In areas with a shallow water table, excessive salt concentration, or abandoned fields, black greasewood

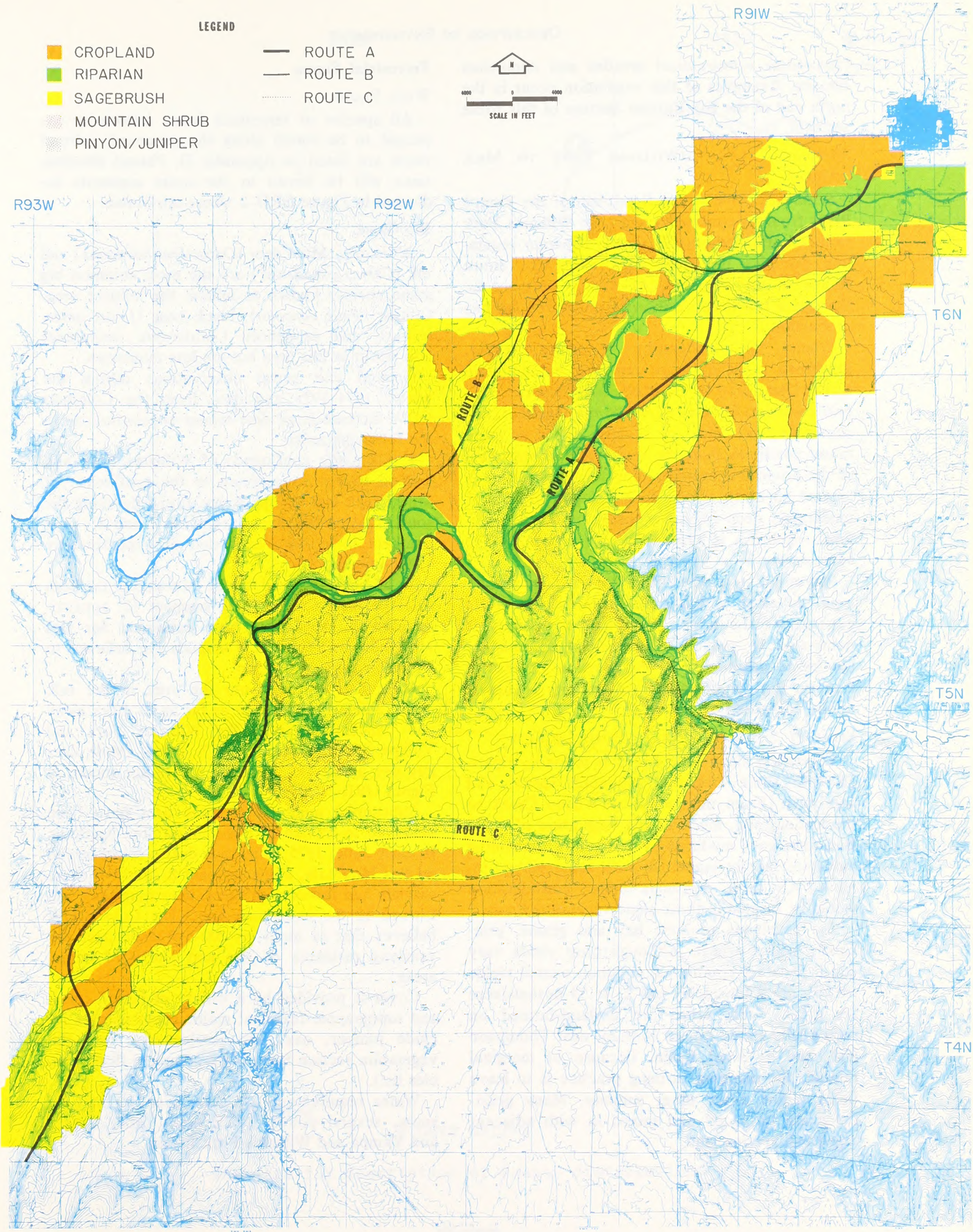


Figure GRII-05 Vegetative types crossed by route A and alternate routes of the proposed W.R.Grace railroad.

(*Sarcobatus vermiculatus*) invades and dominates the site. Examples of this vegetation occur in the north end of the Big Bottom Section of this route segment.

Segment 2: Yampa/Williams Fork to Milk Creek

Segment 2 follows the floodplain of the Yampa River from its confluence with the Williams Fork to the confluence of Milk Creek. Riparian vegetation occupies the river bank along the entire course of this segment. At Round Bottom, the floodplain has been extensively cultivated for hay production.

Where the topography is more severe, sagebrush rangelands are replaced by mountain shrub. Dominated by Gambel's oak (*Quercus gambelii*), and serviceberry (*Amelanchier alnifolia*), this community is typical of slightly higher or more mesic condition than the sagebrush. Along most of the proposed segments, this community type is located on north or east-facing slopes with deep-moderately deep soils. Depending on stand condition, sagebrush is present in this community to some degree.

Pinyon-juniper, the other major community type, develops where rocky outcrops or bluffs exist above the river. This plant community is dominated by pinyon (*Pinus edulis*) and juniper (*Juniperus utahensis*). In this portion of Moffat County, the pinyon-juniper community is almost totally composed of juniper.

Segment 3: Milk Creek to Loadout Site

Vegetation along Milk Creek is primarily riparian with some cropland, mountain shrub, and sagebrush. From the mouth of Wilson Creek to the loadout site, much of the vegetation of Axial Basin has been modified by agriculture; remaining lands are mostly sagebrush with some pinyon-juniper. All three terminals under consideration would be located in these same vegetative types.

The croplands produce hay and grains, principally winter wheat. Although crop yields vary due to weather conditions, common annual yields for hay are 2 tons/acre, and 25 to 35 bushels/acre for grain. Grain crops are dryland-farmed on rolling hills above Round Bottom, near Thompson Hill, and in Axial Basin. Because of marginal rainfall, the common farming practice is to leave fields fallow every other summer. Many grainfields are unfenced and mixed in with adjacent sagebrush grazing land.

Terrestrial Fauna

Wild Fauna

All species of terrestrial fauna known or expected to be found along the proposed railroad route are listed in Appendix D. Faunal distributions will be keyed to the route segments indicated in Figure GRII-2 where applicable.

Big Game

Mule deer. Mule deer (*Odocoileus hemionus*) and elk (*Cervus canadensis*) are the most common big game species known to inhabit the subject area. Cougar (*Felis concolor*), black bear (*Ursus americanus*), and pronghorn (*Antilocapra americana*) also occur in this area but are less numerous.

Ground and aerial observations during the winter 1974-1975 and data from the Colorado DOW indicate large deer winter concentrations in the following areas:

1. From the confluence of Williams Fork and Yampa Rivers downstream to the confluence of Milk Creek and Yampa River, primarily along the south side of the river (Segments 7 and 8); deer numbers have been estimated at approximately 1,000 animals;

2. In both Iles and Duffy Mountains on both sides of Milk Creek, along segment 12; approximately 200 deer have been estimated for Iles Mountain, and about 150 animals are believed to winter in Duffy Mountain.

Mule deer migrate into the area in the fall. Many animals come from as far as 40 miles away and concentrate along the Williams Fork and Yampa Rivers, segments 3, 7, and 8. (Mule deer key use areas and migration routes are shown in Figure GRII-3.)

Substantial numbers of mule deer have been observed to remain in this general area yearlong. In early June, 1975, numerous deer were observed on Iles Mountain, along segment 8. Many of these animals had fawns with them, indicating they had fawned in the immediate area. The Colo. DOW believes that as many as 200-300 mule deer are yearlong residents of Iles and Duffy Mountain areas.

Cover is provided by a variety of brush, trees, and topographic features; major cover species include juniper, oak, and serviceberry; (see the vegetation section for a more complete floral species list).

Water requirements of mule deer are met by snow, several ponds, stock tanks, Milk Creek, and Yampa and Williams Fork Rivers.

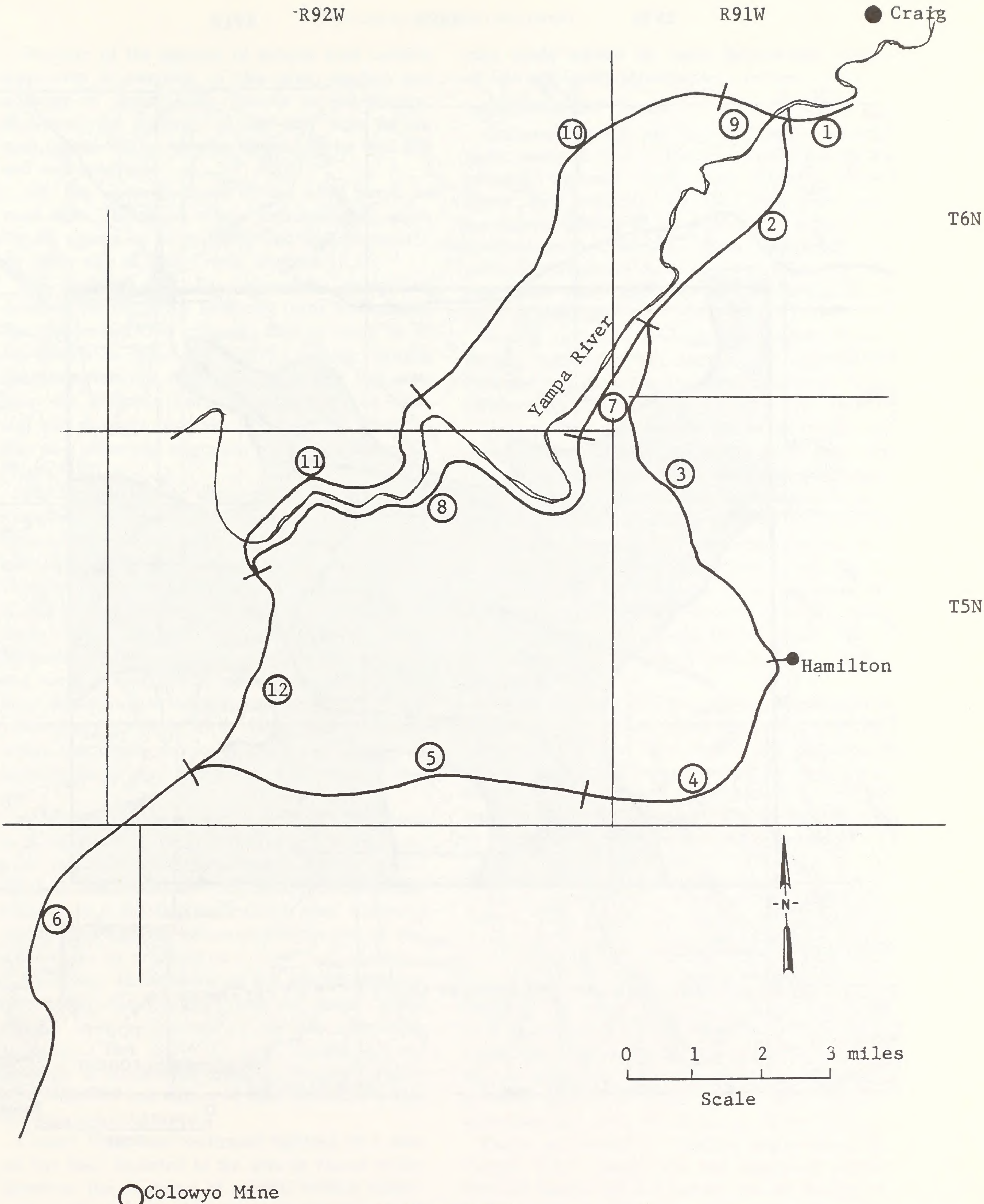


FIGURE GRII-2

Segments for description of faunal distribution.

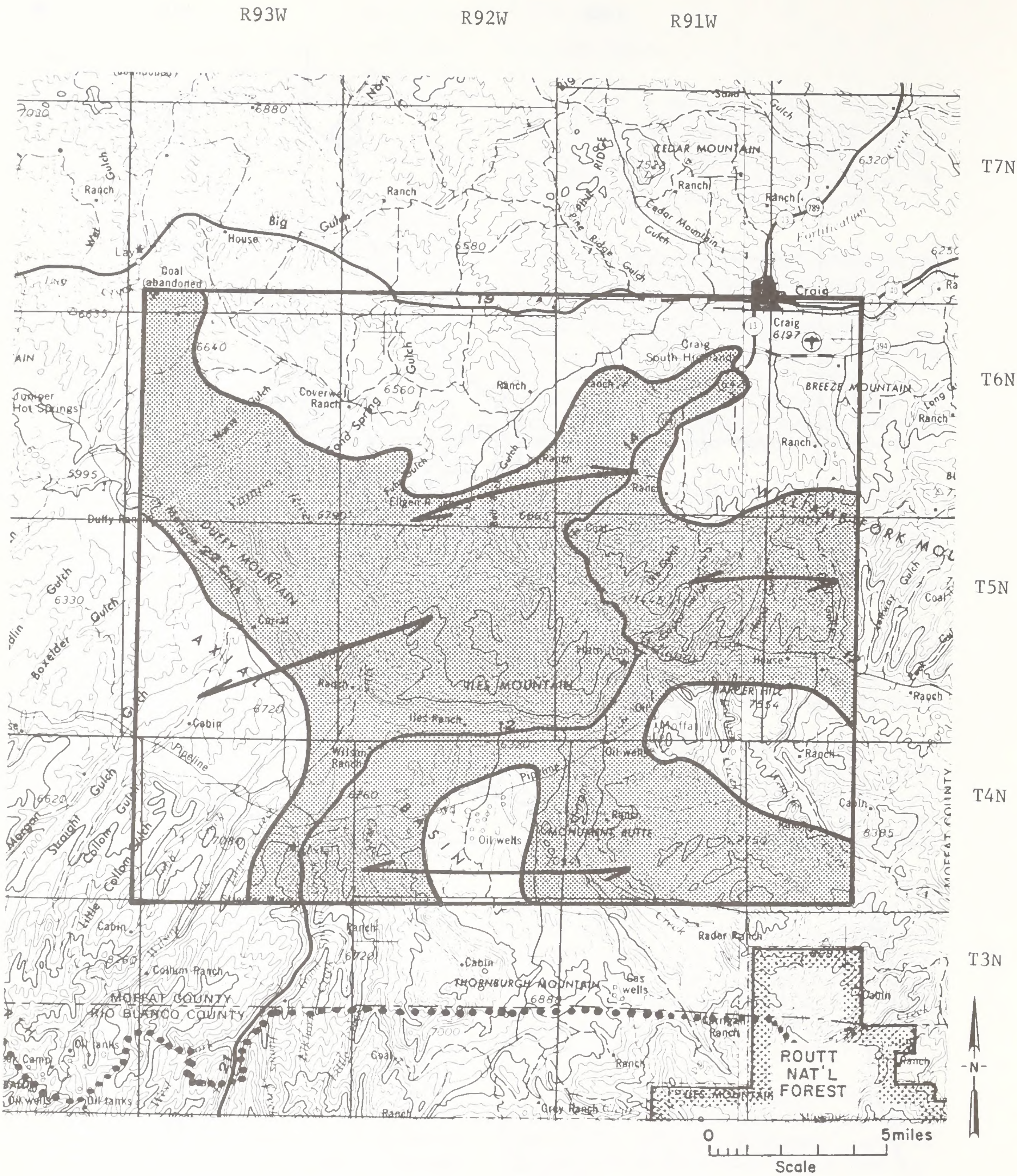


FIGURE GRII-3

Mule deer key use areas (shaded) and migration routes (⟵⟶).

Because of the amount of private land surface ownership in portions of this area, quality and quantity of deer winter browse is not known. However, the majority of the deer seen in the area during winter months appear to be well-fed and well-nourished.

Elk. Elk occur in most of the same areas as mule deer. Important winter concentration areas for elk appear to be in Duffy and Iles Mountains on either side of Milk Creek, segment 12.

Elk numbers on Iles Mountain appear to decrease progressively as spring turns to summer. The Colorado DOW estimates that as many as 50 elk remain in these mountains yearlong. During the winter months many elk move into this area from the Williams Fork Mountains to the east, and elk numbers increase to about 500 animals. Key use areas and migration routes are shown in Figure GRII-4.

The elk that winter along Williams Fork River move into Williams Fork Mountains during the summer months; very few animals live in the immediate vicinity of the river during this period. However, elk are killed on the highway in the Hamilton area yearlong, indicating that some elk move freely between Iles and Williams Fork Mountains during summer months. Food, water, and cover information is basically the same as for mule deer (listed in the previous section).

Pronghorn antelope. Few pronghorns are found within this region; however, the trend appears to indicate an upward swing in pronghorn antelope use.

A small herd of about 25 animals is established in Axial Basin in the vicinity of segments 5 and 6 at the head of Milk Creek Canyon (Figure GRII-5). Additional use has been recorded along segment 10 in the Bell Rock Gulch area. Scattered reports also indicate an increase in the use of segment 8 area by pronghorns.

Black bear. Black bears are not considered common along the proposed railroad route. These animals have been observed on Iles and Duffy Mountains, but only on rare occasions, and generally in areas away from the proposed route; exact numbers and extent of their activities within this area are not known.

Cougar. Only one confirmed sighting of a cougar has been reported in the area in recent years. However, the existence of suitable habitat values, such as adequate food, cover, and rugged terrain, indicate that there is a good possibility that cougars could inhabit the more inaccessible regions of Iles and Duffy Mountains.

Small mammals

Cottontail rabbits are the only species of small game mammal that is known to occur along the proposed railroad route; they might be found along any segment. In the past five years lagomorph numbers have declined severely in northwestern Colorado. Both cottontail and jackrabbit numbers have been very low for the past three years and have not shown significant signs of recovery.

Beaver and muskrat are found along the Yampa River; numbers, exact distribution, and harvest data are not available for these species or other furbearers within the area.

Coyote, fox, and bobcats are found within this area. Coyotes are the most common; they are found throughout the area along any route segment. Fox and bobcats are less numerous and generally are found along the rivers. The trend in fox numbers appears to be upward, whereas bobcat numbers are reportedly stable in this part of Colorado. The influence of these predators on local prey species is not known; however, some deer and pronghorn fawns probably are lost to them each year, as well as many rodents, rabbits, and some birds.

A wide diversity of other non-game mammals is also known to occur within the region (see Appendix D). Species' occurrence and distribution depend greatly upon the existence of appropriate habitat values, such as food, water, cover, and living space. For a generalization of these values as they relate to each species see Appendix D.

Game birds

Ducks. Ducks are very common along the Yampa River, especially during spring and fall mitigations. Many breeding pairs are seen by the Colo. DOW and the U.S. Fish and Wildlife Service during annual spring counts in May (Table GRII-3). The actual number of broods along the river is considered low. Because of high water during the peak of the nesting period, few places are available for nesting, and some nests are probably inundated (Colo. DOW 1975). Primary waterfowl use areas are shown on Figure GRII-6.

Ducks are hunted to a limited degree along the Yampa River during the fall migration period. Harvest figures are not known, but are thought to be low, because private land ownership limits accessibility along the river.

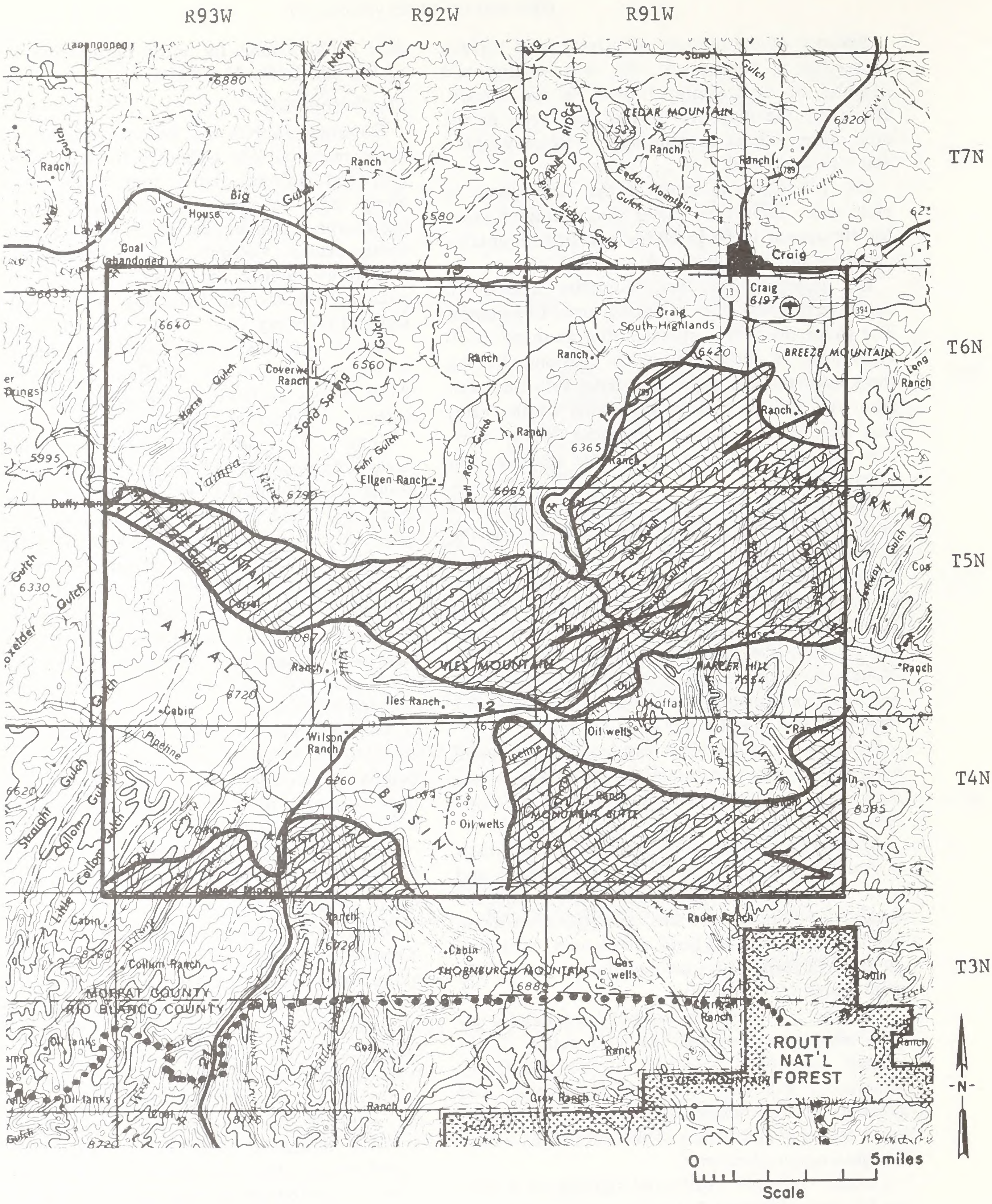


FIGURE GRII-4

Elk key use areas (shaded) and migration routes.

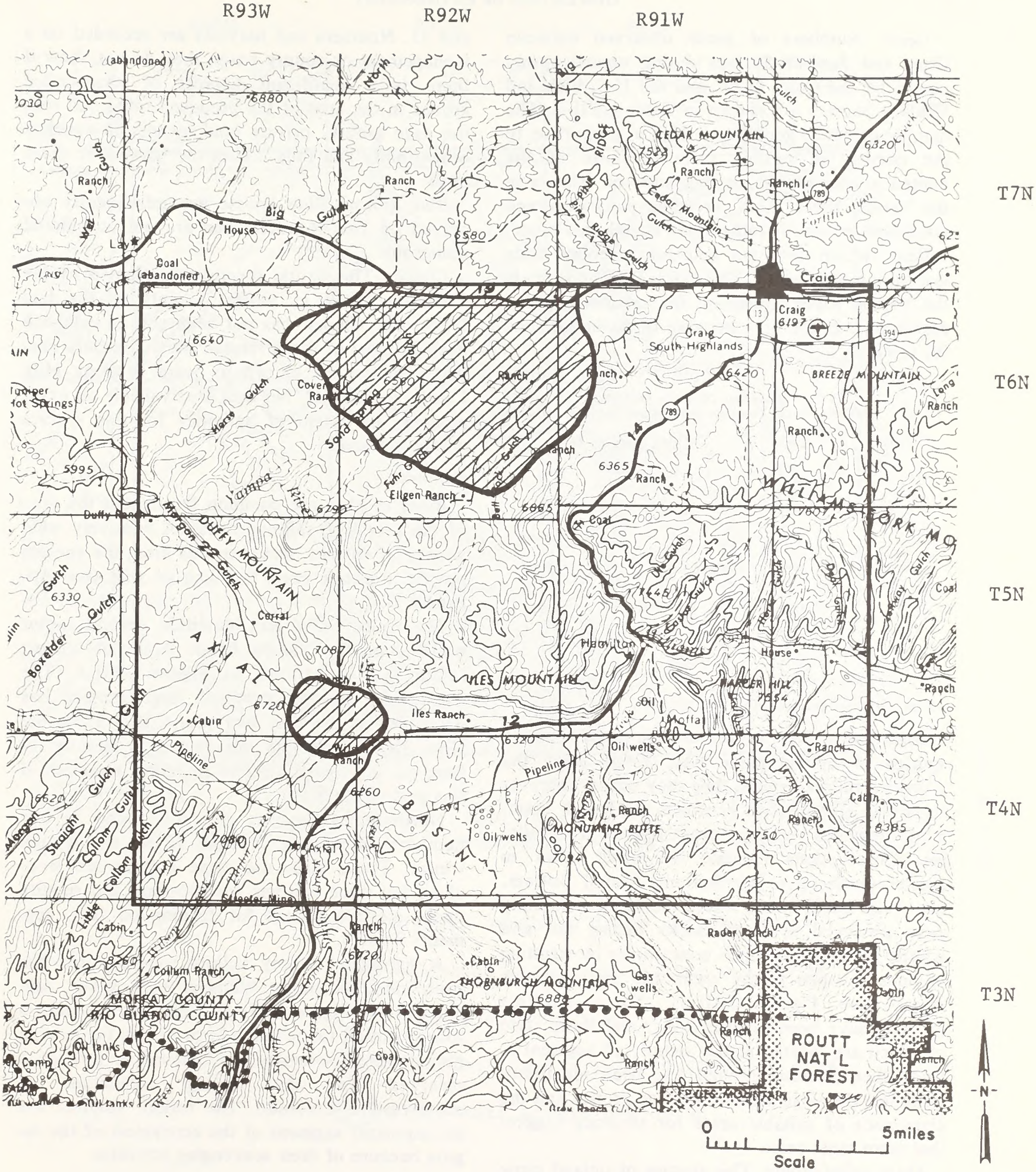


FIGURE GRII-5

Pronghorn antelope use areas (shaded).

Geese. Numbers of geese observed between Craig and Juniper Springs during annual spring counts by the Colo. DOW and the U.S. Fish and Wildlife Service are shown in Table GRII-3. The number of adults generally is high in proportion to the number of nesting pairs, because of the limited availability of nesting sites on islands in the Yampa River. Also, breeding pairs observed are based on broods rather than actual nest observations, which does not take into account nests lost during high water. The Colo. DOW considers the Yampa River significant for sustaining goose populations in the area because of its importance for nesting.

TABLE GRII-3

Waterfowl Counts - 1969-1975
Between Craig, Colorado and Juniper Springs, Colorado

Ducks	Year	Total Breeding Pairs
	1970	2,350
	1971	2,340
	1972	1,857
	1973	2,571
	1974	2,834
	1975	2,354

Geese	Year	Nesting Pairs	Total Adults
	1969	16	145
	1970	5	174
	1971	14	206
	1972	13	209
	1973	7	271
	1974	No Count	---
	1975	16	121

SOURCE: Szymczak Colorado DOW, 1974 and 1975.

Sage grouse. Sage grouse are the most common species of upland game bird found along the proposed railroad route; they may occur wherever sagebrush and meadow ecotones are found. Population densities vary; no exact figures are available. Observations indicate the birds occur in greater numbers in Big Bottom, Round Bottom, and Axial Basin areas, where the birds commonly were observed in large flocks during fall and winter. In spring the birds concentrate on strutting grounds in open grassy areas and on sagebrush ridges (see Figure GRII-7). Three strutting grounds have been identified in Axial Basin, two of which are located in the vicinity of segment 6. One other strutting ground has been identified; however, the large number of sage grouse and the abundance of suitable areas for strutting suggest that more must exist.

Sharp-tailed grouse. This species of upland game bird is found within Axial Basin (see Figure GRII-6); however, data are very limited on their numbers or extent of activity. Sharptails might also use the Bell Rock Gulch area, segments 10 and 11. Numbers and harvests are recorded on a management or county basis; they do not show if there is a significant harvest of sharp-tailed grouse in the area of the proposed route. As with the sage grouse, private land ownership restricts accessibility and thus lowers the harvest of these birds.

Blue grouse. Blue grouse are infrequently observed on Iles Mountain and are not considered numerous.

Chukar. This exotic species was planted by the Colorado DOW in Moffat County in the late 1950s. The Chukar has not been able to establish itself in most of these release sites. The only area that Chukars are known to occur is along Milk Creek, segment 12. No data are available on exact numbers or extent of activities for this species within the area.

Raptors

Birds of prey are common throughout the area of the proposed railroad route. A relatively wide variety of species occurs in this area; the species present depends upon the time of year (see Appendix D).

The Colo. DOW has identified several raptor nests along the Yampa River. Areas of highest raptor use are shown in Figure GRII-6. The number of nesting pairs of large raptors has decreased in the past two years, 1973-1974; the Colo. DOW feels that this decline is directly related to the recent decline in rabbit numbers in this part of the State.

Northern bald eagles also are found in low numbers along the Yampa River during the winter. These birds use large cottonwood trees along the river bottoms for roosting, and require open, ice-free waters for feeding on fish, segments 7 and 8.

A significant turkey vulture roosting area has been identified along Williams Fork River, segment 3 (see Figure GRII-6). This area provides a roost location for juvenile birds during the nesting period; these juveniles are believed to provide a reservoir for the mating population of northwestern Colorado. The turkey vultures are an important segment of the ecosystem of the region because of their scavenging activities.

Amphibians and reptiles

No population or habitat information is available for species of this segment of the terrestrial fauna.

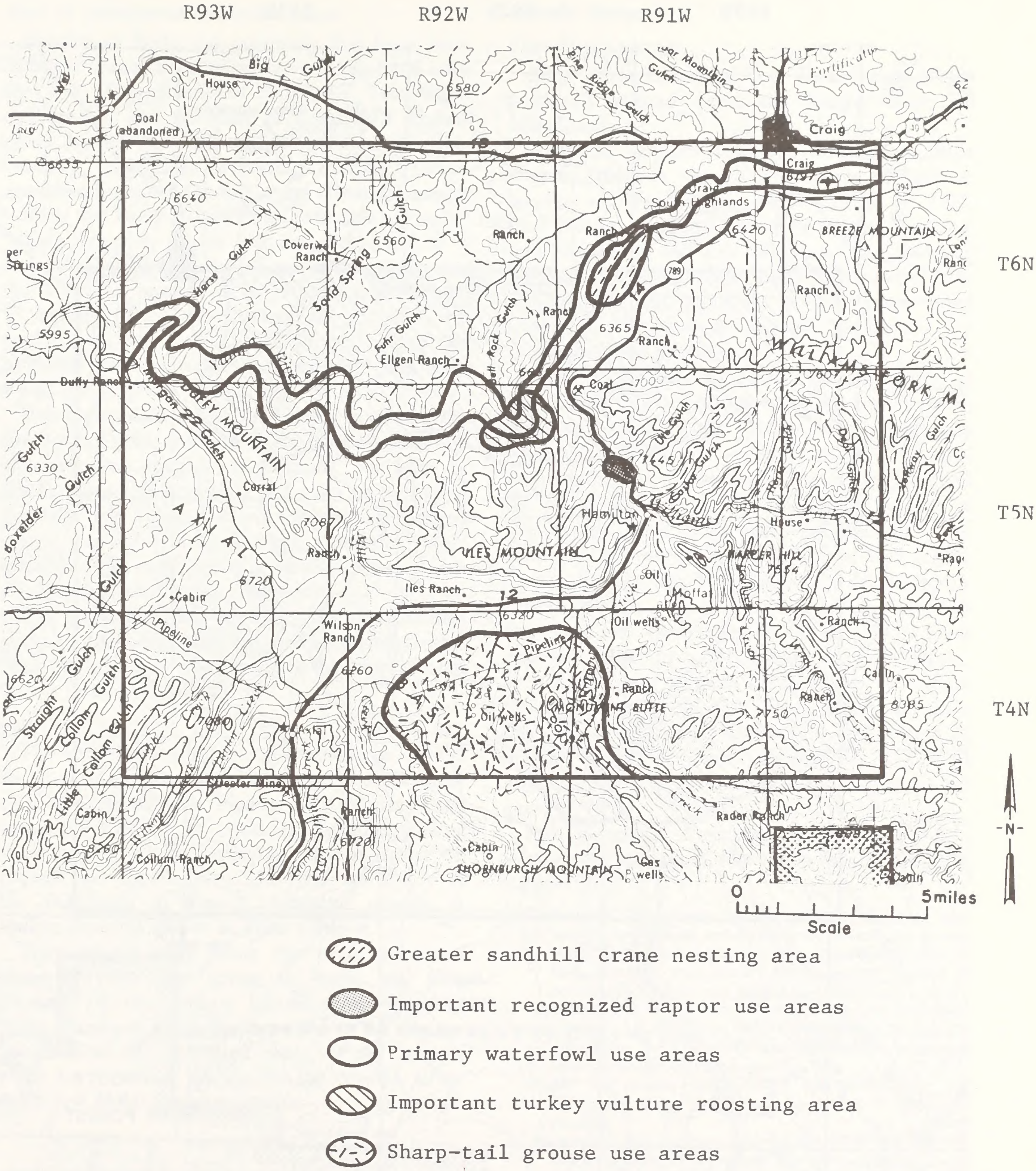


FIGURE GRII-6

Wildlife use areas of particular interest.

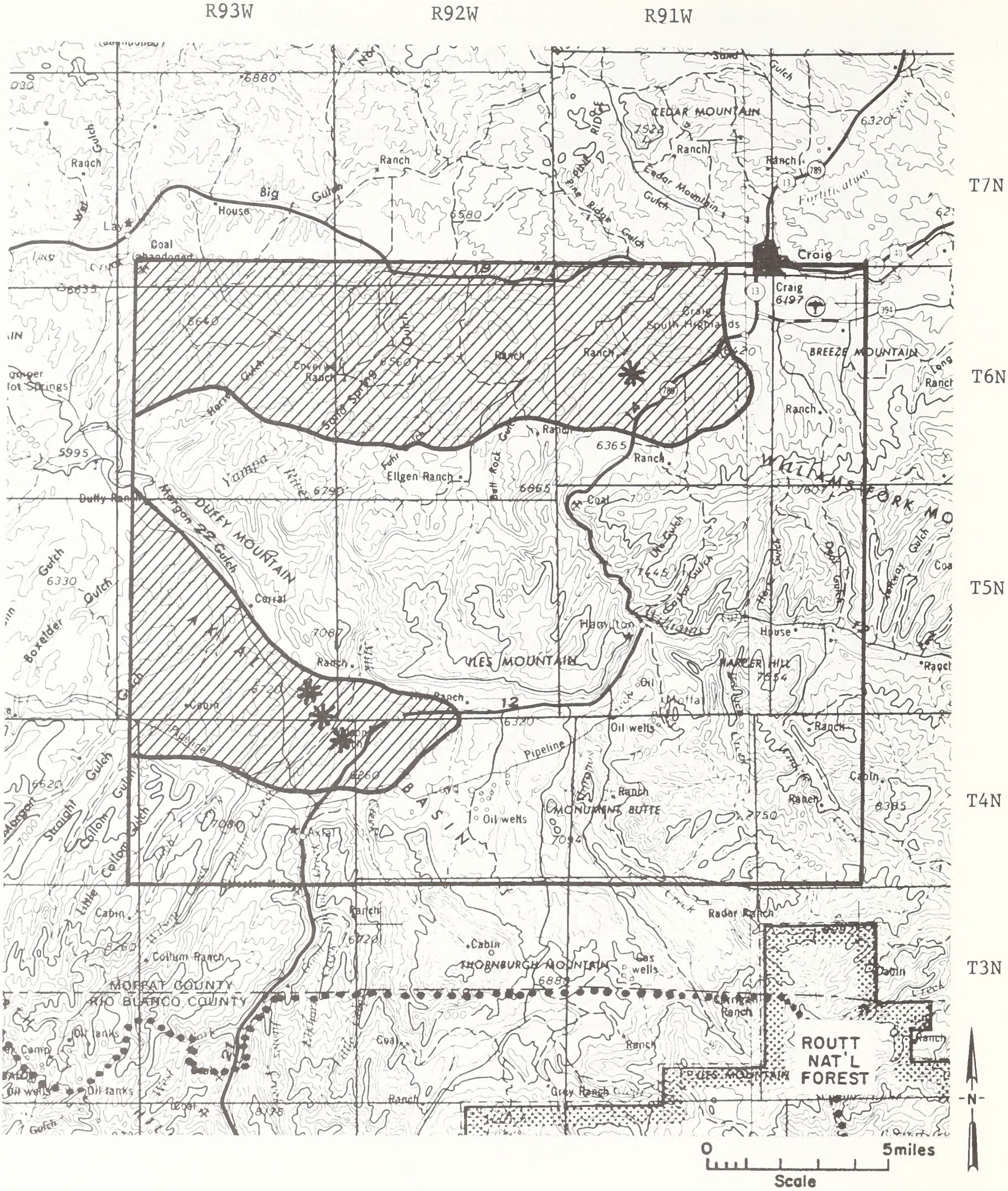


FIGURE GRII-7

Sage grouse distribution, habitat (shaded) and *strutting grounds.

Rare or endangered terrestrial fauna

Species of birds and mammals that have been included under this heading were taken from both the U.S. Department of Interior's Threatened Species List and the State of Colorado's Endangered Species List. Species that come under this category are the peregrine falcon (*Falco peregrinus*), greater sandhill crane (*Grus canadensis tabida*), and black-footed ferret (*Mustela nigripes*).

The peregrine falcon has been reported as a rare summer visitor to the area; indications are that a limited number of these birds might return to Moffat County each summer. Although no peregrine falcons are known to nest along the proposed railroad route, it is possible that they would use this area for hunting.

Greater sandhill cranes are known to inhabit the Big Bottom area, segment 2, during the spring and summer. This species conducts its courtship in Big Bottom, and also nests and rears its broods in this area (see Figure GRII-6). Seven-nine pairs of cranes use this area for nesting. Additional birds might use this same location as a fall staging area prior to their southward migration.

The absence of any known prairie dog colonies along the proposed railroad route creates significant doubts as to the presence of black-footed ferrets in these areas.

DOMESTIC FAUNA

The proposed route would cross lands owned by 11 people, companies, State or Federal agencies as indicated in Figure GRII-8. Hay and wheat fields would be crossed as well as grazing lands used by both cattle and sheep. Based on records and knowledge of the area, the ability of the vegetation to support domestic animals is broken down as shown in Table GRII-4.

The grazing lands along the route are used primarily from late spring to early fall. The majority of the surface use is cattle grazing; sheep grazing is generally restricted to the eastern one-third of the proposed route. Water is provided for livestock grazing by the Yampa River and a few ponds and stock tanks.

TABLE GRII-4

Carrying Capacities by Vegetation Type, Route A

Vegetation Type	Carrying Capacity in Acres Per Animal Unit Months (AUMs)
Mountain shrub	4.50
Sagebrush	5.00
Pinyon-juniper	32.50
Cropland	7.0
Riparian	4.25

Aquatic Biology

FISH POPULATIONS

Two viable fisheries occur in the area of the proposed railroad route: the Yampa River and Milk Creek.

Although detailed data are lacking on these streams, there is enough information to indicate species and productivity (Grace 1975). In 1973, Paul Holden completed a study entitled *Distribution Abundance and Life History of the Fishes of the Upper Colorado River Basin*. In this study, he sampled the fish occurring in the Yampa River from Craig to Juniper Springs; his results are shown in Table GRII-5.

Game fishes known to occur in this section of the Yampa River include rainbow trout (*Salmo gairdneri*), brown trout (*Salmo trutta*), mountain whitefish (*Prosopium williamsoni*), and channel catfish (*Ictalurus punctatus*). Numbers of all but the mountain whitefish are low in this section of the Yampa River, and little reproduction is indicated. This can be attributed to the high degree of siltation and the resultant loss of critical rocky riffle habitat, which are required for fish spawning and feeding areas (Grace 1975). Sand and silt result in a less heterogeneous bottom, producing fewer aquatic invertebrates on which the fish depend. No data are available on exact harvests or fishing pressure along this section of Yampa River; however, pressure is considered low because large parcels of private land limit access.

Fish abundance is recorded in Table GRII-5 in relative terms using the following definitions (Grace 1975):

Abundant: The species was collected in the area with standard equipment and little effort. Several age groups were present indicating a strong, reproducing population. Juveniles were readily taken in most habitats or occasionally in only one habitat by seine.

Common: The species was collected in the area, especially juveniles, if sufficient effort was expended. Usually more than one age group was represented, suggesting some reproduction in the area.

Rare: The species was collected only occasionally and with no certainty in the area regardless of effort expended.

Occasional: The occurrence of the species in the area was due to stocking or movement into the area during a particular season. The species was usually found in low numbers.

The Colo. DOW stocks rainbow trout annually in areas of public access around Craig, which probably accounts for the presence of this species in areas further downstream. Brown trout are

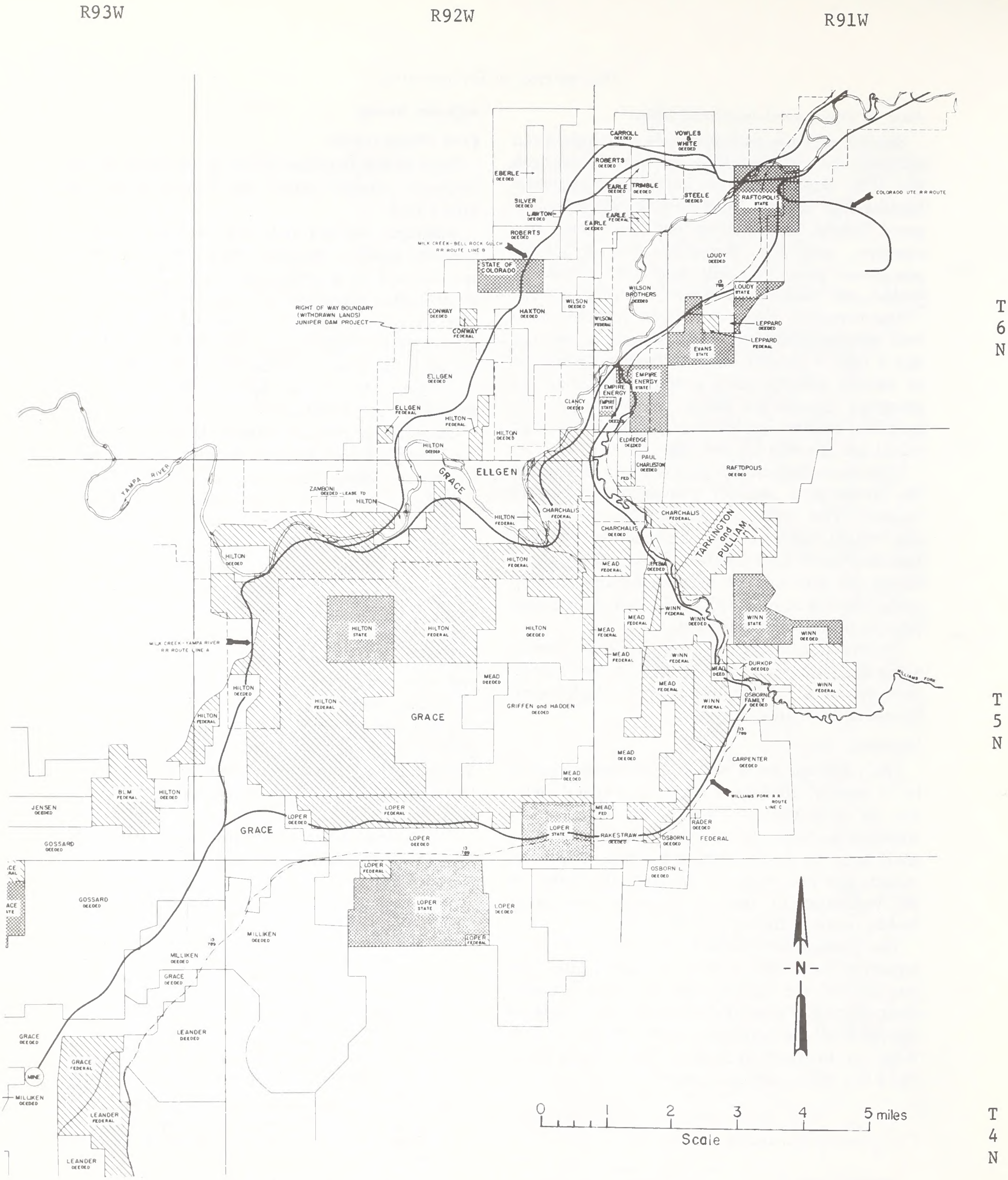


FIGURE GRII-8

Landownership along the proposed railroad and two alternates, as of June 1975.

SOURCE: International Engineering Company Incorporated

TABLE GRII-5

Fish - Species Distribution and Abundance

Species	Yampa River	Williams Fork River
Salmonidae		
Rainbow trout *Salmo gairdneri*	O	O
Brown trout *Salmo trutta*	O	O
Mountain whitefish *Prosopium williamsoni*	A	A
Cyprinidae		
Roundtail Chub *Gila robusta*	A	C
Colorado squawfish *Ptychocheilus lucius*	R	-
Speckled Dace *Rhinichthys osculus*	C	R
Redside shiner *Richardsonius balteatus*	C	C
Fathead Minnow *Pimephales promelas*	C	C
Carp *Cyprinus carpio*	C	-
Catostomidae		
Flannelmouth sucker *Catostomus latipinnis*	C	C
Bluehead sucker *Catastomus disebiolus*	A	A
White sucker *Catostomus commersoni*	A	C
Ictaluridea		
Channel catfish *Ictalurus punctatus*	R	-
Cottidae		
Mottled sculpin *Cottus bairdi*	-	A

A = abundant; C = common; O = occasional; R = rare; - = not collected
SOURCE: Holden, 1973

found in the area on a seasonal basis and in limited numbers; their presence and variation in age classes indicate some natural recruitment is occurring. Whitefish and channel catfish occur in the area as a result of natural recruitment; no data are available on age class distribution and growth in this section of the river. Holden indicates different age classes in these species, but he does not include a breakdown of classes.

Fish in Milk Creek were sampled by VTN biologists in August 1974; two sections of stream were electroshocked; no fish larger than three inches were collected, which is expected in a small, shallow stream high in sediment loads, warm in late summer, and with few places to spawn. The only fish identified were the redsie shiner (*Richardsonius balteatus*), speckled dace (*Rhinichthys nubilus*), fathead minnow (*Pimephales promelas*), and flannelmouth sucker (*Catostomus latipinnis*). This stream is not fished, and only natural recruitment sustains the fish populations (Grace 1975).

Invertebrate Populations

No data are available on the exact nature of the invertebrate populations in the Yampa River or Milk Creek. However, the presence of significant numbers of fishes, game and non-game species, would indicate a substantial, relatively diverse, invertebrate community.

Endangered Species

Of particular importance to the proposed action is the pending consideration of the Yampa River as a "Critical Habitat" for the Colorado River Squawfish (*Ptychocheilus lucius*). The recovery team for this species met in December, 1975 to decide if the Yampa River should be so designated; the results of that meeting are not yet available.

If the "Critical Habitat" criteria is established, then restrictions on any activity that could possibly impact the river become very stringent.

According to Colorado regulations, there are three endemic species classified as endangered, all of which currently or historically inhabit the Yampa River. The species are: Colorado River Squawfish, humpback chub (*Gila cypha*), and bonytail chub (*Gila elegans*). Only the first two are on the Federal Endangered Fauna List, and as such are the only two covered by the Endangered Species Act of 1973.

Two recent inventories (unpublished) have identified the presence of the Colorado River Squawfish in the Yampa River as far upstream as Maybell (Seethaller, Utah State and Prewitt, CSU, 1975). The humpback sucker also was found in the Yampa River, approximately two miles up from its confluence with the Green River.

Squawfish were sampled in early August, with ripe females and spent males present. Indications are that the squawfish spawned approximately a week earlier; however, no site-specific data on spawning are available, nor is the success of the spawning known. This information does put some broad parameters on spawning time in the Yampa River, for a period from mid-July to late August. The water temperatures were 68-70°F with no measurable turbidity.

The humpback suckers were found in the Yampa River during the fall and remained there until May. No specimens were noted during the summer; the significance of their absence during this period is not clearly understood at this time.

The habitat requirements for these four endangered species are similar. All four are known as "large river" forms, found only in the main channels of the Colorado, Green, and Yampa Rivers. Minckley and Deacon (1968) reviewed the status of native fishes in the lower Colorado River Basin (below the Grand Canyon), and concluded that "large river" forms are virtually extinct in the lower basin. Therefore the upper Colorado River basin, including the Yampa River, remains the only refuge for these unique fishes (Holden and Stalnaker 1973). In general, these species require water temperatures from 68°-70° (20°-21° C) and high water clarity (i.e., low sedimentation or turbidity) for spawning. At present the Yampa below Craig remains clear except after rainstorms and spring runoff (Holden and Stalnaker 1973). Data indicate that squawfish move into the Yampa River from the Green River system as waters clear and warm to 68°-70°F, during July and early August. The assumed reason for this movement is spawning (Holden and Stalnaker 1973). The abundance of juvenile squawfish in lower Yampa Canyon has changed since 1968; small squawfish could be readily seined from several areas in lower Yampa Canyon in 1968, but very few were found in 1969, and none in many attempts in 1970. Whether the decrease in juvenile squawfish was natural, or the result of increased sedimentation produced by the activities of man along or near the river, is not clear. Nevertheless the Yampa River appears to be very important as a spawning habitat for Colorado squawfish and maintains a spawning population (Holden and Stalnaker 1973). Presence of the bonytail chub, the humpback sucker, and the humpback chub in the Yampa River is definitely important to fisheries scientists' knowledge and ability to preserve and maintain this species (Holden and Stalnaker 1973).

Cultural Components

Archeological Resources

Dr. Joe Lischka, University of Colorado, conducted an intensive cultural resource survey along both proposed and alternate railroad routes during June and July of 1975. In addition, Dr. Calvin Jennings, Colorado State University, completed an archeological reconnaissance survey of proposed coal lease areas for the BLM during the summer of 1975; this survey supplements Dr. Lischka's intensive survey. Eighty-three cultural sites were inventoried along both proposed and alternate routes; six additional sites occur in the general area of the proposed route. Figure GRII-9 shows approximate locations of these resources and Table GRII-6 indicates the nature of the resource. Forty-seven archeological sites lie along proposed Route A. Two sites, numbers 14 and 78 (see Table GRII-6), are eligible for nomination (Matlock, 1976) to the National Register of Historic Places because of suggested excavation by the surveying archeologist.

Historical Resources

Table GRII-6 and Figure GRII-9 also indicate the nature and location of historical values adjacent to proposed and alternate routes. Thomas Iles' first ranch in Axial Basin is site no. 90. The ranch site occupies portions of Lots six and seven, Section 34, T.5N., R.92W; it was reportedly the first major cattle ranch in Axial Basin (Athearn, 1975). That portion of Lot six containing the ranch originally was patented to Thomas H. Iles on April 1, 1882. Mr. William H. Meadows first obtained a file certificate on July 27, 1885, for that portion of Lot seven upon which the ranch was located; this was ultimately patented on April 17, 1889. Meanwhile the property was transferred to Thomas H. Iles on October 6, 1885.

Site no. 12 was the George Iles' (son of Thomas Iles) homestead and is of no special significance. It was warranty deeded from the original homesteader, Herman Seilass (patented on September 25, 1914), to George Iles on April 25, 1914. This ranch was never solely owned by Thomas Iles, and therefore should not be confused with his first Axial Basin ranch, site no. 90.

Aesthetics

The visibility of proposed and alternate rights-of-way for W. R. Grace Railroad is determined by public access routes: in this area, county, State, and U.S. highway systems. Portions of the proposed Route A and the alternate Routes B and C are visible from Moffat County Roads 17, 30, 32, 41, 45, 49, 51, 107 and 148 as well as from Colorado Highway 13 and U.S. 40.

Refer to Appendix D for a description of the methodology used to derive landscape visibility maps; analysis of the maps will suggest areas more visible than others.

Refer also to Chapter II of the Regional Analysis for a discussion of the regional aesthetic setting for the proposed railroad areas, as well as for a general discussion of visual resources.

Four landscape visibility maps have been prepared to illustrate the relative visibility of one proposed and two alternate railroad routes, as addressed in W. R. Grace's feasibility study (see index to Landscape Visibility Maps in Figure GRII-10). Three maps, at a scale of one inch/mile (Figures GRII-12, GRII-13, and GRII-14), indicate overall visibility for all three routes. One additional map in greater detail was prepared to show visibility more clearly near the area proposed for loadout facilities at the proposed railroad terminus (Figure GRII-15).

Viewshed sequence points were lettered alphabetically beginning northbound on the Bell Rock Gulch road, Moffat County Road 30 (see Figure GRII-14). Immediately south of the confluence of Yampa and Williams Fork Rivers, southbound on Colorado Highway 13, this alphabetical lettering sequence was repeated (see Figure GRII-12). Alphabetical lettering sequence was begun a third time, still southbound on Colorado Highway 13, south of Iles Mountain (see Figures GRII-13 and GRII-14). Care should be taken not to confuse viewshed sequences having the same alphabetical lettering; to help clarify, note the contour alinement and resultant topographic exposure of landscape visual units.

TABLE GRII-6

Archeological and Historical Resources
W. R. Grace Railroad

Site Number (Figure GRII-9)	On Railroad Route A	B	C	Nature of Site: Archeologic: Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Historic: Buildings	Rock Structure	Comments
1	x	x	x							1	
2	x	x	x						11		(Circa 1941-1961)
3	x	x	x	x							
4	x	x	x						2		
5	x	x	x	x							
6	x	x	x	x							
7	x	x	x	x							
8	x	x	x	x							
9	x	x	x	x							Recommended testing.
10	x	x	x	x							Recommended testing.
11	x	x	x	x							Recommended testing.
12	x	x	x						3		George Iles Ranch.
13	x	x	x	x							Recommended testing.
14	x	x			x			x			Recommended excavation--hence, eligibility for National Register nomination.
15	x	x		x							
16	x	x		x							No further action recommended.
17	x	x		x							
18	x	x			x						Recommended testing.
19		x							3		Two buildings are collapsed.
20		x		x							Recommended testing.
21		x		x							
22		x		x							

TABLE GRII-6 (Cont.)

Archeological and Historical Resources
W. R. Grace Railroad

Site Number (Figure GRII-9)	On Railroad Route			Nature of Site: Archeologic					Historic		Comments
	A	B	C	Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Buildings	Rock Struc-ure	
23	x			x							Recommended testing.
24	x						x				
25	x					x					
26	x					x					
27	x					x					
28	x			x							
29	x									1	Partial bldg. foundation.
30	x			x							
31	x			x							
32	x				x						
33	x			x							
34	x			x							
35	x			x							
36	x			x							
37			x					x			
38	x			x							
39			x					x			
40	x			x							Recommended testing.
41	x			x							Recommended testing.
42	x		x	x							
43	x		x	x							
44	x		x				x				
45	x		x						1		Abandoned mine shaft.
46	x		x	x							
47	x		x	x							

TABLE GRII-6 (Cont.)

Archeological and Historical Resources
W. R. Grace Railroad

Site Number (Figure GRII-9)	On Railroad Route			Nature of Site							
				Archeologic					Historic		
	A	B	C	Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Buildings	Rock Struc-ture	Comments
48	x		x	x							
49	x		x	x							Recommended testing.
50	x		x	x							
51	x		x	x							
52	x		x	x							Survey in greater detail.
53	x		x				x				
54	x		x	x							
55	x		x	x							
56	x		x	x							
57	x	x	x	x							
58	x	x	x	x							Recommended testing.
59			x						4		
60	x		x	x							
61			x	x							
62			x			x					
63			x	x							
64			x	x							
65			x	x		x					
66			x								
67			x						4		Dugouts.
68			x	x							
69			x			x					More thorough investigation.
70			x			x					

TABLE GRII-6 (Cont.)

Archeological and Historical Resources
W. R. Grace Railroad

Site Number (Figure GRII-9)	On Railroad Route A	B	C	Nature of Site: Archeologic: Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Historic: Buildings	Rock Structure	Comments
71			x	x							
72			x			x					Recommended testing.
73			x	x							More thorough investigation.
74			x	x							More thorough investigation.
75			x	x							More thorough investigation.
76			x	x							Recommended testing.
77			x	x							Recommended testing.
78			x				x				Recommended testing and excavation--hence, eligible for National Register nomination.
79			x	x							
80			x	x							
81			x	x							Recommended testing.
82			x	x							Recommended testing.
83			x	x							Recommended testing.
84							x				Located in general area.
85				x							Located in general area.
86				x							Located in general area.
87							x				Located in general area.
88								x			Located in general area.
89								x			Located in general area.
90											Thomas H. Iles Ranch site.

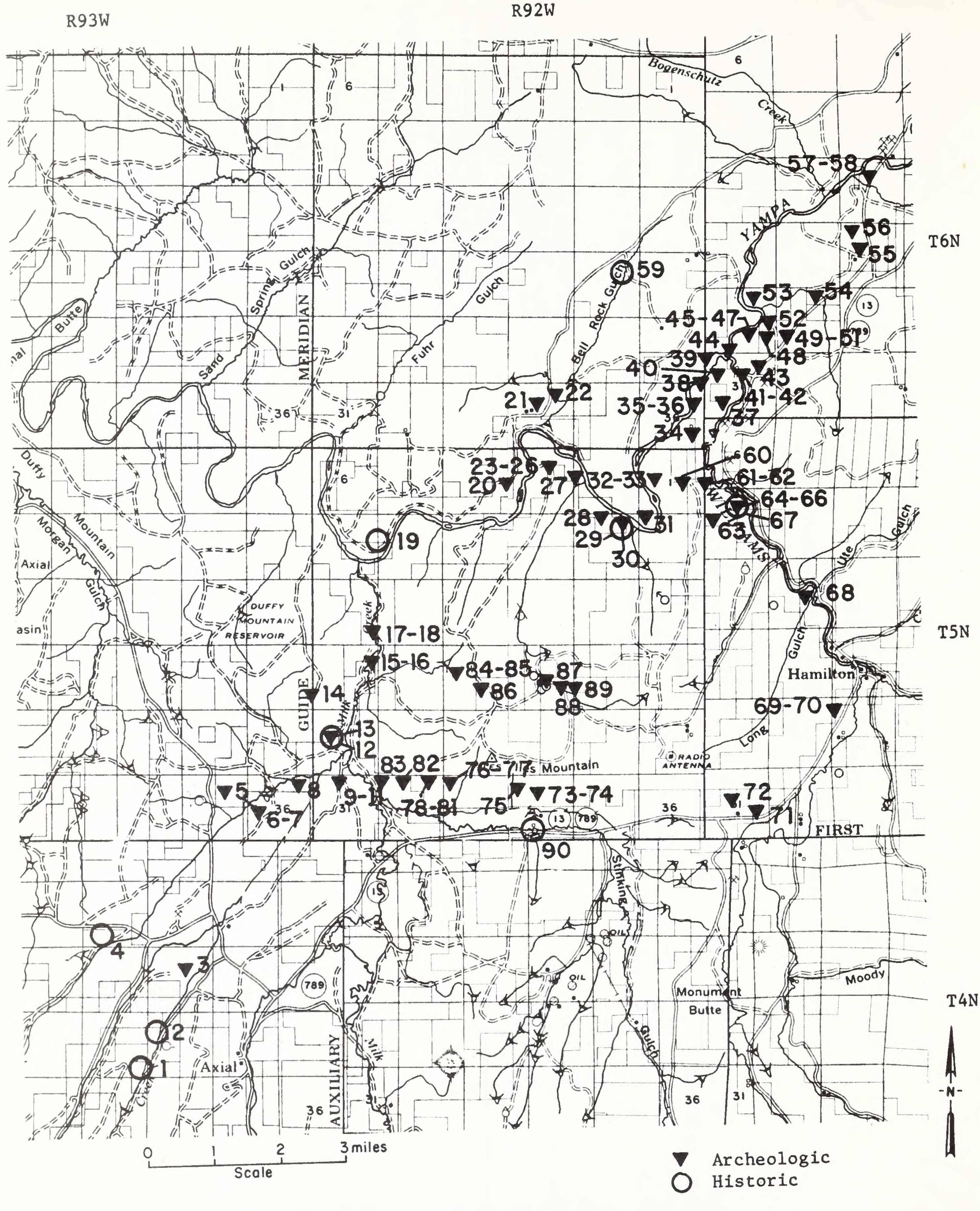


FIGURE GRII-9

Cultural resources adjacent to the proposed W.R. Grace railroad.

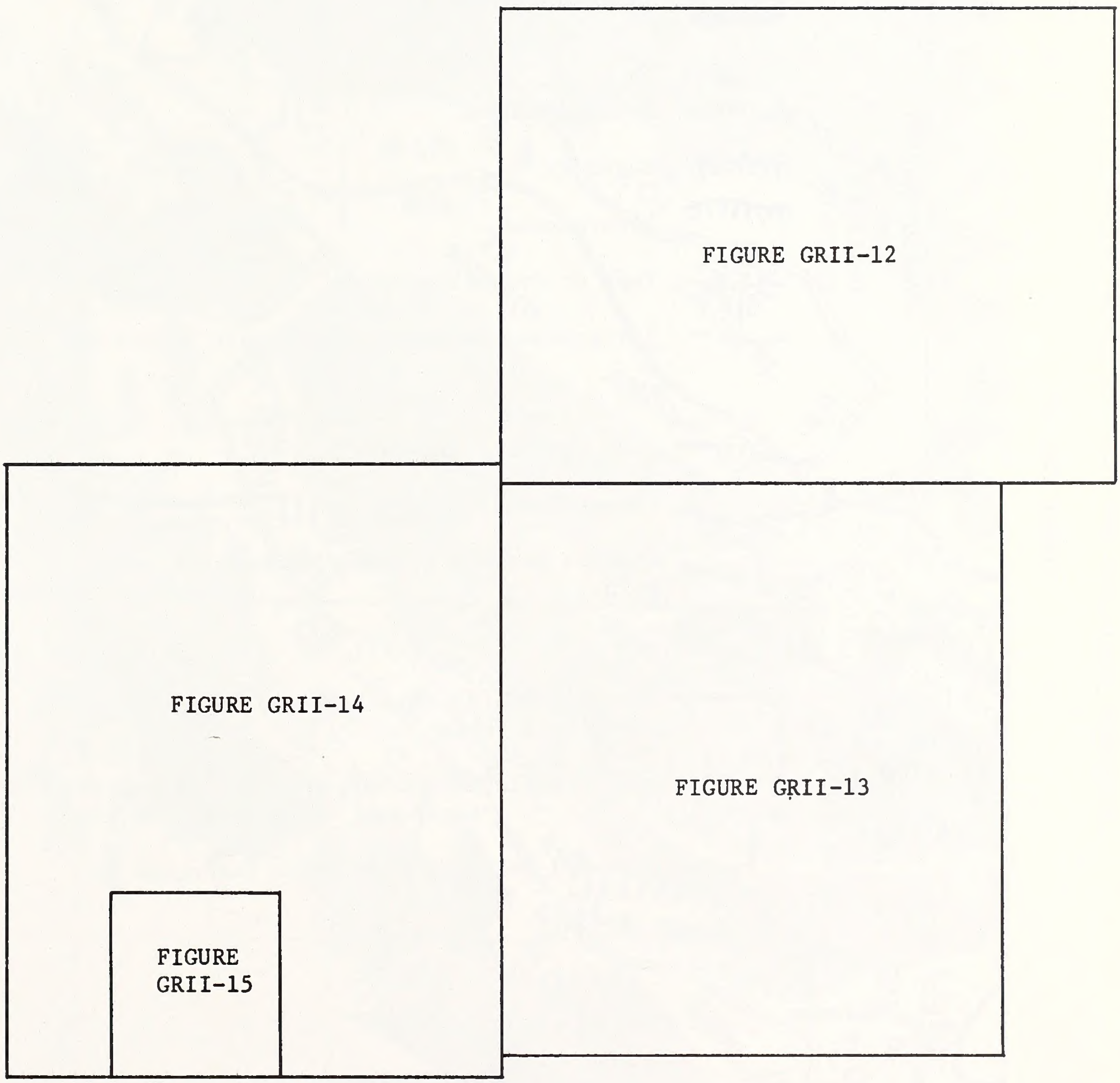


FIGURE GRII-10

Index to landscape visibility maps for W.R. Grace railroad.

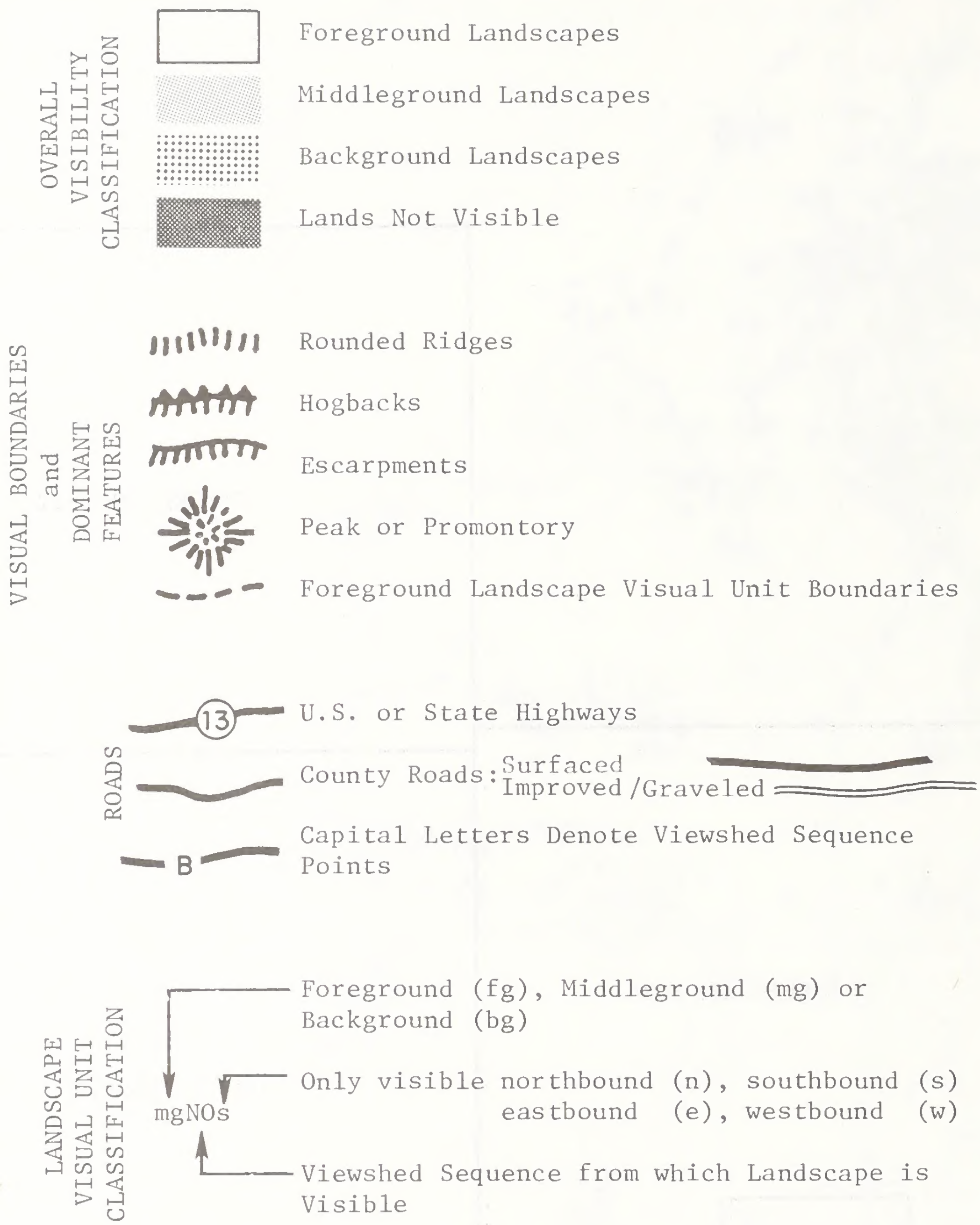


FIGURE GRII-11

Legend for landscape visibility maps.

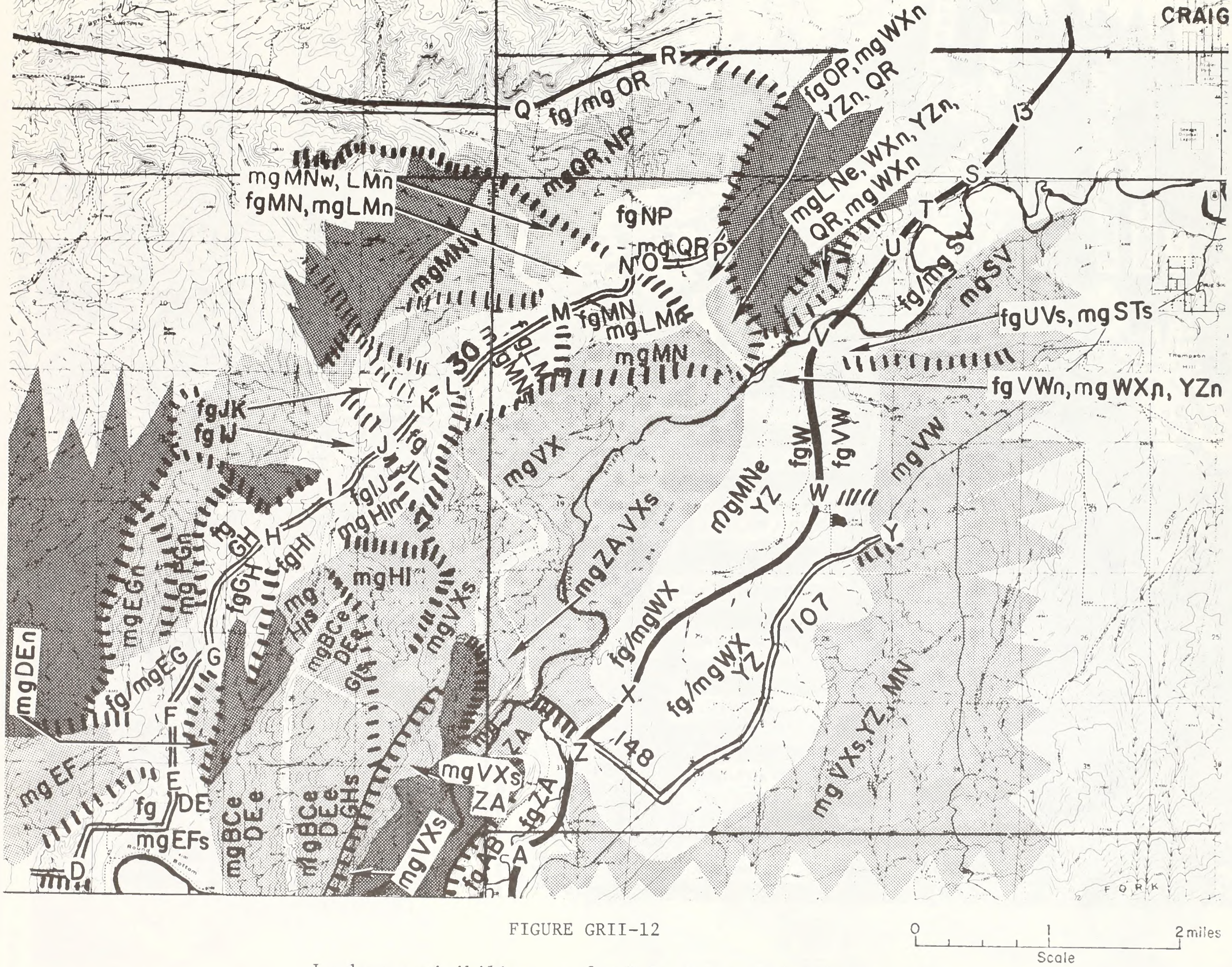


FIGURE GRII-12

Landscape visibility map for W.R. Grace railroad.

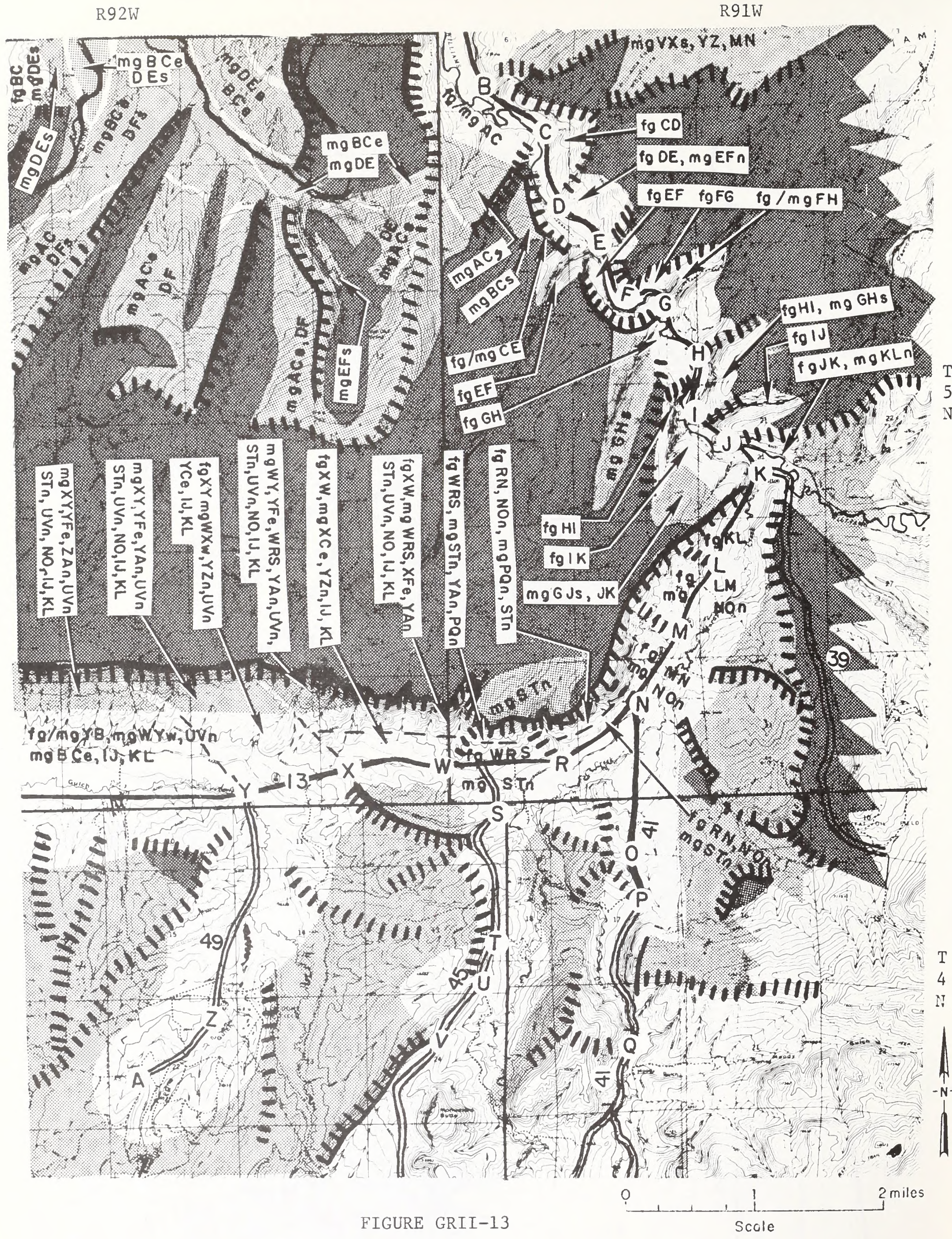


FIGURE GRII-13

Landscape visibility map for W.R. Grace railroad.

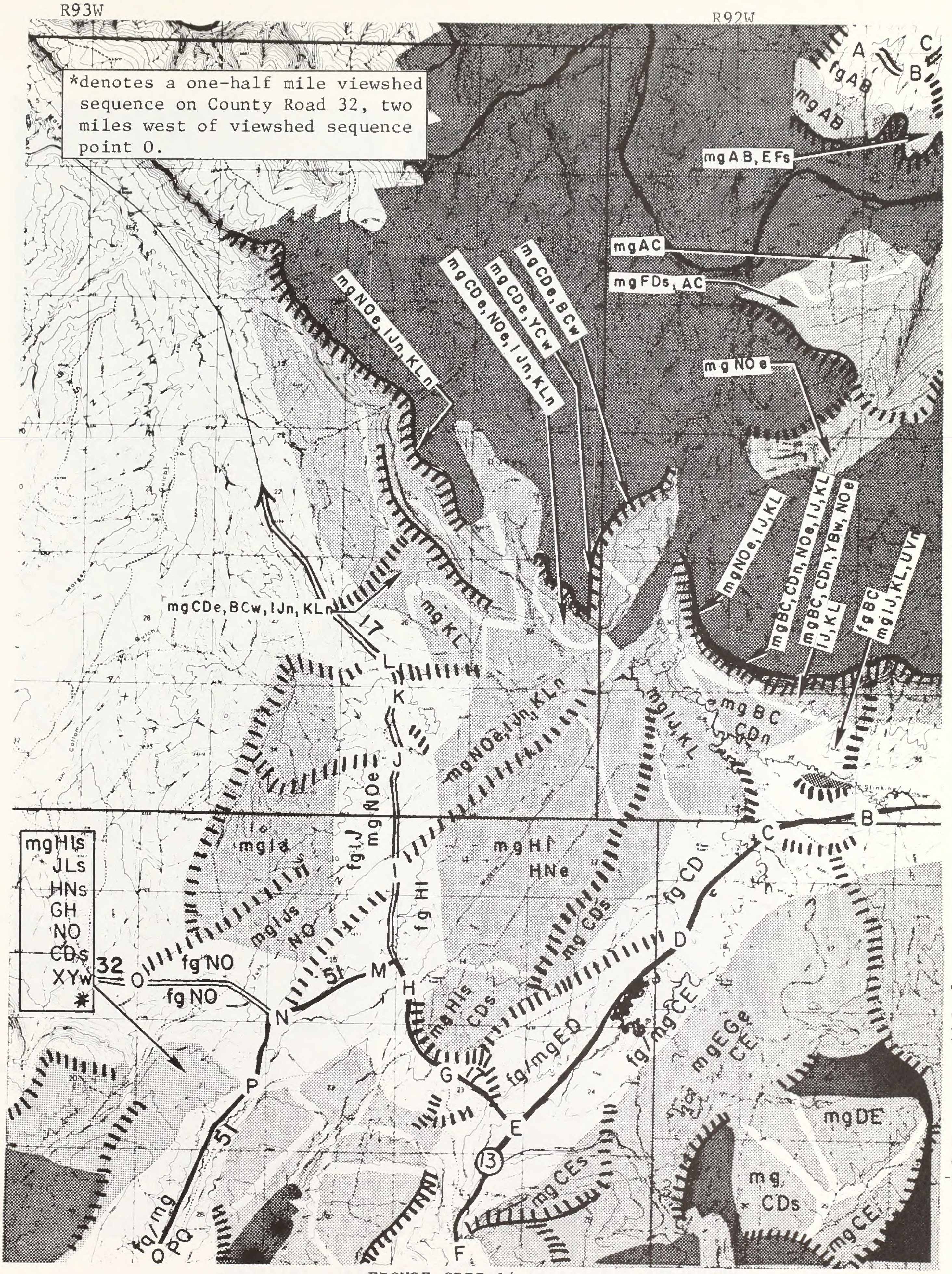
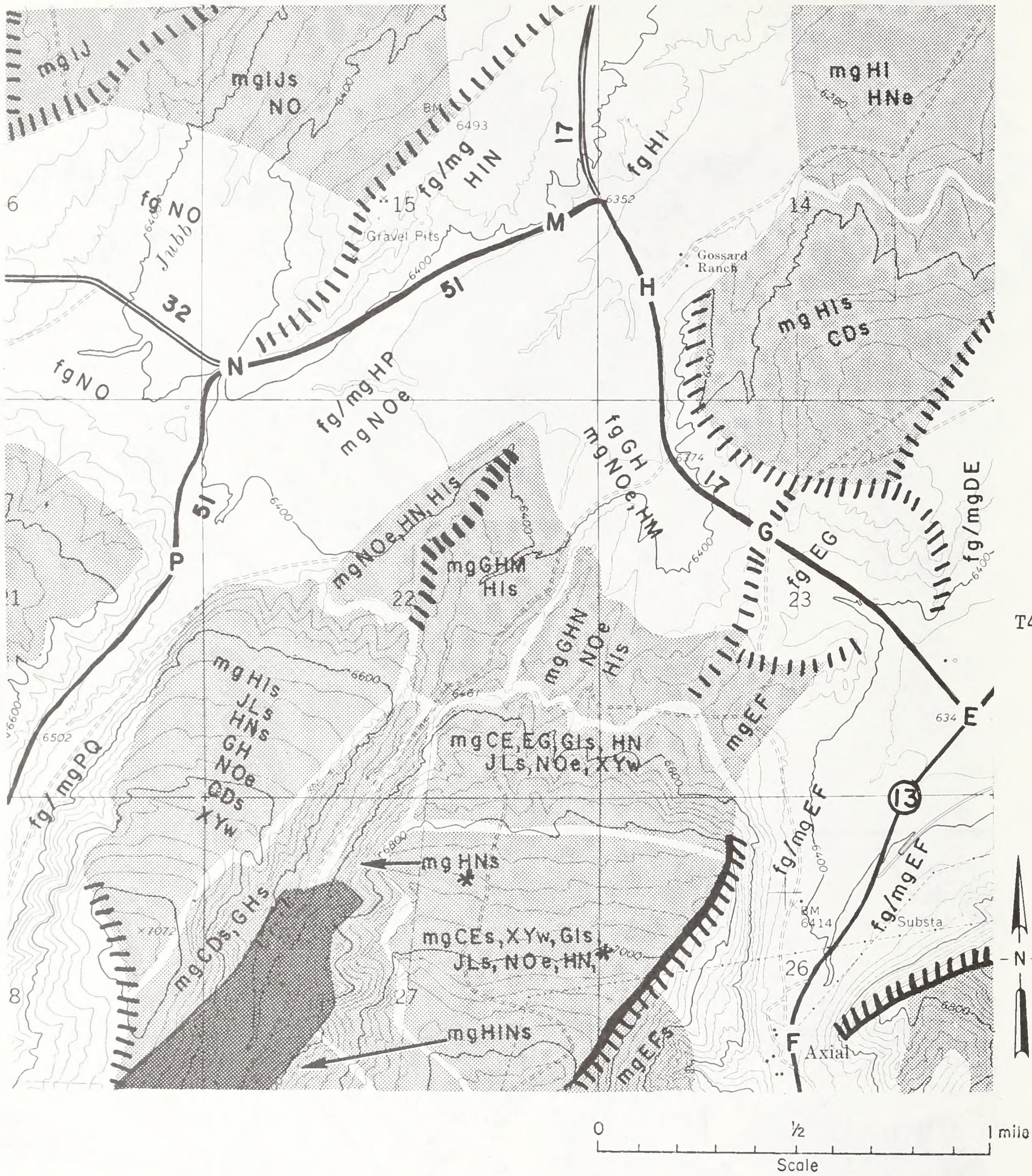


FIGURE GRII-14

Landscape visibility map for W.R. Grace railroad.

R93W

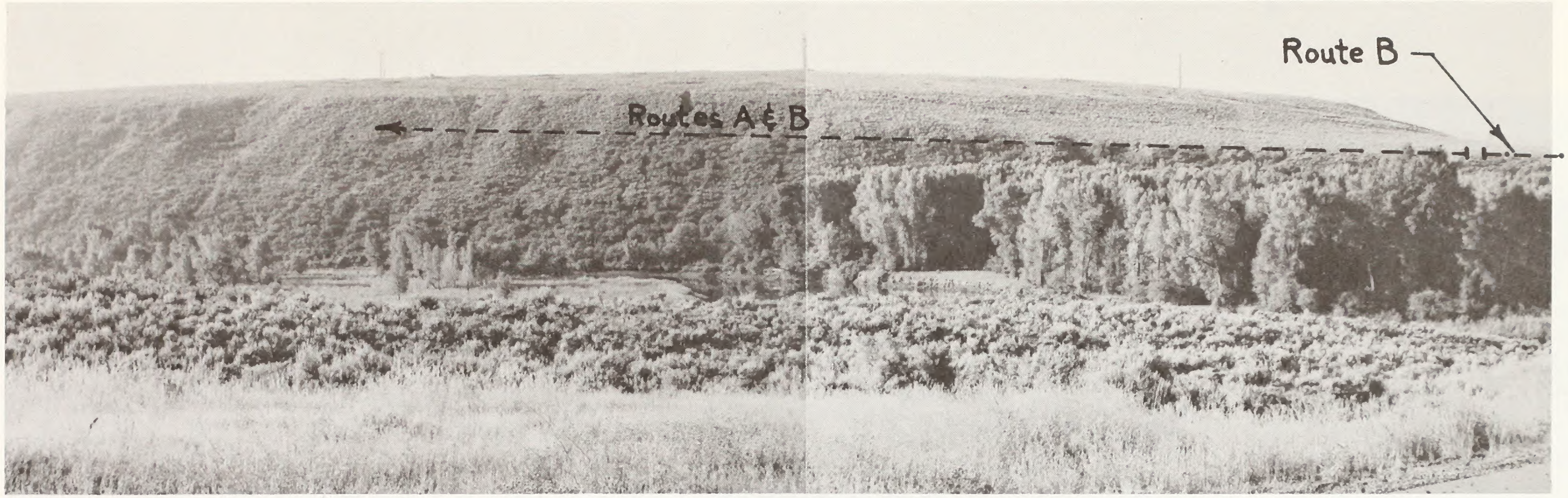


T4N

*denotes a one-half mile viewshed sequence on County Road 32 two miles west of viewshed sequence point O, (see Figure GRII-14).

FIGURE GRII-15

Landscape visibility map for W.R. Grace railroad.



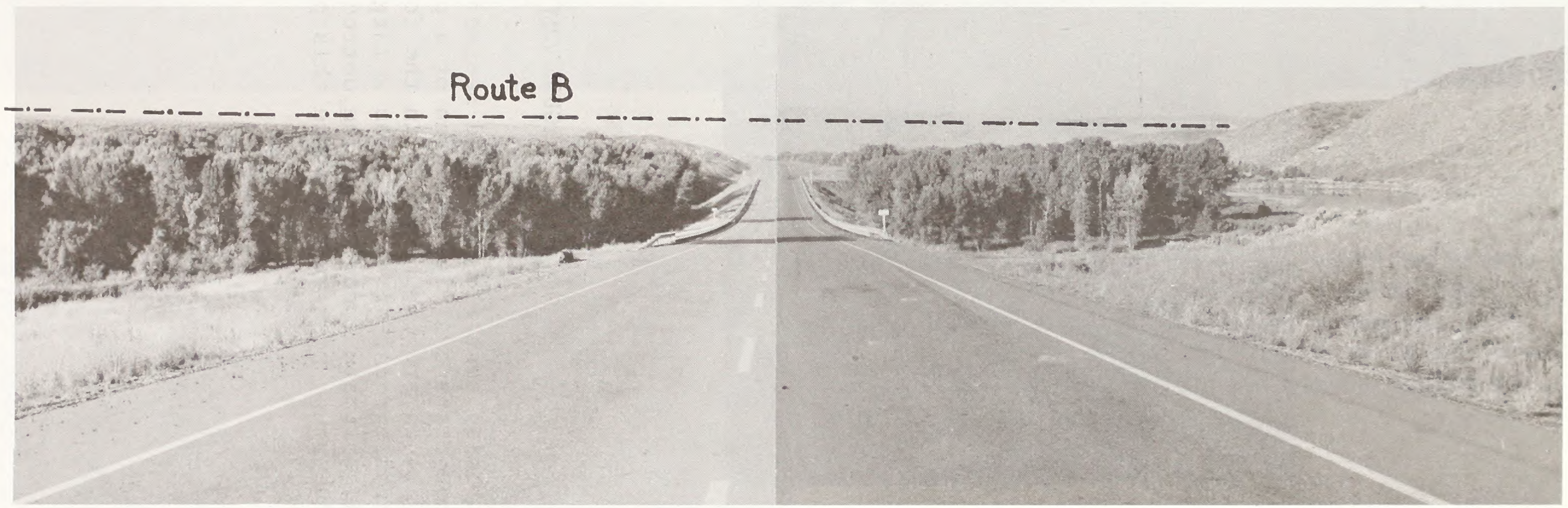


FIGURE GRII-16

Views to the existing Colorado-Ute railroad spur (constructed since this photo was taken) and the beginning of the proposed W. R. Grace Railroad (top photo) are available to southbound Colorado 13 motorists on viewshed sequence UV. Alternate Route B would cross the Yampa River to the right of the highway beyond the bridge (lower photo).

FIGURE GRII-17

Looking east from viewshed sequence VW on Colorado 13, motorists can view the area of a proposed 90 foot high fill on proposed Route A in the foreground. At middleground distances lies a large fill (in the approximate location of the dotted line) on the Colorado-Ute spur, constructed since this photo was taken.

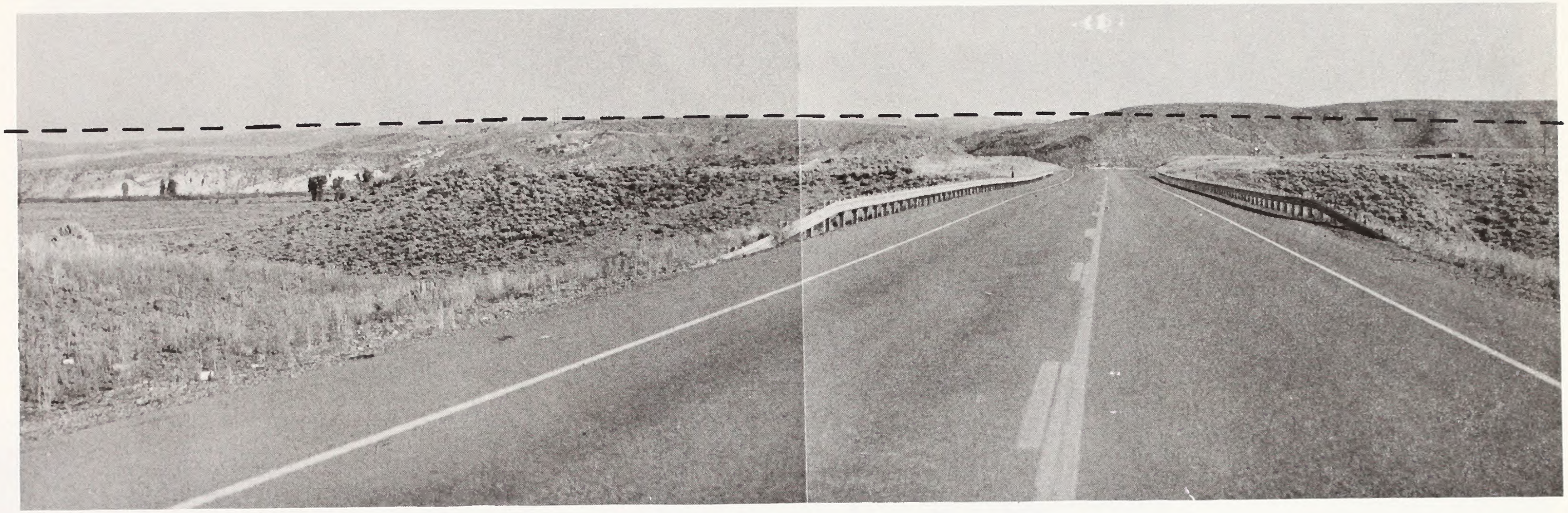


FIGURE GRII-18

Viewshed sequence VW also provides northbound motorists with this view of the proposed Route A railroad crossing; a 75 foot high fill would be placed in the draw immediately left of the highway guard rail.

FIGURE GRII-19

The proposed Route A would result in a 60 foot deep cut into the hillside immediately right of the highway in the foreground; this view from viewshed sequence WX can be seen by southbound motorists on Colorado 13.

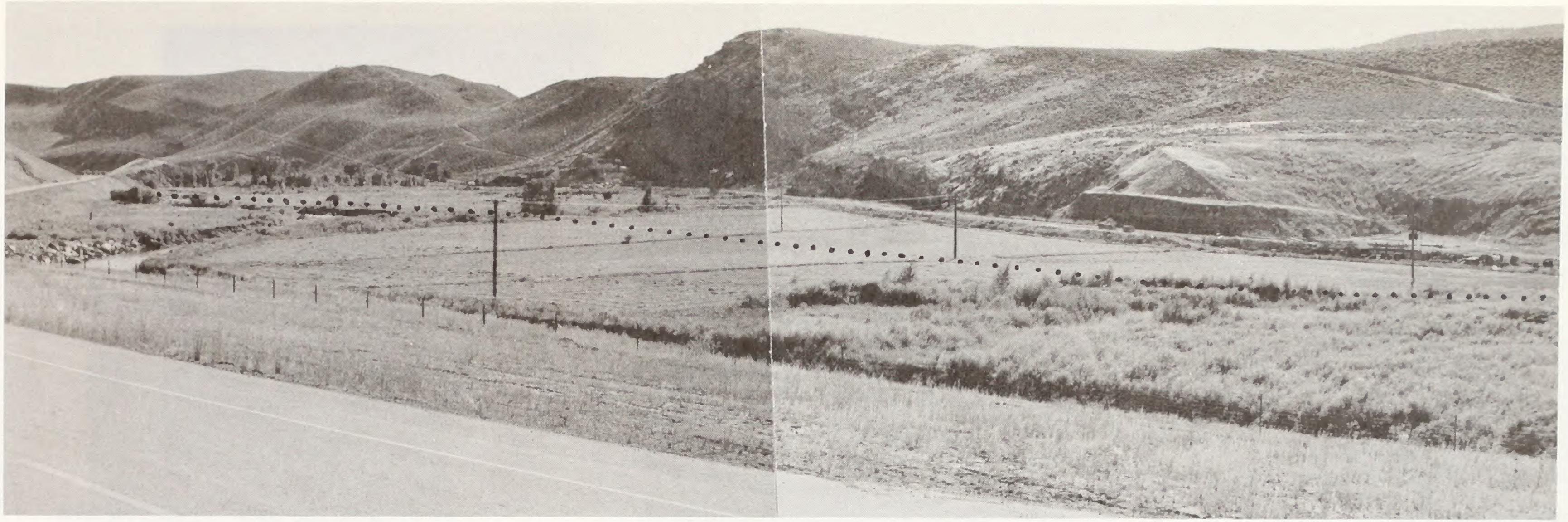


FIGURE GRII-20

Viewshed sequence ZA, adjacent to the Wise Hill 5 underground mine (formerly Selingo), provides this panorama of a rather enclosed landscape. The lower photo contains the proposed Route A crossing of the Williams Fork River. Alternate Route C would parallel the base of the hill opposite the river (top photo).

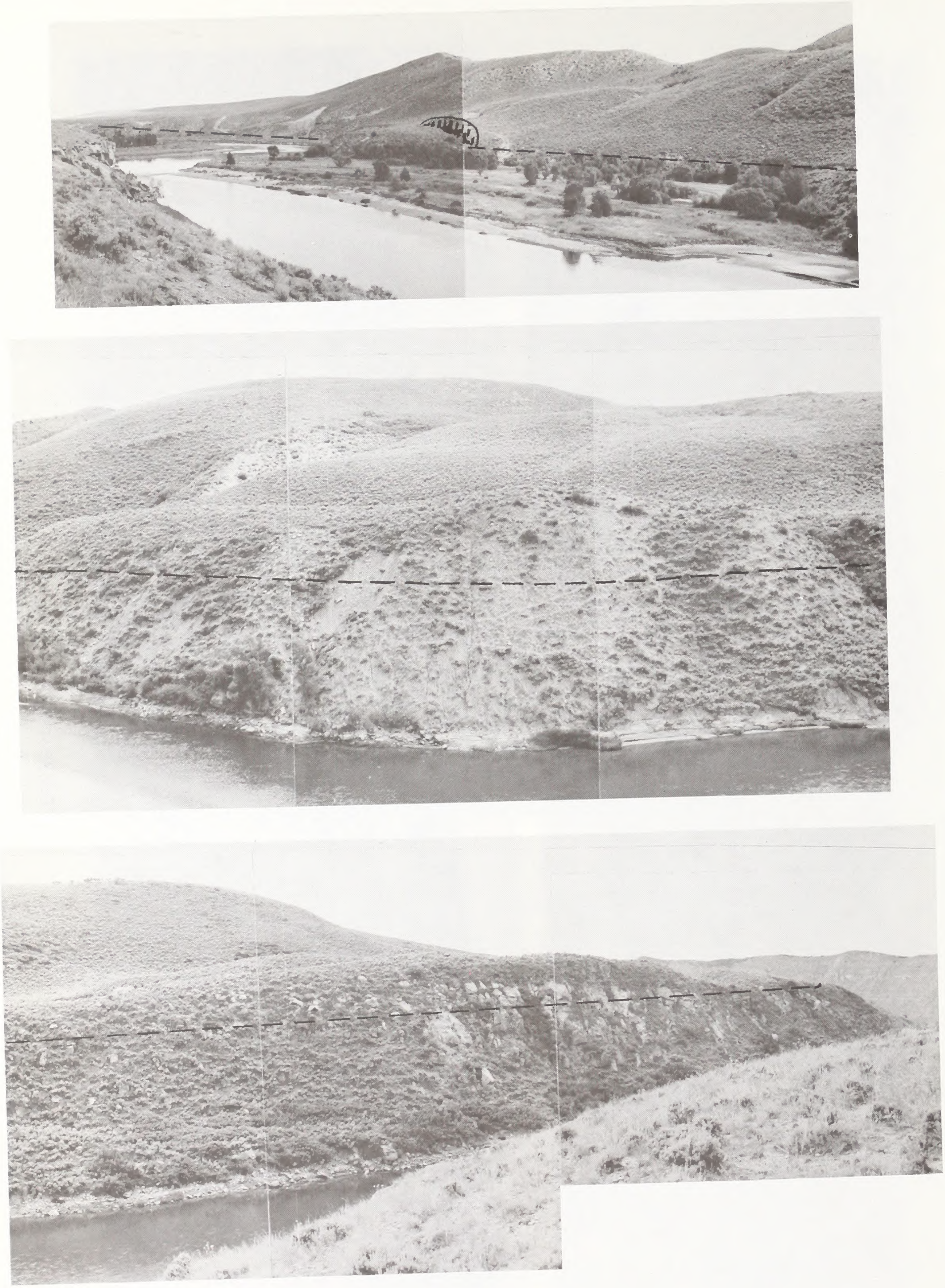


FIGURE GRII-21

Looking south at milepost A-6 adjacent to proposed Route A, this three-piece panorama shows the terrain that must be negotiated if this route is constructed.

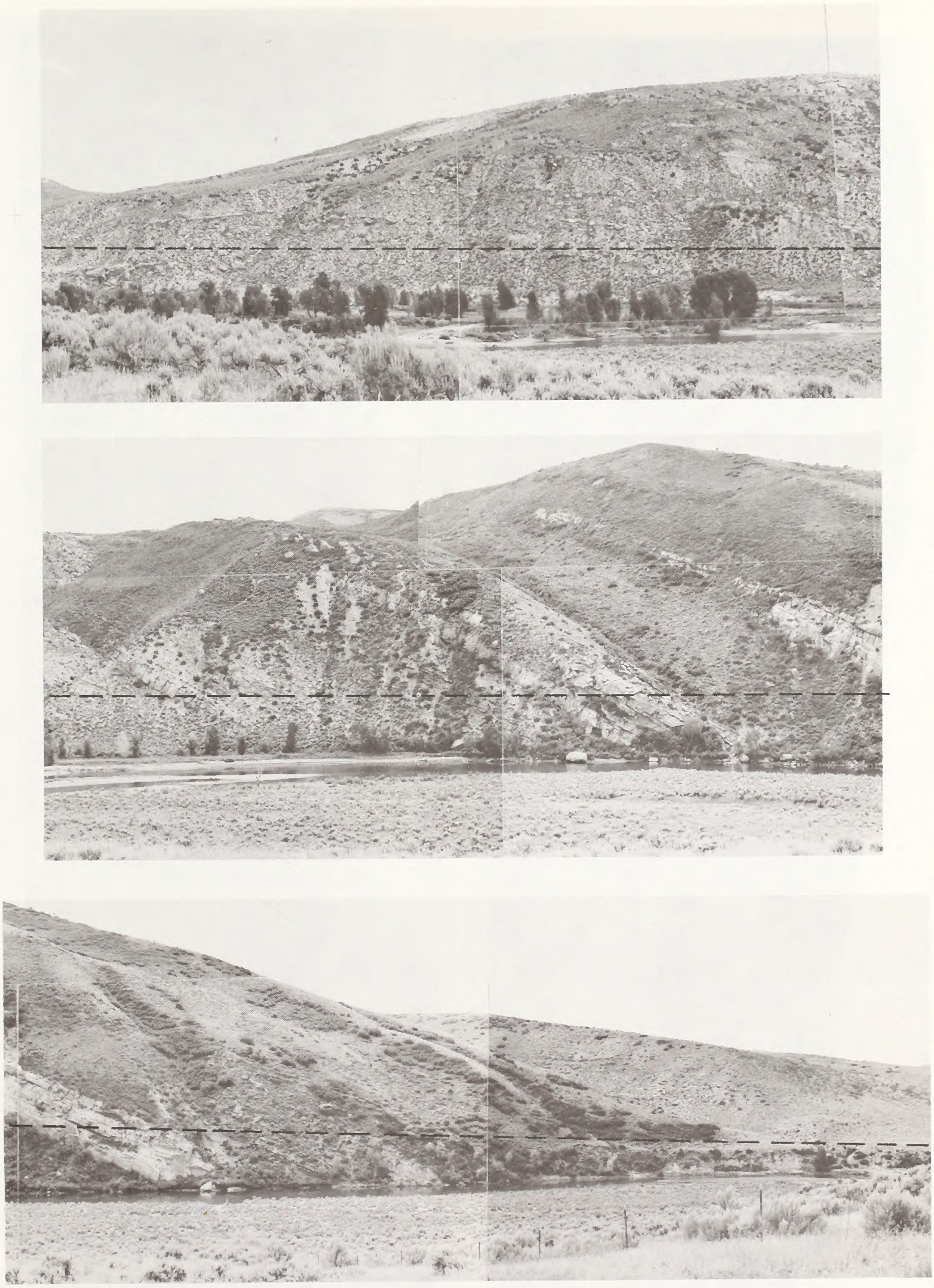


FIGURE GRII-22

Near milepost A-8 proposed Route A traverses these steep rock outcrops; one 50 foot and two 70 foot deep cuts would occur in this landscape visual unit. These are visible as foreground only from the river, but appear as middleground from County Road 30.

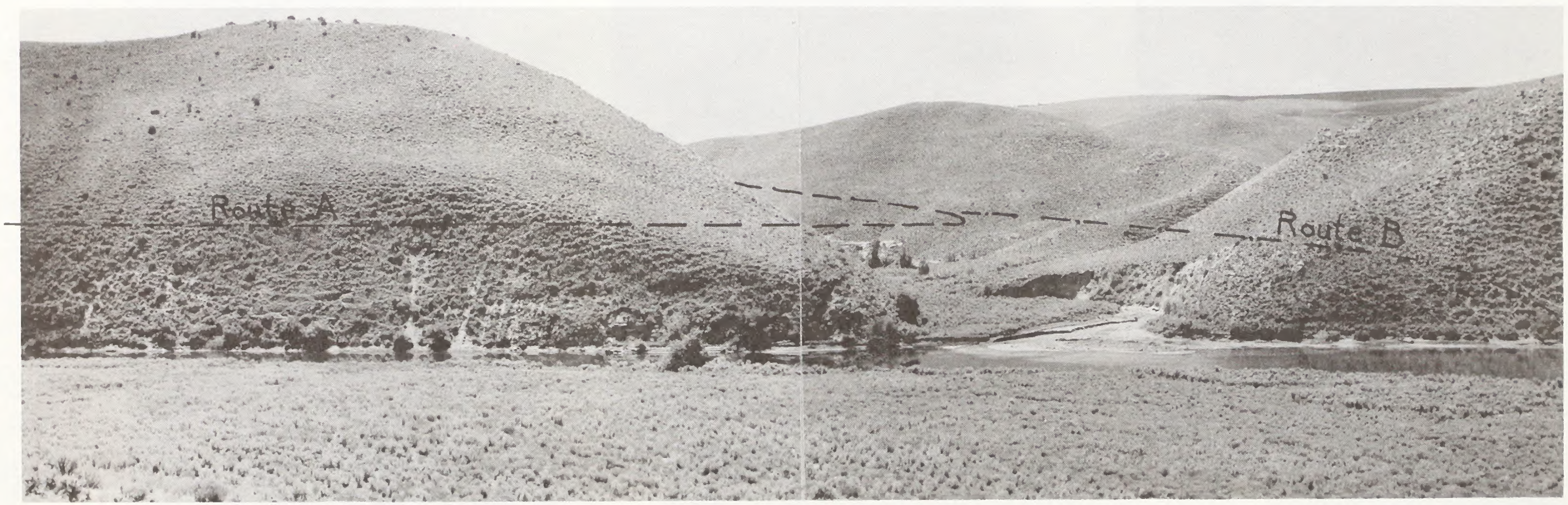


FIGURE GRII-23

The proposed alinement of Route A would cross the steep slopes visible in the upper photo and turn into the Milk Creek drainage (lower photo). A 55 foot deep cut would be necessary to negotiate this turn; the Milk Creek bridge would be 65 feet high. Alternate Route B would cross the Yampa River on a bridge of equal height, also visible in the lower photo.

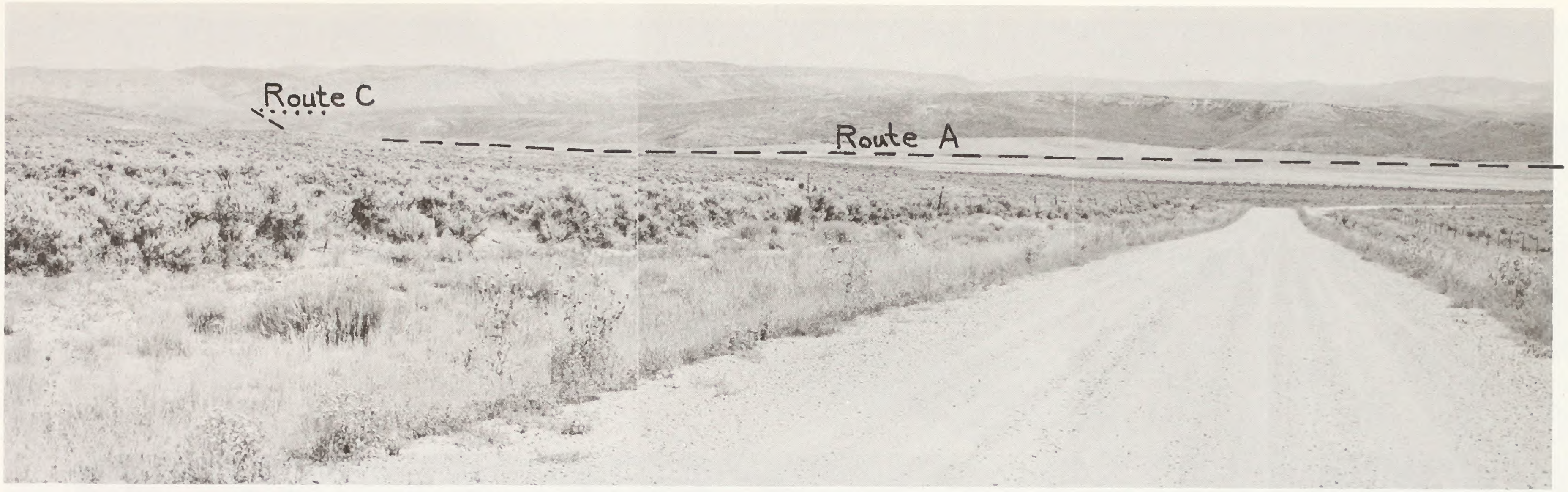


FIGURE GRII-24

Viewshed sequence NO on County Road 32 provides this east-looking view of the proposed railroad route; County Road 51, visible in the lower photo, would be crossed near its intersection with County Road 32.

FIGURE GRII-25

The proposed railroad alinement parallels County Road 51 at viewshed sequence NP, then turns left at the base of the distant sagebrush hill. It cuts through the small ridge (see left side of photo) before entering the loadout area in Taylor Creek Canyon.

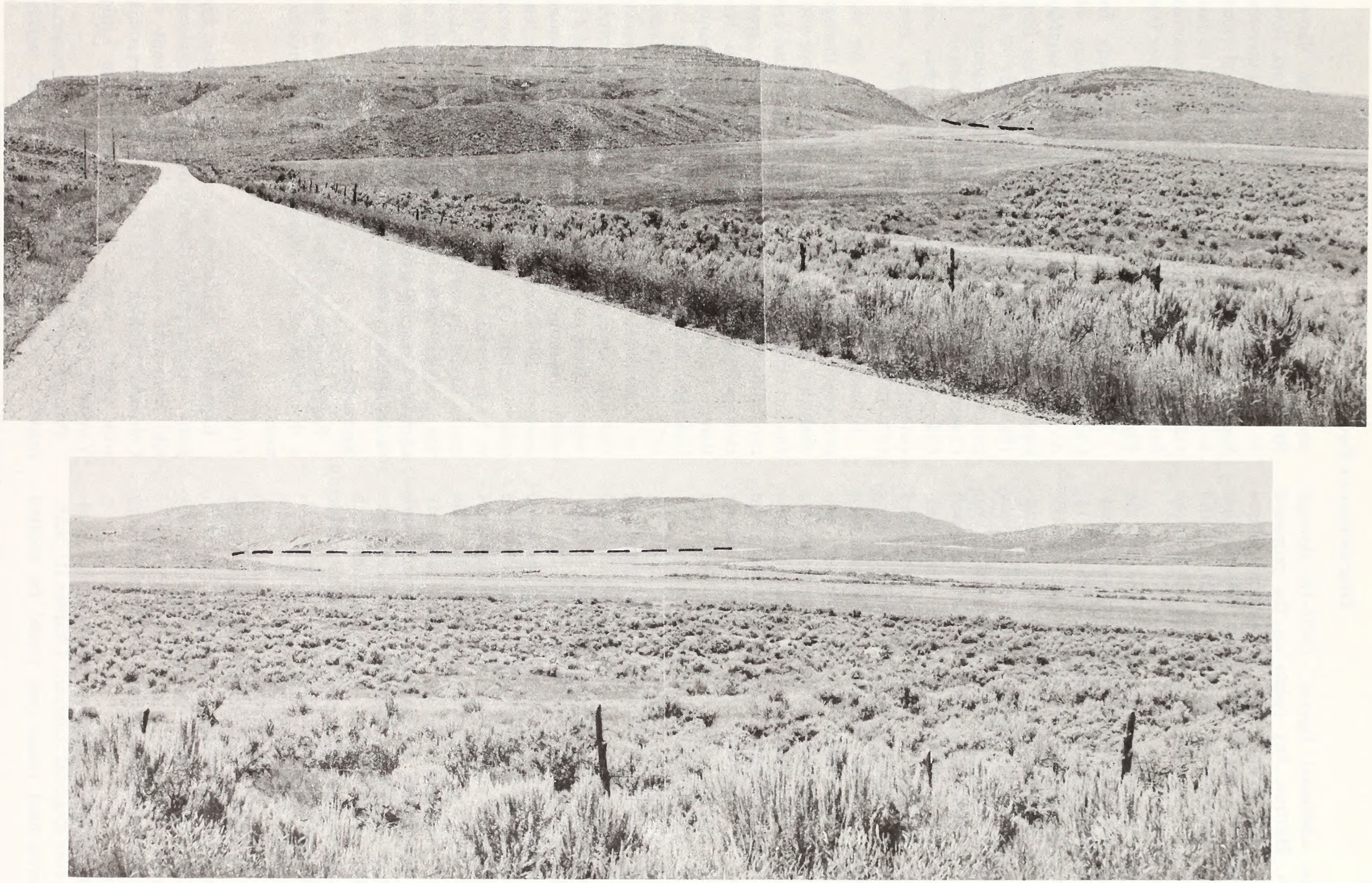


FIGURE GRII-26

This four-photo sequence from County Road 17 on viewshed sequence HG looks south towards Taylor Creek; the proposed railroad alinement is visible in the middleground in both photos.

Eleven additional figures, GRII-16 through GRII-26, illustrate key points on the proposed Route A. Also, Figure GRII-1 is an aerial oblique photograph that shows the steep hillside that would be traversed by proposed Route A, and Figure GRII-22 shows the same hillside as seen from the river.

The most visually sensitive portions of the proposed route would include foreground landscape visual units along Colorado Highway 13; these can be seen from viewshed sequences UV through ZA (see Figure GRII-12). Pastoral landscapes in the Big Bottom area, and rolling sagebrush types characterize these units. Two ranches lie immediately adjacent to viewshed sequence WX. Mixed foreground and middleground landscapes visible from viewshed sequence VW reveal a powerline and pumping station adjacent to the Yampa River. Recent road building and other construction activities are visible at the site of the new Colorado Ute generating plant (see Figure GRII-12). The most obtrusive existing minus deviations are the powerline and Highway 13, because they do not borrow dominance elements (i.e. form, line, color, and texture) from the characteristic landscape.

Foreground units adjacent to County Roads 17, 32, and 51 provide visual access to the proposed railroad terminus. Few visual intrusions occur in this typically rolling sagebrush landscape containing scattered farm lands (see Figure GRII-26).

Less visually sensitive middleground landscape visual units in the Round Bottom area, traversed by Route A, are visible from viewshed sequences AB, BC, DE, and EF on County Road 30. This somewhat enclosed landscape contains relatively greater topographic and vegetative variety with few minus deviations. After the route emerges from Milk Creek Canyon it would enter both foreground and middleground landscapes visible from viewshed sequences NO (County Road 32), IJ, and KL (County Road 17). Where the route enters Taylor Creek drainage, it would also traverse middleground landscapes that are visible from viewshed sequences along County Roads 17, 32, and 51. The route does not traverse any background landscapes, and no portion of the route in Milk Creek Canyon is visible from any public road.

If the proposed Juniper Reservoir is constructed (see Regional Analysis, Chapter II), additional foreground landscapes would be created along ten miles of the route, from the Yampa River's confluence with the Williams Fork River to its confluence with Milk Creek, otherwise known as Little Yampa Canyon. Continual visual access to this portion of the route would be provided to recreational boaters on the reservoir from approximately nine viewshed sequences (see Figures GRII-21, 22, and 23).

Traffic volume data are available only for Colorado Highway 13 and U.S. Highway 40. Average Daily Traffic (ADT) on all five sampled highway segments reflect an overall increase from 1965-1974 (Table GRII-7). U.S. Highway 40 experienced a smaller increase than any segment of Colorado Highway 13, and that portion of Colorado 13 that parallels the route has consistently experienced greater increases from 1970-1974 than from 1965-1970.

Estimation of potential boating use on the proposed Juniper Reservoir is possible through analyzing use at a comparable-sized reservoir with similar climatic conditions, similar shoreland unit capabilities, and at similar distances from metropolitan population centers. Curecanti National Recreation Area in Gunnison County, Colorado, meets these requirements. During the 1974 season 42,975 boating visits were recorded on Curecanti's Blue Mesa Reservoir. Similar visitation may be expected at Juniper Reservoir, which equals an average daily boating use of 175 visits (assuming an eight-month ice-free boating season), that would have visual access to the ten-mile segment of Little Yampa Canyon proposed to be traversed by the railroad. (Visitor-use estimates based on surface acreage were not used in this analysis, as this would reflect the recreation-carrying capacity which would only be realized under optimum conditions).

Recreation

Refer to Chapter II of the Regional Analysis for a discussion of the regional recreation environment.

Resources

Especially significant autumn and winter big game concentrations (largely deer and occasional elk) constitute significant viewing adjacent to Colorado Highway 13 between its intersection with County Roads 49 and 148, and in Little Yampa Canyon southwest of Craig.

Privately-owned acreage lying between national resource lands and public access routes largely

TABLE GRII - 7

Average Daily Traffic (ADT) Volumes

Sampling Segment	Sampling Year	ADT	Average Annual Increase(%) 1/ 2/	3/
U.S. 40 West of Craig	1965	1,500		
	1970	1,550	.66	1.73
	1974	1,750	3.08	
Colorado 13 South of Craig	1965	1,150		
	1970	1,500	5.46	3.00
	1974	1,500	0.00	
North of Hamilton	1965	700		
	1970	690	-0.29	3.69
	1974	970	8.89	
South of Hamilton	1965	650		
	1970	670	0.61	3.68
	1974	900	7.66	
North of Ninemile Gap	1965	380		
	1970	430	2.50	7.52
	1974	730	14.15	

1/ compounded annually.
2/ average annual increase between sampling years.
3/ average annual increase for nine-year period.

SOURCE: Colorado Division of Highways, Traffic Volume Maps; 1965, 1970, and 1974.

precludes public hunting. However, hunting access to Duffy Mountain is maintained via County Road 17, and a solid block of public land extends to Iles Mountain and does allow for walk-in hunting, though no road access is available across Milk Creek. See Regional Analysis, Chapter II, for hunting use statistics.

A small year-long antelope herd is found in the Bell Rock Gulch area southwest of Craig; County Road 30 provides visual access to this area for wildlife viewing.

Six sage grouse strutting grounds and one sharptail grouse dancing ground lie in the general area of the proposed railroad. Access to three of these is maintained by county roads: County Road 30 provides visual access to two sage grouse strutting grounds in Sections 26 and 35, T.5N., R.93W, and Colorado Highway 13 secures visual access to another strutting ground in Section 21, T.6N., R.91W.

Scattered raptor nesting in Little Yampa Canyon and along Williams Fork River constitutes another dimension in wildlife viewing opportunities. See Chapter II, Terrestrial Fauna, for a more complete description of wildlife resources.

Significant recreational fishing opportunities occur in both the Yampa and Williams Fork Rivers; both lie in land units having a moderate capability to attract and sustain recreation use. The setting of the Yampa River (in the Canyon) is especially conducive to realizing its recreational capabilities. No public access is guaranteed on either river; however, the Colo. DOW indicates that 50 percent of this portion of Yampa River is open to the public (see Regional Analysis, Chapter II). Marginal fishing opportunities occur in Milk Creek (see Figure GRII-27). See Chapter II, Aquatic Fauna, for a more complete description of fisheries.

Figure GRII-27 displays the relative inherent recreational capabilities of the various land units surrounding the proposed railroad route and two alternate routes. This rating pertains to existing recreation resources and does not imply management.

Refer to Chapter II, Archeological and Historical Resources, for a detailed evaluation of cultural resources; the recreation capability classification referenced indicates their capacity to attract and sustain recreational use based on their human-interest, interpretive, or educational values.

Public Law 93-621, January 3, 1975, amends the Wild and Scenic Rivers Act (P.L. 90-542) to designate certain river segments for possible inclusion in the system; that portion of the Yampa River lying within the boundaries of Dinosaur National Monument is included. Related to the Act itself, but not to this specific amendment of it, is an inherent "Scenic" classification potential for the Little Yampa Canyon section of Yampa River (through which Routes A and B run). Note that this observation is based purely on known resource values and not on either feasibility studies nor proposed legislative enactments.

Natural values of the Little Yampa Canyon area have been recognized in the BLM Williams Fork Management Framework Plan (MFP) 1974; the document (MFP Step III) tabled action on several recommendations pending the outcome of the proposed Juniper Reservoir. Recommendations were made to establish the area as a natural area and to make it available for public recreation use by acquiring legal ingress and egress for floatboating. This was based on its potential for rockhounding, geologic interpretive study, wildlife viewing, and river floating capabilities, as well as its relatively undisturbed terrain.

Recreation Capability Classification

Legend for Figure GRII-27

I. Capability Classes:

(Capability to attract and to accommodate recreation)

Class 1 - Very high; intensive activities
2 - High; intensive activities
3 - Moderately high; intensive activities
4 - Moderate; dispersed activities
5 - Moderately low; dispersed activities
6 - Low; dispersed activities
7 - Very low; dispersed activities

II. Sub-Classes:

(Recreation resources)
A - angling
C - canoeing/floatboating
E - interesting vegetation
H - cultural resources (historic and archaeologic)
J - rockhounding
K - organized camping
M - small water bodies
O - viewing upland wildlife
P - agricultural interest
Q - topographic - landscape variety
R - rock formations
V - panoramic view
W - waterfowl viewing
XS - snowmobiling

Existing Recreation Developments

Figure GRII-28 shows two private big game hunting operations in the area of the proposed railroad (see Chapter IV Regional Analysis): the Ellgen ranch, 1,936 acres, and the Camilletti

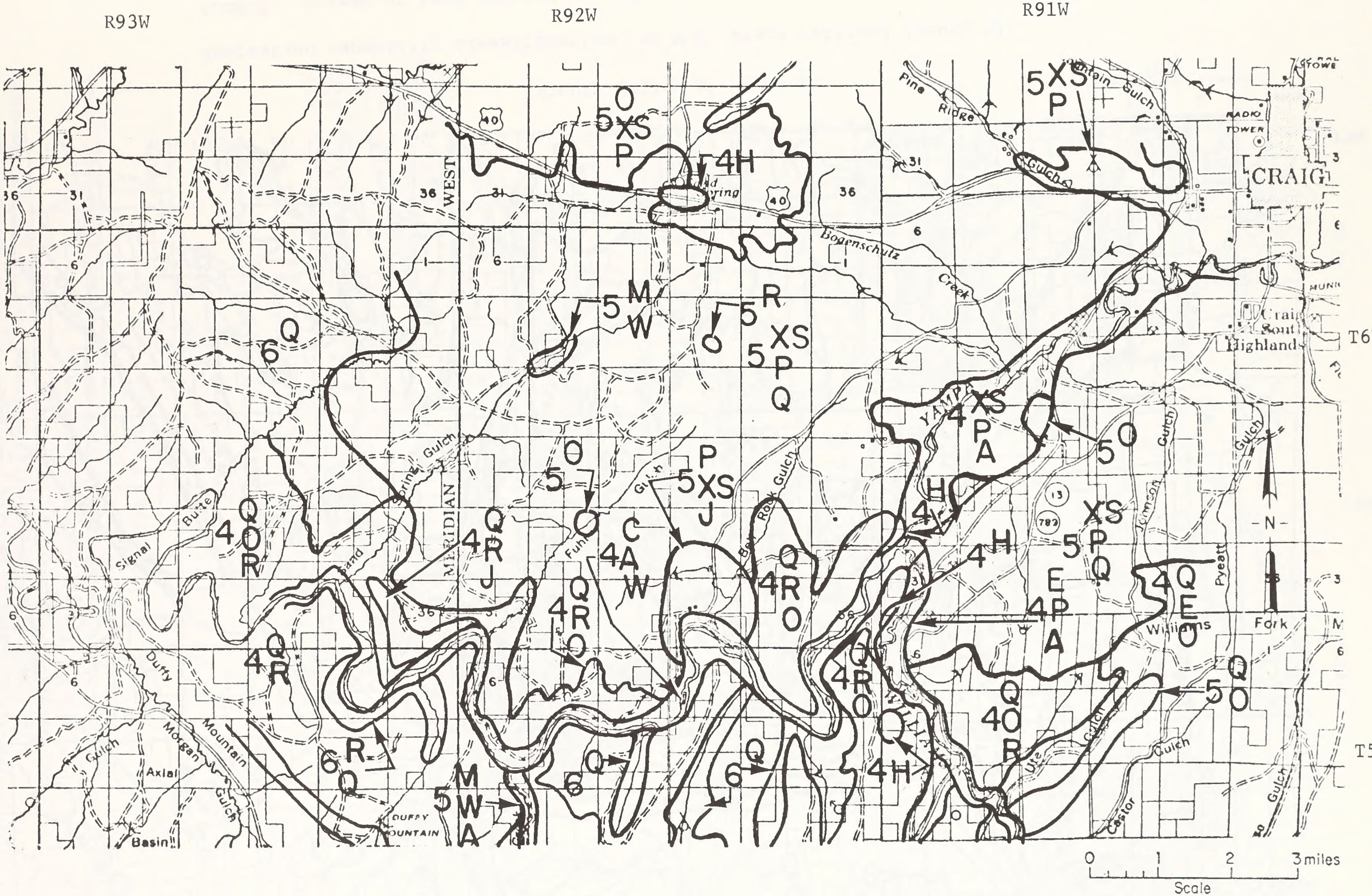


FIGURE GRII-27

Recreation capability classification for W.R. Grace railroad (north ½).

SOURCE: Bureau of Land Management, Williams Fork URA, 1974

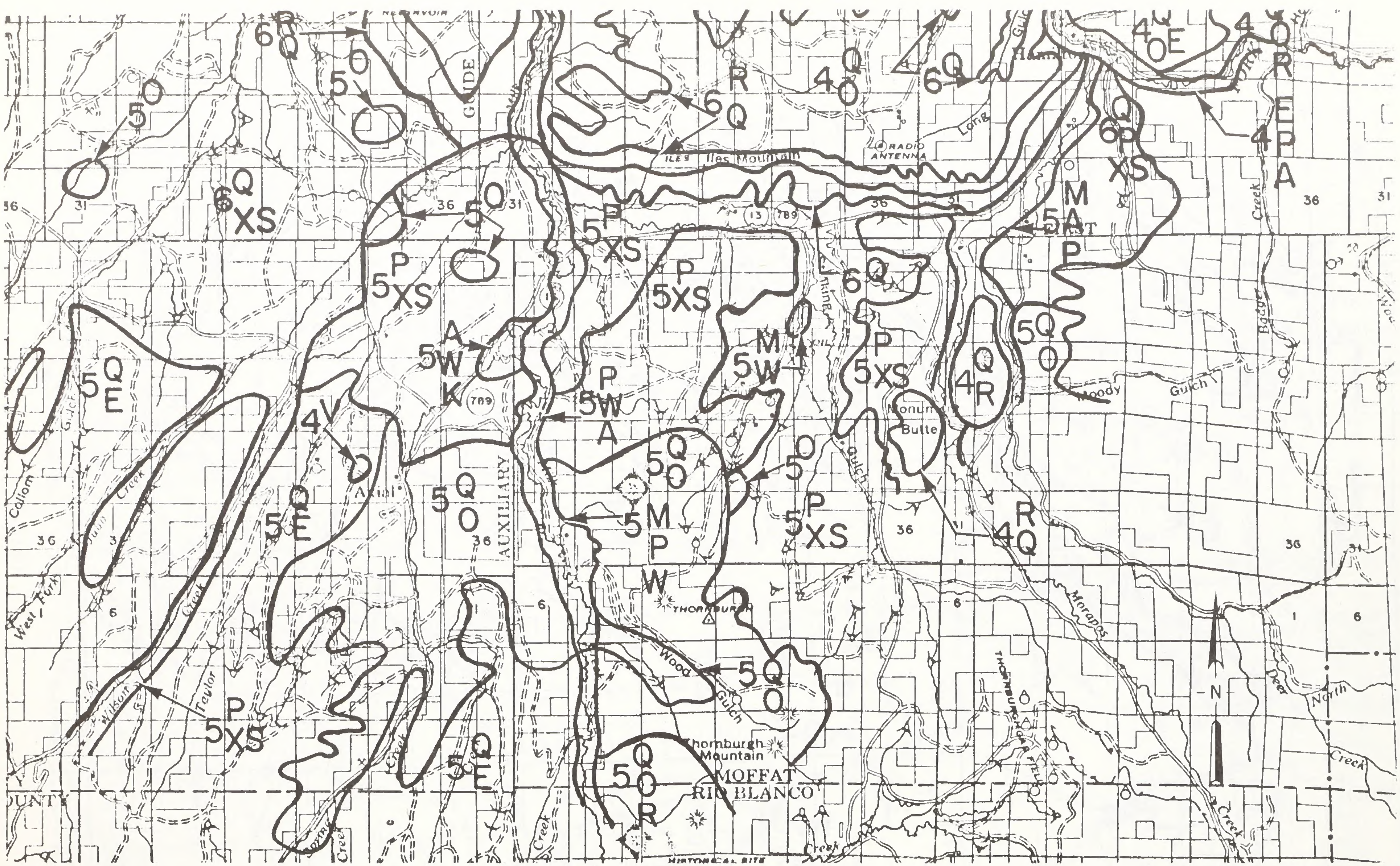


FIGURE GRII - 27 (Cont'd)

Recreation capability classification for W.R. Grace railroad (south ½).

SOURCE: Bureau of Land Management, Williams Fork URA, 1974

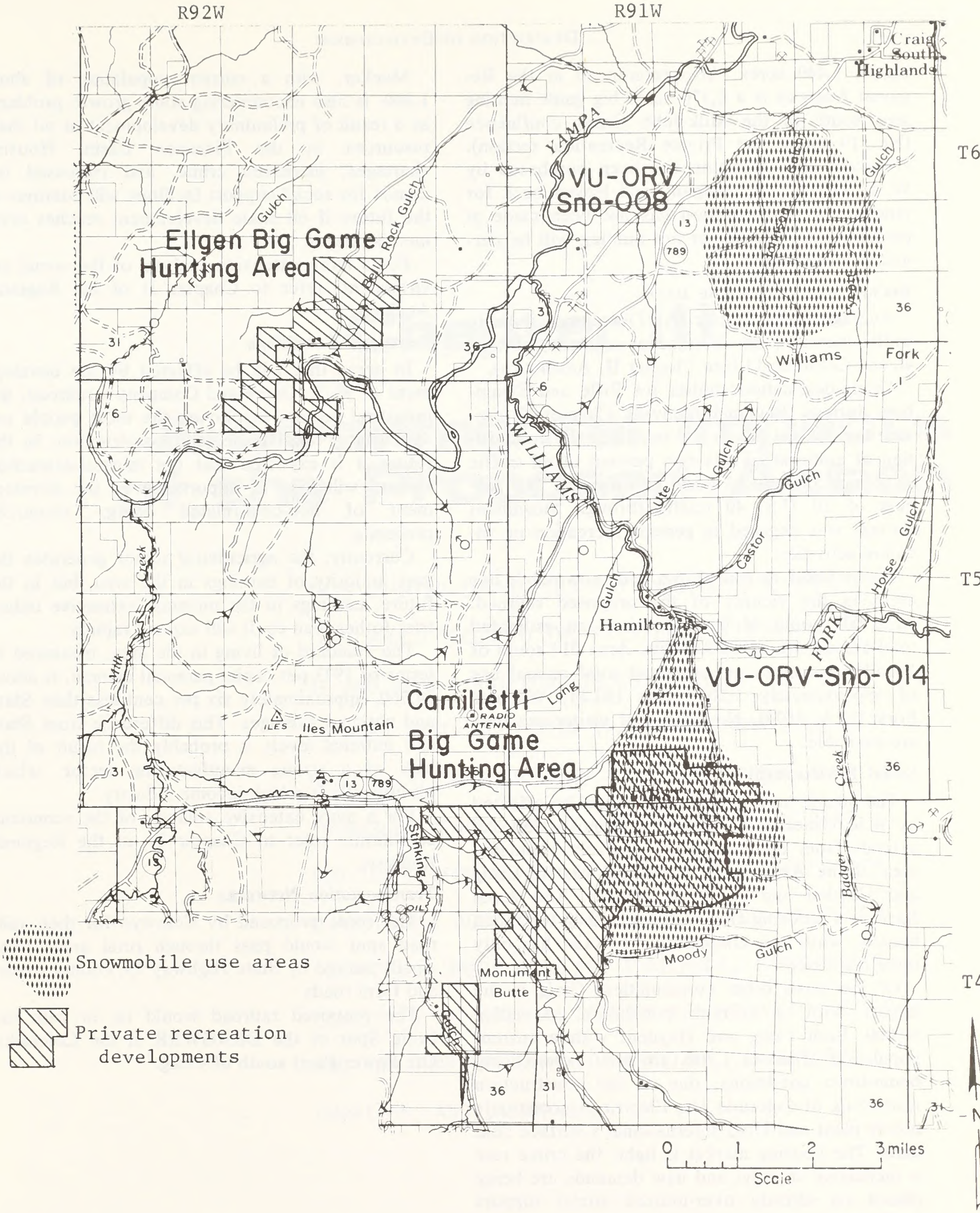


FIGURE GRII -28

Privately owned-and-operated developments and visitor-use at the proposed W.R. Grace railroad area.

SOURCE: Bureau of Land Management, Williams Fork URA, 1974
Soil Conservation Service, NACD Private Recreation Inventory, 1974

ranch, 1,440 acres. Also referenced in the Regional Analysis is a 6,370 acres big game hunting area south of the Milk-Jubb Creek confluence (No. 19 under the Private Recreation section). However, this operation has been purchased by W. R. Grace and Company and leased back for ranching; a determination has not been made at present as to whether or not hunting will be permitted in the future.

Recreation visitor-use data

Average Daily Traffic (ADT) volumes indicate traffic increases on all adjacent segments of U.S. 40 and Colorado 13 (see Chapter II, Aesthetics).

Origin-destination studies for Rifle and Steamboat Springs (Regional Analysis, Chapter II) provide the nearest points for analyzing the composition of motorists. Forty-two percent of all traffic traveling Colorado 13 north of Rifle and 29.5 percent of all U.S. 40 traffic through Steamboat Springs was engaged in general recreation or vacation activities.

Figure GRII-28 also shows two snowmobile use areas in the vicinity of the proposed railroad. Area 008 south of Craig receives an estimated total annual use of 1,260 visits. Area 014 south of Hamilton receives an estimated total annual use of approximately 1,200 visits (BLM, Williams Fork URA, 1974). No additional visitor-use data are available.

Social Environment

The social environment that would be affected by W.R. Grace and Company's proposed railroad extends from the immediate, sparsely populated area of the Axial Basin north and east to Craig and Hayden and south to Meeker. The Axial Basin is a ranching area with fewer than ten ranch houses, while the community of Axial has only three residences.

Of the three other communities, Craig is the largest with a current population exceeding 10,000. Both Craig and Hayden, with a current population of about 1,700, are now experiencing boom-town conditions, due to the construction near Craig of Colorado Ute Electric Association's power plant and Utah International's surface coal mine. The housing market is tight; the crime rate is increasing sharply; and new demands are being placed on already over-utilized social support facilities (e.g., water and sewer treatment, schools, etc.). This condition will probably continue until 1979 when the power plant construction will be completed.

Meeker, with a current population of about 1,800, is also encountering some growth problems as a result of preliminary development of oil shale resources in the Piceance Basin. Housing shortages, increased crime, and increased demands for social support facilities will continue in the future if oil shale development reaches commercial stages.

For a more extensive analysis of the social environment, refer to Chapter II of the Regional Analysis.

Economic Conditions

In areas that will be affected by the development of W. R. Grace and Company's railroad, the industrial sectors employing the most people are agriculture, retail trade, and construction. In the future it is expected that the mineral-extracting sectors will gain in importance as the development of non-coal-related energy resources proceeds.

Currently, the agricultural sector generates the vast majority of earnings in the area, but in the future, earnings in the minerals extractive industries (other than coal) will expand rapidly.

The standard of living in the area, measured in terms of 1973 per capita personal income, is about $4,700, approximately six per cent less than State and national averages. This difference from State and national levels is probably the result of the lack of a strong manufacturing sector, which traditionally is a high-income industry.

For a more extensive analysis of the economic conditions, refer to Chapter IV of the Regional Analysis.

Transportation Networks

The route proposed by Colowyo for their railroad spur would pass through rural areas principally served by State Highway 13, county roads, and farm roads.

The proposed railroad would tie in with the Craig Spur of the D&RGWRR at the Colorado-Ute Power Plant south of Craig.

Chapter III

Environmental Impacts of the Proposed Action

THIS CHAPTER IDENTIFIES AND ANALYZES THE IMPACTS THAT WOULD OCCUR TO THE EXISTING ENVIRONMENT IF AND WHEN A RAILROAD IS CONSTRUCTED. IT IS ASSUMED IN THIS CHAPTER THAT NO EFFORTS WILL BE MADE TO MITIGATE IMPACTS. IN THIS MANNER ALL PROBABLE IMPACTS CAN BE IDENTIFIED AS THE BASE FOR THE DETERMINATION OF MITIGATING MEASURES AND UNAVOIDABLE ADVERSE IMPACTS IN THE TWO SUCCEEDING CHAPTERS. WHERE DATA ARE AVAILABLE, IMPACTS ARE LINKED TO SPECIFIC ASPECTS OF THE PROPOSED ACTION AND ARE QUANTIFIED AS TO MAGNITUDE, INTENSITY, DURATION, AND INCIDENCE.

Non-living Components

Geologic and Geographic Setting

TOPOGRAPHY

The proposed railroad route would impact the topography by adding cuts and fills. Part of these fills would encroach on the Yampa River. Riprap needed for these and similar fills, derived from local materials, is estimated by Morrison-Knudsen (Feasibility Study, October 1974) to be 21,400 cubic yards.

Two areas along the proposed route would require 70-foot cuts with the median cut on the entire route being less than 20 feet. Maximum fill would be about 90 feet at one location, and the median fill on the entire route would be about 15 feet.

STRATIGRAPHY AND STRUCTURE

The only impacts the railroad would have on stratigraphy and structure of the area would be beneficial, in that the numerous cuts would furnish good exposures for study.

PALEONTOLOGY

Adverse impacts to fossils would occur if they are destroyed in construction of the railroad. Given the character of the stratigraphic section, it is likely that at least some invertebrate fossil destruction would occur; proposed Route A traverses four fossiliferous formations: Mancos Shale, Iles Formation, Williams Fork Formation, and the Lewis Shale. Beneficial impacts would occur if unearthed fossils were collected and studied. The stratigraphic section is only moderately likely to yield significant fossils when compared to other areas of the study region.

GEOLOGIC HAZARDS

Certain parts of the routes would be potentially hazardous to the construction and/or maintenance of the railroads. The company's environmental report makes this statement:

> Geologic hazards considered significant to the project are seismic shaking, surface faulting, slope stability, foundation stability, and flooding.

The most obvious potential hazards would be rockfalls, mudflows, landslides, and slumps along steep canyons and cuts. Evidence of instability in the Williams Fork Formation is an existing landslide deposit along the proposed route, between 1.7 and 2.0 miles downstream from the mouth of the Williams Fork River. Flooding streams could undercut the roadbed. Flash-floods could cause maintenance problems where the railroad crosses small streams, such as Ralston Draw, which drains part of Iles Mountain and crosses the proposed railroad before joining the Yampa River.

A potential hazard to the completed and operating railroad would be possibility of earthquakes, which could cause failure of the railroad's subbase, as well as cause landslides and rockfalls. This possibility is considered to be rather remote, as indicated in the environmental report written for the company:

> The region is a relatively quiet seismic area and is within a zone of minor seismic risk. Five earthquakes of Maximum Modified Mercalli Intensity V (estimated) have occurred within 100 miles of the site [during the past 100-125 years].

Earthquakes of such intensity are widely felt but cause very minor damage.

However, a possible source of additional earthquake activity might be present in a few years. Depending on the geology and stress field of the site of the proposed Juniper-Cross Mountain Project, the increased hydrostatic load of the reservoir could increase the potential for earthquakes. The company's environmental report takes note of the hazard of placing the roadbed on deep alluvium:

> Foundation instability in deep alluvium may be a hazard, especially under high fills. Saturated alluvium subject to vibrations or cyclic stress from loaded trains may cause liquifaction. Marshy, low, alluvial deposits may have to be over excavated and recompacted.

Earthquakes would increase the hazard of vibrations affecting saturated alluvium in fills.

Mineral Resources

COAL

A beneficial impact would be increased accessability of the coal in the region, particularly the coal in the Danforth Hills region. An adverse impact could be the interference with future development of coal along the route itself. The amounts affected, however, would be small. Fires might start in coal seams exposed in cuts.

GRAVEL

Ballast for the railroad roadbed would be obtained from a pit south of Craig, presumably in the SW ¼ Section 7, T.6N., R.90W. Use of this gravel would reduce the region's gravel resources by about 92,000 cubic yards.

Water Resources

GROUND WATER

The proposed railroad would impact availability of ground water in the area if any existing wells fall within the right-of-way. None are now known nor are shown on available maps. Also, the railroad would have minor local effects on recharge and discharge of ground water, the net effect of which would be negligible.

The only significant impact related to ground water would be slope instability in cuts that intercept the water table. When the water table is interrupted, a new point of ground water discharge is created with local upward flow of ground water. This upward flow reduces the cohesiveness of the material through which the water is moving. Cuts in the Lewis Shale would be the most likely to cause problems, because the rock has a history of instability.

SURFACE WATER

The principal impact on surface water would be the increase in sediment yield due to the construction of the railroad. This would be from two principal sources: (1) cuts and fills required by construction, and (2) channelization of the streams where the railroad encroaches on them.

Sediment yield as the result of cuts and fills would depend on the erodability of the material and the transport efficiency from the source to the stream. Along 82 percent of the right-of-way the railroad would not infringe directly on the streams, so runoff from cuts and fills would flow over land, and most sediment would be deposited before it reaches the stream. In these areas the sediment yield would be about two acre feet per square mile, which is 1.5 acre feet per square mile more than normal for the area. Where the fills infringed on streams, runoff from fill material could go directly into the stream. In these areas the sediment yield would be about 4.5 acre feet per square mile. The amount of sediment expected from cuts and fills during the first year following construction would be about 1,300 tons for the part that does not infringe on the river, and 900 tons for the part that does infringe on the river, for a total of 2,200 tons.

The channelization of Milk Creek and the Yampa River would expose fine materials to stream erosion. Assuming 4.3 acres of disturbed area for such channelization, and assuming 0.2 feet of erosion from these channel bottoms during the first year following construction, there would be about 1,900 tons of sediment produced from this source. The total first-year sediment yield would therefore be about 4,000 tons. The "first year" sediment yield would, however, be spread out over the two year period of construction; the amount produced during each of the years would depend upon the exact construction schedule.

This discussion covers only the sediment that would result from erosion. There would be some sediment produced by local filling and direct excavations in the stream. No estimate has been made of the amount; however, this subject will be addressed further in the chapter on mitigating measures.

Water contamination could result from spillage of diesel fuel or coal in a train accident. On a modern, well-equipped railroad, the accident rate should be less than 2.7 per million train miles (Federal Railroad Administration Bulletin 142). By applying that figure to the miles of proposed railroad adjacent to a stream where spillage might contaminate surface waters, the maximum percentage probability of an accident is 1/10 of one percent over the 30-year life of the project. Therefore, water quality deterioration from train accidents would not be a matter of concern.

Air Quality

The impact of the railroad on air quality can be divided into two phases: (1) the construction phase, and (2) the operational phase.

The construction phase would involve extensive earth moving, hauling, grading and blasting, as well as bridge construction. Construction is planned for two successive seasons, from April to November for two years. As building proceeds, intermittent fugitive dust emissions would be expected locally along the railroad bed and the haulage roads. Dust emissions would be expected to exceed the 24-hour standards for suspended particulates within 100 meters (300 feet) of the area of maximum activity; these emissions could be mitigated to some extent by watering. Vehicle emissions of NO_x, HC, and particulates during construction would have a minimal impact on air quality, even locally around the zone of maximum activity.

During the operational phase, freight trains would be run periodically, with operations primarily in daylight hours. The proposed operations schedule has been reported by W. R. Grace

(1975). The average emission factors assuming diesel engine usage and expected annual emissions are listed in Table GRIII-1 for proposed Route A and alternate Routes B and C. These railroad emissions represent a minimal impact on local air quality for the regulated pollutants.

TABLE GRIII-1

Annual Diesel Emissions from the Proposed W. R. Grace Railroad

Pollutant	Average Emissions Factors[1/] (kg/10^3 liter)	Emissions[2/] (metric tons/year) Route A	Route B	Route C
Particulates	3	.52	.51	.61
Sulfur oxides (SO_x as SO_2)	6.8	1.18	1.15	1.37
Carbon Monoxide	16	2.78	2.72	3.23
Hydrocarbons	11	1.91	1.87	2.22
Nitrogen Oxides (NO_x as NO_2)	44	7.65	7.47	8.89

[1/]From EPA (1972)

[2/]Computed assuming .10 km/liter fuel use

Living Components

Soils

Impact on soils would result from disturbance of 440 acres by construction of the proposed railroad. About 70 acres would be removed from productivity by a cover of ballast, track, bridges, etc. Acreage permanently disturbed because of steepness, rockiness, riprap, and areas provided for snow removal would be approximately 300 acres.

Impacts would be caused by the following activities: (1) blasting and moving 1,521,700 cubic yards of soil material, (2) compacting of topsoil and underlying material by heavy equipment, (3) removing vegetation, which would increase erosion, (4) exposing fine grained soil and parent material during construction of access roads and camps, (5) mining and removing material for use as ballast, and (6) developing and removing soil from borrow pits along the right-of-way. Removal from productivity and exposure of soil to wind and water erosion on unvegetated steep cut slopes would be permanent impacts. Soil properties and characteristics that would be altered are: resistance to erosion, sediment yield, soil moisture relationships, infiltration rates, available water holding capacity, permeability, bulk density, bearing capacity, soil structure, soil texture, and chemical composition.

Table GRIII-2 lists acreages to be disturbed and lost to productivity by soil associations.

TABLE GRIII-2

Acreage of Soil Associations Disturbed and Removed from Productivity by Railroad Construction Within the Right-of-Way

Association	Acres Disturbed	Acres Permanently Removed
21	97	81
35	282	237
41	61	52
	440	370

Offsite impacts on soils would include those caused by excavation of ballast material, development of disposal areas for liquid and solid wastes, construction of ponds to provide water and control surface runoff, and construction of camps, storage areas, roads, and power lines.

Surface disturbance which destroys topsoil characteristics would reduce permeability and increase runoff, adding to existing sediment load of drainages crossed by the right-of-way. Productivity levels would be lowered until the soil has had time to reestablish its structural and micro-organism relationships.

Compaction would have a major impact on surface soils along the railroad right-of-way and its areas used for access during construction. If not mitigated, compaction would decrease infiltration rates, permeability, and available water-holding capacity for many years after construction, and thus would reduce reclamation potential of the disturbed areas.

Terrestrial Flora

Construction of the railroad would result in disturbance of approximately 440 acres of vegetation, of which at least 70 acres would be permanently covered by the railroad bed, and approximately 300 acres not revegetated because of steepness, rockiness, and areas provided for snow removal. Table GRIII-3 gives approximate acreage disturbance by vegetative type for the proposed Route A, alternate Routes B and C, the proposed Taylor Creek terminal, and the alternate Jubb Creek tail and Jubb Creek loop terminals. The acreages presented are calculated on an areal basis; therefore the actual surface area of disturbance, and thus the area to be reclaimed,

TABLE GRIII-3

Vegetation Types and Amount Disturbed by Each Route and Terminal Alternate (Acres)

	Vegetative Type: Sage-Brush	Mtn. Shrub	Pinyon-Juniper	Cropland	Riparian	Total
Route A	119	67	3	62	115	366
Route B	169	10	6	76	94	355
Route C	176	18	16	59	154	423
Taylor Creek Tail Track	28	-	16	30	-	74
Jubb Creek Loop Creek	16	-	4	47	-	38
Jubb Creek Loop Track	13	-	-	25	-	38

would be larger in areas of variable topography.

If deep cuts were constructed through areas of Lewis or Mancos Shale, some side slopes might need to be as low as ten percent for stability; this would increase the area of disturbance. Steep areas along the Yampa River and Milk Creek would require large steep cuts that would make revegetation difficult or impossible because of the steepness and sparse soil material. Cuts through areas of rock would be relatively free from erosion, but would be permanently void of vegetation.

Areas of sagebrush, cropland, and riparian vegetation would be the easiest to revegetate because they are relatively flat, and sufficient soil would be available to provide a suitable seedbed for plant growth. Areas that are steep or are on Lewis or Mancos Shale would be the most difficult to revegetate. Disturbed areas of riparian vegetation might not be difficult to revegetate, but would be very difficult to return to existing vegetation. Mountain shrub and pinyon-juniper areas along the proposed railroad would be very difficult to revegetate because of the steep, rugged, rocky terrain in which they occur.

Undetermined additional impacts on vegetation would result from borrow areas for fill, and construction and maintenance access routes. These areas of borrow and need for access have not been identified in the proposed action, and therefore impacts are not quantified.

Disturbance of the surface by heavy equipment would create hard flat surfaces that are not conducive to plant establishment. Many areas of exposed subsurface material probably would be lacking in plant nutrients, thereby decreasing revegetation success.

The length of impact of vegetation loss would depend on the success of reclamation. Since the reclamation plan includes seeding of only a few of the species native to the disturbed areas, loss of native vegetation would be quite long, depending upon the rate and ability of native species to invade the areas. In areas that cannot be revegetated due to rockiness, toxicity, steepness, soil texture, etc., loss of vegetation would be a permanent impact. In some years climatic conditions would likely cause revegetation attempts to fail, extending the impacts of vegetative loss.

A secondary impact due to the destruction of vegetation would be the invasion of weedy species. Weedy species such as summer cypress (*Kochia scoparia*) would compete with revegetation attempts, thereby decreasing the success of permanent vegetative establishment. If weedy species are not controlled, their competition with seedlings would be a very significant impact to revegetation efforts.

Young, palatable vegetation produced by revegetation efforts would attract wildlife and livestock; grazing on young plants would inhibit early growth and revegetation of disturbed areas.

The most significant impact to vegetation would be the loss of existing plant ecosystems on approximately 440 acres. Also, much of the area to be revegetated would be cuts and fills, and would be difficult to revegetate; therefore, vegetative production is estimated to be 50 percent less than native areas. No shrubs or trees are included in the reclamation plan, so establishment of species in these categories would depend entirely on natural invasion; thus these species would likely be eliminated from the disturbed areas.

Terrestrial Fauna

WILD FAUNA

Construction of the proposed railroad would impact the area's wildlife in several ways. Major impacts on terrestrial fauna would result from two separate sets of factors: railroad construction and railroad operation.

Railroad construction

The segment of the proposed route from Craig to the Williams Fork River would transect cropland and riparian vegetation types, and could impact nesting and courtship activities of the greater sandhill cranes known to nest in Big Bottom. Approximately seven pairs of sandhills use this area (Figure GRII-6). Although the proposed route would not disturb the nesting area directly, noise and human activity caused by the construction work, blasting, etc., could disturb the cranes' activities and result in a failure to nest, or nest abandonment.

At least one sage grouse strutting ground has been identified in this area and there may be more that have not been located. As proposed, this segment of the railroad would be constructed directly through this critical courtship area, resulting in a loss of its use by these gamebirds.

Sagebrush and mountain shrub, which cover about 214 acres of land that would be disturbed, provide habitat for over 130 species of wildlife, including deer, elk, antelope, sage grouse, and a variety of non-game species (see Appendix D). Destruction of this vegetation would reduce the carrying capacity of the area for those associated species. Deer, elk, and sage grouse would be directly affected. Hawks, coyotes, eagles, and owls would be indirectly affected because of the loss of prey habitat resulting in the eventual loss of prey species.

According to Colo. DOW density estimates, the proposed route would result in the permanent destruction of habitat capable of supporting about five elk, five deer yearlong, and an additional ten deer during the winter months. These losses are related to an estimated disturbance of 440 acres of big game habitat.

In addition to sagebrush and mountain shrub loss, 115 acres of riparian habitat would be destroyed. Riparian vegetation is generally considered the most important habitat for sustaining wildlife numbers and species diversity. Further disturbance of riparian vegetation would be expected from railroad fill material being dumped down slopes and into the Yampa River, covering riverside vegetation. The amount or exact location of this habitat loss are not known.

Ducks and geese are known to nest along the Yampa River. This nesting activity would be disrupted during railroad construction and some nest locations would be destroyed. An estimated five goose nests and as many as 30 duck nests could be lost. Nest and den sites for non-game birds and mammals also would be destroyed.

The remainder of this segment of the proposed route would transect 62 acres of cropland and 3 acres of pinyon-juniper. Pinyon-juniper type provides cover and some browse for big game mammals; however, wildlife species diversity is generally low in this type of habitat. Cropland represents previously disturbed lands that are kept in a constant state of disruption. These areas are monocultures and as such generally provide the poorest habitat in terms of species diversity. Because the land is already disturbed, the impacts on wildlife generally would be minimal in these areas.

Normal animal movements and activities would be disrupted during the construction phase of this operation. The extent and duration of this disruption would depend on the species involved, the time of year the construction work is conducted, and the length of time it takes to complete the railroad.

The Yampa River provides both summer and winter use areas for hawks, eagles, and other raptors. Nest and perch sites could be destroyed or altered to make them unsuitable for use by these birds. The loss of prey habitat would reduce the area's carrying capacity for predatory birds by reducing the number of prey. Human activity and noise associated with railroad construction would cause some reduction in utilization of the area by birds of prey.

The Milk Creek segment of the proposed railroad would cross and recross the creek several times. Almost the entire length of this segment would be constructed within riparian habitat; however, it is not as lush as that found along the Williams Fork or Yampa Rivers. Therefore, overall impacts associated with disturbance of riparian vegetation would be considerably less along Milk Creek.

This segment of the proposed route does cross a deer and elk migration route, and the railroad construction would alter the normal migration patterns for these animals to some degree.

Impacts on nesting waterfowl or raptors would not be expected to be significant along this segment of the proposed route.

The segment of the proposed railroad line that starts at the head of Milk Creek Canyon and runs south across Axial Basin to the proposed terminal area would cross sagebrush and cropland. Railroad construction along this segment could impact both sage grouse strutting activities and pronghorn antelope movements. Three sage grouse strutting grounds have been identified in this area, and if railroad construction takes place in close proximity during the period of mating activity, the breeding potential for a major portion of the Axial Basin sage grouse population could be affected.

Pronghorn antelope that inhabit this area would be impacted by the restriction of their movements during railroad construction. Loss of food and cover capable of supporting one or two pronghorns probably would result.

Some direct loss of wildlife would result from the construction of any segment of the proposed railroad. Small or less mobile animals would be unable to escape the construction equipment. Blasting would kill many animals and destroy dens and nests; bulldozers and scrapers also would cause some deaths.

Small mammal densities and species diversity are normally greatest in areas of riparian vegetation; therefore, segments of the route creating most disturbance in these areas probably would cause the greatest loss of life to small mammals. Greater bird nesting densities are also generally found in this habitat type.

The railroad right-of-way would be fenced; impacts on terrestrial fauna would depend on fence specifications and species present. Fences impede or prevent normal movements of large to medium-sized mammals; they also create potential hazards to birds and mammals that may become entrapped in them. Fences along a railroad right-of-way may also tend to restrict escape inside the right-of-way when animals become alarmed at the approach of a train.

The Taylor Creek terminal area would involve habitat destruction primarily in sagebrush and cropland. Impacts on terrestrial fauna would be similar to those discussed for segments passing through these vegetation types.

Beaver workings have been found along Taylor Creek. The construction work would disturb this species and possibly cause their abandonment of the area.

Some habitat in the right-of-way would be permanently removed from its present productivity, but revegetated areas would provide new habitat. Revegetated areas commonly attract greater numbers of wildlife than the adjacent undisturbed native vegetation for the first few years because of the succulent nature of new growth. If this is the case along the proposed railroad, wildlife would be drawn to these areas and the probability of train-animal collisions would be increased.

Railroad operation

All habitat destruction would be complete before this phase of the plan begins. No new habitat destruction would be expected, although some brush and weed control might be conducted along the railroad right-of-way on previously disturbed areas. The major impacts of the operation of this railroad on terrestrial fauna would be harassment and train-animal collisions.

The main harassment factor of the railroad would be noise associated with passing trains; most wildlife species would become accustomed to this noise. Some species, however, such as sage grouse and sandhill cranes, might not be able to adjust to disturbance during critical nesting and courtship periods, and abandonment of strutting or dancing grounds, as well as traditional nesting areas, could result.

Train-animal collisions would occur during operation of the railroad. Major deer and elk migration routes cross the proposed rail-line, and pronghorn antelope are found along some segments of the route, mainly in Axial Basin. In addition to the big game species, many small mammals such as rabbits, hares, ground squirrels and skunks would likely be lost because of train-animal collisions.

DOMESTIC FAUNA

Livestock probably would not be destroyed as a direct result of the railroad construction. The domestic animals would be moved away from the area during blasting and earth moving. The main impacts on domestic fauna would be loss of food and restriction of movement resulting from new fencing. If the railroad line is not fenced livestock would be lost to train-animal collisions.

Some loss of forage would result from construction of the proposed railroad. Table GRIII-4 indicates the estimated losses of carrying capacity in terms of domestic animal AUMs (Animal Unit Months). No replacement of lost AUMs would be expected in the future because of the proposed fencing of the railroad right-of-way.

TABLE GRIII-4

Loss of Carrying Capacity by the Proposed Railroad

Vegetation Type	Acres Disturbed	Carrying Capacity (Acres per AUM)	Loss of AUMs
Mountain shrub	67	5.5	12
Sagebrush	147	7.0	21
Pinyon-Juniper	19	27.5	1
Cropland	92	7.0	13
Riparian	115	3.5	33
Total	440		80

Aquatic Biology

Construction of the proposed railroad would involve extensive alteration of the natural channel of Milk Creek, thereby creating an increase in stream sedimentation during construction activity and continuing until the disturbed surfaces are revegetated. Increased siltation in Milk Creek would increase the sediment load carried by the Yampa River in the area of the proposed action. Rock cuts required in steep slopes above the Yampa River, and encroachments of fill material into the river's main stream, would be the principal sources of increased sedimentation. The degree of increase depends on construction methods and erosion control measures implemented during and following construction. Construction of two bridges across the Williams Fork River and Milk Creek also would increase sedimentation in the Yampa River.

Construction of the railroad would impact the biological community of Milk Creek. Stream channelization would eliminate organisms through localized destruction of the existing stream habitat. Benthic organisms and periphyton would be particularly impacted due to their relative immobility; members of the existing fish population might be able to migrate into the Yampa River.

Any increase in sedimentation in the Yampa River would impact the aquatic community through the silting-in of critical feeding and spawning areas and direct abrasion and suffocation of organisms. Spawning populations of the four endangered fish species known to inhabit the Yampa River between Craig and the confluence with the Green River are of particular concern. Degradation of the existing water quality of the Yampa River in the area of proposed construction could constitute a violation of Sections 4 or 9 of the Endangered Species Act of 1973 (Public Law 93-205, 93rd Congress, S. 1983, December 28, 1973).

The existing and potential endangered fisheries habitat in the Yampa River in the proposed railroad construction area would be an important consideration. The construction of the proposed rail line would significantly increase, at least temporarily, the sediment load carried by the Yampa River. The sediment load increase in the Yampa River resulting from construction would be temporary. As is the case with most endangered species, any adverse environmental impacts could readily change marginal habitat conditions into intolerable habitat conditions for the species.

The native species in the large rivers of this region have evolved in the presence of high turbidity and salinity. Increased sediment during high-flow periods probably would have minor impact on large river species, but increased sediment during periods of low and clear flow could constitute an impact of considerable consequence. The time of year and duration of increased sediment are important factors because if this impact occurred during spawning it could affect the success of the spawn. Some fisheries' scientists believe that increased turbidity during spawning may be beneficial because of increased cover and protection for eggs and emerging fry. Until more information is available and habitat needs and limitations are clearly understood, the impact of increased sediment during spawnings should be considered adverse.

Regional energy development and associated industries could result in transportation of products other than coal over this line. A derailment into the Yampa River could result in an impact on aquatic fauna, depending on the product, quantity of spill, and time of year. The impact on the squawfish population could be devastating if a toxic spill occurred during spawning when the majority of the population is congregated in the Yampa River during low flow.

Cultural Components

Archeological Resources

Total projected acreage disturbance on the railroad is 440 acres, and destruction of archeological resources would be commensurate with this acreage disturbance. Impacts would also result from increased exposure of archeological values to vandalism; as an indication of this potential impact, the projected railroad construction force is 110 for the first two years. In addition, a 29-man operation crew is projected through 1990.

Table GRIII-5 shows the probable impacts that would result to cultural resources. Site numbers refer to the sites depicted on Figure GRII-9. All sites would be exposed to vandalism and pothunting. Twenty-five lithic sites, three chipping sites, and three campsites are subject to complete physical displacement. Five lithic sites and one rockshelter are subject to partial displacement. However, only two sites are potentially eligible to the National Register; these also would be subject to adverse impact from post-survey excavation, should the surveying archeologist's recommendations be followed (sites numbered 14 and 78, Table GRIII-5). Unknown subsurface archeological sites also could be impacted due to the projected 440 acres of surface disturbance.

The two sites recommended for subsequent excavation have a moderately high likelihood of yielding valuable information concerning man's prehistoric occupation of the area, although they would not be subject to actual displacement by railroad construction. Notwithstanding this fact and based on results of the intensive survey, viewed in both a local and a regional perspective,

TABLE GRIII-5

Impacts to Cultural Resources

Site Number (Figure GRII-9)	On Railroad Route A	B	C	Nature of Site: Archeologic: Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Historic: Buildings	Rock Structure	Probable Impact: Subject to Direct Physical Displacement: Complete	Partial	Subject to Vandalism
1	x	x	x							1			x
2	x	x	x						11		x		x
3	x	x	x	x									x
4	x	x	x						2				x
5	x	x	x	x									x
6	x	x	x	x								x	x
7	x	x	x	x							x		x
8	x	x	x	x								x	x
9	x	x	x	x									x
10	x	x	x	x									x
11	x	x	x	x									x
12	x	x	x						3		x		x
13	x	x	x	x							x		x
14	x	x			x			x					x
15	x	x		x							x		x
16	x	x		x								x	x
17	x	x		x							x		x
18	x	x			x							x	x
19		x							3		x		x
20		x		x							x		x
21		x		x							x		x
22		x		x							x		x
23	x			x							x		x
24	x						x				x		x
25	x					x					x		x
26	x					x					x		x
27	x					x					x		x
28	x			x							x		x
29	x									1	x		x
30	x			x							x		x
31	x			x									x
32	x				x							x	x
33	x			x							x		x

TABLE GRIII-5 (Cont.)

Impacts to Cultural Resources

Site Number (Figure GRII-9)	On Railroad Route A	B	C	Nature of Site: Archeologic: Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Historic: Buildings	Rock Struc-ture	Probable Impact: Subject to Direct Physical Displacement: Complete	Partial	Subject to Vandalism
34	x			x							x		x
35	x			x							x		x
36	x			x							x		x
37			x					x				x	x
38	x			x							x		x
39			x					x				x	x
40	x			x							x		x
41	x			x								x	x
42	x		x	x							x		x
43	x		x	x									x
44	x		x				x				x		x
45	x		x						1		x		x
46	x		x	x							x		x
47	x		x	x							x		x
48	x		x	x								x	x
49	x		x	x							x		x
50	x		x	x							x		x
51	x		x	x							x		x
52	x		x	x							x		x
53	x		x				x						x
54	x		x	x							x		x
55	x		x	x							x		x
56	x		x	x							x		x
57	x	x	x	x							x		x
58	x	x	x	x							x		x
59			x						4		x		x
60	x		x	x									

TABLE GRIII-5 (Cont.)

Impacts to Cultural Resources

Site Number (Figure GRII-9)	On Railroad Route A	B	C	Nature of Site: Archeologic: Lithic	Rock Shelter	Chipping Station	Camp-site	Pictographs and Petroglyphs	Historic: Buildings	Rock Struc-ture	Probable Impact: Subject to Direct Physical Displacement: Complete	Partial	Subject to Vandalism
61			x	x							x		x
62			x			x					x		x
63			x	x									x
64			x	x							x		x
65			x	x							x		x
66			x			x					x		x
67			x						4		x		x
68			x	x							x		x
69			x			x					x		x
70			x			x					x		x
71			x	x							x		x
72			x			x						x	x
73			x	x							x		x
74			x	x							x		x
75			x	x							x		x
76			x	x									x
77			x	x									x
78			x				x						x
79			x	x									x
80			x	x									x
81			x	x									x
82			x	x									x
83			x	x								x	x
84							x						x
85				x									x
86				x									x
87				x			x						x
88								x					x
89								x					x

significance of the total adverse impact would be moderate.

Historical Resources

Impacts to historical features would occur due to acreage disturbance and potential vandalism from construction crews, as identified under Archeological Resources above. Table GRIII-5 indicates probable impacts to historical resources; site numbers refer to the sites depicted on Figure GRII-9. Three sites containing historic buildings and one site containing foundation-like rock structures would be subject to complete physical displacement; they possess no special historical significance. From a regional historic perspective, the impacted resources will yield no significant information.

Aesthetics

Refer to Appendix D for a discussion of procedures to be used in analyzing the landscape visibility maps for assessment of impacts.

Strongly form, line, and color-dominant minus deviations (i.e., adverse visual impacts) would result from railroad construction that has to negotiate steep terrain; this would produce large cuts and fills whose crescent-shaped form would be foreign to the natural terrain. Form-dominant minus deviations would also result where railroad cuts intersect natural terrain at a sharp angle and can be viewed parallel to the rail's alinement. Especially adverse impacts would result from very visible cuts and fills proposed adjacent to the viewshed sequences listed in Table GRIII-6. Natural edges are formed where vegetative types change, where different slopes intersect, and on the periphery of agricultural fields. Railroad routing that fails to borrow from these already occurring lines may create other line-dominant deviations from the characteristic landscape. Failure to successfully revegetate all land disturbances would produce additional minus deviations in color.

Reflective surfaces, intrusive colors, and inharmonious design of proposed bridges over Highway 13 and the Williams Fork River would create other minus deviations from the characteristic landscape. Similar impacts would result from proposed underpass construction at the County Road 51 crossing near the proposed Taylor Creek crushing and loadout facilities.

No similar analysis of the part of Route A common to all three alternates (up Jubb Creek in Axial Basin) is possible. The feasibility report was based on a Wilson Creek routing which has since been abandoned. However, no cut or fill on the formerly proposed Wilson Creek route exceeded 30 feet, which is indicative of the gentle slopes along the Jubb Creek route. But especially significant impacts might result from cuts on the steep hillside immediately adjacent to the present alinement's entrance into Taylor Creek Canyon. Views to the landscape visual units across which this segment is to cross are available from viewshed sequences NO, HN, HIS and GHM (see Figure GRII-21).

If the proposed Juniper Reservoir is constructed, adverse impacts from severe cuts and fills would become more significant because of increased opportunities for viewing. An additional 14 cuts and fills would become visible from the reservoir in foreground landscape visual units, whereas only seven would be visible from roads if the proposed reservoir was not constructed. .

Gravel bars on benches above the river are proposed sources of fill material which would create additional minus deviations, especially of form and texture.

Quantification of impacts in terms of numbers of people viewing them relates directly to the Average Daily Traffic (ADT) volume and potential boaters analyses in Chapter II.

If vegetation that is cleared during road or railroad construction is scattered adjacent to the disturbed areas, or piled and burned, it could produce an aesthetically unconforming landscape of forest litter. Disposal of refuse and waste from the railroad construction operation could also produce an undesirable landscape of litter if it is not properly disposed of.

The overall aesthetic experience along the railroad area would also be adversely impacted. Notwithstanding the subjective nature of mood-atmosphere values, the railroad would result in adverse impacts to the area's inherent capability to kindle feelings of isolation, solitude, or respect for nature, especially where Route A traverses ten miles of largely undisturbed natural terrain in Little Yampa Canyon. Engineering and construction which would make this routing possible might also result in beneficial impacts to mood-atmosphere values by revealing nature's complexity and grandeur, at least to some viewers.

The significance of these aesthetic impacts is moderately high, relative to their effect upon the study region.

TABLE GRIII-6

Route A -- Summary of Significant Cuts and Fills

Number	Landscape visual unit classification in which case cut or fill occurs	Direction of view (s)	Cut or Fill	Size (ft.) (height or depth
1	fg. UV and mg St	S	Cut	80
2-4	fg. VW	E	Fill	90
		W	Fill	75
		W	Fill	40
5	fg. VW & fg/mg WX	N & S	Cut	50
6-8	fg. WX	N & S	Fill	30
			Cut	40
			Cut 60	
9-11	mg. CB, DE	E	2 Cuts	70
	& mg. AC, DE		1 Cut	30
12-13	fg., DE, mg EF	S	Fill	20
			Cut	25
14	mg. BC, DF	S	Fill	20
15	mg. DE	S	Fill	20

(The remaining cuts and fills listed below may be viewed by boaters on the proposed Juniper Reservoir.)

16	(listed moving downstream	fg/mg	Cut	35
17		fg/mg	Cut	20
18		fg/mg	Cut	20
19		fg/mg	Cut	50
20-21	(Same as Nos. 9-15 above)	fg/mg	2 Cuts	2-70
22		fg/mg	Cut	30
23-24		fg/mg	2 Fills	2-30
25		fg	Cut	25
26		fg/mg	Fill	20
27-30		fg/mg	4 Cuts	4-30
31-32		fg/mg	2 Cuts	2-40
33		fg/mg	Cut	30
34-35		fg/mg	2 Cuts	2-50
36	(bridge across Milk Creek)	fg	Fill & Bridge	65
37	(along Milk Creek)	fg	Cut	45

SOURCE: W. R. Grace and Co., Feasibility Study for Coal Haul Railroad, October, 1974, prepared by Morrison-Knudsen Co. Inc.

Recreation

Adverse impacts upon wildlife viewing potentials would result from displacement of sage grouse from strutting grounds; the proposed Route A would go directly through a sage grouse strutting ground in Section 21, T.6N., R.91W.

Construction-induced sedimentation and siltation increases in the Yampa River and Milk Creek would reduce their inherent capabilities to attract and sustain fishing use. There would be an especially significant adverse impact upon recreational fishing capabilities along Milk Creek, where significant re-channelization would be necessary.

Construction of Route A would damage natural values in the largely undisturbed Little Yampa Canyon; as a result, potential for Wild and Scenic River classification of this section of the Yampa River would be reduced from "Scenic" to "Recreational". This projected impact is based solely on observed resource values in relation to established Wild and Scenic River Classification guidelines and has no relation to any formal proposals nor studies.

Railroad construction and operation across the Ellgen property in Round Bottom might displace deer from this acreage, which currently is a privately-operated big game hunting area. Especially if the right-of-way is fenced, it would interfere with the movement of deer between Iles Mountain and the Yampa River. Conversely, the railroad might attract deer and beneficially impact hunting potential if successful revegetation produced desirable browse. Also, the right-of-way would nearly always be free of snow during winter months.

Cultural resources would be destroyed by the railroad's construction; they would thereby lose their human interest value and subsequent inherent capability to attract and sustain recreation use. This loss would occur through actual destruction of the resource both by railroad construction and by vandalism and pot hunting by construction crews.

Beneficial impacts to the recreation resource also result from an increased number of access roads and trails built during railroad construction; these would increase the land's capability to attract and sustain off-road-vehicle (ORV) use where public access is permitted. However, subsequent increases in ORV use could result in secondary adverse impacts upon wildlife in the form of ORV harassment.

Other potential beneficial impacts include increased availability of desirable rockhounding material from excavation of rock materials and greater capabilities for geologic and industrial interpretation. Public access points have the potential for informing the visiting public of the physical and economic conditions resulting in construction of the railroad. This could be accomplished by interpretive signs and by interpretive-educational brochure development.

These impacts would be highly significant as they impact recreation resources that are of region-wide as well as statewide importance.

Social Environment

Table GRIII-7 presents the population impact by county and community of the development of the W. R. Grace railroad; it also indicates expected new school enrollment by county. These data were generated by the gravity-employment multiplier model described in Chapter II of the Regional Analysis, Future Social Environment Without the Proposed Action. They represent incremental increases over and above the base scenario presented in the same section of the Regional Analysis.

Requirements for new social support facilities including housing, health care, education, water and sewage treatment, fire protection, and law enforcement are functions of increases in population. Table GRIII-7 indicates that development of the W. R. Grace railroad would induce a relatively small increase in population; therefore, impacts on existing social support facilities would be relatively minimal. It is the cumulative impact of several new developments that generates significant new requirements for social support facilities; these requirements are addressed in depth in Chapter III of the Regional Analysis.

There have been no expressions of local attitudes specifically oriented toward the development of the W. R. Grace railroad. Rather, attitudes are directed toward the subject of regional and community growth in general, and therefore are examined in Chapter III of the Regional Analysis.

For a more extensive analysis of the regional impacts, mitigations, and unavoidable adverse effects to which the development of W. R. Grace and Company's railroad would contribute, refer to the appropriate chapters of the Regional Analysis.

TABLE GRIII-7

Population Impact of Grace Railroad Development

	1980	1985	1990
Direct Employment at railroad	29	29	29
New Population:			
Moffat County total	67	70	68
Craig	67	70	68
Rio Blanco County total	42	43	44
Meeker	42	43	44
Routt County total	8	8	8
Hayden	8	8	8
Total	117	121	121
New School Enrollment			
Moffat County	5	16	16
Rio Blanco County	6	10	10
Routt County	1	2	2
Total	12	28	28

TABLE GRIII-8

Economic Impact of Grace Railroad Development

	1980	1985	1990
Direct Employment at railroad	29	29	29
Induced Employment			
Moffat County	12	13	15
Rio Blanco County	8	10	12
Total	20	23	27
Direct Earnings	396	444	497
Induced Earnings			
Moffat County	92	141	189
Rio Blanco County	69	111	163
Total	161	252	352

Note: Earnings data in thousands of 1974 constant dollars.

Economic Conditions

Table GRIII-8 presents the economic impact of development of the W. R. Grace Railroad in terms of employment and earnings. These data were generated by the gravity-employment multiplier model described in Chapter II of the Regional Analysis, Future Economic Environment Without the Proposed Action. These data represent the incremental impact over and above the base scenario described in the same section. Note that in each of the benchmark years, the greatest induced employment and earnings impacts from the W. R. Grace railroad development fall in Moffat County.

No adverse economic impacts would be expected to associate with the development of the W. R. Grace railroad because both the direct and induced employment and earnings would be relatively small compared to the economic base of the region.

Transportation Networks

When the mine is at its full output of 3.0 million tons per year, 326 unit trains of 92 cars of 100-ton capacity each would be fed into the D. & R.G.W. rail system per year, or an approximate average of less than one such train per day. The impact on the Craig branch of one unit train per day would be minimal. Proper scheduling would work this train into other traffic with little or no difficulty.

Grade crossings present hazards of collision. The proposed route would cross State Highway 13, a few miles south of Craig, Moffat County Roads 17 and 51 in the Axial Basin near the mine site, one farm road in Section 16, T.6N., R.91W., and the southern access road to the Colorado-Ute Power Plant site south of Craig. The expected increase in both train traffic and vehicular traffic at these crossings would present significant impacts in the form of increased hazards of auto-train collisions at these crossings. These impacts would be especially significant at the Highway 13 crossing and the two county road crossings.

The increased railroad construction and operating employee vehicular traffic on the two county roads and State Highway 13 would present some impacts in the form of increased potential for auto accidents and increased road maintenance costs.

Chapter IV

Mitigating Measures

THIS CHAPTER PRESENTS MEASURES THAT WOULD LESSEN OR ELIMINATE THE ADVERSE IMPACTS OF W. R. GRACE AND COMPANY'S PROPOSED ACTION. THESE MEASURES ARE DISCUSSED IN THREE CATEGORIES: THOSE INCLUDED IN THE COMPANY'S PROPOSAL, THOSE REQUIRED BY LAW OR REGULATION, AND THOSE MEASURES THAT WOULD BE APPLIED AS SPECIAL CLAUSES OR STIPULATIONS IN LEASES OR PERMITS. IN EACH OF THESE CATEGORIES, MEASURES ARE PRESENTED BY IMPACTED ENVIRONMENTAL COMPONENT. BECAUSE SOME MEASURES LESSEN IMPACTS TO MORE THAN ONE RESOURCE, SOME REPETITION OF MITIGATIONS IS UNAVOIDABLE. ALL MEASURES ARE ASSESSED AS TO THEIR PROBABILITY OF IMPLEMENTATION AND/OR SUCCESS. MITIGATING MEASURES ARE PRESENTED AND ANALYZED AS PROCEDURES THAT WOULD BE REQUIRED IF THE PROPOSED ACTION IS APPROVED.

Measures Included in the Applicant's Proposal

Geologic and Geographic Setting

Standard engineering practices would address slope-stability problems and reduce failures to manageable levels for safety and maintenance.

Water Resources

Channel changes and water structures would be designed to accommodate 50-year floods. Riprap would protect all embankments that encroach on flood-flow elevations along streams and the proposed Juniper Reservoir. Riprap would be two feet thick normal to the slope and consist of rocks averaging 150 pounds. Drainage control would be a design objective to prevent roadbed undercutting and to avoid saturation of fill materials.

Air Quality

Watering of construction areas and access roads would reduce fugitive dust.

Terrestrial Flora and Soils

Reclamation procedures would establish a stable, self-perpetuating vegetative cover on lands disturbed by the railroad construction.

Wherever practical, topsoil would be stored and replaced on any Lewis or Mancos Shale that would be disturbed, or on any areas that expose the "C" soil horizon or other strata unsuitable for plant growth, except for steep rock faces. It is doubtful that fertilizer would be required for this operation; however, its usefulness would be evaluated during revegetation.

Seeding would occur as soon as practical after construction, and would be designed to coincide with optimum planting times, spring or fall. In some areas prone to erosion, such as steep slopes, winter wheat or another annual would be planted immediately for erosion control until the next optimum planting time, when a comprehensive seeding mixture would be applied.

Hydromulching or a suitable substitute for seeding would be used on slopes steeper than 25 percent, depending on slope length. A rangeland drill would be utilized for seeding surfaces that would accommodate farm equipment. Depending on slope angles, a scarification procedure would prepare a seedbed suitable for plant growth where hard flat surfaces would be created by dozers; steep surfaces of exposed rock would not be seeded.

Using the Soil Conservation Service's guidelines for revegetating disturbed areas, four seed mixtures have been recommended for different ecological conditions that would be encountered along the railroad route:

Recommendations for south-facing slopes, steep topography and/or low rainfall

Indian ricegrass
Bluebunch wheatgrass
Streambank wheatgrass
Russian wildrye
Needle and thread grass
Sand dropseed
Western wheatgrass
Intermediate wheatgrass
Yellow sweetclover

Recommendations for moderate moist and cold location (east-facing areas)

Smooth brome
Mountain brome
Hard fescue
Western wheatgrass
Orchard grass
Bluebunch wheatgrass
Slender wheatgrass
Yellow sweetclover

Recommendations for areas in the Axial Basin

Indian ricegrass
Bluebunch wheatgrass
Western wheatgrass
Siberian wheatgrass
Green needle grass
Sand dropseed
Streambank wheatgrass
Russian wildrye

Recommendations for Taylor Creek area

Timothy
Smooth brome
Big bluegrass
Orchard grass
Hard fescue
Western wheatgrass
Mountain brome
Bluebunch wheatgrass
Slender wheatgrass
Yellow sweetclover

Exact composition of species in each seeding mixture would be adjusted for slope aspect, location, and degree. Each mixture would total approximately 25 pounds of seed per acre, including a fast germinating annual (such as winter wheat or oats) to provide early competition for weed species, enhance soil stability, provide shade for perennials, and provide quick establishment of green cover. In areas of high wildlife and livestock use, an attempt would be made to utilize unpalatable species in the seeding mixture to discourage stock and wildlife activity immediately adjacent to the railbed. If seedlings fail due to various adverse climatic conditions, additional seeding would be done to establish and maintain vegetative cover.

Terrestrial Fauna

W. R. Grace has proposed to seed all disturbed areas as soon as practical after construction. This would help mitigate impacts on the fauna created by loss of vegetation. In areas of high wildlife and livestock use, an attempt would be made to use unpalatable species in the seeding mixture to discourage stock and wildlife activity immediately adjacent to the railbed.

Areas of the right-of-way that prove hazardous to wildlife or livestock would be fenced. In other areas where the landowners might request fencing of the right-of-way to protect livestock, the fences would be designed to limit livestock, but not hinder deer, elk, and antelope movements.

Every effort would be made to cease or minimize railroad construction in the Big Bottom area during spring season when sandhill cranes would be nesting. Sage grouse strutting grounds would be located prior to railroad construction, and every effort would be made to cease or minimize construction when grouse are strutting. The timing of construction in the areas of sandhill crane and sage grouse activity would be coordinated with the Colo. DOW. Most of the train traffic would be during daylight hours; this would help reduce the probability of train-animal collisions.

Aquatic Biology

The use of riprap where the roadbed encroached on streams would minimize sediment additions, and therefore minimize adverse impacts on aquatic species and habitat.

Aesthetics

Except for rock faces, all railroad construction disturbances would be revegetated with a self-perpetuating vegetative cover; this would help mitigate the strong line and form dominant nature of railroad and access road construction scars. However, if species dissimilar to those on immediately adjacent terrain would be used, there would be deviations from the characteristic landscape in terms of texture and color.

Recreation

Revegetation and riprapping would significantly reduce downstream siltation and minimize degradation of downstream fishing capabilities of the Yampa River.

Transportation Networks

At-grade crossings would be provided for the one farm and two county roads. These crossings would include cattle-guards to protect livestock and signs to warn users of the road. Adequate sight distances would be included in designs of county road crossings to reduce collision hazards. The southern access road to the Colorado-Ute Power Plant site would be moved to avoid intersection with the railroad right-of-way. The crossing of State Highway 13 would be by grade separation.

Measures Required by Law or Regulation

The various laws and regulations mentioned in the Regional Analysis that apply to all kinds of actions, including railroad rights-of-way, cover water and air quality standards, reclamation standards, protection of archaeological and historical values, protection of endangered species, employee safety requirements, noise level standards, etc. A few are concerned specifically with rights-of-way and railroads.

Geologic and Geographic Setting

In accordance with 43 CFR 2800, design specifications for bridges and fills would include appropriate earthquake resistances to mitigate hazardous conditions that would result in the remote possibility of reservoir-caused seismicity.

PALEONTOLOGY

Measures provided for in the 1906 Antiquities Act and 43 CFR 6010.2(a) and (b)(2), when implemented, would provide protection for fossils that are of actual and real scientific significance. This would be accomplished by requiring the lessee to conduct an on-the-ground intensive survey to ascertain the possible occurrence of significant vertebrate fossil remains. If the surveying paleontologist points out potential for significant vertebrate fossils W. R. Grace and Company would conduct on-the-ground paleontology work during construction of certain portions of the railroad.

In addition, the Colorado State Antiquities Act (H.B. 1569) requires such surveys on State-owned lands to ascertain location of significant fossils.

Pursuant to the findings of these intensive surveys, W. R. Grace and Company would have to avert destruction of significant fossils by altering the proposed action or conducting salvage excavations by competent and licensed paleontologists.

43 CFR, Subpart 2801.1-5(a) and 2801.1-5(h), under "Rights-of-Way; Terms and Conditions", further requires compliance with all Federal and State laws applicable to the proposed right-of-way construction and to the project for which the right-of-way is to be proposed.

See the Regional Analysis for a more detailed description of how these surveys and subsequent resource evaluations would be initiated.

Water Resources

Wells in or adjacent to the right-of-way and adversely affected by construction would be replaced or otherwise returned to their original effectiveness, where appropriate. The adverse impacts that would result from sediment yield associated with erosion from cuts and fills are covered under the applicant's proposal. In accordance with 43 CFR 2801.1-5(h), additional precautions, such as settling ponds in affected tributary drainages, would further reduce the introduction of sediment due to construction activities. Some additional precautions would be particularly important during periods of low flow, when the stream normally has a very low sediment discharge and the impacts on aquatic life would be most adverse. If channel widening were done during periods of low flow, the excavation would not extend beyond the water's edge into the low flow channel of the stream; a small amount of unexcavated material would be left alone, so the stream would not be directly disturbed. This unexcavated material would be removed by natural erosion processes during the next period of high water, at a time when the additional turbidity would not have as much impact.

If it should be necessary to place fill directly into the stream channel during periods of low flow, the fill would consist of rock below the water level in the stream to minimize the amount of material that would go into suspension. Fill placed on top of the rocks would contribute little turbidity to the stream. However, all direct sediment-generating activities, such as placement of any kind of fill in the channel of the Yampa River, would be avoided during July and August, the critical spawning period for many fish including the endangered species.

During channelization, erosion of the new channel would be reduced by placing rocks in the channel to increase roughness. This procedure would be followed where the bed materials in the new channel are easily erodible.

The Colorado Department of Health, the agency that has primary responsibility for water pollution control in the study region, has published a booklet (1974) describing standards included in the Water Quality Control Act of 1973, consistent with the goals and policies of the Federal Water Pollution Control Act Amendments of 1972. These standards cover water quality with respect to sludge, debris, toxic materials, and other materials undesirable for aquatic life. The Colorado Department of Health, Water Quality Control Commission, adopted rules as of August 21, 1975, that require discharge permits, and that present effluent limits for BOD_5, suspended solids, fecal coliform, residual chlorine, pH, and oil and grease. These are fully described in Chapter IV of the Regional Analysis, as are sampling techniques and analysis standards necessary to obtain a required permit for waste water discharge into any and all surface or subsurface waters in the State.

These mitigating measures and those proposed by the applicant, would reduce sediment yield from cuts and fills by 75 percent or 1,600 tons after the first year, and sediment resulting from channelization by 90 percent or 1,700 tons after the first year, for a total reduction of 3,300 tons of sediment. Sediment yield for the first year of construction would be virtually unmitigated.

Soils and Terrestrial Flora

In Title 43, Code of Federal Regulations, Subpart 2801-5, terms and conditions are set forth that would be used as the basis for stipulations to lessen impacts on soils and vegetation. By accepting a right-of-way across Federal lands, the applicant agrees and consents to comply with the following condition:

> To take such soil and resource conservation and protection measures, weed control, on the land covered by the right-of-way as the superintendent in charge of such lands may request. To comply with this regulation the following mitigating measures would be required:

Mechanized equipment such as scrapers would be used to remove and stockpile topsoil to minimize soil mixing. Unnecessary off-road vehicle use by equipment operators and employees would be restricted to minimize compaction. Soil erosion would be minimized by mulching, development of erosion structures including waterbars, terraces, contour furrows, and interceptor ditches to divert running water from unprotected disturbed areas.

Topsoil would be removed from borrow areas and replaced after fill material removal.

Measures would be taken to insure that water is not diverted from areas of highly productive or unique vegetation.

Service roads, material sites for sand, gravel, and ballast, campsites, and equipment storage areas would be cleaned up, reshaped, topsoiled, and revegetated. Contingency plans would include measures to clean up accidental spillage of detrimental or toxic materials such as gasoline, oils, and chemicals, and to restore damaged vegetation to a near natural condition.

Edges or sides of all excavated material sites and borrow areas would be sloped to a minimum 3:1 slope to minimize sloughing and to enable revegetation.

Where possible, irrigation would be used to increase reclamation success, especially in years when precipitation is low.

The Endangered Species Act of 1973 provides for the conservation, to the extent possible, of plant species facing extinction. If species in this category were found along the proposed railroad route, their protection would be provided for by enforcement of this act. Because these species are not easily identified, they would likely go unnoticed, and therefore unprotected.

Terrestrial Fauna

The Endangered Species Act of 1973, makes it unlawful to, in any way, harass an endangered species. Peregrine falcons (Falco peregrinus) have been seen in the general vicinity of the proposed route. Therefore, to help mitigate potential harassment of this species, a study would be conducted prior to construction to identify all endangered species habitat and use areas or prove that endangered species do not use the subject area. Mitigating measures such as choosing an alternate route or seasonal restrictions for construction and disturbance would be required, as determined by this study.

Aquatic Biology

The Endangered Species Act of 1973, makes it unlawful to, in any way, harass an endangered species. Every effort would have to be made to insure that the four endangered species of fish would not be affected by this action. No construction activities would be allowed that would result in increasing the Yampa River's sedimentation load during periods of low flow, primarily July and August. During periods of high water and high sediment load, in the spring, the increase in sediment created by the railroad would not seriously affect the endangered fish species.

A supplement to the Endangered Species Act of 1973, published in 40 CFR, 78-22 April 1975, clearly defines the parameters of this act.

Archeological Resources

Protection of archeological resources is provided by a variety of legislation; the Regional Analysis contains a detailed accounting of how these regulations would be implemented.

The 1906 Federal Antiquities Act (P.L. 59-209; 34 Stat. 225) makes it illegal to damage, destroy, appropriate, or excavate any historic or prehistoric object; to help enforce these provisions, issuance of antiquities permits to qualified professionals for purposes of conducting surveys, testing, and excavation is required on Federal lands.

Protection of cultural resources on State lands is provided by the Colorado Antiquities Act of 1973, which is similar to the Federal Antiquities Act. The State has authority to require and subsequently grant or deny, State permits to prospective applicants for purposes of investigating, collecting, and testing of cultural resources on State-owned lands.

Authorization for the Secretary of the Interior to maintain the National Register of Historic Places is given by the 1966 Historic Preservation Act (P.L. 89-665; 80 Stat. 915); the Advisory Council on Historic Preservation is also established by the Act. All Federal actions affecting existing or proposed National Register Properties must be reviewed by the Advisory Council (according to Section 106 of the Act). The National Environmental Policy Act of 1969 (P.L. 91-190) also identifies the Federal government's continuing responsibility to preserve important historic and cultural aspects of our national heritage. Establishment of the Federal government in a leadership role for preserving, restoring, and maintaining cultural resources was accomplished by Executive Order 11593, 1970 (36 F.R. 8921). The most recent Federal legislation is the Archeological and Historical Data Conservation

Act of 1974 (P.L. 93-291) which requires protection of cultural resources affected by any Federal or federally licensed construction project. Title 43 CFR, Subpart 2801.1-5(a) and 2801.1-5(h), under "Rights-of-Way; Terms and Conditions", further requires compliance with all Federal and State laws applicable to the project for which the right-of-way is approved, and other applicable regulations as may be necessary to render right-of-way approval compatible with the public interest.

These legal provisions would be implemented by requiring the lessee to complete intensive cultural resource surveys on all areas subject to surface disturbance, including an evaluation of National Register significance. If significant sites are found, W. R. Grace would be responsible for nominating them to the National Register of Historic Places and subsequently contacting the State Historic Preservation Officer, to comply with Advisory Council review procedures concerning site protection. The surveying archeologist would also make specific recommendations, to be adhered to by W. R. Grace and Company, concerning the possible need for on-site archeological reconnaissance during surface-disturbing activities. These recommendations must be on a location-specific basis to ensure discovery, evaluation, and protection of significant sub-surface archeological resources. The company would be required to protect significant resources by constructing fenced enclosures, interpretive signing, etc., or if necessary, completing salvage archeological excavations as appropriate.

Intensive cultural resource surveys have been completed for proposed and alternate railroad routes. As a result, the surveying archeologist recommended a more thorough investigation of five sites, testing of 18 sites, and excavation of two sites (see Table GRII-6). This recommended additional investigation plus testing must be completed, with all subsequent testing and evaluation, prior to initiation of surface-disturbing actions.

Sites 14 and 78 must be nominated to the National Register of Historic Places through the State Historic Preservation Offices (SHPO). Any additional sites deemed worthy of excavation or nomination by the surveying archeologist after required additional investigation and testing, must also be nominated to the National Register of Historic Places. Subsequently, the SHPO needs to be consulted concerning proposed disturbance of potential National Register entries, to comply with Advisory Council procedures.

The surveying archeologist must also make specific recommendations, on a location specific basis, as to whether or not an on-site archeological reconnaissance needs to be made during actual construction, for the purpose of locating and evaluating subsurface cultural resource values.

Archeological resources derive their primary value from being preserved in-place; their secondary value occurs in excavation. Archeological testing or excavation stemming from intensive surveys on proposed action areas may be permitted where the site is not in imminent danger of being destroyed. This would not preserve the site's primary in-place value, and also would not allow utilization of improved archeological survey and analysis techniques in site excavation at a future date, when more sophisticated techniques could be employed. However, salvage excavation would allow partial mitigation of adverse impacts where a site is threatened by actual physical displacement.

For all practical purposes, not all cultural values can be identified in the required survey; other sites may be buried by alluvium and hidden from view. The regulations themselves would also do little to prevent theft and vandalism of cultural resources due to increased visitor use pressure.

See Chapter IV of the Regional Analysis for a more detailed discussion of enforcement of these legal provisions.

Historical Resources

All current antiquities legislation discussed in the Archeological Resources section is also applicable to protection of the area's historical resources. To mitigate impacts on the local historic value of the George Iles Ranch, an Historic and American Buildings Survey pursuant to the 1935 Historic Sites Act, would be completed by the applicant prior to initiation of on-site surface disturbance; this is essentially a photographic and architectural documentation.

Should this survey identify historic or architectural significance, the site would be nominated to the National Register of Historic Places through the SHPO. The SHPO would also need to be consulted concerning the proposed impact upon the site prior to initiating surface disturbance in the area. In consultation with the SHPO and at his discretion, the buildings would be moved to an alternate location and the sites salvage-excavated.

See Chapter IV of the Regional Analysis for an in-depth discussion of the application of these legal provisions.

Aesthetics

43 CFR 2800, Rights-of-way, Subpart 2801.1-5(a) under Terms and Conditions requires the applicant to comply with State and Federal laws applicable to the project for which the right-of-way is approved. Subpart 2801.1-5(h) further requires the applicant to comply with other conditions that may be found by the supervising agency to be necessary to render the approval compatible with the public interest. To comply with these requirements, the following measures would be taken with respect to aesthetic resources identified in Chapter II.

All cut and fill slopes would be graded into a curving form that intersects adjacent undisturbed terrain at a very low angle, to avoid sharp, angular, minus deviations of form and line. All access roads to material supply points would be located on gentle slopes to minimize cut and fill banks. Where trees or shrubs are removed, irregular clearings with feathered edges, would simulate naturally occurring openings in the vegetative cover. The shape and size of such artificially-created openings would be based on views obtainable from viewshed sequences providing the greatest visual access (see Landscape Visibility maps in Chapter II). When trees or shrubs are removed, they would be buried or chipped. All disturbances would be successfully revegetated with a diverse and self-sustaining vegetative cover similar to immediately adjacent terrain; revegetation would begin as soon as possible following railroad construction. Special attention would be given to revegetation of those cuts and fills listed in Table GRIII-5. All bridges would be designed to minimize the creation of lines and forms that compete with those found in the characteristic landscape. All surfaces would be painted a non-reflective earth-tone brown, buff, or green color characteristic of the adjacent landscape. These colors would also be used for fences that would be viewed at foreground distances, and for screening materials. W. R. Grace and Company would also maintain a litter-free environment by screening refuse disposal areas during railroad construction.

Regulation No. 1, Emission Control Regulations for Particulates, Smokes, and Sulphur Oxides for the State of Colorado, Section II-D, Fugitive Dust, (Colorado, 1971) prohibits mining operations from occurring without a permit that specifies fugitive dust control measures. Implementation of these measures would reduce potential for atmospheric haze.

The Colorado Department of Health's water quality standards (1974) provide regulations consistent with the provisions of the Federal Water Pollution Control Act amendments of 1972. Enforcement of this legislation would prevent the railroad from contributing floating debris, scum, and discoloration to the waters of the Yampa and Williams Fork Rivers, and to Taylor and Wilson Creeks.

Impacts to mood-atmosphere values caused by increased noise levels would be partially mitigated by implementing the provisions of Colorado Senate Bill 197 (1971) which establishes maximum permissible noise levels and abatement procedures. Federal noise pollution guidelines are outlined in P.L. 91-604, The Clean Air Act, Section 401—Noise Pollution and Abatement Act of 1970. The Office of Noise Abatement and Control, established by this Act, provides for enforcement of the guidelines contained in the Act. Enforcement of these laws would lower noise levels adjacent to railroad construction activities.

These regulations and legislative enactments would be effective only to the extent that they are enforceable, that the standards set forth are enforced, and that these minimum standards are actually effective in reducing impact. The probability of all of these actually being enforced would be something less than 100 percent, as evidenced by impacts presently occurring from similar coal-related operations in the region.

See Chapter IV of the Regional Analysis for a more detailed discussion of the implementation of these legal provisions.

Recreation

On-site impacts on recreational capabilities that result from right-of-way construction would be mitigated under provisions of 43 CFR, Subpart 2801.1-5(a) and 2801.0-5(h)—Rights-of-way; Terms and Conditions. These regulations require compliance with Federal and State Laws applicable to coal-related projects for which rights-of-way would be approved and with other regulations necessary to render such rights-of-way approvals compatible with the public interest. All mitigations applicable to recreation impacts generated by the railroad therefore are required to be adhered to and enforced as conditions for granting approval of rights-of-way.

All railroad right-of-way and access road disturbances would be successfully revegetated as soon as possible following construction. No access roads for railroad construction maintenance would be constructed on areas of steep terrain or fragile soils. No fences would be constructed along the railroad right-of-way which would impede normal movements of big game between adjacent terrain and the river. New access roads and trails for construction purposes would be physically blocked to ORV use, if these roads lie in known big game concentration areas, or if they traverse areas having fragile soils.

Water quality standards established by the Colorado Department of Health (1974) provide regulations that could be used to mitigate impacts on recreation resources. All State waters are required to be free of substances or conditions toxic to plant, animal, or aquatic life that produce undesirable aquatic life, and that import any undesirable taste to fish flesh, or make fish inedible. These regulations prohibit railroad construction-caused damage to the recreational potential of downstream fisheries. Impacts to the recreational value of archeological and historical resources would be mitigated as outlined earlier in Chapter IV.

The degree to which these legislative enactments would be successful in mitigating impacts would be dependent upon their enforceability and actual on-the-ground enforcement. Based on past observations of similar coal mining operations, enforcement of current laws has not completely mitigated applicable impacts.

See Chapter IV of the Regional Analysis for a more detailed discussion of how these legal provisions would be implemented.

Transportation Networks

Federal and State regulations and standards apply specifically to safety in designing and operating railroads. These cover: locating highway crossings to reduce potential for car-train collisions, erecting adequate signs and signals at crossings, and implementing accepted engineering standards in design and construction of the railroad (for example, American Railway Engineering Association standards). The type and placement of grade crossing protection devices at the one farm and two county road crossings would be coordinated with the Moffat County government.

Measures to be Included if Authorizations are Granted

Air Quality

Specific additional mitigating measures need not be required unless the cumulative emissions of pollutants in the entire region become sufficiently large to influence air quality (see also Regional Analysis).

Terrestrial Fauna

Efforts would be made to avoid any construction or related activity within the riparian habitat. This action would help mitigate impacts on the most important wildlife habitat type found along the proposed route.

Access and maintenance roads would be kept to a minimum to avoid any unnecessary habitat disturbance.

Topsoil to be stockpiled would be placed where it would create the least damage to wildlife values. Soil stockpiled on bare ground, cropland, or in sagebrush habitat would avoid disturbing mountain shrub or riparian areas.

Aquatic Biology

A high degree of line maintenance and an adequate mobilization plan for spill containment would be required to mitigate potential impacts caused by spillage that might reach the aquatic ecosystem.

Chapter V

Adverse Impacts Which Cannot Be Avoided

THIS CHAPTER PRESENTS THE RESIDUAL ADVERSE IMPACTS OF W. R. GRACE AND COMPANY'S PROPOSED ACTION THAT WOULD REMAIN AFTER APPLICATION OF THE MITIGATING MEASURES DISCUSSED IN THE PRECEDING CHAPTER. THE FOLLOWING DISCUSSION COMPLETES THE ANALYSIS EQUATION: IMPACTS MINUS MITIGATIONS EQUALS ADVERSE IMPACTS WHICH CANNOT BE AVOIDED.

Adverse impacts on the region's topography that cannot be avoided would be the cuts and fills along the proposed route of the railroad, and the pits for ballast gravel and borrow materials.

Impacts to all fossils would be difficult to mitigate and some would be destroyed.

If there is minable coal beneath the right-of-way, it would be unavailable for surface mining during the life of the railroad, but the amount probably would not be significant. The potential for fires in coal seams exposed in cuts, whether the seams are minable or not, would be manageable, but would not be totally avoidable.

Approximately 4,000 tons of sediment produced during the first year of construction would be unmitigated. This would be reduced during subsequent years, to about 700 tons per year, as a result of mitigating measures and the natural stabilization of cuts, fills, and stream channels. Because the normal sediment load of the Yampa River is about 300,000 tons per year, neither the initial sediment increase nor the continuing additional sediment input would cause a significant change in the amount of sediment in the stream except during periods of low flow.

Spillage of coal or diesel fuel into streams as the result of accident would be unlikely but could not be completely avoided.

Fugitive dust from construction, although temporary and local, at times probably would exceed the 24-hour standards for suspended particulates, unless rigorously controlled by watering. Emissions from construction-related vehicles would have a minimal but unmitigated adverse effect on air quality. Emissions from diesel locomotives during railroad operations also would have a minimal but unmitigated adverse effect on air quality. The emission levels expected are shown in Table GRIII-1.

Disturbance of soil on 440 acres during construction would not be avoided. Soil disturbance would lower productivity of the disturbed area to some degree by compaction, mixing of native soils, and accelerated erosion. Partial alteration of all soil horizons, parent material, and soil characteristics which have developed over long periods of geologic time could not be avoided. Present soil biota and soil forming processes would be altered. As a result, new soils would be formed with characteristics unlike those existing prior to disturbance.

Of the 440 acres of vegetation disturbed, a minimum of 70 acres would be occupied by the roadbed and permanently lost. Twelve acres would be permanently lost to community expansion from population increase associated with the railroad. Approximately 80 percent of the remaining disturbed acreage, almost 300 acres, would not be revegetated because of steepness, rockiness, and areas provided for snow removal in cuts; these areas would be permanently void of vegetation. The remaining 20 percent of the right-of-way, approximately 66 acres, would be revegetated; however, the loss of vegetation for as long as four years could not be avoided, and loss of trees and shrubs would be indefinite. Even after revegetation, a return to present native composition would be indefinite, making the loss of native vegetation an unavoidable impact for at least 20 years. Some weed invasion, and thus competition with revegetation efforts, would be unavoidable. Croplands severed by the right-of-way would be an unavoidable impact that would result in increased difficulties for farming.

Some destruction of wildlife habitat could not be avoided. Food, cover, dens, and nests would be lost during the railroad's construction phase; few animals would be displaced because of these activities. The number of animals displaced is not considered great enough to cause a significant alteration in the existing ecosystem, except perhaps in the riparian habitat type. Riparian vegetation is restricted to a relatively small strip of land winding through this region. The loss of approximately 115 acres of this habitat type would create a significant impact on some wildlife species. However, the proposed action would disturb riparian habitat that may be flooded by the proposed Juniper Dam. Approximately 370 acres would be taken out of production permanently because of the railroad bed construction. This disturbance would result in a loss of habitat capable of supporting seven mule deer, three elk, and possibly three pronghorn antelope between Craig and the terminal in Axial Basin. A corresponding loss in the area's carrying capacity for a variety of small mammals, domestic livestock, non-game birds, reptiles, amphibians, and invertebrates also would be unavoidable. Disruption in migration patterns of big game species could take place during the construction period; however, this probably would not have a long-lasting impact on the migration routes unless there were a major increase in rail traffic. Noise associated with railroad construction and operation would not be significant unless there would be a major increase in rail traffic. Fences along the right-of-way would unavoidably impact some large animal movement across, and use of, the right-of-way forage. Vehicle and train collisions with large and small animals would be unavoidable even with fencing as proposed.

Some increased stream sedimentation would be impossible to avoid during construction of the proposed railroad; after construction, the sedimentation impact would become slight after a year or two. Increased sediment yield would adversely impact the quality of the aquatic habitat in the Yampa River. These impacts would result from accumulation of silt in rocky riffles which serve as fish spawning and feeding areas, and from direct harmful effects of increased sedimentation on individual aquatic organisms; e.g., many sedentary benthic invertebrates would perish due to the suffocating effects of silt deposition over their habitat. If the proposed mitigating measures are not fully implemented, the resulting degradation of the aquatic habitat could be construed as a violation of Section 9 of the Endangered Species Act of 1973 (Public Law 93-205; 93rd Congress; S. 1983; December 28, 1973).

Complete loss of 25 lithic sites, three chipping sites, and three campsites, and partial loss of an additional five lithic sites and one rock-shelter, would be unavoidable. Archeological testing and subsequent excavation (if desirable) would lessen the impact, but would yield both adverse and beneficial impacts where it is done only for study purposes, i.e. where sites are not in imminent danger of destruction. The impact on all sites from increased exposure to vandalism and pothunting would be unavoidable, except that interpretive signs and fence exclosures should be effective in protecting those sites eligible for nomination to the National Register.

Complete loss of three historic building sites and one rock structure would be unavoidable. Except for values retained by relocation and/or site excavation of the George Iles Ranch, it would also be displaced, if minor realinements of the railroad cannot be successfully accomplished. Impacts on historical values from theft and vandalism would also be unavoidable.

Several visually incongruous elements or minus deviations would not be mitigated. All mitigations are within rather rigid engineering requirements and could only lessen adverse visual impacts slightly. Cuts and fills would still remain as large-scale elements in these landscapes, and where cuts occur in solid rock, chances for revegetation would be nil. Special engineering designs and painting of bridge structures would also result in some mitigating effect, but adverse visual impacts from these structures could not be totally avoided. Adverse impacts on mood-atmosphere values of isolation, solitude, and respect for nature are significant and could not be mitigated, especially in Little Yampa Canyon.

Adverse impacts on recreational values of the sage grouse strutting grounds adjacent to Big Bottom would not be mitigated; the grouse would be displaced at least temporarily. Some increased sedimentation and siltation in Yampa River and Milk Creek would be unavoidable, and successful revegetation on all disturbed areas would not be possible. The overall result would be a decrease in the inherent capability of these areas to attract and sustain recreation use. Impacts on and loss of natural values in Little Yampa Canyon, along the Yampa River, would be unavoidable, as well as impacts upon its potential for Wild and Scenic River classification. The relative value of these unavoidable adverse impacts is moderately high.

Although the placement of protective devices at the intersection of the proposed railroad with the farm road in Section 16, T.6N., R.91W. and with Moffat County Roads 17 and 51 in Axial Basin would significantly reduce the likelihood of train-auto collisions at these points, some increase in the hazard would be unavoidable. The increase in auto accidents and road maintenance costs on the two county roads and State Highway 13 would be unavoidable.

Chapter VI

Relationship Between Short-Term Uses and Long-Term Productivity of the Environment

THIS CHAPTER DISCUSSES THE EXTENT OF LONG-TERM IMPAIRMENT OR ENHANCEMENT OF RESOURCE VALUES THAT WOULD OCCUR, GIVEN THE SHORT-TERM USES OF THE ENVIRONMENT PROPOSED IN W. R. GRACE AND COMPANY'S PROPOSAL. IN THIS ANALYSIS OF TRADE-OFFS OVER TIME AND TRADE-OFFS AMONG RESOURCE VALUES, SHORT-TERM REFERS TO THAT PERIOD WHEN SUBSTANTIVE PARTS OF W. R. GRACE AND COMPANY'S PROPOSED ACTION TAKES PLACE. LONG-TERM IS THAT PERIOD IN WHICH SUBSEQUENT IMPACTS, BOTH ADVERSE AND BENEFICIAL, STILL AFFECT THE ENVIRONMENT.

Unavoidable paleontological impacts would be experienced in the short-term during the railroad's construction; after completion of the railroad, no further impacts would occur. Options for future use of these subsurface resources would be foreclosed. However, a beneficial impact may result from the operation itself disclosing knowledge of fossils heretofore unknown; this would create options for future generations to benefit from the new-found resources.

Long-term productivity of soils would decline as the railroad is constructed and used. Some of this lowered quality would result from accelerated erosion of denuded and disturbed areas, but the greatest loss would result from mixing and burying soils during construction of the road bed. Soil development is a slow process under the best conditions, and the present climatic conditions in the area magnify the time factor necessary to redevelop a self-sustaining soil system. Loss in soil productivity would be a long-term loss on about 400 acres.

The short-term uses associated with the construction of the railroad would be the destruction of vegetation by construction of the right-of-way, the load-out facility, and access roads, plus the associated population increase. Approximately 440 acres would be disturbed during the construction phase, and approximately 66 acres would be revegetated, leaving nearly 400 acres that would not be returned to productivity. The long-term productivity of revegetated areas would depend on the success of the proposed reclamation program and on natural succession, but because of increased slopes and loss of existing soils a 50 percent decrease in production is projected.

Short-term use of the proposed railroad right-of-way by wild fauna would be reduced because of temporary loss of about 66 acres of wildlife habitat and permanent loss of another 400 acres. All wild faunal species that have been identified as inhabiting the right-of-way would show a reduction in their use of this area; the degree of reduced use would depend on the total acreage of each vegetation type disturbed. The proposed action would cause a loss in short-term use of riparian areas, at least during the construction phase. Reduction in long-term productivity would depend on the success of revegetation efforts. Grasses would be the primary plant species used during reclamation; this would favor those faunal species associated with grasslands or those that require an increase of grasses within their habitat boundaries. The proposed route would cross a major mule deer and elk migration route. Short-term use of these migration routes would be reduced or altered during railroad construction; the long-term effect of the railroad probably would not be significant unless the volume of rail traffic were increased beyond what has been proposed. Most of the railroad right-of-way through livestock use areas would be fenced to exclude domestic animals, eliminating short-term use of those areas. The fences would be expected to remain in place and in good repair for the life of the railroad, eliminating long-term livestock productivity.

Impacts on the aquatic habitat would vary depending on the size of the body of water. Channelization of small streams would produce long-term impacts due to the nature of the small stream ecosystem and its intolerance to disturbance. Even when the small stream is able to re-establish itself, the benthic fauna and flora generally are greatly altered. Large rivers, because of their size and ever-changing configuration, are more tolerant to in-stream impacts. Those species of vertebrates, invertebrates, and plants that are endemic to this environment have evolved this adaptability and tolerance or they would not be present.

Archeological values, both known and unknown, would be impacted during the short-term by actual surface disturbance. Potential for vandalism also would be experienced largely in the short-term. Options for future use of cultural resources would be foreclosed to the degree that unavoidable impact results from building the railroad. However, required additional investigation, testing, and salvage excavation could reveal currently hidden values; this would create options for future generations to benefit from the new-found resources.

Unavoidable impacts on historical resources would occur only in the short-term. Once the railroad is built, the potential for vandalism and destruction of the old buildings and structures would return to its present level.

Given the foregoing mitigating measures, short-term aesthetic impacts would be only somewhat reduced. After construction, long-term unavoidable impacts on the area's aesthetics would remain though they would be less significant than short-term impacts.

Short-term use of the area would result in several adverse as well as beneficial impacts to recreation resources. After construction, several adverse impacts would remain unmitigated, especially the impacts to Little Yampa Canyon's natural and mood-atmosphere values. Conversely, potential increases in off-road vehicle use and additional wildlife viewing opportunities could improve recreation capabilities on a long-term basis. Management decisions by W. R. Grace would ultimately determine whether the potential for rockhounding and geologic-industrial interpretation would be realized; this development rests partly on whether recreation users would be granted access across privately-owned lands.

Chapter VII

Irreversible and Irretrievable Commitments of Resources

THIS CHAPTER QUANTIFIES THOSE RESOURCES THAT WOULD BE CONSUMED AND PERMANENTLY LOST AS A RESULT OF THE IMPLEMENTATION OF W. R. GRACE AND COMPANY'S PROPOSED ACTION. SUCH LOSSES ARE IRRETRIEVABLE COMMITMENTS; I.E., ONCE THESE RESOURCES ARE USED, THEY CANNOT BE REPLACED.

Approval of the right-of-way application would be an irreversible commitment of fossils.

The small amount of coal destroyed along the railroad in cuts and under fills would constitute an irreversible and irretrievable commitment of resources. Approximately 92,000 cubic yards of gravel from terrace gravels just south of Craig would be irretrievably committed to ballast for the railroad.

Approximately 400 acres of the railroad right-of-way would be irreversibly committed to use as a transportation corridor. The remaining 66 acres would be revegetated but probably would produce 50 percent less forage than undisturbed lands. Wildlife habitat and grazing values in this area would be irretrievably committed to transportation. Existing soil profile characteristics would be irretrievably lost on the 440 acres that would be disturbed by railroad construction.

Aquatic habitat would be irretrievably committed to the proposed railroad construction to the extent that channel changes would destroy habitat values and sediment additions to the streams would alter existing habitats.

Unavoidable impacts to cultural resources (archeologic and historic) would consitute an irreversible commitment of these resources.

Unavoidable and long-term adverse impacts on aesthetic resources represent an irreversible commitment of current values.

The proposed action would result in irreversible commitments of recreational resources, even though they would be both adverse and beneficial. Destruction of unknown cultural resources, and of Little Yampa Canyon's isolated character and relatively unspoiled scenery, would be irreversible.

Chapter VIII

Alternatives to the Proposed Action

INCLUDED IN THIS CHAPTER IS A DISCUSSION OF ALL REASONABLE ALTERNATIVES TO W. R. GRACE AND COMPANY'S PROPOSAL. THE IMPACTS RESULTING FROM THESE ALTERNATIVES ARE ALSO ANALYZED IN THIS CHAPTER.

Alternatives to the proposed action are no action, alternate routes for a railroad, and alternate means of transporting the coal (truck, slurry pipeline, or conveyor).

No Action

"No action" here is defined as meaning not only that the proposed railroad would not be built but also that none of the alternate means of transportation would be used. The result of no action therefore would be, for all practical purposes, no development of the Colowyo Mine. A mine-mouth market, such as a power generating plant, has not been nor is likely to be proposed. If the Colowyo Mine is not developed, beneficial as well as adverse impacts discussed in preceding sections of this site-specific analysis would not occur. Also adversely affected would be potential development of coal near the proposed railroad route and to the south, where abundant coal occurs, but where existing transportation facilities are inadequate for major development.

Alternate Routes

Several alternate routes for the railroad were considered; most were abandoned as having significantly greater adverse environmental impacts, largely because most other routes add considerably to the length of the railroad without compensating environmental advantages.

The two shortest alternate routes are presented for comparative analysis with the proposed route. These routes, designated B and C, are shown in Figure GRI-1. An impact analysis matrix for the proposed route and the alternate routes is shown in Table GRVIII-1.

TABLE GRVIII-1

Analysis of Unmitigated Impacts for the Proposed Route and two Alternate Routes

	Proposed Route A	Alternate Route B	Alternate Route C
Geologic and Geographic Setting	-M	-L	-H
Mineral Resources	-O	-M	-L
Water Resources	-L	-O	-O
Air Quality	-L	-L	-L
Soils (Land Use)	-M	-H	-L
Terrestrial Flora	-M	-L	-H
Terrestrial Fauna			
Wild	-M	-L	-H
Domestic	-L	-L	-L
Aquatic Biology	-L	-O	-M
Archeological Resources	-M	-L	-M
Historical Resources	-M	-M	-M
Aesthetics	-M	-L	-H
Recreation	-H	-H	-L
Social Environment	-L	-L	-L
Economic Conditions	+L	+L	+L
Transportation Networks	-L	-L	-L

O - Negligible Impact
L - Low Impact
M - Medium Impact
H - High Impact
+ - Beneficial Impact
- - Adverse Impact

Geographic Setting

Route B begins just east of Route A, along the same steep bluffs overlooking the Yampa River, at an elevation of 6,260 feet. It crosses the Yampa on a 100-foot high bridge at 6,230 feet, and continues westward at this elevation about two miles. Then it climbs a 1.5 percent grade to an elevation of 6,348 feet through a 40-foot cut at the county road crossing in NE¼ Section 13, T.6N., R.92W. From here it goes southwest down Bell Rock Gulch at a one percent grade to 6,185 feet near the lower end of the gulch, turns west through a 40-foot cut just west of a small reservoir in the gulch, and enters Yampa River valley at about 6,140 feet. The line descends to 6,130 feet and follows the west and north side of the Yampa for about four miles. The slopes above this part of the route are not excessively steep except in Sections 5 and 8, T.5N., R.92W., where the 600-foot high northern valley side includes slopes of as much as 100 percent. The route then turns south to cross a bridge over the Yampa at an elevation of 6,130 feet into Milk Creek Canyon (Figure GR-VIII-1); from here it coincides with Route A.

Route C is identical with Route A from the north end south to the Yampa-Williams Fork River confluence. Here Route C crosses the Williams Fork on a 20-foot high bridge at 6,130 feet elevation, then continues southward up the west side of the Williams Fork at a grade of 0.2-0.8 percent to the small town of Hamilton. In this six mile stretch the Williams Fork River flows in a narrow canyon that ranges from about 400-1,000 feet wide at the bottom, and has fairly steep sides which rise about 400-800 feet above the valley floor. The river would be rechanneled in five places; the most extensive of these would be a 2,000-foot segment in S½ S½ NE¼ and N½ SE¼ Section 7; T.5N., R.91W., where the river would be moved eastward away from a steep hillside (about 65 percent slope) to allow room for the railroad. Other rechanneled segments would be about 1,000, 900, 450, and 250 feet long; all would allow the railroad to remain west of the river. At Hamilton the route ascends on a 1.5 percent grade

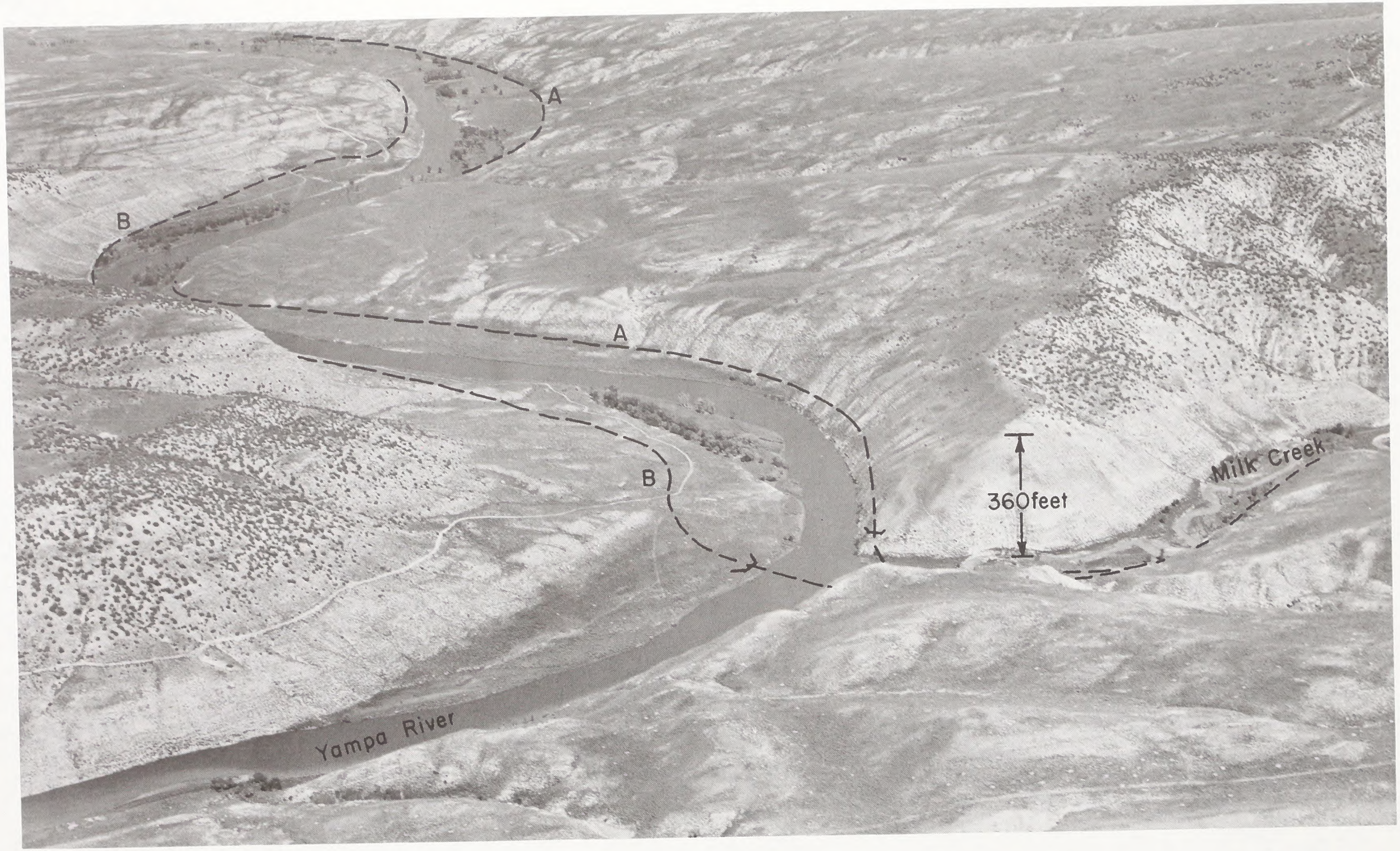


FIGURE GRVIII-1

Aerial oblique view east, showing Routes A and B along the Yampa River and the lower Milk Creek canyon. Route A requires a bridge over Milk Creek and Route B a bridge over the Yampa. Scale shown by hill at canyon mouth.

through three deep rock cuts of 55, 70, and 90 feet. It leaves the Williams Fork River valley at about 6,370 feet and ascends Morapos Creek valley (Figure GRVIII-2) on a 1.1 percent grade. Then it enters Axial Basin at 6,520 feet over the low divide between the Williams Fork River and Milk Creek drainages. Running due west for six miles along the south foot of Iles Mountain, Route C descends on a one percent grade to curve northwest around the end of the mountain, then cross a bridge over Milk Creek at 6,230 feet. Here it curves south to coincide with Routes A and B.

Geologic Setting

Route B begins on uppermost beds of the Williams Fork Formation, crosses the Yampa River, and continues west on Lewis Shale. In Bell Rock Gulch the route traverses the upper beds of the Williams Fork Formation in crossing the Williams Fork Anticline. Beyond this gulch, the route is on alluvium in Round Bottom as it crosses the axis of Round Bottom Syncline. It then traverses gently dipping beds of the Williams Fork Formation on the west flank of Round Bottom Syncline, as it follows the Yampa River's north bank to the mouth of the Milk Creek canyon; here Route B joins Route A.

Route C separates from Route A at the confluence of the Yampa and Williams Fork Rivers, and in its course up the Williams Fork traverses Williams Fork Formation for 1½ miles, and then the Iles Formation to within a mile of Hamilton. Near Hamilton, bedrock is the sandy upper part of the Mancos Shale. Westward along the foot of Iles Mountain, the route runs along the strike of the Mancos Shale on the north flank of the Axial Basin Anticline to join Routes A and B at Milk Creek.

Paleontology

Alternate routes B and C traverse the same four formations as the proposed Route A: Mancos Shale, Iles Formation, Williams Fork Formation and the Lewis Shale. Impacts to fossils would vary in relation to relative lengths of the routes traversing each formation; no specific fossil localities have been found.

Water Resources

Ground water

The most important impact related to ground water would be slope instability in cuts that intercept the water table. This could be a serious problem at the summit of Route B where a 40-foot cut would be required; this cut would be in the Lewis Shale, which is the formation most likely to cause problems. Deeper cuts would be required in other places but the summit cut on Route B would be the only place where the cuts would be likely to intercept the water table. Existing ten percent slopes in this area are stable, and presumably if the slopes of the cut would be flat enough, this cut could also be stabilized.

Surface water

The sediment yield from both Routes B and C would be less than for Route A. Route B would not infringe upon the Yampa River as Route A does, but it would require the same rechannelization of Milk Creek. Route C also would not infringe upon the Yampa River, nor would it require rechannelization of Milk Creek; however, it would require rechannelization of the larger Williams Fork River.

Soils

Route B would affect more private landowners and disturb more acres in grain production than Routes A and C. In addition, since more cropland is involved along this route, there would be a greater possibility that more farming operations would be disrupted by the railroad severing portions of fields. These disruptions mainly would be problems of getting farm equipment into the severed farm tracts, which might result in building additional access roads with increased losses of cropland.

Terrestrial Flora

Segment 2 (see Figure GRII–2): Colorado Ute spur to Bell Rock Gulch

Starting at the same point as Segment 1, this portion of Route B approaches Milk Creek through Bell Rock Gulch. Topography and land use are the dominating factors in the plant ecosystems along this route. Sagebrush, riparian, and agricultural lands are the only existing plant communities. The majority of agricultural lands are devoted to wheat production. Like other areas within this region, sagebrush rangelands are used for livestock grazing.

Segment 4: Yampa/Williams Fork to Hamilton

Plant communities along this portion of Route C are similar to other areas along the other

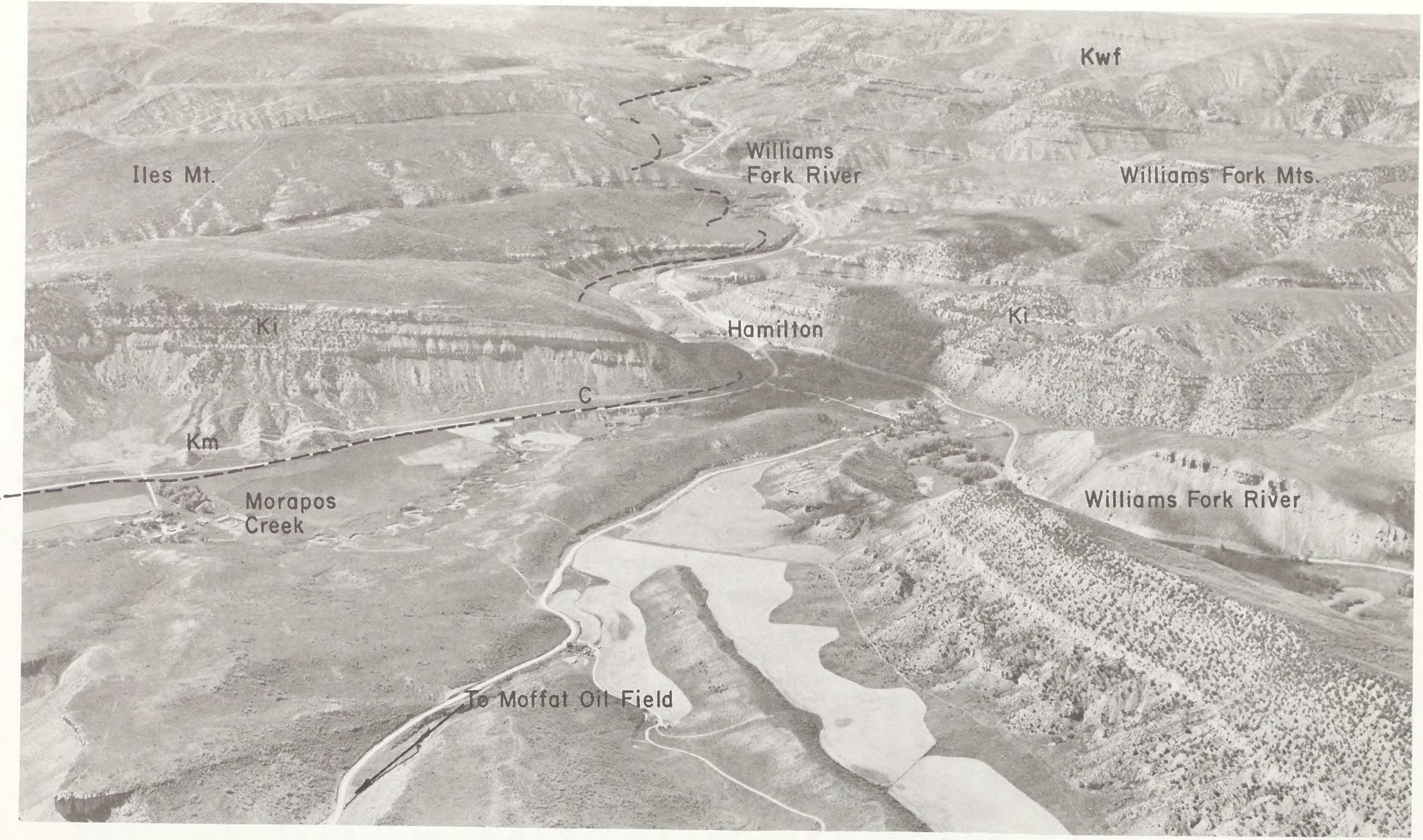


FIGURE GRVIII-2

Aerial oblique photograph with view northwest, showing Route C where it emerges from the Williams Fork River valley at Hamilton and enters the Axial Basin along Morapos Creek. (Km, Mancos Shale; Ki, Iles Formation and Knf, Williams Fork Formation).

proposed corridors. Cultivated lands are not a prominent feature because of the steeper topography. Oak woodland is well developed on moist east and north-facing slopes; pinyon and juniper stands develop along the rocky outcrops of the ridge lines. Cottonwoods and other riparian vegetation exist along the Williams Fork floodplain for the entire length of this segment.

SEGMENT 5: HAMILTON TO MILK CREEK

This segment of Route C generally follows Highway 13 along the flanks of Iles Mountain. Pinyon-juniper, oakbrush, and sagebrush communities occur across the top and down the side slopes of this mountain. Hay fields occur along the highway where topography permits farming. Greasewood is also present throughout this portion of Route C in areas with a higher water table.

Terrestrial Fauna

WILD FAUNA

Route B

This alternate route would result in light impacts to the majority of wildlife species because a greater percent of the route would be constructed through previously disturbed areas, primarily cropland. Only 94 acres of riparian habitat would be impacted by this route, which would be a minimal amount in relation to the other two routes.

Route C

This route would result in the most significant impacts of the three because of the amount of riparian habitat impacted.

DOMESTIC FAUNA

Of the three routes, Route A would result in the loss of approximately 75 AUMs, Route B about 69 AUMs, and Route C about 84 AUMs. The impacts of fencing would be more restrictive along Routes A and C.

No major livestock use areas would be seriously impacted by any of these three routes.

Aquatic Biology

ROUTE B

Impacts on the aquatic community that would result from the construction of Route B would be similar to Route A. However, the impact on the valuable endangered species habitat in the Yampa River would be less if Route B were constructed because significantly fewer rock cuts and stream bed fills would be needed along the Yampa River. Impacts of Route B along Bell Rock Gulch would be minimal, since the drainage only carries water during spring runoff or heavy summer thunderstorms; thus it is doubtful that sediment resulting from construction along Bell Rock Gulch would reach the Yampa River, even if extensive channel realinement would occur.

The remainder of Route B would be common with Route A from the mouth of Milk Creek to the loading facility in Taylor Creek Canyon; impacts to Milk Creek would be the same for the southern portion of Route B as those for Route A.

ROUTE C

The major impact of Route C would occur along the Williams Fork River. The only known study of the Williams Fork River was conducted by the Colorado DOW in 1972 for the proposed construction of Highway 13 which necessitated channelization of the stream in some areas. Species collected on the Williams Fork, and their relative abundance, are also shown in Table GRII-5. The study team concluded that the river was in relatively poor condition as a result of varying degrees of pollution; however, aquatic organisms indicative of improved water conditions were present, and it was believed that the biological capacity of the stream was increasing. This section of the river was and still is considered a marginal fishery, but it retains the potential for improvement if pollution (such as siltation) is controlled. Data collected indicate a very low rainbow trout population; mountain whitefish are the most common fish in this segment of Williams Fork.

Rainbow trout is the only species stocked in the stream; other species survive through natural recruitment. Age class distribution and growth vary depending on the species. Data collected indicate several age classes in most species, but no work has been done on growth rates; detailed data are not available on pressure or harvests. Some stocking occurs in the area and most of these fish probably are harvested. Fishing pressure is regulated by private land that limits access.

Necessary stream channel realinements along the Williams Fork would increase the sediment load in the Yampa River below the confluence of the two rivers. The aquatic community of the Williams Fork River would be significantly affected by the construction of Route C; alterations of the natural channel of the Williams Fork would result in the elimination of many aquatic organisms, due to increased siltation in riffle areas, increased rate of stream flow, and habitat destruction. It is likely that most fishes present could escape the habitat disruption by migrating into the Yampa River; however, most members of the benthic invertebrate, periphyton, and plankton communities would be destroyed. Total recovery of the aquatic community resulting from channelization of the Williams Fork would require several years.

Archeological Resources

ROUTE B

Specific impacts that would result if Route B were constructed are shown in Table GRIII-5. Site numbers refer to sites depicted on Figure GRII-9. All sites would be exposed to vandalism and pothunting; ten lithic sites would be subject to complete physical displacement; three lithic sites and one rockshelter would be subject to partial displacement. Mitigating measures would be similar to those for the proposed route.

ROUTE C

Table GRIII-5 includes probable impacts on archeological values due to Route C's construction. Twenty-two lithic sites, four chipping sites, and one campsite would be subject to complete displacement; four lithic sites, one chipping site, and two pictographs would be subject to partial displacement. All sites would be subject to vandalism and pothunting. Mitigating measures would be similar to those for proposed Route A.

Historical Resources

ROUTE B

Three historical sites with buildings would be impacted (Table GRIII-5).

ROUTE C

Five historical sites with buildings would be impacted (Table GRIII-5).

REALINEMENT OF ROUTES A, B OR C

A minor realinement of the segment shared in common by all three routes (SW¼, Section 30, T.5N., R.92W.) would allow the railroad to bypass the George Iles ranch; this would mitigate adverse impacts to the site. However, impacts to mood-atmosphere values of the site, both audio and visual, would be unavoidable, due to the close proximity of the railroad.

Aesthetics

ROUTE B

The visibility of Route B between its southern terminus and Round Bottom on Yampa River would be the same as described for Route A because the routes coincide.

Seven figures illustrate key points along Route B's alinement (Figures GRVIII-3 through GRVIII-9).

Foreground landscapes visible from viewshed sequences UV and VW on Colorado Highway 13 (Figure GRII-9) contain especially visible portions of Route B as well as Route A. Sequence XW provides the greatest number of viewshed sequences from which to view foreground landscapes containing Route B. Viewshed sequences DE, EF, HI, IJ, JK, KL, LM, MN, and OP provide foreground access to proposed Route B. Minus deviations in these landscapes are few; significant exceptions include the electric transmission line visible from sequences LM, MN, and OP. The landscape of County Road 30 is characterized by strongly form-dominant, rolling sagebrush landscapes containing intermittent line-dominant, agricultural lands—largely grainfields plus irrigated meadowland in the Big Bottom area (Figures GRVIII-4 through GRVIII-8).

Middleground views of Route B approximately one-half mile west of the proposed Yampa River crossing are from viewshed sequence QR on U.S. 40. Viewshed sequence ST on Colorado 13 also provides southbound motorists with middleground views of the beginning segment of Route B. Middleground landscapes containing Route B lie immediately west of the proposed Yampa River crossing at Big Bottom, and can be viewed from viewshed sequences on both County Road 30 and Colorado Highway 13 (see Figure GRII-12). The northern end of Bell Rock Gulch contains middleground landscapes that can be viewed from sequence IJ on County Road 30 (see Figure GRVIII-6); about one mile of Route B will not be visible on the southern end of Bell Rock Gulch. No background landscape visual units occur along Route B.

Additional foreground landscapes along Route B would also be created by construction of the proposed Juniper Reservoir. Potential recreational boaters would have continual visual access to the route for about five miles, on approximately five viewshed sequences; the route would be visible

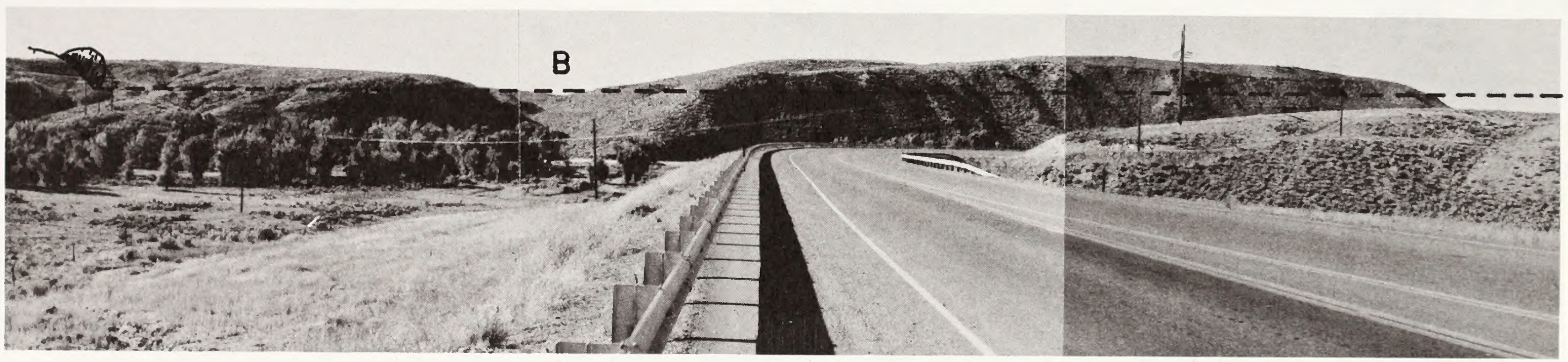


FIGURE GRVIII-3

Looking west on viewshed sequence VW from Colorado 13 one can see Big Bottom (above), the alternate Route B crossing of the Yampa River, and the crossing of Colorado Highway 13 approximately in-line with the existing transmission line, (see lower photo); an 85-foot deep cut would be made through the hill on the horizon (right-hand corner of top photo).

FIGURE GRVIII-4

Viewshed sequence MN on County Road 30 provides southbound motorists with this panoramic view. An 85 foot deep cut would be visible in the middleground (see center of top photo) if alternate Route B were constructed.

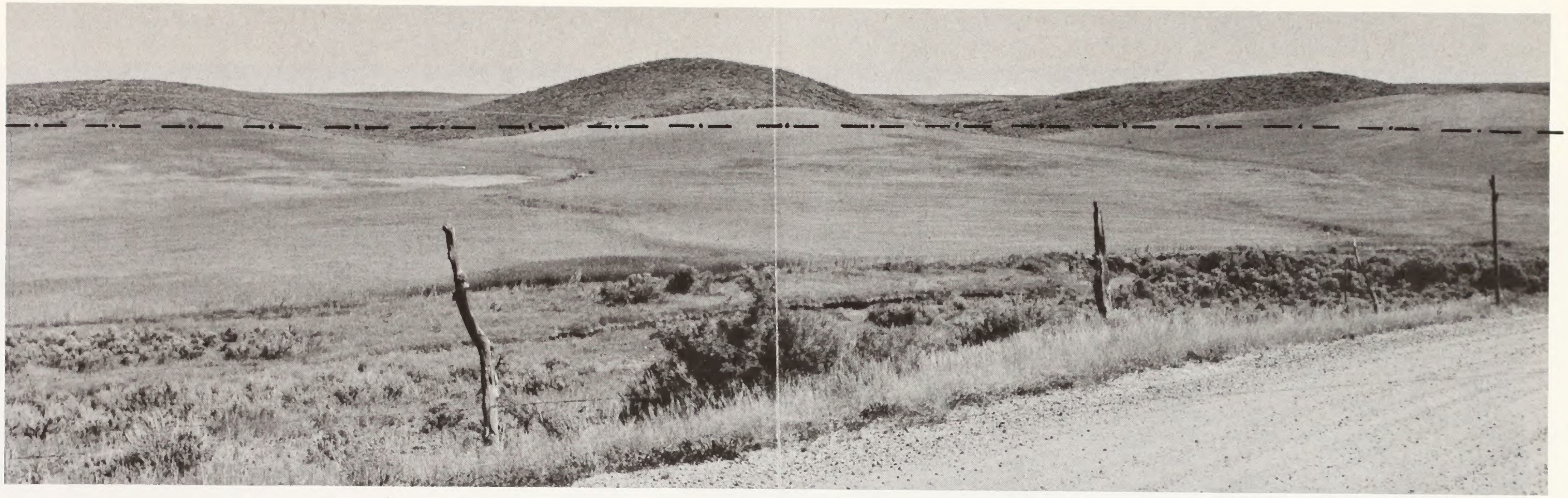


FIGURE GRVIII-5

Northbound motorists on viewshed sequence MN, County Road 30, would have an unobstructed foreground view of alternate Route B as it crosses this agricultural landscape.

FIGURE GRVIII-6

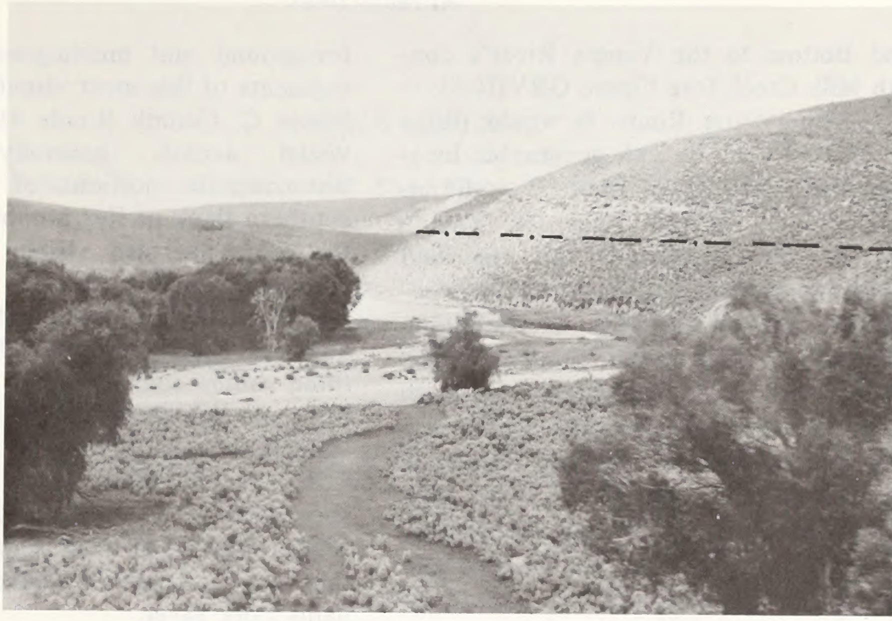
Only a small portion of alternate Route B through Bell Rock Gulch would be seen from public roads. Viewshed sequence IJ would provide visual access to southbound motorists along this portion of the route as seen from County Road 30.

FIGURE GRVIII-7

This four-photo panorama shows alternate Route B's crossing of County Road 30 (lower photo) as seen from viewshed sequence EF; this would result in a 45-foot high fill. The foreground ridge on the left-hand side of the upper photo also would be cut 40-feet deep by Route B.

FIGURE GRVIII-8

This five-shot panorama can be seen from County Road 30 on viewshed sequence DE. The left-hand portion of the lower photo reveals the alinement of Route A across the steep hillsides shown in Figure GRII-22. Both Route A and Route B alinements can be seen in this landscape visual unit.



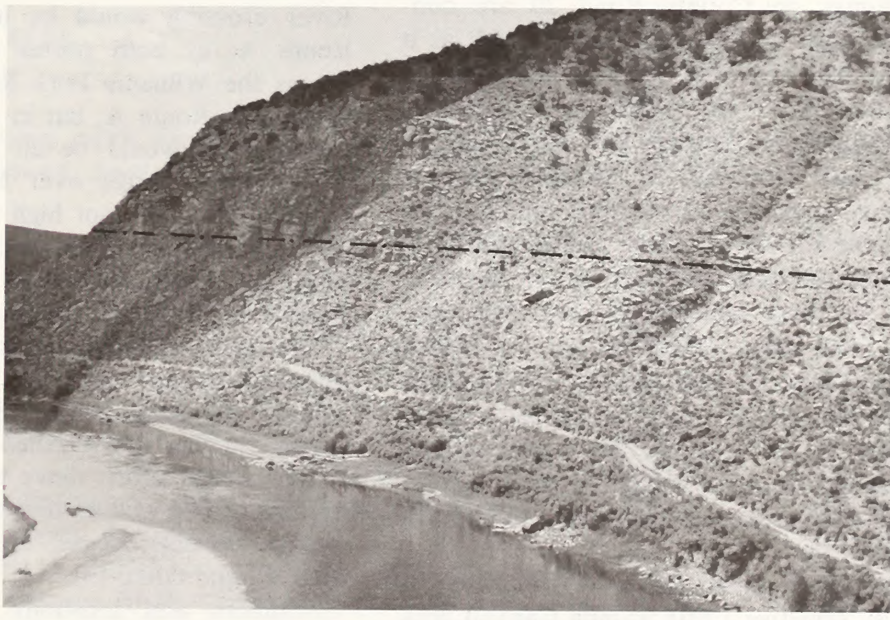


FIGURE GRVIII-9

Alternate Route B would also cross steep hillsides in Little Yampa Canyon. Both photos were taken downstream (looking west); Route B's alinement would lie to the right of the river.

from Round Bottom to the Yampa River's confluence with Milk Creek (see Figure GRVIII-9).

Impacts resulting from Route B would differ from those on Route A, in both geographic location and magnitude. Impacts of Route B would include two additional bridges over the Yampa River: one in the foreground at viewshed sequence VW on Highway 13, and the other visible as middleground at the Milk Creek-Yampa River confluence. It also would entail a higher bridge over Highway 13: 50 feet, as opposed to 20 feet for Route A. Bridge heights over the Yampa River would be 100 feet at viewshed sequence VW north of Big Bottom, and 65 feet at the Milk Creek confluence. Route A's 20-foot high bridge over the Williams Fork River and the 65-foot high bridge over Milk Creek would no longer be needed.

Except for Highway 12 and adjacent Yampa River crossings at viewshed sequence VW, the relative visibility of Route B would be lower. Traffic volumes on County Road 20 are considerably less than on Colorado Highway 13, as it is a graveled dead-end road; local residents would constitute the bulk of this traffic (see Chapter II for traffic volumes on Highway 13).

Numbers and locations of adverse impacts resulting from especially visible cuts and fills are shown in Table GRVIII-2; these can be related to those in Table GRIII-5 for Route A, to enable a comparison of these adverse impacts. Cuts and fills visible from roads would total 15 for Route A and 14 for Route B; cuts and fills visible from the proposed Juniper Reservoir would total 22 for Route A, and 10 for Route B. Seven of the total cuts and fills on Route A might be viewed from both the potential reservoir and roads; this figure for Route B is four.

Mood-atmosphere values adversely impacted in the especially sensitive Little Yampa Canyon area would be about half as significant on Route B; it would traverse about five miles of the canyon, compared to ten miles for Route A.

ROUTE C

With the exception of viewshed sequence XZ, all sequences on Colorado 13 from UV (Figure GRII-12), through BC (Figure GRII-13), provide continuous visual access to foreground landscape visual units containing proposed Route C. Analysis of Landscape Visibility Maps reveals that overlapping viewsheds provide multiple foreground and middleground views of certain segments of this most visually sensitive portion of Route C. County Roads 41, 45, and 49 provide visual access, generally at middleground distances, to portions of Route C along the southern flank of Iles Mountain; these portions of the route are also visible as foreground visual units from Highway 13.

A description of the southern portion of Route C is as described under Route A, because all three routes coincide south of the confluence of Milk and Jubb Creeks. No background landscape visual units occupy Route C.

Six figures, GRVIII-10 through GRVIII-15, show views at key points along alternate Route C. Figure GRVIII-2 is an aerial oblique photograph that shows Route C's alinement along the Williams Fork River.

Impacts resulting from Route C would differ from both Route A and Route B in their geographic location and magnitude. Impacts on that portion of the route north of the Williams Fork River crossing would be identical to those for Route A, as both routes coincide. The bridge across the Williams Fork River would be similar to that for Route A, but in a slightly different location; both would be 20 feet high. Route A's 65-foot high bridge over Milk Creek would be replaced by a 45-foot high bridge at the head of Milk Creek Canyon; it would be visible in middleground landscape visual units from viewshed sequences IJ and KL on County Road 17.

The relative visibility of Route C would be considerably greater than that of Route A. Traffic volumes would be similar (See Chapter II), but a greater number of viewshed sequences (road segments) would offer views to Route C. Colorado Highway 13 as well as several county roads would provide visual access to this route (Figures GRII-12 and GRII-13).

Numbers and locations of adverse impacts resulting from especially visible cuts and fills are shown in Table GRVIII-3; these can be related to those in Table GRIII-6 for Route A for a comparison of adverse impacts. Total numbers of significant cuts and fills that would be visible from roads total 15 for Route A and 50 for Route C; cuts and fills that would be visible from the proposed Juniper Reservoir total 22 for Route A, and 0 for Route C.

Mood-atmosphere values adversely impacted by Route A in the especially sensitive Little Yampa Canyon area would not be impacted by Route C.

TABLE GRVIII-2

Route B -- Summary of Significant Cuts and Fills

Number	Landscape visual unit classification in which cut or fill occurs	Direction of view(s)	Cut or fill	Size (ft.) height or depth
1	fg UV & mg ST	S	Cut	80
2	fg UV & fg VW; mg VX, YZ	N, S & W	Fill	100
3	fg VW; mg VX, YZ & mgMN	N, E & W	Cut	95
4-5	fg OP mgWX, YZ,		Fill	60
	QR & fgMN, mgLM	N & S	Cut	50
6-7	fgMN, mgLM	E	Cut	30
			Fill	45
8	fgLM & fgMN	N	Cut	25
9	fgLM, mgMN	N & S	Cut	40
10	mgHI	S	Cut	30
11-12	fgEF & fgDE	N & S	Cut	40
			Fill	45
13	fgDE	N	Cut	30
		S	Fill	20

(The remaining cuts and fills listed below may be viewed by boaters on the proposed Juniper Reservoir)

15	(Listed moving	mg	Cut	40
16	downstream)	mg	Fill	45
17	(Same as Nos. 11-	fg/mg	Cut	30
18	14 above)	fg/mg	Fill	30
19-20		fg/mg	2 Fills	30
21		fg/mg	Fill	30
22		fg/mg	Fill	25
23		fg/mg	Fill	30
24	(Bridge across Yampa River at Milk Creek)	fg/mg	Fill	65
25	(Along Milk Creek)	fg	Fill	30
26	(Along Milk Creek)	fg	Cut	45

SOURCE: W. R. Grace and Co., Feasibility Study for Coal Haul Railroad, October, 1974, prepared by Morrison-Knudsen Co. Inc.

FIGURE GRVIII-10

Southbound on Colorado 13, the motorist looks directly ahead from viewshed sequence EF to the proposed alinement of alternate Route C, and would encounter a 25-foot deep cut on the steep shadowed hillside.

FIGURE GRVIII-11

A 60-foot deep cut would be made through the rounding foreground ridge (see center of photo sequence) if alternate Route C is constructed. This view is available to northbound motorists on viewshed sequence GH, Colorado 13.

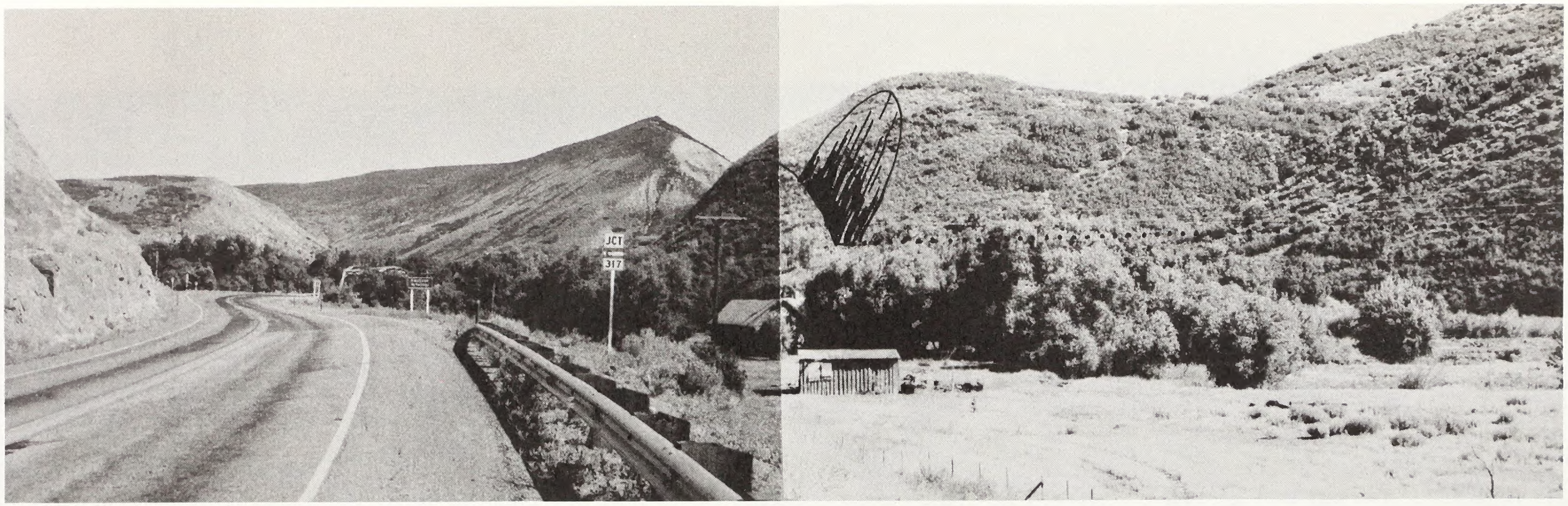


FIGURE GRVIII-12

A 90-foot deep cut would be made through the rounding hillside shown in the center of the photo if alternate Route C is constructed. This view appears southbound on Colorado 13 immediately north of Hamilton on viewshed sequence JK.

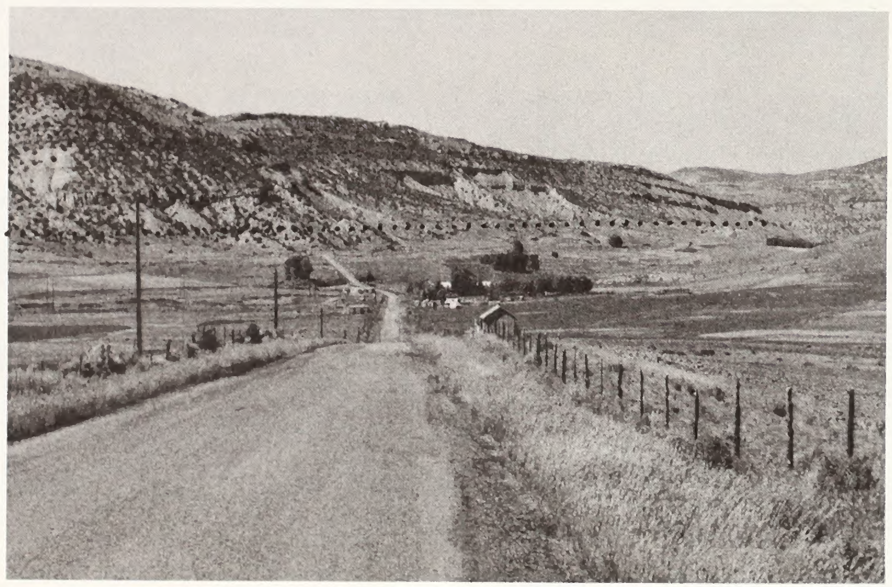


FIGURE GRVIII-13

Looking north from viewshed sequence NO on County Road 41, this three-shot sequence shows alternate Route C's alinement around the southeastern base of Iles Mountain. Several deep cuts would be visible on this railroad segment in the foreground distance zone from Colorado 13.

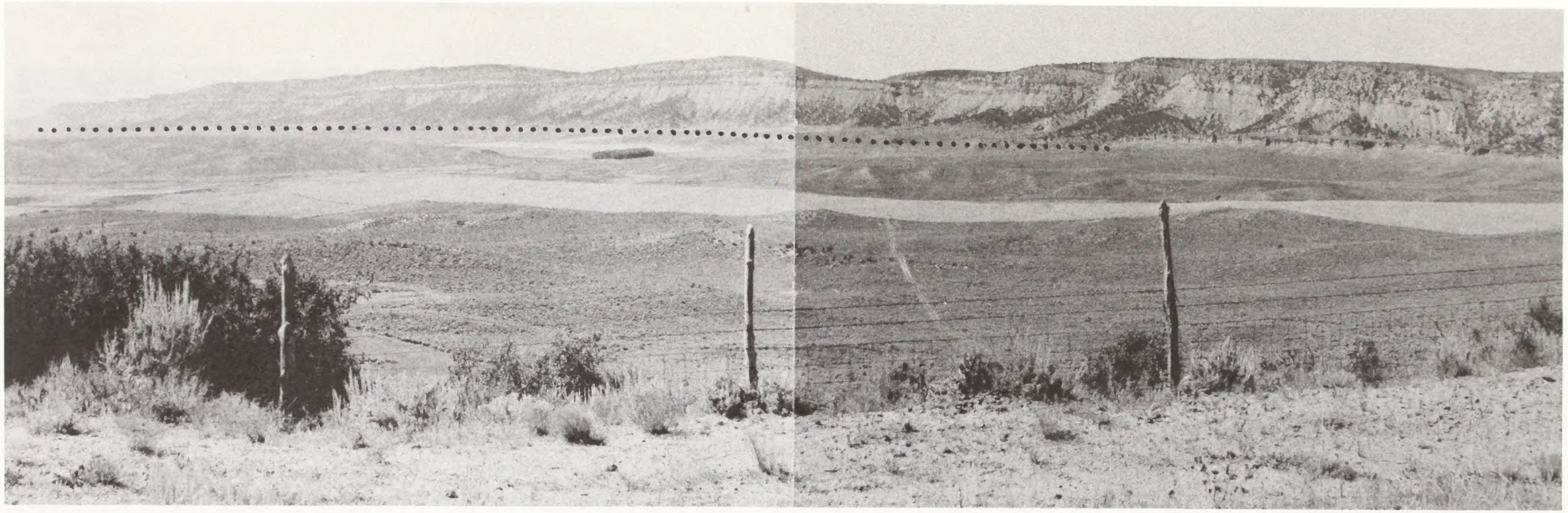


FIGURE GRVIII-14

Distant middleground views of Route C's alinement across the southern base of Iles Mountain are illustrated in these two separate panoramas. The top photo looks northwest from viewshed sequence PQ on County Road 41; the bottom photo looks northeast from viewshed sequence HI on County Road 17.

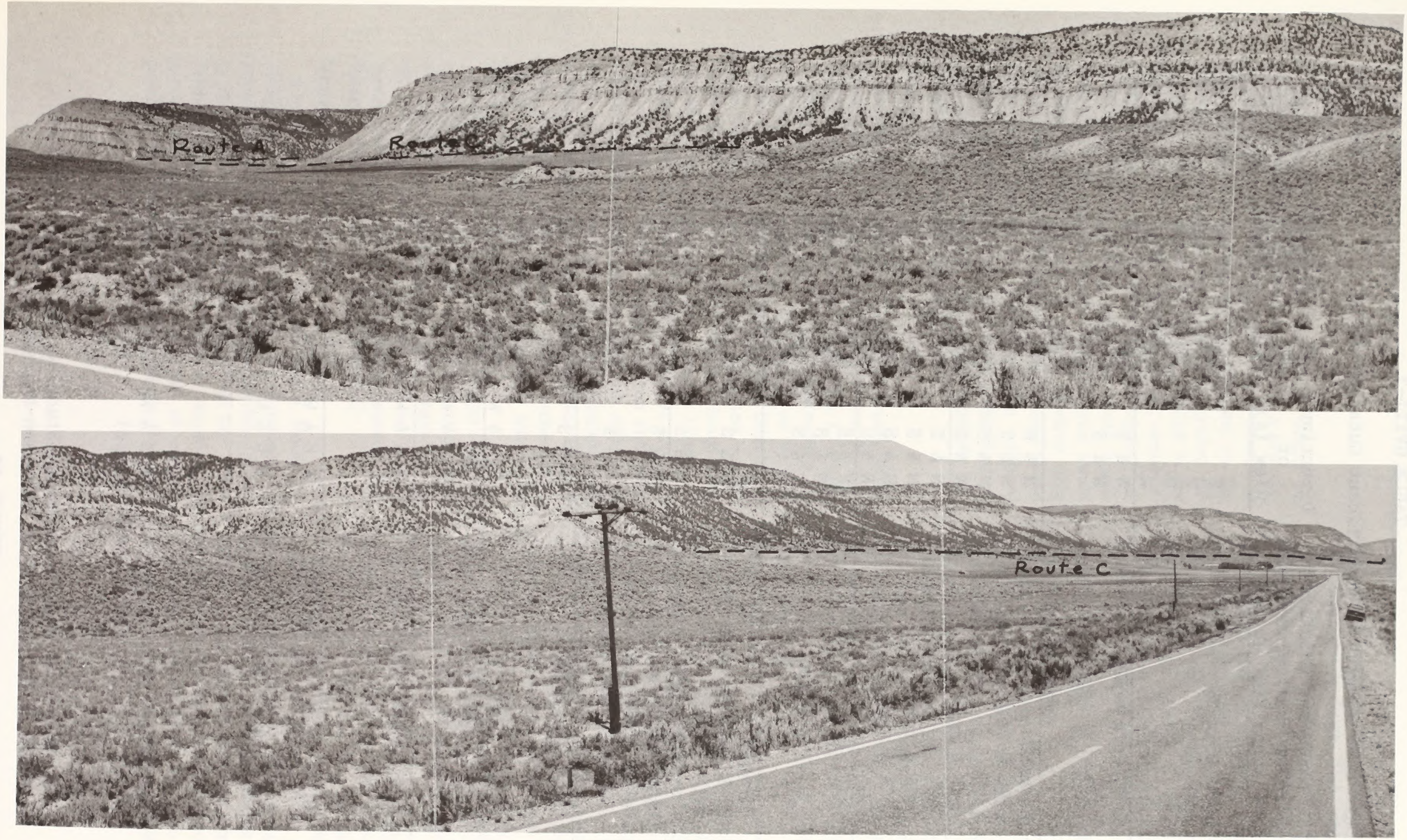


FIGURE GRVIII-15

Colorado 13 motorists at the foot of Iles Mountain have unobstructed foreground views of alternate Route C. This panoramic view from viewshed sequence BC also shows the area where proposed Route A would emerge from Milk Creek Canyon (left side, top photo).

TABLE GVIII-3

Route C -- Summary of Significant Cuts and Fills

Number	Landscape visual unit classification in which cut or fill occurs	Direction of view (s)	Cut of fill	Size (ft.) (height or depth
1	fgUV & mg ST	S	Cut	80
2-4	fgVW	E	Fill	90
		W	Fill	75
		W	Fill	40
5	fgVW & fg/mgWX	N & S	Cut	50
6-8	fgWX	N & S	Fill	30
			Cut	40
			Cut	60
9	fg/mgAC	N & S	Cut	30
10	fgBC & fgCD	N & S	Cut	40
11	fgDE	N & S	Cut	30
12	fgDE & fgEF	N & S	Cut	50
13	fgEF	N & S	Cut	25
14	fgEF & fgEG	N & S	Cut	25
15	fgFG & fgGH	N & S	Cut	60
16	fgHI	N & S	Cut	40
17-18	fgHI 7fgIK	N & S	Cut	50
		N & S	Fill	40
19-21	fgIK	N & S	2 Cuts	55
			Fill	80
22	fg/mgIK	S	Cut	90
23-24	fgKL & fgLM, mgNO	N & S	2 Cuts	70
25	fgLM, mgNO & fgMN, mgNO	N & S	Cut	40
26	fgMN, mgNO	N & S	Fill	25
27-28	fgMN, mgNO & fgRN, NO; mgST	N & S	Cut	35
			Cut	
29-31	fgRN, NO; mgST	N & S	Fill	35
			Cut	25
			Fill	40
32	fgWRS, mgST	N,E & W	Fill	40
33-36	fgWRS, mgST & fgXW; mgXC YZ, IJ, KL	N,E & W	2 Cuts	65
			Cut	30
37-42	fgXW; mgXC, YZ,IJ,KL	N,E & W	3 Cuts	25
			2 Cuts	45
			2 Fills	30
			Fill	45
43	fgXY; mgWX, YZ, UV, YC, IJ, KL	N,E & W	Cut	25
44-48	fgYB; mgWY, UV, BC, IJ, KL	N,E & W	Cut	30
			2 Fills	30
			Cut	40
			Cut	55
			Cut	25
49-50	fgBC; mgIJ, KL, UV	N,E & W	Cut	25
	(Milk Creek Bridge)		Fill	45

SOURCE: W. R. Grace and Co., Feasibility Study for Coal Haul Railroad, October, 1974, prepared by Morrison-Knudsen Co. Inc.

Recreation

ROUTE B

Recreational impacts of Route B would be similar to those for Route A except for a few significant differences: No impacts would accrue to the sage grouse strutting ground adjacent to Big Bottom. Construction on very steep grades adjacent to Yampa River would be avoided in the first five miles of Little Yampa Canyon; commensurate reduction in siltation and subsequent impact reduction on fishing potential would result. Impacts to the natural values of the canyon would be half as great; Route B would traverse only about five miles of the canyon, as opposed to ten miles for Route A. Impacts upon cultural resources between Round Bottom and Big Bottom also would be avoided. Mitigating measures for both routes would be the same.

ROUTE C

Recreational impacts of Route C would differ from those of Route A largely as follows: No impacts to fishing potential in either Milk Creek or Yampa River would result from construction of Route C. There would be no impact on natural values in Little Yampa Canyon. The Ellgen big game hunting area would not be impacted beneficially or adversely; however, similar, though less significant impacts might occur on the Camilletti big game hunting area (Figure GRII-29). Cultural resources in the Little Yampa Canyon and Milk Creek Canyon would not be affected; other cultural resources adjacent to Iles Mountain and Colorado Highway 13 would be impacted instead (see Chapter VIII, History and Archeology). Other beneficial and adverse impacts listed for Route A would be similar for Route C.

Route C also would result in significant impacts on the fisheries in Williams Fork River as a result of siltation and sedimentation; four segments of the river proposed for rechannelization would compound these impacts. Mitigating measures for Route A would be the same for Route C.

Transportation Networks

Compared to Route A, alternative Route B would have four additional grade crossings of county roads. All four would be on Moffat County Road 30. Route B would also cross one additional farm road. Therefore, Route B would have greater adverse impacts in the form of greater potential for auto-train collisions. Route B would not require rerouting the southern access road to the Colorado-Ute Power Plant site.

Route C would cross an additional county road, Moffat County 47, compared to Route A. Route C would not cross any farm roads. Route C would require rerouting the haul road from Empire Energy's Wise Hill No. 5 coal mine, but would not interfere with the Colorado-Ute southern access road. Therefore, Route C would have approximately the same adverse transportation impacts as Route A.

Alternate Means of Transporting Coal

Truck Transportation

Colorado Highway 13 probably would not stand up to even two years of heavy coal hauling at under one million tons per year. With production of three million tons per year for the three benchmark dates of 1980, 1985, and 1900, use of this road for coal transport would require major reconstruction, maintenance, and adverse impacts on existing traffic. Even if an extremely heavy-duty road were constructed, traffic would be a truck every 5 or 6 minutes, 24 hours a day, every day of the year.

Slurry Pipeline

A coal slurry pipeline is a potential alternative to use of rail or truck transport of coal. A line is described in Chapter VIII of the Regional Analysis; it could easily handle the three million tons per year production of the Colowyo Mine. If the slurry pipeline were used only for transport to the railhead, the distance of the proposed coal-haul rail line, no pumping stations would be needed along the right-of-way. Slurry pits along the right-of-way would be required for draining the line in case of stoppage. Preparation stations would be needed at each end. Impacts of the buried pipeline itself would be small relative to railroad construction and operation.

Use of water is the basic problem with a coal slurry pipeline. Since it takes about one ton of water to move one ton of coal, large amounts of water would have to be supplied to W. R. Grace, probably from the Axial Basin area, and subsequently disposed of at the terminus of the pipeline. Effects on the existing ground water system in the Axial Basin area would be adverse, but the degree of importance cannot be forecast.

Another disadvantage of this transportation method would be the high potential for freeze-up in northwestern Colorado during long, cold winters. During all seasons, the possibility of a pipeline break or leakage would exist. As the line would cross underneath many small streams, there would be potential for water pollution. Any spillage or leakage into water courses would result in damage to aquatic life, aesthetics, and recreation values.

Conveyor Belts

Belt conveyors can be used as an alternative to rail or truck transport of coal. Technology is sufficiently advanced to assure sound construction of single or multiple flight belt conveyors for coal transport. They offer great design flexibility and economy where distance and quantity requirements are well known and are expected to remain relatively fixed. Long distance belt conveyors, however, never have been constructed. A 20-30 mile belt probably would require extensive design work.

In general, conveyor construction would cause impacts similar to railroad construction. A belt conveyor would be subject to belt lift by wind and would create quantities of coal dust downwind. To decrease dust, the entire length of the system would be hooded or guarded. This would add to the visibility of the structure and increase the impact on wildlife of the area. Power normally is supplied by electric motors located at frequent intervals along the line, requiring service roads, electric transmission lines, and other service facilities.

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Recreation

ROUTE B

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