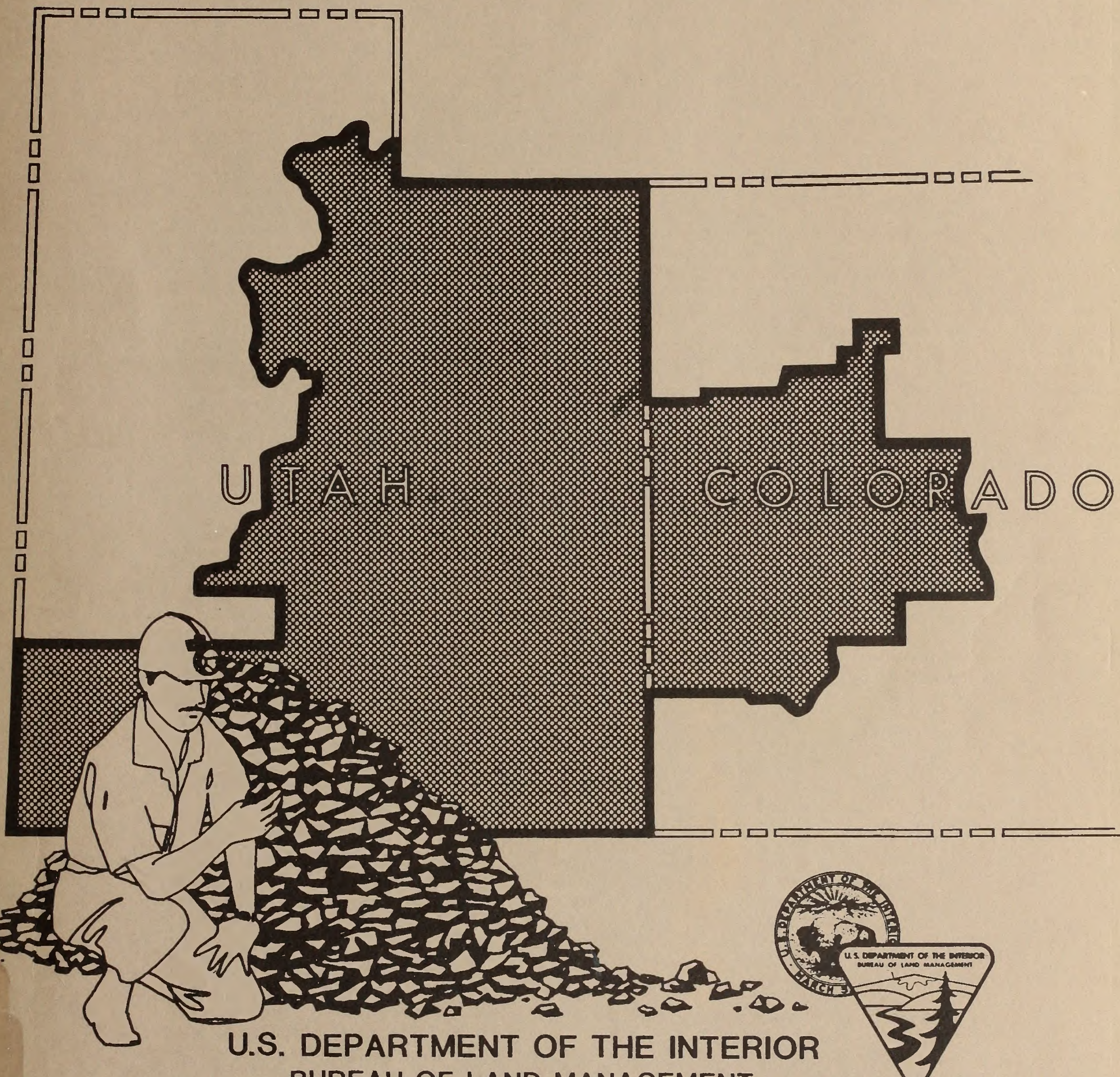
UINTA–SOUTHWESTERN UTAH COAL REGION

ROUND TWO
DRAFT ENVIRONMENTAL IMPACT STATEMENT



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
UTAH STATE OFFICE
136 E. SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

IN REPLY REFER TO
1792 USU-2
(U-933)

Dear Reader:

Enclosed for your review and comment is the Uinta-Southwestern Utah Coal Region Round Two Draft Environmental Impact Statement (DEIS) prepared by the Bureau of Land Management (BLM), Utah State Office.

The draft EIS was prepared pursuant to Section 102(2)(c) of the National Environmental Policy Act of 1969, and in accordance with the Council of Environmental Quality's regulations (40 CFR 1500-1508).

Public hearings on the DEIS have been scheduled in the following communities:

June 6, 1983
Delta Middle School Cafeteria
Delta, Colorado
7:00 p.m.

June 7, 1983
Emery County Courthouse
Castle Dale, Utah
7:00 p.m.

June 8, 1983
BLM Kanab Area Office
Kanab, Utah
7:00 p.m.

June 9, 1983
Room 220, Salt Palace
Salt Lake City, Utah
7:00 p.m.

Comments on the DEIS may be submitted in writing or presented verbally at the public hearings. In order to be considered in the final EIS, all comments must be received by July 6, 1983. Written comments should be addressed to:

Mr. Ron Bolander, Team Leader
Bureau of Land Management
136 East South Temple
Salt Lake City, Utah 84111

Phone: 801-524-4257 (FTS 588-4257)

Please keep this Draft EIS for possible use as part of the final EIS. Council of Environmental Quality regulations provide for circulation of an abbreviated final EIS where major changes to the draft are not required. The final EIS would then consist of this Draft EIS with a supplement containing public comments, responses to comments, and necessary changes or corrections.

Thank you for your interest in the Federal coal management program.

Sincerely yours,

Roland G. Robison

Roland G. Robison
State Director

UINTA-SOUTHWESTERN UTAH COAL REGION

ROUND TWO

DRAFT ENVIRONMENTAL IMPACT STATEMENT

Prepared by

THE DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Robert Robinson

UTAH STATE DIRECTOR

Uinta-Southwestern Utah Coal Region
Round Two
Environmental Impact Statement

(X) Draft ( ) Final

Lead Agency

U.S. Department of the Interior, Bureau of Land Management

Cooperating Agencies

U.S. Department of Agriculture
Forest Service

U.S. Department of the Interior
Geological Survey
Fish and Wildlife Service

Counties That Could be Directly Affected

Utah		Colorado
Carbon	Sanpete	Delta
Emery	Kane	
Sevier	Garfield	

Abstract

This EIS assesses the environmental consequences of four alternative levels of coal development in the region. The alternatives for this second round of leasing activity range from leasing 27 tracts (1.907 billion tons of in-place coal) to leasing 20 tracts (1.316 billion tons of in-place coal), and also includes the No Action alternative. The analysis is generally regional in nature, however, in certain areas, site specific analysis is also conducted. The EIS focuses on major issues identified during scoping.

For further information regarding this statement or proposed alternative actions contact:

Mr. Ron Bolander
Team Leader
Bureau of Land Management
136 East South Temple
Salt Lake City, Utah 84111
Telephone 524-4257 (FTS 588-4257)

Date by Which Comments on the Statement Must be Received: JUL 6 1983

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SUMMARY

Introduction

The Uinta-Southwestern Utah Coal Region was established by the United States Department of the Interior (DOI) as part of the Federal coal management program initiated in June, 1979 to foster greater use of the Nation's coal resources and to offset reliance on imported energy resources. The leasing of Federal coal is expected to facilitate production and use of coal to meet National energy requirements. The overall coal leasing program is descibed in the Federal Coal Management Program Final Environmental Statement (BLM, 1979a).

The current effort represents the second round of coal leasing in the region. First round leasing activities began in 1979. An Environmental Impact Statement (EIS) for Round One was completed in April, 1981, followed by coal lease sales in July, 1981, and February and May, 1982. Thus far, seven tracts covering some 219 million tons of in-place coal have been competitively leased. The possibility exists that an additional four tracts analyzed during the first round may be reoffered for sale. No date has yet been set for the reoffering of these tracts, however, they would be offered independently of the current second round leasing effort. For the purpose of this EIS, these tracts are considered, in general terms, as part of the projected baseline.

On June 12, 1982, the Assistant Secretary, Land and Water Resources, after consultation with the Governors of Utah and Colorado, approved a final Round Two leasing target for the region of 1.6 to 2.1 billion tons of in-place coal. The target was established after analyzing potential production from planned and existing coal mines in the region and projected demand for coal. The decision on the leasing target was made to ensure that sufficient coal resources are offered to enhance industry competition. The Secretary of the Interior has selected February 16, 1984, as the tentative date to initiate Round Two leasing. It was also decided that competitive leasing in southern Utah be confined to the Alton Coal field and that leasing on the Kaiparowits Plateau be deferred. A public hearing on the leasing target was held April 20, 1982, in Salt Lake City, Utah.

The Uinta-Southwestern Utah Coal Region includes 17 counties in Utah and seven counties in Colorado. The area includes all the known commercially minable coal in Utah and 32 percent of that found in Colorado. The leasing proposed in this statement includes only those areas for which land use planning had been updated to determine suitability for leasing. These lands are entirely within Carbon, Emery, Sevier, Sanpete, and Kane Counties in Utah and Delta County in Colorado.

In accordance with the National Environmental Policy Act of 1969 (as amended) and the final regulations of the Council on Environmental Quality, scoping meetings were held in April, 1982, in Delta, Colorado and in Price, Castle Dale, Kanab, and Salt Lake City, Utah. Participants at these meetings aided

BLM in identifying the following as primary concerns in analyzing the proposed coal leasing program: socioeconomics, hydrology, wildlife, land use, aesthetic values, cultural resources, and transportation.

Alternatives

Four alternatives were recommended by the Regional Coal Team for consideration in the EIS. These alternatives range from leasing 27 tracts to leasing 20 tracts and the mandatory No Action.

Alternative One: Maximum Level (1.907 Billion Tons)

Alternative One considers leasing 27 tracts and represents the maximum level of coal leasing for the region. Two tracts would be surface mined, the remaining 25 would be mined by underground methods. The tracts total 82,289.37 acres and include approximately 1.907 billion tons of in-place Federal coal. Approximately 732.6 million tons would be recovered.

Alternative Two: (Preferred Alternative) High Level (1.668 Billion Tons)

Alternative Two considers leasing 22 tracts. One tract would be surface mined, the remaining 21 would be mined by underground methods. The tracts total 72,894.91 acres and include approximately 1.668 billion tons of in-place Federal coal. Approximately 659.7 million tons would be recovered.

Alternative Three: Medium Level (1.316 Billion Tons)

Alternative Three considers leasing 20 tracts. No tracts would be surface mined and none of the five tracts in southern Utah would be considered. The tracts total 58,691.55 acres and include approximately 1.316 billion tons of in-place Federal coal. Approximately 528.7 million tons would be recovered.

Alternative Four: No Action (No Competitive Federal Leasing)

Alternative Four is the No Action Alternative. If implemented, this alternative would result in no new leasing of Federal coal in the region in 1984. However, coal development would continue to occur on existing leases and fee land.

Environmental Consequences of the Proposed and Alternative Actions

The impacts discussed in Alternative Four are projected baseline impacts based on continued coal development in the absence of additional Federal leasing. The analysis found in Alternatives One, Two, and Three considers only the tracts involved and does not include the projected baseline and also does not include those areas in the region not affected by coal leasing.

Alternative One

Four areas near Price, Castle Dale, Mt. Pleasant, and Alton, Utah and two areas near Delta and Cedaredge, Colorado would exceed the primary National Ambient Air Quality Standards (NAAQS) for total suspended particulates (TSP). Total annual TSP emissions would increase an average 10.6 percent over 1982 levels and a 6.1 percent over the projected baseline by the year 2000. Secondary NAAQS would be exceeded in a 2,845 square mile area, by the year 2000, of which 1,275 square miles would be attributed to implementation of Alternative One. The greatest impact contribution would come from vehicular traffic on unpaved roads and growth in population centers.

Soil and vegetation productivity on 2,503 acres would be lost for the life of the mines but would eventually be reclaimed. An additional 2,754 acres productivity would be lost to community development (including retiring irrigated croplands) and would not be reclaimed. An unquantified amount of soil would be lost prior to reclamation.

The mining of 732.6 million tons of coal (38 percent) would result in 1,174.3 million tons (62 percent) of coal remaining underground and unrecoverable by present technology.

Up to 16 feet of subsidence could occur on portions of the 81,047 acres that would be mined by underground methods. Surface mining would alter topography on an additional 687 acres. Changes in aquifers and distribution of surface water due to subsidence could occur. The extent of this change is not known. Annual water requirements for community development would increase by 7,041 acre-feet annually by the year 2000. An additional 484 acre-feet would be required annually for mine development. Development of certain tracts could result in an increase in annual sediment flow into local reservoirs and streams. While water discharged from mines is generally more saline than runoff in adjacent streams, salinity contribution to the Colorado River at Imperial Dam would actually slightly decrease due to the reduction in salinity from reduced irrigation return flow.

An unquantified amount of big game habitat, including winter range and calving grounds, would be lost. Regionwide the loss would be insignificant; however, in some specific areas big game populations would be reduced as a result. The permanent loss of 1,978 acres of irrigated croplands would reduce pheasant and other small game populations. Increased pressures on wildlife through harvest, harassment, and displacement would occur. Highway related deer losses would increase.

Approximately 1,978 acres of irrigated croplands (less than 1 percent regionwide) would be changed to community use. Grazing could be adversely affected by water loss, increased traffic on stock driveways, and direct loss of grazing lands.

Development of three tracts in central Utah would conflict with Carbon County zoning ordinances. Tract development in southern Utah could conflict with protection of irrigated croplands and water resource development provisions of the Kane County Master Plan.

Employment in the region would increase by 11,237 jobs or 20 percent by the year 2000 over projected baseline conditions. Population would increase by 28,349 persons or 21 percent over the projected baseline. Coal development would bring added revenues into the affected counties. However, the counties would also experience significant infrastructure impacts. The elements most affected would be housing, education facilities, social services, water and sewer capacities, and law enforcement.

More than 20,000 additional vehicles per day (21-percent increase) would be on roads in the region by the year 2000. Traffic congestion would be acute in Price, Utah. Portions of Highway 10 near Price would be overloaded as well as US-6 between Price and Spanish Fork, Utah. Secondary unpaved roads would experience deterioration. Associated safety and maintenance problems would result.

Inadvertent loss of cultural resources could occur, and sites that are salvaged would lose context for further study. Losses through illegal collection or vandalism would increase. Increases in local demand for recreation opportunities over the projected baseline (71 percent in southern Utah, 18 percent in central Utah, and an undetermined but slight amount in west-central Colorado) could result in overutilization and deterioration of existing recreation developments and reduced hunter and fisherman success. Recreation facilities in local communities would also be overcrowded. Coal development related noise and fugitive dust could be noticeable on certain days from Yovimpa Point in Bryce Canyon National Park. Tract development in some areas would not meet visual resource management (VRM) standards.

Alternative Two

Two areas near Price and Alton, Utah and two areas near Delta and Cedaredge, Colorado would exceed the primary NAAQS for TSP. Total annual TSP emissions would increase an average 10.6 percent over 1982 levels and a 6.1 percent over the projected baseline by the year 2000. Secondary NAAQS would be exceeded in a 2,730 square mile area by the year 2000, of which 1,160 square miles would be attributed to implementation of Alternative Two.

Soil and vegetation productivity on 2,308 acres would be lost for the life of the mines but would eventually be reclaimed. An additional 2,723 acres productivity would be lost to community development (including retiring irrigated croplands) and would not be reclaimed. An unquantified amount of soil would be lost prior to reclamation.

The mining of 659.7 million tons of coal would result in 1,007.8 million tons (60.4 percent) of coal remaining underground and unrecoverable by present technology.

Up to 16 feet of subsidence could occur on portions of the 71,973 acres that would be mined by underground methods. Surface mining would alter topography on 630 acres. Changes in aquifers and distribution of surface water due to subsidence could occur. The extent of this change is not known. Annual water requirements for community development would increase by 6,964 acre-feet annually by the year 2000. An additional 446 acre-feet would be required annually for mine development. Development of certain tracts could result in an increase in annual sediment flow into local reservoirs and streams. Salinity contribution to the Colorado River would actually slightly decrease.

An unquantified amount of big game habitat including winter range and calving grounds, would be lost. Regionwide the loss would be insignificant; however, in some specific areas, big game populations would be reduced as a result. The permanent loss of 1,956 acres of irrigated croplands would reduce pheasant and other small game populations. Increased pressures on wildlife through harvest, harassment, and displacement would occur. Highway related deer losses would increase.

Approximately 1,956 acres of irrigated croplands would be changed to community use. Grazing could be adversely affected by water loss, increased traffic on stock driveways, and direct loss of grazing lands.

Development of the Castle Valley Ridge tract would conflict with Carbon County zoning ordinances. Tract development in southern Utah could conflict with protection of irrigated croplands and water resource development provisions of the Kane County Master Plan.

Employment in the region would increase by 10,577 jobs or 19 percent over the projected baseline by the year 2000. Population would increase by 27,277 persons or 20 perent over the projected baseline. Coal development would bring added revenues into the affected counties. However, the counties would also experience significant infrastructure impacts. The elements most affected would be housing, education facilities, social services, water and sewer capacities, and law enforcement.

More than 18,000 additional vehicles per day (19 percent) would be on roads in the region by the year 2000. Traffic congestion would be acute in Price, Utah. Portions of Highway 10 near Price would be overloaded as well as US-6 between Price and Spanish Fork, Utah. Secondary unpaved roads would experience deterioration. Associated safety and maintenance problems would result.

Inadvertent loss of cultural resources could occur, and sites that are salvaged would lose context for further study. Losses through illegal collection or vandalism would increase. Increases in local demand for recreation opportunities (71 percent in southern Utah, 17 percent in central Utah, and an undetermined but slight amount in west-central Colorado) could result in overutilization and deterioration of existing recreation developments and reduced hunter and fisherman success. Recreation facilities in local communities would also be overcrowded. Coal development related noise and fugitive dust could be noticeable on certain days from Yovimpa Point in Bryce Canyon National Park. Tract development in some areas would not meet VRM standards.

Alternative Three

Three areas near Price, Castle Dale, and Mt. Pleasant, Utah and two areas near Delta and Cedaredge, Colorado would exceed the primary NAAQS for TSP. Total annual TSP emissions would increase an average 7.7 percent over 1982 levels and a 5.5 percent over the projected baseline expected in these areas by the year 2000. Secondary NAAQS would be exceeded in a 2,605 square mile area by the year 2000, of which 1,035 square miles would be attributed to implementation of Alternative Three. The greatest impact contribution would come from the vehicular traffic on unpaved roads and growth in population centers.

Soil and vegetation productivity on 1,373 acres would be lost for the life of the mines but would eventually be reclaimed. An additional 1,910 acres productivity would be lost to community development (including retiring irrigated croplands) and would not be reclaimed. An unquantified amount of soil would be lost prior to reclamation.

The mining of 528.7 million tons of coal would result in 787.5 million tons (59.8 percent) of coal remaining underground and unrecoverable by present technology.

Up to 16 feet of subsidence could occur on portions of the 58,692 acres that would be mined by underground methods. Changes in aquifers and distribution of surface water due to subsidence could occur. The extent of this change is not known. Annual water requirements for community development would increase by 4,855 acre-feet annually by the year 2000. An additional 363 acre-feet would be required annually for mine development. Development of certain tracts could result in an increase in annual sediment flow into local reservoirs and streams. Salinity contribution to the Colorado River would actually slightly decrease.

An unquantified amount of big game habitat including winter range and calving grounds, would be lost. Regionwide the loss would be insignificant; however, in some specific areas, big game populations would be reduced as a result. The permanent loss of 1,375 acres of irrigated croplands would reduce pheasant and other small game populations. Increased pressures on wildlife through harvest, harassment, and displacement would occur. Highway related deer losses would increase.

Approximately 1,375 acres of irrigated croplands would be changed to community use. Grazing could be adversely affected by water loss, increased traffic on stock driveways, and direct loss of grazing lands.

Development of two tracts would conflict with Carbon County zoning ordinances.

Employment in the region would increase by 7,842 jobs or 14 percent over the projected baseline by the year 2000. Population would increase by 19,765 persons or 14 percent over the projected baseline. Coal development would bring added revenues into the affected counties. However, the counties would also experience significant infrastructure impacts. The elements most affected would be housing, education facilities, social services, water and sewer capacities, and law enforcement.

More than 13,000 additional vehicles per day (14 percent increase) would be on roads in the region by the year 2000. Traffic congestion would be acute in Price, Utah. Portions of Highway 10 near Price would be overloaded as well as US-6 between Price and Spanish Fork, Utah. Secondary unpaved roads would experience deterioration. Associated safety and maintenance problems would result.

Inadvertent loss of cultural resources could occur, and sites that are salvaged would lose context for further study. Losses through illegal collection or vandalism would increase. Increases in local demand for recreation opportunities (18 percent in central Utah and an undetermined but slight amount in west-central Colorado), could result in overutilization and deterioration of existing recreation developments and reduced hunter and fisherman success. Recreation facilities in local communities would also be overcrowded. Track development in some areas would not meet VRM standards.

Alternative Four

Even though no new Federal coal would be developed, the region would continue to be an active coal producing area and the following impacts would be expected.

Three areas near Price, Castle Dale, and Mt. Pleasant, Utah and two areas near Delta and Cedaredge, Colorado may exceed the primary NAAQS for TSP. In these areas, an average increase of 74 percent is expected by the year 2000 over 1982 conditions. Currently, 245 square miles exceed the secondary NAAQS; this would increase to 1,570 square miles by the year 2000.

Cumulatively, over 5,500 acres of surface disturbance would occur. Over 4,600 acres disturbance would occur in central Utah and would be attributable to coal mining and related community expansion. The majority of the remaining acres would be attributable to general community growth.

Over 500 million tons of coal left underground in existing holdings would not be recovered by present technology. Coal in seven of the tracts proposed for leasing in this round would also not be mined and could be bypassed resulting in a total loss of the resource. About 21.6 million tons would be produced annually in central Utah and 1.35 million tons annually in Delta County in west-central Colorado by the year 2000.

An undetermined amount of subsidence of up to 16 feet would occur on areas that would be mined. Changes in aquifers and distribution of surface water could result; however, the extent of this change is not known. Over 9,000 acre-feet of water would be consumed by mining and population growth annually by the year 2000. Of that amount, 7,798 acre-feet would be consumed in central Utah. Water required to meet population growth or community development would result in the loss of nearly 2,500 acres of irrigated cropland by the year 2000, 1,500 acres of which would be lost in central Utah.

Community expansion and mining activities would result in an unquantified but expected insignificant loss of wildlife habitat. Direct wildlife loss would result from highway mortality, hunting, and illegal killing. An undetermined number of animal unit months (AUMs) would be lost as a result of soil and vegetation disturbance.

No significant conflicts are expected between coal development of existing holdings and county zoning ordinances.

A 44-percent population increase in central Utah, 34 percent in southern Utah, and 14 percent in west-central Colorado is projected by the year 2000 over 1982 estimated population. Much of this growth, especially in southern Utah, would not be coal related. Waste water treatment facilities would need to be constructed or upgraded for several communities. Some housing shortages are anticipated. Coal mining would produce jobs and income for local residents and additional revenue for affected counties.

The potential exists for overcrowding on Highway 10 south from Price, Utah as well as US-6 east from Price across Soldier Summit. Price would also experience traffic congestion during rush hours. No significant traffic related problems are anticipated for southern Utah or west-central Colorado.

Inadvertent loss of cultural resources could occur, and sites that are salvaged would lose context for further study. Losses through illegal collection or vandalism would increase.

Local demand for recreation by the year 2000 would increase by 44 percent in central Utah, 34 percent in southern Utah, and a slight amount in west-central Colorado over 1982 levels. Some developed sites could experience overcrowding and deterioration. Some facilities in towns would also be overcrowded. There would be a reduction in hunter and fisherman success regionwide.

Coal development would continue to modify the natural landscape in isolated portions of the region. Visual resource management objectives would probably not be met in some areas. Special Designation Areas, while not directly affected, would experience increased recreation activity. Some values could be degraded.

Unresolved Issues

1. Markets for coal were not identified except on a general basis: therefore, additional analysis of coal transportation systems and interrelated projects may be needed on an individual basis as specific markets become known.

2. Tract boundaries are subject to change based on additional exploratory drilling and subsequent surveys.

3. The determination of recoverable coal reserves on the tracts is subject to revision based on ongoing and planned drilling programs.

4. Cultural resource inventories of affected areas would also be required as provided for in the coal programmatic Memorandum of Agreement between the

President's Advisory Council on Historic Preservation, Office of Surface Mining, and BLM. Full compliance with procedures outlined in 36 CFR, Part 800 Protection of Historic and Cultural Properties must also be completed.

5. A consolidated lawsuit is pending in the U.S. District Court for the District of Utah regarding the availability of coal for surface mining in the Alton coal field. Resolution of these suits may affect the availability of certain of the five tracts in the Alton Coal field being considered in this EIS.

6. Application of the coal unsuitability criteria in the Alton coal field did not consider Criterion 16, special flood plains, and Criterion 19, alluvial valley floors, due to lack of data. If Federal land in this area is leased, the lessees' mining plans will have to comply with these criteria under the Surface Mining Control to Reclamation Act of 1977 prior to obtaining a mining permit.

Identification of the Preferred Alternative

Alternative Two, the high level scenario (1.668 billion tons) involving the leasing of 25 tracts in southern and central Utah and west-central Colorado is the Regional Coal Team's preferred alternative. Prior to leasing, a record of decision identifying the preferred alternative and the rationale for its selection will be prepared. An environmentally preferred alternative will also be identified.

President's Advisory Council on Historic Preservation, Office of Surface Mining, and BLM. Full compliance with procedures outlined in 36 CFR, Part 800 Protection of Historic and Cultural Properties must also be completed.

5. A consolidated lawsuit is pending in the U.S. District Court for the District of Utah regarding the availability of coal for surface mining in the Alton coal field. Resolution of these suits may affect the availability of certain of the five tracts in the Alton coal field being considered in this EIS.

6. Application of the coal unsuitability criteria to the Alton coal field did not consider Criterion 16, special flood plains, and Criterion 17, municipal watershed. The Kanab Creek drainage, if leased and if this area is leased, the lessees' mining plans will have to comply with these criteria under the Surface Mining Control and Reclamation Act of 1977 prior to obtaining a mining permit.

Identification of the Preferred Alternative

Alternative Two, the High Level Scenario (1,286 million tons), involving the leasing of 25 tracts in southern and central Utah and west-central Colorado is the Regional Coal Team's preferred alternative. Prior to issuing a record of decision identifying the proposed tracts for lease and the rationale for this selection will be prepared. An environmentally preferred alternative will also be identified.

CHAPTER 1

INTRODUCTION

Purpose and Need for Action

The Uinta-Southwestern Utah Coal Region was established by the United States Department of the Interior (DOI) as part of the Federal coal management program initiated in June 1979. The program is to foster greater use of the Nation's coal resources and to offset reliance on imported energy resources. The leasing of Federal coal is expected to facilitate production and use of coal to meet National energy requirements. The overall coal leasing program is described in the Federal Coal Management Program Final Environmental Statement (BLM, 1979).

The current effort represents the second round of coal leasing in the region. First round leasing activities began in 1979. An Environmental Impact Statement (EIS) was completed in April 1981, followed by coal lease sales in July 1981 and February and May 1982. Thus far, seven tracts covering some 219 million tons of in-place coal have been competitively leased. The possibility exists that an additional four tracts analyzed during the first round may be re-offered for sale. No date has yet been set for the re-offering of these tracts; however, they would be offered independently of the current second round leasing effort. For the purpose of this EIS these tracts are considered, in general terms, as part of the projected baseline.

A combined Federal and State Regional Coal Team (RCT) provides guidance for Federal coal activities within the region. The RCT made recommendations to the Director of the Bureau of Land Management (BLM) and to the Secretary of the Interior concerning adoption of regional coal production goals, regional coal leasing targets, and the selection and scheduling of tracts to be analyzed in this EIS and offered for competitive coal lease sale. The RCT provided guidance concerning tract delineation and preparation of site specific analyses (tract profiles). They also ranked the tracts and developed the alternative leasing levels analyzed in this EIS.

On June 12, 1982, the Assistant Secretary, Land and Water Resources (DOI), after consultation with the Governors of Utah and Colorado, approved a final leasing target for the region of 1.6 to 2.1 billion tons of in-place coal. The target was established after analyzing potential production from planned and existing coal mines in the region and projected demand for coal. The decision on the leasing target was made to ensure that sufficient coal resources are offered to enhance industry competition. It was based in part on the fact that industry formally expressed interest in some 3.8 billion tons of in-place coal resource. The Secretary of the Interior has selected February 16, 1984, as the tentative date to initiate Round Two leasing. It was also decided that competitive leasing in southern Utah be confined to the Alton coal field and that leasing on the Kaiparowits Plateau be deferred. A public hearing on the leasing target was held April 20, 1982, in Salt Lake City, Utah. Four comments were received with all but one supporting the leasing target.

The region produces very high quality coal, but increased markets are relatively limited due to the reduced growth of local electric power generation, higher production costs resulting from underground mining, and distances to other markets. Currently, the coal demand is somewhat evenly split between use in the region and export to other states. Nevada, California, and the midwest are the primary users of exported coal. Coal use for electric power generation accounts for about 60 percent of the market. The remainder is used for general industrial use. Future market expansion is expected to be in local electric power generation with moderate growth in exports outside the region.

Regional Setting

The Uinta-Southwestern Utah Coal Region consists of 17 counties in Utah and 7 in Colorado (Figure 1-1). Several major coal fields are located in the region which cumulatively includes all known commercially minable coal in Utah (Doelling, 1972; Doelling and Graham, 1972a; Doelling and Graham, 1972b) and approximately 32 percent of all known commercially minable coal in Colorado (Landis, 1959). The estimated in-place coal resources in the major coal fields of the region are (in billions of tons): Wasatch Plateau 6, Emery 1.4, Book Cliffs 3, Alton 1.5, Kaiparowits 7.9, Kolob 2, (Doelling, 1972), Colorado Book Cliffs 7.2, Carbondale 5.2, Grand Mesa 8.6, and Somerset 8, (Colorado Geological Survey, 1980).

The region is an active coal producing area. In September 1981 there were 270 Federal coal leases in the region, and 204 of these were in Utah. Forty-two leases are producing coal, and 28 of these are in Utah. Cumulatively, there are 364,279 acres currently under lease in the region and 238,319 acres are on public land surface administered by BLM. The remaining acreage under lease includes 72,811 acres of National Forest System surface administered by the Forest Service (FS) with the remainder (53,149 acres) being private or State-owned surface (DOI, 1982).

Required Authorizations

Development of Federal coal resources is controlled by numerous laws and regulations imposed by Federal, State, and local agencies and authorities. Federal laws of importance include the Mineral Leasing Act of 1920, Federal Coal Leasing Amendments Act of 1976 (FCLAA), Federal Land Policy and Management Act of 1976 (FLPMA), Surface Mining Control and Reclamation Act of 1977 (SMCRA). and the National Forest Management Act of 1976.

The Mineral Leasing Act of 1920 set the government policy of retaining ownership and leasing Federal coal resources. This act was modified by the FCLAA which set forth major requirements including strictly competitive bidding, the abolishment of preference right leasing, the concept of logical mining units, diligent development requirements, maximum economic recovery, and lease acreage restrictions.

FLPMA provides BLM with a statutory framework for land use planning on public lands and requires BLM to use principles of multiple use and sustained yield, give priority to the protection of areas of critical environmental concern

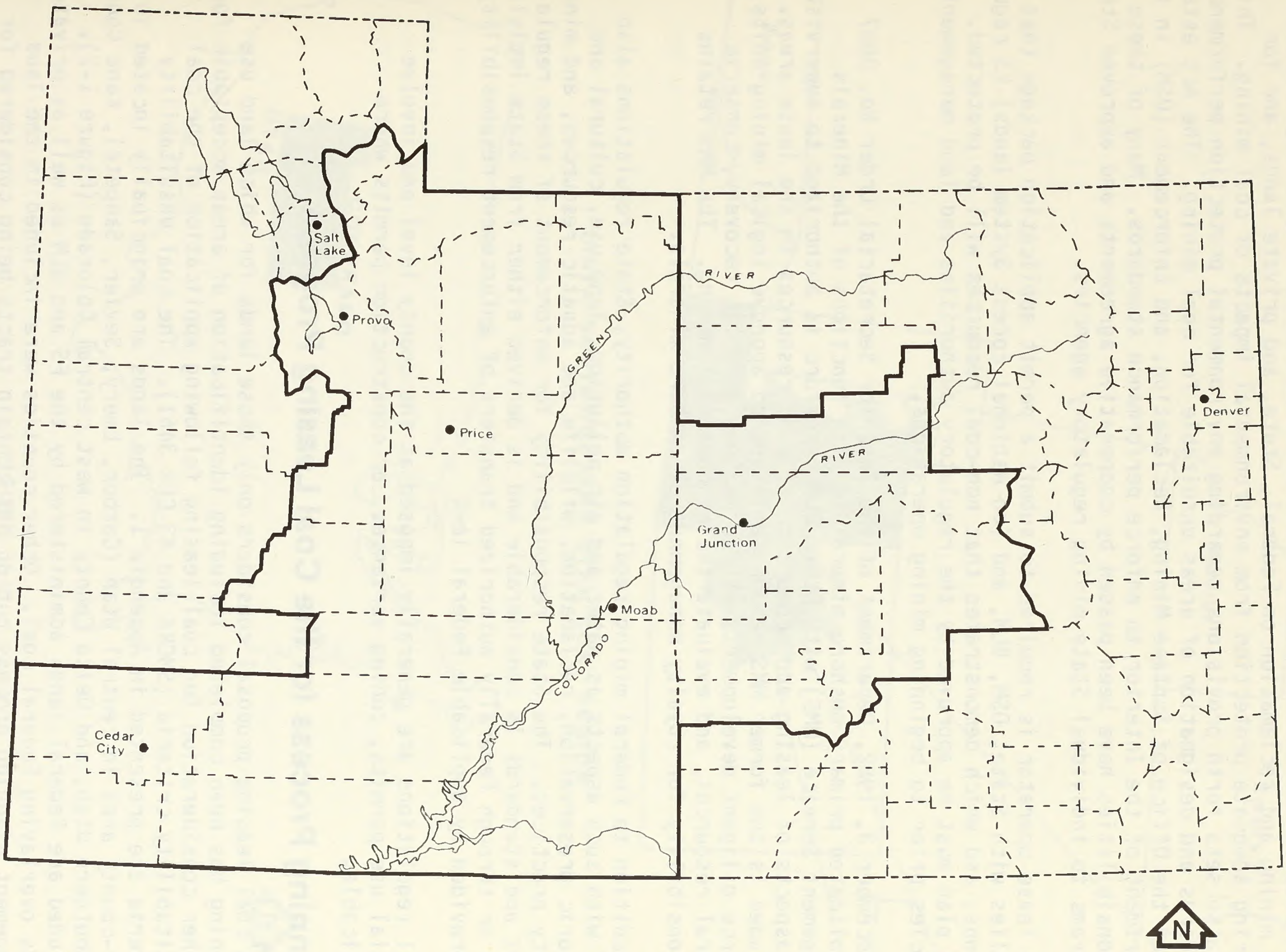


FIGURE 1-1

UINTA-SOUTHWESTERN UTAH COAL REGION

(ACEC), consider present as well as future uses of public lands, and coordinate planning activities with Federal, State, and local agencies.

SMCRA established uniform minimum Federal standards for regulating surface coal mining and reclamation on Federal, State, and private lands, and for ensuring adequate protection from environmental impacts of coal mining. This Act also sets forth provisions regarding environmental protection performance standards and designation of areas unsuitable for coal mining. The Act established the Office of Surface Mining, Reclamation, and Enforcement (OSM) in the Department of the Interior to enforce performance standards. Many of these responsibilities have been passed by cooperative agreements and approved State programs to individual State mining regulatory agencies.

Each lease operator is required to submit a permit application package that complies with State, OSM, BLM, and (on National Forest System lands) FS regulations, and which demonstrates that non-coal resources will be protected. This plan must be approved by the regulatory authorities and land management agencies prior to beginning mining operations.

On December 3, 1982, Department of the Interior Secretarial Order No. 3087 consolidated primary onshore mineral leasing functions of the Minerals Management Service (MMS) with BLM. BLM therefore is authorized to supervise all aspects of leasing and production of coal resources in the lease areas. Included is the former MMS responsibilities to approve logical mining units, enforce diligent development, attain maximum economic recovery, conserve mineral resources, and evaluate the economics of mining. The MMS retains responsibility for royalty management of onshore minerals.

In addition to Federal mining regulation authority, State regulations also deal with such aspects as water and air pollution, land use, cultural and historic preservation, reclamation, wildlife and aquatic resources, and mine safety practices. The State responsibility for enforcement of these regulations and standards is considerable and is derived either from State legislation or through Federally authorized transfers of enforcement responsibility as provided by applicable Federal law.

Local regulations are generally imposed at the county level and involve special use permits, zoning variances, or construction permits where applicable.

Planning Process for the Coal Leasing Program

This coal leasing proposal considers only those lands for which land use planning has been completed including identification of areas acceptable for further consideration for coal leasing following application of the coal unsuitability criteria (SMCRA and 43 CFR 3461). The coal unsuitability criteria are presented in Appendix 1. The lands are principally located in a four-county area in central Utah (Carbon, Emery, Sevier, Sanpete), Kane County in southern Utah, and Delta County in west central Colorado (Figure 1-2). Included are Federal lands administered by the FS and BLM as well as private lands overlaying Federal coal. Other counties were included in the land management planning process but do not contain tracts being considered for

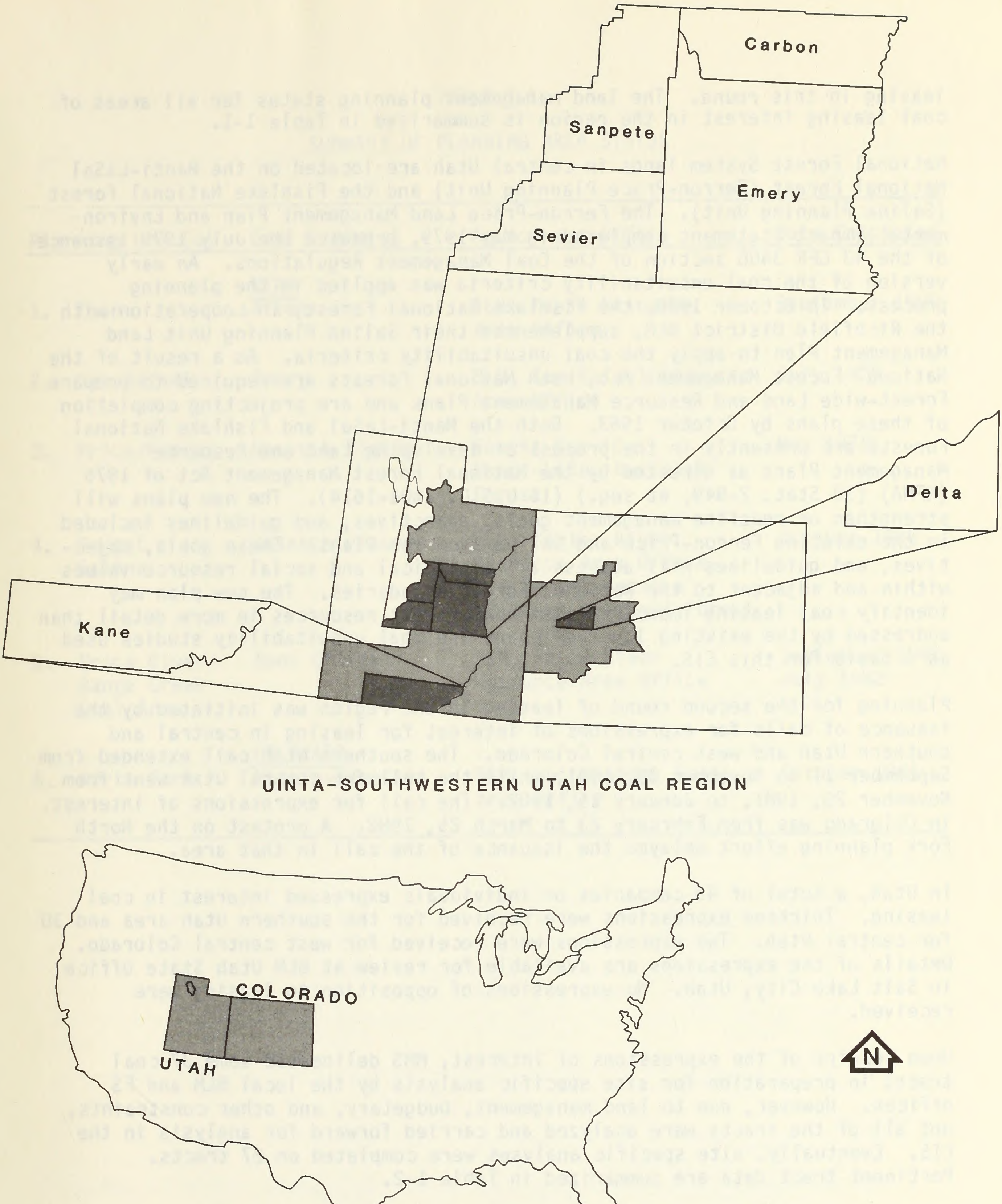


FIGURE 1-2

UINTA-SOUTHWESTERN UTAH COAL REGION:

AREAS OF LEASING CONSIDERATION

leasing in this round. The land management planning status for all areas of coal leasing interest in the region is summarized in Table 1-1.

National Forest System lands in central Utah are located on the Manti-LaSal National Forest (Ferron-Price Planning Unit) and the Fishlake National Forest (Salina Planning Unit). The Ferron-Price Land Management Plan and Environmental Impact Statement completed in May 1979, predated the July 1979 issuance of the 43 CFR 3400 section of the Coal Management Regulations. An early version of the coal unsuitability criteria was applied in the planning process. In October 1980, the Fishlake National Forest, in cooperation with the Richfield District BLM, supplemented their Salina Planning Unit Land Management Plan to apply the coal unsuitability criteria. As a result of the National Forest Management Act, both National Forests are required to prepare Forest-wide Land and Resource Management Plans and are projecting completion of these plans by October 1983. Both the Manti-LaSal and Fishlake National Forests are presently in the process of developing Land and Resource Management Plans as directed by the National Forest Management Act of 1976 (NFMA) (90 Stat. 2-949, et seq.) (16 U.S.C. 1601-1614). The new plans will strengthen or redefine management goals, objectives, and guidelines included in the existing Ferron-Price and Salina Land Use Plans. These goals, objectives, and guidelines will address all biological and social resource values within and adjacent to the National Forest boundaries. The new plan may identify coal leasing impacts to National Forest resources in more detail than addressed by the existing land use plans and coal unsuitability studies used as a basis for this EIS.

Planning for the second round of leasing in the region was initiated by the issuance of calls for expressions of interest for leasing in central and southern Utah and west central Colorado. The southern Utah call extended from September 11 to November 30, 1981, while the call for central Utah went from November 20, 1981, to January 15, 1982. The call for expressions of interest in Colorado was from February 23 to March 25, 1982. A protest on the North Fork planning effort delayed the issuance of the call in that area.

In Utah, a total of 43 companies or individuals expressed interest in coal leasing. Thirteen expressions were received for the southern Utah area and 30 for central Utah. Two expressions were received for west central Colorado. Details of the expressions are available for review at BLM Utah State Office in Salt Lake City, Utah. No expressions of opposition to leasing were received.

Upon receipt of the expressions of interest, MMS delineated some 37 coal tracts in preparation for site specific analysis by the local BLM and FS offices. However, due to land management, budgetary, and other constraints, not all of the tracts were analyzed and carried forward for analysis in the EIS. Eventually, site specific analyses were completed on 27 tracts. Pertinent tract data are summarized in Table 1-2.

On July 22-23, 1982, the RCT met to rank the tracts and establish alternatives for the EIS (individual tract ranking summaries are presented in Appendix 2). However, as a result of questions concerning unleased tracts from first round activities, several additional weeks were required to finalize the alternatives.

TABLE 1-1

SUMMARY OF PLANNING AREA STATUS

Planning Unit(s)	Coal Field(s)	Agency and Office	Date Completed
	UTAH		
1. Zion	Alton	BLM, Kanab Resource Area Office	September 1980
2. San Rafael	Emery	BLM, San Rafael Resource Area Office	July 1979
3. Price/Ferron	Wasatch Plateau	Forest Service Manti-LaSal National Forest	May 1979
4. Forest Salina	Wasatch Plateau	BLM, Sevier River Resource Area Office and Forest Service Fishlake National Forest	October 1980
5. Price River/ Range Creek Coal Area	Book Cliffs	BLM, Price River Resource Area Office	September 1981 July 1982
	COLORADO		
6. North Fork	Paonia-Somerset	BLM, Uncompahgre Basin Area Office	October 1981

TABLE 1-2
SUMMARY OF INDIVIDUAL TRACT DATA

Office	Tract	Acres	In-Place Coal million metric tons	Recoverable Coal million metric tons
BLM-Moab				
	Soldier Creek	2,168.02	81.9	37.0
	Coal Creek	4,198.09	114.4	46.0
	Graves	550.16	19.8	7.0
	Hoffman Creek	120.00	2.0	1.0
	Blue Trail Canyon	320.00	1.0	0.9 (Surface)
	Whitmore Park	160.00	6.3	1.9
	Alkali Creek	2,080.30	33.8	15.0
	Dugout-Pace	3,149.62	106.7	25.0
	Subtotals	12,746.19	365.9	133.8
BLM-Richfield/FS Fishlake NF				
	Walker Flat (BLM)	1,520.43	73.6	25.0
	Ivie (Fishlake)	1,040.00	10.1	5.6
	Skumpah (Fishlake)	639.80	4.5	2.0
	Acord (Fishlake)	120.00	3.4	1.5
	Subtotals	3,320.23	91.6	34.1
BLM-Cedar City				
	Alton Amphitheater	2,781.15	74.8	24.0
	Flax Lakes	5,600.48	112.7	30.0
	Ford Pasture	1,400.00	36.3	20.0 (Surface)
	Fisher Canyon	5,724.91	134.0	54.0
	Mill Creek Canyon	6,562.48	204.0	65.0
	Subtotals	22,069.02	561.8	193.0
FS-Manti-LaSal NF				
	Gooseberry	920.00	46.3	16.0
	North Trough Springs	3,195.61	30.2	12.0
	Castle Valley Ridge	3,442.16	73.7	35.0
	Mud Creek	1,208.80	27.9	10.0
	Trail Mountain	6,950.61	87.3	40.0
	Ferron Canyon	2,680.38	28.5	10.0
	Quitchupah	9,986.35	276.3	115.0
	The Pines	8,924.97	167.0	70.0
	Subtotals	37,308.88	737.2	308.0
BLM-Montrose				
	Cedaredge	1,847.20	46.4	23.2
	Paonia D Seam	4,997.85	104.0	40.5
	Subtotals	6,845.05	150.4	63.7
	TOTALS	82,289.37	1,906.9	732.6

Scoping Process

Several Federal, State, and local government agencies, and private groups and individuals participated in the scoping process through meetings and correspondence. They provided information, made suggestions, and raised questions regarding potential issues. (See Chapter 5 for details of scoping and issues identified.)

Alternatives

The RCT identified the Alternatives for analysis in the EIS in meetings on July 22, 1982, and January 14, 1983. The Alternatives ranged from leasing all 27 tracts to no new Federal coal leasing. Details of the Alternatives are presented in Chapter 2.

With the exception of no Federal action, the alternatives recommended by the RCT are near or within the leasing target established by the Secretary of the Interior. However, the Secretary's decision on a course of action is not limited solely to the alternatives presented in the EIS. He may, through the use of his discretionary authority, select additional alternatives that are intermediate in magnitude to those analyzed. These intermediate alternatives could be developed through changes in the proposed level of leasing, changes in tract combinations, changes in the lease sale schedule, or modification of the leasing target. These alternatives could be developed in response to expressed preferences of the Governors of Utah and Colorado, the analysis in the EIS, recommendations of the RCT, public input, or coordination with other Federal agencies.

Interrelationships

Transportation

Feasibility of additional railroad development in many parts of the region is directly tied into development and transportation of coal from existing and future mines. An example is the planned Denver and Rio Grande Western Railroad in Castle Valley which is scheduled for development from Wellington, Utah, south to Emery. A draft EIS on the proposed railroad was released in November 1982 by the Interstate Commerce Commission The line could play a role in delivering coal to the Intermountain Power Project (IPP). Rail operations are expected to begin in the 1985-1990 period if the line is approved and constructed.

Electrical demand has moderated, reducing construction of new generating facilities. Construction of one coal-fired powerplant (IPP near Lynndyl, Utah) in the area is continuing. IPP is projected for operation in 1986, and the coal source (some 4.5 million tons annually) would come from the coal fields, including certain proposed tracts, in Emery and Carbon Counties.

Construction of the fourth unit of Utah Power and Light Company Hunter powerplant in Emery County has been indefinitely delayed. Plans call for its construction at some future date.

Other possible energy developments in Utah could significantly interact with coal development. Foremost among these are the proposed tar sand developments in the Sunnyside Special Tar Sand Area in Carbon County. While details on possible tar sand developments are not yet available, these projects could compete with coal for available water, workforce, housing, etc. Since details are not available, possible tar sand development is not considered in the baseline of this EIS. Future tar sand studies will include interrelationships with coal development.

Three law suits are pending in the U.S. District Court for the District of Utah which seek to set aside a decision on December 16, 1980, by Cecil Andrus, then Secretary of the Interior, which declared a portion of the Alton coal field unsuitable for surface mining. Resolution of these suits may affect the availability of certain of the five tracts in the Alton coal field being considered in this EIS.

State and Local Land Use Plans, Programs, and Controls

In addition to Federal land use plans, coal development is also subject to State and local programs and controls. The State of Utah has no State land use plan, however, Section 17 of the Utah State Code empowers counties within the State to develop zoning ordinances and enforcement procedures. County zoning ordinances are detailed in the Land Use Plans (County Plans) Section of Chapter 3.

The State of Colorado enacted Colorado Revised Statutes 29-20-101 and 24-65-101 to assist counties with general and specific power to manage land use. Delta County completed a land use plan in January 1983.

CHAPTER 2

ALTERNATIVES INCLUDING THE PROPOSED ACTION

Introduction

Four alternative levels of leasing for the Uinta-Southwestern Utah Round Two leasing program are identified. The Round Two proposed leasing includes 27 coal tracts in coal fields at three separate geographic locations: central Utah (20 tracts), southern Utah (5 tracts), and west-central Colorado (2 tracts). Each coal leasing alternative is described by identifying specific tracts, in-place and recoverable coal resources, projected annual production rates, acres proposed for leasing, and identification of mining methods. Figure 2-1 presents a production graph depicting projected coal development for the three leasing Alternatives and the No Action Alternative. Mining plans are not prepared for coal tracts until after lease issuance; therefore, for analysis of potential impacts, a series of assumptions has been made regarding probable development scenarios. Stipulations (mitigating measures) that would be part of lease issuance were considered in the analysis and are included as Appendix 3. A scenario for surface mine reclamation is also presented. A list of analysis assumptions used in describing the potential impacts that would result from development of individual tracts is presented in the introduction to Chapter 4. These assumptions are used to develop quantification for work force, acreages, and water requirements and have been carried to decimal points to avoid rounding errors. However, it should be recognized that the quantifications used are approximate figures only.

Anticipated environmental impacts are summarized in narrative table form at the end of this chapter. The impacts discussed are those considered to be most significant as determined through the scoping process (40 CFR 1501.7) and environmental analysis (Chapter 4). Individual tract development discussions are presented in Chapter 6.

Tract delineation reports and site specific environmental analyses detailing probable mine development and anticipated environmental impacts have been completed for all tracts under consideration. These reports are available for review at BLM's Utah State Office in Salt Lake City. In addition, reports for the Utah tracts are available at the Moab, Cedar City, and Richfield District BLM Offices, the Manti-LaSal National Forest Supervisor's Office in Price, and the Fishlake National Forest Supervisor's Office in Richfield. Colorado tract reports are available for review at BLM's Colorado State Office and the Uncompahgre Area Office in Montrose, Colorado. Surface mining would not occur on private surface; consequently, surface owner consultation was not required for any of the tracts. Table 2-1 is a summary of the information presented in the tract development descriptions. Coal quality data for each tract are found in Table 2-2. All tracts have been found suitable for leasing and preliminarily ranked by the Regional Coal Team (Appendix 2). All tracts are proposed for multiple seam leasing with the exception of the Paonia tract which is proposed for single (D) seam leasing. If all tracts were developed, five new 20-acre coal delivery and loadout facilities would likely be needed, one each at Castle Dale, Emery, and Fairview and two east of Wellington, Utah.

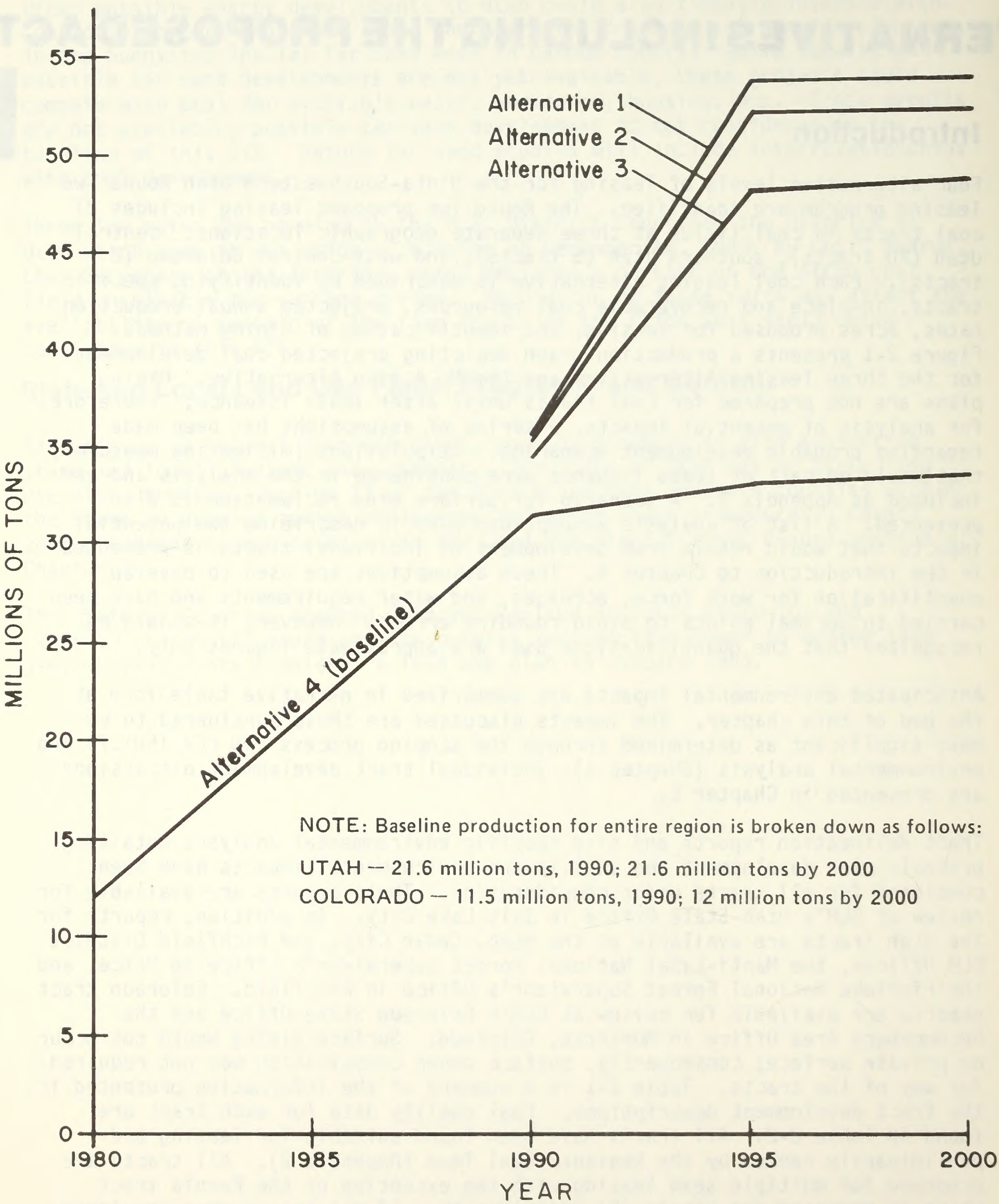


FIGURE 2-1
PROJECTED COAL PRODUCTION IN REGION BY ALTERNATIVE

TABLE 2-1

UINTA-SOUTHWESTERN UTAH COAL REGION
ROUND TWO LEASING SUMMARY

Tract	Surface Acres Total	Surface Acres Federal	Surface Acres Non-Federal	Coal Resource In-Place (mmt)[a]	Coal Resource Recoverable (mmt)	Mining Methods	Average Annual Production[b] (tons/year)	Mine Life[b] (yrs)	New Portal
Central Utah: Book Cliffs Area									
Alkali Creek	2,080.3	220	1,860.3	33.8	15	U[e]	600,000	25	Yes
Coal Creek	4,198.09	40	4,158.09	114.4	46	U	1,150,000	40	Yes
Dugout-Pace	3,149.62	0	3,149.62	106.7	25	U	555,000	45	No
Graves	550.16	228	322.16	19.8	7	U	700,000	10	No
Hoffman Creek	120.0	120	0	2.0	1	U	153,000	6.5	No
Soldier Creek	2,168.02	0	2,168.02	81.9	37	U	925,000[b]	40[b]	No
Whitmore Park	160.0	0	160.0	6.3	1.9	U	380,000	5	No
Subtotal	12,426.19	608	11,818.19	364.9	132.9	N/A	4,463,000	N/A	N/A
Central Utah: Wasatch Plateau Area									
Acord	120.0	0	120.0	3.4	1.5	U	83,000	18	No
Castle Valley Ridge	3,442.16	3,442.16	0	73.7	35	U	875,000	40	Yes
Ferron Canyon	2,680.38	2,680.38	0	28.5	10	U	500,000	20	Yes
Gooseberry	920.0	0	920	46.3	16	U	400,000[b]	40[b]	Yes
Ivie	1,040.0	1,040.0	0	10.1	5.6	U	140,000	40	No
Mudcreek	1,208.8	569.0	639.8	27.9	10	U	250,000	40	Yes
North Trough Springs	3,195.61	2,913.9	281.71	30.2	12.0	U	300,000	40	Yes
Quitchupah	9,986.35	9,906.35	80	276.3	115	U	2,875,000	40	Yes
Skumpah	639.8	520.0	119.8	4.5	2	U	50,000	40	Yes
The Pines	8,924.97	8,924.97	0	167	70	U	1,750,000	40	Yes
Trail Mountain	6,950.61	6,950.61	0	87.3	40	U	1,000,000	40	Yes
Subtotal	39,108.68	36,947.37	2,161.31	755.2	317.1	N/A	8,223,000	N/A	N/A
Central Utah: Emery Area									
Blue Trail Canyon	320.0	320.0	0	1.0	0.9	S[e]	45,000	20	N/A
Walker Flat	1,520.43	1,440.0	80.43	73.6	25	U	625,000	40	No
Subtotal	1,840.43	1,760.0	80.43	74.6	25.9	N/A	670,000	N/A	N/A
Southern Utah: Alton Area									
Alton Amphitheater	2,781.15	0	2,781.15	74.8	24	U	600,000	40	Yes
Fisher Canyon	5,724.91	3,149	2,575.91	134.0	54	U	1,350,000	40	No
Flax Lakes	5,600.48	3,920.48	1,680	112.7	30	U	750,000	40	Yes
Ford Pasture	1,400.00	1,400	0	36.3	12.4/7.6	S/U	1,000,000	20	Yes
Mill Creek	6,562.48	2,911	3,651.48	204.0	65	U	1,625,000	40	Yes
Subtotal	22,069.02	11,380.48	10,688.54	561.8	193	N/A	5,325,000	N/A	N/A
UTAH TOTAL	75,444.32	50,695.85	24,748.47	1,756.5	668.9	N/A	18,681,000	N/A	N/A
Western Colorado									
Paonia D Seam	4,997.85	1,000.0	3,997.85	104.0	40.5	U	1,500,000	27	Yes
Cedaredge	1,847.2	1,108.0	739.2	46.4	23.2	U	600,000	40	Yes
COLORADO TOTAL	6,845.05	2,108.0	4,737.05	150.4	63.7	N/A	2,100,000	N/A	N/A
GRAND TOTAL	82,289.37	52,803.85	29,485.52	1,906.9	732.6	N/A	20,781,000	N/A	N/A

(continued)

TABLE 2-1 (cont'd.)

Tract	Water Requirement[c] (ac. ft./yr)	Total Mining Related Surface Disturbance (Acres)[d] 1987	1990	1995	2000	Improved Access (miles)	New Access (miles)	Loadout Destination	Haul Distance (miles)
Central Utah: Book Cliffs Area									
Alkali Creek	12.9	6.7	40.7	40.7	45.8	0	7.55	East Wellington	18.0
Coal Creek	24.7	8.6	69.3	92.1	92.1	4.5	10.05	East Wellington	19.4
Dugout-Pace	11.9	8.2	8.2	10.7	10.7	0.5	4.0	Sunnyside Junc.	18.3
Graves	0	0.2	0.2	0.2	0.2	0	0	Wildcat Siding	19.4
Hoffman Creek	0	0	0	0	0	0	0	Wildcat Siding	19.4
Soldier Creek	19.9	9.1	9.1	20.9	20.9	0	5.75	East Wellington	17.6
Whitmore Park	0	0.3	0.3	0.3	0.3	0	0	East Wellington	17.6
Subtotal	69.4	33.1	127.8	164.9	170.0	5.0	27.35	N/A	N/A
Central Utah: Wasatch Plateau Area									
Acord	1.8	0.5	0.5	0.5	0.5	0	0.25	Levan	83.4
Castle Valley Ridge	18.8	33.9	186.9	186.9	188.9	11.6	23.0	Wildcat Siding	13.9
Ferron Canyon	10.7	27.5	155.4	155.4	157.4	8.8	23.1	Castledale	24.4
Gooseberry	8.6	4.3	36.4	36.4	38.4	1.5	1.25	Fairview	13.6
Ivie	3.0	0.9	0.9	0.9	2.9	0	0.5	Emery	16.0
Mudcreek	5.4	7.7	34.4	34.4	36.4	1.2	2.75	Eccles Canyon	4.6
North Trough Springs	6.4	23.2	79.3	79.3	81.3	2.0	9.75	Eccles Canyon	8.4
Quitchupah	61.8	28.7	181.8	181.8	183.8	4.4	19.6	Emery	10.4
Skumpah	1.1	6.5	80.5	80.5	82.5	3.75	6.3	Levan	83.4
The Pines	37.6	26.0	138.1	138.1	140.1	7.7	14.2	Emery	15.1
Trail Mountain	21.5	69.5	144.4	144.4	146.4	4.6	21.5	Castledale	17.6
Subtotal	176.7	228.7	1,038.6	1,038.6	1,058.6	45.55	122.2	N/A	N/A
Central Utah: Emery Area									
Blue Trail Canyon	1.0	2.4	31.3	46.1	64.9	1.7	1.7	Emery	18.5
Walker Flat	13.4	1.0	1.0	1.0	1.0	0	0	Emery	0
Subtotal	14.4	3.4	32.3	47.1	65.9	1.7	1.7	N/A	N/A
Southern Utah: Alton Area									
Alton Amphitheater	12.9	29.1	69.4	69.4	71.4	4.0	9.0	Slurry Prep Plant	10.7
Fisher Canyon	29.0	58.2	58.2	58.2	60.2	0	18.0	Slurry Prep Plant	5.0
Flax Lakes	16.1	56.5	120.6	120.6	122.6	4.5	18.5	Slurry Prep Plant	17.0
Ford Pasture	21.5	2.3	78.8	361.3	643.8	0	1.25	Slurry Prep Plant	2.7
Mill Creek	34.9	70.3	128.8	128.8	130.8	4.5	20.5	Slurry Prep Plant	5.0
Subtotal	114.4	216.4	455.7	738.3	1,028.8	13.0	67.25	N/A	N/A
UTAH TOTAL	374.9	481.6	1,654.4	1,988.9	2,323.3	65.25	218.5	N/A	N/A
Western Colorado									
Paonia D Seam	78.0	0	40.0	40.0	40.0	0	0.75	Paonia	4.0
Cedaredge	31.0	0	40.0	40.0	40.0	0	0	Delta	14.0
COLORADO TOTAL	109.0	0	80.0	80.0	80.0	0	0.75	N/A	N/A
GRAND TOTAL	483.9	481.6	1,734.4	2,068.9	2,403.3	65.25	219.25	N/A	N/A

(continued)

TABLE 2-1 (concluded)

Tract	Average Coal Haul Truck Round Trips/day	Average Service Truck Visits/day	Maximum Employment Construction	Maximum Employment Permanent	Additional Employment by Year 1987	1990	1995	2000
Central Utah: Book Cliffs Area								
Alkali Creek	62.5	12.0	28	185	10	74	185	185
Coal Creek	120.0	23.0	73	358	18	144	358	358
Dugout-Pace	57.8	11.0	0	86	5	35	86	86
Graves	72.9	14.0	0	0	0	0	0	0
Hoffman Creek	15.9	3.1	0	0	0	0	0	0
Soldier Creek	96.4	18.5	95	163	9	63	163	163
Whitmore Park	39.6	7.6	0	0	0	0	0	0
Subtotal	465.1	89.2	196	792	42	316	792	792
Central Utah: Wasatch Plateau Area								
Acord	8.6	1.7	0	15	1	6	15	15
Castle Valley Ridge	91.1	17.5	241	289	16	116	289	289
Ferron Canyon	52.1	10.0	147	183	10	73	183	183
Gooseberry	41.7	8.0	100	229	12	92	229	229
Ivie	14.6	2.8	0	30	2	12	30	30
Mudcreek	26.0	5.0	19	69	4	28	69	69
North Trough Springs	31.2	6.0	26	114	6	46	114	114
Quitchupah	299.5	57.5	175	1,125	57	450	1,125	1,125
Skumpah	5.2	1.0	128	30	2	12	30	30
The Pines	182.3	35.0	110	637	32	225	637	637
Trail Mountain	104.2	20.0	55	337	17	135	337	337
Subtotal	856.5	164.5	1,001	3,058	159	1,195	3,058	3,058
Central Utah: Emery Area								
Blue Trail Canyon	7.5	0.9	0	12	1	5	12	12
Walker Flat	0	12.5	0	30	2	12	30	30
Subtotal	7.5	13.4	0	42	3	17	42	42
Southern Utah: Alton Area								
Alton Amphitheater	62.5	12.0	50	210	11	84	210	210
Fisher Canyon	140.6	27.0	70	330	17	132	330	330
Flax Lakes	78.1	15.0	100	400	20	160	400	400
Ford Pasture	104.2	20.0	70	330	17	132	330	330
Mill Creek	169.3	32.5	140	550	28	220	550	550
Subtotal	554.7	106.5	430	1820	93	728	1,820	1,820
UTAH TOTAL	1,883.8	373.6	1,627	5,712	297	2,256	5,712	5,712
Western Colorado								
Paonia D Seam	0.0	30.0	150	0	150	0	0	0
Cedaredge	62.5	12.0	100	160	100	100	160	160
COLORADO TOTAL	62.5	42.0	250	160	250	100	160	160
GRAND TOTAL	1,946.3	415.6	1,877	5,872	547	2,356	5,872	5,872

a Million metric tons.
b Only production from Federal lands is considered. Production from fee lands and/or existing leases may increase the amount or length of production.
c Does not include approximately 159 acre-feet per year for exploratory drilling from 1987 through 1989.
d Approximately 100 additional acres would be required for coal loadout facilities.
e U is underground; S is surface mining.

TABLE 2-2

COAL QUALITY

Tract Name	Coal Ranking	Moisture(%)	Volatile Matter(%)	Fixed Carbon(%)	Ash(%)	Sulfur(%)	Heat Value (btu/lb)
Alkali Creek	High volatile B bituminous	--[a]	--	--	10.3	0.68	13,665
Coal Creek	High Volatile B bituminous	5.12	37.81	51.64	5.42	0.63	12,593
Dugout-Pace Canyon	High volatile B bituminous	6.25	38.6	50.3	10.1	1.0	12,250
Graves	High volatile B bituminous	5.12	37.81	51.64	5.42	0.63	12,593
Hoffman Creek	High volatile B bituminous	5.1	37.5	51.7	5.5	0.63	12,149
Soldier Creek	High volatile B bituminous	--	--	--	10.3	0.68	13,665
Whitmore Park	High volatile B bituminous	-	--	--	10.3	0.68	13,665
Acord	High volatile C bituminous	-	39.36	41.35	8.58	0.37	10,750
Castle Valley Ridge	High volatile B bituminous	6.5	40.8	46.3	6.3	0.8	12,286
Ferron Canyon	High volatile B bituminous	<7	42	44	9	0.6	12,500
Gooseberry	High volatile B bituminous	8	--	45	13	0.6	12,200
Ivie	High volatile C bituminous	11.00	36.04	42.07	10.41	0.49	10,063
Mud Creek	High volatile B bituminous	7.2	41.8	45.9	4.9	0.6	12,459
North Trough Springs	High volatile B-C bituminous	<6.5	<43	<45	<10	<1.0	<12,000
Quitchupah	High volatile C bituminous	7.23-7.97	31.54-39.13	43.29-49.5	10.35-10.89	0.56-0.86	11,950-12,000
Skumpah	High volatile C bituminous	10.7	39.36	41.35	8.58	0.37	10,750
The Pines	High volatile C bituminous	7.26-8.88	38.02-38.56	44.83-47.61	6.37-10.74	0.46-0.88	11,625-12,640
Trail Mountain	High volatile B bituminous	4.58	40.14	47.15	8.13	0.55	12,575
Blue Trail Canyon	High volatile B or C bituminous	6	35.6-43.9	45.2-51.0	24.0	0.5	9,800
Walker Flat	High volatile B or C bituminous	5.11-11.8	35.6-43.9	42.2-51.0	5-20.0	--	10,000-13,000
Alton Amphitheater	Subbituminous A	17.2	39.5	49.3	9.5	1.4	9,959
Fisher Canyon	Subbituminous A	17.2	39.5	49.3	9.5	1.4	9,959
Flax Lakes	Subbituminous A-B	15.7-16.7	31.2-32.8	29-39.0	11.6-29.0	1.4-1.7	7,321-9,539
Ford Pasture	Subbituminous A, B, or C	11.4-20.6	31.8 35.2	40.2-47.8	5.6-7.4	0.4-0.9	9,530-10,910
Mill Creek	Subbituminous C	18.5	37.2	36.8	7.5	0.9	8,208
Paonia D Seam	High volatile C bituminous	5-15	--	--	5-15	0.4 0.7	9,600-12,300
Cedaredge	High volatile C bituminous to subbituminous A	9.8-20.0	--	--	2.1-16.1	0.5-1.8	9,360-11,670

a Indicates that data are not available.

Description of the Alternatives

Alternative One: Maximum Level Alternative (1.907 Billion Tons)

Alternative One considers leasing all 27 delineated tracts in Utah and Colorado (Table 2-3). The tracts total 82,289.37 acres with an in-place coal resource of 1,906.9 million tons of which 732.6 million tons are estimated to be recoverable. BLM and Forest Service administer 52,803.85 surface acres of the lease areas; 29,885.52 acres are in non-Federal ownership. All coal on the tracts is owned by the Federal Government. The locations of the individual tracts are shown in Chapter 6 and in the Regional map located inside the back cover of this document.

Coal would be mined underground by room and pillar and/or longwall methods except for 687 acres of surface mining on the Blue Trail Canyon and Ford Pasture tracts. Up to 17 new portals and five new coal loadouts would be required. Maximum annual coal production would be 20.78 million tons per year. About 2,503 acres of surface disturbance (Table 2-4) would be required for mine development by the year 2000, including exploratory drilling, portal areas, ventilation shafts, coal storage, required access, and coal loadouts. Approximately 65.25 miles of existing access roads would be improved and 219.3 miles of new road construction would be needed. The average number of additional coal haul truck round trips per day in the region would be 1,946 in addition to 416 round trips per day by service vehicles.

Approximately 5,872 permanent employees (including truckers) would be needed in the region by 1995. A maximum of 1,877 temporary employees would be needed for construction from 1987 through 1989.

Exploratory drilling would require a total of about 477 acre-feet of water from 1987 through 1989 and the estimated maximum water requirement for mining after 1995 would be 483.9 acre-feet per year. Table 2-4 summarizes the maximum level alternative.

Alternative Two: (Preferred Alternative) High Level Alternative (1.668 Billion Tons)

Alternative Two considers leasing 22 of the 27 tracts in Utah and Colorado (Table 2-3). The Dugout-Pace, Mud Creek, North Trough Springs, Blue Trail Canyon, and Walker Flat tracts in central Utah are not considered in this alternative. About 72,894.91 acres with an in-place coal resource of 1,667.5 million tons would be leased. About 659.7 million tons are estimated to be recoverable. BLM and Forest Service administer 47,560.95 surface acres of the lease area, while 25,333.96 acres are in non-Federal ownership. All coal on the tracts is owned by the Federal Government.

Coal would be mined underground by room and pillar and/or longwall methods except for 630 acres of surface mining on the Ford Pasture tract. Up to 15

TABLE 2-3

TRACTS INCLUDED IN THE UINTA-SOUTHWESTERN UTAH REGION: ROUND TWO ALTERNATIVES

Tract	Alternatives One[a]	Two[b]	Three[c]	Four[d]
Central Utah				
Alkali Creek	*	*	*	
Coal Creek	*	*	*	
Dugout-Pace	*		*	
Graves	*	*	*	
Hoffman Creek	*	*	*	
Soldier Creek	*	*	*	
Whitmore Park	*	*	*	
Acord	*	*	*	
Castle Valley Ridge	*	*	*	
Ferron Canyon	*	*	*	
Gooseberry	*	*	*	
Ivie	*	*	*	
Mud Creek	*			
North Trough Springs	*		*	
Quitchupah	*	*	*	
Skumpah	*	*	*	
The Pines	*	*	*	
Trail Mountain	*	*	*	
Blue Trail Canyon	*			
Walker Flat	*		*	
Southern Utah				
Alton Amphitheater	*	*		
Fisher Canyon	*	*		
Flax Lakes	*	*		
Ford Pasture	*	*		
Mill Creek Canyon	*	*		
West Central Colorado				
Paonia D Seam	*	*	*	
Cedaredge	*	*	*	

a Maximum Level, 1.907 billion tons
b High Level, 1.668 billion tons
c Medium Level, 1.316 billion tons
d No Competitive Federal Leasing (No Action)

TABLE 2-4

ALTERNATIVE ONE SUMMARY

Number of Tracts:	27			
Total Acres:	82,289.37			
Total In-Place Coal Resource:	1,906.9 million tons			
Total Recoverable Coal Resource:	732.6 million tons			
a. Surface Mining:	13.3 million tons			
b. Underground Mining:	719.3 million tons			
Average Annual Production[a]:	20.78 million tons			
Total Water Requirements: (acre-feet/year)	1987	1990	1995	2000
Water Required for Mining:	159.0	359.0	483.9	483.9
Water Required for Community Development:	1,333.0	2,438.0	5,980.1	7,041.8
Totals: (acre-feet/year)	1,492.0	2,797.0	6,464.0	7,525.7
Total Acres Disturbed:	1987	1990	1995	2000
Mining Operations[b]:	481.6	1,834.4	2,168.9	2,503.3
Community Development[c]:	530.7	971.6	2,341.9	2,753.7
Totals:	1,012.3	2,806.0	4,510.8	5,257.0
Employment:	1987	1990	1995	2000
Construction Workers:	547	1,877	-	-
Mining Workers[d]:	-	479	5,872	5,872
Total Workers:	547	2,356	5,872	5,872

a Assumes maximum production for each tract.

b Includes exploration activities, surface facility construction and access, powerline access, loadout facilities, and ventilation construction and access.

c Includes acres retired from irrigation to provide water for community development.

d Includes coal transportation employees.

new portals and five new coal loadouts would be required. Maximum annual coal production from the tracts would be 19.01 million tons per year. Approximately 2,308 acres of surface disturbance (Table 2-5) would be required for mine development by the year 2000, including exploratory drilling, portal areas, ventilation shafts, coal storage, required access, and coal loadouts. Approximately 59.9 miles of existing access roads would be improved and 201.1 miles of new road construction would be needed in the region. The average number of additional coal haul truck round trips per day in the region would be 1,824 in addition to 380 trips per day by service vehicles.

Approximately 5,561 permanent employees (including truckers) would be needed by 1995 and about 1,832 temporary employees would be needed for construction from 1987 through 1989.

Exploratory drilling would require a total of about 402 acre-feet of water between 1987 and 1990 and the estimated water requirement for mining would be 445.8 acre-feet per year. Table 2-5 summarizes the high level alternative.

Alternative Three: Medium Level Alternative (1.316 Billion Tons)

Alternative Three considers leasing 20 of the 27 delineated tracts in Utah and Colorado (Table 2-3). The southern Utah tracts (Alton Amphitheater, Fisher Canyon, Flax Lakes, Ford Pasture, and Mill Creek Canyon) and the Mud Creek and Blue Trail Canyon tracts in central Utah would not be offered for lease. About 58,691.55 acres with an in-place coal resource of 1,316.2 million tons would be leased. About 528.7 million tons are estimated to be recoverable. BLM and Forest Service administer 40,534.37 surface acres of the lease area while 18,157.18 acres are in non-Federal ownership. All coal on the tracts is owned by the Federal Government.

Coal would be mined underground by room and pillar and/or longwall methods. Twelve new portals and five new coal loadouts would be required. Maximum annual coal production would be 15.16 million tons per year. Approximately 1,373.2 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling, portal areas, ventilation shafts, coal storage, required access, and loadout areas. Approximately 49.4 miles of existing access roads would be improved and 147.6 miles of new road construction would be needed in the region. The average number of additional coal haul truck round trips per day would be 1,358 in addition to 303 trips per day by service vehicles.

Approximately 3,971 permanent employees (including truckers) would be needed by 1995 and about 1,428 temporary employees would be needed for construction from 1987 through 1989.

Exploratory drilling would require a total of about 328 acre-feet of water from 1987 through 1989 and the estimated water requirement for mining after 1995 would be 363.1 acre-feet per year. Table 2-6 summarizes the medium level alternative.

TABLE 2-5

ALTERNATIVE TWO SUMMARY

Number of Tracts:	22			
Total Acres:	72,894.91			
Total In-Place Coal Resource:	1,667.5 million tons			
Total Recoverable Coal Resource:	659.7 million tons			
a. Surface Mining:	12.4 million tons			
b. Underground Mining:	647.3 million tons			
Average Annual Production[a]:	19.01 million tons			
Total Water Requirements: (acre-feet/year)	1987	1990	1995	2000
Water Required for Mining:	134.0	324.0	445.8	445.8
Water Required for Community Development:	1,298.7	2,341.3	5,806.6	6,963.9
Totals: (acre-feet/year)	1,432.7	2,665.3	6,252.4	7,409.7
Total Acres Disturbed:	1987	1990	1995	2000
Mining Operations[b]:	439.1	1,680.2	1,997.4	2,308.0
Community Development[c]:	428.1	933.9	2,275.4	2,723.4
Totals:	867.2	2,614.1	4,272.8	5,031.4
Employment:	1987	1990	1995	2000
Construction Workers:	529	1,832	-	-
Mining Workers[d]:	-	398	5,561	5,561
Total Workers:	529	2,230	5,561	5,561

[a] Assumes maximum production for each tract.

[b] Includes exploration activities, surface facility construction and access, powerline access, loadout facilities, and ventilation construction and access.

[c] Includes acres retired from irrigation to provide water for community development.

[d] Includes coal transportation employees.

TABLE 2-6

ALTERNATIVE THREE SUMMARY

Number of Tracts: 20

Total Acres: 58,691.55

Total In-Place Coal Resource: 1,316.2 million tons

Total Recoverable Coal Resource: 528.7 million tons

a. Surface Mining: 0.0 million tons
b. Underground Mining: 528.7 million tons

Average Annual Production[a]: 15.16 million tons

Total Water Requirements: (acre-feet/year)	1987	1990	1995	2000
Water Required for Mining:	109.3	259.3	363.1	363.1
Water Required for Community Development:	948.1	1,726.5	4,181.6	4,854.6
Totals: (acre-feet/year)	1,057.4	1,985.8	4,544.7	5,217.7

Total Acres Disturbed:	1987	1990	1995	2000
Mining Operations[b]:	255.1	1,313.0	1,350.1	1,373.2
Community Development[c]:	381.7	697.2	1,648.1	1,909.6
Totals:	636.8	2,010.2	2,998.2	3,282.8

Employment:	1987	1990	1995	2000
Construction Workers:	449	1,428	-	-
Mining Workers[d]:	-	167	3,971	3,971
Total Workers:	449	1,595	3,971	3,971

[a] Assumes maximum production for each tract.

[b] Includes exploration activities, surface facility construction and access, powerline access, loadout facilities, and ventilation construction and access.

[c] Includes acres retired from irrigation to provide water for community development.

[d] Includes coal transportation employees.

Alternative Four: No Action (No Competitive Federal Leasing)

Alternative Four is the No-Action Alternative. If implemented, no Federal coal from the 27 described tracts would be offered for lease in 1984.

Even with no additional leasing, portions of the Uinta-Southwestern Utah Coal Region will continue to be active coal producing areas, particularly central Utah. This anticipated growth and development for central Utah was first analyzed in the Central Utah Coal Development Environmental Statement (ES) prepared in 1979 by Geological Survey (GS). The mid-level annual production rate of 24 million tons by 1990 analyzed in that ES was further considered in the first Uinta-Southwestern Utah Coal Region EIS. Full production from 10 proposed underground mines, for which leases had been issued, added to the 1976 coal production in central Utah, plus a moderate increase in production from existing mines, was analyzed.

GS also analyzed various levels of coal production in southern Utah. This analysis was published in the Development of Coal Resources in Southern Utah ES in 1979.

Consultation with the State of Utah Office of the State Planning Coordinator resulted in a slight downward modification of the baseline production figures discussed above. The Planning Coordinator's Office now projects an annual 21.6 million ton production rate for the State by the year 2000 which is some 4 million tons over Utah's record estimated production of 17.6 million tons in 1982. All of this projected production would come from fee lands and existing State and Federal leases in central Utah and the possible re-offering of some or all of the four tracts offered but not leased in the Uinta-Southwestern Utah Round One leasing effort. No production is projected for southern Utah. However, if mining development occurs in the Alton area, it would be on existing leases which were analyzed in the Southern Utah Regional EIS (GS, 1979b) and the Allen-Warner Valley EIS (BLM, 1980a).

Baseline assumptions and figures used in this EIS for west-central Colorado were calculated from data obtained from Delta County, State of Colorado, and local coal related industries. This information is available for review at the BLM Colorado State Office and Uncompahgre Resource Area Office in Montrose, Colorado.

The annual production rate considered in this document is subject to change as additional data are obtained and as local and national trends develop. However, to this point, the production rate planned from existing leases and private mines has not been significantly altered.

Mitigating Measures and Monitoring Program

In addition to the laws and regulations which govern land management and coal leasing in general, several additional measures have been identified which would mitigate some anticipated impacts and are listed in Appendix 3. These measures would be made stipulations to leases as applicable. Additional mitigating measures may be made stipulations as a result of further analysis and public review. Measures may also be modified as deemed necessary by appropriate Federal officials. Further details are available for review in a technical report prepared for this EIS by the Uncompahgre Basin Resource Area Office personnel and the individual tract profiles.

Surface Mine Reclamation

Mining plans have not been prepared for proposed surface mining operations analyzed in this statement; therefore, it is assumed that a typical surface mining sequence would occur and that requirements for operating and reclamation plans and mining permits would be met. Figure 2-2 shows a scenario for a potential surface mining operation. Since the surface mines would disturb and reclaim areas in stages, only part of the potential mining area would be disturbed annually. Table 2-7 and Figure 2-3 illustrate the assumed reclamation sequence and maximum area of unreclaimed land at any one period of time.

As shown in Figure 2-2, vegetation would be established on initially disturbed acreage after 3 years. This does not imply that a total return to original vegetation would occur in that time period, but vegetation cover sufficient to retard wind and water erosion of soil would be established. Depending upon the original vegetation type in the area, restoration to original conditions would require a much longer period of time (15 to 20 years or more).

A detailed reclamation plan based on permanent program performance standards for surface mining (30 CFR Chapter VII, Subchapter K) must be submitted and approved by Office of Surface Mining prior to mining activity.

Comparative Analysis Matrix

A comparative summary of major impacts for Alternatives One through Four is presented in Table 2-8. Alternative Four is the No Action Alternative and no new competitive coal leasing is proposed. The future environment (projected baseline) without the proposed alternatives is analyzed in Chapter Four, Alternative Four. Significant cumulative impacts associated with individual leasing alternatives and the projected baseline are discussed separately for each alternative in Chapter Four.

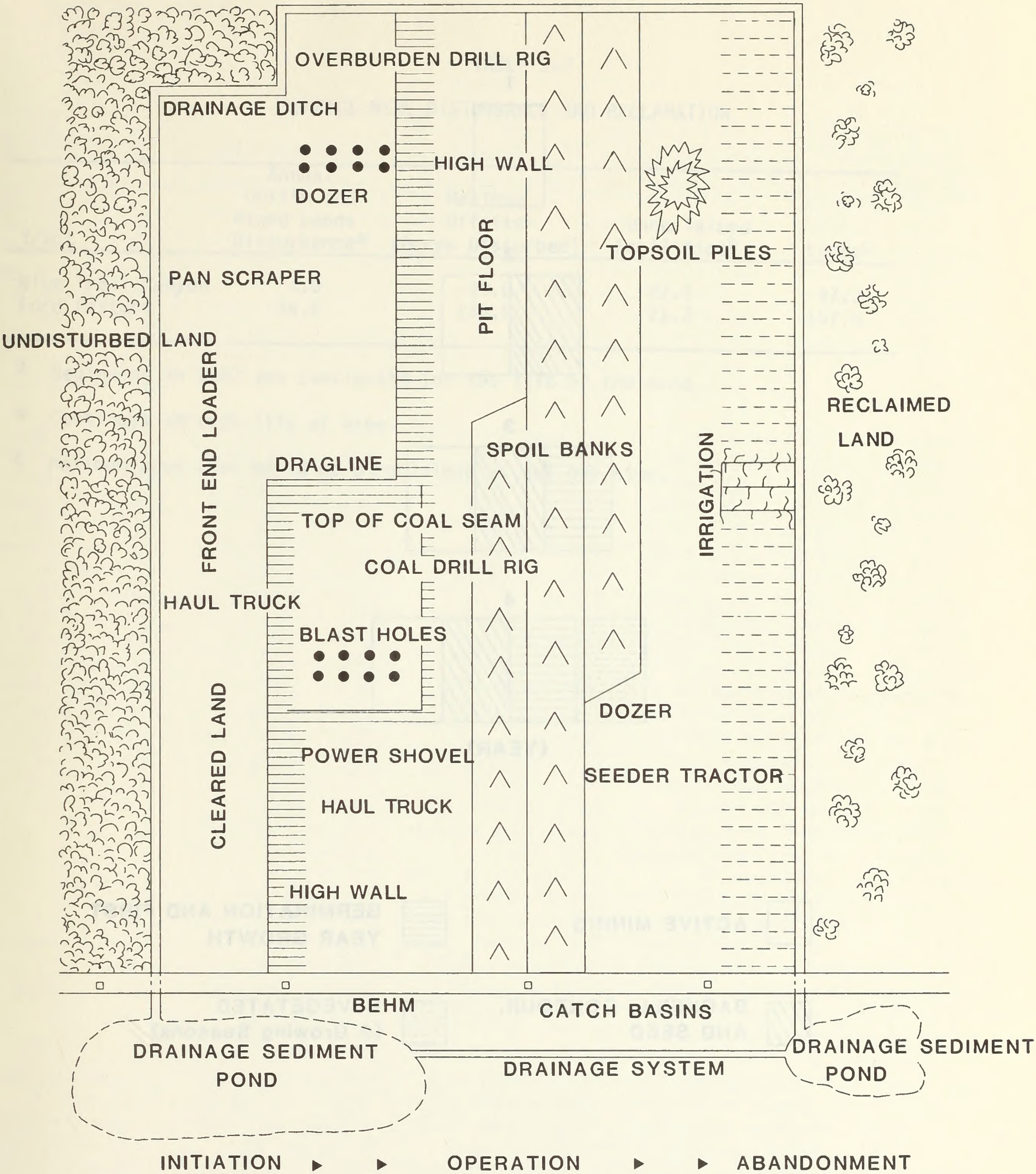


FIGURE 2-2

TIME PHASED SCENARIO OF A POTENTIAL STRIP MINE

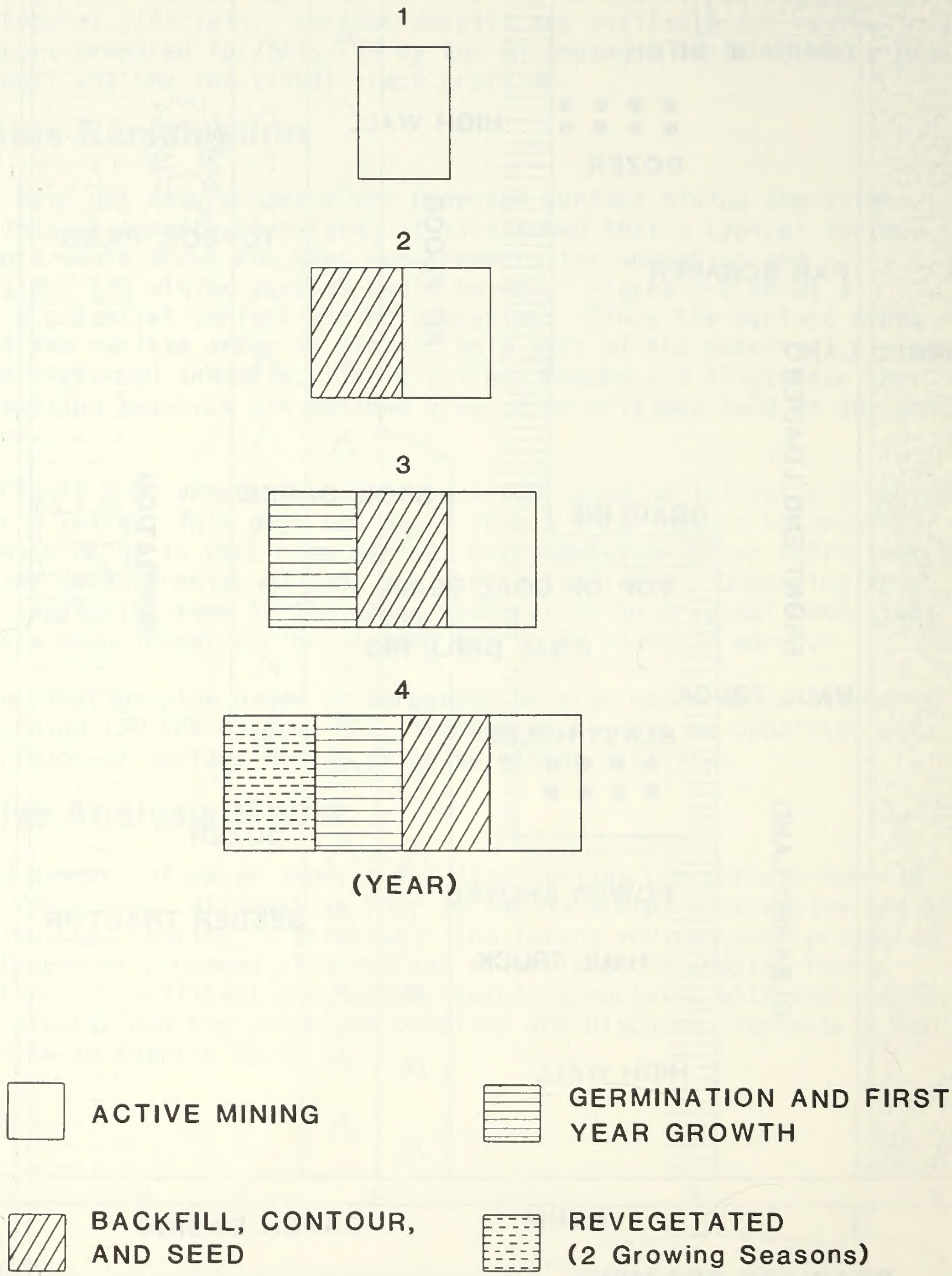


FIGURE 2-3

RECLAMATION SEQUENCE

TABLE 2-7

SURFACE MINE DISTURBANCE AND RECLAMATION

Tract	Annual Onsite and Mined Lands Disturbance[a]	Maximum Offsite (Acres Disturbed)	Unreclaimed Facilities[b]	Lands[c]
Blue Trail Canyon	4.0	20.0	27.3	47.3
Ford Pasture	56.5	135.5	22.3	157.8

[a] Beginning in 1987 and continuing for the life of the mine.

[b] Continues through life of mine.

[c] Maximum area that would be unreclaimed at any one time.

TABLE 2-8

COMPARATIVE SUMMARY OF MAJOR IMPACTS

RESOURCE CATEGORY	ALTERNATIVE ONE (1.907 billion tons)	ALTERNATIVE TWO (1.668 billion tons)	ALTERNATIVE THREE (1.316 billion tons)	ALTERNATIVE FOUR (No Action)
				Even though no new Federal coal would be developed, the region would continue to be an active coal producing area and the following impacts would be expected.
Climate, Air Quality	Four areas near Price, Castle Dale, Mt. Pleasant, and Alton, Utah, and two areas near Delta and Cedaredge, Colorado, would exceed the primary NAAQS for TSP by an average of 10.6 percent over 1982 conditions and 6.1 percent over the projected baseline. Secondary NAAQS would be exceeded in a 2,845 square mile area by the year 2000, of which 1,275 square miles would be attributed to Alternative One. The greatest impact contribution would come from vehicular traffic on unpaved roads and growth in population centers.	Two areas near Price and Alton, Utah, and two areas near Delta and Cedaredge, Colorado, would exceed the primary NAAQS for TSP by an average of 10.6 percent over 1982 conditions and 6.1 percent over the projected baseline. Secondary NAAQS would be exceeded in a 2,730 square mile area by the year 2000, of which 1,160 square miles would be attributed to Alternative One. The greatest impact contribution would come from vehicular traffic on unpaved roads and growth in population centers.	Three areas near Price, Castle Dale, and Mt. Pleasant, Utah, and two areas near Delta and Cedaredge, Colorado, would exceed the primary NAAQS for TSP by an average of 7.7 percent over 1982 conditions and 5.5 percent over the projected baseline. Secondary NAAQS would be exceeded in a 2,605 square mile area by the year 2000, of which 1,035 square miles would be attributed to Alternative One. The greatest impact contribution would come from vehicular traffic on unpaved roads and growth in population centers.	Three areas near Price, Castle Dale, and Mt. Pleasant, Utah, and two areas near Delta and Cedaredge, Colorado, may exceed the primary NAAQS for TSP. Currently, 245 square miles exceed the secondary NAAQS, this would increase to 1,570 square miles by the year 2000.
Soils	Cumulatively, 5,257 acres of surface disturbance would occur by the year 2000. 2,503 acres disturbance would result from mining activities and would eventually be reclaimed. 2,754 acres disturb-	Cumulatively, 5.125 acres of surface disturbance would occur by the year 2000. 2,308 acres disturbance would result from mining activities and would eventually be reclaimed. 2,723 acres disturb-	Cumulatively, 3,353 acres of surface disturbance would occur by the year 2000. 1,373 acres disturbance would result from mining activities and would eventually be reclaimed. 1,910 acres would be	Cumulatively, over 5,500 acres of surface disturbance would occur. Over 4,600 acres disturbance would occur in central Utah and would be attributable to coal mining and related community

TABLE 2-8
(cont'd.)

RESOURCE CATEGORY	ALTERNATIVE ONE (1.907 billion tons)	ALTERNATIVE TWO (1.668 billion tons)	ALTERNATIVE THREE (1.316 billion tons)	ALTERNATIVE FOUR (No Action)
Soils (continued)	ance would result from community development (including retiring irrigated croplands) and would not be reclaimed. An undetermined amount of soil would be lost prior to reclamation.	ance would result from community development (including retiring irrigated croplands) and would not be reclaimed. An undetermined amount o of soil would be lost prior to reclamation.	used for community development (including retiring irrigated croplands) and would not be reclaimed. An undetermined amount of soil would be lost prior to reclamation.	expansion. The remaining acres disturbed would also be attributable to community growth and would not be reclaimed.
Mineral Resources	732.6 million tons of coal would be recovered by underground and surface mining methods, leaving 1,174.3 million tons (62%) in the ground and unrecoverable by current mining technologies. Annual production would be 20.78 million tons by the year 2000. Conflicts with oil and gas operations could occur in some areas.	659.7 million tons of coal would be recovered by underground and surface mining methods, leaving 1,007.8 million tons (60.4%) in the ground and unrecoverable by current mining technologies. Annual production would be 19.01 million tons by the year 2000. Conflicts with oil and gas operations could occur in some areas.	528.7 million tons of coal would be recovered by underground mining methods, leaving 787.5 million tons (59.8%) in the ground and unrecoverable by current mining technologies. Annual production would be 15.16 million tons by the year 2000. No coal would be developed in southern Utah.	Over 500 million tons of coal would not be mined from existing leases and would be unrecoverable by current mining methods. Coal in seven of the tracts proposed for leasing in this round may also not be mined and could be bypassed by existing operations. No coal mining would occur in southern Utah. 21.6 million tons would be produced annually in central Utah and 1.35 million tons annually in west-central Colorado.
Topography, Geology, Paleontology	Up to 16 feet of subsidence would occur on portions of the 81,047 acres that would be mined by underground methods. Surface mining would alter topography on 687 acres. Significant plant fossils could be destroyed by coal mining in the Blackhawk Formation (central Utah).	Up to 16 feet of subsidence would occur on portions of the 71,973 acres that would be mined by underground methods. Surface mining would alter topography on 630 acres. Significant plant fossils could be destroyed by coal mining in the Blackhawk Formation (central Utah).	Up to 16 feet of subsidence could occur on portions of the 58,692 acres that would be mined by underground methods. Significant plant fossils could be destroyed by coal mining in the Blackhawk Formation (central Utah).	An undetermined amount of subsidence of up to 16 fet would occur on areas currently under lease. In central Utah, plant fossils could be destroyed by mining in the Blackhawk Formation.

TABLE 2-8
(cont'd.)

RESOURCE CATEGORY	ALTERNATIVE ONE (1.907 billion tons)	ALTERNATIVE TWO (1.668 billion tons)	ALTERNATIVE THREE (1.316 billion tons)	ALTERNATIVE FOUR (No Action)
Water Resources	Annual water requirements for community development would increase by 7,041 acre-feet annually by the year 2000. An additional 484 acre-feet would be required annually for mine development. Development of certain central Utah tracts would result in an increase in annual sediment flow into local reservoirs and streams used for recreation and community water supply. Subsidence could cause changes in ground and surface water movement. Overall, salinity contribution to the Colorado River would actually decrease.	Annual water requirements for community development would increase by 6,964 acre-feet annually by the year 2000. An additional 446 acre-feet would be required annually for mine development. Development of certain central Utah tracts would result in a slight increase in annual sediment flow into local reservoirs and streams used for recreation and community water supply. Subsidence could cause changes in ground and surface water movement. Overall, salinity contribution to the Colorado River would actually decrease.	Annual water requirements for community development would increase by 4,855 acre-feet annually by the year 2000. An additional 363 acre-feet would be required annually for mine development. Development of certain central Utah tracts would contribute to a slight increase in annual sediment flow into local reservoirs and streams used for recreation and community water supply. Subsidence could cause changes in ground and surface water movement. Overall, salinity contribution to the Colorado River would actually decrease.	Over 9,000 acre-feet of water would be consumed by mining and population growth annually by the year 2000. Of that total, nearly 8,000 acre-feet would be consumed in central Utah. Mining could disrupt local aquifers and cause some redistribution of natural ground water discharge points. Water required to meet population growth or community development would result in the loss of approximately 2,934 acres of irrigated cropland by the year 2000, 2,125 acres of which would be lost in central Utah.
Vegetation	Vegetation production on 2,503 acres would be lost for the life of the mines. Production on an additional 2,754 acres lost to community development would be permanently lost, of which 1,978 acres would be irrigated croplands. This is less than 1% of the total cropland in the region.	Vegetation production on 2,308 acres would be lost for the life of the mines. Production on an additional 2,723 acres lost to community development would be permanently lost, of which 1,956 acres would be irrigated croplands. This is less than 1% of the total cropland in the region.	Vegetation production on 1,373 acres would be lost for the life of the mines. Production on an additional 1,910 acres lost to community development would be permanently lost, of which 1,375 acres would be irrigated croplands. This is less than 1% of the total cropland in the region.	Vegetation production on 5,092 acres would be lost as a result of mining and community growth. Acreage lost to community growth would not be reclaimed. Nearly 2,500 acres lost would be irrigated croplands.

TABLE 2-8
(cont'd.)

RESOURCE CATEGORY	ALTERNATIVE ONE (1.907 billion tons)	ALTERNATIVE TWO (1.668 billion tons)	ALTERNATIVE THREE (1.316 billion tons)	ALTERNATIVE FOUR (No Action)
Wildlife	An unquantified amount of big game habitat would be lost. This loss is expected to be slight. The loss of irrigated cropland would reduce pheasant and other small game habitat. However, overall populations would not be significantly reduced. Increased pressures on wildlife through harvest, harassment, and displacement would occur. Highway related deer losses would increase. Efforts to establish a moose herd would continue to be stymied by illegal killing.	An unquantified amount of big game habitat would be lost. This loss is expected to be slight. The loss of irrigated cropland would reduce pheasant and other small game habitat. However, overall populations would not be significantly reduced. Increased pressures on wildlife through harvest, harassment, and displacement would occur. Highway related deer losses would increase. Efforts to establish a moose herd would continue to be stymied by illegal killing.	An unquantified amount of big game habitat would be lost. This loss is expected to be slight. The loss of irrigated cropland would reduce pheasant and other small game habitat. However, overall populations would not be significantly reduced. Increased pressures on wildlife through harvest, harassment, and displacement would occur. Highway related deer losses would increase. Efforts to establish a moose herd would continue to be stymied by illegal killing.	Community expansion and mining activities would result in an unquantified but expected insignificant loss of wildlife habitat. Direct wildlife loss would result from highway mortality and illegal killing. Increased populations would exert greater pressures on wildlife through harvest, harassment, and displacement.
Land Use	1,978 acres would be changed from irrigated croplands to community use, 1,232 acres of which would be located in central Utah. Grazing could be adversely affected by water loss, increased traffic on stock driveways, and direct loss of grazing lands.	1,956 acres would be changed from irrigated croplands to community use, 1,210 acres of which would be located in central Utah. Grazing could be adversely affected by water loss, increased traffic on stock driveways, and direct loss of grazing lands.	1,375 acres would be changed from irrigated croplands to community use, 1,213 acres of which would be located in central Utah. Grazing could be adversely affected by water loss, increased traffic on stock driveways, and direct loss of grazing lands.	Land use on approximately 2,434 acres would change from agriculture use to community use either by direct community expansion or acres retired to provide water for community growth. An undetermined number of AUM's would be lost as a result of vegetation disturbance.
Land Use Plans, Controls, and Constraints	Development of three tracts in central Utah would conflict with Carbon County's zoning ordinances which currently do not allow coal mining	Development of the Castle Valley Ridge tract in central Utah would conflict with Carbon County's zoning ordinances which currently do	Development of two tracts in central Utah would conflict with Carbon County's zoning ordinances which currently do not allow coal mining	No significant conflicts would exist between coal development of existing holdings and county zoning in central Utah or west-

TABLE 2-8
(cont'd.)

RESOURCE CATEGORY	ALTERNATIVE ONE (1.907 billion tons)	ALTERNATIVE TWO (1.668 billion tons)	ALTERNATIVE THREE (1.316 billion tons)	ALTERNATIVE FOUR (No Action)
Land Use Plans, Controls, and Constraints (continued)	on certain portions of the Wasatch Plateau. Tract development in southern Utah could conflict with protection of irrigated croplands and development of water resources provisions of the Kane County Master Plan.	not allow coal mining on certain portions of the Wasatch Plateau. Tract development in southern Utah could conflict with protection of irrigated croplands and development of water resources provisions of the Kane County Master Plan.	on certain portions of the Wasatch Plateau.	central Colorado. No coal development is projected for southern Utah.
Socioeconomics	Employment in the region would be increased by 11,237 jobs (20 percent) over the baseline by the year 2000. Population in the region would increase by 23,117 persons (21 percent) by the year 2000. Coal development would bring added revenues into affected counties, however, these counties would experience significant infrastructure impacts. The elements most affected would be housing, education facilities, social services, water and sewer capacities, and law enforcement.	Employment in the region would be increased by 9,577 jobs by the year 2000. This would result in an overall population increase in the region by 22,272. Increased employment would be in additional revenues to the affected counties. The most significant infrastructure impacts would be overcrowding in the county schools and needs for additional housing, social services, water and sewer capacities, and law enforcement.	Employment in the region would be increased by 7,842 jobs (14 percent) by the year 2000. This would result in an additional 19,765 people (14 percent) living in the region by 2000. Increased employment would bring in additional revenues to affected counties. The most significant infrastructure impacts would be overcrowding in the schools and the needs of additional housing, social services, water and sewer capacities, and law enforcement.	A 44 percent population increase in central Utah, 34 percent in southern Utah, and 4 percent in west-central Colorado is projected by the year 2000 over the estimated 1982 population. Much of this growth would not be coal related. Wastewater treatment facilities would need to be constructed or upgraded in several communities. Some housing shortages could also be expected. Coal mining would produce jobs and income for local residents and revenues for central Utah and west-central Colorado counties.
Transportation	More than 20,000 additional vehicles per day (21 percent increase) would be on roads in the region.	More than 18,000 additional vehicles per day (19 percent increase) would be on roads in the region.	More than 13,000 additional vehicles per day (14 percent increase) would be on roads in the region.	The potential exists for overcrowding on Highway 10 south from Price, Utah, as well as US-6 across

TABLE 2-8
(cont'd.)

RESOURCE CATEGORY	ALTERNATIVE ONE (1.907 billion tons)	ALTERNATIVE TWO (1.668 billion tons)	ALTERNATIVE THREE (1.316 billion tons)	ALTERNATIVE FOUR (No Action)
Transportation (continued)	Traffic congestion would be acute in Price, Utah. Portions of Highway 10 near Price would be overloaded as well as US-6 across Soldier Summit. Secondary, unpaved roads would experience an undetermined amount of deterioration. Associated safety and maintenance problems would result.	Traffic congestion would be acute in Price, Utah. Portions of Highway 10 near Price would be overloaded as well as US-6 across Soldier Summit. Secondary, unpaved roads would experience an undetermined amount of deterioration. Associated safety and maintenance problems would result.	Traffic congestion would be acute in Price, Utah. Portions of Highway 10 near Price would be overloaded as well as US-6 across Soldier Summit. Secondary, unpaved roads would experience an undetermined amount of deterioration. Associated safety and maintenance problems would result.	Soldier Summit. Price would also experience traffic congestion during rush hours. Secondary, unpaved roads would experience an undetermined amount of deterioration. No traffic related problems are anticipated for southern Utah or west-central Colorado.
Cultural Resources	Some uninventoried sites could be destroyed. Increased vandalism and collecting would occur.	Some uninventoried sites could be destroyed. Increased vandalism and collecting would occur.	Some uninventoried sites could be destroyed. Increased vandalism and collecting would occur.	Some uninventoried sites could be destroyed. Increased vandalism and collecting would occur.
Recreation	Local demand for recreation in the region would increase by approximately 18 percent in central Utah, 71 percent in southern Utah, and an undetermined but slight amount in west-central Colorado. Some developed sites would experience overcrowding and deterioration. Some facilities in towns would be overcrowded. There would be a reduction in hunter and fisherman success. Traffic congestion on	Local demand for recreation in the region would increase by approximately 17 percent in central Utah, 71 percent in southern Utah, and an undetermined but slight amount in west-central Colorado. Some developed sites would experience overcrowding and deterioration. Some facilities in towns would be overcrowded. There would be a reduction in hunter and fisherman success. Traffic congestion on	Local demand for recreation in the region would increase by approximately 18 percent in central Utah and an undetermined but slight amount in west-central Colorado. Some developed sites would experience overcrowding and deterioration. Some facilities in towns would be overcrowded. There would be a reduction in hunter and fisherman success. Traffic congestion on recreation roads would occur.	Local demand for recreation would increase by 44 percent in central Utah, 34 percent in southern Utah, and a slight but unquantified percent in west-central Colorado. Some developed sites could experience overcrowding and deterioration. Some facilities in towns would be overcrowded. There would be a reduction in hunter and fisherman success. Traffic congestion on some recreation roads would occur.

TABLE 2-8
(cont'd.)

RESOURCE CATEGORY	ALTERNATIVE ONE (1.907 billion tons)	ALTERNATIVE TWO (1.668 billion tons)	ALTERNATIVE THREE (1.316 billion tons)	ALTERNATIVE FOUR (No Action)
Recreation (continued)	recreation roads would occur. Coal development related noise could be noticable on certain days from the Yovimpa Point area of Bryce Canyon National Park.	recreation roads would occur. Coal development related noise could be noticable on certain days from the Yovimpa Point area of Bryce Canyon National Park.		
Visual Resources	Development of some tracts would be visible from highly traveled recreation roads. Fugitive dust from the two surface mines would be visible from I-70 and from Bryce Canyon's Yovimpa Point. In certain cases, VRM standards would not be met.	Development of some tracts would be visible from highly traveled recreation roads. Fugitive dust from the two surface mines would be visible from I-70 and from Bryce Canyon's Yovimpa Point. In certain cases, VRM standards would not be met.	Development of some tracts would be visible from highly traveled recreation roads in central Utah. VRM objectives would not be met in some areas.	Coal development would continue to modify the natural landscape in isolated portions of the region. VRM objectives would probably not be met in some areas. However, because development would be localized, the average visitor would probably note little change in the region's overall scenic character.
Special Designation Areas	No direct impacts would occur, however, the large increase in population would result in increased recreation demand in these areas. Some values could be degraded. Land management agencies would be under stress to protect these values.	No direct impacts would occur, however, the large increase in population would result in increased recreation demand in these areas. Some values could be degraded. Land management agencies would be under stress to protect these values.	No direct impacts would occur, however, the large increase in population would result in increased recreation demand in these areas. Some values could be degraded. Land management agencies would be under stress to protect these values.	No direct impacts would occur, however, the expected population increase would result in increased recreation demand in these areas. Some values could be degraded.

CHAPTER 3

DESCRIPTION OF THE AFFECTED ENVIRONMENT

Introduction

This chapter describes the existing environment of the Uinta-Southwestern Utah Coal Region that would be affected by implementation of any of the alternative levels of coal leasing described in Chapter 2. The information provided is commensurate with the significance of the anticipated impacts and no attempt has been made to describe all components of the environment in detail. Less important data are summarized, consolidated, or referenced.

Central Utah

Climate, Air Quality

Climate

The central Utah study area is basically semiarid and annually receives almost 70 percent of the total possible sunshine (U.S. Environmental Data Service, 1968). The higher elevations generally experience cooler temperatures and receive adequate moisture while the lower elevations east of the Wasatch Plateau and along the Colorado River are much drier. The precipitation pattern for the region closely follows elevation contours. Highest annual precipitation totals occur at the higher elevations and portions of the Wasatch Plateau receive over 30 inches per year. This contrasts with less than 8 inches observed near the Emery tracts and other areas east of the Wasatch Plateau. The Book Cliffs receive 12 to 16 inches of precipitation annually. Most precipitation on the Wasatch Plateau occurs in the colder months (October to March). The areas east of the plateau experience a peak in monthly precipitation totals during the summer as a result of thunderstorm activity.

Average January Fahrenheit temperatures range from the teens at higher elevations to the high 20s in the valleys. Average July temperatures range from the high 50s in the mountains to the high 70s at lower elevations along the Colorado River. The average frost-free period ranges from less than 60 days at higher elevations to 150 days at lower elevations along the Green and Colorado Rivers.

Air Quality

Air Quality Standards

The national primary and secondary ambient air quality standards (NAAQS) were developed to identify air pollutants of concern and establish maximum ground level concentration limits which are allowable, with an adequate margin of safety, to protect human health (primary standards) and public welfare (secondary standards).

The prevention of significant deterioration of (PSD) air quality regulations have been established to protect air quality in those areas which are presently better, than the NAAQS. PSD incremental limitations have been established for sulfur dioxide and total suspended particulates (TSP) and are shown in Table 3-1. All areas to which the PSD regulations apply are classified as Class I, II, or III. Class I allows the least increase in pollutant levels, while Class III allows the greatest increase. Class I areas also are protected against adverse impacts to air quality related values, including visibility, odors, and impacts to flora, fauna, soils, water, geologic, and cultural structures. All areas in central Utah are classified as Class II, with the exceptions of Capitol Reef, Canyonlands, and Arches National Parks, which are Class I areas.

The PSD increments do not apply to any area until a major air quality modification source submits a complete PSD permit application, at which time an air quality baseline is established. After that time, any area impacted by a PSD permitted source with an annual average concentration of 1 microgram per cubic meter is subject to the PSD increments. All new sources in the area must be counted toward those increments. At this time, a baseline concentration has been established in only a small portion of Emery County.

The central Utah region is principally rural with light or dispersed industrial activity and existing air quality is generally excellent. TSP at monitoring sites within the region are shown in Table 3-2. With the exception of TSP, concentrations of pollutants are 20 percent or less of the NAAQS.

The 24-hour TSP standard has been exceeded at Price, Castle Dale, and Green River, and the annual secondary standard has been exceeded at Price and Green River. The exceedences resulted from dust raised by travel on unpaved roads and soil particles suspended during windy conditions. Price had been classified as a non-attainment area for TSP, but was granted an exemption under EPA's rural fugitive dust policy. Annual average baseline TSP concentrations throughout central Utah were estimated for 1981 by air quality modeling. The model ISCLT, Cedar Mountain meteorological data, and 1981 emissions data were used. The results are shown in Figure 3-1. The predicted concentrations compare well with measured TSP levels, especially near Price and Castle Dale. The model predicts 1981 TSP levels slightly greater than the secondary annual average NAAQS over a small area in and near Price. The 1977 and 1978 monitoring data in Price also showed exceedences of the secondary annual average NAAQS.

Carbon monoxide, ozone, lead, and hydrocarbons were not monitored in the region. Due to the lack of major industrial sources of these pollutants and the relatively low vehicle population, it is expected that their concentrations are within the NAAQS.

Visibility

Visibility measurements taken at Capitol Reef and Canyonlands National Parks indicate that average visual ranges between 1978 and 1981 were 113 miles at Capitol Reef and 118 miles at Canyonlands. These figures probably represent the maximum for the region.

TABLE 3-1
PREVENTION OF SIGNIFICANT DETERIORATION INCREMENTS

Pollutant	Averaging Time	Maximum Allowable Concentrations Micrograms Per Cubic Meter Class I	Class II	Class III
Sulfur Dioxide	Annual	2	20	40
	24-hour	5	91	182
	3-hour	25	512	700
Total Suspended Particulates	Annual	5	19	37
	24-hour	10	37	75

TABLE 3-2
CENTRAL UTAH
MEASURED PARTICULATE (TSP) CONCENTRATIONS

Monitoring Location	Year	TSP Concentrations Micrograms Per Cubic Meter: Maximum 24-hour Average	Second Maximum 24-hour	Annual Geometric Mean
Castle Dale	1977	265	225[a]	49
	1978	170	157[a]	40
	1979	121	120	44
	1980	125	114	38
	1981	312	108	36
Green River	1979	196	169[a]	64[a]
	1980	163	154[a]	53
	1981	196	172[a]	58
Huntington Canyon	1977	144	140	34
	1978[b]	93	74	33
Price	1977	406	346[a]	69[a]
	1978	303	246[a]	61[a]

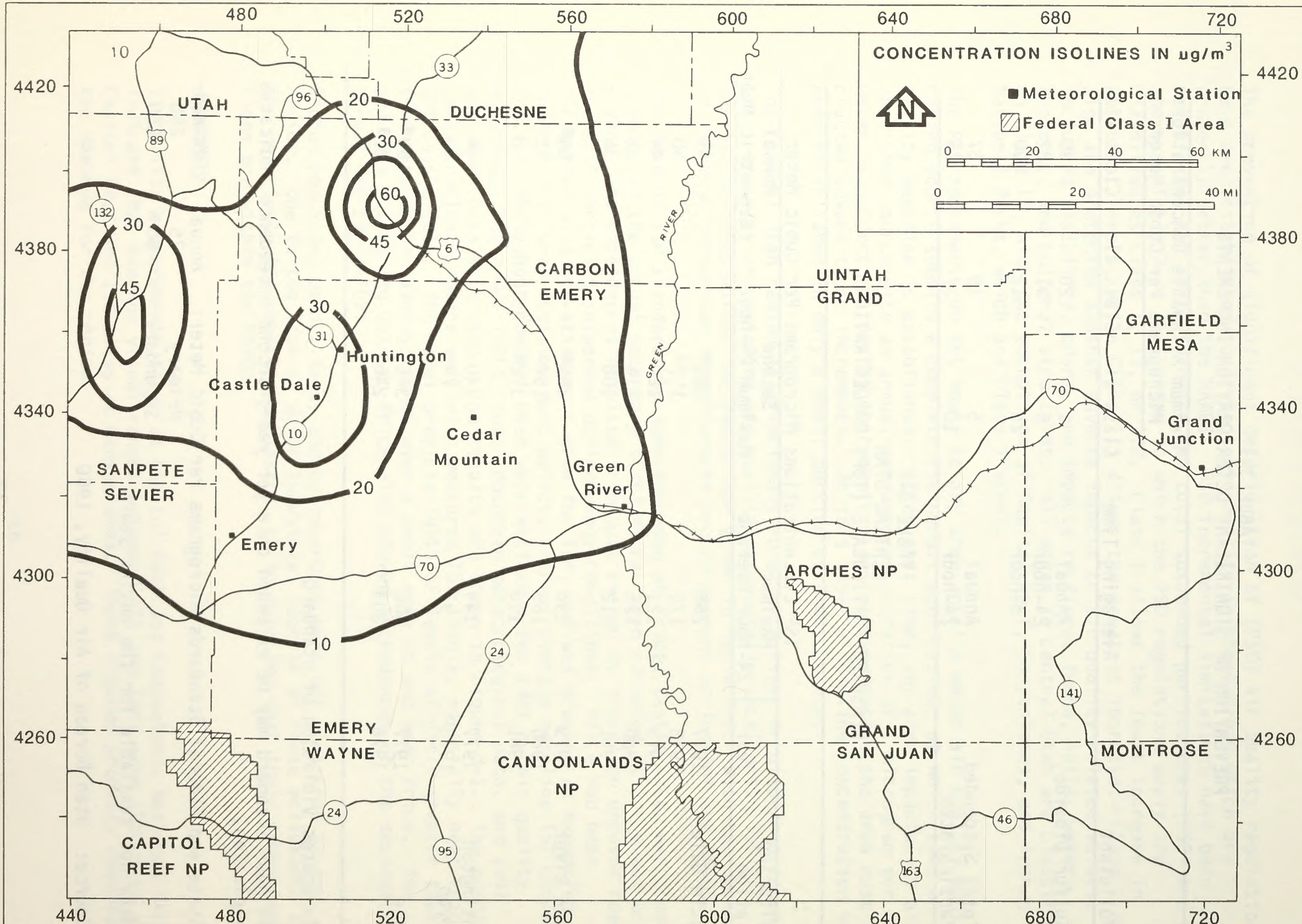
[a] Indicates violation of standard

24 hour standard may be exceeded once per year; second exceedence indicates violation.

State and Federal Standards Micrograms Per Cubic Meter:	Annual	24-hour
Primary	75	260
Secondary	60	150

[b] Data not available for the entire year.

Source: Utah Bureau of Air Quality, 1980



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 3-1

ESTIMATED ANNUAL AVERAGE TSP CONCENTRATIONS IN CENTRAL UTAH - YEAR 1981

Soils

Special soil management concerns, natural sediment yields, and soil loss tolerance values for soil on the central Utah coal tracts are presented in Tables 3-3 and 3-4. The following narrative addresses soil characteristics and limitations. Reclamation potentials for the soils of central Utah are discussed in the Vegetation section of this chapter.

The potential use of soils along the escarpments and in associated canyons of the Book and Roan Cliffs is limited by steep slopes, rockiness, and low available moisture. Water erosion potential on the steep slopes is high.

Above the Book Cliffs the slopes form gentle to rolling benches. Soils in this area are dominantly dark-colored soils of the mountains and plateaus and are usually somewhat moist during the summer. The water and wind erosion potential is low to moderate.

Soils along the eastern front of the Wasatch Plateau are very rocky, occur on steep slopes, and support very little vegetation. Water erosion potential on these slopes is high. Westward from this erosional escarpment, the elevation increases to 11,000 feet. Typically, soil development and vegetation density increases with elevation to about 9,800 feet. Above that level temperature and growing seasons become limiting to soil development and plant growth. Water erosion potential is moderate to high. Some soils primarily on the North Horn Formation, have a high potential for mass movement and most slopes on this formation are generally unstable. Where other formations are on the surface, occasional instability occurs although most of the slopes are generally stable.

Most soils in the Emery area are well drained, calcareous, loamy or coarse loamy in texture, and range from shallow to deep. Finer textured soils occur on floodplains or valley sideslopes where the parent material is residuum weathered from shale. On some sites, soils have developed from marine shale and are high in soluble salts.

Miscellaneous land types including Badlands also occur in the Emery area. Little soil exists in these areas and most are moderately to severely eroded. Included are areas having excessive slopes (50 to 80 percent) where 50 to 70 percent of the surface is covered by stone.

More than 50 percent of the Blue Trail Canyon tract is comprised of Rockland and Shaley Colluvial soils with limited topsoil, shallow to very shallow plant rooting depths, and high salt content. The erosion hazard potential is high on the majority of soils which comprise the tract. Potentially limiting characteristics identified in overburden samples include nitrogen, potassium, and phosphorous deficiencies, high sodium concentrations, excessive boron and selenium levels, and high arsenic, nickel, pH, and salinity levels.

Minerals Resources

Coal resources and quality on the proposed coal tracts are summarized in Chapter 2. The coal beds of the Book Cliffs field have a moderate to high

TABLE 3-3

CENTRAL UTAH

SPECIAL SOIL MANAGEMENT CONCERNS

Physiographic Area and Coal Tract	Management Concern
Book Cliffs Area	
Graves, Coal Creek, Soldier Creek, Alkali Creek, and Dugout-Pace	On steep slopes (greater than 30 percent) revegetation attempts of disturbed areas have been less than 30 percent successful (BLM, 1982b).
Coal Creek, Alkali Creek and Dugout-Pace	Slight to moderate wind erosion hazard potential exists over portions of tracts (surface of the plateau especially near the crest of the Book Cliffs, 1,679 acres of 4,198 acres). Roads, utility lines, and portal locations would be located on steep rocky slopes (50 percent +); high water erosion hazard and low soil productivity potentials exist on these slopes.
Wasatch Plateau	
North Trough Springs	Portions of North Hughes Canyon drainage in parts of Sections 7, and 17-20, T.14S., R7E., are currently experiencing severe natural water erosion.
Mud Creek	Soil-disturbing activities on the steep escarpments in Mud Creek Canyon drainage cause revegetation and soil stabilization difficulties.
Castle Valley Ridge	Soil disturbing activities on the steep slopes of the northern three-fourths of the tract cause revegetation and soil stabilization difficulties. Sheet erosion, soil creep, gully formation, and slope failures presently occur or exist in that portion of the tract.
Trail Mountain and Ferron Canyon	Portions of roads, utility lines, and portal locations would be on steep (30-60 percent) sideslopes. Most of the tracts are located on the North Horn Formation which is high in shale content and yields highly erodible soils. Soil disturbing activities on these slopes may cause revegetation and soils stabilization difficulties. Portions of the tracts are located on areas that have been mechanically contoured and trenched for watershed erosion control. Erosion and sediment have been substantially controlled in these areas.
Pines and Quitchupah	The potential portal site and access road locations are on steep canyon sideslopes. The soils on these slopes are highly erosive. The soils have a high rock fragment content, are dry, usually hot, and have a relatively low productivity.
Emery Area	
Blue Trail Canyon	Soils on the Blue Trail Canyon tract have a moderate to high wind and water erosion potential and a low revegetation and soil reconstruction potential.

Source: Book Cliffs - Roan Plateau Area - Uinta-Southwestern Utah Coal Region, Site Specific Analyses for Graves, Coal Creek, Soldier Creek, Alkali Creek, and Dugout-Pace Coal Tracts, June 1980. Bureau of Land Management, Moab District, Price River Resource Area.

Wasatch Plateau Area - Uinta-Southwestern Utah Coal Region, Site-Specific Analysis for North Trough, Mud Creek, Castle Valley Ridge, Trail Mountain, Ferron Canyon, Pines and Quitchupah, July 1982. Forest Service, Manti-LaSal and Fishlake National Forests, Price and Richfield, Utah.

TABLE 3-4
CENTRAL UTAH
NATURAL SEDIMENT YIELDS AND SOIL LOSS TOLERANCE VALUES
FOR COAL TRACTS WITH SPECIAL SOIL MANAGEMENT CONCERNS
(Water erosion rates unless otherwise indicated)

Coal Tract Area	Natural Sediment Yield[a] (Tons per acre per year)	Soil Loss Tolerance Values[b] (Tons per acre per year)
Book Cliffs Area	-Slopes in excess of 30% (Exposed soil) = 0.5 to 3.0[c]	Slopes in excess of 30% = 2 to 5[d]
	-Plateau Areas (Rolling benches = 0.5 to 1.0[c] exposed soil)	Plateau Areas (Rolling benches) = 3 to 5[d]
Wasatch Plateau Area		
Gooseberry, North Trough Springs, Mud Creek, and Castle Valley Ridge	-Slopes in excess of 25% (Vegetation covered surface) = 0.2[e] (Exposed soil) = up to 22.0[e]	Slopes in excess of 25% = 1 to 3 for soils with rooting depth of 10-40 inches[f] = 2 to 5 for soils with rooting depth of 40-50 inches[f]
Trail Mountain, Ferron Canyon, The Pines, and Quitchupah	-Slopes in excess of 25% (Exposed soil) = 20.0+[g]	Slopes in excess of 25% = 1 to 3[f]
	-Plateau Areas (Rolling benches Exposed soil) = 0.5 to 1.0	Plateau Areas (Rolling benches) = 3 to 5[f]
Emery Area		
Blue Trail Canyon	-All Slopes (Water Erosion) = 0.5 to 1.0[h] (Wind Erosion) = 20.0+	All slopes = 1 to 2

SOURCES:

a Natural Sediment Yield = The amount of soil an area loses every year through natural processes. This is a result of the normal and ongoing processes.

b Soil Loss Tolerance Values = Maximum rate of soil erosion that can occur and still remain a productive soil (1 ton per acre per year is approximately equivalent to 0.0063 inches per year).

c Final Environmental Statement Site-Specific Analysis - Part 2 - Development of Coal Resources in Central Utah, U.S. Department of the Interior, Geological Survey, 1979, p. FD-II-4 (GS, 1979b).

d Personal Communication, Hansen, BLM-Moab, Utah, 1982.

e Final Environmental Statement, Site-Specific Analyses - Part 2 - Development of Coal Resources in Central Utah, U.S. Department of the Interior, Geological Survey, 1979, p. BO-II-3 (GS, 1979b).

f Personal Communication, Iaquinta, FS, Manti-LaSal National Forest, Price, Utah, 1982.

g Uinta-Southwestern Utah, Coal Region, Site-Specific Analyses for Trail Mountain, Ferron Canyon, The Pines and Quitchupah Coal Tracts, 1982 (FS/BLM, 1982).

h Reclaimability Analysis of the Emery Coal Field, Emery County, Utah, EMRIA Report 16, Bureau of Land Management, 1979 (BLM, 1979b).

methane content (Doelling et al., 1979). Methane is being extracted in advance of coal mining operations in Soldier Creek.

There are no Known Geologic Structures (KGS) for oil and gas within the boundaries of the Book Cliffs or Emery coal fields. Five KGSs (Clear Creek, Joe's Valley, Gordon Creek, Ferron, and Flat Canyon) are within the boundaries of the Wasatch coal field. Portions of the North Trough Springs and Mud Creek tracts are within the Clear Creek KGS. Gas is being extracted from the Ferron Sandstone and two producing gas wells, Deck 1A and Walton #1, are adjacent to the North Trough Springs tract. Two producing gas wells south of the Flat Canyon gas field have prompted a request for the drilling of additional wells in the Cottonwood Canyon area northeast of the Trail Mountain tract. Other possible drill sites have been identified. No data are available on the reserves or production potential of oil and gas under any of the proposed lease tracts.

None of the tracts in central Utah are expected to contain significant minerals other than oil, gas, or coal.

Topography, Geology, Paleontology

The Book Cliffs coal field lies slightly east of the central part of Utah in Carbon and Emery Counties adjacent to and east of the Wasatch Plateau coal field (Figure 3-2).

The southern and western edge of the Book Cliffs coal field is a cliff line with relief varying from 1,000 to 2,000 feet. The elevation at the base of the cliffs near Green River is 5,000 feet but increases to 7,000 feet from Soldier Canyon westward. Behind the cliffs are mountains with more gentle slopes and elevations up to 10,285 feet (Bruin Point).

Rock formations of the Book Cliffs coal field range in age from the early most late Cretaceous to the Tertiary. Formations ranging from Cretaceous Dakota Sandstone to Tertiary Green River Formation outcrop in the Book Cliffs and associated highlands. Each formation is described in the stratigraphic section in Figure 3-3. Colluvial and alluvial deposits have accumulated along the drainages, benches, and gentle slopes. The coal-bearing formation is the Blackhawk. The most important coal seams and zones in ascending order are Spring Canyon, Castlegate, Kenilworth, Gilson, Rock Canyon, and Lower Sunnyside. The first three are important in the Castlegate area, the next two in the Soldier Creek area, and the last in the Sunnyside area (Doelling, 1972). In-place coal resources on the tracts have been estimated to be 365.9 million tons.

The Book Cliffs are a gently dipping homocline (3 to 7 degrees), dipping into the Uinta Basin. The cliff line roughly parallels the strike of the beds. Most faulting has occurred in the Sunnyside area where two steeply dipping fault sets occur. One fault set trends north-northwest, the other east-northeast. Within the coal beds the maximum displacement is 200 feet. The faults that occur within the rest of the field are unimportant because displacement is small.

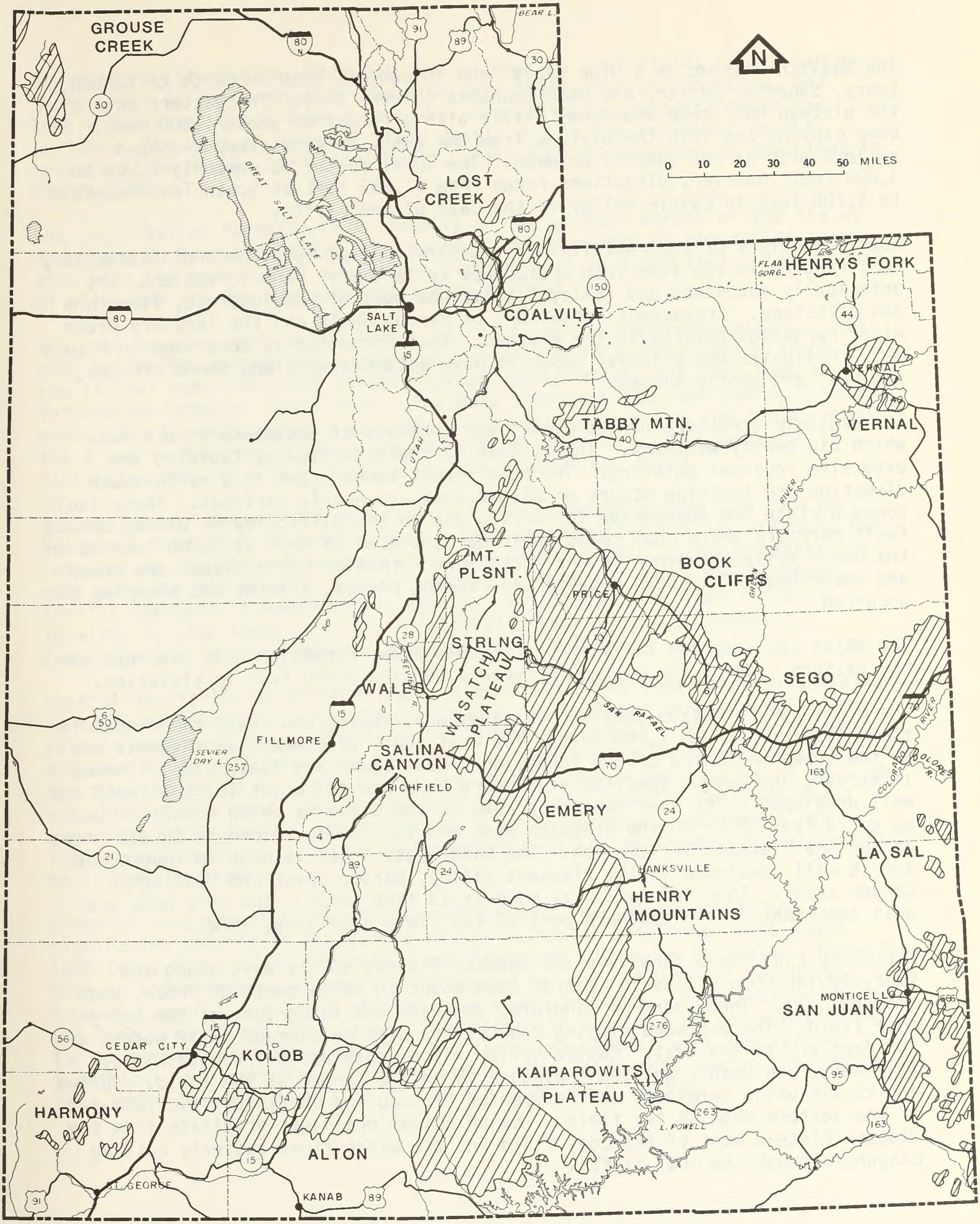


FIGURE 3-2

UTAH COAL FIELDS

The Wasatch Plateau is a high table land in central Utah in parts of Carbon, Emery, Sanpete, Sevier, and Utah Counties (Figure 3-2). The eastern edge of the plateau has steep erosional cliffs with a relief of about 1,000 feet. Deep canyons cut into the plateau from the east, forming steep V-shaped valleys with narrow summits between. The local relief is commonly 2,000 to 3,000 feet, however, elevations range from 11,283 feet at South Tent Mountain to 5,700 feet in Castle Valley at the base of the cliffs.

Rock formations of the coal field are generally flat-lying beds of sedimentary rock ranging in age from late Cretaceous to Tertiary. The formations, are principally sandstone and shale, but include beds of conglomerate, limestone and siltstone. Cretaceous Formations of Mancos Shale and the Tertiary Green River Formation outcrop in the plateau. Each formation is described in Figure 3-3. Colluvial and alluvial deposits have accumulated along the drainages, benches, and gentle slopes.

The geologic structure of the coal field consists of sedimentary rock beds which dip gently westward. The plateau is characterized by faulting and extensive regional jointing. The major fault zones trend in a north-south direction and faulting occurs on planes that are nearly vertical. These fault zones dictate the boundaries for mining due to the difficulty of mining across fault barriers where coal seams could be displaced as much as 3,000 feet as in the Joe's Valley graben. In the North Horn Formation where slopes are steep and water has infiltrated between the bedding planes, sliding and slumping has occurred

The major coal-bearing formation is the Blackhawk Formation. It outcrops on the eastern side of the plateau between 7,000 and 8,000 feet in elevation.

The Blackhawk Formation consists of sandstone, shale, and coal, and ranges in thickness from 700 to 1,000 feet. The coal seams of commercial interest are in the lower one-third of the formation. Coal seams are lenticular, limited in extent, and have a specific area where beds are thick (at least 4 feet) and well developed. The most important seam is the Hiawatha which occurs in beds up to 28 feet thick in the Hiawatha area and in minable thickness in all areas except the Pleasant Valley area. The Castlegate A bed is next in importance and is well developed in the Pleasant Valley, Gordon Creek and Huntington Canyon areas. This bed can be as much as 19 feet thick. The Ivie beds are most important in the southern part of the field (Doelling, 1972).

The Emery coal field parallels the Wasatch Plateau to the east along the Emery-Sevier County line in central Utah about 70 miles south of Price, Utah (Figure 3-2). Three general landforms dominate the topography of the Emery coal field. The westward sloping coal cliffs with an average cliff height of 800 feet are to the east. Castle Valley which contains low rounded hills, flatlands, and deeply gullied drainages is in the center of the field. Buttes and knolls which terminate at the Wasatch Plateau are characteristic features of the western edge of the field. The principal drainages originate from the Wasatch Plateau west of the coal field and the water flows easterly cutting canyons through the coal cliffs.

The only rock formation which outcrops within the coal fields is the Mancos Shale which is represented by the Blue Gate Shale, Ferron Sandstone, and Tununk Shale members. Some Quaternary unconsolidated deposits cover the surface. The beds of the coal field gently dip to the northwest on the western flank of the San Rafael Swell. Each formation member is described in Figure 3-3.

The Joe's Valley-Paradise Fault zone is on the western margin of the field. According to Doelling (1972), the vertical displacement of the faults associated with the zone varies from a few hundred feet to 2,000 feet. Faults east of this zone are few and have small displacement.

The coal-bearing zone in the Emery coal field is the Ferron Sandstone. The coal is shallow enough for surface mining on the Blue Trail Canyon Tract. Of the 14 coal beds contained in this member approximately six coal beds have thicknesses greater than 4 feet. The most important beds are the A, C, and I beds. The C and I beds are located in the northern part of the field, while the A bed is located in the southern part of the field. The beds are lenticular and dip 3 to 5 degrees westward (Doelling, 1972).

Scientifically significant fossils are known to occur in the coal-bearing Blackhawk Formation in central Utah. Some of the plant fossils are used for correlation and paleoenvironmental guides (Parker, 1976). The potential is only moderate for finding mollusc, turtle, crocodile, fish, and dinosaur fossils (personal communication, Robison, FS, 1980). One insect fossil locality is also known and is scientifically significant (personal communication, Jensen, Brigham Young University 1978).

Several localities of scientifically significant fossil vertebrates are also found in the North Horn Formation. Unique dinosaur and other reptilian fossils have been reported by Gilmore (1946) and others. Rare fossilized dinosaur egg shells have been described by Jensen (1966). The mammalian fauna has been described by Gazin (1941) and others. Mammalian fossils of this age are considered significant as they are known only from the Rocky Mountain region of North America and Mongolia. A North American Land Mammal Age (Dragonian) is based on the fossil mammals from the North Horn Formation near North Horn Mountain.

Although some invertebrate fossils are common, the chance of finding significant fossils in the Mancos Shale, Starpoint Sandstone, Castlegate Sandstone, Price River Formation, and Flagstaff Limestone is small. There has been no comprehensive survey of the region for paleontological resources; however, several unrelated studies have been completed. A literature search was conducted to evaluate research completed in this region and identify as far as possible the known fossils and their association with the various formations in the region. The results of this literature search are compiled in a technical report on file at the BLM Utah State Office.

FIGURE 3-3

GENERALIZED STRATIGRAPHIC COLUMN OF THE WASATCH PLATEAU, BOOK CLIFFS, AND EMERY COAL FIELDS

Period	Stratigraphic Unit		Thickness (Feet)	Description
TERTIARY	Green River Formation		--	Greenish gray and white claystone and shale, also contains finegrained and thin-bedded sandstone. Shales often dark brown containing carbonaceous matter. Full thickness not exposed.
TERTIARY	Colton Formation	Wasatch Formation	300-2000	Colton consists of brown to dark red lenticular sandstone, shale, and siltstone, thins westwardly and considered a tongue of the Wasatch.
TERTIARY		Wasatch Formation	3000	Wasatch predominantly sandstone and interbedded red and green shales with basal conglomerate. Found in East Book Cliffs.
TERTIARY	Flagstaff Limestone	Wasatch Formation	0-500	Dark yellow-gray to cream limestone, evenly bedded with minor amounts of sandstone, shale, and volcanic ash, ledge former.
TERTIARY	North Horn Formation		500-2500	Varigated shales with subordinate sandstone, conglomerate, and freshwater limestone, thickens to north, slope former.
CRETACEOUS	Tuscher Formation		0-200	Light gray to cream-white friable massive sandstone and subordinate buff to gray shale. Contains minor conglomerate and represents lower part of North Horn only present in east part of Book Cliffs field.
CRETACEOUS	Price River Formation		600-1000	Gray to white gritty sandstone interbedded with subordinate shale and conglomerate, ledge and slope former.
CRETACEOUS	Castlegate Sandstone		150-500	White to gray, coarse-grained often conglomeratic sandstone, cliff former, weathers to shades of brown.
CRETACEOUS	Blackhawk Formation MAJOR COAL SEAMS		700-1000	Yellow to gray, fine to medium-grained sandstone, interbedded with subordinate gray and carbonaceous shale, several thick coal seams.
CRETACEOUS	Star Point Sandstone		90-1000	Yellow-gray massive cliff-forming sandstone, often in several tongues separated by Masuk Shale, thickens westward.
CRETACEOUS	Mancos Shale	Masuk Shale Mbr.	300-1300	Yellow to blue-gray sandy shale, slope former, thick in north and central plateau area, thins southward.
CRETACEOUS	Mancos Shale	Emery Sandstone COAL (?)	50-800	Yellow-gray friable sandstone tongue or tongues, cliff former, may contain coal (?) in south part of plateau if mapping is correct, thickens to west and south. Coal may be present in subsurface to west.
CRETACEOUS	Mancos Shale	Blue Gate Mbr.	1500-2400	Pale blue-gray, nodular and irregularly bedded marine mudstone and siltstone with several arenaceous beds, weathers into low rolling hills and badlands, thickens northerly.
CRETACEOUS	Mancos Shale	Ferron Sandstone MAJOR COAL SEAMS	50-950	Alternating yellow-gray sandstone, sandy shale and gray shale with important coal beds of Emery coal field, resistant cliff former, thickens to the south.
CRETACEOUS	Mancos Shale	Tununk Shale	400-650	Blue-gray to black sandy marine slope forming mudstone.
CRETACEOUS	Dakota Sandstone MINOR COAL		0-60	Variable assemblages of yellow-gray sandstone, conglomerate shale and coal. Beds lenticular and discontinuous.

Modified from Doelling, 1972.

Water Resources

Surface Water

Most of the Acord and the Skumpah tracts are in the Sevier River basin and runoff from those tracts reaches the Sevier River by way of Salina Creek. All the other central Utah tracts are in the Upper Colorado River Basin and runoff from those tracts reaches the Colorado River by way of the Price, San Rafael, and Dirty Devil Rivers. The Dirty Devil empties directly into the Colorado at Lake Powell while the Price and San Rafael empty into the Green River, a major tributary of the Colorado. Each tract is listed in Table 3-5 according to the drainage basin and tributary sub-basins in which it is predominantly located.

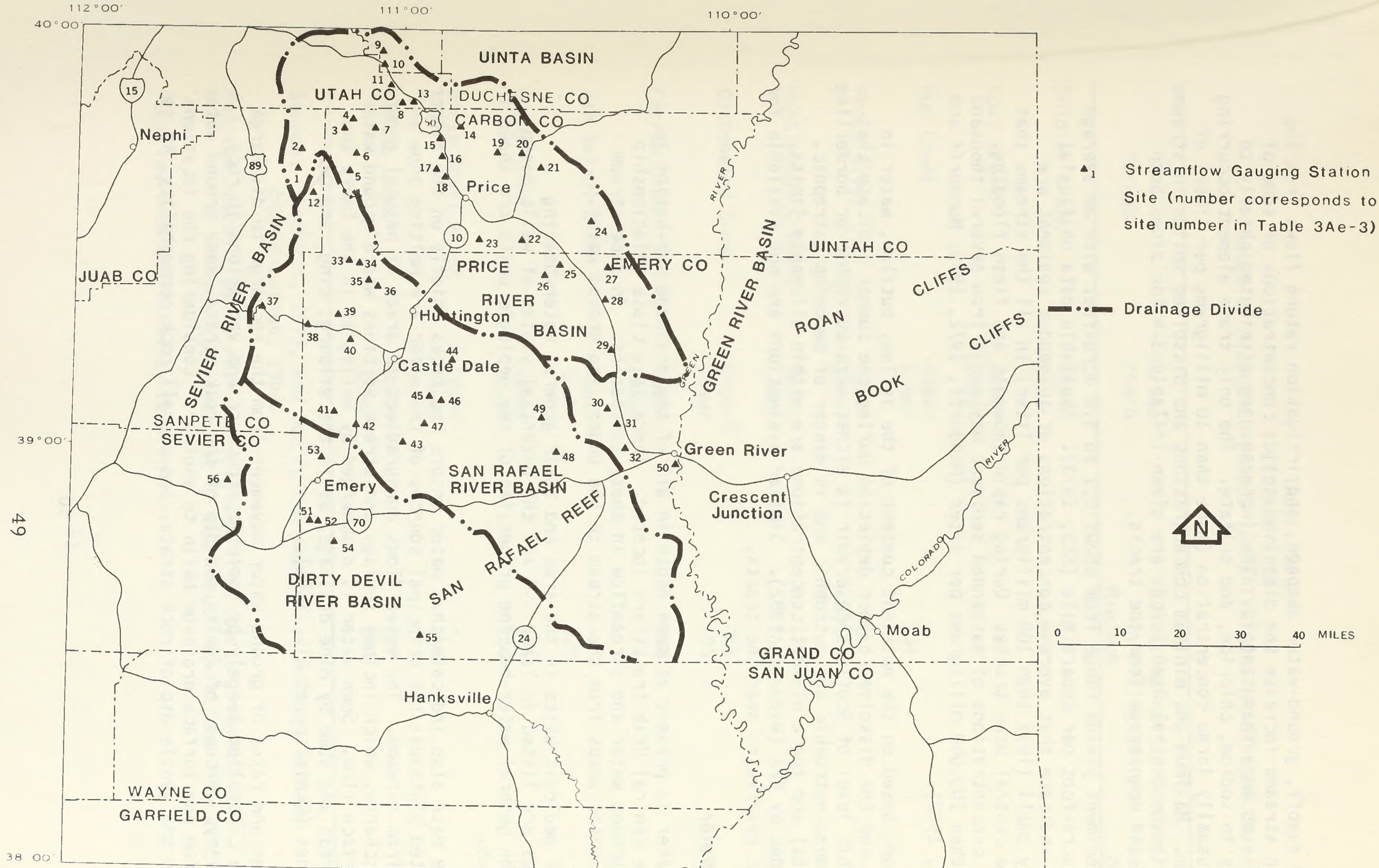
Estimated mean annual runoff from the central Utah tracts ranges from less than 1 inch (less than 50 acre-feet per square mile) in the vicinity of the Walker Flat, Blue Trail Canyon, and Emery tracts to about 18 inches (about 1,000 acre-feet per square mile) in the vicinity of the Gooseberry tract. Most runoff is generated on the highest parts of the Wasatch and Tavaputs Plateaus upstream from the tracts where it is estimated to locally exceed 20 inches (1,060 acre-feet per square mile) (Bagley et al., 1964). The seasonal peak runoff period is generally May through June, chiefly in response to the melting of winter snowpacks. Some runoff is also generated by local torrential summer rainstorms. Flash floods resulting from such storms have been recorded throughout the Price, San Rafael, and Dirty Devil River basins. They have occurred in perennial, intermittent, and ephemeral stream channels, and in some cases have caused considerable property damage (Woolley, 1946; Butler and Marsell, 1972). Flood stages of the affected streams have ranged from several to more than 10 feet higher than the medium-flow stage.

Records of runoff (including annual peak discharges of some streams) have been collected by the Geological Survey at streamflow gauging stations throughout the Price, San Rafael, and Dirty Devil River basins. The gauging sites are shown in Figure 3-4. Principal average annual river basin discharges are 103,600 acre-feet for the Price River (site 18), 96,940 for the San Rafael River (sites 46 and 47), 16,820 for the Dirty Devil River (site 55), and 162,300 acre-feet for the Sevier River (site 58). Runoff data from the area of the central Utah tracts indicate that surface waters range from fresh to slightly saline. Dissolved-solids concentrations in the headwaters of the Price, San Rafael, and Dirty Devil Rivers are commonly less than 250 milligrams per liter during both high and low flow periods. The concentrations of the individual dissolved constituents are generally well within maximum allowable limits for drinking water as stated in the Utah Water Quality Standards (Utah Division of Health, 1978). However, in some samples some constituents have exceeded the Utah State water quality standards. Within the Wasatch Plateau, Clyde et al., (1981) detected excessive mercury in both surface and groundwater. Some water samples collected from streams on the Manti-LaSal National Forest have contained mercury concentrations that exceed water quality standards. Dissolved-solids concentrations of runoff generally increase downstream. This increase is most pronounced downstream of the proposed tracts where the streams emerge from the Wasatch and Tavaputs Plateaus and flow into the salt- and gypsum-bearing Mancos Shale. Natural

TABLE 3-5
CENTRAL UTAH
DRAINAGE BASINS AND TRIBUTARY SUB-BASINS

River Basin Tract	Principal Tributary Sub-basin	Principal Use of Streamflow
	Sevier River Basin	
Sevier		
Skumpah	Salina Creek	Irrigation
Acord	Salina Creek	Irrigation
	Upper Colorado River Basin	
Price		
Dugout-Pace Graves Hoffman Creek	Dugout Creek	Irrigation
Whitmore Park	Soldier Creek	Irrigation
Soldier Creek	Soldier Creek	Irrigation
Alkali Creek	Coal Creek	Irrigation
Coal Creek	Coal Creek	Irrigation
Mud Creek	Mud Creek Price River	Irrigation, municipal, industry, recreation
San Rafael		
Gooseberry	Huntington Creek Price River	Irrigation, industry, recreation, municipal
North Trough Springs	Huntington Creek	Irrigation, industry, recreation, municipal
Castle Valley Ridge	Huntington Creek	Irrigation, industry, recreation, municipal
Trail Mountain	Cottonwood Creek	Irrigation, municipal, industry, recreation
Ferron Canyon	Ferron Creek	Irrigation, municipal, industry, recreation
Dirty Devil		
The Pines	Muddy Creek	Irrigation, municipal
Quitchupah	Muddy Creek	Irrigation, municipal
Ivie	Muddy Creek	Irrigation
Walker Flat	Muddy Creek	Irrigation
Blue Trail Canyon	Muddy Creek	Irrigation

Source: GS Sub-basin Maps



(Base from U.S.G.S., 1969)

FIGURE 3-4

U.S. GEOLOGICAL SURVEY GAUGING STATION SITES overland runoff, ground-water seepage, and irrigation return flows from the Mancos to streams increase the dissolved-solids concentrations of some of those streams more than tenfold. The increases are attributed chiefly to increases in sodium, chloride, and sulfate. The only trace element occurring is an unusually large concentration (more than 10 milligrams per liter) of strontium. Maximum and minimum concentrations and dissolved solids in streams that drain the central Utah tracts are given in Table 3-6 for sites both upstream and downstream from the tracts.

Annual sediment yields range from about 0.1 to 3.0 acre-feet with an average of 0.75 acre-foot per square mile (SCS, 1973). Available data on fluvial sediment indicate that average concentrations of suspended sediment are generally small (less than 100 milligrams per liter) in all the streams that drain the central Utah tracts. During rapid snowmelt and flash flooding, however, concentrations of suspended sediment may range from several thousand to more than 100,000 milligrams per liter (Mundorff, 1972, 1979; Mundorff and Thompson, 1982).

Evaluations based on the nutrient content of the inflow, outflow, water in storage, and the dissolved oxygen depletion during the summer indicate that the trophic level of Scofield Reservoir is either mezo-eutrophic or borderline between mezo-eutrophic and eutrophic and in danger of becoming eutrophic. Heavy metal and trace element concentrations are within allowable limits recommended by EPA (Waddell, 1982). Similar evaluations are not available for the other reservoirs near the tracts.

Ground Water

Ground water is present at some depth in all of the drainage sub-basins in which the central Utah tracts are located. There is a close relationship between ground water and streamflow in those sub-basins. In some stream sections water seeps from the stream to the underlying ground water.

Principal geologic units in the area and their general water-bearing properties are listed in Table 3-7 and the potential yields of wells based largely on general water-bearing properties of the geologic units are shown in Figure 3-5.

Available data also indicate that water enters the rocks chiefly on the higher well-wetted plateaus; the principal sources of the water are melting snow and seeping from streams. The water flows downgradient to areas of natural ground water discharge, which include springs and stream sections where ground water joins surface flow. Some water is discharged by wells, as in the Emery and Salina areas and some by mine drainage, as in the Wilberg, King, and Deer Creek Mines (Danielson et al., 1981).

Directions and rates of ground water movement from the recharge to discharge areas are controlled largely by geologic structure and variations in rock permeability. Because of faults and dip of the rock strata, some ground water passes from one surface drainage basin to another. Considering the locations of faults the gentle dip of rock strata, and overall rock permeability, it is

TABLE 3-6
CENTRAL UTAH
RANGES OF DISSOLVED-SOLIDS CONCENTRATIONS OF STREAMFLOW

Stream	Stream reach[a]	Dissolved-solids concentration, in milligrams per liter Minimum	Maximum
Soldier Creek	Upper	277	696
	Lower	1,440	6,050
Coal Creek	Upper	499	625
	Lower	2,260	3,270
Mud Creek	Upper	-	-
	Lower	204	304
Price River	Upper	-	
	Lower	2,610	6,270
Huntington Creek	Upper	177	193
	Lower	761	5,540
Cottonwood Creek	Upper[b]	224	226
	Lower	305	4,650
Ferron Creek	Upper	188	492
	Lower	574	9,630
San Rafael River	Upper	-	-
	Lower	526	6,030
Muddy Creek	Upper	175	409
	Lower	3,200	8,100
Dirty Devil River	Upper	-	-
	Lower	963	3,460
Salina Creek	Upper	217	447
	Lower	285	9,360

Source: Mundorff, 1979, and Don Price, Geological Survey, written communication, 1982.

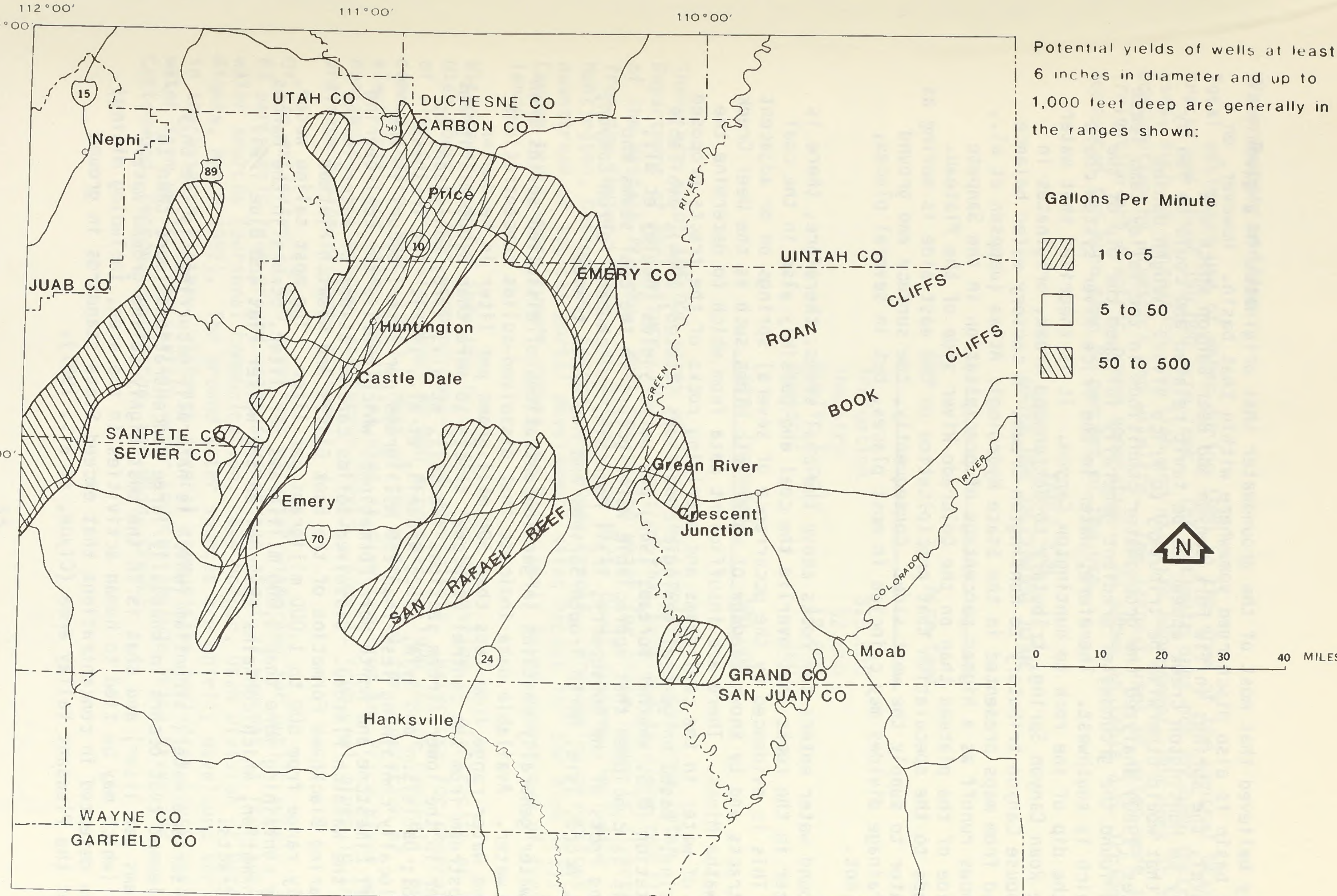
[a]Stream reach: Upper, near, or upstream from tracts proposed for leasing; lower, at or near mouth downstream from tracts.

[b]Outflow from Joe's Valley Reservoir

TABLE 3-7
CENTRAL UTAH
GENERAL WATER-BEARING PROPERTIES OF PRINCIPAL GEOLOGIC UNITS

Formation	Lithology and Water-Bearing Characteristics
Holocene and Pleistocene Formations	Alluvium and colluvium; clay, silt, sand, gravel, and boulders; yields water to springs that may cease to flow in late summer.
Flagstaff Limestone	Dark yellow gray-to-creme, dense, cherty, lacustrine limestone with some interbedded thin gray and green-gray shale; light-red or pick calcareous siltstone at base in some places; yields water to springs in upland areas.
North Horn Formation	Variegated shale and mudstone with interbeds of tan-to-gray sandstone; all of fluvial and lacustrine origin; yields water to springs.
Price River Formation	Gray-to-brown, fine-to-coarse, and conglomeratic fluvial sandstone with thin beds of gray shale; yields water to springs locally.
Castlegate Sandstone	Tan-to-brown fluvial sandstone and conglomerate; forms cliffs in most exposures; yields water to springs locally.
Blackhawk Formation	Yellow-to-gray discontinuous sandstone and gray carbonaceous shales with coal beds; all of marginal marine and paludal origin; locally scour-and-fill deposits of fluvial sandstone within less permeable sediments; yields water to springs and coal mines, mainly where fractured or jointed.
Star Point Sandstone	Yellow-to-gray, white, massive, and thin-bedded sandstone, grading downward from a massive cliff-forming unit at the top to thin interbedded sandstone and shale at the base; all of marginal marine and marine origin; yields water to springs and mines where fractured and jointed.
Musuk Member Mancos Shale	Yellow-to-blue-gray marine shale with thin, discontinuous layers of gray limestone and sandstone; yields water to springs locally.

Source: Danielson et al., 1982



(Base from U.S.G.S., 1969)

FIGURE 3-5

POTENTIAL YIELDS OF INDIVIDUAL WELLS

generally believed that most of the groundwater that originates in a given drainage basin is also discharged somewhere within that basin. However, on a local level, the springs in Tie Fork Canyon and Bear Canyon which are tributary to Huntington Creek appear to be fault related and could be fed by sources that would otherwise be tributary to Price River. Vaughn Hansen Associates (1980) analyzed the groundwater conditions in the Valley Camp lease area and found the groundwater gradient generally followed the dip of the rock, which is southwest. Therefore, water in the Price River system could follow the dip of the rock to Huntington Canyon. It is theorized that water from the Roan Canyon Spring, tributary to Cottonwood Creek, originates in Meetinghouse Canyon tributary to Huntington Creek. A cursory water balance localized from maps presented in the State Hydrologic Atlas (Jeppsen et al., 1981) shows runoff as a higher percentage of precipitation in the Sanpete River side of the plateau than on the Colorado River side of the Plateau. This leads to the speculation that precipitation on the east side is moving as groundwater to supply the west side. Consequently, the surface and ground water drainage divides may coincide in most places, but in several places, they do not.

Most ground water enters the rocks above the coal seams; therefore, there is some water in the rocks that overlie the coal and possibly also in the coal seams. This is evidenced by the occurrence of several springs on or adjacent to the tracts and by known seepage of water into mines such as the Deer Creek and Hiawatha Mines. There are insufficient data from which to determine the volumes of water in the coal seams and overlying rocks of the tracts proposed for leasing. Based on general geologic conditions (Stokes, 1964), available precipitation (U.S. Weather Bureau, 1963) and water yields (Bagley et al., 1964), it is concluded that appreciable water occurs in the coal seams and overlying rocks of the Gooseberry, Trail Mountain, Quitchupah, Ferron Canyon, Skumpah, Acord, Ivie, North Trough Springs and Mud Creek tracts.

Ground water generally contains larger concentrations of dissolved solids than surface water. Available data indicate that dissolved-solids concentrations of ground water range from less than 500 milligrams per liter in headwater areas upstream from the central Utah coal tracts to more than 3,000 milligrams per liter in the lower stream sections (Waddell, et al., 1978; Danielson, et al., 1981; Danielson and Syla, 1982; Waddell, et al., 1982). The freshest water, locally containing less than 250 milligrams per liter, occurs in the Flagstaff Limestone and North Horn Formations, which overlie the coal-bearing beds on the Wasatch Plateau. Dissolved-solids concentrations of water in the coal-bearing Blackhawk Formation of the Book Cliffs and Wasatch Plateau generally range from 500 to 1,000 miligrams per liter. The most saline water, commonly containing more than 3,000 milligrams per liter, occurs in the Mancos Shale Formation, which contains the coal on the Walker Flat and Blue Trail Canyon tracts.

As with surface water, strontium (which is naturally occurring) is the only trace element that occurs in unusually large concentrations (more than 10 milligrams per liter) and that is in the most highly saline ground water. Mercury (which may be tied to human activities in the area, including mining) has been detected in concentrations that exceed State standards in ground water of the Pleasant Valley area (Clyde, et al., 1981).

Water Supply and Use

Total estimated use of water during 1980 in the area of the central Utah tracts was about 390,000 acre-feet. The estimate does not include instream uses, such as recreation and fish and wildlife management, nor does it include consumption by livestock and wildlife. The largest uses of water were for irrigation and electric power generation. As shown in Table 3-8, irrigation accounted for more than 80 percent of the use.

TABLE 3-8
WATER USE IN CENTRAL UTAH

Use	Acre-feet
Irrigation	315,000
Industry	62,000
Public Supply	12,600
Domestic	100
Total (rounded)	390,000

There are about 105,000 acres of irrigated cropland in the area (Utah Department of Agriculture, 1981). Most of that cropland is along the flanks of the Wastach Plateau. Most irrigation water for these lands is diverted from the Sevier, Price, San Rafael, and Dirty Devil systems, including Huntington, Cottonwood, Ferron, and Muddy Creeks. Irrigation diversions are downstream of logical portal development sites except for the Blue Trail Canyon tract where runoff enters the Dirty Devil River downstream of irrigated lands.

Withdrawal use for industry is chiefly for generation of electricity at three Utah Power & Light Company coal-fired powerplants. Water use for generation of electricity totaled about 62,000 acre-feet in 1980 (Wayne Campbell, oral communication, March 1982). Most of the water used for generation of electricity and other industrial uses is diverted from the Price River and Huntington, Cottonwood, and Ferron Creeks. Some is from coal mines in the drainage basins of these streams.

Of the estimated 12,600 acre-feet of water withdrawn for public supply, about 63 percent is from ground water sources and about 37 percent is from surface water sources (personal communication, Dave Hooper, Utah Division of Water Rights, March 1982). The ground water sources are chiefly developed springs in the Wasatch Plateau, although several communities including Emery obtain water from wells. The surface water sources include Price River and Cottonwood, Ferron, Huntington, and Muddy Creeks.

Water Rights

The Utah State Engineer is responsible for the administration of all water rights within the State and for determining if proposed water right applications can be approved. The coal fields lay within State Basin 91, the Price River drainage; State Basin 93, the San Rafael River; and State Basin 95, Muddy Creek. There are esentially no unapproved waters in basins 91, 93, and 95. All three basins are in the process of adjudication. Based on an estimated 6.3 million acre-feet per year available in the upper basin, Utah's annual share of Colorado River water is estimated to be about 1,438,000 acre-feet.

Vegetation

Vegetation Types

Vegetation varies considerably over the region, ranging from low desert shrubs to conifer stands and mountain meadows. Change in elevation, with associated moisture and temperature changes, is a major factor in the distribution of vegetation types. Topography, aspect, soils, and past and present land use are also important factors that have affected plant distribution.

Eleven major vegetation types are found within the region including: Agricultural, Riparian, Grassland, Desert Shrub, Sagebrush Grass, Pinyon-Juniper Woodland, Mountain Brush, Ponderosa Pine, Aspen, Conifer-Aspin, and other. A list of common species found in each vegetation type is in Appendix 4. The distribution of these general vegetation types in central Utah is shown in Figure 3-6.

Dominant vegetation types on the Wasatch Plateau and Book Cliffs tracts include Sagebrush-Grass, Ponderosa Pine, Mountain Brush, Pinyon-Juniper Woodland, Aspen, and Conifer-Aspen. The Riparian type, including cottonwood and willow trees, is found along perennial streams, as is the Mountain Brush type which is often interspersed with other types. The Book Cliffs and Wasatch Plateau areas also contains stands of Douglas fir which are too small to be shown on the vegetation distribution map. Little or no Douglas fir reproduction is occurring on these stands.

On the Emery coal field the shallow, saline soils and sparse precipitation have resulted in a plant distribution pattern made up of species adapted to this harsh environment. The dominant vegetation types in this area are Desert Shrub, Pinyon-Juniper Woodland, and Grassland. The Riparian type along perennial streams in the area includes greasewood, saltcedar, and saltgrass. A list of plant species in the Emery coal field is included in Energy Minerals Rehabilitation, Inventory and Analysis Report (EMRIA) No. 16 (BLM, 1979b). The EMRIA study indicates the following vegetation production in pounds per acre: Pinyon-Juniper 1,000, Riparian 2,000, Desert Shrub 525, and Grassland 245. Nonproductive areas such as cliffs, rocky outcrops, talus slopes, and Blue Gate Shale are also present in the Emery area.

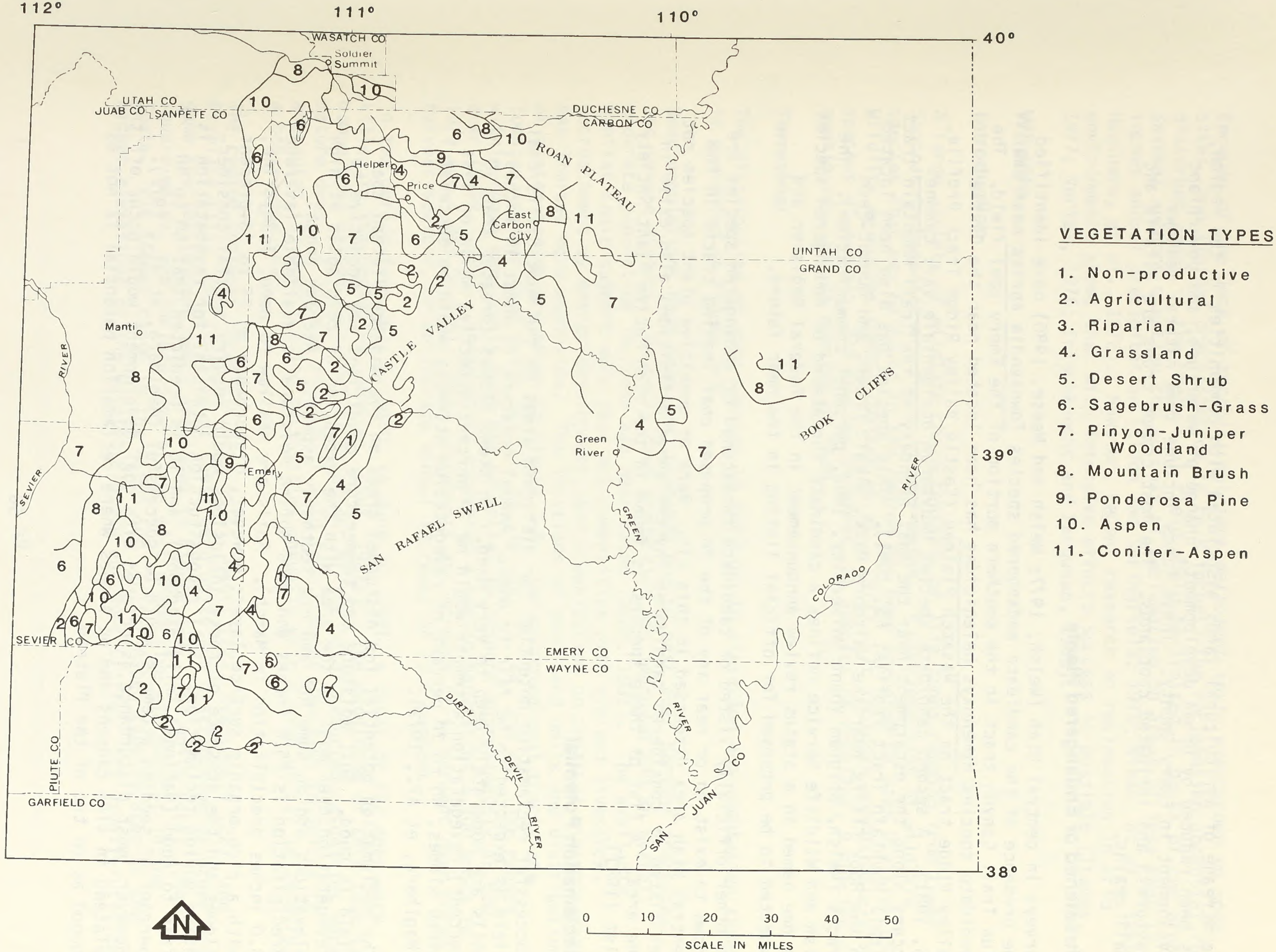


FIGURE 3-6
CENTRAL UTAH VEGETATION TYPES

The acreage of agricultural lands associated with communities in the region, has been reduced by urban development, change of water use, and powerplant development in Emery County. These lands include some natural meadows (pastures) and irrigated croplands. The most common crops are alfalfa and small grains.

Threatened or Endangered Plants

Surveys in central Utah (Welsh, 1977; Welsh and Neese, 1980) have identified the presence of the candidate endangered species Townsendia aprica near the Blue Trail Canyon tract in the southern portion of the Emery coal field. The candidate species Hymenoxys helenioides has been located near the Castle Valley Ridge tract on the Wasatch Plateau (Castle Valley Ridge Tract Profile, FS, 1981). A second candidate species Hedysarum occidentale var. canone occurs along the escarpment near the east boundary of the Trail Mountain tract (Trail Mountain Tract Profile, FS, 1981). This species has also been located in the Book Cliffs near the Whitmore Park, Alkali Creek, and Dugout-Pace tracts (Welsh, Brigham Young University, 1982, personal communication). The Fish and Wildlife Service defines a candidate threatened or endangered species as one named in a status review announcement in the Federal Register and expected to be proposed for official listing in the near future.

No other officially listed or candidate threatened or endangered species are known to exist on or near any of the 20 proposed coal leasing tracts in the central Utah area discussed in this EIS. Rare or sensitive plant species not yet listed or considered candidates (by the above definition) also exist in the area. A list of these species is found in the Utah Native Plant Society List (1981).

Reclamation Potential

Successful reclamation potential for disturbed areas on the Book Cliffs coal field is expected to be fair to good. Annual moisture is about 16 inches. Soils are moderately deep to very deep. On steep slopes (greater than 30 percent) revegetation attempts would be 30 percent effective while on less steep slopes, 50 to 70 percent of revegetation attempts would be successful (Hagihara, et al., 1972).

The reclamation potential for disturbed areas on the Wasatch Plateau coal field is good. Soil moisture and temperature conditions are conducive to revegetation over most of the area with the exception of cold soils at high elevations and on some hot and dry southerly aspects. Average annual precipitation is 25.0 inches and good spring moisture is available (average 3.0 inches precipitation in March). Soils are shallow to deep, loamy-fine, with a rich organic surface layer; however, disturbance on 25 to 33-precent slopes and the presence of rocky inclusions would require special consideration during reclamation. Soil reconstruction potential for revegetation is fair to good (National Soils Handbook), and it is predicted that 50 to 80 percent of seeding attempts would be successful (Hagihara, et al., 1972). However, most disturbance associated with coal development would occur off the plateau in side canyons and on slopes where reclamation potential is not as goood as on top of the Plateau.

Because of the lack of topsoil, nutrient deficient toxic overburden on some sites, and limited precipitation (6 to 8 inches) the reclamation potential for disturbed areas in the Emery coal field would be limited in parts of the area. Several authors question the success of reclamation on areas of less than 12 inches annual precipitation (Aldon and Springfield, 1975; Bleak, et al., 1965; Hagihara, et al., 1972). However, recent research on reclamation in arid environments shows that with intensive efforts success is possible (Thames, 1977; Vories, 1976; Frischknecht and Ferguson, 1980).

Wildlife

Introduction

A large variety of wildlife characteristic of life zones ranging from Lower Sonoran to Canadian are found in the region. A complete list of wildlife species that may be found in the region has been prepared by Utah Division of Wildlife Resources (UWDR) (Dalton et al., 1977). It includes approximately 90 species of mammals, 270 species of birds, 26 species of reptiles, 9 species of amphibians, and 25 species of fish.

Terrestrial

The distribution of game species in relation to elevation and vegetation types is presented in Figure 3-7.

Deer populations have been low, probably due to past deer harvest practices and severe winters. Recently fawn production has improved and an overall moderate population increase has been noted (UWDR, 1981). The available habitat could support more deer but competition with elk and livestock, encroachment by energy development, and urbanization on critical winter ranges has limited herd expansion. The locations of deer herd units and distribution of winter ranges are shown in Figure 3-8. The proposed coal tracts are located in deer herd units 32, 33, 34, 35, 36, 37, 44, and 45. The ranges witnin these herd units have the potential to support approximately 48,500 deer (UWDR, 1980). These units supported a hunter harvest of 3,400 bucks in 1979 and 4,863 in 1981. This represents an increase of 41 percent over three harvest seasons, or an average annual increase of 13.6 percent.

In the period from July 1, 1980, to June 30, 1981, a total of 292 deer were killed in the region by vehicles (UDWR, 1981a). The magnitude of this loss is compounded by the fact that 51.8 percent of the total reported casualties were mature does. A 33-mile stretch of I-70 from Fremont Junction to Salina is averaging 107 deer traffic mortalities annually with a high of 317 in 1978-79, a heavy snow year.

The region includes three elk herd units, Manti (12), Avantaquin (22), and Fishlake (11). The location of these herd units and distribution of other big game species (except deer) are shown in Figure 3-9. The units total 3,866 square miles, and include some of the most productive elk habitat in the State. Elk summer range is the Aspen and Conifer-Aspen type located at the higher elevations of the Wasatch Plateau and Book Cliffs. Elk usually utilize

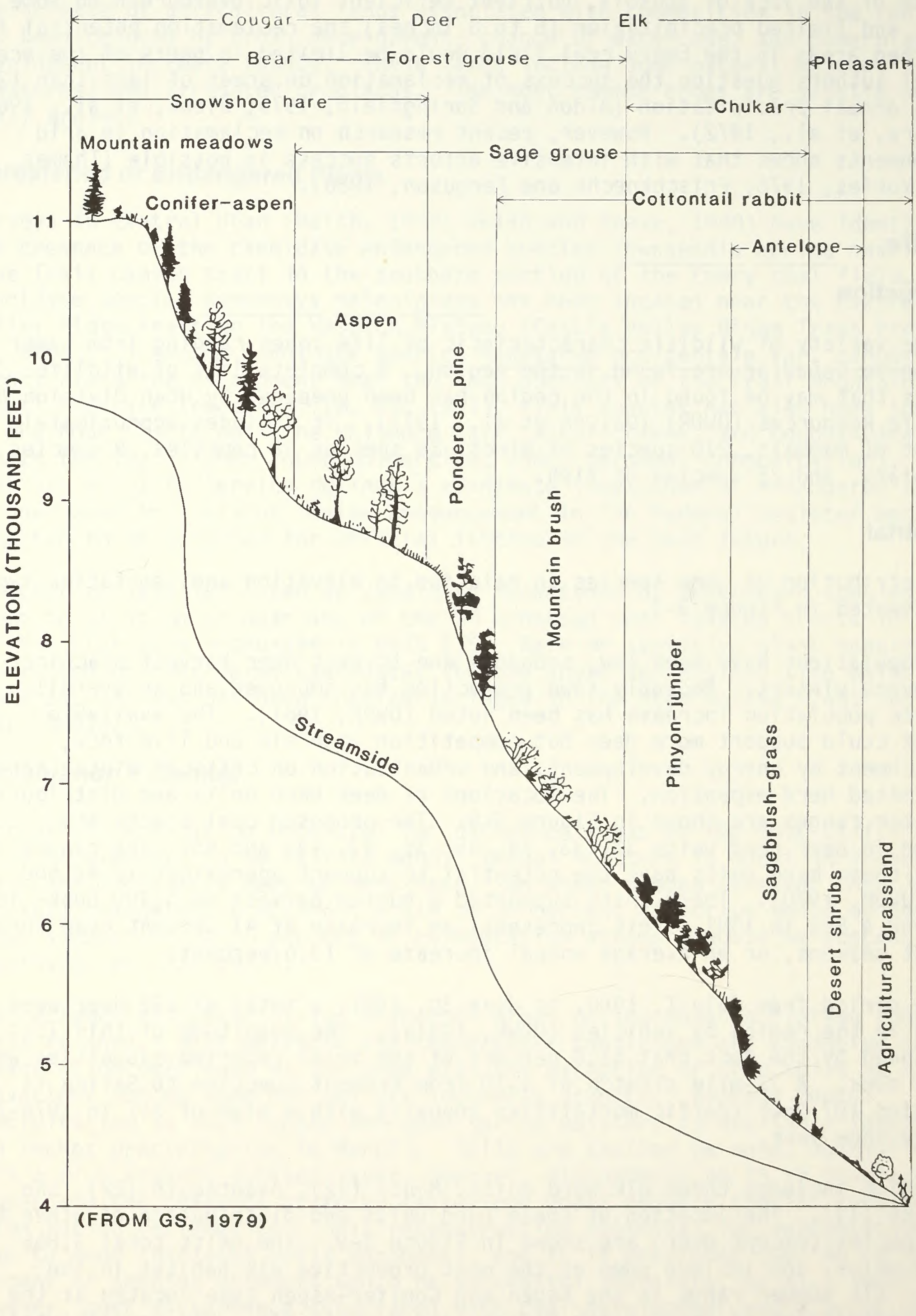


FIGURE 3-7

TYPICAL VEGETATION AND GAME DISTRIBUTION CHANGES WITH ELEVATION

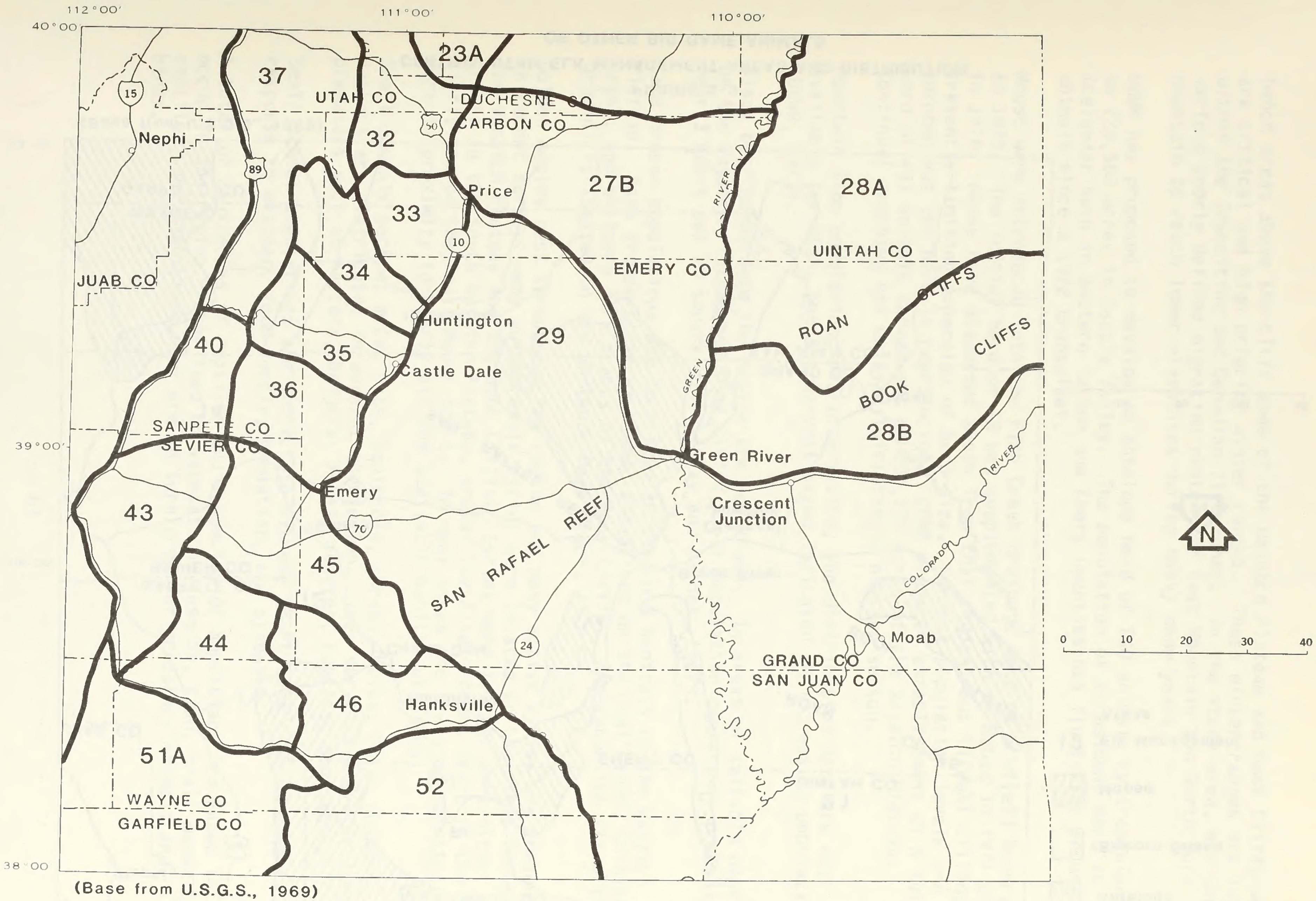
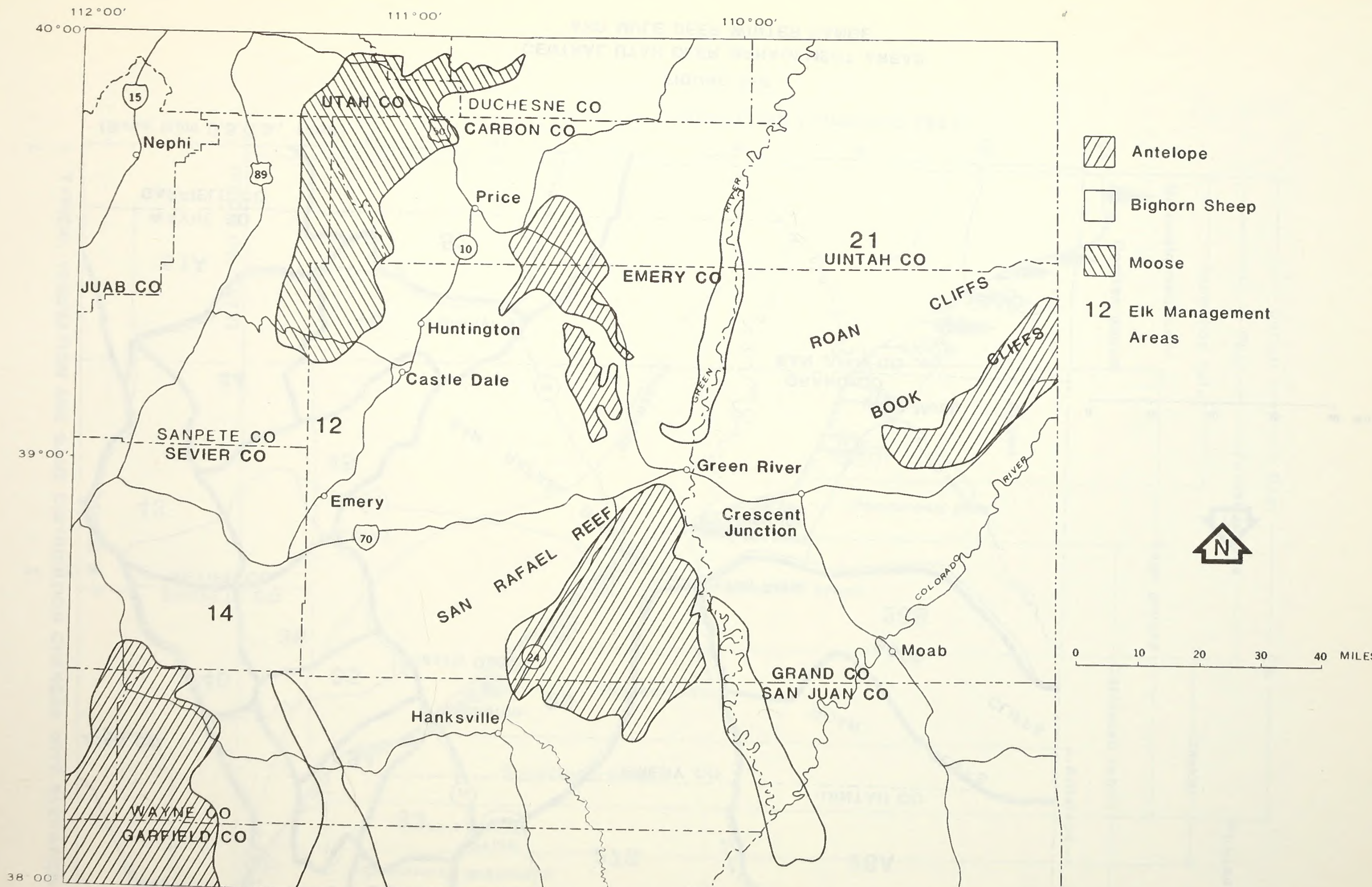


FIGURE 3-8
CENTRAL UTAH DEER MANAGEMENT AREAS
AND MULE DEER WINTER RANGE



(Base from U.S.G.S., 1969)

FIGURE 3-9
CENTRAL UTAH ELK MANAGEMENT AREAS AND DISTRIBUTION OF OTHER BIG GAME ANIMALS

bench areas above the cliff zone of the Wasatch Plateau and Book Cliffs which are critical and high priority winter ranges. These winter ranges are located within the Transition and Canadian life zones. In the study area, elk use various poorly defined migration routes off East Mountain and North Horn Mountain to reach lower elevations during heavy snow years.

UDWR has proposed to develop an antelope herd of 700 animals by transplanting on 226,560 acres in Castle Valley. The population of a resident herd in Icelander Wash in eastern Carbon and Emery Counties has fluctuated around 200 animals since a 1972 transplant.

Moose were introduced into the Fish Creek drainage west of Scofield Reservoir in 1973. The initial herd of 18 was supplemented with 19 moose in 1974 and 6 in 1978. Moose have dispersed south from that region, but illegal killing is presently limiting expansion of herd size. Current population levels are unknown but the herd is reproducing. UDWR projects establishment of a future herd of 487 animals spread out on 981,130 acres of the Wasatch Plateau. Continual poaching has delayed initiating a hunting season.

Mountain lion population, characteristics, and distribution data are not available for Utah, but the harvest trend indicated an increasing population (UDWR, 1977).

Black bear numbers in the region are not known. In areas of suitable habitat on the Wasatch Plateau and Book Cliffs, bear population density is probably near 3 bears per 20 square miles (Bray and Barnes, 1967).

Sage grouse populations are localized in disjunct habitats on the Wasatch Plateau. Sage grouse occur at higher elevations on the Coal Creek, Soldier Creek, and Whitmore Park tracts of the Book Cliffs. One known lek (strutting ground) is located on the Whitmore Park tract.

Golden eagles nest throughout the region and many active eyries are present. In recent surveys many golden eagle eyries were located on the cliff faces of the Wasatch Plateau and the Book Cliffs. Eyries were located on all the tracts in the south Wasatch Plateau, around the Alkali Creek tract in the Book Cliffs and on the Trail Mount tract. In many areas the breeding territories were in proximity to nearly all the available habitat utilized.

Small mammals such as mice, rats, squirrels, shrews, moles, bats, gophers, and rabbits are distributed throughout the region. They serve as prey for larger predators such as raptors, badgers, foxes, coyotes, bobcats, and skunks.

Small mammal populations are subject to extreme short-term fluctuations in response to weather, food supply, predation, and disease.

A total of 26 species of reptiles and 9 species of amphibians are known to occur in the region. They feed on vegetation, insects, fish, small mammals, reptiles, and amphibians, and are in turn prey for predatory mammals and birds.

Fisheries

Twenty-five species of fish are known to inhabit waters within the region. Some of the more common game species are rainbow, cutthroat, brown, and brook trout; channel catfish; and largemouth bass. Fish habitat in the region is shown in Figure 3-10.

Threatened or Endangered Species

The endangered American peregrine falcon has been sighted in the region. These birds are probably migrants although a few may be residents. The only known active eyrie is located adjacent to a historical eyrie along the San Rafael River in Emery County. Historically, at least four to five eyries existed in Carbon and Emery Counties (Porter and White, 1973).

Bald eagles, an endangered species, are annual winter visitors to the region between November and March. They often congregate in groups at roost areas near food sources. A survey in January and February 1977 of known areas recorded 31 bald eagles at 4 roost sites (Boner et al., 1977). None of the roost sites are near (within 5 miles) any of the proposed coal lease tracts.

The Uinta-Southwestern Utah region includes the historical range of the endangered black-footed ferret (Snow, 1972; Scott et al., 1977). The Blue Trail Canyon tract is located within their historical range. The nearest sighting of possible black-footed ferret sign occurred in 1977 and was 12 miles east of Ferron, Utah, approximately 15 miles northeast of the Blue Trail Canyon tract (Boner et al., 1977).

No threatened or endangered reptiles or amphibians are known to occur in the region. No threatened or endangered fish are known to exist in waters on or downstream of the tracts within a distance that would be affected by mining of these tracts.

Land Use

Agriculture and Range

The Book Cliff and Wasatch Plateau are tributary to several streams that are used for irrigation of cropland in Clark Valley between Price and Sunnyside, Utah and for several thousand acres in Castle Valley and areas near Salina. Overall, approximately 105,000 of the 227,069 acres of irrigated cropland in Carbon, Emery, Sevier, and Sanpete Counties receive water that originates on or passes through the proposed tracts. No agricultural lands, intake structures, canals or ponds associated with irrigation systems are found on any of the proposed tracts. Surface water from the Blue Trail Canyon and Walker Flat tracts and streams passing through the tracts are not used for downstream irrigation in Emery County.

Twenty-two livestock grazing allotments are located on the coal tracts. The Coal Creek, Whitmore Park, Acord and Gooseberry tracts are on unalloted lands but grazing on the Gooseberry tract is administered in conjunction with

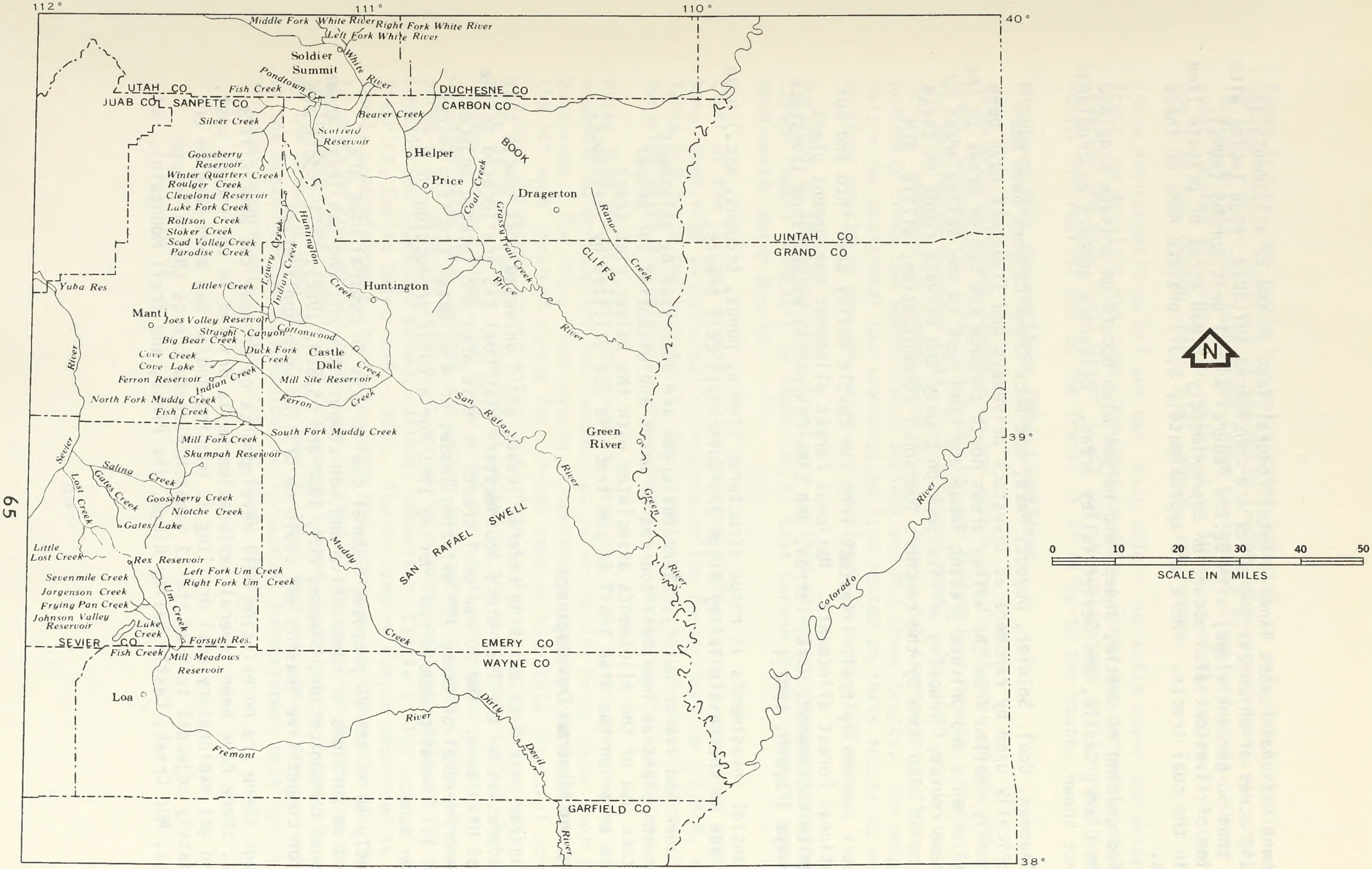


FIGURE 3-10

CENTRAL UTAH RIVERS, STREAMS AND LAKES OF IMPORTANCE TO WILDLIFE adjacent National Forest lands. Total Federal land in the 22 allotments is 450,243 acres of which 299,360 acres are considered suitable range (acres with less than 50 percent slope) with 52,130 Federal animal unit months (AUMs). Grazing of livestock also occurs on approximately 16,838 acres of private land within the coal tracts. There are approximately 2,377 private AUMs on these acres.

Limited grazing of cattle, sheep, and horses also occurs on private cropland in the Clark, Castle, and Sevier Valley areas. Livestock numbers on croplands are not known.

The Deadman, Coal, Soldier, Dugout, Pace, and Rock Creek Canyons have been historically used by ranchers as livestock driveways and livestock have been seasonally trailed from the valley areas north through the canyon areas to the BLM allotments and private grazing lands and then back to the valley areas by the same routes. Trucking of livestock on county and private roads in these canyons is also done by the ranchers (personal communication, Willis, BLM, 1982).

Ranchers seasonally trail livestock from the Castle Valley area into and out of National Forest allotments. National Forest allotment management plans recognize Cottonwood, Rock, Ferron, and Link Canyons as established livestock driveways (FS/BLM, 1982).

Substantial investments in range structures (fence, ponds, troughs, etc.) have been made on the Castle Valley Ridge and Quitchupah coal tracts.

Ivie Creek and its tributary, Saleratus Creek are addressed by allotment management plans as important sources of water and essential for proper livestock use of the allotments associated with the Walker Flat tract. Surface water on the Blue Trail Canyon tract is not utilized by livestock.

Energy and Minerals Development

One hundred seventeen existing Federal leases and 4 unleased coal tracts that were addressed by the 1981 Uinta-Southwestern Utah Coal EIS are located in the central Utah area. The 20 new coal tracts in this area are located adjacent to one or several of these 117 existing leases or 4 unleased tracts. Thirty of the 117 leases produced coal during 1981 for a total production of 8.58 million tons.

Currently 18 of the 20 proposed Federal coal tracts in central Utah are located on portions of competitive and non-competitive oil and gas lease areas (personal communication, Simmons BLM, 1982 and FS/BLM, 1982). All tracts are open for competitive leasing and could be drilled upon application.

Although there are no existing well developments on or near the Book Cliffs tracts, there have been several exploration wells drilled in the recent past. Oil and gas exploratory well drilling is ongoing and/or has been done on or immediately adjacent to 5 of the 11 Wasatch Plateau tracts (North Trough Springs, Mud Creek, Castle Valley Ridge, the Pines, and Trail Mountain). Of these tracts, gas producing wells exist adjacent to only the North Trough Springs tract. Portions of the North Trough Springs and Mud Creek tracts are located within the Clear Creek Known Geological Structure (KGS). Other KGS areas located adjacent to or within 3 to 10 miles of the above five tracts are Joe's Valley, Gordon Creek, Flat Canyon, and Ferron.

Three non-competitive oil and gas lease offers currently cover the Walker Flat Tract; no drilling has been conducted to date. There are currently no leases covering the Blue Trail Canyon Tract and no exploratory drilling has been done. The nearest KGS to the tracts is 16 miles to the south.

Rights-of-Way, Special Uses, Other Land Uses

Major arterial roads passover or are within one-fourth mile of the Alkali Creek, Gooseberry, Ivie, Trail Mountan and Walker Flat tracts. These include the Wellington to Myton Road, Eccles Canyon Road, I-70, U-29 and U-10. Several segments of buried Mountain Fuel Supply gas transmission lines presently cross the North Trough Springs and Mud Creek tracts. The potential exists for additional gas transmission line routes on these tracts as well as on other tracts as new gas wells are developed in nearby KGS areas.

Portions of the Dugout-Pace tract are located in watershed areas considered by Carbon County officials as important to East Carbon City's domestic and nondomestic water supply.

Eight of the 11 coal tracts in the Wasatch Plateau are in drainages that have been identified as municipal watersheds by the Forest Service (FS/BLM, 1982). Table 3-9 lists (by coal tract) the associated municipal watersheds and the municipalities and unincorporated communities served by the watersheds.

Water from the Scofield drainage and from the Price River are sources of domestic water supplies for communities served by the Price River Municipal Watershed. The Price River system is currently rated by the State of Utah as the 6th most impaired stream for current uses in the State (personal communications, Paraskeva, Southeastern Utah Association of Local Government, 1982; State of Utah, 1982). Communities served by the Huntington Canyon, Cottonwood Canyon, Ferron Canyon, and Muddy Creek municipal watersheds presently receive culinary water from springs and spring-fed streams located within the watersheds. The water is treated at spring or stream locations adjacent to the communities (personal communications, Leamaster, Castle Valley Special Service District, Castle Dale, Utah, 1982). The Huntington Canyon watershed is presently contaminated by bacteria, with the source of contamination attributed to existing coal mining facilities located at the mouth of Huntington Canyon. Cottonwood Creek, within the Cottonwood Canyon watershed, is currently rated by the State of Utah as the thirteenth, most impaired stream for current uses in the State (personal communication Paraskeva, Southeastern Utah Association of Local Governments, 1982; State of Utah, 1982).

TABLE 3-9
MUNICIPAL WATERSHEDS ASSOCIATED WITH COAL TRACTS IN THE WASATCH PLATEAU AREA

Coal Tract	Municipal Watershed
Gooseberry, North Trough Springs, Mud Creek, and Castle Valley Ridge	Price River - providing water to municipalities of Helper, Price, and Wellington and unincorporated communities of Kenilworth, Spring Glen, Carbonville, Miller Creek, West Price, and South Price (20,000 residents).
	Huntington Canyon - providing water to municipalities of Cleveland, Elmo, and Huntington and the unincorporated community of Lawrence (4,617 residents).
Trail Mountain	Cottonwood Creek - providing water to municipalities of Orangeville and Castle Dale (3,192 residents).
Ferron Canyon	Ferron Canyon - providing water to municipalities of Ferron and Clawson (1,673 residents).
The Pines, Quitchupah	Muddy Creek - providing water to the municipalities of Emery and the unincorporated community of Moore (432 residents).

Source: Uinta-Southwestern Utah Coal Region - Site-Specific Analyses, 1982.
Richard Walker, Carbon County Planning and Zoning, Price, personal communication, Utah, 1982.
Dan S. Hunter, Emery County Commission, Castle Dale, personal communication, Utah, 1982.

Land Use Plans, Controls, and Constraints

Federal Plans

BLM and FS land management and land use plans which address coal development in central Utah are identified in Table 3-10. National Forest System lands are currently being reevaluated and new land use plans are being prepared as detailed in Chapter One. These plans are scheduled for completion by October 1983.

County Plans

Carbon County

All of the Book Cliffs tracts and portions of the North Trough Springs, Mud Creek, and Castle Valley Ridge tracts on the Wasatch Plateau are in Carbon County. The Carbon County Land Use Plan addresses planning for coal development. The coal planning effort is centered around mine siting and county government participation in the costs of managing coal mining related growth.

The planning philosophy of the county is that coal mining proponents will assess project impacts to various county sectors and identify plans to mitigate these impacts (personal communication, Walker, Carbon County Planning and Zoning, 1982).

The Whitmore Canyon watershed in eastern Carbon County and the Scofield drainage are considered a prime protection area. County zoning ordinances are written to address watershed protection and the mitigation of mine interception of water, subsidence, erosion, sediment, and the enforcement of regulations.

Relevant county zoning ordinance reference, specifically related to coal mining in the Book Cliffs are as follows (Carbon County, 1981):

1. The Book Cliffs tracts are all zoned as Critical Environmental Zone 2 (CE-2). Coal mining developments are classified as "permitted conditional uses" in this zone and are permitted upon compliance with the requirements as set forth in the applicable county ordinance code and after approval has been given by the designated governmental agency.

2. Major coal mining developments are required to meet codes established for socioeconomic assessments and associated mitigation plans and for on- and off-site mine reclamation.

3. Each new coal mine or mine increase in production requiring 75 employees or more is required to go through the planning commission and through the approval process outlined in specific ordinance codes established for large scale developments.

4. Cash performance guarantees for work required under applicable code provisions are addressed in the ordinance codes.

TABLE 3-10
BUREAU OF LAND MANAGEMENT AND FOREST SERVICE PLANS ADDRESSING
DEVELOPMENT OF COAL RESOURCES IN CENTRAL UTAH

BLM Management Framework Plans (MFP) and Supplements and FS Land Management/Use Plans		Coal Tracts
Agency/Office	Plan	
FS - Manti-LaSal N.F.	Ferron-Price Land Management Plan and Amendments (FS, 1979)	Gooseberry North Trough Springs Mud Creek, Castle Valley Ridge Trail Mountain[a], Ferron Canyon, The Pines[a], Quitchupah [a,b]
FS - Fishlake N.F.	Salina Land Use Plan and Amendments (FS, 1976 & 1980)	Quitchupah[a,b], Skumpah[c] Ivie[c]
BLM - Moab District - San Rafael Resource Area	San Rafael Area MFP and Supplement (BLM, 1979c)	Trail Mountain[a], The Pines[a], Quitchupah[a], Blue Trail Canyon
Moab District - Price River Resource Area	Price River/Range Creek Coal Area Land Use Plan (BLM, 1981b)	Alkali Creek, Coal Creek, Dugout-Pace, Graves, Hoffman Creek, Soldier Creek, Whitmore Park
Richfield District - Sevier River Area	Forest MFP and Supplement (BLM, 1977 and 1980)	Skumpah[c], Acord[c], Ivie[c] Walker Flat[c]

Source: Site-Specific Analyses for Coal tracts to be included in the Uinta-Southwestern Utah Coal Region, Environmental Impact Statement: Round Two Leasing.

a Tracts containing both BLM and FS surface.

b Tracts containing lands administered by both the Manti-LaSal and Fishlake National Forests.

c Tracts included in a joint BLM-FS coal unsuitability study completed in 1980; unsuitability study results became part of the referenced land use plans and management framework plans.

5. The Wasatch Plateau coal tracts in Carbon County are zoned as CE-1. Coal mining developments are not allowed in this zone. The position taken by the county is that no development of mines can occur in this zone without rezoning of the minable area to CE-2 or the Mining and Grazing zone (M and G1) (personal communications, Walker, Carbon County Planning and Zoning, 1982). After rezoning, "permitted conditional use" requirements and the code requirements for "major coal mining developments" and approval processes for "large scale developments" would apply.

Emery County

Portions of the North Trough Springs, Mud Creek, Castle Valley Ridge, Ferron Canyon, the Pines and all of the Trail Mountain and Blue Trail Canyon tracts are in Emery County. The Emery County Land Use Plan addresses planning for coal developments, with the main focus on attaining a maximum cost-effective use of the land within the county.

The plan specifically addresses coal developments and the resulting effects on the cost of government and costs to the residents, landowners, and businesses within the county. Coal development impacts on watershed and other natural resource values are also addressed. County zoning ordinances (applicable to coal mines) are written to address protection of the areas that have historically served as primary watershed for most of the irrigation and culinary water supply needs in the Castle Valley area (personal communication, Johansen, Emery County Attorney, 1982).

Relevant county zoning ordinance references, specifically related to coal mining on the Wasatch Plateau tracts are as follows: (Emery County, 1979):

1. The coal areas are zoned as Critical Environmental Zones 1 and 2 (CE-1 and CE-2). Coal mining developments in these zones are classified as "permitted conditional uses", permitted when approved by the County Commission in accordance with code provisions dealing with "Large Scale Developments".

2. Controls in the location and operation of coal mine activities and the requirements for reclamation of lands subjected to such activities are outlined in the specific ordinance codes established for "Large Scale Developments".

3. Supplementary regulations pertaining to the CE-1 and CE-2 zones are outlined in specific ordinance codes. These codes deal mainly with pollution prevention and the construction, operation, and maintenance of transportation and utility routes.

4. Cash performance guarantees for work required under applicable code provisions are also outlined in the ordinance codes.

The Blue Trail Canyon tract in the Emery area is zoned as Mining and Grazing Zone 1 (M&G-1). County ordinances for this zone encourage coal mining developments, provided that adequate guarantees for the protection of the area are incorporated. Major underground and surface coal mine developments are classified as a "permitted conditional use" in this zone, permitted when approved by the County Commission in accordance with code provisions dealing with "Large Scale Developments". The discussion for reclamation requirements and supplementary regulations as presented for Emery County in the Wasatch Plateau area also apply to the M&G Zone.

Sanpete County

Portions of Ferron Canyon and all of the Gooseberry tracts are in Sanpete County. The Sanpete County Development Plan identifies issues and concerns relative to the development of coal activities (Sanpete County, 1981a). Specific issues and concerns addressed in the county planning process center around the hauling of coal west from the Gooseberry tract on State Highway U-31 to U.S. Highway 89 at Fairview and the resulting impacts to public road use, and the increase in county population from increased coal mine employment and the resulting impacts on small rural community socioeconomics and infrastructural needs. Highway U-31, as presently located, designed and constructed, is considered unsuitable for coal hauling,

The development plan also addresses (in general terms) the need to protect existing watershed values, to maintain water quality and protect existing appropriated water rights and uses (personal communication, Fawcett, Six-County Association of Governments, 1982).

The Sanpete County Development Code establishes specific procedures for mitigation of coal development related impacts as generally addressed in the Development Plan (Sanpete County, 1981b). References to county development codes relevant to coal mining on the Gooseberry and Ferron Canyon Tracts are as follows:

1. The tracts are zoned as Forestry and Watershed 10 (FW-10). Coal mining developments are a "permitted conditional use" in this zone. Special code provisions for the zone afford protection to soil and water resources by regulating development activities on steep and moderately steep slopes and excavation, grading, filling, and drainage proposals for all areas within the zone.

2. Supplementary regulations and general provisions of the Development Code dealing with fire protection, health and safety, air and water pollution, and transportation and utility routes will be applied to coal development activities.

3. The Development Code also specifies "development standards", which include performance bonds and fees, for all permitted conditional uses.

Sevier County

Portions of the Pines and all of the Acord, Ivie, Quitchupah, Skumpah and Walker Flat tracts are in Sevier County. General planning direction is given for "mining areas" in the Sevier County and Cities Master Plan Report (Sevier County, 1976). Specific report references to coal development activities are not made. The general direction, applicable to coal mining development activities, is in the form of planning guidelines for the protection of soil and water resources in "forest areas" and for properly located and designed transportation routes. County ordinances address general regulatory provisions for the forest areas. There are no specific ordinances for regulation of coal mining activities (personal communication, Fawcett, Six-County Association of Governments, 1982).

Sevier County ordinance provisions applicable to coal development activities in the Wasatch Plateau and Emery tracts area are as follows (Sevier County, 1979):

1. The tracts are zoned as Grazing, Recreation, and Forestry Zone 1 (GRF-1). Coal mining developments are permitted in this zone; no conditional use permit is needed. The regulation of coal development activities is based on existing ordinances; such ordinances cover all uses permitted in the GRF-1 Zone, i.e., the ordinances are not site-specific or specific to one use.

2. Ordinance provisions address the regulation of land use activities for the protection of air and water quality and for the enhancement of values associated with forestry, grazing, wildlife, and recreation.

Socioeconomics

The socioeconomic material presented in this EIS including the various tables used, was provided by the State of Utah, Office of the State Planning Coordinator and Department of Community and Ecomomic Development.

Population, Income, and Employment

The area of analysis for the central Utah region includes four Utah counties--Carbon, Emery, Sanpete, and Sevier. These four counties are contiguous and had a 1980 census population of 62,977 residents. The 1982 population is 69,598 residents. (Unless otherwise noted, this discussion will rely on data from the 1980 Census.) These counties are typical of rural counties in Utah with populations concentrated in small communities along major roads. The largest community in the area is Price with 9,086 residents; it is nearly twice the size of Richfield, the second largest with 5,482 people.

Emery County has an average household size of 3.48 persons which is significantly higher than the State average of 3.2 persons. Carbon County has 3.03 persons per household. Sanpete and Sevier Counties have 3.17 and 3.19 respectively.

The mean household income of the four counties varies widely. The State figure is $20,320. Sevier and Sanpete Counties have mean household incomes of $17,517 and $14,570, respectively. Carbon and Emery Counties are slightly higher with $20,823 and $20,536, respectively. The income differentials are largely explained by the predominant employment sectors of each county and relative wage levels. In the higher income counties, mining is the primary employment sector.

In Emery County, 46 percent of wage and salary employement was in coal mining in 1980, and in Carbon County 27 percent of its total employment was in mining. Carbon County's other major employment sectors are trade, 21 percent, and government, 22 percent. Total wage and salary employment was 8,509 and the unemployment rate was 5.1 percent in 1980. Unemployment nearly doubled by 1982 with layoffs in the coal mining industry. In Emery County the sectors of government, construction, and transportation-communication-public utilities are the next largest sectors but together account for only 39 percent of the total employment of 4,503. The unemployment rate was 4.5 percent in 1980; in 1982 this rate rose to 5.4 percent. In Sevier County the trade and government sectors accounted for 50 percent of total wage and salary employment of 4,617. Coal mining employment represented 9 percent of the total. This is much lower than Carbon or Emery Counties, but significantly higher than the State proportion of 3 percent of total employment in mining. The unemployment rate was 4.7 percent in 1980 but rose to 7.9 percent in 1982. Total wage and salary employment in Sanpete County was 3,340; of this total the largest employment sectors were government 37 percent, manufacturing 27 percent, and trade 15 percent. Sanpete County has historically experienced high rates of unemployment; in 1980 it was 8.8 percent as compared to the State rate of 5.4 percent. In 1982 the Sanpete County rate was 12.7 percent.

Infrastructure

Housing

The majority of housing units in each of the four counties are conventional single family houses. However, in Emery County about 34 percent of these units are mobile homes. Carbon, Sanpete, and Sevier Counties all have about 7 percent of their housing units in mobile homes.

Information concerning the existing housing supply is presented in Table 3-11.

Education

Carbon and Emery Counties had 1981 enrollments of 4,486 and 3,372 students, respectively. This resulted in a pupil/teacher ration of 24.68 to 1 for Carbon County and 23.09 to 1 for Emery County.

The school districts, which have experienced boom/bust cycles in the past, have developed a growth plan that utilizes temporary classrooms to avoid overbuilding in boom times and to allow the tax base to be in place before incurring new debt for additional school construction.

Sanpete County has two school districts, North Sanpete and South Sanpete. One hundred and fifty-nine teachers currently instruct the 3,656 students in the County. This 23 to 1 pupil teacher ratio compares favorably to the State guideline of 25 pupils per teacher.

The Sevier School District is a county-wide district that in 1982 had 158 teachers instructing 4,049 students.

TABLE 3-11

CENTRAL UTAH
EXISTING DWELLING UNITS MIX BY COUNTIES

County	Conventional	Mobile	Multi-Family
Carbon	4,120 (85.7%)	342 (7.1%)	345 (7.0%)
Emery	1,516 (62.7%)	830 (34.4%)	67 (2.8%)
Sanpete	3,682 (81.9%)	336 (7.6%)	467 (10.6%)
Sevier	2,538 (80.8%)	183 (5.8%)	419 (13.3%)
Total	11,797 (79.8%)	1,691 (11.4%)	1,298 (8.8%)

Water and Sewer

Adequacy of culinary water systems is determined by the Utah Department of Health based on three components: water rights, supply/flow, and storage.

The majority of communities in the study area are deficient in at least one of these categories. However, only in Carbon and Emery Counties are there present deficiencies of sufficient magnitude as to present general, county-wide constraints on future development. Most of the communities where deficiencies exist are pursuing programs to bring their systems up to standards.

Septic tanks are the primary waste water facilities in all the counties and are generally considered adequate, at least for the present. Some of the larger communities have sewer and treatment systems. Of these, the Price system is currently operating seriously over capacity, and the towns of Mt. Pleasant in Sanpete County and Salina in Sevier County are approaching their maximum rated capacities. Additional data are presented in Tables 3-12 and 3-13.

Public Safety

In general the affected counties rely on the County Sheriff for the major portion of their law enforcement capacity. The larger communities in each county generally have a separate police force and facilities, while Sanpete and Sevier Counties have at least a part-time marshal in the majority of their small communities. Summary law enforcement data for each of these counties are presented in Table 3-14.

Fire protection in the area is provided on a community level and is manned almost entirely by volunteer fire fighters. Average response times range

TABLE 3-12
CENTRAL UTAH
SUMMARY OF WATER SYSTEM CHARACTERISTICS

County	Source	Number of Connections	Storage Capacity Gallons per day	Connections	Water Rights	Flow Gallons per minute
Carbon						
East Carbon	springs, wells, res.	830	784,000	(980)		409
Helper	springs, wells	1,035	4,000,000	(5,000)		1,100
Hiawatha	tunnel	50	125,000	(156)		
Price	springs, well, river	3,010	7,500,000	(9,375)		3,100
Scofield	spring	175	58,000	(72)		22
Sunnyside	reservoir, tunnel	200	850,000	(1,062)		100
Wellington	Price River Water Improvement District	527	300,000		433.3 acre-feet	245
Emery						
Castle Dale	Joe's Valley Res.	827	750,000	(932)	864 acre-feet	900
Cleveland	springs				2,654 shares	220
Elmo	springs	636	360,000	(450)		
Emery	well	155	1,000,000	(1,250)	Total well	40
Ferron	Mill Site Res.	510	750,000	(937)	635 acre-feet	260
Huntington	springs	1,057	1,000,000	(1,250)	839 acre-feet	650
Orangeville	Joe's Valley Res.	435	500,000	(628)	401 acre-feet	760
Sanpete						
Centerfield		300	500,000	(1,600)		450
Ephraim		800	2,500,000	(4,250)	city	NA
Fairview	springs, wells	480	700,000	(825)	3,996 acre-feet	
Fntn. Green	springs, wells	251	250,000	(312)	799 acre-feet	
Gunnison		475	1,500,000	(2,500)	city	NA
Manti		800	1,000,000	(5,000)	city	NA
Moroni	wells, springs	409	300,000	(375)	1,918 acre-feet	
Mt. Pleasant	springs, wells	937	1,750,000	(2,187)	2,029 acre-feet	
Richfield		1,900		(6,000)	city	NA
Spring City	spring	260	450,000	(562)	879 acre-feet	
Wales	spring	64				
Sevier						
Aurora	wells, springs	360	572,000	(712)	665 acre-feet	
Redmond	wells	210	300,000	(375)	624 acre-feet	
Salina	springs	810	1,700,000	(2,125)	1,998 acre-feet	
Richfield	well, spring	1,900	1,000,000	(1,250)	4,235 acre-feet	

TABLE 3-13
CENTRAL UTAH
SUMMARY OF SEWAGE CHARACTERISTICS

County	Capacity	Flow Gallons per day	System Type	Plans for Expansion
Carbon				
Sunnyside				
East Carbon			clarigester	
Helper		1,800,000	trickling filter	
Hiawatha			septic tank	
Price		3,200,000[a]	trickling filter	yes
Scofield			septic tanks	
Wellington				
Design Capacity 1,800,000				
Emery				
Castle Dale	7,000	750,000	lagoon	no
Orangeville				
Cleveland	1,400	98,000	lagoon	new
Elmo	700	49,000	lagoon	new
Emery	1,300	200,000	lagoon	no
Ferron	1,700	700,000[a]	lagoon	no
Huntington	3,000	700,000	lagoon	no
Design Capacity - Huntington 300,000, Ferron 93,000				
Sanpete				
Centerfield	NA	NA	septic tank[d]	
Ephraim	7,000[d]	4.86[b]	lagoon[d]	
Fairview			septic tank	no
Fountain Green			septic tank	no
Gunnison	4,000	2.78[b]	lagoon[d]	
Manti	8,000	5.55[b]	lagoon[c]	
Moroni	10,000		aerating system	no
Mt. Pleasant	6,000		lagoon	
Spring City			septic tank	no
Wales			septic tank	no
Sevier				
Aurora			septic tank	no
Redmond			septic tank	no
Richfield	1 million	694[b]	trickling filter	yes
Salina	3,000		enc. digester system	no

[a] Severe infiltration
[b] Gallons per minute
[c] Engineers Report for Manti City Wastewater System
[d] Application to the Comm. Impact Account for the renovation of Richfield's Sewage Treatment Facility, Eckhoff, Watson and Preator Engineering

TABLE 3-14
CENTRAL UTAH
EXISTING EDUCATION, HEALTH, AND LAW ENFORCEMENT SERVICES (1982)

Service	County: Carbon	Emery	Sevier	Sanpete
Education				
Enrollment	4,486	3,302	4,049	3,656
Excess Capacity				
Student/Teacher Ratio	24.68/1	23.09/1	25.62/1	23.03/1
Teachers	182	143	158	159
Health Facilities				
Hospital Beds	70	0	28	46
Doctors	17	2	8	11
Dentists	10	3	5	5
Nurses	141	21	56	44
Emergency Medical Technicians	49	128	91	87
Ambulances	8	7	4	3
Nursing Home Beds	57	48	98	37
Clinical Psych.	5.3		3	
Master's Degree in Social Work	21.7		11	
Law Enforcement				
Police	44	19	14	14
Police Cars	31	20	10	15
Fire Trucks	15	21	6	15
Number of Firemen	n/a	84	38	77
Jail Capacity	20	48	30	4

between 3 to 5 minutes with maximum response times from 30 to 45 minutes. Equipment availability ranges from six fire fighting vehicles in Sevier County to three vehicles per community in Emery County. Additional data are presented in Table 3-14.

The four counties are currently served by four hospitals (two in Sanpete County, one in Carbon County, and one in Sevier County) with utilization rates ranging from a low of 49.5 percent for the one in Gunnison to a high of 69.9 percent for the Sevier Valley Hosital. Ratios of doctors, dentist, and nurses to population are generally below national standards. Emergency and ambulance service is provided by emergency medical technicians. Additional data are presented in Table 3-14.

Solid Waste

Much of the solid waste disposal in the area is accomplished with open dumps that are not State approved; however, there are several areas that have approved landfills, which are generally considered to be adequate for the present and immediate future.

Carbon County has a new landfill that serves most communities in the county with the exception of East Carbon and Sunnyside who share an open dump. Emery County has a newly established county landfill that is less than 10 percent filled. All communities in the study are participating in this service district.

Sanpete County does not operate a landfill or any other facility for solid waste. All communities, except Fairview, maintain open dumps. Individuals are responsible for handling trash and refuse to the dump site. Capacities are limited by the available acreage for the dump. None of the communities in the study area are meeting State minimum standards.

Sevier County operates three approved landfills, which are described as adequate for the immediate needs of the County; an additional landfill is under construction. Salina operates a city landfill which also serves Redmond.

Social/Attitudes

Emery County has experienced negative effects of rapid population growth from powerplant construction in the 1970s. This resulted in some opposition to further development; however, the emergence of this opposition has not eroded all support for additional coal leasing. It has added cautiousness to the local government entities' approach to growth. Local opinion leaders have expressed a strong commitment to the orderly development of the area's coal resources, and local elected officials have organized themselves into an impact mitigation team to assure that they are adequately prepared for growth. A review of local master plans and subsequent planning and zoning ordinances is currently underway by the local municipalities and the Six-County Association of Government. There appears to be ample sensitivity by the local officials to the issues surrounding rapid growth and a commitment to work toward the minimization of the negative aspects of rapid growth.

Transportation

Vehicular traffic within the central Utah area is carried on four major highways which form a loop (Figure 3-11). The north leg is formed by US 6, the east leg by U-10, the south leg by I-70, and the west leg by US 89. In addition, there is some local traffic across the Wasatch Plateau on U-29 between Orangeville and Joe's Valley and the county road between Joe's Valley and Ephraim, on U-31 between Huntington and Fairview, and on the county road between Ferron and Mayfield. Recently, the county road from U-96 at Eccles Canyon across to U-31 east of Fairview was improved and paved. These roads are not always passable at higher elevations in the winter.

Average annual daily traffic (AADT) values for 1981, as determined by the Utah Department of Transportation, show that traffic is heavest on the four-lane portion of US 6 north and west of Price (segments 9, 10, 12). A bypass south of Price has been partially coompleted and has relieved some traffic congestion in Price. Highway U-10 south of Price is reaching a practical maximum for a two-lane highway, considering the number of trucks it is carrying.

The main roads in this area are paved with asphalt. Highway U-10, while paved with asphalt, was built for lighter duty use than it is now getting from construction and increased coal mine development; furthermore, it was built on bentonitic Mancos Shale, which has a very high shrink-swell coefficient so continuing maintenance of this road is necessary. U-29 west of Orangeville has been paved as far as Joe's Valley Reservoir. The county road connecting with Ephraim has a gravel surface.

The Denver & Rio Grande Western (D&RGW) Railroad main line passes through Price and Helper, ascends to Soldier Summit, and descends through Spanish Fork Canyon into the Provo area. A D&RGW spur from Thistle to Salina is too light to accommodate the heavier 100-ton coal cars. The Union Pacific Railroad main line passes 2 miles west of Levan in Juab County. A coal loadout at this point is being used by Southern Utah Fuels in Convulsion Canyon. In addition, the Utah Railway goes southward from a point near Helper to serve Hiawatha and Wattis mines. The Utah Railway shares track with the D&RGW to form a dual track system across Soldier Summit. Parts of the Union Pacific main line are double track. Both the Union Pacific and D&RGW main line systems are heavily traveled but neither has reached capacity.

Property has been acquired for a proposed D&RGW Castle Valley spur line, to begin at the Wellington coal loadout facilities about 1 mile west of Wellington and continuing southward some 65 miles through Castle Valley to a proposed loop and coal loadout facility about 4 miles southeast of Emery. It is expected that the railroad spur would be constructed and operable by 1990.

Cultural Resources

A variety of human cultures have inhabited the central Utah coal lease tracts under consideration. The temporal contimuum extends over a range of 12,000 years involving such groups as the early prehistoric big game hunters, the archaic hunter-gatherers, the semi-horticultural Fremont, the nomadic

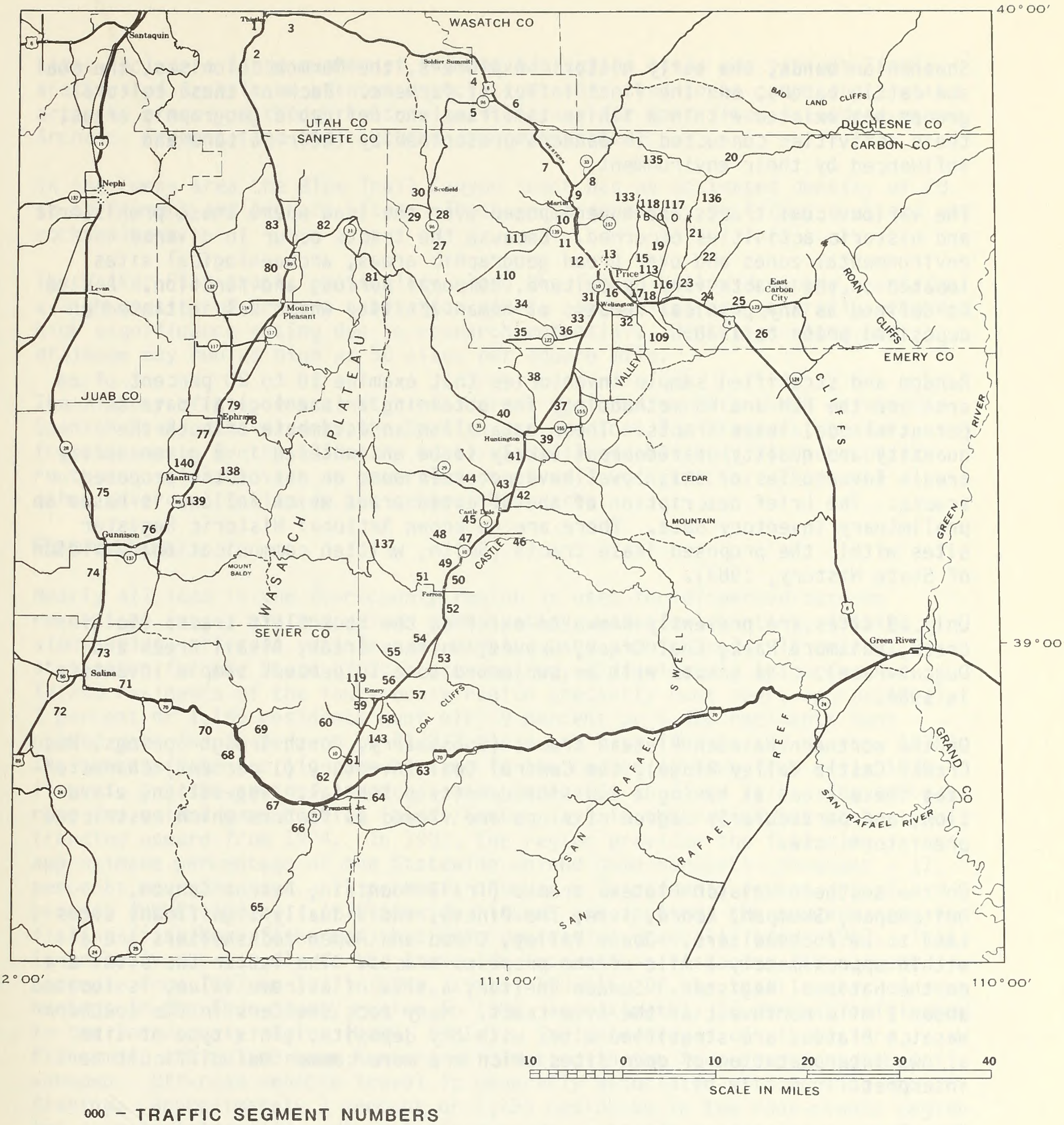


FIGURE 3-11
CENTRAL UTAH REGIONAL TRAFFIC MAP

Shoshonian bands, the early historic explorers, the Mormon colonists, the coal and cattle barons, and the final influx of farmers. Each of these cultural groups has existed within a finite timeframe and definable geographic areas, their activities conducted in manners prescribed by their culture and influenced by their environment.

The various coal tracts are superimposed over the land where these prehistoric and historic activities occurred. Because the tracts occur in diverse environmental zones and over broad geographic areas, archaeological sites located on the tracts vary by culture, temporal period, and function. A site is defined as any physical remains of human activity which was initiated or deposited prior to 1930.

Random and stratified sample inventories that examine 10 to 20 percent of an area are the BLM and FS methodology for obtaining archaeological data on potential coal lease tracts. These data allow an estimeate of both the quantity and quality of resources likely to be encountered in a given survey area. Inventories of this level have not been done on all of the proposed tracts. The brief description of the affected areas which follows is based on preliminary inventory data. There are no known National Historic Register sites within the proposed lease tracts (Smith, written communication, Division of State History, 1983).

Only 12 sites are presently known to exist on the Book Cliff tracts (Soldier Creek, Whitmore Park, Coal Creek, Graves, Hoffman Creek, Alkali Creek and Dugout-Pace). The tracts will be subjected to a 10 percent sample inventory in 1984.

On the northern Wasatch Plateau tracts (Gooseberry, North Trough Springs, Mud Creek, Castle Valley Ridge), the Central Coal Inventory (1 percent) characterizes these areas as having a low site density potential. Vegetation, elevation, and particularly degree of slope are viewed as factors which restricted prehistoric use.

On the southern Wasatch Plateau tracts (Trail Mountain, Ferron Canyon, Quitchupah, Skumpah, Acord, Ivie, The Pines), individually significant sites tend to be rockshelters. Joe's Valley, Cloud and Aspen rockshelters are all within approximately 1 mile of the proposed tracts. The latter two sites are on the National Register. Sudden Shelter, a site of extreme value, is located about 1 mile northwest of the Ivie tract. Many rock shelters in the southern Wasatch Plateau are stratified sites with dry deposits. This type of site allows interpretation of open sites which are more common but difficult to interpret.

Open Fremont habitation sites are characterized by the utilization of permanent dwellings, ceramics, and some degree of corn horticulture which also occur on the Ferron Canyon tract. Such sites would probably be of National Register quality.

Cultural resources on the Pines and Quitchupah tracts occur on canyon rims, along smaller tributaries and above springs which occur in cliff faces. These sites include a large number of Fremont habitation sites and various lithic scatters of Archaic or unknown association; they tend to be camps and limited activity areas. Although cultural affiliation for most sites is undetermined, Archaic, Fremont, and Ute cultures are represented.

In the Emery area the Blue Trail Canyon tract has an estimated density of 20 to 50 Fremont and Archaic sites. These would generally be lithic scatters and rockshelters.

The Walker Flat tract, particulary along the Trough Hollow drainage, contains a high density of Fremont habitation sites. Such sites are generally accorded high significance rating due to research potential. Densities along the drainage may run as high as 50 sites per square mile.

The history of the central Utah coal areas includes a route known as the Old Spanish Trail, traveled by the Spanish and American fur trappers, traders, and frontiersmen. By the 1830s the trail was well established; portions of its route can still be seen as several sets of well worn tracts. There are also other divergent trails in the central Utah area.

Recreation

Nearly all land in the four-county region is used for dispersed outdoor recreation (e.g., big and upland game hunting, waterfowl hunting, fishing, sightseeing, off-road vehicle use, camping, and picnicking). If overall statistics for the State of Utah are applied, approximately 18 percent or 12,200 residents of the four-county region presently hunt deer; approximately 2 percent or 1,185 residents hunt elk; 9 percent or 5,926 residents hunt upland game and 45 percent or 31,372 residents fish (Thayne and Hudson, 1978). The success rate for big game hunting in the region is down from early 1970 figures, but the success trend has been generally up since 1975. The success rate for upland game hunting (birds/hunter day) in the region has been trending upward from 1974. In 1981, the region provided the following approximate percentage of the Statewide upland game harvest: pheasant - 17 percent; mourning dove - 11 percent; chuckar - 15 percent; forest grouse - 9 percent (UDWR, 1981b). If Statewide figures are applied, the success rate for fishing (fish/hour/fisherman) has been decreasing gradually since 1967. This is probably due largely to the Statewide increase in fishermen (50 percent increase from 1967 to 1977) (UDWR, 1981a, 1981b). Of the total number of deer hunters in the four-county region in 1980, approximately 30 percent originated in the four-county region (UDWR, 1981a). The percentages of elk hunters, fishermen, and upland game hunters originating in the four-county region is unknown. Off-road vehicle travel is generally associated with hunting and fishing. Approximately 7 percent or 4,733 residents in the four-county region own motorcycles and approximately 25 percent or 17,400 residents presently own a 2-wheel drive truck or a 4-wheel drive vehicle (Utah Outdoor Recreation Agency (UORA), 1978). Camping and picnicking in dispersed areas, like off-road vehicle travel, is most often associated with hunting, fishing, and sightseeing. In general, the dispersed use areas have been able to absorb demands. A notable exception is the San Rafael/Buckskin Draw area in Emery County. This area of approximately 48,000 acres administered by BLM receives approximately 24,325 visitor days annually. Use is largely in the spring and fall months. Seventy percent of the users originate in Carbon and Emery Counties. The area is presently used far beyond the level for which it is being managed and in many locations recreational use is causing resource damage.

Developed recreation sites (campgrounds and picnic areas) within the Plateau and Swell areas and their current visitor use are listed in Table 3-15. Of the 37 developed sites, only three are now being used at or above their capacity. In general, Sevier and Sanpete Counties have camping and picnicking sites in excess of demand. Carbon and Emery Counties have an excess of demand for camping and picnicking sites over the current supply (UORA, 1973).

There are not enough golf courses, playfields, and swimming pools in the four-county region to meet standards proposed by the State of Utah (UORA, 1973, 1978). A 1980 study by the Southeastern Utah Association of Local Governments (SEUALG) (including Carbon, Emery, San Juan, and Grand Counties) indicates that of 586 residents polled, 86 percent of the respondents rated local recreational facilities as poor. Fifty-six percent of the respondents indicated that recreational facilities should be either first or second priority for spending of local tax dollars. In the study, playgrounds and swimming pools were rated as the first and second recreational needs (SEUALG, 1980). According to a 1980 Centaur Associates study, some of the towns in the four-county region have identified needs for other diversified recreational facilities including handball and tennis courts, bowling alleys, skating rinks, city parks, and ball parks (Centaur Associates Inc., 1980).

None of the proposed lease tracts contain developed recreation sites. All of the tracts support intermittent dispersed recreational activities (e.g., big and upland game hunting, sightseeing, and ORV activity associated with hunting). However, none of the tracts provide exceptional opportunities for any of these activities.

Existing roads (both paved and primitive) that would be used for mining access to the tracts currently provide recreational access. Important recreational access roads are described in Table 3-16. The average daily traffic on these roads, if available, is given under the Transportation section of this document.

Visual Resources

The scenic character of the four-county region is one of variation. The landscape includes sparsely vegetated desert valleys, forested plateaus, and colorful canyons. Rural towns, access roads, mining developments, power developments, transmission lines, recreational development, and livestock grazing have modified the landscape character in some of the area, especially valley locations, from natural to agrarian and/or industrial. The region as a whole, however, retains a feeling of vast open space.

Several Federal coal leases are situated in the vicinity of the proposed tracts in the Bookcliffs, Wasatch Plateau, and Emery areas. Coal mining

TABLE 3-15

RECREATION USE ON SELECTED DEVELOPED SITES IN THE CENTRAL UTAH (FOUR-COUNTY) REGION

Managing Agency and Site	Visitor Days[a]	Percent of Theoretical Maximum Capacity[b]
BLM		
Price Canyon Recreation Area	14,600	NA[c] (perceived to be under capacity)
Cleveland Lloyd Dinosaur Quarry	3,200	NA (perceived to be under capacity)
Cedar Mountain Recreation Area	500	NA (perceived to be under capacity)
San Rafael Campground	1,852	NA (perceived to be under capacity)
Sand Ledges	5,000[d]	NA (perceived to be at or over capacity)
Koosharem Campground	5,000[d]	NA (perceived to be at or over capacity)
FS		
Fish Creek Campground	613	14
Flat Canyon Campground	8,098	33
Gooseberry Campground	3,501	19
Lake Hill Campground	2,824	14
Old Folk Flat Campground	4,934	15
Spring City Picnic Area	681	15
Indian Creek Campground	3,236	3
Manti Community Picnic Area	4,004	21
Pinchot Picnic Area	3,124	16
Joe's Valley Campground	11,113	18
Twelve Mile Campground	532	26
Ferron Canyon Picnic Area	803	4
Maple Canyon Campground	2,594	11
Maple Grove Campground	29,300	49
Gooseberry Campground	6,400	25
Doctor Creek Campground	16,600	34
Mackinaw Campground	36,800	35
Bowery Picnic Area	1,300	8
Doctor Creek Group Camping	6,600	20
Frying Pan Campground	6,800	22
Bowery Campground	25,900	30
Monrovian Picnic Area	5,300	14
Forks of Huntington Campground	2,599	19
Ferron Reservoir Campground	6,530	19
Twin Creek Picnic Area	4,000	18
Johnson Valley Reservoir Boatlaunch and Picnic Area	4,100	20

continued

Table 3-15 (cont'd.)

Managing Agency and Site	Visitor Days[a]	Percent of Theoretical Maximum Capacity[b]
STATE OF UTAH		
Scofield Lake State Recreation Area	73,897[d]	NA
Huntington Lake State Beach	73,291[d]	NA
Palisade Lake State Recreation Area	15,283[d]	NA
Green River State Recreation Area	92,289[d]	NA
Goblin Valley State Reserve	16,966[d]	NA

Source: BLM, FS, State of Utah 1980-1981 visitor use figures through personal communication.

[a] Recreation use reported in visitor days. (Visitor day consists of 12 visitor hours which may be aggregated by one or more persons.)

[b] Beyond 40 percent use, sites deteriorate rapidly, require heavy maintenance, and user experience levels diminish from overcrowding (i.e., loss of privacy, increase in noise, etc.).

[c] Not available. Perceived to be under capacity by local Federal officials.

[d] Given in number of visits - visitor day estimates are not available.

TABLE 3-16
CENTRAL UTAH RECREATION ACCESS ROADS

Map[a] No.	Road	Tracts That Would be Assessed	Recreational Access Area
20, 23	Myton Road	Soldier Creek Whitmore Park Alkali Creek	Book Cliffs
19	Coal Creek Road	Coal Creek	Book Cliffs
22	Dugout Canyon Road	Dugout-Pace Canyon	Book Cliffs
28, 30	U-96 (Eccles-Clear Creek Canyons)	North Trough Springs Mud Creek	Wasatch Plateau - Scofield Reservoir
40	U-31 (Huntington Canyon)	Gooseberry	Wasatch Plateau - Electric Lake, Joe's Valley Reservoir
51	Ferron Canyon Road	Ferron Canyon	Wasatch Plateau - Ferron Canyon Picnic Area
43,44	U-29 (Straight Canyon)	Trail Mountain	Wasatch Plateau - Joe's Valley Reservoir
141	Cottonwood Canyon Road	Trail Mountain	Wasatch Plateau

[a] Map numbers correspond to Figure 3-11

developments have modified the natural landscape character adjacent to the tracts in all three areas. In most cases actual mining activities are located away from major travel routes and are seldom seen by individuals traveling through the region. Mining-related disturbance (including coal-fired powerplants, coal stock piles, and coal loading facilities) are highly visible from US Highway 6 from Woodside through Price Canyon, from the Wellington to Myton road, from Utah Highway 31 through Huntington Canyon, and from Utah Highway 10.

The tract lands are located on dissected plateaus or flat valley areas that are common to the region. In general, the tract lands have neither outstanding nor unique scenic values, although the Moab District, BLM, has given portions of the Blue Trail Canyon and Dugout-Pace tracts high scenic quality ratings when considered within the physiographic region.

The tract lands have been given visual resource management (VRM) ratings as shown in Table 3-17. Management objectives for each VRM classification allow a different degree of modification in the landscape. Management objectives are described in Appendix 5.

Portions of almost all of the tracts are visible at varying distances from primitive roads that are often used for dispersed recreation access. Portions of some of the tracts are visible from major recreation access roads or use areas as described below. Use figures, if available, are given in the Transportation or Recreation sections of this document.

Although portions of Alkali Creek, Soldier Creek, and Whitmore Park tracts are visible from the Wellington to Myton road, and although portions of the North Trough Springs tract are visible from Utah Highway 31, the logical surface development areas are not visible from these roads. The eastern escarpments of the Pines and Quitchupah tracts are visible from highway U-10 but surface development areas cannot be seen from the highway.

Portions of the Gooseberry tract and its logical portal location are visible at distances of less than 1.0 to 2.5 miles from segments of Utah Highway 31 and the Skyline Drive, from the Flat Canyon Campground and an area of summer cabins, and from roads that access the above attractions.

Portions of the Trail Mountain tract are visible from Utah Highway 29 and from the Cottonwood Creek road. Logical portal locations are visible at viewing distances of less than 1.0 mile for approximately 0.5 miles along Utah Highway 29, and for approximately 2.5 miles along the Cottonwood Creek Road.

Portions of the Ferron Canyon tract including the logical portal location are visible from the Ferron Canyon road at distances of approximately 1.0 to 4.0 miles. The Ferron Canyon road which would be reconstructed lies within a partial retention area.

Portions of the Ivie tract at a distance of less than 1.0 mile, and the Blue Trail Canyon tract at a distance of 2.0 to 3.0 miles, are visible from Interstate 70, a major scenic travel route to national recreational

TABLE 3-17

VISUAL RESOURCE MANAGEMENT CLASSIFICATIONS
OF COAL TRACTS IN CENTRAL UTAH

Tract	Classification	General Location of Classification Area
Book Cliffs Area		
Alkali Creek[a]	VRM Class III	Area highly visible (foreground) from the Wellington to Myton road.
	VRM Class IV	Remainder of tract.
Coal Creek[a]	VRM Class IV	Entire tract.
Dugout-Pace[a]	VRM Class III	In general an area of high quality scenery along the northern boundary of the tract.
	VRM Class IV	Remainder of tract.
Graves[a]	VRM Class IV	Entire tract.
Hoffman Creek[a]	VRM Class IV	Entire tract.
Soldier Creek[a]	VRM Class III	Area highly visible (foreground) from the Wellington to Myton road.
	VRM Class IV	Remainder of tract.
Whitmore Park[a]	VRM Class III	Entire tract.
Wasatch Plateau Area		
Acord[a]	Partial Retention	Entire tract.
Castle Valley Ridge	Not Available	
Ferron Canyon	Partial Retention	Area highly visible (foreground) from the Ferron Canyon road.
Gooseberry[a]	Not Available	
Ivie	Partial Retention	Area highly visible (foreground) from I-70.
	Modification	Remainder of tract.
Mud Creek	Not Available	
North Trough Springs[a]	Not Available	

continued

Table 3-17 (cont'd.)

Tract	Classification	General Location of Classification Area
Quitchupah	Partial Retention	Area highly visible (foreground) from the Quitchupah road and Link Canyon roads.
	Modification and Maximum Modification	Remainder of tract.
Skumpah[a]	Partial Retention	Entire tract.
The Pines	Not Available	
Trail Mountain	Partial Retention	Entire tract.
Emery Area		
Walker Flat[a]	VRM Class III	Entire tract.
Blue Trail Canyon	VRM Class II	Area of high quality rated scenery in the southeastern portion of the tract.
	VRM Class IV	Remainder of the tract.

a This entire tract is either partially or entirely under private surface ownership. The VRM classification given indicates how the lands would be classified if entirely under Federal surface ownership. Although VRM classifications are not generally applied to private surface lands, they are applied here so that the effect of Federal coal leasing and development can be determined for private surface lands in the same manner as for Federal surface areas.

attractions. Because of intervening terrain, logical surface development areas on the tracts are probably not visible from the Interstate.

Utah Highway 10 transects the Walker tract from north to south, however, logical off-tract portal locations are not visible from the highway.

Special Designation Areas

The four-county region contains portions of one national park, one natural area, and one natural landmark. Although there are no officially designated wilderness areas or wild and scenic rivers within the four-county region, there are 12 areas presently under wilderness review and four rivers presently being inventoried for wild and scenic values. In total there are 17 areas in the region with special designation or potential for special desingation. These areas are listed in Appendix 6. None of these areas are within the proposed lease tracts.

Southern Utah
Climate, Air Quality

Climate

General characteristics of the climate discussed under central Utah also apply to southern Utah.

Climate data collected at Alton, Utah represents the potential lease tracts. Wide diurnal variations in temperature are common, with an annual average diurnal variation of 29 degrees F at Alton. January is the coldest month with a mean temperature of 27 degrees F. July is the warmest month with an average temperature of 66 degrees F. Frost-free days or growing season averages 112 days at Alton. Annual precipitation at Alton averages 16 inches. Precipitation is spread evenly throughout the year, except for May and June when less than 1 inch occurs on the average. All other months average between 1 and 2 inches of precipitation. Precipitation north and east of the tracts on the Paunsaugunt Plateau averages about 25 inches per year. Annual average snowfall is 68 inches at Alton and up to 150 inches on the Paunsaugunt Plateau (Science Applications Incorporated, 1981).

The most frequent wind directions are north-northeast and northwest, occurring 34 percent of the time. These wind directions, associated with low wind speeds, result primarily from drainage flow off the Paunsaugunt Plateau.

Delta T measurements at the Bald Knoll meteorological tower indicates the frequency of unstable conditions is 11 percent, neutral stability conditions 28 percent, and stable conditions occur 61 percent of the time. Unstable conditions occur most frequently in summer and during afternoons, while stable conditions occur most frequently in fall and winter and during nighttime and early morning hours (see Chapter 3, Climate Central Utah).

Air Quality

Air Quality Standards

The central Utah discussion explains the applicable air quality standards and objectives.

High particulate concentrations exceeding the 24-hour NAAQS have been measured at Bullfrog, Cedar City, Hurricane, and Wahweap (Table 3-18). These concentrations resulted primarily from windblown dust and dust from traffic on unpaved roads. Sulfur dioxide and nitrogen dioxide concentrations are less than 30 percent of the NAAQS. Monitoring of lead and ozone at Page, Arizona indicated concentrations well within the NAAQS. Although there is no information concerning carbon monoxide and hydrocarbons, concentrations should be well within the standards due to the rural setting and low traffic volumes.

The area near the proposed lease tracts is rural and has a very low population density; consequently the existing air pollutant levels are expected to be very low. Because TSP concentrations are expected to increase substantially

TABLE 3-18

SOUTHERN UTAH
MEASURED PARTICULATE CONCENTRATIONS

Monitoring Location	Year	Concentrations micrograms per cubic meter: Maximum 24-hour average	Second Maximum 24-hour	Annual Geometric Mean
Bullfrog Basin	1977	423	258[a]	17
Cedar City	1977	151	132	51[a]
	1978	262	245[a]	47
	1979	162	162[a]	51
	1980	154	151	57
	1981	161	140	53
Hurricane	1977	175	167[a]	16
	1978	193	133	20
Page	1977	543	213[a]	35
	1978	137	120[a]	25
	1979	83	75	34
	1980	97	83	37
Wahweap	1977	661	322[a]	24
	1978[b]	186	143	11

Sources: Arizona Dept. of Health Services, 1977-1980
Utah Bureau of Air Quality, 1977-1981
ERT, 1980.

[a] Indicates violation.

[b] Incomplete year.

24 hour standard may be exceeded once per year; second exceedence indicates violation.

State and Federal Standards micrograms per cubic meter:	Annual	24-hour
Primary	75	260
Secondary	60	150

due to coal mining, existing TSP levels in the potential impact area were estimated by air quality modeling. The models ISCLT and PALDS, Bald Knoll meteorological data, and 1981 emissions data were used. Figure 3-12 shows the annual average TSP concentrations estimated using ISCLT. An annual average background TSP concentration of 15 micrograms per cubic meter is assumed to be representative of southern Utah and should be added to the annual average concentrations.

The modeling results suggest that TSP concentrations are only slightly above background levels, except near Kanab, where annual TSP concentrations are predicted to approach 50 micrograms per cubic meter due to greater population density.

Visibility

Visibility measurements taken at Bryce Canyon National Park are shown in Table 3-19. The average visual range between summer 1978 and fall 1981 was 120 miles.

Soils

The dominant soils within the Alton area are formed on mountainous terrain from shale and sandstone parent material. Most soils are well drained and loamy or clay loam in texture. The dominant landscapes associated with these soils are dissected rolling and hilly uplands and rolling upland benches. Poorly drained, clayey, and sandy clay textured soils occur on fans and valley bottoms which are the next most dominant landscapes in the area. The parent materials for these fan and valley soils are residuum, weathered from shale, sandstone, and minor amounts of basalt. A dominant landscape in the northern half of the Ford Pasture tract is a lava flow, consisting of a complex of basaltic rockland with shallow to moderately deep loamy textured soil over a basalt bedrock; these soils are well drained and have a moderate to high wind and water erosion potential.

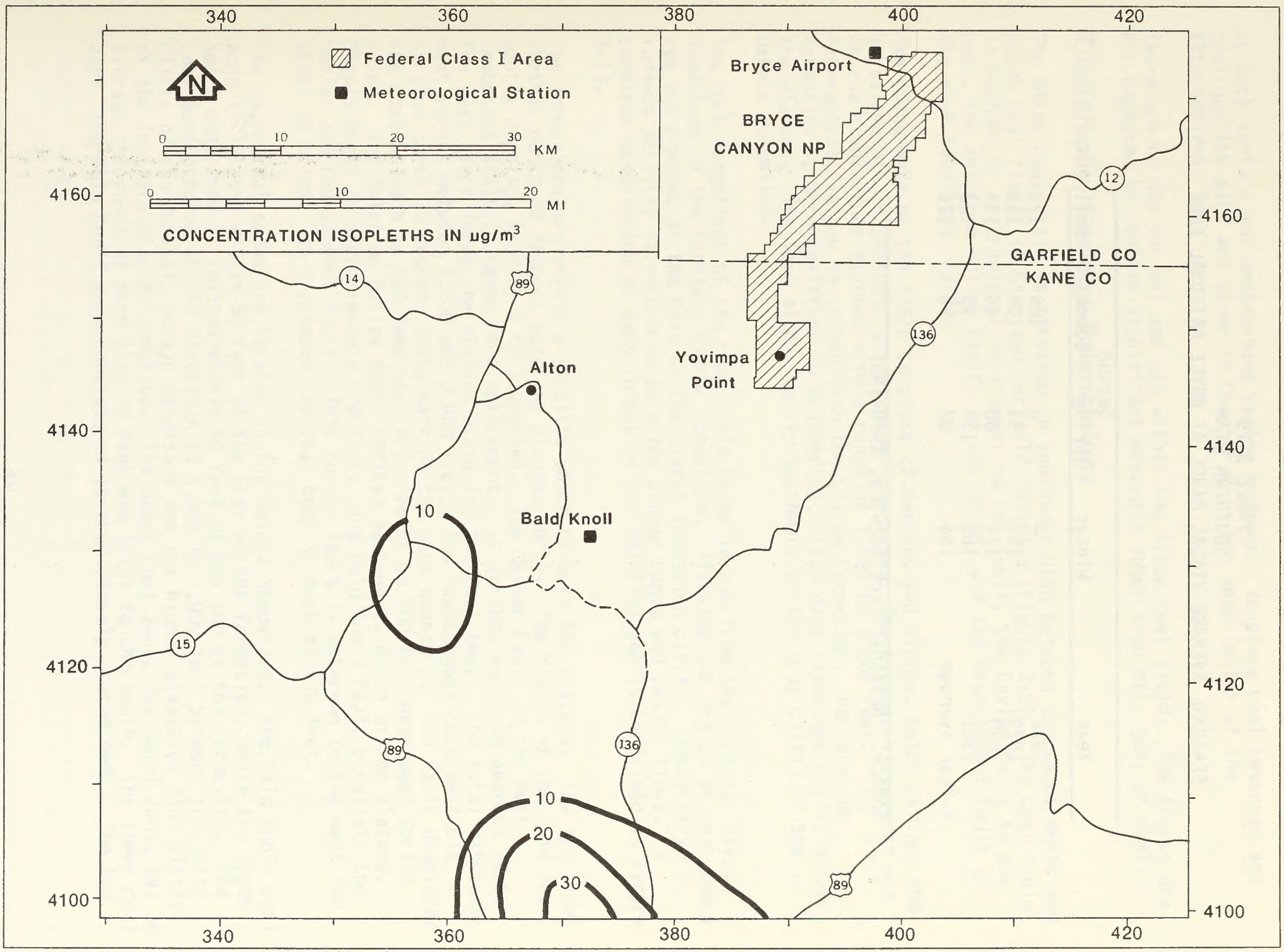
The majority of the soils are nonsaline and salts in the surface soils are generally not a problem. Some soils are moderately and highly saline in the substratum. Soil parent material on all of the tracts is Tropic Shale and Dakota Sandstone. Exposures of the Tropic Formation easily erode, producing high sediment yields and saline and sodic conditions. Steeply incised gullies with active headcuts are found in all but the Ford Pasture tract.

The water erosion hazard potential as well as existing natural water erosion is moderately high for the majority of the soils that comprise the area.

Infiltration rates are high enough to limit erosion damage from low intensity storms, but high intensity storms are common in this area. The existing erosion has contributed to a high percentage of bare ground cover over the general area.

Minerals Resources

Within the proposed tracts, coal on all but the Ford Pasture tract, can only be mined by underground mining methods. The Ford Pasture Tract can be mined



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 3-12

AVERAGE ANNUAL TSP CONCENTRATIONS IN SOUTHERN UTAH

TABLE 3-19
SOUTHERN UTAH
SEASONAL AVERAGE VISUAL RANGE AT BRYCE NATIONAL PARK

Year	Season			
	Winter	Spring	Summer	Fall
1978	-	-	106	129
1979	157	93	104	119
1980	174	80	86	134
1981	160	119	95	122
4-Year Average	164	98	98	126

Source: National Park Service, 1978-1981 by both surface and underground mining methods. In-place coal reserves and coal quality data are given in Chapter 2 in the description of the alternatives.

There are no KGS for oil and gas within the Alton coal field. The tracts are not expected to contain significant minerals other than oil, gas, or coal.

Topography, Geology, Paleontology

The Alton coal field is situated in southwest Utah between the Kaiparowits and Kolob coal fields in Kane and Garfield Counties (Figure 3-2). The coal field is bounded by an erosional escarpment to the south, the Sevier Fault to the west, the Ahlstrom Hollow Faults to the north, and the Paunsaugunt Fault to the east (Doelling, 1972).

The topography of the field consists of benches and slopes, which reflect the stratigraphy and geologic structure of the area. The highest elevations are on the Paunsaugunt Plateau with a range of 7,500 to 9,000 feet. The Paunsaugunt Plateau is capped with the Claron Formation. Because the formation is more resistant to weathering, steep pink limestone cliffs border the plateau. The land slopes gently southward on the gray cliffs of the Dakota Formation.

The rock formations of the coal field range in age from the Jurassic Navajo Sandstone to the Tertiary Claron Formation. Alluvium and gravel of Quaternary age are present at the base of the Claron Formation cliffs. Quaternary igneous activity is evidenced by a few cinder cones and basalt flows. A complete description of each formation and relative age is contained in Figure 3-13.

The formations are within a syncline which bisects the plateau. The syncline strikes north 30 degrees east and plunges north. The flanks of the fold are gently dipping, usually 1 to 3 degrees. The Sevier Fault is the most important fault in terms of displacement. It strikes north 30 degrees east. The east block forms the plateau elevating the coal beds. The total displacement varies between 1,000 and 2,000 feet. The Paunsaugunt reverse fault strikes north 15 degrees east, marking the east boundary. The fault displaces the coal as much as 500 feet near Bryce Point to 100 feet near Deer Spring Point. The Ahlstrom Hollow Fault strikes east-west, north of the plateau. Displacement is approximately 500 feet. The Bald Knoll Fault parallels the Sevier and Paunsaugunt Fault. This normal fault is upthrown to the west for about 12 miles. It displaces the coal beds as much as 500 feet.

The major coal seams are located in the Dakota Sandstone. The Bald Knoll coal zone is located within 50 feet of the base of the formation, while the upper Smirl coal zone is located within 50 feet of the top of the formation. The coal beds outcrop at the elevation of 6,500 to 7,000 feet between the White Cliffs of the Jurassic Navajo Sandstone and the higher elevation Pink Cliffs of the Tertiary Claron Formation. The upper coal zone, the Smirl zone, has an average thickness of more than 12 feet and thins to the south. The lower coal zone, the Bald Knoll zone consists of several closely spaced beds. The bed

FIGURE 3-13

GENERALIZED STRATIGRAPHIC COLUMN OF THE
ALTON COAL FIELD

Period	Stratigraphic Unit	Thickness (Feet)	Description
Cretaceous	Claron Formation	1000-1300	Pink, white, and varicolored limestone, cliff former, conglomerate of quartzite and limestone cobbles and pebbles.
Cretaceous			Unconformity
Cretaceous	Kaiparowits Formation	265-700	Dark gray to gray-green arkosic sandstone, friable, calcareous cementation.
Cretaceous			Unconformity
Cretaceous	Wahweap Formation MINOR COAL	500-1300	Alternating sandy shale and thin to thick bedded resistant sandstone, ledge and slope topography.
Cretaceous	Straight Cliffs Formation MINOR COAL	80-500	Yellow-gray to brown thick bedded to massive cliff-forming sandstone with intervening gray shale, shaley sandstone coal, and carbonaceous shale.
Cretaceous	Tropic Shale	700-1000	Gray shale with subordinate thin brown fine grained sandstone, slope former.
Cretaceous	Dakota Formation MAJOR COAL SEAMS	150-450	Yellow gray to brown fine to medium grained sandstone alternating with gray shale, sandy shale, carbonaceous shale and coal, ledge and slope former creating Gray Cliffs; best coal near bottom and top of unit.
Jurassic			Angular Unconformity
Jurassic	Entrada Sandstone: Cannonville Member	0-300	White and reddish banded fine-grained sandstone and siltstone friable and earthy weathering, massive.
Jurassic	Entrada Sandstone: Gunsight Butte Member	0-300	Red-brown and light green siltstone, red cross-bedded sandstone.
Jurassic	Carmel Formation: Judd Hollow Tongue of Carmel: Wiggler Wash Member	0-60	Limestone, red siltstone, white and greenish gypsum.
Jurassic	Carmel Formation: Judd Hollow Tongue of Carmel: Winsor Member	180-250	White, pink, brown sandstone alternating with thin red siltstone and mudstone.
Jurassic	Carmel Formation: Judd Hollow Tongue of Carmel: Paria River Member	55-200	Interbedded light gray and red sandstone, limestone, siltstone, shale, and gypsum.
Jurassic	Carmel Formation: Judd Hollow Tongue of Carmel: Thousand Pockets Tongue of Navajo Sandstone	0-60	Yellowish cross-bedded friable, but resistant sandstone.
Jurassic	Carmel Formation: Judd Hollow Tongue of Carmel: Crystal Peak Member	120-190	Dark reddish brown and white to light gray fine-grained sandstone, medium-bedded with minor thin gypsiferous of calcareous shales and conglomerate.
Jurassic	Carmel Formation: Judd Hollow Tongue of Carmel: Kolob Limestone	122-350	Gray and tan dense limestone with some thin sandy red shale near the base and thin gypsum near top.
Jurassic	Navajo Sandstone	1000+	Light gray to tan, locally red fine-grained sandstone, massive, exhibiting large-scale aeolian cross-bedding, calcareous and cliff forming.

Modified from Doelling and Graham, 1972

thickness averages 5.5 feet with 1.2 feet of waste due to splits. The bed is not minable in the vicinity of the Sevier Fault zone.

Potential fossil-bearing units within the study area range in age from unconsolidated Pleistocene deposits to the early Jurassic Windsor Formation, which is in part equivalent to the Carmel Formation. Significant fossils have been found in almost every stratigraphic unit across the southern half of the State.

The Kaiparowits Formation and underlying Wahweap Sandstone (both of Late Cretaceous age) are potentially important, having yielded dinosaur bones as well as other fossil vertebrate, invertebrates, and plants. The Straight Cliffs sandstone is also paleontologically important having yielded fish remains, as well as invertebrate and plant fossils.

The Lower Cretaceous Tropic shale is most important paleontologically as a source of fossil cephalopods (from key horizons) and other invertebrates.

Rare and very significant fossils have been found in the coal-bearing Dakota Sandstone. Among these are dinosaurs, bird remains, other reptiles, invertebrates, and plant material.

A literature search was conducted to evaluate research completed in this region to identify, as far as possible, the known fossils and their association with the various formations in the region. The results of this literature search are compiled in a technical report on file at the BLM Utah State Office.

Water Resources

Surface Water

All of the southern Utah tracts proposed for leasing in the Alton area are in the Lower Colorado River Basin. Runoff from those tracts reaches the Colorado River by way of the Virgin River and Kanab Creek. The Flax Lakes tract drains to the Virgin River, whereas the Alton Amphitheater, Fisher Canyon, Mill Creek Canyon, and Ford Pasture tracts drain to Kanab Creek.

Estimated mean annual runoff from the southern Utah tracts proposed for leasing ranges from about 1 inch (about 50 acre-feet per square mile) in the lowest parts of the Flax Lakes and Ford Pasture tracts to about 8 inches (about 400 acre-feet per square mile) in the highest part of the Alton Amphitheater tract. Most of the runoff, however, is generated on the highest parts of the Paunsaugunt Plateau upstream from the tracts where it is estimated to exceed 12 inches (640 acre-feet per square mile) locally (Bagley et al., 1964). The seasonal peak runoff period is generally May to June, chiefly in response to the melting of winter snowpacks. Some runoff is also generated by local torrential summer rainstorms; flash floods resulting from such storms have been recorded throughout the Virgin River and Kanab Creek basins. They have occurred in perennial, intermittent, and ephemeral streams, and in some cases have caused considerable property damage (Woolley, 1946; Butler and Marsell, 1972). In some cases flood stages of the affected streams have ranged from several to more than 10 feet higher than the medium-flow stage.

Records of runoff (including annual peak discharges of some streams) have been collected by the Geological Survey at several streamflow gauging stations in the Virgin River and Kanab Creek basins. The gauging station sites are shown in Figure 3-14.

Runoff from the area of the southern Utah tracts ranges from fresh to slightly saline (Table 3-20). In most places, dissolved-solids concentrations of streamflow are less than 500 milligrams per liter during low flow and less than 250 milligrams per liter during high flow. In sections of Kanab and Johnson Canyon Creeks that cross the salt- and gypsum-bearing Tropic Shale and Carmel Formations, dissolved-solids concentrations of the streamflow generally exceed 1,000 milligrams per liter during both low and high flow periods (Price, 1980).

Principal minerals in the freshwaters are calcium and bicarbonate; in the most highly saline waters they are sodium and sulfate. There are no unusually large concentrations of trace elements in the streamflow.

According to the U.S. Soil Conservation Service (SCS, 1973) general sediment yields in the area of the southern Utah tracts range from about 0.1 to more than 3.0 acre-feet per square mile, with an average of about 1.8 acre-feet per square mile.

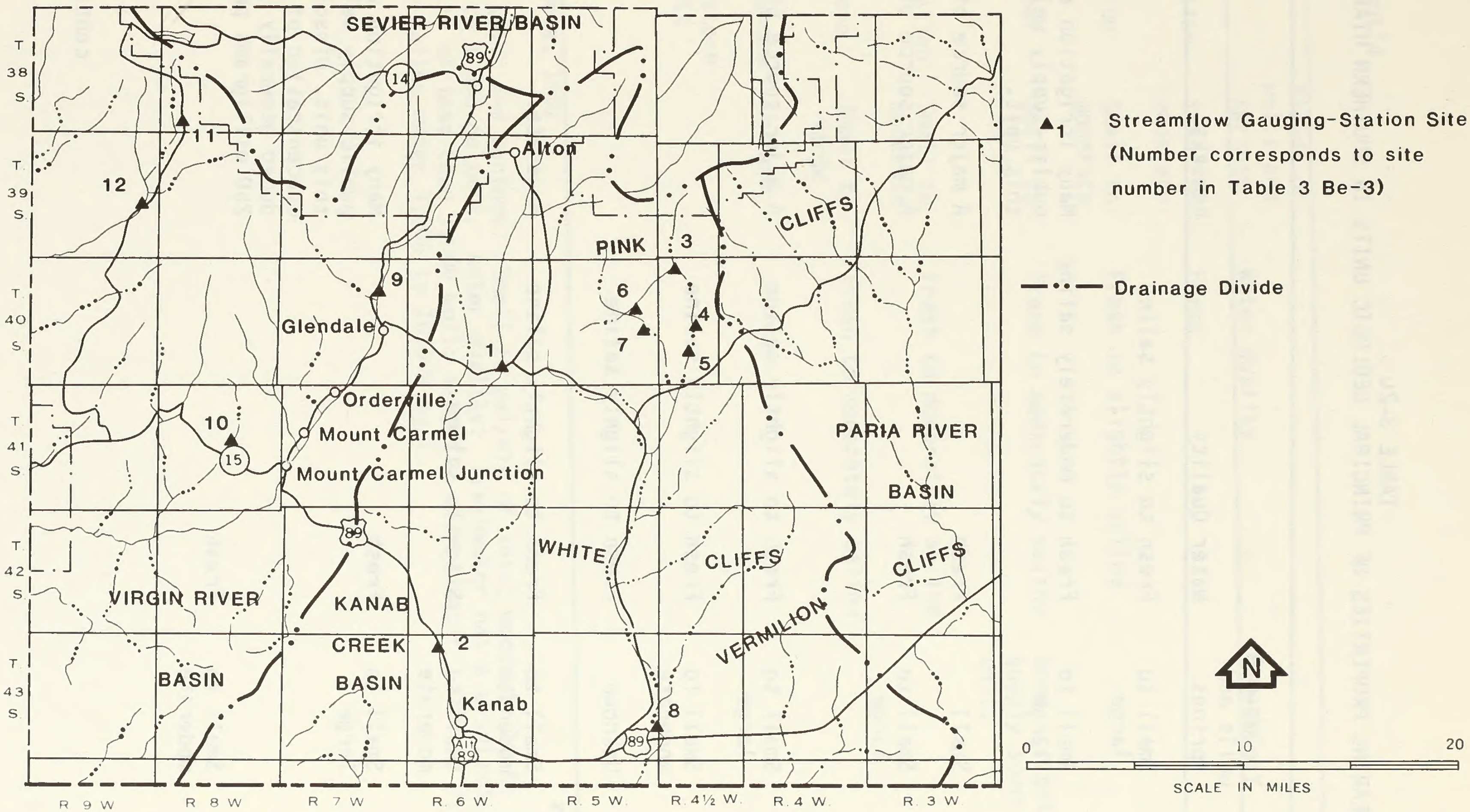
Available data on alluvial sediment indicate that average concentrations of suspended sediment in the upper reaches of the Virgin River and Kanab Creek are generally small (less than 100 milligrams per liter). During rapid snowmelt and cloudburst flooding; however, concentrations of suspended sediment may range from several thousand to more than 100,000 milligrams per liter.

Ground Water

Available data indicate that most geologic units in the area of the southern Utah tract contain water at some depth. Principal geologic units and their general water-bearing properties are listed in Table 3-20, and potential yields of wells based largely in the geologic units are shown in Figure 3-15. The Navajo Sandstone is the principal source of ground water in the area. It is tapped by many wells in the Kanab Creek drainage basin, but lies several hundred feet beneath the coal-bearing beds of the southern Utah tracts.

According to Cordova (1981), water enters the rocks in the upper sections of the Virgin River and Kanab Creek and moves generally southward to springs and natural discharge areas in lower sections of those streams. There appears to be no significant interbasin movement of the water between the Kanab Creek basin and adjacent drainage basins.

Because water enters the geologic units above the coal-bearing beds, it it concluded that water occurs in the rocks that overlie the coal-bearing beds. Considering geologic conditions (Stokes, 1964), available precipitation (U.S. Weather Bureau, 1963) and mean annual runoff (Bagley et al., 1964) rocks overlying the Alton Amphitheater tract probably contain relatively more water than rocks that overlie the other southern Utah tracts.



(Base from USGS, 1977)

FIGURE 3-14
SOUTHERN UTAH G.S. GAUGING STATION SITES

TABLE 3-20
WATER BEARING PROPERTIES OF PRINCIPAL GEOLOGIC UNITS IN SOUTHERN UTAH

Geologic Unit	Yields of[a] wells and springs	Water Quality	Remarks
Quaternary Basalt	Small to large	Fresh to slightly saline	
Quaternary Valley fill	Small to large	Fresh to moderately saline	Many irrigation and some public-supply wells are in this unit.
Wasatch Formation	Small	Fresh	A major source of base flow.
Kaiparowits Formation	Small to large	Fresh	A major source of base flow.
Wahweap Sandstone Straight Cliffs Sandstone	Small to large	Fresh to slightly saline	A major source of base flow.
Tropic Shale	Small to moderate	Fresh to slightly saline	
Dakota Sandstone	Unknown	Fresh to slighly saline	
Undivided; excludes Carmel Formation	Small to moderate	Fresh to slightly saline	Moderate.
Carmel Formation	Small to moderate	Slightly saline	
Navajo Sandstone	Small to large	Fresh	Many irrigation and most public-supply wells are in this unit. Dissolved-solids concentration of water produced generally less than 250 milligrams per liter.
Kayenta Formation (exclusive of Tanney Canyon Tongue)	Small to moderate	Fresh	

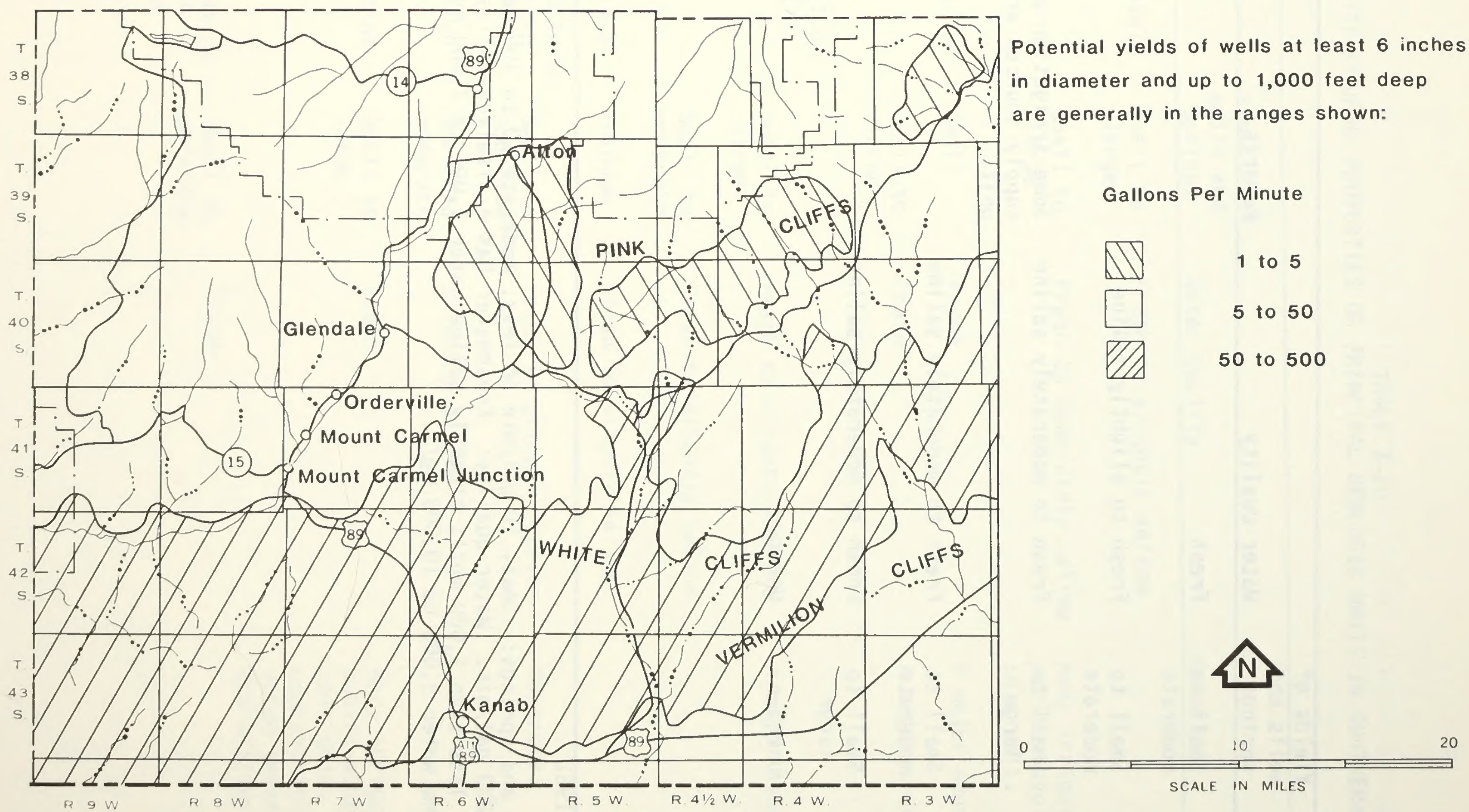
continued

TABLE 3-20. cont'd

Unit	Yields of wells and springs	Water Quality	Remarks
Moenave Formation	Small to moderate	Fresh	
Chinle Formation	Small to moderate	Fresh to slightly saline	
Shinarump Member of the Chinle Formation	Small to large	Fresh to moderately saline	Some irrigation and public supply sources are in this unit.
Moenkopi Formation	Small to moderate	Fresh to moderately saline	
Kaibab Limestone	Small to large	Fresh to moderately saline	
Undivided sequence in which the Coconino Sandstone is the thickest unit	Unknown	Unknown	

Source: Cordova, 1981

[a] Yields of wells and springs: Small 10 gal/min or less; moderate 10 to 100 gal/min; large 100 to 1,000 gal/min. Water quality: Freshwater has a disolved-solids concentratio of less than 1,000 mg/l; slightly saline water 1,000 to 3,000 mg/l; moderately saline water 3,000 to 10,000 mg/l.



(Base from USGS, 1977)

FIGURE 3-15

POTENTIAL YIELDS OF WELLS IN SOUTHERN UTAH

Water in the Wasatch Formation and most other geologic units that overlie the coal-bearing beds is generally fresh and in most places contains less that 500 milligrams per liter of dissolved solids; this is also generally true of the Navajo Sandstone. Water in most other geologic units, including the coal-bearing beds, is generally fresh to slightly saline. Locally, however, the Tropic Shale and the Carmel Formation may be moderately saline, containing more than 3,000 milligrams per liter of dissolved solids (Price, 1980).

Few analyses have been made for trace elements in ground water in the area of the southern Utah tracts. The limited data available indicate that there are not unusually large concentrations of trace elements in the water from most geologic units. Arsenic concentrations of as much as 70 micrograms per liter have been found in water from the Navajo Sandstone near Lake Powell. The arsenic may be related to the Carmel Formation or rocks of Cretaceous age (Personal communication, Paul Blanchard, GS, 1982).

Water Supply and Use

Irrigation is the principal use of water in the area of the southern Utah tracts. According to the Utah Department of Agriculture (1981) there are about 8,900 acres of irrigated land in Kane County. Most of this land is in the valleys of the East Fork, Virgin River, Kanab Creek, Johnson Canyon Creek, and the upper Paria River. Total annual use of water for irrigation in the area is about 27,000 acre-feet. According to Cordova (1981), approximately 1,000 acre-feet is from ground-water sources, chiefly the Navajo Sandstone and older rocks in the Kanab Creek basin.

Most water withdrawn for public supply, domestic, and stock use is from ground-water sources. Based on Cordova's estimates (1981) total annual withdrawals for these uses is about 2,000 acre-feet.

In addition to the foregoing uses, both surface water and ground water (springflow) is used by wildlife and livestock. The volume consumptively used is unknown, but does not greatly exceed 1,000 acre-feet per year.

Water Rights

Water rights in Utah are discussed in the central Utah section of this Chapter.

Vegetation

Vegetation Types

As shown in Figure 3-16, dominant vegetation types in the Alton coal field include Pinyon-Juniper, Sagebrush-Grass, Mountain Brush, Ponderosa Pine, and Agricultural. Small areas of limited riparian vegetation can also be found near springs and adjacent to ephemeral and perennial streams. Nonproductive areas such as rock outcrops or escarpments, roads, and communities are also found (ERT, 1980b). These areas are often quite small, and are not depicted on the vegetation map. The area of the Ford Pasture tract that would be

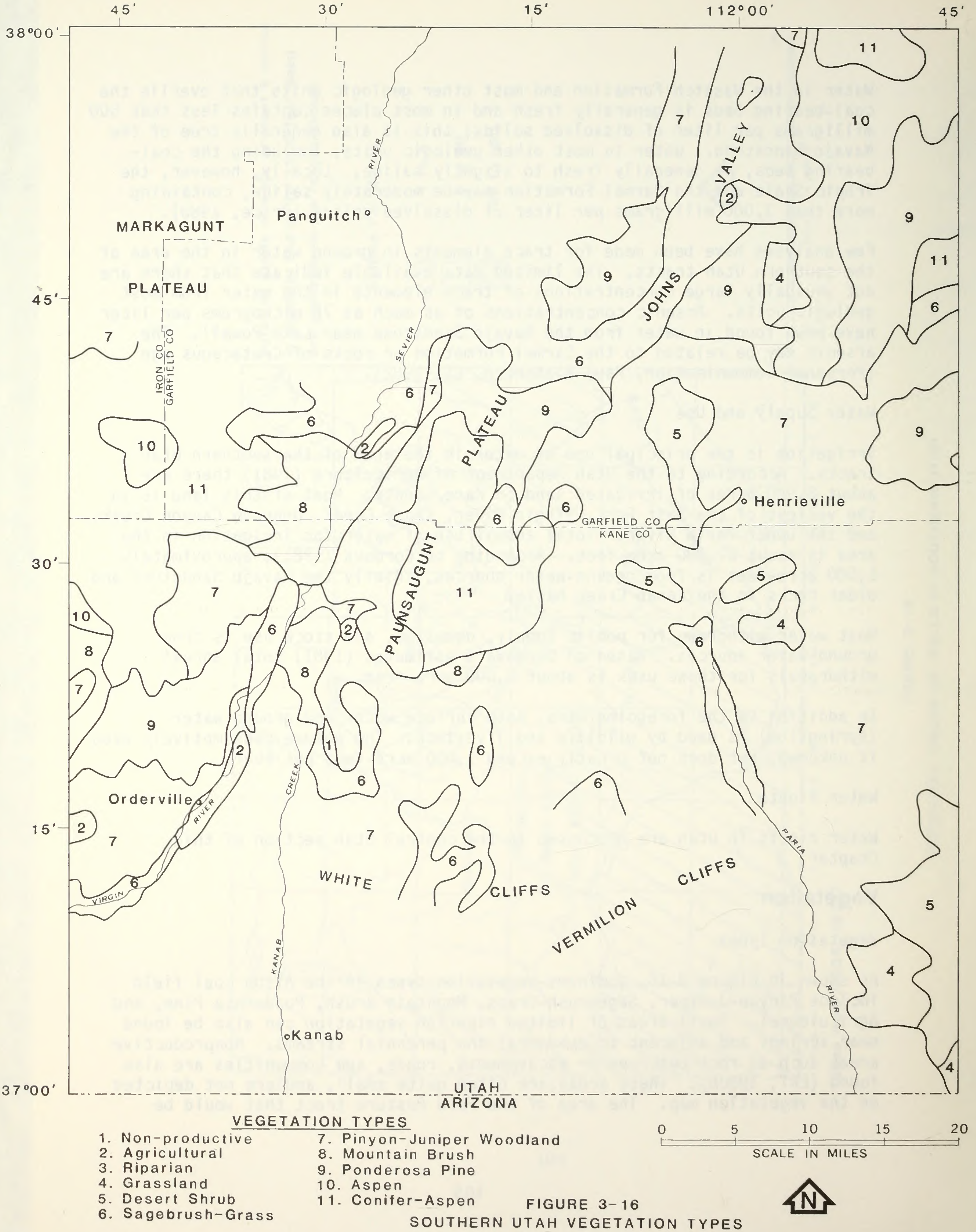


FIGURE 3-16
SOUTHERN UTAH VEGETATION TYPES

surface mined is essentially Pinyon-Juniper Woodland interspersed with sagebrush parks.

Threatened or Endangered Plants

No officially listed threatened or endangered plant species or candidate species have been located on any of the five tracts in the Alton coal field. However, vegetation types and geologic setting on the tracts is similar to nearby areas where such species have been found. These species and their critical habitats are listed in the Final Environmental Statement: Southern Utah Coal (GS, 1979) and Kaiparowits Coal Development and Transportation Study (ERT, 1980b). Additional threatened or endangered plant species searches on the individual tracts are necessary.

Reclamation Potential

Mean annual precipitation is approximately 16 inches and May and June are normally the driest months of the year. Twenty-eight percent of the annual precipitation occurs during July, August, and September often coming as localized intense storms of short duration. This results in high rates of runoff with attendant soil erosion hazard.

Based on the above climatic conditions, it is probable that without irrigation, vegetation would be successfully established in about one-third of the seeding efforts according to EMRIA Report No. 4 (BLM, 1975). There would be about an even chance of establishing some vegetation in another one-third of the seeding efforts depending on the timeliness and distribution of the precipitation. The EMRIA Report concludes that the remaining one-third of the time, seeding would most likely result in failures. Local conditions affecting reclamation include depth of soil, high rock volume in some areas (basalt or sandstone rock exposures), and Tropic Shale Formation exposure which erodes easily and produces high yields of sediment and saline and sodic conditions. The primary constraint to revegetation is the high rate of surface runoff which results in high water erosion rates.

Wildlife

Terrestrial

Garfield County has a large variety of wildlife in life zones ranging from Upper Sonoran to Hudsonian. Mule deer occupy all of the life zones, with elk and blue grouse occupying primarily the Canadian and Hudsonians zones. Sage grouse occur in sagebrush in valleys and on benches.

Life zones present in Kane County range from the Lower Sonoran near the Arizona border to the Canadian on the Markagunt and Paunsaugunt Plateaus at the northwestern corner of the county. Much of the lower terrain is dry and sparsely vegetated and is characterized by steep cliffs, canyons, breaks, and eroding stream beds that support only limited riparian habitat. The small agricultural areas are confined to lands adjacent to the small communities. These conditions somewhat limit the variety of wildlife species and population densities. Figure 3-17 shows the distribution of major game species and Table 3-21 depicts life zones, plant communities, and representative wildlife relationship.

Mule deer are the most common large mammal in the area and historically reached very high population levels. Currently, deer numbers are depressed especially in Herd Unit 60 A, which includes the Paunsaugunt Plateau and the Alton area; this unit has been closed to hunting since 1980 (Figure 3-17). Counts in 1981 (from summer spotlight routes) indicate a population level only 12.5 percent of the previous 1971 counts. The 1971 counts were prior to a decline that apparently began in 1972. The existing herd probably lacks sufficient mature does (5 to 7 years old) to increase productivity; this is evidenced by the fact that even with complete protection, the herd level is static or decreasing (UDWR, 1982). The UDWR management objective is to maintain a herd capable of producing an annual average harvest of 450 bucks (UDWR, 1980). This has not occurred since 1972 and herd levels would need to be at 1971 levels to produce this harvest. The herd unit prior to closure was utilized by an average of 1,000 hunters annually. Thus future hunting regulations would probably be restrictive and any antlerless harvest would be site specific and tightly controlled.

Elk have only recently become established in Kane County on the Markagunt and Paunsaugunt Plateaus. Only the Markagunt Plateau is open to hunting. The few elk on the Paunsaugunt Plateau apparently drifted south from the Mount Dutton Herd Unit.

A small band of antelope, established from early 1970s transplants, inhabits the Clark Bench area but has never prospered due to continual poaching.

Mountain lion (cougar) exist wherever deer are established. The population appears stable and provides a fair sport harvest annually. Black bear, in Kane County, inhabit only the Canadian life zone in scattered numbers.

Sage grouse occur in Long Valley and the Alton area. County residents harvest a few birds each year. Leks have been located in Ford Pasture and Sink Valley near the proposed lease tracts. Counts in 1982 indicate a fall population of 100 to 150 birds (Ruzzo, 1982). Blue grouse occur in the Transition and Canadian life zones in widely scattered populations. A few hunters pursue these birds with moderate success. Wild turkeys inhabit the oak-ponderosa communities. The largest population occurs in the North Fork Virgin River watershed with only a few scattered flocks around Alton. All the hunting occurs west of Highway 89. The oak and ponderosa pine communities are important nesting habitat for the migrant band-tail pigeons. The fall flocks shift around following the feed supply until they leave in September. Mourning doves are widely distributed but are most numerous in the Sonoran life zones.

Sparrow, red-tail, and Cooper's hawks, great horned and screech owls, and golden eagles are common resident species nesting wherever suitable habitat and prey exists. Most are tree nesters but golden eagles also nest on cliff faces. Migrant rough-legged, Swainson's, and goshawks are found here only in

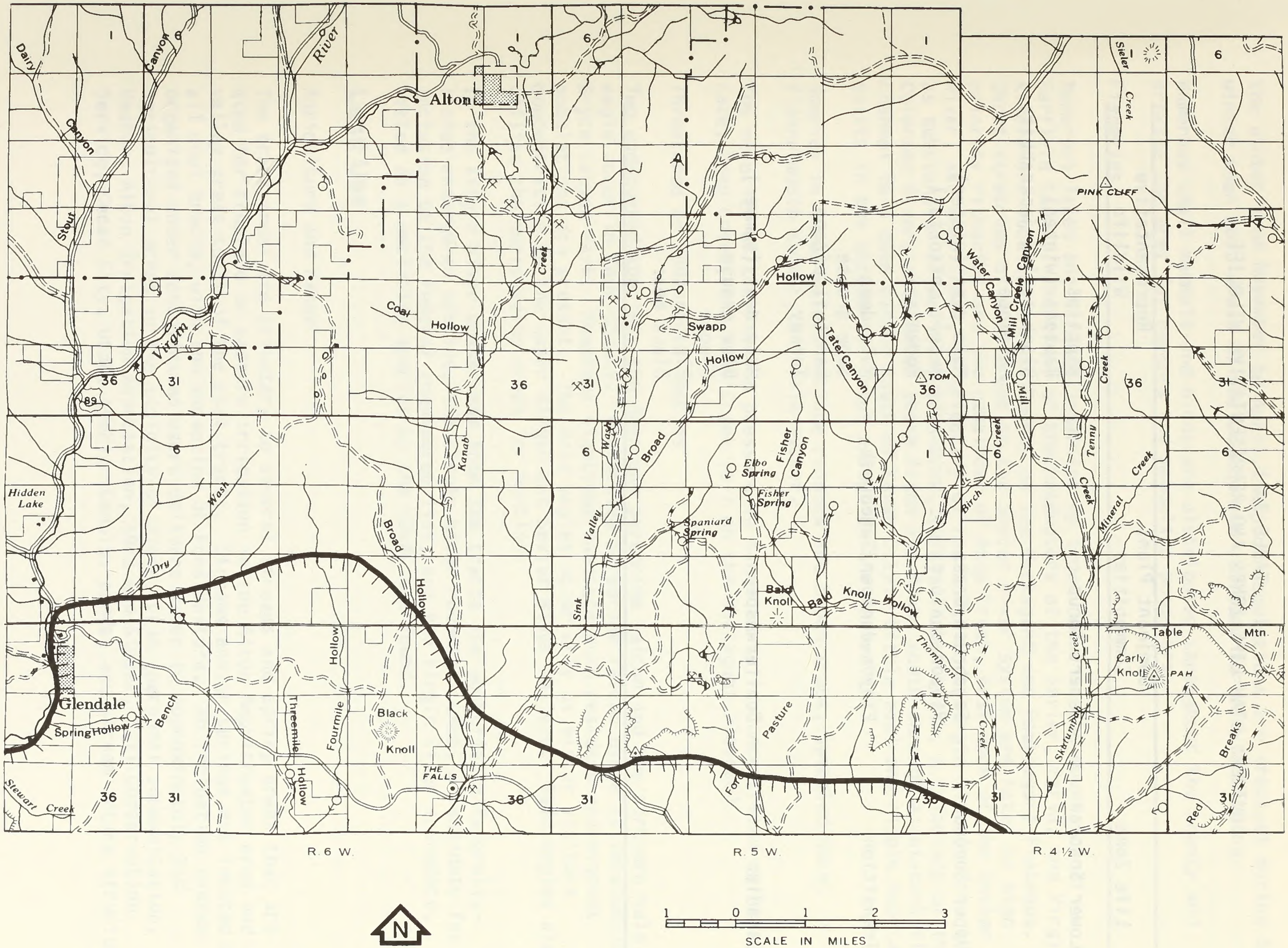


FIGURE 3-17

SOUTHERN UTAH BIG GAME SPECIES DISTRIBUTION

TABLE 3-21
SOUTHERN UTAH LIFE ZONES AND REPRESENTATIVE WILDLIFE

Life Zone	Dominant Plant Communities	Representative Wildlife
Lower Sonoran	Desert Shrub	Reptiles Raptors (winter) Black-tailed jackrabbits Antelope
Upper Sonoran	Sagebrush/Grass Pinyon-Juniper	Mule deer (winter) Desert cottontail Rodents
Transition	Pinyon-Juniper/Sagebrush	Mule deer Sage grouse Bandtail pigeon Turkey
Canadian	Conifer-Aspen	Mule deer (summer) Blue grouse Cougar Elk Black bear

the winter from November to April. Raptor populations are greatest during the winter when most areas of the county are utilized for prey searching.

Numerous small mammals and birds are distributed throughout the county and provide the prey for raptors and mammalian predators.

Fisheries

Numerous lakes and streams inhabited by trout occur in the mountains of Garfield County. Portions of the headwaters of the Sevier, Paria, and Virgin Rivers are located in Kane County on the Markagunt and Paunsagunt Plateaus. Short stretches of Asay Creek on the Sevier River system are rated as high priority fisheries and the remainder of Asay Creek, East Fork of the Sevier River, and Deep Creek, (a tributary of the North Fork Virgin River), are rated as substantial fisheries (USFWS-UDWR, 1978). Kanab Creek, a tributary of the Colorado River, originates above Alton and flows south through a cut-bank flat channel to a deep canyon south of Kanab City. Little pool and ripple habitat exists in the stream for trout except in the headwaters.

Species in these waters include rainbow and brown trout, speckled dace, flannelmouth sucker, and Gila sucker.

The majority of the fishing pressure in Kane County is concentrated on Navajo Lake, Deep Creek, and Asay Creek (all on the Markagunt Plateau).

Threatened or Endangered Species

Two endangered species, the American peregrine falcon and the northern bald eagle occur in Kane County. One active peregrine falcon eyrie is located in Bryce Canyon Park. Numerous sightings indicate both resident and migrant populations are present. The bald eagles occur only as winter visitors concentrating in the upper Virgin and Sevier River valleys. Bald eagles also utilize the surrounding areas for hunting.

In the Virgin River downstream from the tracts the woundfin, a Federally-listed endangered species, the Virgin River roundtail chub, a candidate for inclusion on the Federal endangered list, and the Virgin River spinedace, listed as a declining species by the UDWR, are found.

Land Use

Agriculture and Range

The tract areas are tributary to several streams and spring areas that are used for cropland or pasture irrigation in the Alton Amphitheater area and in valley areas south of the coal tracts. Streams and/or springs are located on all coal tracts, with the exception of Ford Pasture. An irrigation system organized under consolidated users delivers water to approximately 310 agricultural acres in the vicinity of Alton, Utah (personal communication, Heaton, Alton Irrigation Association, 1982 and Simper, Soil Conservation Service, Cedar City, Utah, 1982). Canals, ponds, and stream intake structures operated by the irrigation company, and approximately 95 acres of irrigated pasture land are located on the Alton Amphitheater tract (BLM, 1982c). The farmlands that are under full irrigation in the Alton Amphitheater area are classified as prime farmlands by the Soil Conservation Service (personal communication, Simper SCS, Cedar City, Utah, 1982). Irrigation of cropland and pasture in the valley areas south of the tracts is done by systems developed by individual private landowners. These valley areas are irrigated by stream and well water. As with the Alton Amphitheater area, the fully irrigated cropland in the valley areas is classified as prime farmlands by the SCS.

Public lands administered by BLM and the private lands are being grazed by livestock. Eleven grazing allotments are located within the coal tract areas and each tract is occupied by portions of two to six of the 11 allotments (personal communication, Wilkens, BLM, Cedar City, Utah, 1982). There are 53,180 acres in these 11 allotments, of which 24,737 acres are classified as suitable range. The present use on these allotments is 2,360 AUMs. There are 6,360 private acres being grazed on the coal tract areas with a production of about 584 AUMs (BLM, 1982c).

Streams and springs located on the coal tracts are used for livestock watering. Livestock watering rights on these sources are held by ranchers and BLM (BLM, 1982c).

In the Alton Amphitheater area, ranchers seasonally trail and truck livestock into and out of the BLM allotments. No defined livestock driveways are established.

Several farm and ranch operators graze substantial numbers of cattle and limited numbers of sheep and horses on cropland areas in the Alton Amphitheater area and in the vicinity of Kanab and Panguitch.

Energy and Minerals Development

Twenty-eight existing leases, involving 25,818 surface acres, are in the Alton coal field. None of these lease areas have been developed, and the coal resources are currently being investigated by the lessees.

Portions of from 1 to 14 oil and gas lease areas are located on the coal tract areas (personal communication, Wilkens, BLM, Cedar City, Utah, 1982). There have been several exploratory wells drilled on the tracts but no producing wells have been developed.

Rights-of-way, Special Uses, Other Land Uses

Several springs and creeks on the Mill Creek Canyon Tract serve as domestic water supplies for scattered summer cabins and ranches located on the tract. No other known domestic water sources exist on the other four coal tracts. Domestic water supplies for the community of Alton and for scattered ranch facilities south of Alton are derived from wells on springs located off the tract areas. Kanab derives water from a spring and five wells located about 7 miles north of the municipality; the water comes from the Navajo Sandstone aquifer.

A portion of the southern boundary of the Alton Amphitheater tract is located contiguous to the community of Alton. Improved roads, domestic and agriculture water developments, electrical power distribution lines, telephone lines, and pastures are located along this boundary.

Proposed rights-of-way for segments of the coal slurry pipelines and power distribution lines associated with the proposed Allen-Warner Valley Project coal preparation would cross the southwest portion of Ford Pasture Tract.

Land Use Plans, Controls, and Constraints

Federal Plans

As part of the BLM Zion MFP, a Summary applying the Unsuitability Criteria (CFR 43 3461) to the Alton KRCRA was completed in October 1980 (BLM, 1980b). A petition of November 28, 1979, asked that lands near Bryce Canyon, of which the five Alton Area coal tracts were a part, be declared unsuitable for coal mining. A Petition Evaluation Document and EIS was completed in November 1980 (OSM, 1980). A decision by the Secretary of the Interior was issued on December 16, 1980 which amends the decisions presented in the MFP Summary for The Planning Unit. None of the land within the Alton Area coal tracts is affected by the Secretary's decision. The Zion MFP and Summary address all lands within the tract boundaries as acceptable for further leasing consideration. The Secretary's decision designated all Federal lands in township T. 40 S., R. 4 W.; T. 39 S., R. 4 W.; T 38 S., R. 4 W.; T 38 S., R. 3 W.; T 37 S., R. 4 W.; T 37 S., R. 3 W as unsuitable for surface coal mining operations. These lands are in the northeastern portion of the Alton coal field. None of the Alton area coal tracts is in the unsuitable area. All five Alton tracts are in areas identified as acceptable for further consideration for coal leasing in the Zion MFP.

Following the Secretary's decision, three suits were filed with the United States District Court for the District of Utah seeking to have the Alton decision set aside on the basis that it was arbitrary and capricious. Two companies that hold coal leases in the area argue that the decision impaired their contractural rights under their leases and that it constituted a taking of private property for public purpose without due process of law. The State of Utah argues that the Secretary's decision would preclude coal development on intermingled State lands. The third suit, filed by several environmental organizations and individuals, who argue that the Secretary erred in not designating the entire Alton coal field as unsuitable for surface mining. These suits have been consolidated into one lawsuit and are still pending and no court date has been set.

County Plans

All of the tracts in the southern Utah area are in Kane County. The thrust of the Kane County Master Plan in regard to coal mining developments is twofold; (1) support for development to increase economic potential and diversity of the area which will provide greater job and income opportunities for local citizens, and (2) implementation of land use strategies that will control growth and provide adequate services and facilities for county citizens. Plan direction emphasizes the following in regard to impacts resulting from energy-related projects: (1) permanent year-round subdivision development should be within the existing communities; (2) existing and potential irrigated cropland will be protected through preferential tax treatment and restricting incompatible lands uses; (3) zoning ordinances should be up-dated to preserve agricultural land in the county for food and livestock production; (4) coal and other resources should be developed for the greatest economic advantage to the area; (5) areas defaced through mining, exploration, or timber removal, should be restored to the original condition or better.

Access roads into these areas should be built according to proper standards and be maintained with County equipment, to take advantage of agricultural development or recreational attraction; (6) the priority of natural resource development should be: water first, followed by coal, oil, and gas, the mining of minerals in the area and community development; (7) the county should promote and identify utility corridor and transportation routes for present and future development of natural resources to benefit both tourism and economy (Kane County, 1982a). Energy-related projects generating socioeconomic development impacts in county areas presently dedicated to rural agricultural uses and located in areas that have poor or no transportation access will be mandated to assess project impacts, identify plans to mitigate the impacts, and bear the major costs for mitigation (personal communication, McDonald, Five-County Association of Governments, 1982).

Relevant county zoning ordinance references, specifically related to coal mining in the Alton Areas, are as follows (Kane County, 1982b): All of the Alton Amphitheater and Flax Lakes tracts are zoned as agricultural, as are major portions of the Fisher and Mill Creek Canyon tracts. The Ford Pasture tract and small portions of the Fisher and Mill Creek Canyon tracts (including the logical portal areas) are zoned as multiple use zone MU-160. (The numerical designation MU-160 refers to minimum building or structure lot size in acres.) County zoning ordinances for the agricultural zone are written to preserve appropriate areas for permanent and temporary agricultural and open space uses. Uses normally and necessarily related to agriculture are permitted and uses adverse to the continuance of agricultural activity are not allowed. County zoning ordinance for the MU-160 zone are written to avoid excessive damage to watersheds, prevent or control water pollution, control soil erosion, and prevent excessive damage to land presently used for livestock grazing, forestry resources, and wildlife habitat. Coal mining developments in both zones are classified as "permitted conditional uses"... permitted when approved by the County Planning Commission, in accordance with ordinance provisions dealing with mining. Controls in the location and operation of coal mine activities and the requirements for reclamation of land subjectd to such activities are outlined in the planning document.

Socioeconomics

Population, Income, and Employment

The area of analysis for the southern Utah region includes Garfield and Kane Counties. The 1980 census population of that area was 7,697. The estimated 1982 population is 8,800. (Unless otherwise noted, this discussion will rely on the data from the 1980 census). These counties are typical of rural counties in Utah with the population concentrated in a few small communities along major roads. The largest of the communities in the area is Kanab with 2,148 residents and Panguitch with about 1,343 people. Kane County has an average household size of 3.12 persons, and Garfield has 3.00 both smaller than the State average of 3.20. Kane County had a 1980 mean household income of $14,200, significantly below the State mean income of $20,320, and Garfield is also low with mean household income of $14,956. Garfield and Kane Counties had total wage and salary employment of 1,786 and 1,017 in 1980 with unemployment rates of 7.4 percent and 5.2 percent, respectively. Unemployment rates in 1982 rose to 8.6 percent in Kane County and 15.3 percent in Garfield. The government sector is the primary employment sector for Garfield County. With the fall in demand for uranium, mining and milling employment has declined since 1980. Kane County's primary employment sectors are trade, government, and services.

Infrastructure

Housing

The majority of housing units in both counties are conventional single family houses. Kane County has about 7 percent of their housing units in mobile homes and Garfield has about 4 percent mobile homes. Detail relative to the existing housing supply is presented in Table 3-22.

Education

The Garfield County School District had a 1981 enrollment of 920 students and 50 teachers, while the Kane County District had 1,002 students and 47 teachers. This represents pupil/teacher ratios of 18 to 1 and 21 to 1 for Garfield and Kane, respectively. These figures are significantly below the State service guide of 25 to 1.

Water and Sewer

Adequacy of culinary water systems is determined by the Utah Department of Health based on three components: water rights, supply/flow, and storage. Table 3-23 summarizes these components for the two-county area.

Septic tanks are the primary waste water facilities in all the counties and are generally considered adequate, at least for the present.

Kanab City completed an extensive new sewerage project in 1981. The lagoon system has more than adequate flow capacity. Orderville, Glendale, Mt. Carmel are on a cooperative regional sewer system called the Long Valley Sewer System. The present system has a design capacity for 800 population, which is adequate for the present population. Alton residents use septic tanks for sewage disposal. Table 3-24 gives additional information.

TABLE 3-22
SOUTHERN UTAH EXISTING DWELLING UNITS MIX BY COMMUNITY

County	Conventional	Mobile	Multi-family
Garfield			
Panguitch	570	20	4
Hatch	73	5	0
Total	643 (95.7%)	25 (3.7%)	4 (0.006%)
Kane			
Kanab	601 (37.7%)	45 (6.53%)	43 (6.2%)
Alton	31	4	0
Glendale	65	11	0
Mt. Carmel	35	4	0
Orderville	129	6	0
Total	861 (88.4%)	70 (7.19%)	43 (4.4%)
Grand Total	1,504 (91.4%)	95 (5.8%)	47 (2.9%)

TABLE 3-23
SOUTHERN UTAH
SUMMARY OF WATER SYSTEMS

County	Source	Connections	Storage Capacity Gallons per day	Water Rights	Flow Gallons per minute
Garfield					
Hatch	wells	64	50,000	399	224
Panguitch	springs, wells	391	1,000,000	4,272	1,500
Kane					
Alton		25	18,000	204	215
Glendale		174	300,000	120	67
Kanab	springs, wells	1,290	3,500,000	11,026	2,917
Mt. Carmel		33	30,000	580	323
Orderville		175	550,000	336	189

TABLE 3-24
SOUTHERN UTAH SEWAGE AND SOLID WASTE DISPOSAL FACILITIES

Characteristics	Garfield County Hatch	Garfield County Panguitch	Kane County Alton	Kane County Glendale	Kane County Kanab	Kane County Mt. Carmel	Kane County Orderville
Sewage							
Capacity (100 gal/day)	--	--	--	800[a]	5,000	800[a]	800[a]
Flow gallons per minute	--	--	--	80,000[a]	1,200,000	80,000[a]	80,000[a]
System Type	Septic Tank	Septic Tank	Septic Tank	Lagoon	Lagoon	Lagoon	Lagoon
Plans for Expansion	no	yes	no	no	no	no	no
Solid Waste Disposal							
Type of Facility	Landfill	Landfill	Open Dump	Open Dump	Open Dump	Open Dump	Open Dump
Percent of Cap. Used	Adequate	Adequate	N/A	Limited	Limited	--	Limited
Type of Collection	Green Box	Green Box City	Voluntary	Boy Scouts	Private	Individual	Individual
City/County	County	County	Private	City	City	City	Glendale

[a]Long Valley.

Public Safety

In general the affected counties rely on the county sheriff for the major portion of their law enforcement capacity. The larger communities in each county generally have a separate police force and facilities. Summary law enforcement data for each of these counties are presented in Table 3-25.

The communities of Garfield County have well organized volunteer fire departments. Panguitch is currently recruiting a full-time fire chief to further enhance reliability. Response time is indicated at 3 minutes average with maximum time of 30 minutes.

Currently, there are no county-administered fire protection services in Kane County. All communities of the county have some form of fire protection plan ranging from well organized volunteers to a loosely organized effort of every available citizen. The entire county has only four fire fighting vehicles, one of which is a push cart pumper. Local officials, particularly on the west side of the county, indicated some reliance on Federal and State fire fighters.

Garfield County is served by the 14-bed Garfield Memorial Hospital in Panguitch. The hospital had a 43.1 percent utilization rate and a 4.61 day average length of stay. Medical manpower is provided by two physicians, 16 nurses, and one dentist. The emergency medical services within the area are provided by 41 EMTs and five ambulances.

Kane County has one hospital at Kanab with 33 beds with a 22.2 percent utilization rate. In 1981, there were 1,620 patient days and a 2.9 day average length of stay. The County is served by two physicians, two dentists, and 13 nurses. The County is also served by nine EMTs and two ambulances.

Much of the solid waste disposal in the study area is accomplished with open dumps that are not State approved; however, there are several areas that have approved landfills which are generally considered to be adequate for the present and immediate future. Table 3-24 contains detailed information on present facilities.

Garfield County operates a State-approved landfill which serves Hatch and Panguitch, as well as other county communities. Collection is relatively sophisticated, employing a "green box" method refuse collection. The County has an established fee for cities and for each resident for use of the "green boxes" and the landfill. The landfill has had difficulty in maintaining open hours so that individuals can bring large items to the landfill. For this reason, some additional open dump sites still remain in use.

Social/Attitudes

The area of Kane and Garfield Counties is comprised of sparsely populated Mormon communities whose growth has been slow and, with the exception of Kanab in Kane County, has experienced a population decline. There is generally a very favorable attitude toward development of the area's coal resources which

TABLE 3-25
SOUTHERN UTAH EDUCATION, HEALTH, AND
LAW ENFORCEMENT SERVICES 1982

Service	County Kane		Garfield
Education			
Enrollment	1,002		920
Excess Capacity			
Student/Teacher Ratio	21.1/1		18.4/1
Teachers	47		50
Health Facilities			
Hospital Beds	33		14
Doctors	9		2
Dentists	2		1
Nurses	13		16
Emergency Medical Technicians	9		41
Ambulances	2		5
Nursing Home Beds	13		0
Clinical Psych.		0.53	
Masters Degree in Social Work		3.0	
Law Enforcement			
Police	7		6
Police Cars	8		7
Fire Trucks	5		4
Number of Firemen	47		40
Jail Capacity	28		8

is strongly linked to a desire of the local populace to improve their economic base. The strong desire for growth has encouraged local officials to be active in pursuing growth and opposing those who for environmental reasons would place constraints on development. In Kane County, the Alton coal field is located near some of the State of Utah's most significant park resources, and environmental groups have opposed any development in the area.

Transportation

Road segments in the southern Utah area are shown on Figure 3-18. Vehicle transportation in the southern Utah area is primarily on US 89 which forms an L along the west and south sides of the coal tracts. It is the main route between Flagstaff, Arizona and the cities of the Wasatch Front in northern Utah and carries commerical and recreational traffic.

The county and other roads within the bend of the L of US 89 are generally not paved. Johnson Canyon Road is asphalted to the Skutumpah junction south of the Ford Pasture tract, and carries local traffic. The access road into Alton (U-136) is also asphalted. Other roads including a road eastward out of Glendale are graveled, or are graded and maintained. These roads are not suitable for large amounts of either auto or truck traffic.

A preparation plant and pumping terminal for a coal slurry pipeline was proposed for the Allen-Warner Valley project, but has not yet been built. It is assumed that this facility would be in operation by 1990 and would transport all of the coal from the proposed tracts to the potential market areas.

Cultural Resources

As discussed for central Utah, detailed knowledge of the cultural affiliation and density of prehistoric and historic archaeological sites is not available for the southern Utah coal tracts under consideration. The broad outlines of regional prehistory are documented, however, and include the following Aboriginal cultures; Paleo Indian, Archaic, Formative (Anasazi) and Post Formative (Ute and Southern Paiute).

Preliminary data results from a 20-percent simple random sample inventory with 5 percent additional coverage indicates a site density of approximately 11 sites per square mile (Nickens-Christensen personal communication, 1983) in the tracts. This is in agreement with previous inventories conducted in the area. There are no known National Register sites in the lease tract areas (Smith, 1983). At present, environmental variables or settlement patterns which affect site distributions have not been identified. Sites are generally temporary camps and limited activity areas, although two extended camps and a possible habitation are known to exist. Archaic, Anasazi, and Southern Paiute cultures are represented in roughly equal proportions. Cultural affiliation for two-thirds of the recorded sites has not been determined. Site significance ratings are generally low for such sites.

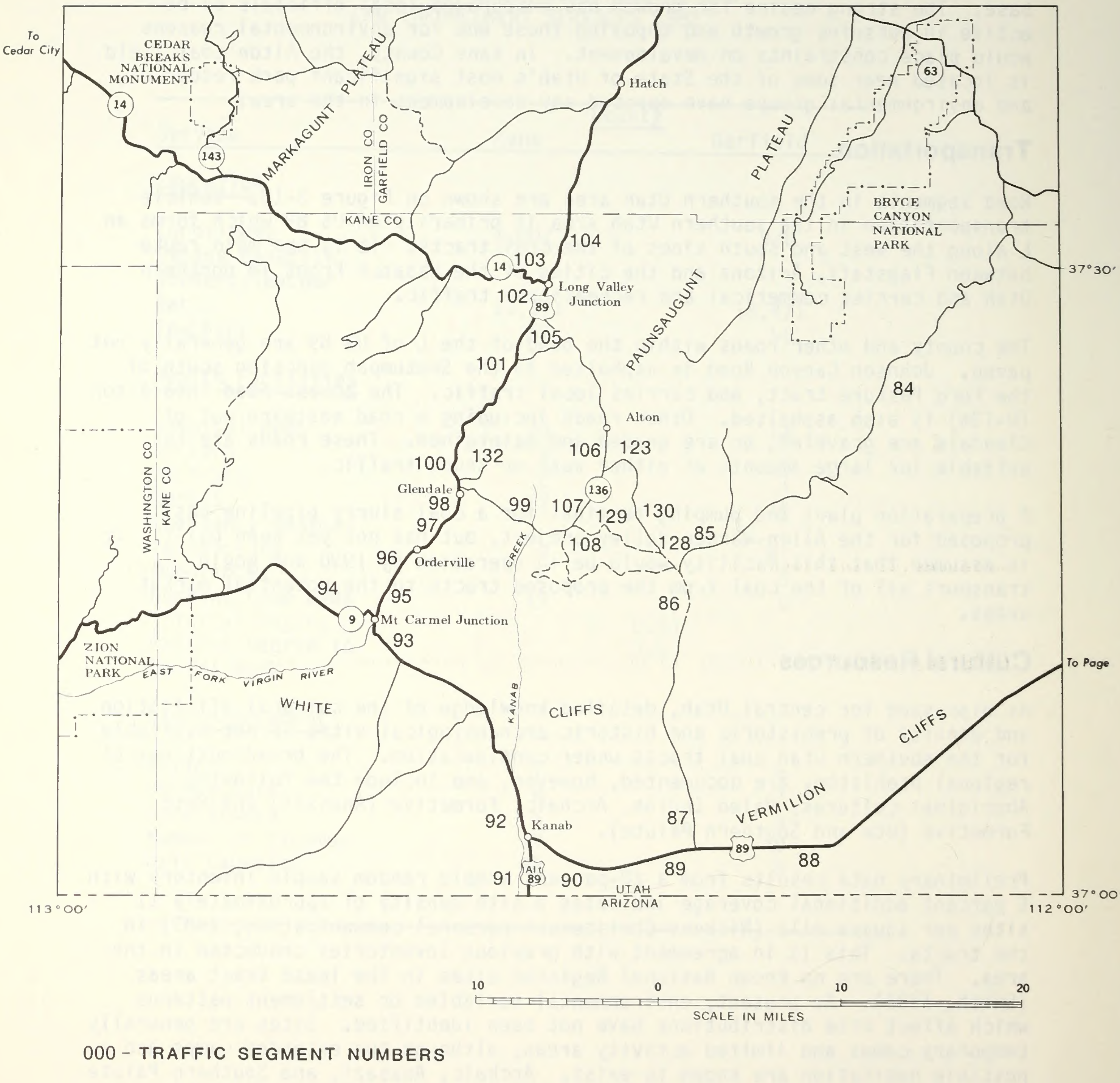


FIGURE 3-18
SOUTHERN UTAH REGIONAL TRAFFIC MAP

Recreation

Garfield and Kane Counties have an abundance of nationally significant recreation lands and are the two most tourism-dependent counties in Utah. Within the two-county region are portions of the Dixie National Forest, Bryce, Canyonlands, Zion, and Capital Reef National Parks, and Glen Canyon National Recreation area.

Nearly all land in the two county region is used for dispersed outdoor recreation (e.g., sightseeing, backpacking, camping, picnicking, big and upland game hunting, fishing, and off-road vehicle use). The Escalante and Paria rivers are known nationally for the outstanding backpacking and sightseeing opportunities they provide. If Statewide statistics are applied, approximately 18 percent or 1,540 residents of the two-county area presently hunt deer; approximately 2 percent or 150 residents hunt elk; approximately 9 percent or 748 residents hunt upland game; and approximately 45 percent or 3,960 residents fish (Thayne and Hudson, 1978). The success rate for big game hunting in the region is down from early 1970 figures, but the success trend has been generally up since 1975. The success rate for upland game hunting (birds/hunter day) in the region has been trending upward from 1974. In 1981, the region provided for approximately 16 percent of the Statewide sage grouse harvest. The region provided for less than 3 percent of the harvest for all other upland game species (UDWR, 1981b). If Statewide figures are applied, the success rate for fishing (fish/hour/fisherman) has been decreasing since 1967 (UDWR, 1981a; UWDR, 1981b; UWDR 1978). Of the total people hunting deer in the two-county region, about 25 percent originate in Garfield and Kane counties (UDWR, 1981). It is not known what percentage of elk hunters, upland game hunters, and fishermen originate from within the two-county region. Off-road vehicle activity is generally associated with hunting and fishing. Approximately 7 percent or 598 residents in the two-county region own motorcycles and approximately 35 percent or 3,080 residents presently own a 2-wheel truck or 4-wheel drive vehicle (UORA, 1978).

Despite the vast amount of dispersed recreation resources in the region, developed recreation sites (campgrounds and picnic areas), particularly campsites, are in short supply (UORA, 1973). Twenty of the 38 developed sites listed in Table 3-26 demonstrate 1981 use rates at or greater than capacity.

There are not sufficient golf courses, tennis courts, playing fields, and swimming pools in the two-county region to meet standards proposed by the State of Utah (UORA, 1973).

None of the proposed lease tracts contain developed recreation sites. The tracts support intermittent dispersed recreational activities generally associated with sightseeing. The Alton-Skutumpah road, segment numbers 84, 85, 106, 107, 108 and 128 of Figure 3-18, which would be a mining access road to all the tracts is also a popular recreational road for sightseeing south of Bryce Canyon National Park. Although the tracts are located near Bryce Canyon (approximately 3 to 15 miles away), none of the tracts are visible from the Park.

TABLE 3-26

RECREATION USE ON SELECTED DEVELOPED SITES IN GARFIELD AND KANE COUNTIES

Managing Agency and Site	Visitor Days[a]	Percent of Theoretical Maximum Capacity[b]
BLM		
Hog Springs	1,090	NA[c] (perceived to be under capacity)
Calf Creek	5,175	NA (perceived to be at capacity)
Lonesome Beaver	275[d]	NA (perceived to be under capacity)
McMillan Spring	230[d]	NA (perceived to be under capacity)
Starr Springs	3,330[d]	NA (perceived to be at capacity)
Deer Creek	1,500	NA (perceived to be under capacity)
Paria Picnic Area	NA	NA
Ponderosa Grove Campground	2,500[d]	NA
Paria-Hackberry Movie Set and Picnic Area	6,700[d]	NA
FOREST SERVICE		
Panguitch Lake North Campground	3,200	71
Spruces Campground	11,900	36
Duck Creek	57,700	43
Panguitch Lake South Campground	10,900	106
Pine Lake Campground	8,000	22
Blue Spruce Campground	900	14
Posey Lake Campground	4,900	14
White Bridge Campground	8,400	27
Antimony Creek Picnic Area	2,900[d]	70
Oak Creek	3,600[d]	32
Pleasant Creek	6,900[d]	32
Lower Browns	1,000[d]	12
Teah Campground	20,800[d]	53
Navaho Campground	16,800[d]	48
Kings Creek Campground	18,000[d]	47
Red Canyon	48,900[d]	48
NPS		
Bryce Canyon - North and Sunset Campgrounds	136,326[d]	(perceived to be at or above capacity)
Zion - South and Watchman Campgrounds[e]	276,206[d]	(perceived to be at or above capacity)
Capital Reef Campground[e]	31,686[d]	(perceived to be at or above capacity)
Glen Canyon - Bullfrog, Hite, Hall's Crossing, Wahweep, Lee's Ferry[e]	1,086,266[d]	(perceived to be at or above capacity)

continued

TABLE 3-26 (cont'd.)

Managing Agency and Site	Visitor Days[a]	Percent of Theoretical Maximum Capacity[b]
STATE OF UTAH		
Coral Pink Sand Dunes	17,906[d]	NA
Escalante Petrified Forest	27,705	NA
Kodachrome Basin	16,779	NA

Source: BLM, FS, NPS, State of Utah 1980-1981 visitor use figures through personal communications.

a Recreation use reported in visitor days. (Visitor day consists of 12 visitor hours which may be aggregated by one or more persons)

b Beyond 40-percent use, sites deteriorate rapidly, require heavy maintenance, and user experience levels diminish from overcrowding (i.e., loss of privacy, increase in noise, etc.)

c Not available

d Reported in number of visits - visitor day estimates are not available.

e Campground adjacent to Garfield/Kane Counties.

In a visitor survey of Bryce Canyon National Park (Kelly, 1980), 89 percent of the respondents said that natural forest, wildlife, and solitude are important characteristics of the Park.

Typical background sound levels measured in the Park are extremely low. In the absence of strong winds, ambient sound levels frequently fall below 20 dBA which is comparable to sound levels in a high quality recording studio. Even at higher visitor use areas, ambient sound levels frequently fall below 30 dBA during the day (Foch and Oliver, 1980).

Visual Resources

The scenic character of Garfield and Kane Counties is one of variation. The landscape includes sparsely vegetated desert valleys, forested plateaus, and colorful canyons. The region is rich in scenic attractions of national significance (see Special Designation Areas). Developments have had minimal impact on the region, which appears largely undisturbed by the presence of man.

The proposed coal tract lands have been inventoried for visual resource values. They have neither outstanding nor unique scenic values when considered in the physiographic region. They are located on rolling foothills covered with pinyon-juniper, oakbrush, scattered ponderosa, and sagebrush. Although located near Bryce Canyon National Park, the tracts are not visible from the Park. The VRM class ratings given to the tract lands are shown in Table 3-27. The VRM objectives for each class are described in Appendix 5. The tract lands appear natural. In the vicinity of the tracts, the town of Alton and the surrounding agricultural lands provide the only significant manmade contrast with the natural landscape.

Portions of all tracts are visible from the Alton-Skutumpah road (segments 84, 85, 106, 107, 108 and 128 of Figure 3-18) which receives approximately 19,400 visitors each year, the majority of which travel the road for the purpose of viewing the scenery, particularly the pink cliffs, south of Bryce Canyon National Park. Those portions of the Mill Creek Canyon and Fisher Canyon tracts where portal and associated surface facilities would most likely be located, however, cannot be viewed from the Alton-Skutumpah road. The Ford Pasture tract is readily visible from the Alton Skutumpah road at distances of approximately 1.0 to 5.0 miles, and as viewed from the road is in a visual line with the pink cliffs. Portions of the Alton Amphitheater tract including logical portal and surface development areas are readily visible from Utah Highway 136, which is a paved portion of the Alton-Skutumpah road, and from the town of Alton at distances of approximately 0.2 to 3.0 miles. Although portions of the Flax Lakes tract are highly visible from U-89 and from the Alton Skutumpah road including Utah Highway 136, those portions of the tract in which portals and other surface developments would logically be located are visible only from the Alton-Skutumpah road, and from there only at a distance of approximately 6.0 miles.

TABLE 3-27

VISUAL RESOURCE MANAGEMENT CLASSIFICATIONS
OF COAL TRACTS IN GARFIELD AND KANE COUNTIES

Tract	Classification	General Location of Classification Area
Alton Amphitheater[a]	VRM Class III	Area highly visible (foreground) from the Utah Highway 136 portion of the Alton-Skutumpah road.
	VRM Class IV	Remainder of tract.
Mill Creek Canyon[a]	VRM Class IV	Entire Tract
Fisher Canyon[a]	VRM Class III	Area highly visible (foreground) from the Alton-Skutumpah road.
	VRM Class IV	Remainder of tract.
Flax Lakes[a]	VRM Class III	Area highly visible (foreground) from Utah Highway 89 and from the Utah Highway 136 portion of the Alton-Skutumpah road.
	VRM Class IV	Remainder of tract.
Ford Pasture	VRM Class III	Area highly visible (foreground) from the Alton-Skutumpah road.
	VRM Class IV	Remainder of tract.

[a] This entire tract is either entirely or partially under private surface ownership. The VRM classification given is how the lands would be classified if entirely under Federal ownership. Although VRM classifications are not generally applied to private surface lands, they are applied here so that the effect of Federal coal leasing and development can be determined for private surface lands in the same manner as for Federal surface areas.

Special Designation Areas

The two-county region contains portions of four National parks, one National recreation area, one State reserve, five natural areas, one primitive area, and one natural landmark. Although there are no officially designated wilderness areas or wild and scenic rivers within the two-county region, there are 31 areas presently under wilderness review and six rivers presently being inventoried for wild and scenic values. In total, there are 40 areas in the region with special designation or potential for special designation. These areas are listed in Appendix 6. None of the above are located within the proposed lease tracts.

West-Central Colorado

Climate, Air Quality

Climate

West-central Colorado is located in a semiarid, continental climate regime, characterized by dry air, sunny days, clear nights, little precipitation, extreme evaporation, and large diurnal temperature changes. The region's complex topography causes considerable variation in site-specific temperature, precipitation, and winds; these influences are less on the plateaus than in the valleys. Generally, summer temperatures range from lows of 55 degrees F to highs of 90 degrees F. Winter temperature range from 15 degrees F to 40 degrees F. Frost-free periods vary from year to year and by location, but tend to range from 140 to 160 days. Annual precipitation is highly variable ranging from 7 to 25 inches, with slightly more than half of the moisture coming from late summer thunderstorms. Snowfall amounts vary from 15 to 100 inches.

Inversions are formed under stable conditions, trapping pollutants within a certain layer of air. Moderate inversions are typical during the summer in the evening and dissipate at dawn. Winter inversions are stronger and last longer.

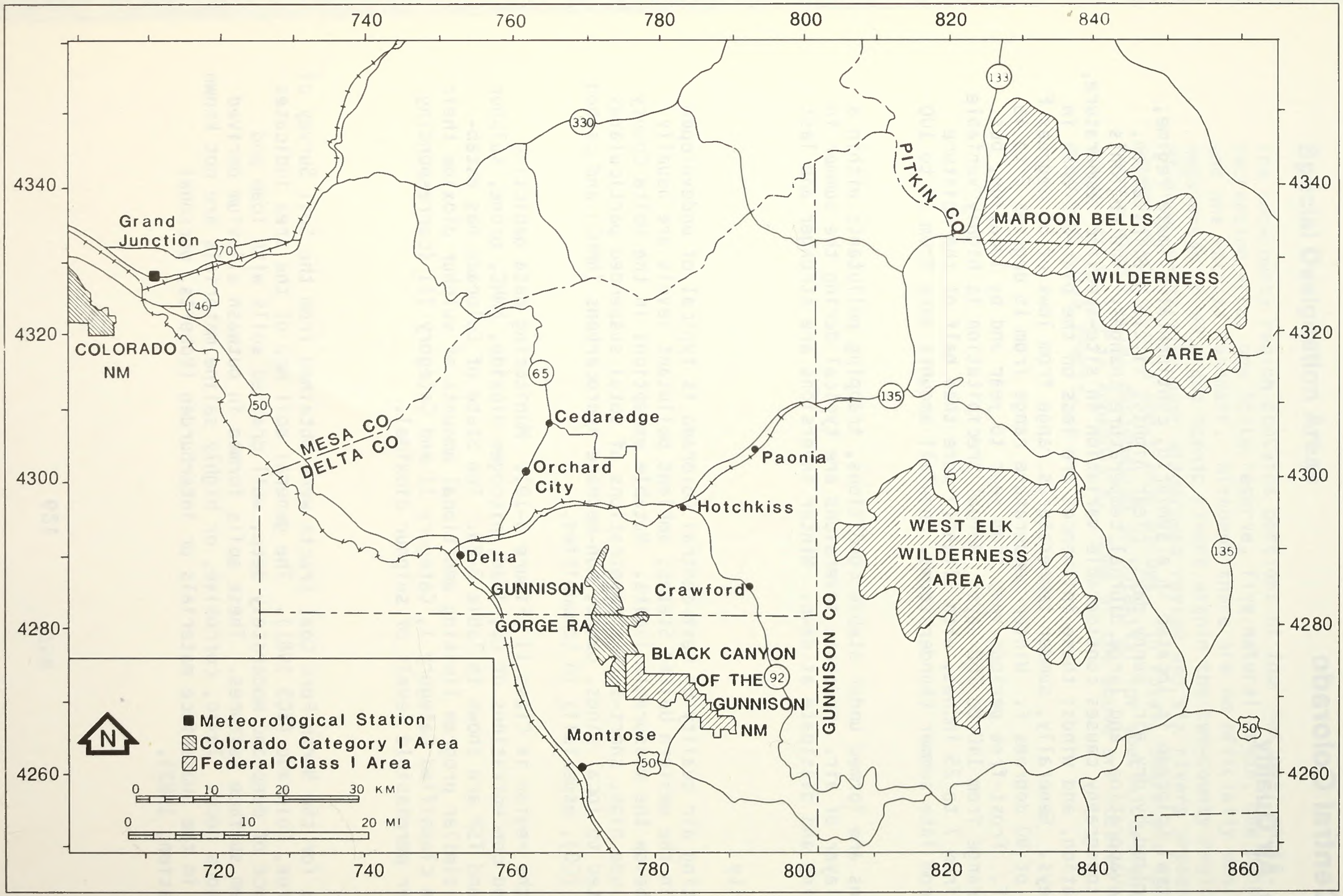
Air Quality

The existing air quality of west-central Colorado is typical of undeveloped regions in the western United States; ambient pollutant levels are usually near or below the measurable limits. Notable exceptions in the Delta County area include high, short-term concentrations of total suspended particulates TSP related to local winds, ozone, non-methane hydrocarbons (NMHC) and carbon monoxide (CO), especially in communities.

Most of the region is Class II (Figure 3-19). Monitoring data depicting background concentrations of CO, lead, nitrogen dioxide, NMHC, ozone, sulphur dioxide and TSP are shown in Table 3-28. The State of Colorado has established a similar program limiting additional amounts of sulphur dioxide their lands are classified Category I, Category II and Category III (corresponding to greater permissible levels of sulphur dioxide).

Soils

Soil data for the North Fork Coal tracts were obtained from the Soil Survey of Paonia area, Colorado (SCS 1981). The general soil map of the area indicates a dominance of deep and moderately deep, well drained soils with loam and stony loam surface textures. These soils formed in outwash alluvium derived from igneous rock. Toxic, corrosive, or highly saline materials are not known to occur in the subsurface materials or interburden (Roberts, personal communication, 1982).



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 3-19

LOCATIONS OF COLORADO CATEGORY I AND FEDERAL CLASS I AREAS IN WEST CENTRAL COLORADO

TABLE 3-28
WEST-CENTRAL COLORADO SELECTED POLLUTANT CONCENTRATION

Station/Period		TSP # Days	TSP Ann. Geo. Mean	TSP 2nd 24hr Max.	SO_2 Ann. Arth Mean	SO_2 2nd 3hr Max.	SO_2 2nd 24hr Max.	CO 1st 8hr Max.	CO Ann. 2nd 8hr Max.	CO 1st 1hr Max.	CO 2nd 1hr Max.	Lead Ann. Arth Mean	Lead 1st 1/4 Max.	T_{15} # Days	T_{15} Ann. Arth Mean	T_{15} 1st 24 hr Max.
Delta	1981	86	70	232												
	1980	80	74	231								(.30)	.40			
	1979	83	86	266								.40	.55			
	1978	89	94	226								.40	.70			
Fruita	1981	79	86	178										74	102	129
	1980	71	69	145												
	1979	77	76	164								(.35)	.45			
	1978	88	71	147												
Grand Junction	1981	84	77	232	13	52	21	9660	9315	18400	14375	.70	1.0	65	57	194
	1980	82	78	144				7015	7015	16100	13225	.75	1.0			
	1979	83	82	176				5060	4370	8050	8050	1.0	1.5			
	1978	85	74	142								.95	1.5			
Montrose	1981	85	60	155												
	1980	30	(74)	124								(.45)	.60			
	1979	80	66	154								.60	.75			
Ambient Air Quality Standards																
Primary			75	260	80	-	365	-	10000		40000	-	1.5			
Secondary			60	150	-	13000	-	-	-		-	-	-			

Source: Colorado Department of Health, n.d.

Note: Underlined values indicate violation of Ambient Air Quality Standards.
Parentheses indicate insufficient data to determine reliable average.
Ambient standards are the absolute maximum level, allowed to protect either public health (primary) or welfare (secondary). All figures in micrograms per cubic meter.

Prime and unique farmlands occur less than 2 miles downslope from the Paonia tract (SCS 1979). Approximately 50,560 acres of prime farmland and 8,000 acres of unique farmland are located in Delta County (SCS, 1979). No portions of the North Fork tracts are deemed unsuitable due to the presence of alluvial valley floors.

The present erosion rate for the soils occurring on the proposed lease tracts varies from 1 to 6 tons per acre per year. Differences in surface texture, structure, organic matter content, rock fragment content, slopes gradient and length, and protective cover account for this variability.

Reclamation potential is fair on both tracts. Precipitation and growing season length are favorable for successful seeding and planting of a wide variety of adapted plant species during most years. Limiting soil factors for reclamation are excess stones, excess lime, high erosion hazards, steep slopes, clayey subsoils, shallow soils and low available water capacity.

Establishing plants used in revegetation would take 2 to 5 years for recontouring, topsoil redistribution, seedbed preparation and seeding; and 4 to 5 years to establish vegetation cover sufficient for wildlife and livestock use. Seed planting should occur during the fall (October - November) to allow adequate soil moisture for seedling survival the following spring.

Minerals Resources

The Paonia-Somerset coal field in which the tracts are located contains approximately 215,550 acres of medium to high coal development potential deposits. The tracts total about 6,845 acres or about 3.2 percent of the total coal field.

Gas has been discovered adjacent to this coal field in the Mesa Verde Formation north of the lease tracts and the coal field is prospectively valuable for oil and gas. There are no known oil and gas deposits on the lease tracts; however, oil and gas are known to occur in the Entrada, Morrison, Dakota, Mancos Shale, Mesa Verde, and Wasatch formations. The tracts are presently leased for oil and gas.

Topography, Geology, Paleontology

The Paonia-Somerset coal field is located in the southeastern end of the Piceance Basin, bounded by the Gunnison Uplift to the south, the West Elk mountains to the east, and the Uncompahgre Plateau to the west.

The elevation varies from 5,500 to 9,500 feet above sea level in the coal field. Over half of the Paonia D Seam tract surface is steep sloping (34 percent), with only 17 percent of the surface gently to moderately sloping (0 to 15 percent). The rest is characterized by moderately steep slopes ranging from 16 to 33 percent. Weathering and water erosion dissect the slopes, creating rounded ridgelines and exposing prominent sandstone rock outcrops and cliffs.

The Cedaredge tract is characterized by moderately steep slopes, comprising about 70 percent of the surface. Seventeen percent is steep sloping, and about 13 percent is gentle to nearly flat.

The geologic formations occurring within the tracts are the Ohio Creek, and Mancos Shale and the coal-bearing Cretaceaous Mesa Verde formations. The coal is found in the Mesa Verde Formation and outcrops between the 7,000 to 7,500 foot elevation contour line.

The Somerset-Paonia coal field is within a seismically inactive area. There are no active faults adjacent to or on the tracts (Kirkham, 1981). However, a major fault (47 feet displacement) was encountered in the Orchard Valley Mine, adjacent to the Paonia D tract. The may extend into the tract; however, there is no surface evidence of faults.

No quantitative data exist for subsidence on or adjacent to the tracts, however,the surface effects of subsidence have been recorded in the study area (Dunrud, 1976). The overburden thickness ranges from 0 feet at the coal outcrop of the uppermost minable coal seam to 2,000 feet above the coal seam at the northern boundary of the tracts. Because of the rugged topography and the dip of the coal seam (approximately 3 degrees to 6 degrees north-northeast), the overburden gets progressively thicker to the north. The overburden thickness is generally less than 500 feet when the topographic elevation is between 7,500 and 7,700 feet above sea level. Subsidence is directly affected by the thickness of the coal seam mined (12 feet for the Paonia D tract and 4 to 11 feet for the Cedaredge tract), the overburden thickness, and overburden composition.

Other geologic hazards occurring on the tracts are landslides, unstable slopes, and rockfalls. These hazards usually form due to the clays and sandstones in the Mesa Verde Formation and between the contact of the Mesa Verde Formation and the Mancos Shale.

The Wasatch, Mesa Verde, and Mancos Shale Formations are known to contain invertebrate and plant fossils (Lee, 1912); however, no known fossils of significance have been found on or near the tracts.

Water Resources

The area is in the Gunnison River Drainage which is part of the Upper Colorado River Basin. The area is comprised of semiarid watersheds at the lower elevations and forested-mountain watersheds at the higher elevations. The lower-elevation watersheds are characterized by intermittent and ephemeral streams with surface runoff primarily occurring during high-intensity summer thunderstorms. Because of the low annual precipitation (7 to 12 inches) and high runoff potential, these areas contribute little to groundwater recharge. In contrast, the higher elevation watersheds are responsible for producing the majority of the river basins' water yield. These areas are characterized by perennial streams with high flows primarily occurring during the spring snowmelt. From late summer to early spring, streamflow is comprised mostly of groundwater discharge.

Because of local topography and geology, differences exist between surface water and regional groundwater divides. In the vicinity of the coal tracts, the surface water systems drain generally to the south and west while the regional groundwater flows in the direction of the geologic formation dip (3 to 6 degrees to the north-northeast). There are, however, several local (shallow) groundwater systems that discharge to the areas' surface water systems.

There are no special floodplains, municipal watersheds, or National Resources Waters located on the lease tracts.

Water Quantity and Distribution

The Paonia tract is dissected by several intermittent and ephemeral streams. There are also approximately 21 stockponds, three water pipelines, three irrigation water ditches and at least 16 springs located on the tract. East Roatcap Creek, located on the western portion of the tract, is used as an irrigation water conveyance system.

The Cedaredge tract supports two perennial streams (Camp Creek and Oak Creek) and several intermittent and ephemeral streams. There are also one stock pond, three irrigation water ditches, and an unknown number of springs on the tract.

Ground Water

The Rollins Sandstone, the lowest member in the Mesa Verde Formation, and some of the coal seams are the only potential aquifers associated with a regional groundwater flow system. The springs, seeps and baseflow associated with the Cedaredge and Paonia coal tracts are believed to be areas of natural discharge from local groundwater flow systems.

Faults and fractures in the Mesa Verde Formation are the primary paths through which water flows both vertically between rock strata and horizontally within rock strata. When faults and fractures are encountered within some of the present coal mines in the North Fork of the Gunnison River Valley, they produce mine inflows. The flow characteristics of these inflows depend upon the lateral extent and the proximity of the fault or fracture to a stream valley (Colorado Mined Land Reclamation Board, 1982).

Groundwater discharging in the area's surface water from the Mancos Shale is usually highly saline. The Mancos Shale Formation in the North Fork of the Gunnison River Basin is primarily responsible for contributing an estimated 72,600 tons per year of baseflow salt load to the Colorado River System (GS, 1980).

Water Quality

The major rivers in the study area show a progressive increase in salinity in the downstream direction. The primary source of the salinity is the Mancos Shale Formation. This formation is exposed in the low-lying portions of the study area and underlies more recent geologic formations in the higher areas.

Both natural and man-caused processes contribute to the salinity problem. Surface runoff dissolves salts contained in the soils overlying the Mancos Shale and groundwater dissolves subsurface minerals while flowing through the salt-laden shale layers. Agricultural irrigation practices contribute to the salinity increases by diverting water from the river systems, and through consumptive use by crops and evaporation. Salts are concentrated in the remaining water. In addition, SCS (1982) showed that most crops are irrigated in excess of normal water needs. Deep percolation of this excess water results in return flows through the salt-laden shale layers. The lower Gunnison River Basin which includes the North Fork of the Gunnison River, produces approximately 42 percent of its salinity by natural processes and 58 percent from agricultural irrigation practices and related water conveyance systems.

Data collected by the Bureau of Reclamation showed the total dissolved solids (TDS) concentration of the North Fork of the Gunnison River near Somerset, Colorado averaged 178 milligrams per liter; 25 miles downstream, near the confluence with the Gunnison River, the TDS averaged over 1000 milligrams per liter.

The sediment yield throughout the study area varies considerably. Some of the controlling factors are: drainage size, slope, soil texture, amount of vegetation cover, and amount of surface disturbance. The low-lying areas, comprised of soils derived from Mancos Shale, can yield on the average 16 tons of sediment per acre per year (GS, 1971), whereas, the higher-elevation watersheds typically produce less than 1 ton per acre per year.

Depending on the controlling factors discussed above, the annual sediment yield on the Paonia and Cedaredge tracts varies from less than 1 to 5 and from 1 to 7 tons per acre, respectively.

Geological Survey is currently completing a groundwater study of the Paonia D and Cedaredge tracts. The study will describe the groundwater systems and potential impacts from subsidence in greater detail than is presented in this document and will be referenced in future actions on both of the tracts.

Water Rights and Uses

The study area is within District 40 of Colorado Water Division 4. Presently, all surface and groundwater within the District is appropriated by the State of Colorado. There are several water decrees in or adjacent to the coal tracts with uses including: irrigation, industrial, recreation, and domestic (municipal and livestock). Water flowing off the tracts is crucial to satisfy water decrees downstream. In the 1981 water year, District 40 had direct flow diversions amounting to approximately 388,000 acre-feet. Water use estimates are as follows: irrigation (90 percent); domestic (municipal and livestock) (6 percent); industrial (3 percent); trans-mountain diversions, less than 1 percent. (Colorado Water Division, 1981).

Vegetation

Vegetation types within the study area consist of Agricultural, Riparian, Saltbush, Sagebrush, Pinyon-Juniper, Mountain Shrub, Aspen, Spruce-fir and Mountain Meadows. The proposed lease tracts are dominated mainly by Pinyon-Juniper and Mountain Shrub, with small acreages of Sagebrush, Aspen and Riparian vegetation types. A list of the dominant species found in each vegetation type is found in Appendix 4.

Inventories and literature searches conducted by the Natural Heritage Inventory (Lapin and Peterson, personal communication, 1982), Bureau of Land Management, and the North Fork coal companies have not located any endangered, threatened or sensitive plants in the vegetation types found on these coal tracts in the North Fork Valley.

Wildlife

Both tracts have populations of terrestrial wildlife species typical of pinyon-juniper, mountain brush zones, aspen, and deciduous riparian habitats in west-central Colorado. Approximately 85 percent of the Cedaredge tract and 50 percent of the Paonia tract are crucial deer and elk winter range. Most of the remaining acreage could be classed as intermediate range. A substantial, but unquantified amount of crucial winter range is provided by private land. The fencing of about 1,500 acres of orchards and the conversion of private farmland and native range to housing and industrial uses is causing reductions in available winter range (Taylor, personal communication, 1982).

The Paonia and Cedaredge tracts are in Game Management Units 521 and 411. Pellet group counts conducted by the Bureau, Colorado Division of Wildlife (1969) and Colorado Westmoreland, Inc. (1981-1982) have been used to estimate deer and elk densities for these tracts. Winter mule deer densities are estimated to be 186 deer per square mile on the Paonia tract and 152 deer per square mile on the Cedaredge tract. Winter elk density figures are estimated at 22 elk per square mile on the Paonia tract, and 30 elk per square mile on the Cedaredge Tract. The actual densities would vary yearly depending on the severity of the winter. There are no resident elk on either tract; summer mule deer densities are estimated at 10 deer per square mile.

Big game mortality from vehicle collisions is a problem throughout the North Fork area when the animals are concentrated on the winter range. These losses are especially evident when traffic densities are increased due to coal production and haulage. During the winter of 1981-82 about 20 deer and one elk were killed by vehicles directly connected with coal production adjacent to the Paonia tract (Craig, personal communications, 1982).

Black bear densities in the lease tract areas are unknown, but fluctuate seasonally. Typically in this region most of the bears move into the oakbrush zone in August where they feed actively while preparing for hibernation (Beck, 1982). Therefore, the oakbrush types present on these tracts may be essential to the local bear population. Two bears were harvested on the Paonia tract during the 1981 season (Craig, personal communications, 1982). Mountain lion numbers on these tracts probably fluctuate seasonally with the occurrence of their principal prey, mule deer. There are no estimates of density for this area.

Riparian habitat is the most productive and limited habitat type in the area (Thomas, et al., 1979; Johnson, et al., 1977; Bottorff, 1974). All of the perennial and ephemerial streams, and some irrigation canals provide some type of riparian habitat. These habitats are essential to many species of nongame birds and mammals as well as serving as migration corridors for big game species. None of the streams on the tracts are sport fisheries but all support some aquatic life including nongame fish.

A number of species of birds of prey are found in the region. Repeatedly used nest sites have been identified for golden eagles and red-tailed hawks only. Coopers hawks have been sighted on the Paonia tract, but no nest site has been found (BLM, 1982d).

A 1978 through 1980 Bureau of Land Management inventory (BLM, 1981d) has shown that bald eagles (Haliaeetus leucocephalus) use the proposed tracts on an incidental basis from November until April. The North Fork of the Gunnison receives a moderate amount of use. No roost areas have been identified in or near either lease tract.

Land Use

The predominant land use in the North Fork Valley is agriculture associated with cattle and sheep ranching and orchards with a few vineyards scattered throughout the valley. Local ranchers depend heavily on Federal land for grazing. However, in the Cedaredge area the majority of the farms are orchards owned by retired persons with less emphasis on large family ranches and less dependence on Federal land.

In 1981, there were eight producing coal mines as well as numerous abandoned coal mines in the area. Approximately 90 percent of the Federal lands in the North Fork Valley area are leased for oil and gas.

There are three irrigation ditches (Hossier, Eagle, and Sandburg) and one unnamed reservior on the Cedaredge tract. The Paonia tract contains seven rights-of-way and three irrigation ditches (Overland Ditch, the ditch off Roatcap Creek, and the ditch off Terror Creek). Water requirements both for coal production, agriculture, and domestic use are obtained from irrigation ditches or from other water sources such as wells, streams, or lakes in both areas.

The Stevens Gulch public road, which provides access to Forest Service lands, passes through the Paonia Tract.

Land Use Plans, Controls, and Constraints

Delta County does not have detailed land use plan or zoning regulations. A county land use plan is scheduled for completion sometime in 1983.

The Colorado tracts were considered in BLM's North Fork land use plan amendment completed in 1981 and were found acceptable for further leasing consideration through application of the unsuitability criteria in 43 CFR 4361.

Socioeconomics

Between 1974 and 1981 Delta County experienced a 30-percent population increase, a 29-percent growth in employment and a 53-percent rise in personal income. Over this period coal production in the North Fork Valley of Delta and Gunnison Counties rose from 1.26 to 2.97 million tons annually. This represents an 136-percent increase in coal production. This coal production increase was accompanied by a corresponding rise in mine employment from 416 to 897 employees.

Delta County received $619,000 in coal tax revenues in 1981 which includes Federal royalty and State severance taxes. Mine employment in Delta County was responsible for approximately 13 percent of total labor and properties income in 1980 falling only behind retail trade and government enterprises as sources of income. Though mining represents a relatively small part of the economy of Delta County, the increase in population, employment and personal income experienced over the 1974 to 1981 period can be shown to be highly correlated statistically with North Fork Valley mine employment.

In 1981 Delta County experienced a 4.3 percent unemployment rate. In August 1982, two of the eight mines that produced coal in 1981 were closed, three are producing at lower levels, and one is reaching the end of a short-term potentially renewable production contract. Only one mine is under a long-term contract and is assured of continuing to produce at 1981 levels. Between January and June of 1982, unemployment increased from 5.8 to 8.3 percent.

Infrastructure

A 30-percent increase in population over 8 years has left the communities in Delta County with infrastructural deficiencies. Continued population growth at 1974 to 1981 rates would place a strain on local and county governments in financing additional facility expansion.

A breakdown of Delta County infrastructural facilities reveals that problems currently exist in Delta County fire fighting capabilities in four communities, health care facilities in three communities, police protection in one community, sewage capacity in three communities and water storage and delivery capacity in four communities.

Social Conditions

Delta County had a 1981 population of approximately 21,272. A socioeconomic survey of Delta County residents was conducted in 1981 concerning their perceptions and ideas about energy-related growth. In general, respondents felt that clean air and scenery should not be sacrificed to meet the country's energy needs (62 percent). Most agreed that the costs of growth related to energy production should not be borne by the residents (76 percent) and since increased job opportunities were seen as a positive benefit resulting from energy develoment, many (48 percent) foresaw increased crime as an adverse effect of energy development.

Crime rate, a major indicator of disintegrating social ties in a community, increased 230 percent in Delta County between 1974 and 1980, compared to a 37-percent increase for the State of Colorado between these years. Increased crime rates, alcohol and drug abuse, higher divorce rates, and increased levels of violence within the family are thought to be major effects of disintegrating social ties in rural communities resulting from rapid growth.

Transportation

The Paonia tract is accessed by the paved Stevens Gulch road off Colorado State Highway 133. Several other primitive unsurfaced roads exist in the tract and provide access to private and Federal land.

The daily traffic volume (DTV) from Paonia to Hotchkiss on State Highway 133 was 3,000 in 1980 (Colorado Department of Highways, 1980). Traffic peaks in the months of July and August, and is comprised of recreational, agricultural, and coal development associated traffic. Construction of a new alignment for State Highway 133 is in progress. The old highway will be used for local traffic, including coal trucks, while through traffic will be routed to the new highway. When completed, the new highway will result in a major reduction in the 190 reported accidents during 1978 (which included 2 fatalities and 57 other injuries), and property loss which exceeded $670,000 (Colorado Department of Highways, 1978).

The Cedaredge tract is accessed by State Highways 65 and 92 and county road 2075 from Delta, Colorado. The DTV on State Highway 65 at the intersection with State Highway 92 has averaged 3,850. Studies have shown an average of almost three accidents per year at this intersection. Other unsurfaced county roads also provide access directly to the tract. No traffic data are available for these roads.

The Denver and Rio Grande Western railroad spur from Grand Junction is used solely for coal haulage. The line ends just past Somerset at the Hawks Nest Mine and connects loadout facilities of several coal mines along the route. Rail service is at Delta, Colorado, 14 miles to the south of the Cedaredge tract. Two 100-car train loads of coal use the tracks between Somerset and Grand Junction and return every day. Coal cars are sided at loadout facilities until they are filled with coal near Delta and Paonia.

Cultural Resources

Approximately 30 percent of the Paonia tract was inventoried for cultural values at a Class III (100 percent) level and eight sites were located. In addition, the area surrounding the tract has been subject to other inventory efforts and eight additional sites were found. Consultation with the State Historic Preservation Officer (Dec. 10, 1981) during the unsuitability process

(43 CFR 3461.1 (q)(1)) identified eight of the sixteen recorded sites as eligible to the National Register of Historic Places. Three sites: a circa 1910 homestead, a circa 1919 homestead, and a 1925 homestead, lie within the lease tract. Five other sites, prehistoric lithic scatters, and a historic sawmill lie outside the lease tract area.

The Cedaredge tract has had minimal inventory conducted on it and to date no cultural values have been located. Consultation with the State Historic Preservation Officer (Dec. 10, 1981) during the unsuitability process (43 CFR 3461.1 (q) (1)) identified no additional sites eligible to or listed on the National Register of Historic Places on the tract.

Recreation

The lease tracts do not contain developed recreation facilities or sites, nor do they exhibit a potential for future development. Both tracts support opportunities for some incidental or intermittent dispersed recreational activities (e.g., hunting). However, neither tract is recognized as having exceptional opportunities for any specific recreational activity. Visitor use is unquantifiable since the marginal recreational demand has never warranted special efforts to collect visitor use data. Less than 25 deer hunters would use the general area within and surrounding the lease tracts on any one day of the regular deer season.

Regionally, the areas in the bottom of the North Fork Valley and in the surrounding high country have high recreation values and support most types of recreational activities. The intermediate hills (the public lands managed by BLM in which the lease tracts occur) have a relatively low value and capacity to attract and support recreation use. The privately owned pastoral lands of the valley bottom and the lands in the high country, such as Grand Mesa and the Ragged Mountains, possess a greater diversity of environments and features which provide outstanding opportunities for hunting, fishing, camping, picnicking, cross-country skiing, and snow mobiling.

Visual Resources

The character of the landscape in the Cedaredge and Paonia D seam coal lease tracts is defined by the steep, stream dissected slopes common in the southern foothills of Grand Mesa defining the North Fork Valley. The Cedaredge tract is dominated by evergreen, pinyon-juniper vegetation, while the Paonia D seam tract is dominated by mountain shrub vegetation. The setting of both tracts is primarily agricultural and natural with farms, ranches, and orchards dominating the activities in the valley. Small towns and dispersed urbanizing areas are found along the main highways. Coal mines, loading sites, and a railroad are found in the vicinity of the Paonia D seam tract.

About 10 percent of the Paonia D seam is visible from Paonia and Highway 133 in the foreground-middleground, and about 40 percent in the foreground from Stevens Gulch Road. The rest of the tract is seldom seen. Roughly half of the Cedaredge tract is visible in the background from the town of Cedaredge and Highway 96.

Preliminary visual management Class III is applicable to all areas visible from State Highway 133 and Stevens Gulch Road in the foreground-middleground, and Class IV to all seldom seen areas. Class V rehabilitation goals apply to exploration, drilling, and road modifications affecting about 15 acres on both tracts.

Special Designation Areas

The Adobe Badlands (BLM) and a portion of the Gunnison Gorge (BLM) Wilderness Study Areas are located within Delta County. The West Elk Wilderness Area lies immediately east of the general lease tract area. The Gunnison Gorge Recreation Lands (BLM), Black Canyon of the Gunnison National Monument (NPS), Needle Rock Natural Area (BLM), and a portion of the Gunnison River (BLM/NPS), which has been recommended for inclusion into the Wild and Scenic Rivers System, also occur within the general study area. None of the above areas are within the proposed tract lands.

preliminary development proposal ... from State Highway 139 and Stevens Gulch Road in the ... area ... on BLM land ... road construction ... about 49 acres ... tracts.

Special Designation Areas

The Rocks Sections (Dinosaur) ... Gunnison Gorge (BLM) Wilderness Study Areas are located within Delta County. The ... Wilderness Area ... immediately east of the general study area. The Gunnison Gorge Recreation Lands (BLM), Black Canyon of the Gunnison National Monument (NPS), Needle Rock Natural Area (BLM), and a portion of the Gunnison River ... which has been recommended for inclusion into the Wild and Scenic Rivers System, also occur within the general study area. None of the above areas are within the proposed tracts.

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter analyzes anticipated impacts arising from implementation of any one of four alternatives. Discussions for each alternative focus on three separate geographical areas: central Utah, southern Utah, and west-central Colorado. No impact interactions are anticipated between the three areas. The analyses presented are for the most part summaries of more detailed technical reports prepared by resource specialists from Bureau of Land Management, Forest Service, Geological Survey, the State of Utah, and Sanpete County. Copies of these reports are available for review at BLM Utah State Office, FS Supervisor's Office in Price and Richfield, Utah, and BLM Uncompahgre Area Office in Montrose, Colorado. Where reliable sources of information or references were unavailable, analyses were based on the professional judgments of the resource specialists.

Discussion of impacts is focused on those resources which would be most significantly affected. The majority of physical impacts would be restricted to the actual tracts. However, anticipated impacts to resources such as air quality, socioeconomics, transportation, recreation, and visual resources would have regional implications and are considered on a broader basis. Additional site specific environmental analysis will be required upon submission of mine plans for the individual tracts.

The first section of this chapter consists of analysis assumptions and guidelines used in impact analysis. This section is followed by the general impact analysis which constitutes the main body of the chapter. Also included are regional summaries of unavoidable adverse impacts, the relationship between the short-term use of man's environment and the maintenance and enhancement of long-term productivity, and irretrievable or irreversible commitment of resources. The final section under each alternative is a synopsis of significant cumulative impacts for each geographical region.

Analysis Assumptions and Guidelines

Impact analysis assumes that appropriate laws, regulations, and the mitigating measures listed in Appendix 3 will be applied and enforced. The following basic assumptions and estimates were made to facilitate analysis of the environmental impacts of mining and other coal related developments considered in this EIS:

1. Where a tract has the potential to be developed independent of adjacent operations or leases, the analysis is based on that assumption even though the probability is that the tract would be developed from adjacent properties.

2. The impacts described in this chapter that are attributable to Alternatives One through Three would be in addition to baseline impacts described in Alternative Four (No Action). The cumulative impacts that

would result by the year 2000 can be determined by adding the projected impacts from proposed leasing to the projected baseline impacts from other development. To facilitate the identification of significant cumulative impacts, a summary analysis of such impacts is presented at the end of each alternative discussion.

3. Timeframes for the proposed tracts to be addressed:

1984 - Proposed Round Two leasing.
1987 - Exploration and construction period begins (first year of appreciable impacts mainly from exploration).
1990 - Coal production would begin.
1995 - Full production reached (significant impacts still accumulating).
2000 - Expression of maximum impacts that would continue through the life of the mine.

Exploration would be conducted from 1987 through 1989. Mine construction would begin in 1987 and full production reached by 1995. Impacts are analyzed only to the year 2000. Percent recovery for each tract is identified in Chapter 6.

4. Coal production figures are based on a 23- to 50-percent recovery rate for underground mines and an 85- to 90-percent recovery rate for surface mines.

5. Mine production would average 15 tons per man-shift for underground mining and 75 tons per man-shift for surface mining.

6. In underground mines, longwall mining methods would be used where technically and economically feasible. Room and pillar methods would be used where necessary.

7. Lands disturbed by exploration and mining activities would be reclaimed. Lands utilized in community development or retired to provide community or mine water would not be reclaimed or returned to their original use.

8. Community development would be at the rate of approximately 18 people per acre; half of this land would come from irrigated cropland.

9. Water needs for mining and expanded communities would be met by obtaining rights to irrigation water. For each acre of community development, an additional 0.75 acre of irrigated cropland would be retired to provide community water needs. Mining would require an average of 7 gallons per ton of coal produced.

10. Annual water use per person would be at the rate of 225 gallons per day (4.5 acre-feet/18 people/year). The water required to irrigate 1 acre annually would supply the annual water needs of 14.3 people (3.6 acre-feet/acre/year).

11. Sewage treatment plants and effluent would conform to State and/or Environmental Protection Agency standards.

12. The planned Castle Valley Railroad Spur would be built by Denver and Rio Grande Western (D&RGW) and functioning by the time the tracts begin producing coal. Current plans call for the railroad to be functioning by 1985.

13. Traffic projections for 1995 are based on historic trends plus projections for a baseline coal production rate of 21.6 million tons per year between 1990 and 2000 and the distribution of increased population resulting from Federal coal leasing considered in this statement.

14. Future traffic would be accommodated on the existing and proposed highway system. Shortfalls in capacity would be accommodated through upgrading of the specific overloaded elements of this system.

15. Coal-haul trucks using public roads would have a net load capacity of 40 tons.

16. Coal transportation in central Utah and west central Colorado would be to railroad loading facilities by truck.

17. Coal transportation in the Alton coal field would be by truck to a slurry pipeline originating from the Bald Knoll area.

18. Incidental service-truck traffic to mines would be 20 visits per day per million tons per year of coal production.

19. On tracts where portal area size was not estimated site specifically, it is assumed that if production is greater than 1 million tons per year the portal would require 20 acres; if production is less than 1 million tons per year, the portal would require 10 acres.

20. On tracts where ventilation shafts for underground mines were not estimated site specifically, it is assumed that two 1-acre areas for ventilation shafts would be developed by the year 2000. Access for assumed ventilation shafts would be through the mine. Where outside access for ventilation shafts would be needed, it is assumed that access road width would be 20 feet.

21. It is assumed that four to six 0.1-acre drill hole sites would be required for each section of land in the tracts depending on complexity of the geologic structure. It is also assumed that existing access would be utilized where possible and on the average 0.25 to 0.5 mile of 12 to 25-foot-wide disturbance for new roads (depending on slope) would be required for each bore hole. Some upgrading of existing roads may be required, but roads would not be substantially widened. Exploratory drill hole pads and roads would be reclaimed immediately unless the disturbance would occur on sites that would later be used for portals or other project components.

22. Main access and truck haul roads would disturb 10 acres per mile (82.5-foot width).

23. Reclamation of surface-mined land would involve separate stockpiling of overburden and surface soils. Prior to replacement of surface soils, the overburden would be replaced as slightly undulating terrain in order to minimize long flows and concentrations of water runoff. The surface soils would then be replaced on the reshaped overburden.

Alternative One: Maximum Level (1.907 Billion Tons)

Central Utah

Climate, Air Quality

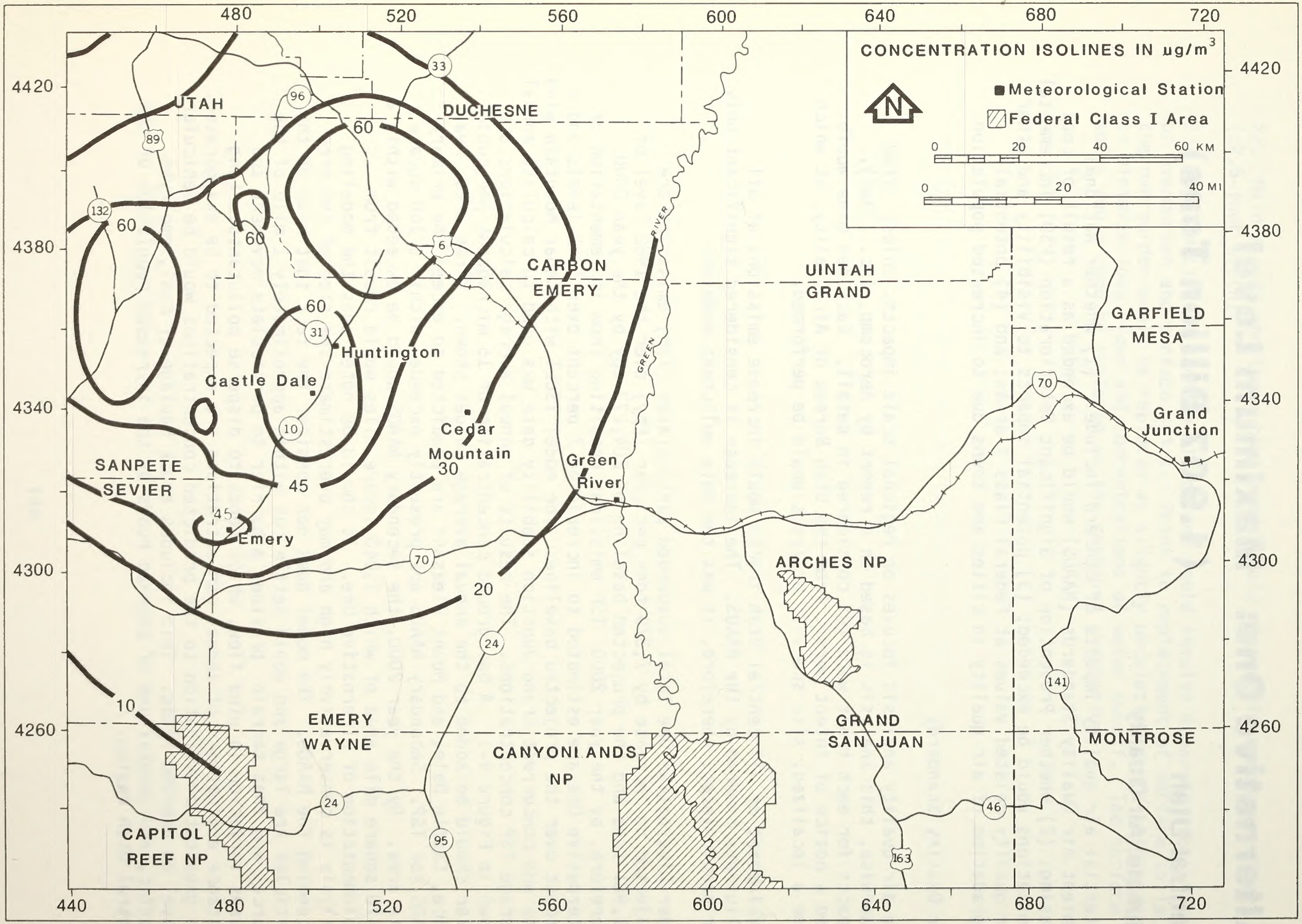
Potential air quality impacts of concern include: (1) whether National Ambient Air Quality Standards (NAAQS) would be exceeded as a result of coal leasing; (2) whether Prevention of Significant Deterioration (PSD) incremental limitations would be exceeded; (3) potential impacts to visibility and other air quality related values at Federal Class I areas; and (4) potential degradation of air quality in cities and towns due to increased population.

Air Quality Standards

The air quality analysis focuses on regional scale impacts. Unless cited otherwise, this analysis is based on a report by Aerocomp, Inc. (1982). Impacts for each tract were not considered in detail. Each new mine would need a notice of intent permit from the Utah Bureau of Air Quality, at which time a localized, site specific analysis would be performed.

Development of all central Utah tracts would increase emissions of all pollutants covered by the NAAQS. The increase is considered significant only for particulates; therefore, it was the only pollutant modeled.

Under Alternative One total suspended particulates (TSP) emissions are projected to increase by 7,379 tons per year (tpy) over the 1982 level of 111,981 tons and the projected baseline of 204,273 tpy by the year 2000. Therefore, by the year 2000, TSP emissions resulting from implementation of Alternative One are estimated to increase by 7 percent over 1982 levels and 4 percent over the projected baseline. The model ISCLT with Cedar Mountain wind data and concurrent Grand Junction stability data was used to calculate annual average TSP concentrations. The results of annual average calculations are shown in Figure 4-1. A background concentration of 15 micrograms per cubic meter should be added to the annual average values shown. Three areas near Price, Castle Dale, and Mount Pleasant are predicted to exceed the primary NAAQS for TSP. Secondary NAAQS are presently exceeded within a 160 square mile area. By the year 2000, the secondary NAAQS would be exceeded within a 2,470 square mile area of which 1,040 square miles would result from implementation of Alternative One. It should be noted that the modeling analysis is conservatively high and may overestimate the size of the area exceeding the NAAQS. The model does not consider the fact that most of the particles are large and would settle out within approximately 1 mile of the source, and that terrain provides a barrier to particulate movement and causes variation in wind flow, which tends to disperse pollutants. Long distance estimations of annual concentrations are expected to be exaggerated. The greatest contribution to the predicted concentrations would be vehicular travel on unpaved roads. This includes truck haulage of coal, employee traffic, and general use of unpaved roads by the increased population of the central Utah region.



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 4-1
ANNUAL AVERAGE TSP CONCENTRATIONS IN CENTRAL UTAH - YEAR 2000
ALTERNATIVE ONE

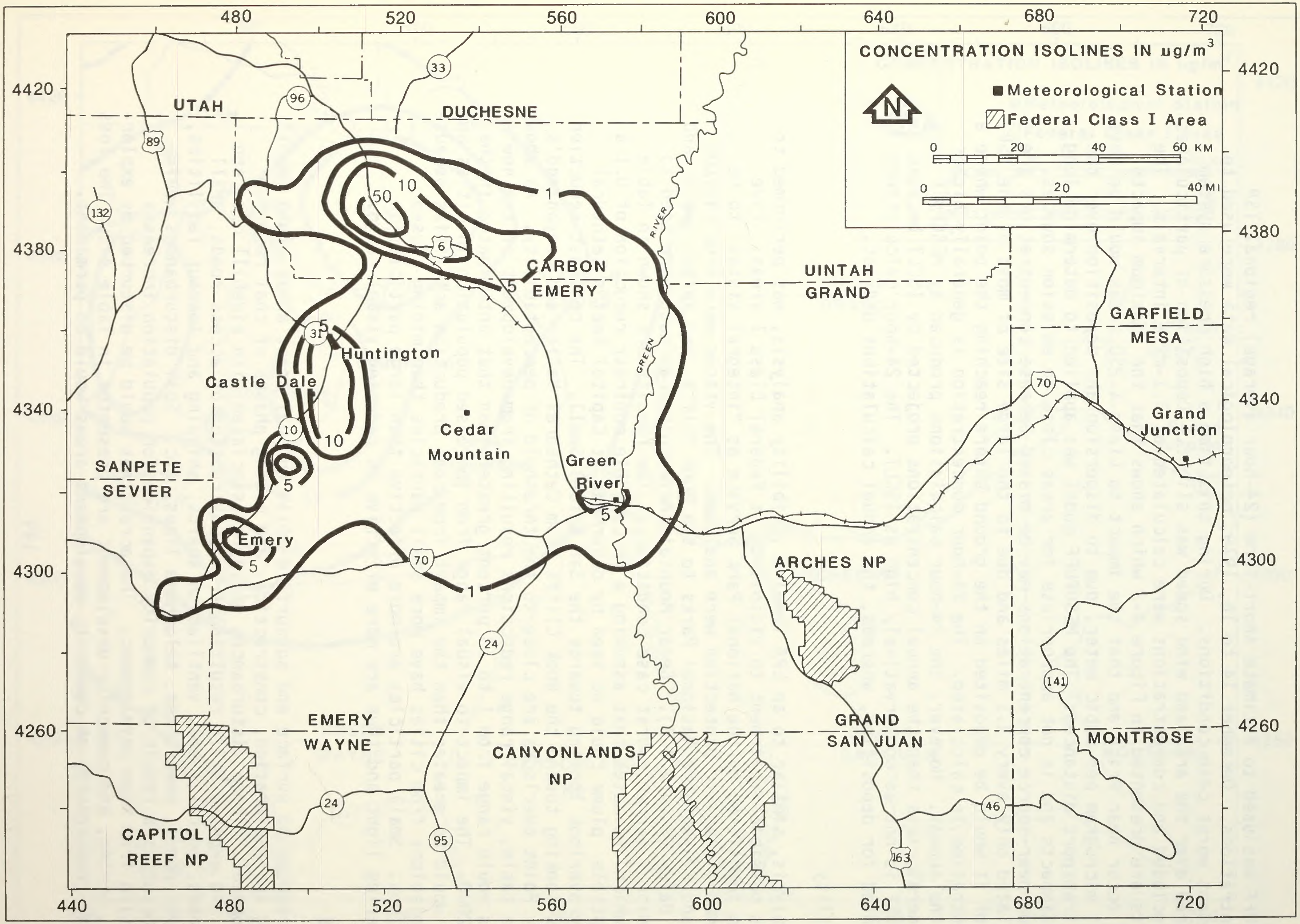
MESOPUFF was used to estimate short-term (24-hour average) regional TSP concentrations. December 14 to 16, 1979, meteorological data were used to represent worst case conditions. During this time a high pressure system centered over the area and wind speed was slight. Deposition of particulates was included and concentrations were calculated at 3.1-mile intervals. The results are presented in Figure 4-2 which shows that the maximum impacts would occur near Price and that the impact to Class I PSD areas would be less than 1 microgram per cubic meter, due to dispersion and deposition over the long transport distances. The MESOPUFF model was applied to determine long range impacts and is not appropriate for areas close to emission sources. Maximum near-source concentrations may be missed because concentrations are calculated only every 3.1 miles and due to the large size of most of the TSP, much of it would be deposited on the ground before reaching the point where a concentration is calculated. The 24-hour concentration is generally higher than the annual. However, the 24-hour calculations produced by MESOPUFF were, in general, less than the annual concentrations projected by ISCLT because MESOPUFF is not as conservatively high as ISCLT. The 24-hour calculations accounted for deposition, whereas, the annual calculations did not.

Visibility

An analysis, similar to an EPA level-2 visibility analysis, was performed to assess possible impairment to visibility at Federal Class I areas. Five vistas identified by the National Park Service as "integral vistas" to be afforded visibility protection were analyzed. The vistas were from Capitol Reef and Canyonlands National Parks to the Book Cliffs, San Rafael Swell, and Mount Baldy (Figure 4-3). Cedar Mountain meteorological data were used to determine 1 percent worst case conditions. The results are shown in Table 4-1, which indicates that assuming a perceptible contrast reduction of 0.1 a perceptible plume could be seen by observers at Capitol Reef's Cathedral Valley overlook looking towards the San Rafael Swell. The contrast reduction values looking toward the Book Cliffs from Cathedral Valley and Canyonland's Murray Point overlooks are close to the threshold of perceptibility. As shown in the table, visual range reductions resulting from development of the new tracts would range from 1 to 13 percent greater than that anticipated in the year 2000. The impact to visual range from increased population in cities and towns would be greater than the impact from coal production activities because TSP emissions from cities have more small particles than mining caused emissions. Small particles are more effective than large particles in scattering light and thus are more effective in reducing visual range.

Soils

Disturbances to surface and subsurface soils on coal tract areas would result during the exploration, construction, and mining phases of coal resource development. These disturbances would be associated with sidehill cuts and fills and exposed soils resulting from construction of access roads, drill hole pads, portal sites, ventilation shafts, shipping and loadout facilities, sediment ponds, powerlines, telephone lines, etc. Soil disturbances would also occur as a result of community expansion for population increases resulting from mine development. The acres that would be disturbed by exploration, mining, and community development are presented in Table 4-2. The loss of soil productivity on community development areas would be permanent.

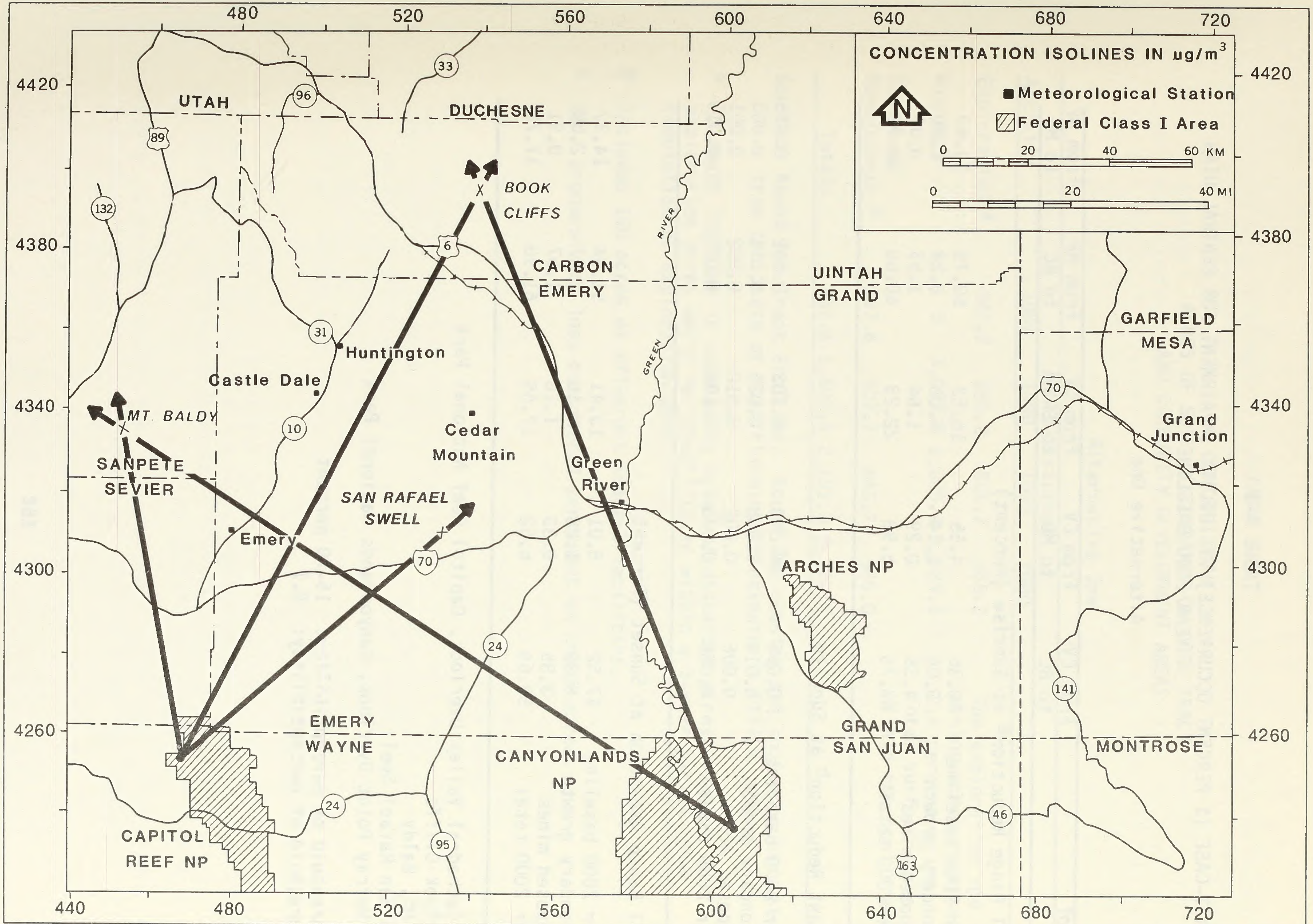


Note: Base does not meet National Mapping Accuracy Standards

FIGURE 4-2

24 HOUR TSP CONCENTRATIONS IN CENTRAL UTAH - YEAR 2000

(BASELINE PLUS ROUND II)



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 4-3

LINES OF SIGHT FOR VISIBILITY ANALYSIS IN CENTRAL UTAH

TABLE 4-1

WORST-CASE (1 PERCENT OCCURRENCE) VISIBILITY IMPAIRMENT FOR CENTRAL UTAH
YEAR 2000 BASELINE

Alternative One

Line of Sight	From CV to BC	From CV to MB	From CV to SRS	From MP to BC	From MP to MB
Visual Range Reduction[a] at Sunrise (Percent)					
Year 2000 baseline	50.36	4.55	16.53	50.79	13.49
Secondary growth	9.05	1.14	4.06	8.28	2.36
Proposed mines	4.35	0.29	1.64	1.53	0.87
Year 2000 total	63.76	5.98	22.23	60.60	16.72
Contrast Reduction[b] at Sunrise					
Year 2000 baseline	0.066	0.033	0.103	0.062	0.015
Secondary growth	0.014	0.008	0.025	0.011	0.003
Proposed mines	0.006	0.002	0.010	0.002	0.001
Year 2000 total	0.086	0.043	0.138	0.075	0.019
Visual Range Reduction at Sunset (Percent)					
Year 2000 baseline	47.52	5.01	13.41	51.94	14.37
Secondary growth	8.32	1.28	3.10	8.47	2.50
Proposed mines	3.85	0.33	1.18	1.57	0.91
Year 2000 total	59.69	6.62	17.69	61.98	17.78

CV - Cathedral Valley Overlook, Capitol Reef National Park
BC - Book Cliffs
MB - Mt. Baldy
SRS - San Rafael Swell
MP - Murray Point Overlook, Canyonlands National Park

[a] Threshold of perceptibility: 15-70 percent
[b] Threshold of perceptibility: 0.1

TABLE 4-2

CENTRAL UTAH
ACRES OF SOIL DISTURBANCE ON COAL TRACT
AND COMMUNITY DEVELOPMENT AREAS

Alternative One

Activity	Acres Disturbed 1987	1990	1995	2000	
Exploration [a]	265.2	265.2	265.2	265.2	The exploration and mining acres represent 2.4 percent of the total surface acres within the coal tracts.
Mining [b]	0	1,033.5	1,085.4	1,129.3	
Community Development [c]	167.6	303.7	840.7	985.0	
Totals	432.8	1,602.4	2,191.3	2,379.5	

Source: Round Two Tract Profiles. Round Two Leasing and socioeconomic data from the State of Utah Planning Coordinator's Office, 1982.

[a] Although included in cumulative total of disturbed acres, these exploration acres would be rehabilitated within a 3-year period after completion of exploration work.

[b] Includes 100 acres of off-tract loadout facilities.

[c] Soil productivity loss considered permanent on these acres.

Soil disturbance in general would cause increased susceptibility to erosion or displacement. The degree of susceptibility would vary according to soil erodibility characteristics, topography, surface roughness, and the presence or absence of protective soil cover such as vegetation, plant residues, gravel, cobble, or rock. The amount of erosion would be related to the time between the disturbance and re-establishment of vegetation or implementation of erosion control measures. Soil productivity could be reduced by the loss of topsoil or the mixing of topsoil with substratum materials (excavated during exploration, construction, and mining phases) that are high in salinity, alkalinity, other toxic materials, or unweathered parent materials.

Soil loss on disturbed areas would continue until erosion control and revegetation of the areas were successful. In areas of native vegetation, where climatic and soil conditions are favorable and slope gradients are gentle, successful erosion control and revegetation would likely be achieved within 1 to 2 years.

Table 4-3 presents estimated soil losses on critical soil erosion areas. The losses depicted are considered as averages over the potentially disturbed tract areas. As shown, the upper range of percent increases could be large, but would occur on a relatively small portion of the total tract acreage (from 1 to 4 percent). Revegetation and erosion control measures in compliance with applicable laws and regulations would reduce soil erosion to acceptable levels within a 2- to 10-year period on most tract areas. Soil loss on all disturbed acres would exceed soil loss tolerance values.

The distance of soil movement from disturbed areas and its effect on offsite resources, e.g., water courses and vegetation, cannot be projected without site specific mine plans and facility locations. Soil on some sites would move only a few feet while in other locations it may move into perennial streams and be carried long distances. Any soil movement is considered a soil loss as it would change soil structure and its potential as a plant growth medium. The critical soil areas on the Book Cliffs and Wasatch Plateau coal tracts would experience larger differences between soil losses and tolerance values than the Emery area tracts.

The following discussions on soil disturbances are presented by geographical area for exploration and production activities, with emphasis on impacts to critical soil erosion areas. For exploration activities, soil impacts on total acres of potential disturbance are discussed; for production activities, only soil impacts on cut and fill slopes are analyzed, with the assumption that minimal soil erosion and loss would result on the road running surfaces due to engineering design features.

Soil disturbances from exploration activities in central Utah would be temporary (1 to 2 years) on approximately 265 acres. Revegetation and soil erosion control procedures should establish adequate groundcover and stabilize soils within a 2-year period on most sites.

On the Alkali Creek, Coal Creek, Soldier Creek, and Dugout-Pace tracts, slopes in excess of 30 percent would probably be encountered during exploration in

TABLE 4-3

CENTRAL UTAH
ESTIMATED SOIL LOSSES[a] ON CRITICAL SOIL EROSION AREAS

ALTERNATIVE ONE

	EXPLORATION ACTIVITIES				PRODUCTION ACTIVITIES			
Coal Tract	Estimated Soil Loss Without Tract Developments[b]	Estimated Soil Loss With Tract Developments[c]	Differences Attributed to Tract Developments	Percent Increases Over Present	Estimated Soil Loss Without Tract Developments[b]	Estimated Soil Loss With Tract Developments[c]	Differences Attributed to Tract Developments	Percent Increases Over Present
Book Cliffs Tracts	0.5 to 3.0	5.0 to 50.0 (Moderately steep areas)	4.5 to 47.0	900 to 1600	Same as shown for exploration[d]			
		50.0 to 100.0 (steep escarpment areas)	49.5 to 97.0	1000 to 3200	0.5 to 3.0	5.0 to 50.0	4.5 to 47.0	900 to 1600
Wasatch Plateau Tracts								
Cooseberry, North Trough Springs, Mud Creek, and Castle Valley Ridge	0.2 to 22.0	20.0 to 50.0	19.8 to 28.0	130 to 100	Same as shown for exploration.			
Trail Mountain, Ferron Canyon, The Pines, & Quitchupah	20.0+	50.0 to 100.0	30.0 to 80.0	200 to 400	Same as shown for exploration.			
Emery Area Tracts	Water Erosion 0.5 to 1.0	0.5 to 1.0	0	0	Water Erosion 0.5 to 1.0	5.0 to 20.0[e]	4.5 to 19.0	900 to 1900
	Wind Erosion 20.0+	50.0+	30.0+	200	Wind Erosion 20.0	50.0 to 100.0	30.0 to 80.0	200 to 400

a Tons per acre per year in water erosion rates on steep slopes unless otherwise indicated. Lack of site specific project and soil survey information prevents projection of cumulative total soil losses from construction activities on critical soil erosion areas as compared to total cumulative soil losses from natural erosion on these same areas.
b Source: Table 3-4.
c Site specific analyses for coal tracts to be included in the Uinta-Southwest Utah Coal Region Environmental Impact Statement: Round Two Leasing.
d Soil loss for production activities on the Book Cliffs tracts would be the same as for exploration activities with the exception of utility line routes where soil loss with tract development would be 0.5 to 20.0 tons per acre per year.
e In the Emery area, production activities would occur only on the Blue Trail Canyon tract because the Walker Flat tract would be mined from an existing portal.

the location of some drill pads and access roads. Erosion or mass movement on these steep slopes would be accelerated where disturbed by exploration activities.

Major portions of the Gooseberry, North Trough Springs, Mud Creek, and Castle Valley Ridge tracts have slopes in excess of 25 percent. Sheet erosion, soil creep, gully formation, and slope failures presently occurring on portions of these slopes (Table 3-3) would be accelerated by exploration activities. Soil loss could range from 5 to 50 tons per acre per year on moderately steep areas to 50 to 100 tons per acre per year on the steeper escarpment areas (BLM, 1982b; Iaquinta, personal communication, FS, 1982). The severity of soil loss is indicated by comparison with allowable soil loss tolerance values of 1 to 5 tons per acre per year in central Utah as listed in Table 3-4. These soil losses would occur during the first year after disturbance, mainly during intensive summer storms and spring runoff periods. Accelerated soil loss, combined with low soil fertility, productivity, and high salt and clay content, would cause revegetation problems on the Trail Mountain, Ferron Canyon, The Pines, and Quitchupah tracts (Table 3-3). Soil losses from water erosion on 3 acres of the Walker Flat and Blue Trail Canyon tracts disturbed by exploratory activities would be less than 1 ton per acre per year (BLM, 1982b); however, wind erosion losses could be in excess of 50 tons per acre per year until successful reclamation occurs (BLM, 1982b).

Approximately 353 acres would be disturbed by production activities on steep slopes within critical soil erosion areas.

In the Book Cliff tracts, 52 acres of steep slopes would be disturbed mainly on the Alkali Creek, Coal Creek, and Dugout-Pace tracts. Disturbances on steep slopes could result in soil losses of 50 tons or more per acre per year from combined water and wind erosion (BLM, 1982b). Successful revegetation and soil erosion control could be achieved within 10 years after initiation of reclamation procedures.

In the Wasatch Plateau, even with required mitigation, soil losses on exposed soils of cut and fill slope acres could range from 20 to 50 tons per acre per year on 106 acres in the North Trough Springs, Mud Creek, and Castle Valley Ridge tracts and from 50 to 100 tons per acre per year on 195 acres in the Trail Mountain, Ferron Canyon, The Pines, and Quitchupah tracts. Due to the high erosion potential, low soil fertility, and high salt and clay content, revegetation problems would exist on the disturbed acres of these tracts. Soil erosion on an unestimated number of offsite acres on the steep slopes of all tracts would be accelerated or initiated by the concentration of water from cut and fill slopes and road surfaces into numerous intermittent drainages crossed or intercepted by production facilities.

Subsidence, as evidenced on coal lease operations within the Wasatch Plateau could increase the potential for mass soil movement on all tracts especially the unstable soils of the Castle Valley Ridge, Trail Mountain, and Ferron Canyon tracts (see Topography section). This could accelerate soil erosion and cause increased sediment transport into intermittent and perennial stream courses within or adjacent to these tracts.

On the Blue Trail Canyon tract about 65 acres would be disturbed by mining activities by the year 2000. Access road and work site construction activities on the mesa top would affect approximately 25 acres; soil lost by water erosion would be 1 to 5 tons per acre per year, with the potential for significantly larger losses from wind erosion, i.e., in excess of 50 tons per acre per year (BLM, 1982b). Surface mining operations would disturb approximately 40 acres at a rate of 4 acres per year. A maximum of 20 acres would be unreclaimed at any one time. Soil lost by water erosion would be less than 5 tons per acre per year but could exceed 20 tons per acre per year on cutbanks and spoilbanks (BLM, 1982b). Soil lost by wind erosion could exceed 100 tons per acre per year on sandy areas and stockpiled topsoil; such significant soil losses would limit the amount of area that could be rehabilitated. Seeding success on disturbed soil could be poor due to low annual precipitation (10 inches or less), shallow to very shallow plant rooting depths, the potential of exposure of highly saline and toxic materials, the high wind erosion potential, and the limited area of suitable topsoil (BLM, 1979b). Revegetated areas would be subject to accelerated water and wind erosion for up to 10 years.

Minerals Resources

Approximately 132.9 million tons or 36 percent of the coal in the Book Cliffs tracts, and 317.1 million tons or 41.9 percent of the coal in the Wasatch Plateau tracts, would be recovered using current mining techniques. A north-south trending fault with a down-throw of more than 200 feet, prevents the economical recovery of the eastern two-thirds of the Mud Creek tract. This may reduce the amount of recoverable coal presently projected for the tract. Approximately 25.9 million tons of coal would be recovered from the Emery tracts. This represents 34 percent of the total resource on the Walker Flat tract and 90 percent on the Blue Trail Canyon tract.

The mining of coal would result in total depletion of the coal resource as the 718.8 million tons of unrecoverable coal, though still in the ground, would no longer be available as a mineral resource given present mining technology.

Surface and subsurface mining activities and subsidence could hinder the subsequent exploration and location of facilities related to oil and gas development in the Book Cliff and Wasatch Plateau areas. The potential reduction in recoverable resources cannot be estimated at this time. See Land Use Section for additional details.

Topography, Geology, Paleontology

Construction of surface facilities would cause permanent changes in topography on 1,295 acres in central Utah.

Surface mining would alter 65 acres of the Blue Trail Canyon tract. Due to the swell factor of the excavated materials local topography after mining could be as much as 30 feet above the present elevation of the surface.

Topography would be altered as a result of subsidence on portions of 53,055 total acres. Tension cracks, buckling, and troughs can be expected in these areas. The extent of the effect is dependent on the strength and thickness of the overburden, the geologic structure of the rock formations, the width of the mined out area, the thickness of the coal bed being extracted, the mine configuration, and the rate and uniformity at which the coal is mined (Dunrud, 1976). Surface Mining Control and Reclamation Act requires that subsidence be considered in the permit application, controlled during mining, and included in reclamation.

The median overburden of the Book Cliffs is comparable to the Wasatch Plateau, but more local variation in overburden depth occurs within the Book Cliffs' tracts. Since surface expressions of subsidence tend to be less in areas of thicker overburden, there may be an increase in topographic slope gradients from areas of thicker overburden to areas of shallow overburden (Moore, Nawrocki, 1980). Moore and Nawrocki predict a maximum subsidence in the Book Cliffs of 12 feet, assuming a median overburden of 1,105 feet and a maximum coal seam thickness of 15 feet. If a 1-mile square area is extracted, leaving no barrier pillars where a limit angle of 16 degrees is considered representative, it is estimated that the maximum surface that would be susceptible to subsidence would be 168 percent of the area mined. Tension cracks that occur above the pillars could reach the surface as fissures. Near escarpments a wider pillar is required, otherwise escarpment failure could occur.

Moore and Nawrocki also predict a maximum subsidence of 16 feet for the Wasatch Plateau. If a 1-mile square area of coal is extracted, leaving no barrier pillars where a limit angle of 16 degrees is considered representative, the estimated maximum surface area that would be susceptible to subsidence would be 170 percent of the area mined. The Ivie tract has considerably less overburden (600 feet) than the other tracts and open tension fractures as well as subsidence may occur on this tract.

In the Emery area, subsidence resulting from underground mining would only affect the Walker Flat tract containing 1,520 acres. Because seam thickness is small, subsidence would not exceed 6 feet. Moore and Nawrocki predict the maximum lateral extent of subsidence in the Emery Area as 117 percent with a limit angle of 16 degrees. The effects of subsidence would be more pronounced than in the Wasatch or Book Cliffs fields due to the shallower overburden. Open tension fractures may occur at the surface.

Subsidence damage to geologic formations above underground coal mines can deform other coal beds, reduce mine safety, and disrupt the hydrologic regime so that production efficiency is lowered reducing the minable coal reserves (Dunrud, 1976).

Subsidence usually does not exceed 50 percent of the thickness of the seam extracted. Geologic conditions and/or mining methods could increase or decrease this percentage. The effects of subsidence can be identified geologically in the area directly above the coal extracted and the area within the limit angle. Though 16 degrees is the representative limit angle for the coal fields, this angle can increase or decrease with varying geologic conditions. Though the effects of subsidence can be identified topographically within the area of the limit angle, those effects may be considerably less than that area above the extracted coal.

In the Wasatch Plateau and Book Cliffs coal fields, significant plant fossils used for correlation and paleo-environmental guides could be destroyed by coal removal activities in the fossil-rich Blackhawk Formation. However, much of the flora has already been documented and recorded (Parker, 1976). Significant disturbances to other scientifically important fossils could be avoided if mitigating measures are followed (Appendix 3). Surveys and mining activities could also expose new fossils and enhance paleontological studies.

Water Resources

Surface Water

Surface mines and the construction of roads and other facilities associated with both surface and underground mining would require some modification of local surface-drainage patterns. This would increase erosion and fluvial sediment. It would also increase the rate of sediment deposition in local reservoirs such as Millsite and Scofield Reservoirs and would increase the load on local public-supply filtration systems. The regional impact, however, would be small.

According to the U.S. Soil Conservation Service (SCS, 1973), annual sediment yields in the area of the central Utah tracts range from about 0.1 to more than 3.0 with an average of 0.75 acre-feet per square mile. Kilpatrick (1979) indicates that land disturbance associated with synfuels development could increase sediment yields tenfold. Consequently, annual sediment yields on the lands that would be disturbed by mining and associated development of the central Utah tracts could increase to nearly 28 acre-feet by the year 2000 (Table 4-4). This is 0.08 percent of the estimated combined annual sediment yield in the Green and Dirty Devil River basins. The sediment would add additional stress to already stressed ecosystems in and along the affected streams. The stress would be greater nearer the source because there would be less water for dilution and some sediments would be deposited along the channel.

Table 4-5 shows by drainage subbasin the estimated increase in annual sediment yields from areas that would be disturbed by maximum development of the central Utah tracts.

TABLE 4-5

CENTRAL UTAH
ALTERNATIVE ONE
SEDIMENT YIELD INCREASE

River Drainage Basins	Estimated Increase in Sediment Yield (acre-feet per year)	Percent of estimated annual basin yield
Price River	11.4	0.98
Dirty Devil River	8.5	0.70
Sevier River	5.6	0.18
San Rafael River	2.4	0.05
Total	27.9	N/A

TABLE 4-4

CENTRAL UTAH
ALTERNATIVE ONE

IMPACTS ON WATER RESOURCES AND REGIONAL SIGNIFICANCE

Item	1987	1990	1995	2000
Water requirement (acre-ft/year)				
Mining and exploration	114.0	260.5	260.5	260.5
For public supply	759.5	1377.8	3813.0	4470.7
Total	873.5	1638.3	4073.5	4731.2
Consumptive water use				
Total (acre-ft/year)[a]	493.8	949.4	2167.0	2495.8
Percent of runoff[b]	.01	.02	.05	.05
Increased annual sediment yield				
Total (acre-ft)	5.1	18.8	25.7	27.9
Percent[c]	.01	.05	.07	.08
Increase in salinity				
(milligrams per liter)[d]	.04	.08	.19	.22

[a] Assumes 50 percent of withdrawal for public supply and 100 percent of withdrawal for exploration and mining.

[b] Percent of combined average annual runoff of the Green River at Green River, Utah, and the Dirty Devil River near Hanksville, Utah.

[c] Percent of estimated annual yield upstream from the stations cited in footnote b.

[d] As determined at Imperial Dam. Does not include reduction in salinity from reduced irrigation return flow.

Development of the Gooseberry and Mud Creek tracts in the Upper Price River subbasin could increase annual sediment inflow to Scofield Reservoir by up to 0.06 acre-feet. This is only about 0.11 percent of the average annual inflow from 1943 to 1979 as determined by bathymetric surveys (K. M. Waddell, written communication, GS, 1982). The effect on the life and utility of the reservoir would be small. By the same analogy, the effect of increased sediment production due to development of the Ferron Canyon tract would have a slightly larger impact on the life and utility of Millsite Reservoir. Annual sediment yields for acres disturbed by development of the Ferron Canyon tract could increase by an estimated 1.2 acre-feet, or about 1.0 percent of the estimated annual sediment inflow to Millsite Reservoir.

Maximum development of the central Utah tracts would have a minor impact on surface-water quality in the general area of the tracts, access roads, loadouts, and affected communities. The regional impact on water quality would also be negligible.

Water discharged from mines is generally more saline than runoff in adjacent streams (BLM, 1981a). Consequently, discharge of mine water to such streams as Cottonwood and Ferron Creeks would increase the salinity in the receiving stream. In most cases, however, the increase would be small because the ratio of mine discharge (generally less than 100 gallons per minute) to the discharge of receiving streams such as Cottonwood and Ferron Creeks is so small that the average concentration of dissolved solids would not increase by more than 2 to 3 milligrams per liter (BLM, 1981a). Except in the case of trans-basin diversion of water by mines and possible contamination of the mine water, the salt load of the receiving streams would not be significantly increased by the mine water because much of that water and its salt load reaches the streams through seeps and springs under natural (nonmining) conditions. Any increase in salt loading from mine dewatering would be negligible compared to the salt loading from irrigated lands in the lower stream reaches, especially those in the Price, San Rafael, and Dirty Devil River drainage basins. It should be noted that State law now prohibits issuance of new National Pollution Discharge Elimination System (NPDES) permits on National Forest lands. Development of some tracts on the Wasatch Plateau may conflict with this law.

Recent Geological Survey studies (written communication, Waddell, GS, 1983) indicate that Scofield Reservoir in the Upper Price River Basin is borderline between meso-eutrophic and eutrophic. Accidental pollution and pollution control failures on the Gooseberry and Mud Creek tracts could add nutrients to streams flowing into Scofield Reservoir. This would contribute to eutrophication of the reservoir.

By the year 2000, 4,731 acre-feet per year more water would be diverted for mining and associated population growth under Alternative One; the annual consumption rate would be 2,496 acre feet (Table 4-4). Salt concentration resulting from withdrawal of the water and salt loading resulting from return of the unconsumed water (chiefly from fluid-waste disposal systems) would have a minor effect on the salinity of the Colorado and Sevier Rivers. For example, the salinity of the Colorado at Imperial Dam would be increased by an estimated 0.22 milligrams per liter. This increased salinity is negligible compared to the salt loading of irrigation and natural runoff from the salt-bearing Mancos Shale. Locally, that runoff contains more than 5,000 milligrams per liter of dissolved solids and deposits more than 7 tons of salt per acre-foot of water into lower reaches of the Price, San Rafael, and Dirty Devil Rivers.

Rock fracturing associated with the subsidence tends to divert more snowmelt and rainfall underground, increasing ground water recharge at the expense of overland runoff. This fracturing, however, could also cause water in certain near-surface aquifers such as those in the Flagstaff Limestone to drain downward more rapidly than normal. Consequently, the flow of springs that provide baseflow to headwater streams (including those in municipal watersheds) might be reduced. Similarly, the flow of some springs that provide water for the wildlife, livestock, irrigation, and public supply could be either reduced or increased. Subsidence-caused fracturing can also divert streamflow directly underground if the fracture intersects a stream channel and remains open. Springflow and streamflow diverted underground by subsidence-caused fracturing would not be lost from the hydrologic system and might not be lost from the drainage subbasin in which it originates. The water would move through newly formed fractures and would degrade in quality more rapidly than it would as overland runoff. For example, runoff in the headwaters of such streams as Ferron, Cottonwood, and Huntington Creeks commonly contain less than 200 milligrams per liter of dissolved solids. Water discharged from the Blackhawk Formation to the Wilberg Mine has an average dissolved-solids concentration of more than 280 milligrams per liter (BLM, 1981a).

Without mine plans and detailed hydrologic inventories for the central Utah tracts it is not possible to determine how many or which springs or streams would be affected by subsidence-caused fractures if the tracts were leased and developed. The probability of a spring or stream being affected decreases as the thickness of the geologic section above the mined-out area increases. In central Utah most of the largest and important springs are in the Wasatch Plateau area. These springs discharge from the Flagstaff Limestone and North Horn Formations 1,500 to over 3,000 feet above the coal seams that would be mined. Therefore, even on such tracts as the North Trough Springs tract, which probably contains more than 50 springs, the chance of a subsidence-caused fracture reaching the land surface and diverting the flow of even one spring (or headwater stream) is very small.

Ground Water

Mining and mine dewatering would create pressure gradients in the local ground-water systems causing ground water to move toward the mine workings. This could induce the movement of saline water (such as that found in the Mancos Shale) into freshwater aquifers such as the Star Point Sandstone, thus locally reducing the quality of the freshwater aquifers (Lines, 1983).

Underground mine workings would disrupt local ground water flow systems in the Blackhawk Formation and adjacent formations causing a redistribution of ground water discharge. The mine workings could divert water away from springs used by wildlife and livestock, or from streams used for public supply or irrigation. In most cases this redistribution of ground water discharge would not result in a loss of water from the drainage subbasin in which the water originates. The new discharge points (in most cases mine discharge sites) would generally be in the same drainage subbasins as the former natural discharge points; however, several of the tracts straddle the divides between drainage subbasins. Mine workings extending beneath those divides would intercept water naturally tributary to one of the drainage subbasins and divert that water to the other drainage subbasin.

Mining of the Book Cliffs tracts could divert some ground water from the Uintah Basin to the Price River basin. In a similar manner, mining of the other central Utah tracts could prevent ground water originating in the subbasin from reaching natural discharge points in the adjacent subbasin.

The volume of ground water that would be diverted from one drainage subbasin to another is unknown but probably very small compared to the total water yield of the individual subbasins affected. Based on data collected by GS (written communication, Waddell, GS, 1982), the fine grained, poorly permeable beds probably transmit about 30 acre-feet of water per year from the area of the Book Cliffs tracts to the Uinta Basin. This is only about 0.02 percent of the estimated mean annual runoff from the southern Uinta Basin as estimated by Price and Miller (1975). Proportionately small amounts of water probably are transmitted through the rocks in the area of the other central Utah tracts assuming mine workings on those tracts do not intersect as yet unmapped faults similar to those intersected in the Wilberg and Deer Creek mines.

Water Supply and Use

Maximum development of the central Utah tracts would require up to 4,731 acre-feet of water per year for mining and public water supply needs (Tables 4-4 and 4-6). Sources of the water probably would be springs and streams currently used for public water supply and irrigation, water producing mines, and wells. These impacts are further discussed in the Land Use Section of this Chapter. An estimated 2,496 acre-feet of water would be consumed annually. This represents about 0.05 percent of the combined average annual discharge of the Green River at Green River, Utah, and the Dirty Devil River near Hanksville, (GS, 1982) and about 0.17 percent of Utah's share of Colorado River water. Impacts on the available supply in individual drainage subbasins could be larger. Table 4-6 shows the estimated annual mine-and-population-related water requirement from affected river drainage basins as related to average annual discharge at maximum flow gaging stations.

TABLE 4-6

CENTRAL UTAH WATER REQUIREMENTS COMPARED TO RIVER DRAINAGE BASIN RUNOFF

River Drainage Basin	Gaged site (Figure 3-4)	Combined average annual discharge at gaged site (acre-feet)	Approximate total Round Two Leasing water requirement: Acre-feet	Approximate total Round Two Leasing water requirement: Percent of average annual gaged discharge
Price River	18	103,600	2,764.8	2.7
San Rafael River	46, 47	96,940	689.0	0.7
Dirty Devil River	55	16,820	329.6	1.9
Sevier River	58	162,300	947.8	0.6
Total	N/A	N/A	4,731.2	N/A

Maximum annual water requirement from affected drainage subbasin would range from about 0.6 percent of the annual discharge in the Sevier River basin to about 2.7 percent of the discharge of the Price River.

Vegetation

Implementation of this alternative involving development of coal on 20 central Utah tracts would directly disturb a total of 1,395 acres of vegetation by the year 2000. This disturbance both onsite and offsite would result from exploration activities, construction of surface facilities, access roads, powerlines, loadout facilities, and surface mining activities. The majority of this disturbance would occur in the Pinyon-Juniper woodland and Conifer-Aspen forest. In addition to direct disturbances, subsidence may cause some alteration in vegetation types due to changes in underground or surface water systems. However, this impact is difficult to predict and not quantifiable.

An additional 1,796 acres of vegetation would be lost or altered as a result of community expansion and mine water use. By the year 2000, 985 acres of land would be required for community development of which 493 acres would be from irrigated cropland. In addition, 811 acres of irrigated lands would be retired from irrigation to provide water for mining and community needs. Table 4-7 summarizes disturbance by year and vegetation type.

Since mining plans have not been submitted or housing areas identified, the figures used are only estimates based on projected areas of development and the percentage of vegetation types found in those areas. The actual acreage of vegetation types that would be disturbed, should this alternative be implemented, may vary from these projected figures.

Cumulative vegetation disturbance would total 3,191 acres; however, vegetation loss would occur at different periods of time following lease issuance. As a result, disturbed areas would be in various stages of reclamation by the year 2000. The following summarizes major vegetation disturbing activities and if or when vegetation reclamation would likely occur.

Strip mining and associated developments on the Blue Trail Canyon tract would result in total removal of vegetation from 65 acres by the year 2000. However, only about 4 acres would be disturbed annually by strip mining activities. Based on a projected reclamation plan it is anticipated that no more than 20 acres would be unreclaimed at any one time in the mining area.

Exploration activities involving construction of drill pads and access roads would disturb a total of 265 acres by the year 1990. By the year 2000 this acreage, while included in the cumulative total of acres disturbed, would be in advanced stages of reclamation.

Implementation of this alternative would result in the loss of 1,130 acres of vegetation from construction of surface facilities, portal access, powerlines, ventilation installation, and loadout facilities. Most of these acres would not be fully reclaimed until completion of mining activities. Certain access roads may continue to be used for other purposes following completion of

TABLE 4-7

CUMULATIVE VEGETATION DISTURBANCE BY VEGETATION TYPE: CENTRAL UTAH

ALTERNATIVE ONE

Vegetation Type	Direct Mining Impacts[a] (Acres)				Indirect Impacts[b] (Acres)	Total[c]
	1987	1990	1995	2000	2000	2000
Agriculture	-	-	-	-	1304.0[d]	1304.0
Riparian	3.0	6.0	11.0	11.0	-	11.0
Desert Shrub	1.0	90.0	90.0	93.0	107.3	200.3
Sagebrush-Grass	45.0	125.1	138.9	138.9	11.0	149.9
Pinyon-Juniper Woodland	12.5	390.0	418.3	442.4	283.6	726.0
Mountain Brush	4.9	59.9	59.9	59.9	21.4	81.3
Ponderosa Pine	24.7	132.1	132.1	135.1	-	135.1
Aspen	10.9	45.9	45.9	45.9	-	45.9
Conifer-Aspen	96.1	325.2	325.2	329.2	-	329.2
Non-Productive	7.0	24.0	27.0	29.0	69.0	98.0
Other (Douglas Fir, Mountain Meadow, Grassland, etc.)	60.1	100.5	102.3	110.1	-	110.1
TOTAL	265.2	1298.7	1350.6	1394.5	1796.3	3190.8

a Includes surface facilities, portal access, mining operations, exploration activities, powerlines, ventilation construction, and loadouts.

b Total lands lost to community development including agricultural lands retired from irrigation to provide water for community needs. This acreage was computed for the year 2000 only and does not include 96 acres of irrigated cropland that would be retired for exploration water requirements from 1987 through 1990.

c Total vegetation disturbance by the year 2000.

d Includes 492.7 acres lost to community development, 739.3 acres retired from irrigation to provide water for community needs, and 72.0 acres retired from irrigation to provide water for mine use.

mining and would not be reclaimed. Agricultural and nonagricultural lands surrounding local communities which would be lost to community expansion (493 and 492 acres, respectively) or retired from irrigation (811 acres) to provide water for community expansion and mining would not be reclaimed.

Even though less than 50 acres of Douglas fir communities in the Book Cliffs would be removed, it would represent a permanent commitment of the resource as the stands are not reproducing themselves. The areas disturbed would eventually revert to a mountain brush community.

For areas that would be reclaimed, the duration of the impact of total vegetation loss would depend upon the success of reclamation. Because of the well developed soils and annual average precipitation of 25 inches, reclamation attempts on the Wasatch Plateau and Book Cliffs tracts are expected to be 50 to 80 percent successful (Hagihara et al., 1972). On steep slopes and poorly developed soils in these areas, 30 percent of revegetation attempts are expected to be successful. At the end of the mine life, vegetation loss would continue for about 10 years on previously unreclaimed lands. Two years would be required for reclamation work and up to 8 years for establishment of vegetation cover. Shrub and tree cover would not become established for approximately 15 years after reclamation begins. Reestablishment of native species is expected to occur through natural succession over the long term. On areas of Aspen-Conifer, restoration to the original type would take longer. Fifteen to 20 years or more would be required for a return to original types.

Reclamation of vegetation on the two Emery coal field tracts would be difficult. Due to climate (average annual precipitation 7.55 inches) and soil conditions, some special treatment and supplemental irrigation may be necessary. The disturbance of topsoil through strip mining would compound this problem. Studies at nearby Huntington and other sites in Utah indicated a decrease in plant production of approximately 40 percent with removal of the top 3 inches of soil. The amount of water needed to produce predisturbance levels of vegetation increased 60 to 90 percent (Lyons, 1978). The EMRIA study of the reclaimability of these lands (BLM, 1979) concluded that because of the extent and sensitivity of present vegetation and the severity of the climate, the post-mining environment on some sites would probably not be suitable for plant growth without significant long-term support for seeded shrubs and grasses; however, reclamation would be successful with proper treatment. Positive results would be achieved in years with above normal precipitation, but success in dry years may depend on supplemental irrigation (Bleak et al., 1965; Aldon and Springfield, 1975).

The use of native species for reclamation has the highest potential for reclamation success (BLM, 1979b). Grass competition is a major deterrent of shrub and forb survival, and could produce a monoculture as a result of reclamation (Hubbard, 1956).

Mitigating measures regarding survey and clearance of proposed onsite and offsite locations and routes for mining facilities associated with the Blue Trail Canyon tract would effectively eliminate impacts to the candidate endangered species *Townsendia aprica*.

Wildlife

Terrestrial

The surface disturbance from production activities of 1,030 acres by the year 2000 could decrease the deer populations in herd units 33, 34, 35, 36, 38, 43, and 45 by 150 deer. Elk loss from habitat destruction would be 33 animals per year or 0.3 percent of the potential Manti elk herd. The majority of the elk loss would be in critical winter range. No comparable losses of elk from the proposed mining activity would occur in the Avintaquin-White Rocks-Anthro-Argyle herd unit (Table 4-8).

Construction of roads and surface facilities could disrupt elk migration routes as well as encroach on critical elk and deer winter range in Ferron and Quitchupah Canyons. The Castle Valley Ridge, North Trough Spring and Mud Creek tracts are located within known elk calving areas. Developments on these tracts could result in an undetermined amount of habitat loss.

Encroachment by mining activity on mountain lion and black bear home ranges, illegal killing, and loss of prey species such as deer and elk would reduce lion and bear populations by an unknown amount until reclamation was completed. The increased development and widespread human disturbance on this range would cause abandonment of some home areas and a reduction in size or use of others.

Potential damage to riparian zones, a critical element of wildlife habitat, could occur from portal and road construction: however, stipulations, where practical, could help alleviate this impact. Moose require willows year-round and disturbance of riparian habitat associated with the development of the Mud Creek tract beginning in 1987 could displace moose and other wildlife from riparian habitat along 2 miles of Mud Creek and Long Canyon. While significant locally, this impact would be insignificant regionally.

Acreage utilized in community development would be irreversibly lost as wildlife habitat. Half of the acreage would come from irrigated cropland adjacent to expanding communities. Many species inhabit these lands, notably pheasants, cottontail rabbits, doves, small birds, and mammals. With 1,304 acres of irrigated agricultural land committed to urban use by 2000 (subdivisions and water right purchases), the regional pheasant population could be reduced by 846 birds potentially reducing the cock harvest by 245 (Appendix 7). Regionally this would be insignificant, but in Carbon County where over one-half of the community development would occur, the potential cock harvest loss would be 5.7 percent of the average annual harvest.

Surface expression of subsidence such as cracks, bulges, and displacements are not expected to directly affect wildlife, but any reduction or elimination of surface water flows and associated vegetation communities could adversely affect some species. Loss of water sources would result in reduced utilization of habitat by mobile species such as deer, elk, beaver, and birds, and elimination of species such as small mammals, reptiles, and amphibians that are unable to relocate. Because of lack of data on wildlife populations and

TABLE 4-8

CENTRAL UTAH
BIG GAME HABITAT DISTURBANCE
ALTERNATIVE ONE

Tract	Acres Disturbed	Plant Community	Wildlife[a] Use	Species	Losses/[b] Year
Alkali Creek	39.1	P-J/P. Pine[c]	HP Winter	Deer	5
Coal Creek	83.5	P-J/Sagebrush	HP Winter	Deer	6
Dugout Pace	2.5	Sagebrush	HP Winter	Deer	1
Graves	0	P-J	HP Winter	Deer	2
Hoffman Creek	0	-	-	-	-
Soldier Creek	11.8	Sagebrush	S Summer	Deer	1
Whitmore Park	0	-	-	-	-
Acord	0	Sagebrush	HP Summer	Deer	0
			C Winter	Elk	0
Castle Valley		Conifer/	HP Summer	Deer	26
Ridge	155.0	Grass	HP Summer	Elk	7
			C Winter	Elk	7
Ferron Canyon	129.9	P-J/	HP Winter	Deer	10
		Sagebrush	HP Winter	Elk	7
Gooseberry	34.1	Aspen/Grass	HP Summer	Deer	13
			HP Summer	Elk	2
Ivie	2.0	Mt. Shrub	S Winter	Deer	0
			C Winter	Elk	0
Mud Creek	28.7	Conifer/	HP Summer	Deer	4
		Grass	HP Summer	Elk	2
		Riparian	C Winter	Moose	1
North Trough		Conifer/	HP Summer	Deer	28
Springs	58.1	Grass	HP Summer	Elk	3
Quitchupah	155.1	P-J/P.Pine	C Winter	Deer	11
			C Winter	Elk	7
Skumpah	76.0	Mt. Shrub	HP Summer	Deer	18
			C Winter	Elk	4
The Pines	114.1	P-J/Sagebrush	C Winter	Deer	21
			C Winter	Elk	5
Trail Mountain	76.9	P-J/Sagebrush	HP Winter	Deer	4
Blue Trail		P-J/			
Canyon	62.5	Desert Shrub	Yearlong	Deer	0
Walker Flat	0	Desert Shrub	S Winter	Deer	0
Totals	1,029.3			Deer	150
				Elk	33
				Moose	1

[a] See Appendix 7. HP, high priority; S, substantial; C, critical.
[b] Includes 0.1 mile influence zone. Based on optimum herd management level objectives (UDWR, 1981a).
[c] Pinyon-Juniper/Pinyon pine

the unpredictability of subsidence and its effects, the number of animals that could be affected cannot be quantified. At the projected production level up to 53,055 acres would be susceptible to subsidence.

Construction of a minimum of 43 miles of new utility lines (estimated length of new utility and new portal access) in the area would provide additional perching and hunting sites for raptors. This would be a beneficial impact; however, use of these structures along roadsides or in areas open to human access would expose the birds to illegal shooting and disturbance (BLM, 1981a). The extent of losses from this activity cannot be tabulated but approximately 16 miles of the new utility lines would be adjacent to portal access roads.

With this proposed level of production, 68 miles of new and improved portal access roads would be needed for access and truck hauling of coal. Most of these roads would be in deer and elk summer and winter ranges and vehicle traffic would present an additional hazard to wildlife (BLM, 1981). In the 1980-81 field year 292 deer were recorded as traffic mortalities in deer herd units 33, 34, 35, 36, 3, 43, and 45. By 2000 an estimated 21 percent increase in traffic from coal hauling and commuting could increase the deer traffic mortality on existing roads to 352 animals per year. An additional 204 deer could become traffic mortalities on new roads (Table 4-9). However, this could decrease after the initial years of use because of habituation and dispersal of deer by human activity. Total traffic mortality (556) when combined with habitat losses would result in the loss of 1 percent of the deer population in central Utah. Anticipated elk mortality has not been quantified but is expected to be low.

Because they would be heavily traveled, portal access roads could be a limiting factor to small, isolated animal populations and become an obstacle to small animal movement especially among forest dwelling species (BLM, 1981a). On the Wasatch Plateau some of the new roads would pass through forest and meadow habitat.

The escarpments of the Wasatch Plateau and the Book Cliffs are favored nesting sites for raptors especially golden eagles. Nesting concentrations are located in the south Wasatch Plateau and around Alkali Creek in the Book Cliffs. Because many of the portals and access roads would be located in or adjacent to the escarpment, potential conflicts would exist (Table 4-10).

Construction, vehicle traffic, and noise within proximity of nest sites could cause abandonment of nests and subsequent loss of productivity for these protected species.

The human population increase in 1987 is expected to be 4 percent above the projected baseline, peaking at 18 percent above by 2000. Similar increase in hunters, fishermen, and off-road vehicle use (Recreation Section) would result. The presence of a larger human population could exert greater pressures on the wildlife populations through harvest, harassment, and displacement from habitat. The legal harvest could be controlled by instituting more stringent regulations while harassment could be partially controlled by enforcement of regulations. However, the disturbance of animals by human intrusion in natural habitats could not be eliminated.

TABLE 4-9

CENTRAL UTAH
POTENTIAL DEER TRAFFIC MORTALITY FROM NEW ROADS
ALTERNATIVE ONE

Tract	New Roads (miles)	Deer Range[a]	Deer Loss/ Year[b]	Deer Loss/ Mine Life[c]
Alkali Creek	1.6	HP Winter	2	25
Coal Creek	4.8	HP Winter	6	40
Dugout Pace	0	HP Winter	0	45
Soldier Creek	0	S Summer	0	40
Acord	0	HP Summer	0	18
Castle Valley Ridge	14.1	HP Summer	69	40
Ferron Canyon	11.7	HP Winter	28	20
Gooseberry	1.5	HP Summer	10	40
Ivie	0	S Winter	0	40
Mud Creek	1.7	HP Summer	4	40
North Trough Springs	5.0	HP Summer	24	40
Quitchupah	8.5	C Winter	13	40
Skumpah	4.05	HP Summer	16	40
The Pines	7.9	C Winter	19	40
Blue Trail Canyon	2.1	Yearlong	0	20
Trail Mtn.	4.6	HP Winter	13	40
Totals	67.55		204	

a See Appendix 7. HP, High priority; S, Substantial; C, Critical

b 1,280 acre (1 mile each side of road) X road length/deer density X 0.076 = deer loss/year. Divided again by 2 because occupancy of summer or winter range for six months.

c Deer losses at this rate only apply to initial years of road use.

TABLE 4-10

CENTRAL UTAH

RAPTOR NESTING TERRITORIES ON PROPOSED TRACTS
ALTERNATIVE ONE

Tract	Raptor Territories[a] on Tract	Raptor Territories Affected	Potential Conflicts
Alkali Creek	3	1	access road, portal
Coal Creek	0	1	access road off tract
Dugout Pace	0	1	access road, portal off tract
Soldier Creek	0	1	portal off tract
Hoffman Creek	1	0	none
Ferron Canyon	5	1	portal
Ivie	4	1	access road
Quitchupah	5	1	portal
Skumpah	2	2	access road, portal
The Pines	6	0	none
Trail Mtn.	5	0	none
Walker Flat	2	0	none
Totals	33	9	

[a] Source USFWS 1981-82 aerial surveys.

Seventy-five percent of the elk habitat in the Manti herd unit is located within 1 mile of a road. By 2000 an additional 4,444 2-wheel and 4-wheel drive trucks could be located in the four-county region. An increase in unregulated use of unimproved roads on the Wasatch Plateau and Book Cliffs would result and would adversely affect adjacent elk habitat (Lyon, 1979). This effect would also apply to other wildlife species inhabiting these areas.

Utah Division of Wildlife Resources (UDWR) reports a 250-percent increase in citations issued during a period of a 48-percent population increase. Seventy-three percent of these citations were for violations that directly reduced wildlife populations (BLM, 1981a).

Assuming a rate equal to the reported increase, the 18-percent human population increase projected by the year 2000 could result in a 66-percent increase in illegal taking of wildlife. Illegal killing of wildlife could significantly reduce big game populations. For example, illegal killing of moose on the Wasatch Plateau has apparently stymied efforts to establish a viable herd despite transplants, protection, and advertisement of the herd's plight by the UDWR (UDWR, 1982).

Fisheries

Pollution of fisheries from coal wastes and coal mine drainage would not be anticipated with reasonable enforcement of applicable State and Federal laws. If accidental pollution from spillages of coal, untreated mine drainage, caustics, sewage, or petroleum products occurs, important fisheries that would be affected are Straight Canyon Creek, Ferron Creek, Pleasant Valley Creek, and Salina Creek. The extent of the stream damage would be dependent upon the type, quantity, and duration of spill. These spills could directly kill fish and/or the aquatic fauna, or increase algae growth thereby choking the stream. Fugitive dust from coal hauling trucks could add sediments and coal fines to 6.5 miles of stream habitat in steep canyons where roads could not be located more than 0.25 mile from the streambed. No fisheries would be directly affected in the Book Cliffs.

Ferron, Mud, Muddy, Quitchupah Creeks, and some tributaries of Huntington Creek could suffer dewatering in short sections if subsidence occurred and altered the channels. Mitigation measures could repair the channel and restore the flow avoiding permanent damage and total loss of fisheries.

Anticipated human population increases could significantly increase fishing pressure on popular waters such as Electric Lake, Huntington Creek, Joe's Valley Reservoir, Scofield Reservoir, Johnson Valley Reservoir, and Fish Lake. Quality fishing in these waters would decrease unless hatchery production was increased to satisfy the demand or harvest limits reduced.

Threatened or Endangered Species

No developments are anticipated to occur within critical habitats, therefore, no significant impacts to threatened or endangered species or known habitats would be expected.

Land Use

Agriculture and Range

During the construction and production phases of coal resource development on all coal tracts, there would be changes principally from grazing to mining and support uses, from agricultural land to community use, and from irrigated cropland to retired cropland. Table 4-11 displays projected total acres of temporary and permanent land change by activity. Table 4-12 displays acreage converted permanently to community development, agricultural acreage converted to community development, and irrigated cropland retired to provide community water. Impacts to non-agricultural and irrigated croplands located off coal tract areas as well as the effects to existing uses on coal tract areas are discussed below.

Permanent land use changes associated with community expansion would affect cropland agriculture and community development in Carbon, Emery, Sanpete, and Sevier Counties. By the year 2000, these counties would experience a permanent change of approximately 985 acres from grazing and agricultural uses to housing and community development. Of the 985 acres, 493 acres (50 percent) would be irrigated cropland (consisting mainly of alfalfa and small grains). The remaining 492 acres would be non-irrigated lands adjacent to existing communities. An additional 739 acres of irrigated croplands would be retired to provide community water requirements (Table 4-12). Overall permanent land changes would occur on 1,724 acres (Table 4-11) due to conversion of land for community expansion and the retirement of irrigated cropland to provide community water needs.

Water requirements for exploration and mining activities would also impact irrigated cropland. Water for approximately 96 acres of irrigated cropland would be diverted to exploration activities over a 3-year period. For mining activities, irrigation water sufficient for approximately 72 acres of cropland would be diverted annually during the life of the mines.

In summary, total agricultural lands affected by the year 2000 due to the conversion of irrigated croplands for community development, retirement of irrigated croplands for community water supply, and the diversion of water for exploration and mining activities would be 1,400 acres. Water for approximately 96 acres of cropland (retired by exploration activities) would be available for cropland use upon completion of exploration (1989). All of the affected irrigated cropland would be off the proposed coal tracts. These acres represent less than 1 percent of the total four-county cropland acreage, but they include lands that are among the most favorable for agricultural use (Utah Department of Agriculture, 1982). Some prime farmland could be among that which is converted and retired, unless planning avoided such areas.

About 971 of the 1,400 acres of affected irrigated cropland would be in Carbon and Emery Counties. The communities in these counties are mostly on lands that, if available for agriculture, would be highly productive. About one-half of the community expansion would occur on similar farmland if community development trends in the area persist (BLM, 1981b). The remaining 429 acre irrigated cropland loss would occur in Sanpete and Sevier Counties, with no significant impacts to the two-county agricultural land base (0.2 percent).

TABLE 4-11

CENTRAL UTAH
ACRES OF LAND USE CHANGES DUE TO COAL TRACT DEVELOPMENTS
BY YEAR 2000
ALTERNATIVE ONE

Projected Maximum[a] Total Acres Changed From One Land Use to Another	Temporary Land Changes Acres of Land Change Due to Mining Operations, Including On-Tract and Offsite Support Facilities	Permanent Land Changes--Acres Changed for Community Development and Acres Irrigated Cropland Retired to Provide Community Water Needs
	899 acres for access routes,[b]	1,724
	396 acres for on-tract facilities	
	100 acres for offsite loadout facilities	
	72 acres of irrigated land retired for mine water	
Totals 3,191	1,467	1,724

Source: Utah State Office - Bureau of Land Management, 1982.

a Projected Maximum Total Acres Changed From One Land Use to Another are totals of Temporary Land Changes plus Permanent Land Changes.

b Exploration drill pads counted as part of access acres.

TABLE 4-12

CENTRAL UTAH
LANDS AFFECTED BY COMMUNITY DEVELOPMENT AND WATER REQUIREMENTS
ALTERNATIVE ONE

County	Total Acres Community a Development	Irrigated Acres for Community b Development	Additional Irrigated Acreage c Retired	Total Irrigated d Lands Affected	Total Acres Community a Development	Irrigated Acres for Community b Development	Additional Irrigated Acreage c Retired	Total Irrigated d Lands Affected
	1987				1990			
Carbon	6.7	33.6	50.2	83.8	135.7	68.0	101.8	169.8
Emery	43.3	21.7	32.5	54.2	99.5	49.8	74.7	124.5
Sanpete	24.1	12.1	18.2	30.3	26.4	13.3	19.9	33.2
Sevier	33.2	16.6	24.9	41.5	42.1	21.1	31.6	52.7
Total	167.6	84.0	125.8	209.8	303.7	152.2	228.0	380.2
	1995				2000			
Carbon	375.9	188.1	281.9	470.0	589.0	294.4	441.8	736.2
Emery	268.6	134.3	201.5	335.8	187.6	93.8	140.7	234.5
Sanpete	73.2	36.7	54.9	91.6	77.2	38.6	58.0	96.6
Sevier	123.6	61.6	92.2	153.8	131.7	65.9	98.8	164.7
Total	840.7	420.7	630.5	1,051.2	985.0	492.7	739.3	1,232.0

Source: Utah State Office, Bureau of Land Management, 1982
a,b,c Figures based on Analysis Assumptions and Guidelines listed in Chapter Four.
d Total Irrigated Lands converted and/or retired = b+c.

Land changes from irrigated cropland to community use and from irrigated cropland to retired cropland would eliminate cattle, sheep, and horse grazing on such land. Due to variability of grazing numbers and season of use on the existing cropland acres, actual animal unit month (AUM) losses could not be predicted. Due to the high grazing capacity on such areas, overall losses could be high, i.e., one AUM lost for every 5 acres converted. Such losses would significantly affect small operators.

There would be temporary land changes on 1,467 acres (Table 4-11). The following discussion presents the effects of these land changes on existing uses. Some of the effects would be long-term, extending beyond mine life.

Losses of livestock grazing numbers (AUMs) on BLM and FS allotments would be insignificant with a loss of less than 2 percent of the total AUM capacity of any Federal allotment and less than a 2 percent annual reduction on directly affected private surface. Grazing reductions on BLM and FS allotments and private surface would affect ranching operations on private lands off the tract areas. Ranchers would have to acquire additional feed to prevent reductions of animal numbers on private off-tract areas during late fall, winter, and early spring months (seasons of nonuse on the tract areas).

There would be increased difficulty in moving livestock to and from grazing areas served by Deadman, Coal, Soldier, Dugout, Pace, Rock, and Cottonwood Creek Canyons and in Ferron and Link Canyons. Congestion caused by new developments and increased traffic in these canyons would result in greater hazards of vehicle collisions with migrating livestock.

Subsidence could reduce or eliminate the flows of an undetermined number of natural springs used by livestock. Stream flows and channels could be reduced and changed; range structures such as watering impoundments and water conveyance pipelines could be disrupted. Such subsidence impacts could eliminate livestock water sources. Range impacts related to subsidence would be most evident on the Castle Valley Ridge and Quitchupah Coal tracts, where a large number of range structures exist. Replacement of the facilities and water lost would be required by lease stipulations, therefore, these impacts should be temporary.

The livestock water sources provided by Ivie and Saleratus Creeks could be lost due to subsidence on the Walker Flat tract. Loss of these water sources would necessitate large reductions in grazing numbers on the Saleratus Allotment where there are 1,843 Federal and 325 private AUMs until the water is replaced by the lessee.

Energy and Minerals Development

Conflicts could result between the development of the coal tracts and the development and operation of existing leases if there were different lessees involved. These conflicts would mainly involve transportation and utility access.

Oil and gas development could be hampered by underground coal mining. In the Book Cliffs and Emery areas, quantification of the effects are unknown since the tracts have not been sufficiently drilled to determine oil and gas potential. According to the Price River/Range Creek Coal Area Land Use Plan ..."Development of oil and gas leases should be simultaneously allowed where the development of one would not significantly affect the development of the other; when only one development could occur, coal development should be favored, since oil and gas reserves have not been proven" (BLM, 1981b). Oil and gas exploration may be locally deferred but would probably not be precluded.

In the Wasatch Plateau area, exploration and development of coal resources on the North Trough Springs, Mud Creek, Castle Valley Ridge, Trail Mountain, and The Pines tracts could conflict with the oil and gas exploratory well drilling presently being conducted on or immediately adjacent to these tract locations. Coal development and production phases would affect oil and gas exploration activities on the areas occupied by coal production surface facilities or underground mining areas. Oil and gas drilling would either be precluded from such areas or the drilling methods would have to be modified to meet oil and gas exploration objectives. Coal exploration and development activities would also conflict with the development of potential and known oil and gas fields located within the boundaries of the above coal tracts. Quantification of the effects are unknown since information on oil and gas reserves and production potentials for the fields have not been published by the companies involved.

Subsidence and/or surface disturbing operations associated with coal exploration and development on the North Trough Springs and Mud Creek tracts could accidentally damage wellhead facilities and pipelines and curtail gas production. Mining permits would provide for protection or relocation of existing facilities.

Rights-of-Way, Special Uses, Other Land Uses

Adherence to Environmental Protection Agency and State water discharge criteria and standards would protect the established beneficial uses of affected streams, including those streams classified as sources for domestic water systems. In most cases, water treatment facilities and procedures within central Utah would not have to be upgraded or modified in response to increased mining activity. However, water contamination accidents or periodic system failures at mine locations (such as cited for Huntington Canyon - see Chapter 3, Land Uses) could require that the coal lessees or communities in Carbon and Emery Counties plan and fund new water treatment facilities and measures.

If coal extraction resulted in subsidence within the tracts, the quality and quantity of water from the seven municipal watersheds in Carbon and Emery Counties could be impacted. Water quality would change due to a disrupted aquifer and discharge rates would be slowed or stopped. Communities deriving domestic water from affected springfed streams would have to upgrade existing treatment facilities and/or develop new water sources.

Exploration and production activities on the Trail Mountain and Ferron Canyon tracts could disturb the mechanical watershed treatment areas located on portions of these tracts. Additional watershed treatments are proposed for the North Trough Springs tract and could also be affected. Disturbance to the contour trenches and seeded areas would cause erosion problems on sensitive soil areas and would nullify past erosion control investments. Restoration would be required under Surface Mining Control and Reclamation Act.

The Eccles Canyon road could be damaged by subsidence on the Gooseberry tract.

Land Use Plans, Controls, and Constraints

Federal Plans

Coal leasing in central Utah has been addressed in Federal Land Use plans (Chapter 1). The Secretary of the Interior would consult with the Secretary of Agriculture for consent to offer tracts located on National Forest System lands (43 CFR 3420.4-2). The Secretary of Agriculture's decision would be based on Land and Resource Management plans directed by the National Forest Management Act of 1976. The Manti-LaSal and Fishlake National Forests are scheduled to complete the plans by October 1983. For all other tracts it has been determined that leasing would not conflict with any Federal land use plans if mitigating measures are applied as directed by the Surface Managing Agency.

County Plans

All tract developments in Central Utah would be in county zones where coal development would be permitted, with the exception of portions of the North Trough Springs, Mud Creek, and Castle Valley Ridge tracts. These portions are within Carbon County's CE-1 land use zone where coal mining is not allowable. Zoning variances or rezoning would have to be approved by Carbon County before mining could proceed. After rezoning, mining would be a permitted conditional use.

All coal mine developments would be required to implement county mitigation requirements for protection of other land resources as well as for social and economic concerns (see Chapter 3 for description of county plan concerns). If such measures are applied and met, potential conflicts could be resolved to the satisfaction of the counties.

Socioeconomics

Introduction

The socioeconomic impacts provided in this EIS are taken from a draft technical report entitled Social and Economic Impact Analysis Uinta-Southwestern Utah Coal Environmental Impact Statement. This document was prepared by the Utah State Office of the State Planning Coordinator and Department of Community and Economic Development.

Population, Income, and Employment

A summary of population and employment projections for Alternative One is provided in Table 4-13. Growth would begin in 1987 with a population increase of 3,016. By the year 2000 the population would increase by 17,777 persons, or 26 percent over 1982 population levels, and 18 percent over the projected baseline. Total employment would increase by 7,480 jobs or 18 percent over projected baseline conditions. Carbon County would receive about 47 percent of the population growth and 44 percent of the employment. Sevier County would receive about 13 percent of the population and 31 percent of the employment.

Projected personal and per capita income is shown in Table 4-14. Relatively higher per capita income would be anticipated with additional leasing because of the higher wages paid in the mining sector. The total personal income is a weighted average of the baseline projections and the impact projections of personal income. This may somewhat understate total income because the baseline projections reflect historical wage patterns as compared to the impact projections which are based on the mining based economy of Carbon County. However, the effect of increased mining would be to increase per capita incomes in all the counties.

Infrastructure

Housing

Carbon County would require an additional 1,440 single family units, 360 multi-family units and 600 mobile home units by the year 2000. Emery County would need a housing mix of 960 single family units, 240 multi-family units, and 400 mobile home units. Sanpete County would need an additional 414 single family units, 172 mobile home units, and 104 multi-family units to provide for growth from Alternative One over the projected baseline growth. A total of 5,100 new housing units would be needed in central Utah by the year 2000 under Alternative One. This would represent a 34 percent increase over 1982 levels and an 18 percent increase over the projected baseline by the year 2000. Table 4-15 summarizes additional demand for housing by type for each county. If required housing units are not available as needed, housing prices could increase to the point of causing personal hardship and the use of substandard housing would also increase.

Education

Growth in the Carbon School District would expand beginning with a 3-percent increase in student population (over baseline projections) by 1987, expanding to a 25-percent increase in the school-age population over baseline forecasts by 2000. This would require 96 additional teachers over the baseline demand of 388 to instruct the additional 2,400 students.

The Emery School District would experience a 36-percent growth over baseline forecasts by the year 2000. This would require an additional 64 teachers to be added to a baseline demand of 178 to instruct the additional 1,600 school-age children that would be in the district at that time under this alternative.

TABLE 4-13

POPULATION AND EMPLOYMENT IMPACT
PROJECTIONS BY COUNTY
ALTERNATIVE ONE

County	Population	Employment
Carbon County		
1987	1,206	821
1990	2,443	1,069
1995	6,766	2,860
2000	8,371	3,300
Emery County		
1987	780	176
1990	1,800	374
1995	4,861	1,012
2000	5,645	1,200
Sanpete County		
1987	432	348
1990	455	251
1995	1,316	663
2000	1,390	680
Sevier County		
1987	598	620
1990	758	890
1995	2,241	2,291
2000	2,371	2,300
Total (year 2000)	17,777	7,480

TABLE 4-14

TOTAL PERSONAL INCOME PROJECTIONS BY COUNTY
ALTERNATIVE ONE

Year	1987	1990	1995	2000
Carbon County				
Total Personal Income ($1,000)	359,644	603,967	500,191	536,760
Total Population (Basline + Impact)	34,075	37,602	43,984	46,027
Per Capita Personal Income	$10,554	$10,743	$11,372	$11,662
Emery County				
Total Personal Income ($1,000)	142,805	166,617	223,857	238,287
Total Population (Basline + Impact)	14,874	16,578	19,923	20,347
Per Capita Personal Income	$ 9,601	$10,050	$11,236	$11,711
Sanpete County				
Total Personal Income ($1,000)	130,286	144,788	179,758	198,330
Total Population (Basline + Impact)	19,496	20,857	23,152	23,807
Per Capita Personal Income	$ 6,683	$ 6,942	$ 7,764	$ 8,331
Sevier County				
Total Personal Income ($1,000)	170,231	214,766	285,139	322,640
Total Population (Basline + Impact)	20,345	22,373	26,305	27,785
Per Capita Personal Income	$ 8,367	$ 9,599	$10,840	$11,612

TABLE 4-15

CENTRAL UTAH
HOUSING DEMAND BY TYPE
ALTERNATIVE ONE
1987, 1990, 1995, 2000

	Single Family		Multi-Family		Mobile Homes	
County	Total	Increase	Total	Increase	Total	Increase
Carbon						
1987	6,546	246	1,637	62	2,727	102
1990	7,140	480	1,770	120	2,950	200
1995	8,160	1,260	2,040	315	3,400	525
2000	8,520	1,440	2,130	360	3,550	600
Emery						
1987	2,502	162	626	41	1,042	67
1990	2,760	360	690	90	1,150	150
1995	3,360	900	840	225	1,400	375
2000	3,360	960	840	240	1,400	400
Sanpete						
1987	3,390	90	848	23	1,412	37
1990	3,570	90	893	23	1,487	37
1995	3,900	240	975	60	1,625	100
2000	3,966	246	992	62	1,652	102
Sevier						
1987	3,606	126	902	32	1,502	52
1990	3,810	150	953	38	1,587	62
1995	4,428	408	1,107	102	1,845	170
2000	4,614	414	1,154	104	1,922	172
Total (year 2000)	20,460	3,060	5,116	766	8,524	1,274
Total additional units (year 2000)	5,100					

By the 1990s, projected growth of this magnitude would stress the school district to meet required accommodations and maintain quality education. Careful planning would be required to ensure an adequate capital availability for operating costs and new facilities.

Sevier and Sanpete would face similar growth rates through 1990 with growth at 2 percent higher than baseline forecasts in 1987 and increasing to 6 to 9 percent higher by the year 2000. This would require 17 additional teachers in Sanpete County over the baseline demand for 260 teachers. Sevier County District would need 28 additional teachers to instruct the additional 710 students. With assistance from potential lessees and developers, the Sevier and Sanpete School Districts should be able to accommodate the anticipated growth. Additional information is presented in Table 4-16.

Water and Sewer

Water and sewer needs for each community in the impact area are shown in Table 4-17 and 4-18, respectively. A proposed new water storage tank and upgrade and moderation of existing water and sewer lines in Price would be necessary to handle anticipated growth resulting from implementation of Alternative One.

The demand for water connections would grow from the existing 3,010 to 4,975 in 1987, 5,559 in 1990, 5,577 in 1995, and reach 7,016 in the year 2000, an average 11-percent growth per year between now and the end of the decade. The Price River Water Improvement District regional sewer system that services the communities of Price, Helper, Wellington, as well as adjacent unincorporated areas would also need to be substantially upgraded to handle the anticipated increased sewage needs. Estimates on the cost of upgrading the sewer system to National Pollution Discharge Elimination System standards are between 3.8 and 4.0 million dollars. In addition, Wellington would need $750,000 to upgrade its water system.

Plans to upgrade and expand the water system in the East Carbon/Sunnyside area scheduled to commence in the spring of 1983 should be adequate to handle anticipated growth in that area. The sewer system also appears adequate to accommodate the increased population.

The communities of Emery County have joined together to form the Castle Valley Special Services District which has already passed a $2 million bond for water and a $2.5 million bond for sewer improvements. These improvements will not provide capacity for projected baseline growth even without the increased population resulting from implementation of Alternative One. By 1987, Castle Dale would require 795 water connections which represents a 7-percent growth over baseline or just over 1 percent annually. This growth would accelerate to a 5 percent per annum increase over baseline late in the decade and grow further to 7-percent per annum increase through the year 2000. Growth of this magnitude is significant considering the limited capacity of the existing system. Ferron would also experience significant growth in the demand for water connections, reaching 12 percent per annum over baseline forecasts. Current expansion plans that have received $450,000 from the community account should provide for this demand through 1990; however, additional expansion

TABLE 4-16

IMPACTS ON EDUCATION, HEALTH, AND LAW ENFORCEMENT BY COUNTY
ALTERNATIVE ONE
1987, 1990, 1995, 2000

County	1987 Projected Baseline Need	1987 Total Need w/ Impact	1987 Impact	1987 Percent Change a	1990 Projected Baseline Need	1990 Total Need w/ Impact	1990 Impact	1990 Percent Change a
CARBON								
Education								
Students	7,890	8,110	220	3	8,863	9,313	450	5
Teachers	316	324	8	3	355	373	18	5
Health Facilities								
Hospital Beds	66	68	2	3	70	75	5	7
Doctors	18	19	1	6	19	21	2	11
Dentists	16	17	1	6	18	19	1	6
Nurses	66	68	2	3	70	75	5	7
Clinical Psych[b]	2	2	0	0	2	2	0	0
MSWs[c]	7	7	0	0	7	8	1	14
EMTs[d]	46	48	2	4	49	53	4	8
Ambulances	7	7	0	0	7	8	1	14
Nursing Homes	120	123	3	3	125	130	5	4
Law Enforcement								
Police	66	68	2	3	70	75	5	7
Police Cars	66	68	2	3	70	75	5	7
EMERY								
Education								
Students	3,987	4,127	140	4	4,390	4,720	330	8
Teachers	159	165	6	9	176	189	13	8
Health Facilities								
Hospital Beds	28	30	2	7	30	33	3	10
Doctors	8	8	0	0	8	9	1	13
Dentists	7	7	0	0	7	8	1	14
Nurses	28	30	2	7	30	33	3	10
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	3	3	0	0	3	3	0	0
EMTs[d]	20	21	1	5	21	23	2	10
Ambulances	3	3	0	0	3	3	0	0
Nursing Homes	35	37	2	6	36	40	4	11
Law Enforcement								
Police	28	30	2	7	30	33	3	10
Police	28	30	2	7	30	33	3	10

(continued)

Table 4-16 (cont'd.)

County	1995 Projected Baseline Need	1995 Total Need w/ Impact	1995 Impact	1995 Percent Change a	2000 Projected Baseline Need	2000 Total Need w/ Impact	2000 Impact	2000 Percent Change a
CARBON								
Education								
Students	9,889	11,589	1,700	17	9,692	12,092	2,400	25
Teachers	396	464	68	17	388	484	96	25
Health Facilities								
Hospital Beds	74	88	14	19	75	92	17	23
Doctors	20	23	3	15	21	25	4	19
Dentists	19	22	3	16	19	23	4	21
Nurses	75	88	13	17	75	92	17	23
Clinical Psych[b]	2	2	0	0	2	2	0	0
MSWs[c]	7	9	2	29	8	9	1	13
EMTs[d]	52	62	10	19	53	64	11	21
Ambulances	7	9	2	29	8	9	1	13
Nursing Homes	129	140	11	9	129	142	13	10
Law Enforcement								
Police	74	88	14	16	75	92	17	23
Police Cars	74	88	14	16	75	92	17	23
EMERY								
Education								
Students	4,716	5,916	1,200	25	4,459	6,059	1,600	36
Teachers	189	237	48	25	178	242	64	36
Health Facilities								
Hospital Beds	30	40	10	33	30	41	11	37
Doctors	8	11	3	38	8	11	3	38
Dentists	8	10	2	25	7	10	3	43
Nurses	30	40	10	33	30	41	11	37
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	3	4	1	33	3	4	1	33
EMTs[d]	21	28	7	33	21	28	7	33
Ambulances	3	4	1	33	3	4	1	33
Nursing Homes	36	44	8	22	35	43	8	22
Law Enforcement								
Police	30	40	10	33	29	41	12	25
Police Cars	30	40	10	33	29	41	12	25

(continued)

Table 16 (cont'd.)

County	1987 Projected Baseline Need	1987 Total Need w/ Impact	1987 Impact	1987 Percent Change a	1990 Projected Baseline Need	1990 Total Need w/ Impact	1990 Impact	1990 Percent Change a
SANPETE								
Education								
Students	4,930	5,010	80	2	5,508	5,588	80	1
Teachers	197	200	3	2	220	224	4	1
Health Facilities								
Hospital Beds	38	39	1	3	40	41	1	2
Doctors	10	11	1	10	11	12	1	9
Dentists	10	10	0	0	10	10	0	0
Nurses	38	39	1	3	41	42	1	2
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	4	4	0	0	4	4	0	0
EMTs[d]	27	27	0	0	29	29	0	0
Ambulances	4	4	0	0	4	4	0	0
Nursing Homes	83	96	13	14	82	83	1	1
Law Enforcement								
Police	38	39	1	3	41	42	1	2
Police Cars	38	39	1	3	41	42	1	2
SEVIER								
Education								
Students	5,282	5,402	120	2	6,032	6,172	140	2
Teachers	211	216	5	2	241	247	6	2
Health Facilities								
Hospital Beds	39	41	2	5	43	45	2	5
Doctors	11	11	0	0	12	12	0	0
Dentists	10	10	0	0	11	11	0	0
Nurses	39	41	2	5	43	45	2	5
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	4	4	0	0	4	5	1	25
EMTs[d]	28	29	1	4	30	31	1	3
Ambulances	4	4	0	0	4	5	1	25
Nursing Homes	78	80	2	3	78	80	2	3
Law Enforcement								
Police	40	41	1	3	43	45	2	5
Police Cars	40	41	1	3	43	45	2	5

(continued)

Table 4-16 (concluded)

County	1995 Projected Baseline Need	1995 Total Need w/ Impact	1995 Impact	1995 Percent Change a	2000 Projected Baseline Need	2000 Total Need w/ Impact	2000 Impact	2000 Percent Change a
SANPETE								
Education								
Students	6,315	6,655	340	5	6,501	6,921	420	6
Teachers	253	266	13	5	260	277	17	6
Health Facilities								
Hospital Beds	44	46	2	5	45	48	3	7
Doctors	12	13	1	8	12	13	1	8
Dentists	11	12	1	9	11	12	1	9
Nurses	44	46	2	5	45	48	3	7
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	4	5	1	25	4	5	1	25
EMTs[d]	31	32	1	3	31	33	2	6
Ambulances	4	5	1	25	4	5	1	25
Nursing Homes	78	79	1	1	70	71	1	1
Law Enforcement								
Police	44	46	2	5	45	48	3	7
Police Cars	44	46	2	5	45	48	3	7
SEVIER								
Education								
Students	7,203	7,783	580	8	7,619	8,329	710	9
Teachers	288	311	23	8	305	333	28	9
Health Facilities								
Hospital Beds	48	53	5	11	51	66	15	29
Doctors	13	14	1	8	14	15	1	7
Dentists	12	13	1	8	13	14	1	8
Nurses	48	53	5	10	51	56	5	10
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	5	5	0	0	5	7	2	40
EMTs[d]	34	37	3	9	36	46	10	28
Ambulances	5	7	2	40	5	7	2	40
Nursing Homes	77	81	4	5	71	75	4	6
Law Enforcement								
Police	48	53	5	10	51	56	5	10
Police Cars	48	53	5	10	51	56	5	10

a Percent Change: Change from Projected Baseline Need to Total Need with Impact.
b Clinical Psych: Clinical Psychologist.
c MSW: A person with a Master's Degree in Social Work.
d EMT: Emergency Medical Technician.

TABLE 4-17

PROJECTED DEMAND FOR WATER CONNECTIONS BY COUNTY
ALTERNATIVE ONE
1987, 1990, 1995, 2000

County	1987		1990		1995		2000	
	Total	Impact	Total	Impact	Total	Impact	Total	Impact
Carbon								
East Carbon	559	8	552	16	569	40	558	44
Helper	1,238	48	1,288	64	1,319	74	1,431	170
Hiawatha	NA	NA	NA	NA	NA	NA	NA	NA
Price	4,975	208	5,559	434	5,577	110	7,016	1,328
Schofield	NA	NA	NA	NA	NA	NA	NA	NA
Sunnyside	176	3	174	5	179	13	176	14
Wellington	822	58	936	120	1,167	307	1,251	368
Emery								
Castle Dale	795	51	901	115	1,089	285	1,112	323
Cleveland	172	9	187	20	217	49	220	55
Elmo	106	6	115	13	136	33	138	37
Emery	147	22	176	46	246	114	254	123
Ferron	677	98	810	209	1,117	508	1,162	558
Huntington	846	36	895	82	1,008	204	1,020	231
Orangeville	564	36	624	82	750	204	767	231
Sanpete								
Centerfield	NA	NA	NA	NA	NA	NA	NA	NA
Ephraim	1,071	15	1,128	13	1,223	38	1,282	36
Fairview	425	35	498	36	567	97	570	99
Fountain Green	213	3	213	3	216	7	217	8
Gunnison	NA	NA	NA	NA	NA	NA	NA	NA
Manti	792	10	834	9	902	25	947	24
Moroni	373	7	393	8	411	20	413	20
Mt. Pleasant	919	32	991	33	1,066	87	1,069	88
Spring City	250	6	264	7	278	17	280	18
Wales	50	1	52	1	54	3	55	3
Sevier								
Aurora	353	23	375	26	436	69	450	70
Redmond	249	15	264	17	305	45	314	45
Richfield	2,506	104	2,717	138	3,167	366	3,232	375
Salina	815	63	865	69	1,022	185	1,054	187

Total columns indicate total demand for water connections, baseline plus impact.
NA - Information not available.

TABLE 4-18

PROJECTED CAPACITY FOR WASTEWATER TREATMENT FACILITIES BY COMMUNITY
(GALLONS PER DAY)
ALTERNATIVE ONE
1987, 1990, 1995, 2000

County	1987 Total	1987 Impact	1990 Total	1990 Impact	1995 Total	1995 Impact	2000 Total	2000 Impact
Carbon								
East Carbon	174,700	2,300	175,300	5,000	184,300	13,500	180,000	15,500
Helper	386,600	14,200	408,700	19,600	427,100	25,000	463,000	59,600
Hiawatha	NA	NA	NA	NA	NA	NA	NA	NA
Price	1,553,200	61,000	1,763,200	133,300	2,137,800	371,900	2,286,400	466,200
Schofield	NA	NA	NA	NA	NA	NA	NA	NA
Sunnyside	55,000	800	55,200	1,600	58,000	4,300	56,700	5,000
Wellington	256,100	16,900	296,300	36,900	380,700	103,000	411,800	129,100
Emery								
Castle Dale	282,700	14,900	322,900	35,300	393,500	96,000	402,600	112,900
Cleveland	61,100	2,600	67,200	6,100	78,600	16,500	79,900	19,400
Elmo	37,700	1,700	41,500	4,000	49,200	11,000	50,100	12,900
Emery	51,100	6,000	61,000	13,300	86,600	37,900	90,800	42,800
Ferron	237,700	29,200	285,000	65,000	397,000	171,800	417,000	195,500
Huntington	302,300	10,600	322,800	25,200	366,000	68,600	370,300	80,700
Orangeville	200,600	10,600	223,700	25,200	270,500	68,600	277,300	80,700
Sanpete								
Centerfield	NA	NA	NA	NA	NA	NA	NA	NA
Ephraim	366,900	4,400	393,500	4,100	439,600	12,400	462,100	12,40
Fairview	144,300	10,200	172,300	11,000	200,700	31,600	203,700	33,800
Fountain Green	73,000	800	73,800	800	77,600	2,400	78,100	2,600
Gunnison	NA	NA	NA	NA	NA	NA	NA	NA
Manti	271,300	2,900	290,900	2,700	324,500	8,300	341,100	8,200
Moroni	127,800	2,100	136,700	2,300	147,400	6,500	148,500	6,900
Mt. Pleasant	314,200	9,200	344,700	9,900	380,700	28,400	384,300	30,300
Spring City	85,600	1,800	91,600	2,000	99,700	5,700	100,500	6,100
Wales	17,100	300	18,200	300	19,500	800	19,800	900
Sevier								
Aurora	120,100	6,800	130,500	7,800	155,000	22,400	162,000	23,900
Redmond	84,700	4,500	92,000	5,100	109,700	15,800	113,300	15,500
Richfield	853,400	30,200	948,400	41,800	1,134,200	122,800	1,201,600	128,600
Salina	276,500	18,300	300,800	21,200	362,700	60,500	379,000	64,300

NA - Information not available.

would be required at that time. Ferron currently faces critical problems with an inadequate sewage system. This problem would be exacerbated under Alternative One and by 1987 Ferron would experience a shortfall of capacity for 677 persons. This would grow to a 1,150 persons shortfall by 1990, and reach a 2,270 persons shortfall by 1995. This would require a 234-percent increase in capacity over existing conditions to handle the sewage demands forecast for Alternative One.

Similarly, major expansion of water and sewer capacity would be required throughout the Emery County area to provide for growth from Alternative One particularly in the decade of the 1990s and beyond.

Redmond, Richfield, and Salina would need to expand their water systems to accommodate Alternative One population increases by the 1990s. Richfield has already begun this effort and upon completion should be able to accommodate growths forecast that would call for a total of 3,167 water connections by 1995. Sanpete County communities would be required to upgrade and modernize components of their water system by the 1990s, although generally they appear adequate to handle projected growth.

Public Safety

Law enforcement needs for all counties are found in Table 4-16. The increase in demand for law enforcement services would increase approximately 23 to 25 percent over baseline forecasts in Carbon and Emery County requiring totals of 92 officers and 41 officers, respectively, by the year 2000. Sevier and Sanpete Counties would experience a 10 and 7 percent increase in demand for law enforcement services at the same time with a total need for 56 officers and 48 officers, respectively.

By 1990 a 10-person staff would be necessary to provide adequate fire protection for the community of Price. By the year 2000, an additional five full-time firemen would be needed. In addition, the expansion of water flow, distribution, and equipment would also be necessary. The remaining communities in Carbon and Emery County would need to train additional volunteers and perhaps add fire equipment although the type and level of fire protection services they currently provide would generally be adequate to handle demand under Alternative One.

The City of Richfield would also need a full-time firefighting staff by 1995. A six or seven person full-time fire-fighting force added at that time should be adequate until the end of the century. Fire fighting equipment and in particular an expansion of the communications system would be necessary. The remaining communities would need to expand their volunteer force as well as monitor the adequacy of their fire-fighting equipment but, in general, Sanpete and Sevier Counties have adequate fire-fighting capacity to handle growth under this Alternative.

If local fire protection efforts do not keep pace with population growth, the resultant shortfall would increase the risk of personal injury, death, and property destruction.

Cumulatively, Carbon and Emery Counties would need an additional 28 hospital beds to handle projected demand by the year 2000. An additional four doctors and four dentists would be required in Carbon County. Emery County would require three additional physicians and three dentists by the year 2000.

Sanpete County would need to add three hospital beds to the existing 45 hospital beds to meet the anticipated demand by the year 2000. In addition, the need for dentists and physicians would increase by one over the baseline. Sevier County would need an additional 15 hospital beds by the year 2000, as well as one doctor and one dentist.

It would be difficult for communities to meet these additional needs for facilities and personnel. If regional facilities and personnel are not maintained, the quality and availability of necessary medical services would deteriorate.

Solid Waste

Communities within Carbon, Emery, Sevier, and Sanpete Counties should have adequate disposal areas for the additional solid waste generated under Alternative One although additional landfill acreage may be necessary in Richfield, Fountain Green, Moroni, and Mt. Pleasant. Failure to maintain adequate solid waste facilities would result in over-use of existing facilities and use of unauthorized areas resulting in possible degradation of surrounding land.

Social/Attitudes

The attitude of residents of the four-county area toward additional coal development in the future cannot be accurately predicted because social and political attitudes toward growth change in response to economic conditions. When employment is high, additional growth is generally opposed, but during periods of high unemployment economic development is promoted.

The projected population growth in Carbon and Emery Counties could change the social and political structure of communities. Because of the present cultural diversity of Carbon County, changes in social and political structure would probably be acceptable to long-time residents. However, in Emery County where there is a more homogeneous culture, the introduction of cultural diversity associated with growth in the coal industry may be opposed by the present residents.

The lifestyles of Sanpete and Sevier Counties would not be disrupted by the projected coal related population growth and the creation of new jobs would be acceptable to local residents.

Transportation

Table 4-19 shows predicted increases in traffic due to development of the 20 central Utah tracts. Vehicles per day would increase by over 13,000 by the year 2000. Increased traffic would require increased road maintenance

TABLE 4-19

CENTRAL UTAH
MAXIMUM INCREASES IN TRAFFIC AND VEHICLE USE
ALTERNATIVE ONE

Feature	Coal Trucks	Service Trucks	Commuters	Other Trucks	Other Cars	Totals
Max. Vehicles/day	2,507	534	5,987	419	3,606	13,053
Total Million Miles[a]	325	226	2,116	34	260	2,961
Total Mi. Gals. Fuel[a]	81	42	83	6	9	221
Total Vehicles Lives[a]	325	445	21,164	67	2,610	24,611

[a] Within area of influence only. Travel outside this area is not included.

throughout the area and there would be an increased but unquantified number of traffic accidents. If road improvements are implemented as needed (see Alternative Four), the accident rate should remain typically low. The largest increases in traffic would occur on Highway U-10 in the Price area. Traffic on U-10 from Price southward to Castle Dale would exceed prudent limits for a two-lane highway, without any additional coal mining. Proposed lease development would add additional traffic on this segment.

The other highway most heavily impacted by additional mining would be US-6, a four-lane highway segment from Castle Gate to Price. This segment of highway would be capable of carrying the increased traffic volume without significant increases in accidents or safety hazards.

Assuming that one-half of the annual central Utah coal production (6.7 million tons) would pass through Price, there would be an increase of up to four 65-car railroad trains per day. This increased train traffic would cause delays on U-10 and local streets in Price varying from 20 to 40 minutes per day. Highway traffic would back up both north and south of the train crossings affecting the east and west traffic on U-6 and local streets in the downtown Price area. An additional 3,000 vehicles per day (vpd) at Price due to increased mining would increase the frequency of traffic jams and number of vehicles involved.

Four secondary roads in the Book Cliffs and southern part of Castle Valley would either be overloaded or approach overloading from traffic increases. The Alkali Creek and Ferron Canyon Roads would carry 400 vpd; the Coal Creek Road would carry 850 vpd; and the poor quality Quitchupah Road would be traveled by 2,300 vpd. Above 500 vpd on a loose-surfaced road, maintenance increases disproportionately, and the likelihood of increased numbers of accidents due to dust and poor visibility in dust also increases markedly.

Mine-related traffic in the central Utah area would add about 13,000 vpd to the highways, traveling about 2.96 billion miles, using 221 million gallons of fuel and wearing out 24,600 vehicles over the lives of the mines. Traffic associated with additional proposed mining would not by itself overload any of the State highways in the area.

Cultural Resources

Exploration and construction of surface facilities for underground mining could inadvertently disturb or destroy historic and prehistoric cultural resources. A 100-percent survey of development sites would be required prior to disturbance. The majority of site disturbance could be avoided by proper placement of facilities. Where avoidance is not possible, data recovery by salvage excavation would mitigate most adverse effects. The total number and significance of the affected sites is unknown.

Avoidance on the Blue Trail Canyon tract which would be strip mined would not be feasible. Site density on this tract is moderate to high. Salvage of as many as 50 sites could be required, placing a substantial financial burden on the lessee.

Inadvertent damage or destruction of cultural sites from mining and salvage activities would result in the loss of scientific and cultural information for future research and resources that may be valuable in terms of uniqueness in their natural setting. There are no known National Register Sites within the lease tracts (Smith, written communication, Division of State History, 1982). The loss of these values, on the other hand, would be partially offset by information gained from overall excavation and salvage programs. Such information would add to the growing data base for cultural resources in Utah and enhance our knowledge of prehistoric resource utilization and settlement patterns.

The extent of cultural resource disturbance that would result from mine-related community expansion is unknown. Mitigation of losses to cultural values in community expansion areas cannot be assured as they would be on private lands where mitigation would be subject to approval of individual land owners unless community development were funded by the Federal Government.

Indirect impacts would increase as a result of greater accessibility and local population increases. Recreational activities of two types, those intentional illegal activities associated with artifact collection and treasure hunting, and unintentional recreational use (hiking, hunting, off-road vehicles), could cause irreplaceable, unmitigable site damage. Both scientific and aesthetic site values would be lost as a result of these indirect impacts. This loss would occur to many on and off-tract significant cultural resources in Carbon, Emery, Sanpete, and Sevier Counties.

Recreation

By the year 2000, assuming continuation of present trends and use patterns, mining-related population growth would increase the local demand (users originating from within the four-county region) for both dispersed and developed recreation opportunities by approximately 26 percent from 1982 use figures and by approximately 18 percent over the baseline use figures projected for that year.

Table 4-20 shows the anticipated increase in local demand for hunting and fishing for the period 1987 to 2000. This increase in demand would occur at the same time that game numbers would be reduced from mining-related displacement and road kills. The additional competition for available game and fish would lead to less hunting and fishing success. To maintain present hunting success it would be necessary to restrict animal harvests, thereby reducing hunting opportunities. To maintain present fishing success, stocking activities would have to be increased by the Utah Division of Wildlife Resources.

Table 4-21 shows the anticipated increase in local demand for off-road vehicle (ORV) activities for the period 1987 to 2000. Although the four-county region has adequate miles of primitive dirt roads to absorb the ORV demand without resources damage, the increase would conflict with other recreational uses, reducing the overall opportunity for dispersed recreation and reducing the quality of the recreation experience to some visitors.

TABLE 4-20

PROJECTED INCREASE IN LOCAL HUNTER AND FISHERMAN DEMAND WITHIN THE FOUR-COUNTY REGION
ALTERNATIVE ONE

		Projected Annual Increase in Numbers						
Year	Coal-Related Population	Deer Hunters	Elk Hunters	Upland Game/ Waterfowl Hunters	Fishermen	Increased Demand for Fish	Overall Percent Increase from 1982	Overall Percent Increase from Projected Baseline
1987	3,016	543	60	271	1,357	40,710	4	4
1990	5,448	981	109	490	2,450	73,500	8	6
1995	15,184	2,733	304	1,367	6,828	204,840	22	16
2000	17,777	3,200	356	1,600	7,994	239,820	26	18

Note: Projections were made assuming that the percentage of Utah's population that currently hunts or fishes would remain the same, and that the Utah percentage can be applied to the four-county area. Approximately 18 percent of Utah's population hunt deer, approximately 2 percent hunt elk, and approximately 9 percent hunt upland game or waterfowl. Approximately 53 percent of Utah's population under the age of 12 and 42 percent of the population over the age of 12 fish. Approximately 27 percent of Utah's population is under and 73 percent is over 12 in age (Thayne and Hudson, 1978). An average of 30 fish per person per year were caught in 1977 (UDWR, 1978).

TABLE 4-21

PROJECTED INCREASE IN LOCAL OFF-ROAD VEHICLE DEMAND WITHIN THE FOUR-COUNTY REGION
ALTERNATIVE ONE

Year	Projected Coal-Related Population Increase	Projected Increase in Pickup and Four-Wheel Drive Numbers	Projected Increase in Motorcycle Numbers	Overall Percent Increase from 1982	Overall Percent Increase from Projected Baseline
1987	3,016	754	211	4	4
1990	5,448	1,362	381	8	6
1995	15,184	3,796	1,036	22	16
2000	17,777	4,444	1,244	26	18

Note: Projections were made assuming that the percentage of the population in the four-county region that owns off-road vehicles would remain the same (approximately 7 percent of the population currently owns motorcycles, and approximately 25 percent of the population currently owns four-wheel drive vehicles or light pickups) (Utah Outdoor Recreation Agency, 1978).

Developed camping and picnicking sites in the four-county region would receive increased use by the new population. Additional recreational use would most often occur at sites being used at greater than 20 percent of their design capacity (see Table 3-15), probably increasing use to 40 percent or more at some of the sites, which would result in overcrowding, user dissatisfaction, and deterioration of the environment. Overcrowding and deterioration would intensify at some sites presently being used at greater than 40 percent capacity. Federal and State governments would be under greater stress to provide adequate maintenance for existing developed sites and to construct new sites. These overcrowded conditions would cause additional recreational pressures on undeveloped, dispersed areas. These dispersed areas would generally be able to absorb increased recreational pressures without resource damage; however, an increase in use of the San Rafael/Buckskin Draw area would result in an intensified deterioration of the environment and facilities and an increase in user dissatisfaction.

The overcrowded conditions of available recreation facilities in the towns would accelerate, resulting in increased facility deterioration and user dissatisfaction. Stress would be placed on local governments to provide urban recreation facilities (e.g. playfields, swimming pools, golf courses) to meet minimum standards recommended by the Utah Outdoor Recreation Agency (UORA, 1978).

Development of the tracts, including onsite and offsite disturbance, and development of homesites, would displace dispersed recreational use from as much as 433 acres by 1987, 1,602 acres by 1990, 2,191 acres by 1995, and 2,380 acres by the year 2000. Because surrounding areas offer comparable or better opportunities and because access to these surrounding areas would not be eliminated, the recreational opportunities lost would not be significant, even when the increase in recreational demand is considered.

About 75 miles of road would be improved or constructed for mining purposes, and this would permanently improve accessibility for dispersed recreation. About 102 miles of exploration access would be available for recreation use between 1987 and 1990. The visual and audio impacts from mining development would reduce the quality of the recreation experience to some people using mining-related roads to access the Wasatch Plateau and Book Cliffs areas. Others could find coal development interesting, adding to their recreational experience. Most development would be hidden from view of major recreational access roads and recreation attractions. Exceptions are noted in the Visual Resources Section.

Increased industrial traffic resulting from mining operations in the Soldier Creek, Whitmore Park, Alkali Creek, Coal Creek, Dugout Creek, North Trough Springs, Mud Creek, Gooseberry, Trail Mountain, and Ferron Canyon tracts would present increased danger to recreational traffic on the Myton, Coal Creek, Dugout Creek, Eccles Canyon, Huntington Canyon, Straight Canyon, Cottonwood Canyon, and Ferron Canyon roads, resulting in stress to the recreational visitor and loss of enjoyment with the recreational experience.

Upgrading of the Ferron Canyon road would likely result in destruction of the Ferron Canyon Picnic Area. Should this happen, the approximately 803 annual visitor days the site receives would be displaced to other developed sites as well as to dispersed areas. Because of the small number of visitor days involved, impacts resulting from displaced visitor use would probably be unnoticeable.

The loss in visual range (1 to 13 percent over baseline conditions by the year 2000) in scenic vistas viewed from overlooks in Canyonlands and Capitol Reef National Parks (see Air Quality Section) would, during 1 percent of the time, be perceptible to some park visitors, and may reduce the quality of their recreational experience.

Visual Resources

Development of the central Utah tracts would change the scenic character of isolated portions of the region both on- and off-tract from natural to industrial during the life of the mines. Visual disturbance in all cases would be greatest during the coal production stage. It is unlikely that disturbance from subsidence would be visible or disturbing to most people.

Development associated with underground mining of the Gooseberry tract (e.g., portal access, exploration roads and drill pads, buildings, transmission lines, etc.,) would be visible in varying degrees of contrast from many recreation attractions including segments of Utah Highway 31 and the Skyline Drive, Flat Canyon Campground, and from the roads accessing the above attractions. Mining disturbance would degrade the natural appearing vistas as seen from these areas. Although the viewing distance involved (over 1 mile in most cases), taken in conjunction with the careful use of color and location of facilities in both exploration and development phases would help soften the visual change, mining disturbance would probably conflict with visual resource management objectives of the area for the life of the mining operation. Some people may consider the mining development an unacceptable visual intrusion, while others could find it interesting.

There would be visual conflict associated with underground mining of the Trail Mountain tract, where the portal area including buildings and stockpiled coal would dominate the landscape as viewed from the Cottonwood Creek road and Utah Highway 29. Because of the sensitivity of the visual area, the development would result in an unacceptable modification of the partial retention area for the life of the mine.

Because of intervening terrain, development of the Blue Trail Canyon tract would not be visible to travelers on I-70, although fugitive dust resulting from the surface mining operation could be visible. Because development would not be visible from the Interstate, the Visual Resource Management (VRM) Class II and IV objectives for Blue Trail Canyon tract would most likely be met. However, because surface mining would severely modify the landscape, the high quality scenery identified within tract boundaries may be irreparably disturbed.

In development of Soldier Creek, Whitmore Park, Alkali Creek, North Trough Springs, Ferron Canyon, Ivie Creek, and Walker Flat tracts, careful use of location, and color in placement of exploration roads, drill pads, and ventilation shafts to avoid unnecessary disturbance and high visibility from the Myton road, Utah Highway 31, Ferron Canyon road, I-70, and Utah Highway 10, respectively, would prevent what would otherwise be temporary degradation of visual quality and probable conflict with the VRM objectives for these tracts. Realignment of the Ferron Canyon road would result in temporary conflict with the partial retention classification during the construction period. If the Ferron Canyon picnic site is not destroyed, the visual contrast as viewed from the site would be high and disturbing to most visitors. However, upon completion the road would be constructed so as to meet visual objectives.

With the exception of the conflicts noted above, disturbance associated with development both on and off the Alkali Creek, Coal Creek, Castle Valley Ridge, Ferron Canyon, Mud Creek, North Trough Springs, Quitchupah, Skumpah, Dugout-Pace, Graves, Hoffman Creek, Soldier Creek, Whitmore Park, Acord, Ivie, and Walker Flat tracts would not significantly impact visual resource values.

Reclamation would be effective in re-establishing the present scenic quality and character of the Wasatch Plateau and Book Cliff tracts within 10 years of completion of the mining operations. The arid nature and lack of topsoil in the Blue Trail Canyon tract would make reclamation difficult, and the tract would continue to appear somewhat disturbed after reclamation was completed. Overall the average visitor would probably note little change in the region's scenic character from development and reclamation of the tracts.

Special Designation Areas

Mining activities including new mines and transportation routes would not directly impact any special designation areas. However, the increase in local recreational demand could result in increased ORV and other dispersed use of some of the 17 areas within the four-county region with special designation or potential for special designation. The more intensive use and resultant littering and vandalism would tend to degrade values for which the areas are being protected and/or reviewed. Agencies managing the lands would be under stress to protect these values. The degree of impact is not quantifiable. However, due to the temporary nature of impacts resulting from dispersed recreational use, it is extremely unlikely even in a worse case situation that possible degradation would affect the suitability of any area for special designation.

Southern Utah

Climate, Air Quality

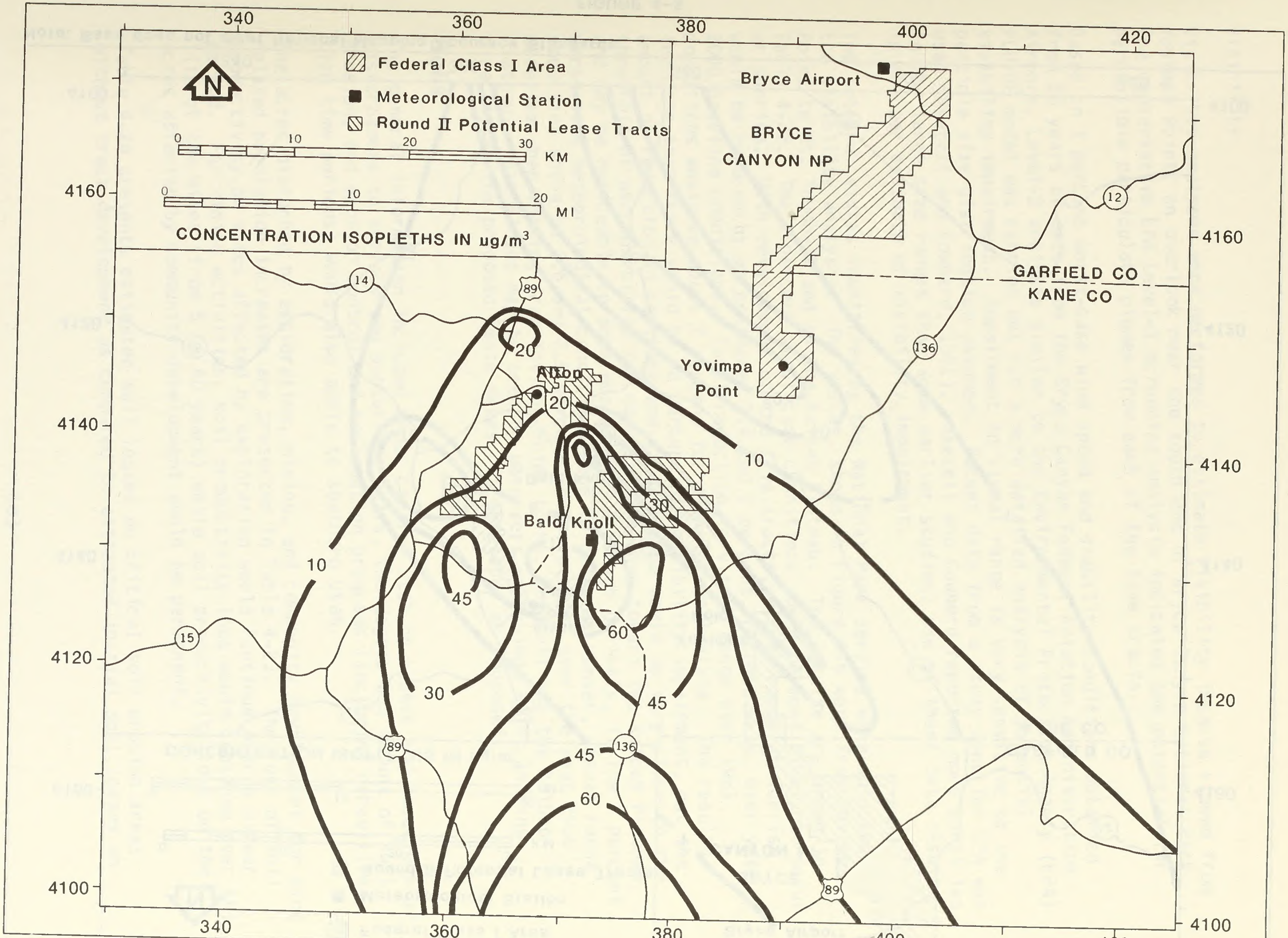
Air Quality Standards

The development of the five Alton tracts would cause an increase in emissions of all pollutants covered by NAAQS. Because the increase is considered significant only for particulates, it was the only pollutant modeled. Under Alternative One total TSP emissions are projected to increase by about 740 tpy over the 1982 level of 4,489 tpy and the projected baseline of 9,900 tpy by the year 2000. Therefore, by the year 2000, annual TSP emissions due to implementation of Alternative One are estimated to increase by approximately 17 percent over 1982 levels and 8 percent over the projected baseline.

Annual average TSP concentrations were estimated using the model ISCLT. Figure 4-4 shows the predicted annual average TSP concentrations in the year 2000 with the five new mines in full operation (without background of 15 micrograms per cubic meter). The secondary NAAQS are predicted to be exceeded near the Ford Pasture surface mine and in the Kanab area. Concentrations approaching the secondary NAAQS are predicted to occur south of the Flax Lakes tract. The exceedences near the mines would result from mining activities while the high concentrations near Kanab would result primarily from travel on unpaved roads and other population induced emissions. The secondary NAAQS for TSP is not currently exceeded in Kane or Garfield Counties. However, by the year 2000, secondary NAAQS would be exceeded within 185 square miles of which 165 square miles would be attributed to Alternative One.

The modeling analysis is conservatively high and may overestimate the size of the area that would exceed the NAAQS because deposition and terrain are not accounted for. Annual average concentrations within Bryce Canyon National Park are overestimated because, except for the extreme south portion of Bryce Canyon (below Yovimpa Point), the National Park is much higher in elevation than the lease areas. The TSP emissions from mining activities occur at ground level and few particles would be raised high enough to reach the elevated terrain in the park. Additionally, because of the large size of the particles generated from mining related activities, most would settle out before reaching the park.

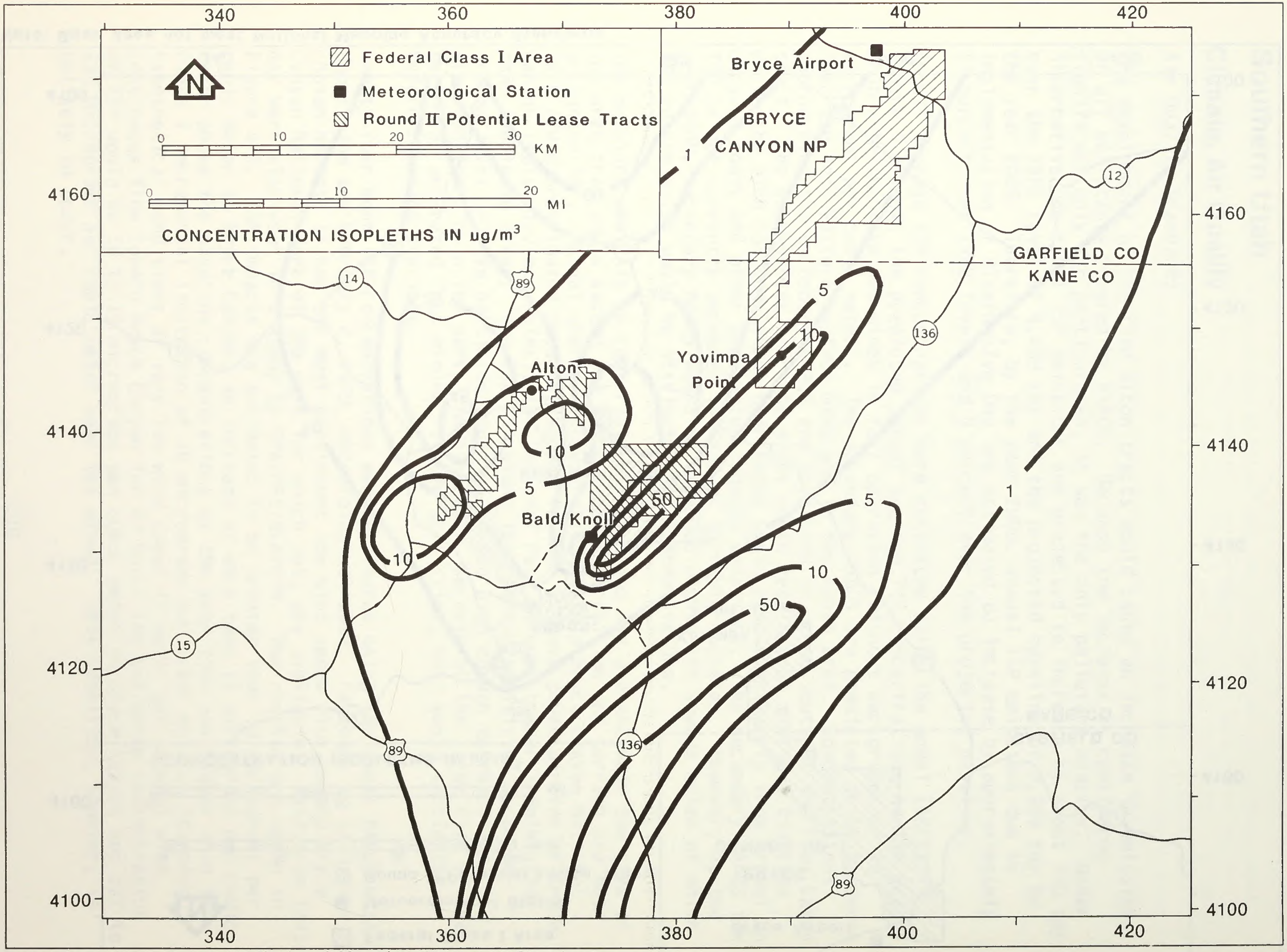
Twenty-four hour TSP concentrations were estimated using the model PALDS with deposition and February 2, 1979, meteorological data. February 2, 1979, was chosen because it had the most persistent low wind speed flow toward Bryce Canyon National Park of the days for which data are available. Data from this day were also used in a study by EPA/NPS/BLM/OSM. The results are shown in Figure 4-5. TSP impacts are estimated to be greater than 10 micrograms per cubic meter at Bryce Canyon, an increase of more than 10 micrograms per cubic meter above the baseline concentrations by the year 2000 and higher than the Class I incremental limitation of 10 micrograms per cubic meter. Assuming hypothetical conditions of very low wind speed (1 meter per second) with continuous flow toward Bryce Canyon for 24 hours the estimated concentration of TSP would be 16 to 19 micrograms per cubic meter in Bryce Canyon and 222 to 235 micrograms per cubic meter near the mines. This condition, however, is unlikely to occur.



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 4-4

ANNUAL AVERAGE TSP CONCENTRATIONS IN SOUTHERN UTAH - YEAR 2000



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 4-5

24-HOUR TSP CONCENTRATIONS IN SOUTHERN UTAH - YEAR 2000

Visibility

Visibility analyses were performed to estimate visibility impacts viewed from Yovimpa Point, an overlook near the south end of Bryce Canyon National Park. The conservative EPA Level-1 screening analysis indicated the potential for perceptible particulate plumes from each of the five tracts.

Based on 1 percent worst-case wind speed and stability conditions obtained from 10 years of data from the Bryce Canyon Federal Aviation Administration Airport, Level-2 analysis similar to the Environmental Protection Agency (EPA) PLUVUE model was carried out for a more detailed analysis of potential visibility impairment. Impairment to visual range is very sensitive to the particle size distribution assumed. Recent data from a study done for EPA was used (Axetell and Cowherd, 1981). Axetell and Cowherd reported more particles in the large size ranges than some earlier studies; use of these data results in a lower estimate of visibility impairment.

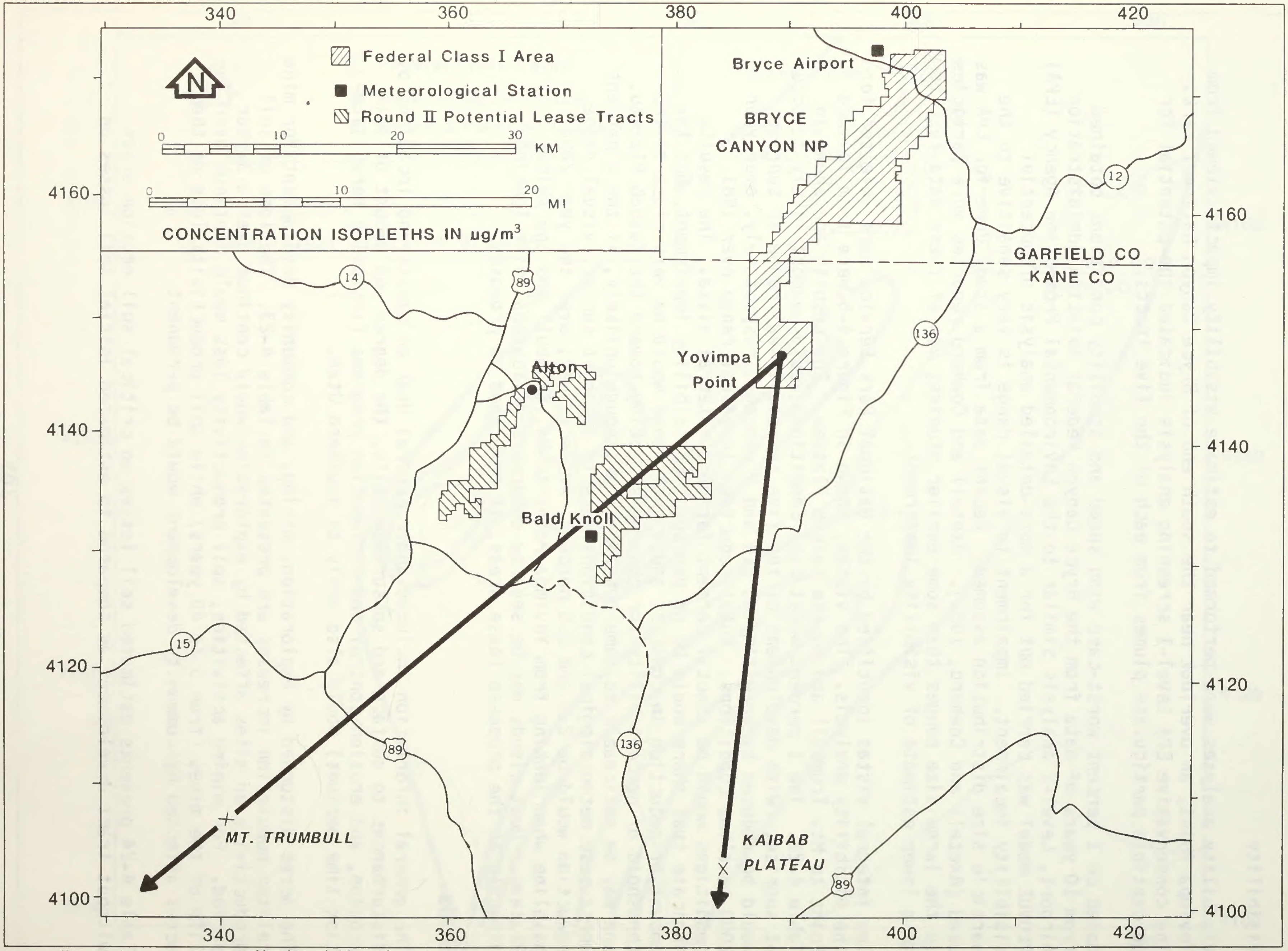
Two integral vistas identified by the National Park Service were selected for the visibility analysis. The vistas, shown in Figure 4-6 were from Yovimpa Point to Mt. Trumbull and to the Kaibab Plateau. The results are shown in Table 4-22. The 1 percent worst-case conditions would be most likely to occur at sunrise. With development of the five tracts, visual range at sunrise would be reduced by an estimated 1.4 and 2 percent, respectively, over year 2000 baseline conditions. Total reduction in visual range over 1981 conditions would be about 7 percent for each integral vista. The results indicate that there would be no perceptible visibility impairment, but the amount of reduction in contrast and visual range would be very close to the threshold of perceptibility for observers looking toward the Kaibab Plateau, and may be noticeable to some observers. Although unlikely, if the 1 percent worst-case meteorological conditions were to occur at sunset, visual range reduction would be 2.6 and 2.5 percent, respectively, over the year 2000 baseline when looking from Yovimpa Point to Mt. Trumbull and the Kaibab Plateau. Dust clouds may be seen by observers at Yovimpa Point looking directly at the proposed lease areas, if developed as proposed.

Soils

The general information included under central Utah on causes and locations of disturbances to surface and subsurface soils, the degree and amount of soil erosion, and erosion control and reclamation programs (including rehabilitation time periods) would also apply to southern Utah.

The acres disturbed by exploration, mining, and community development for mine related population increases are presented in Table 4-23. The loss of soil productivity on sites affected by exploration would continue over a 3-year period. For mining activities, soil productivity loss would continue over the life of the mines (from 5 to 40 years) while soil productivity loss on the acres affected by community development would be permanent.

Table 4-24 presents estimated soil losses on critical soil erosion areas without tract development as compared to estimated initial soil losses on



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 4-6

LINES OF SIGHT FOR THE LEVEL-2 VISIBILITY ANALYSIS IN SOUTHERN UTAH

ALTERNATIVE ONE

TABLE 4-22

SOUTHERN UTAH
WORST-CASE (1 PERCENT OCCURRENCE) VISIBILITY IMPAIRMENT
ALTERNATIVE ONE - YEAR 2000

Line of Sight	From Yovimpa Point to Mt. Trumball	From Yovimpa Point to Kaibab Plateau
Visual Range Reduction[a] at Sunrise (Percent)		
Baseline Year 2000	1.94	1.36
Secondary Growth	0.59	0.33
Proposed Mines	0.80	1.65
Year 2000 Total	3.33	3.34
Contrast Reduction[b] at Sunrise		
Baseline Year 2000	0.017	0.018
Secondary Growth	0.005	0.005
Proposed Mines	0.007	0.022
Year 2000 Total	0.029	0.045
Visual Range Reduction at Sunset (Percent)		
Baseline Year 2000	3.04	1.61
Secondary Growth	1.00	0.39
Proposed Mines	1.63	2.14
Year 2000 Total	5.67	4.14

[a] Threshold of perceptibility: 7-12 percent
[b] Threshold of perceptibility: 0.1

TABLE 4-23

SOUTHERN UTAH
ACRES OF SOIL DISTURBANCE ON COAL TRACT
AND COMMUNITY DEVELOPMENT AREAS

ALTERNATIVE ONE

Activity	Acres Disturbed 1987	1990	1995	2000	
Exploration [a]	216.4	216.4	216.4	216.4	The exploration and mining acres represent 4.7 percent of the total surface acres within the coal tracts.
Mining	0	239.3	521.9	812.4	
Community Development [b]	81.9	150.8	383.8	466.8	
Totals	298.3	606.5	1122.1	1495.6	

Source: Round Two Individual Tract Profiles. Round Two Leasing and socioeconomic data from the State of Utah Planning Coordinator's Office, 1982.

[a] Although included in cumulative total of disturbed acres, the exploration acres would be rehabilitated within a 3-year period after completion of exploration work.

[b] Soil loss productivity considered permanent on these acres.

TABLE 4-24

SOUTHERN UTAH
ESTIMATED SOIL LOSSES ON CRITICAL SOIL EROSION AREAS[a]
ALTERNATIVE ONE

Coal Tract		Exploration Activities: Estimated Soil Loss Without Tract Developments[b]	Exploration Activities: Estimated Soil Loss With Tract Developments[c]	Exploration Activities: Differences Attributed to Tract Developments	Exploration Activities: Percent Increases	Production Activities: Estimated Soil Loss Without Tract Developments	Production Activities: Estimated Soil Loss With Tract Developments	Production Activities: Differences Attributed to Tract Developments	Production Activities: Percent Increases
SOUTHERN UTAH									
Alton Coal Tracts	Water Erosion								
	Slopes in excess of 20% = 8.0	4.0 to 11.0	0 to 3.0	0 to 38	Same as shown for exploration.				
Flax Lakes, Alton Amphitheater, Fisher Canyon, and Mill Creek Canyon	Hilly and rolling uplands = 0.6 to 4.0	4.0 to 11.0	3.4 to 7.0	0 to 200	Same as shown for exploration.				
	Wind Erosion[d] All Slopes = ?	20.0	---	Unknown	Same as shown for exploration.				
	Rolling uplands (Underground mining) = 4.0	4.0 to 11.0	0 to 7.0	0 to 300	Same as shown for exploration.				
	Rolling uplands (Surface Mining) = 4.0	4.0 to 11.0	0 to 7.0	0 to 300	Rolling Uplands (Surface Mining) = 4.0	4.0 to 14.0	0 to 14.0	0 to 400	
	Wind Erosion[d] All Slopes = ?	20.0	---		---	20.0+	---		

Source: [a] Tons per acre per year in water erosion rates on steep slopes unless otherwise indicated.
[b] Table 3-4
[c] Site-Specific Analyses for Coal Tracts to be included in the Uinta-Southwest Utah Coal Region Environmental Impact Statement: Round Two Leasing.
[d] No data available on natural sediment yields from wind erosion in the Alton area.

these same areas with tract development. The losses are depicted as tons per acre per year, and are considered as averages over the potentially disturbed tract areas.

The percent increases in water and wind induced soil erosion over that occurring under natural conditions are also shown in Table 4-24. As noted, the upper range of percent increases could be large, but would occur on less than 2 percent of total tract acreage on all but the Ford Pasture tract, where surface disturbance would cover approximately 44 percent of the tract. Soil loss on all disturbed acres would exceed soil loss tolerance values for these areas until reclamation as prescribed by applicable laws and regulations would be successful.

The disturbances associated with exploration activities would be of a temporary nature (1 to 2 years) on approximately 216 acres.

On the Flax Lakes, Alton Amphitheater, Fisher Canyon, and Mill Creek Canyon tracts, slopes in excess of 30 percent would probably be encountered during the exploration phase in the location of some drill pads and access roads. The soils on these slopes presently exhibit high water erosion hazards with rapid surface runoff. Exploration activities would increase soil erosion, surface water runoff, and sediment yields. Exposure of the Tropic Shale Formation would also produce high sediment yields in addition to saline and sodic conditions; revegetation problems would result. Potential soil losses from water erosion on portions of these slopes from exploration activities could range from 4 to 11 tons per acre per year. Wind erosion sediment losses on these same areas could be as much as 20 tons per acre per year (GS, 1979b).

Approximately 812 acres would eventually be occupied by production and support facilities and surface mined areas. Approximately 191 of the 812 acres would be on the underground mining tracts of Flax Lakes, Alton Amphitheater, Fisher Canyon, and Mill Creek Canyon and the underground mining portion of the Ford Pasture Tract. These acres would remain essentially unreclaimed during the life of the mine developments. Portal and ventilation shaft access roads and sites and utility line access roads and routes would for the most part be located on fairly steep hillslopes and in narrow valleys. In these areas, the channel gradients are relatively steep, many of the soils, particularly those developed from the Tropic Shale, are inherently erodible, and there is a lack of understory in the dominant pinyon-juniper and sagebrush types. There are, however, surface materials in parts of the area that modify overland flow and reduce erosion so that natural sediment yields are only low to moderate. If, during rehabilitation, these or similar materials were not placed back on the surface, erosion would be significantly increased, particularly prior to the time when vegetation became well established (BLM, 1975).

Moderate slope cutting would be necessary for mine location to gain access to the coal on all of the proposed tracts. It is estimated that 82 of the 191 acres would consist of cut and fill slopes ranging from 25 to 50 percent. Soil losses from water erosion on exposed soils of the 82 acres could range from 4 to 11 tons per year. Wind erosion on an unestimated number of these acres could result in soil losses of 20 tons per acre per year (GS, 1979b).

Again, due to the high water and moderate wind erosion potential and rapid surface water runoff, revegetation problems would result on the disturbed acres of these tracts. Where the Tropic Shale Formation was exposed additional revegetation problems would result. An intensive revegetation and soil erosion control program could achieve successful results within a 10-year period.

The remaining 622 disturbed acres would be on the surface mining portion of the Ford Pasture tract. Approximately 56 acres per year would be surface mined from 1990 through the year 2000, with a maximum of 136 acres unreclaimed at one time in the surface mined area. The soils of the surface mined area originate from shale, sandstone, and lava flow parent materials. Soil lost by water erosion on these acres could range from 7 to 14 tons per acre per year on shale material and from 4 to 6 tons per acre per year on sandstone material (BLM, 1975). Rehabilitation could reduce soil loss to a range of 0.5 to 1.4 tons per acre per year within a 5-year period (BLM, 1975). Soil loss by wind erosion could exceed 20 tons per acre per year on sandy areas and stockpiled topsoil. Such significant soil losses would limit the amount of area that could be rehabilitated (GS, 1979b). On the portion of the surface mining area covered by lava flows (490 acres), mining activities would destroy the small amounts of soil that have accumulated. Areas covered by the lava flows could only be revegetated by bringing in large amounts of topsoil.

Minerals Resources

When considering those coal seams that are presently economical and safe to mine using current underground mining techniques, 180.6 million tons of coal would be recovered. This represents approximately 33 percent of the total reserves. Approximately 7.6 million tons or 80 percent of the total reserves to be mined by surface mining on the Ford Pasture tract would be recovered.

The mining of coal would result in a total depletion of the coal resource as the 368.8 million tons of unrecovered coal, though still in the ground, would no longer be available as a mineral resource given present mining technology.

The potential oil-bearing Kaibab Limestone underlies the tracts at depths well below the coal bearing Dakota Sandstone. While not destroying the resource itself, subsurface mining activities could hinder the subsequent exploration and location of facilities related to oil and gas development (see the Land Use section).

Topography, Geology, Paleontology

Underground mining would occur on all tracts; however, approximately 45 percent of the 1,400 acres in the Ford Pasture tract would be surface mined. Construction of surface facilities for underground operation would cause permanent changes to the natural topography on approximately 191 acres. Because of shallow overburden depths, the effects of subsidence that would occur on portions of 21,147 acres would be similar to those effects expected for the Emery Field (see Central Utah discussion). Subsidence usually does not exceed 50 percent of the thickness of the seam extracted. As discussed for central Utah, the effects of subsidence may be considerably less than the area above the extracted coal. Open fractures at the surface are possible. Subsidence would deform coal beds and reduce mine safety and production efficiency for underground mining (Dunrud, 1976).

Surface mining would alter 622 acres of the Ford Pasture tract. This mining method, after coal extraction and recontouring, could alter topography as much as 30 feet above the original elevation of the surface due to the swell factor of the excavated materials.

The coal-bearing Dakota Sandstone Formation has the potential for yielding scientifically important vertebrate and plant fossils. When encountered by coal mining activities, these fossils could be destroyed, resulting in a loss of scientific and educational information. Because the extent and location of the fossils in this formation are not known, the anticipated impacts resulting from coal mining activities cannot be quantified or significance determined. Significant disturbances to scientifically important fossils would likely not occur if mitigating measures are followed. With mitigation as outlined in Chapter 2, surveys and mining activities could also expose new fossils and produce new paleontological information.

Water Resources

Surface Water

Surface mines and the construction of roads and other facilities associated with both surface and underground mining would require some modification of local surface-drainage patterns. This would increase erosion and fluvial sediment but the regional impact would be small.

According to the U.S. Soil Conservation Service (SCS, 1973) annual sediment yields in the area of the southern Utah tracts range from about 0.1 to more than 3.0 acre-feet per square mile (with an average of 1.8). Kilpatrick (1979) indicated that land disturbance associated with synfuels development could increase sediment yields tenfold. Consequently, annual sediment yields on the lands that would be disturbed by mine development (including exploration) of the southern Utah tracts could increase from 8.4 in 1987 to 42.0 acre-feet by the year 2000 (Table 4-25). This amounts to about 0.9 percent of the estimated annual sediment yield of the Kanab Creek and the Virgin River drainage basins.

Development of the southern Utah tracts would have a minor impact on surface-water quality in the general area of the tracts, access roads, and affected communities. This would be due chiefly to mining and mine dewatering, population growth, and lands disturbed by construction. The regional impact on water quality, however, would be negligible.

Diversion and consumption of as much as 2,232 acre-feet per year more water for mining activities and associated population growth would increase salt concentration in the Colorado River Basin. The increased population would increase fluid and solid waste production thus increasing salt loading in the

TABLE 4-25

SOUTHERN UTAH
IMPACTS ON WATER RESOURCES AND REGIONAL SIGNIFICANCE
ALTERNATIVE ONE

Item	1987	1990	1995	2000
Water requirement (acre-ft/year)				
Mining and exploration	45.0	114.4	114.4	114.4
Public supply	371.5	684.2	1741.1	2117.1
Total	416.5	798.6	1855.5	2231.5
Consumptive water use				
Total (acre-ft/year)[a]	230.8	456.5	984.9	1172.9
Percent of runoff[b]	.13	.26	.56	.66
Increased annual sediment yield				
Total (acre-ft)	8.4	17.0	31.6	42.0
Percent[c]	.18	.36	.68	.90
Increase in salinity (milligrams per liter)[d]	.03	.04	.08	.10

[a] Assumed to be 50 percent of withdrawal for public supply and 100 percent of withdrawal for mining.

[b] Percent of combined average annual runoff of Kanab Creek near Fredonia, Arizona, and the Virgin River near Hurricane, Utah.

[c] Percent of estimated annual yield upstream from the stations cited in footnote b.

[d] As determined for Imperial Dam. Does not include reduction in salinity from reduced irrigation return flow.

basin. The increased population and mining-related activities would also increase the potential for local contamination of both ground and surface water.

The salt concentration resulting from freshwater diversions and the salt loading resulting from fluid-waste disposal to streams would have a minor adverse impact on local surface-water quality. The resulting increase in salinity in the lower stream reaches probably would be masked by the relatively large amount of salt loading due to natural runoff from the salt-bearing Tropic Shale and irrigation return flows to lower stream reaches. A beneficial regional impact could incur with regard to the Colorado River salinity problem. It is estimated that development of the southern Utah tracts would by the year 2000 increase the salinity of the Colorado River at Imperial Dam by about 0.1 milligrams per liter. This increase, however, would be more than offset by a decrease in salt loading from irrigated lands that would be retired to accommodate population growth. For example, irrigation return flows from the irrigated land that would be retired locally dumps up to 7 tons per acre foot of salt into the Colorado River system annually. The unconsumed water diverted (chiefly from irrigation) for public supply probably would dump less than 1.5 tons per acre-foot of salt into the river system.

Land subsidence (see Topography Section of this Chapter) tends to change local drainage patterns. Rock fracturing associated with the subsidence diverts more snowmelt and rainfall underground increasing ground water recharge at the expense of overland runoff. This fracturing, however, could also cause near-surface aquifers to drain downward through the fractures toward the mine workings at a faster rate than normal. Consequently, the flow of springs that provide baseflow to streams could be reduced. The flow of those springs that provide water for the wildlife, livestock, irrigation, and public supply could either be reduced or increased. Although this water would not be lost from the hydrologic system, it would move through newly formed fractures in shale-bearing rocks, degrade in quality more rapidly than it would as overland runoff. The probability of a spring (or a stream) being diverted underground by subsidence-caused fracturing is discussed briefly in the Alternative One discussion for the central Utah tracts. At least 30 springs are known to exist on the Fisher Canyon tract. There is a good chance that one or more of those springs, and perhaps even Thompson Creek could be affected by subsidence caused fracturing.

Ground water

Surface mining of the Ford Pasture tract would disrupt aquifers in the mined-out areas; however, there appear to be no important aquifers on that part of the tract most likely to be affected by surface mining. Mining and mine dewatering would create pressure gradients in the local ground water systems causing ground water to move toward the mine workings. This could induce the movement of saline water into fresh water aquifers, thus locally reducing the utility of the fresh water aquifers. For example, the Dakota Sandstone contains both fresh and saline water aquifers, and the Tropic Shale contains generally saline water. The pressure gradients created by mine dewatering could induce saline water from the Tropic and saline water aquifers of the

Dakota into the fresh water aquifers of the Dakota. Available data indicate that the probability exists for this to occur on the Mill Creek Canyon and Fisher Canyon tracts.

Underground mine workings would disrupt local ground water flow systems causing a redistribution of ground water discharge as discussed for the central Utah tracts, however, no water would be lost from the ground water system. Mine workings on the Flax Lakes tract could divert some water from the Kanab Creek basin to the Virgin River basin. The annual diversion, however, would be negligible compared to the water yields of the respective drainage subbasins. This is because the fine-grained, poorly permeable coal-bearing beds transmit water very slowly.

Water Supply and Use

Maximum development of the southern Utah tracts by the year 2000 would require up to 2,232 acre-feet per year of water for mining and associated activities and public water supply needs. Sources of the water probably would be springs and streams currently used for public water supply and irrigation, water-producing mines, and wells. The estimated volume of water that would be consumed is 1,173 acre-feet which is about 0.66 percent of the combined average annual discharge of Kanab Creek at Fredonia, Arizona, and the Virgin River at Hurricane, Utah, (Table 4-25). It is about 0.08 percent of Utah's share of Colorado River water. Impacts on the available supply in individual drainage subbasins would be much larger. For example, the estimated annual water requirement is nearly 50 percent of the average annual discharge of Kanab Creek at Fredonia, Arizona.

Vegetation

Anticipated impacts to vegetation would be similar in nature to those discussed in detail for central Utah and are only summarized here.

Implementation of this alternative would result in development of coal on five southern Utah tracts and the direct disturbance of 1,029 acres of vegetation by the year 2000, mainly in Pinyon-Juniper woodland.

By the year 2000, an additional 817 acres of vegetation would be lost as a result of community expansion. Included would be 234 acres of irrigated cropland and 233 acres of nonagricultural lands lost to actual community development and an additional 382 acres of cropland retired from irrigation to provide water for community needs. Thirty-two acres of cropland would be retired to provide water for mining. Acres of vegetation that would be lost by year and vegetation type are shown in Table 4-26.

The following summarizes major vegetation disturbing activities and if or when vegetation reclamation would likely occur.

Strip mining and associated developments on the Ford Pasture tract would result in total removal of vegetation from 644 acres by the year 2000. Approximately 56 acres would be disturbed annually by strip mining activities.

TABLE 4-26

CUMULATIVE VEGETATION DISTURBANCE BY VEGETATION TYPE: SOUTHERN UTAH

ALTERNATIVE ONE

Vegetation Type	Direct Mining Impacts[a] (Acres)				Indirect Impacts[b] (Acres)	Total[c]
	1987	1990	1995	2000	2000	2000
Agriculture	-	-	-	-	615.6[d]	615.6
Riparian	-	-	-	-	-	-
Desert Shrub	-	-	-	-	77.2	77.2
Sagebrush-Grass	21.0	52.7	100.0	160.0	30.0	190.0
Pinyon-Juniper Woodland	129.8	293.0	528.3	757.8	80.6	838.4
Mountain Brush	49.1	65.0	65.0	65.0	35.5	100.5
Ponderosa Pine	16.5	45.0	45.0	46.0	-	46.0
Aspen	-	-	-	-	-	-
Conifer-Aspen	-	-	-	-	-	-
Non-Productive	-	-	-	-	10.0	10.0
Other (Douglas fir, Mountain Meadow, Grassland, etc.)	-	-	-	-	-	-
TOTAL	216.4	455.7	738.3	1028.8	848.9	1877.7

a Includes surface facilities, portal access, mining operations, exploration activities, powerlines, and ventilation construction.

b Total lands lost to community expansion including agricultural lands retired from irrigation to provide water for community needs. This acreage was computed for the year 2000 only.

c Total vegetation disturbance by the year 2000.

d Includes 233.5 acres lost to community growth and 382.1 acres retired from irrigation to provide water for mining and community needs.

Based on a projected reclamation plan it is anticipated that a maximum of 136 acres would be unreclaimed at any one time in the surface mined area.

Exploration activities involving construction of drill pads and access roads would disturb a total of 216 acres by the year 1990. By the year 2000 this acreage, while included in the cumulative total of acres disturbed, would be in advanced stages of reclamation.

Implementation of this alternative would result in the loss of 813 acres of vegetation for which no reclamation would begin until completion of mining activities. This would include areas used for surface facilities, portal access, powerlines, and ventilation installation. Certain access roads may continue to be used for other purposes following completion of mining and would not be reclaimed. Irrigated cropland and nonagricultural lands which would be lost to community expansion (234 and 233 acres, respectively) or retired from irrigation (382 acres) to provide water for mining and community expansion would not be reclaimed.

For areas that would eventually be reclaimed, the duration of the impact of total vegetation loss would depend upon the success of reclamation. Based on the EMRIA No. 4 study in the Alton area (BLM, 1975), 42 percent of the general area would be well suited for supporting revegetation efforts. Seventeen percent of the area would be unsuitable, and the remaining 41 percent is classified as marginal for revegetation suitability.

The majority of disturbance (758 acres) would occur in the Pinyon-Juniper Woodland which contains little or no vegetation understory. Areas thus disturbed would be revegetated with native grasses and shrubs. This disturbance would actually result in an increase of vegetation production which would favor large herbivores such as deer or livestock. These areas would eventually revert to a Pinyon-Juniper Woodland.

Revegetation efforts would be positive on marginal areas in years with above normal precipitation, but success in dry years may depend on supplemental irrigation. Without irrigation the extreme variability of precipitation would reduce the success of revegetation. Limited success-to complete failure could be expected on the average of 2 of every 3 years.

One area considered unsuitable for revegetation would be the lava flows which cover approximately 35 percent (490 acres) of the Ford Pasture tract. Although vegetation has become established on portions of the flows, topsoil is almost nonexistent. Surface mining activity on an unestimated number of acres of lava flows would destroy the small amounts of soil that have accumulated. Areas covered by the lava flows could only be revegetated by bringing in large amounts of topsoil from other areas.

No known threatened or endangered plant species would be disturbed by mining activities. However, suggested stipulations regarding survey and clearance of proposed disturbance areas would protect any uninventoried species present.

Wildlife

Terrestrial

The 813 acres disturbed for coal production activities by the year 2000 would displace about nine deer annually from transitional and winter ranges (Table 4-27). Sage grouse leks and brood habitat would not be directly affected by this disturbance. Seeding trials demonstrate that the disturbed sites could be reclaimed possibly to a more productive level for wildlife.

About 14 miles of new and improved portal access roads would be constructed to accommodate a peak load of 1,109 coal trucks daily. The initial mortality to resident deer could be as high as 7 deer annually. Deer should disperse away from the road activity because of the large amounts of similar adjacent range available. Mine traffic could cause mortality of an unknown number of sage grouse and other small animals in and around Sink Valley and the Ford Pasture seedings.

All of the tracts except Ford Pasture contain raptor nesting territories (UDWR 1982b) but there would not be any direct conflict with buteo and horned owl nesting territories.

Construction of a minimum of 14 miles of new utility lines in the area would provide additional perching and hunting sites for raptors. This would be a beneficial impact; however, use of these structures along roadsides or in areas open to human access would expose the birds to illegal shooting and disturbance (BLM, 1981a).

The population in Kane and Garfield counties would increase by approximately 71 percent over the projected baseline by 2000. Kane County would more than double its 1982 population level. An additional 1,470 deer hunters would be located here due to the proposed action. The management plan for deer herd unit 60A would accommodate 1,200 to 1,400 hunters annually harvesting 450 bucks. This plan estimates that only 350 hunters could come from Kane and Garfield Counties. If the majority of the 1,513 new hunters chose to hunt in herd unit 60A this unit would not be open buck hunting in the foreseeable future and UDWR would be forced to operate 60A on a permit basis.

To accommodate this population increase, community development would occupy 496 acres of irrigated cropland in Kane County. This land is an integral part of the habitat for pheasants, cottontail rabbits, quail, doves, and numerous small birds and mammals in the Upper and Lower Sonoran life zones. Community development would eliminate 4 percent of this habitat and would not have a significant effect on the resident populations.

The number of two-wheel drive and four-wheel drive trucks in the area would almost double by 2000, and the increased use of unimproved roads would depreciate the value of adjacent habitat to wildlife. Two possible impacts of this activity could be the curtailment of the establishment of elk on the Paunsugunt Plateau and inhibition of raptor use of winter feeding areas and nesting sites because of continual harassment.

TABLE 4-27

SOUTHERN UTAH
BIG GAME HABITAT DISTURBANCE
ALTERNATIVE ONE

Tract	Acres Disturbed	Plant Community[a]	Wildlife Use	Species	Losses/ Year[b]
Alton Amphitheater	71	P-J	Yearlong	Deer	1
Fisher Canyon	60	P-J/Sagebrush	Yearlong	Deer	1
Flax Lakes	123	P-J/Mtn. Shrub	Yearlong	Deer	2
Ford Pasture	644	P-J/Sagebrush	Yearlong	Deer	7
Mill Creek	131	P-J/Sagebrush	Yearlong	Deer	2
Totals	813				13

[a] P-J = Pinyon-Juniper
[b] Includes 0.1 mile influence zone. Based on optimum herd management objective levels (UDWR, 1980a).

Fisheries

Road construction and traffic would add sediments to the Kanab Creek drainage. However, the short stretches of trout habitat in the upper reaches of the stream would not be directly affected. The additional sediments in the Virgin River would probably not affect the indigenous fish as they are accustomed to high sediment loads. The increased fishing pressure on the trout fisheries of the Markagunt and Paunsugunt Plateaus would require additional stocking or a reduced limit to maintain an acceptable harvest level. The large warm water fisheries at Lake Powell would not be significantly affected.

Threatened or Endangered Species

The peregrine falcon nesting territory is located at a distance from the proposed mining area but portions of the hunting territory are located around Alton. The hunting territory would either be shifted by the peregrine to avoid the activity or the present hunting-nesting complex relocated in another remote site.

Land Use

Agriculture and Range

Land use changes associated with community expansion would affect cropland agriculture and community development in Garfield and Kane Counties. By the year 2000, these counties would experience a permanent change of approximately 467 acres from grazing and agricultural uses to community development. Of the 467 acres, 234 acres (50 percent) would be irrigated cropland converted to meet community growth and associated water requirements; this land is presently producing alfalfa and small grains. The remaining 233 acres would come from non-irrigated lands adjacent to existing communities. An additional 350 acres of irrigated cropland would be retired to provide water for community expansion (Table 4-28). Overall, permanent land changes would occur on 817 acres (Table 4-29).

Irrigated cropland would also be impacted by the diversion of water for exploration and mining activities. Water that would have been used to irrigate approximately 36 acres of cropland would be diverted to exploration activities over a 3-year period. For mining activities, irrigation water for approximately 32 acres of cropland would be diverted during the life of the mines.

In summary, by the year 2000, total agricultural lands impacted due to the conversion of irrigated cropland for community development, retirement of irrigated cropland for community water supply, and the diversion of water for exploration and mining activities would be 652 acres. The 36 acres of cropland affected by exploration activities would be available for cropland uses upon completion of exploration activities, i.e., a 3-year period.

All of the affected cropland would be located off of the coal tracts with the exception of 95 acres of irrigated cropland on the Alton Amphitheater tract which could be affected by land conversion and/or water diversion on or near

TABLE 4-28

SOUTHERN UTAH
LANDS AFFECTED BY COMMUNITY DEVELOPMENT AND WATER REQUIREMENTS
ALTERNATIVE ONE

County	Total Acres Converted for Community Development a	Irrigated Acres Converted for Community Development b	Additional Irrigated Acreage Retired c	Total Irrigated Lands Affected d	Total Acres Converted for Community Development a	Irrigated Acres Converted for Community Development b	Additional Irrigated Acreage Retired c	Total Irrigated Lands Affected d
	1987				1990			
Kane	69.6	34.9	52.2	87.1	128.1	64.1	96.1	160.2
Garfield	12.3	6.2	9.2	15.4	22.7	11.4	17.0	28.4
Total	81.9	41.1	61.4	102.5	150.8	75.5	113.1	188.6
	1995				2000			
Kane	326.0	163.0	244.5	407.5	396.5	198.3	297.4	495.7
Garfield	57.8	28.9	43.4	72.3	70.3	35.2	52.7	87.9
Total	383.8	191.9	287.9	479.8	466.8	233.5	350.1	583.6

Source: Utah State Office, Bureau of Land Management (BLM, 1982).

a,b,c Figures based on Analysis Assumptions and Guidelines listed in Chapter 4.

d Total Irrigated Lands converted and/or retired = b+c.

TABLE 4-29

SOUTHERN UTAH
ACRES OF LAND USE CHANGES DUE TO COAL TRACT DEVELOPMENTS
BY YEAR 2000
ALTERNATIVE ONE

	Projected Maximum[a] Total Acres Changed From One Land Use to Another	Temporary Land Changes Acres of Land Change Due to Mining Operations, Including On-Tract and Offsite Support Facilities	Permanent Land Changes--Acres Changed[c] for Community Development and Acres Irrigated Cropland Retired to Provide Community Water Needs
		1,029 (329 acres involved in access)[b] 32 (acres retired for mine water)	817
Totals	1,878	1,061	817

Source: Utah State Office - Bureau of Land Management (BLM, 1982a).

a Projected Maximum Total Acres Changed From One Land Use to Another are totals of Temporary Land Changes plus Permanent Land Changes.

b Exploration drill pads counted as part of access acres.

c Figures shown are totals taken from Table 4-28 (Total Acres Converted for Community Development column plus Additional Irrigated Acreage Retired column for year 2000).

the tract area. The total agricultural lands impacted represent less than 2-percent of the two-county total of agricultural land; but as with the central Utah cropland areas, the impacted acres would be lands that are among the most favorable for agricultural uses, with such lands comprising only a small percentage of the overall land base in the region (Utah Department of Agriculture, 1982). Prime farmland would be among that affected if land conversion and/or water diversion occurred in the Alton area (the five coal tracts, including the areas south of the tracts to the Glendale Bench and Skutumpah Terrace). An undetermined amount of prime farmland could be utilized for community expansion near Orderville and Kanab communities, unless community plans avoid such land. No prime farmland would be affected in the Panguitch area.

At present the communities within Kane County are located on lands that, if available, would be highly productive agricultural lands. Projected community developments would result in the loss of 496 acres of highly productive farmland adjacent to the Kane County communities. This represents 76 percent of the agricultural land that would be affected in southern Utah under Alternative One.

Due to the high carrying capacity of the existing cropland areas that are being grazed, agricultural land conversion in the Kanab and Panguitch areas could significantly reduce grazing of cattle, sheep, and horses. Such grazing is an important part of small farm and ranch operations but actual AUM losses cannot be predicted.

There would be temporary land changes on 1,061 acres (see Table 4-29). The following discussions present the short- and long-term effects of these land changes on existing uses.

Coal exploration and development activities on the Alton Amphitheater tract could interrupt water flows and damage canals, ponds, and stream intake structures on portions of the tract. Such damage would interfere with livestock watering and the irrigation of approximately 310 acres of cropland in the immediate vicinity of Alton, Utah. This impact should be temporary as the lessee would be required to replace any water lost as a result of mining activity.

Subsidence occurring on the tract areas could affect the flows of an undetermined number of natural springs and streams presently providing water to cropland irrigation systems and livestock water impoundments. Reduced flows from these water sources could reduce the number of acres that could be irrigated and the livestock numbers on grazing allotments until water availability is again restored by the lessee.

Exploration and production activities on the five coal tracts would result in only minor reductions of grazing acreages. There would be less than a 2-percent annual reduction in grazing for all BLM and private lands involved. Grazing reductions on all but the Ford Pasture tract would not exceed a 2-percent annual reduction on the associated BLM or private allotments; a 4-percent annual reduction would occur on the allotments in the Ford Pasture tract. As discussed in the central Utah analysis, small operators could be required to reduce their animal numbers up to two AUMs for every AUM lost on the tracts (Jacobson, 1981).

The seasonal trailing of livestock into and out of grazing allotments on the coal tracts would be affected by exploration and production activities. The construction of access roads and portal sites and mine-related vehicle traffic would impede normal trailing schedules and patterns and increase the probability of vehicle collisions with migrating livestock.

Energy and Minerals Development

The coal lease and oil and gas development impacts in the Alton area would be similar to those discussed for central Utah. Development of coal resources could interfere with oil and gas drilling schedules and locations. Oil and gas drilling would either be precluded from mining areas or the drilling methods would have to be modified. The effects on potential oil and gas production cannot be determined as no oil and gas exploration data are available.

Rights-of-Way, Special Uses, Other Land Uses

The flow and quality of domestic water supplies (springs and streams) could be temporarily reduced by disruption of aquifers and introduction of pollutants resulting from coal exploration and production activities (see Water Resources section). Water pipelines running from these supplies to scattered summer cabins and ranches located on the Mill Creek Canyon tract could be broken by subsidence or construction of access roads. Lease stipulations would require that any water lost by mining activities by replaced by the lessee. As discussed for central Utah, adherence by a lessee to EPA Water Quality Criteria and State of Utah Water Protection Standards would protect the quality of the water.

The rights-of-way for the proposed coal slurry pipelines and power distribution lines associated with the Allen-Warner Valley Energy System have been applied for and if granted before mine development would have priority over proposed surface mining on the Ford Pasture tract. Protection of the rights-of-way would interfere with mining operations and prevent full recovery of coal from the surface mined portion. This would reduce the amount of recoverable coal projected for the tract.

Land Use Plans, Controls, and Constraints

Federal Plans

All tracts identified in southern Utah have been addressed in Federal Land Use Plans (see Chapter 1). With mitigation as outlined in Chapter 2, leasing and subsequent development would not conflict with any applicable Federal Land Use Plans.

County Plans

With appropriate mitigation as enforced by Kane County, development of the coal resources within the five coal tracts would not conflict with the general direction of the Kane County Master Plan. The Chapter 3 discussion of Land Use Plans and Controls for southern Utah describes the major concerns of the county plan. Development of the coal tracts and related community expansion would conflict with the specific Kane County Master Plan direction for (1) protection of existing and potential irrigated cropland from incompatible uses and (2) developing the water resource (springs and streams) for existing county needs prior to the development of mineral resources. Under Alternative One, 616 acres of irrigated cropland would be converted and retired for community development and to supply mine water. The Kane County Master Plan direction is that such development be confined within existing community boundaries so as to avoid use of irrigated cropland areas. Also under Alternative One, exploration and production activities and related community development would require utilization of water resources that might not have been fully developed for existing county uses. All tract developments in southern Utah would be in county zones where coal development would be a permitted conditional use. County zoning ordinances address potential impacts from coal mining and emphasize the mitigation of socioeconomic impacts and protection of agricultural land.

Socioeconomics

Population, Income, and Employment

A summary of population and employment growth for southern Utah (Garfield and Kane Counties) is provided in Table 4-30. Kane County would receive the greatest growth from Alternative One with about 85 percent of the new population and 94 percent of the new employment. Population in southern Utah would increase by 8,407 by the year 2000 representing a 96 percent increase over 1982 population and 71 percent over the projected baseline by the year 2000. Employment would increase by 3,175 jobs by the year 2000 representing an 88 percent increase over 1982 levels and 74 percent over the projected baseline.

Projections for wages and personal income in southern Utah are provided in Table 4-31. Relatively higher per capita income would be anticipated with the projected increases in coal mining and the higher wages paid in the mining sector. The effect of increased mining would be to increase per capita incomes in both counties. Per capita income in Kane County would increase by as much as 21 percent over baseline projections.

Infrastructure

Housing

The largest percentage increase in demand for housing would occur in Kane County where the demand for additional single family units would reach 1,260 units by the year 2000, a 77 percent increase over 1982 levels and a 34

TABLE 4-30

SOUTHERN UTAH
POPULATION AND EMPLOYMENT
INCREASE BY COUNTY
ALTERNATIVE ONE
1987, 1990, 1995, 2000

County	Population	Employment
Garfield		
1987	222	33
1990	410	62
1995	1,044	161
2000	1,271	202
Kane		
1987	1,252	721
1990	2,307	1,108
1995	5,869	2,743
2000	7,136	2,973
Total (year 2000)	8,407	3,175

TABLE 4-31

SOUTHERN UTAH
TOTAL PERSONAL INCOME PROJECTIONS BY COUNTY
ALTERNATIVE ONE
1987, 1990, 1995, 2000

County	1987	1990	1995	2000
Garfield				
Total Personal Income ($1,000)	34,483	43,153	57,257	64,347
Total Population (Basline + Impact)	4,667	5,003	5,877	6,264
Per Capita Personal Income	$ 8,246	$ 8,626	$ 9,743	$10,273
Kane				
Total Personal Income ($1,000)	63,378	77,494	133,996	152,273
Total Population (Basline + Impact)	6,764	8,175	12,246	13,914
Per Capita Personal Income	$ 9,370	$ 9,479	$10,942	$10,944

percent increase over the projected baseline. Table 4-32 provides a summary of the projected additional demand for housing by type for each county. Garfield County would see a demand for an additional 222 single family units, 56 multi-family units, and 92 mobile home units by the year 2000.

The large increases noted above could result in a housing shortage. If required housing units are not available as needed, housing prices could increase to the point of causing personal hardship and the use of substandard housing.

Education

Forecasts of educational needs are found in Table 4-33. Under this alternative, the Kane School District would receive the most substantial growth in demand for educational services over baseline forecasts. As early as 1987, a 15-percent growth over baseline projections would occur. This would stress the capacity of the school district facilities even though a major building program is currently underway. Without additional construction, the currently programmed capacity would be exceeded by late in the decade and a serious shortfall could face the school district by the 1990s. In addition, local planners have identified a multipurpose auditorium facility for cultural activities and multipurpose events as necessary if the development of coal leases occurs on the Alton coal fields. By the year 2000, the total number of school-age children could reach nearly 4,000, a 92-percent increase over baseline forecasts. This alternative would require an additional 76 new teachers, over current baseline needs. The majority of growth is expected to occur in the Kanab area.

In addition to classroom teachers, there would also be an increase in the number of guidance counselors, administrative staff, and special education services required; that would tend to increase the operations costs for the school district. The school district would also need to both add and replace school buses at a more rapid rate because of the additional usage from an expansion of this size. Growth of this magnitude would require careful planning and considerable cooperation between developers and school oficials to prevent deterioration within the Kane County education systems.

Garfield School District, which currently has excess capacity, should be able to handle the impacts of additional demand on education services through 1990. The 8 to 16 percent per annum growth in the number of students forecast for Garfield County in the 1990s, however, would require expanded facilities as well as support services.

Water and Sewer

Kanab, with some minor modification to its existing sewer system, should be able to handle anticipated growth demands that could reach 920,000 gallons per day of sewage by 1995. Additional capacity could then be required. Improvements in the collection system, hookups, and lift pumps are estimated at $300,000. Site improvements necessary to Kanab's water system to handle anticipated growth would include an additional 5,000,000 gallons of water

TABLE 4-32

SOUTHERN UTAH
HOUSING DEMAND BY TYPE
ALTERNATIVE ONE
1987, 1990, 1995, 2000

County	Single Family	Multi-Family	Mobile
Garfield			
1987	48	12	20
1990	84	21	35
1995	192	48	80
2000	222	56	92
Kane			
1987	256	65	107
1990	456	114	190
1995	1,080	270	450
2000	1,260	315	525
Total (year 2000)	1,482	371	617
Total New Units (year 2000)	2,470		

TABLE 4-33

SOUTHERN UTAH
IMPACTS ON EDUCATION, HEALTH, AND LAW ENFORCEMENT
ALTERNATIVE ONE
1987, 1990, 1995, 2000

County	1987 Projected Baseline Need	1987 Total Need w/ Impact	1987 Impact	1987 Percent Change a	1990 Projected Baseline Need	1990 Total Need w/ Impact	1990 Impact	1990 Percent Change a
GARFIELD								
Education								
Students	1,088	1,140	52	5	1,175	1,270	95	8
Teachers	44	46	2	5	47	51	4	8
Health Facilities								
Hospital Beds	9	9	0	11	9	10	1	11
Doctors	2	3	1	50	3	3	0	0
Dentists	2	2	0	0	2	3	1	50
Nurses	9	9	0	0	9	10	1	11
Clinical Psych[b]	0	0	0	0	0	0	0	0
MSWs[c]	1	1	0	0	1	1	0	0
EMTs[d]	6	7	1	17	6	7	1	17
Ambulances	1	1	0	0	1	1	0	0
Nursing Homes	20	21	1	5	20	21	2	10
Law Enforcement								
Police	9	9	0	0	9	10	1	11
Police Cars	9	9	0	0	9	10	1	11
KANE								
Education								
Students	1,511	1,741	230	15	1,682	2,092	410	24
Teachers	60	70	10	17	67	84	17	25
Health Facilities								
Hospital Beds	11	14	3	27	12	16	4	33
Doctors	3	4	1	33	3	5	2	67
Dentists	3	4	1	33	3	4	1	33
Nurses	11	14	3	27	12	16	4	33
Clinical Psych[b]	0	0	0	0	0	0	0	0
MSWs[c]	1	1	0	0	1	2	1	100
EMTs[d]	8	10	2	25	8	11	3	38
Ambulances	1	1	0	0	1	2	1	100
Nursing Homes	23	26	3	13	24	29	5	21
Law Enforcement								
Police	11	14	3	27	12	16	4	33
Police Cars	11	14	3	27	12	16	4	33

(continued)

Table 4-33 (concluded)

County	1995 Projected Baseline Need	1995 Total Need w/ Impact	1995 Impact	1995 Percent Change a	2000 Projected Baseline Need	2000 Total Need w/ Impact	2000 Impact	2000 Percent Change a
GARFIELD								
Education								
Students	1,318	1,530	212	16	1,358	1,740	382	28
Teachers	53	61	8	16	54	70	16	30
Health Facilities								
Hospital Beds	10	12	2	20	10	13	3	30
Doctors	3	3	0	0	3	4	1	33
Dentists	2	3	1	50	2	3	1	50
Nurses	10	12	2	20	10	13	3	30
Clinical Psych[b]	0	0	0	0	0	0	0	0
MSWs[c]	1	1	0	0	1	1	0	0
EMTs[d]	7	8	11	14	7	9	22	22
Ambulances	1	1	0	0	1	1	0	0
Nursing Homes	19	22	3	16	18	2	3	17
Law Enforcement								
Police	10	12	2	20	10	13	3	30
Police Cars	10	12	2	20	10	13	3	30
KANE								
Education								
Students	1,949	3,249	1,300	67	2,066	3,966	1,900	92
Teachers	78	130	52	67	83	159	76	92
Health Facilities								
Hospital Beds	13	25	12	92	14	28	14	100
Doctors	4	8	4	100	4	8	4	100
Dentists	3	8	5	167	3	7	4	133
Nurses	13	25	12	92	14	28	14	100
Clinical Psych[b]	0	1	1	100	0	1	1	100
MSWs[c]	1	3	2	200	1	3	2	200
EMTs[d]	9	17	8	89	9	24	15	167
Ambulances	1	3	2	200	1	3	2	200
Nursing Homes	24	36	12	50	23	36	13	54
Law Enforcement								
Police	13	25	12	92	14	28	14	100
Police Cars	13	25	12	92	14	28	14	100

a Percent Change: Change from Projected Baseline Need to Total Need with Impact.
b Clinical Psych: Clinical Psychologist. There is an impact although it does not justify a full time person.
c MSW: A person with a Master's Degree in Social Work.
d EMT: Emergency Medical Technician.

storage capacity and internal improvement in distribution. These expansions and improvements are estimated at $1,639,344 which is in addition to the $1,127,000 planned upgrade of water supply lines, wells, and pumping facilities which are currently under consideration. The Long Valley communities would need to expand their lagoon size from the existing 9 acres to 20 acres. This expansion as well as the expansion of flow capacity has been estimated to cost $500,000. Orderville, which is currently undertaking a $600,000 water improvement project to add storage and complete new supply and distribution systems, would be able to accommodate projected growth through the turn of the century when 262 additional connections would be required.

Glendale is currently 65 acre-feet short of adequate water rights; this shortage would be accelerated if new water rights are not acquired. By the year 2000, the shortfall could reach 125 acre-feet. Improvements to the distribution system, as well as additional water rights and storage capacity have been estimated at $250,000. Alton has adequate water rights to handle the 94 connections that could be required in the year 2000; however, improvement to the storage capacity would be necessary.

Panguitch has adequate water rights to meet projected demand through the year 2000 although additional storage capacity estimated at $500,000 would be required.

Projected water and sewer needs for each county are shown in Table 4-34 and Table 4-35.

Public Safety

Law enforcement needs for the counties are found in Table 4-33. Kane County would experience the largest growth in demand for law enforcement services. In the year 2000, there would be an increase of 100 percent over the projected baseline demand for law enforcement services which would require a total of 28 police officers and patrol cars.

Garfield County would require three new police offices and patrol cars, a 30-percent growth over baseline demand.

Kane County would see the largest increase over baseline forecasts in the demand for health care services. Ample excess capacity within the current hospital system would meet projected demand by the year 2000. In addition, four new doctors, four dentists, 14 nurses, 15 EMTs, and two ambulances would be needed. Garfield County would need one additional doctor and a dentist by the year 2000. Additional details are presented in Table 4-33.

Kane County has established a special services district in fire protection in the western part of the county and has agreements between the communities and the Forest Service. Additional trained volunteers will be necessary by the late 1980s in Kanab and the Long Valley communties. Additional fire fighting equipment would be necessary in all communities affected by the implementation of Alternative One.

TABLE 4-34

SOUTHERN UTAH
PROJECTED DEMAND FOR WATER CONNECTIONS BY COUNTY
ALTERNATIVE ONE
1987, 1990, 1995, 2000

County	1987	1990	1995	2000
Garfield				
Hatch	63	78	121	134
Panguitch	600	672	870	946
Kane				
Alton	42	53	86	94
Glendale	98	106	124	133
Kanab	1,444	1,806	2,905	3,227
Mt. Carmel	NA	NA	NA	NA
Orderville	180	198	242	262

Note: Numbers indicate total demand for water connections, baseline plus impact.
NA - Information not available.

TABLE 4-35

SOUTHERN UTAH
PROJECTED CAPACITY FOR WASTEWATER TREATMENT FACILITIES BY COMMUNITY
ALTERNATIVE ONE
1987, 1990, 1995, 2000

	Gallons per Day			
County	1987	1990	1995	2000
Garfield				
Hatch	19,000	23,700	37,700	43,400
Panguitch	180,600	205,700	271,700	302,600
Kane				
Alton	12,900	16,500	27,400	30,900
Glendale	30,600	33,700	40,200	43,700
Kanab	442,900	561,400	920,000	1,061,900
Mt. Carmel	NA	NA	NA	NA
Orderville	56,200	62,800	78,400	87,900

Note: Numbers represent total sewer capacity, baseline plus impact.
NA - Information not available.

Solid Waste

Under conditions cited for this alternative, an undetermined additional amount of landfill space may be necessary in Panguitch, Garfield County, and the creation of a landfill may be necessary for the Long Valley area of Kane County.

Social/Attitudes

In Kane County the Alton coal field is located near Bryce Canyon National Park and environmental groups have opposed development in the area. It is generally perceived by local spokesmen that the proposed leases would not significantly deteriorate the value of the resources of the park. Local elected officials who express strong support for growth are also aware of the problems that can occur when rapid growth occurs. A review and update of county master plans and local zoning ordinances is either underway or recently completed in Garfield and Kane Counties. It is generally felt that with the proper growth management tools the positive aspects of growth can be maximized and the negative aspects minimized. However, a large population influx under the proposed leasing would introduce new people with different backgrounds, and significantly alter the cultural homogeneity predominant in the area.

Transportation

Table 4-36 shows anticipated increases in traffic in the Alton area (Figure 4-7). A major impact resulting from coal hauling and increasing traffic due to population increases would be the rapid deterioration of secondary roads in the absence of increased maintenance and upgrading. Due to large volumes of traffic on dusty roads, the incidence of traffic accidents is likely to increase markedly unless road improvements were made. Although the number of vehicle accidents would rise, it is anticipated that the rate of vehicle accidents would remain at or below Utah averages.

The greatest increases in traffic on secondary roads would be within the area bounded by Alton on the north, Johnson Canyon road on the east, and US-89 on the south and west. These roads presently carry only 5 to 35 vpd and are graded and loose-surfaced. The asphalt road from US-89 into Alton and the loose-surfaced road eastward from Glendale would receive moderate increases in traffic. Greater increases in traffic would occur on Highway U-136, the road passing through the proposed Ford Pasture mine tract, and an access road from US-89 into the Flax Lakes tract. Increases in traffic on the road from U-136 to Bald Knoll from the northwest and the road connecting Bald Knoll with the Mill Creek Canyon tract would not result in road deterioration and accidents because these roads would likely be upgraded as part of the mine portal access.

Because most new miners would live in Kanab, traffic there would almost double by the year 2000. This would contribute to traffic congestion along the main streets. Other communities would see proportionate rises in traffic volume, but since present traffic volumes are low, increases would not cause traffic congestion.

TABLE 4-36

SOUTHERN UTAH
MAXIMUM INCREASES IN TRAFFIC AND VEHICLE USE
ALTERNATIVE ONE

Feature	Coal Trucks	Service Trucks	Commuters	Other Trucks	Other Cars	Totals
Max. Vehicles/day	1,109	213	2,800	198	1,804	6,124
Total Million Miles[a]	48	95	717	6	40	906
Total Million Gallons of Fuel[a]	11	17	28	1	1	58
Total Vehicles Lives[a]	48	189	7,162	10	401	7,810

a Within area of influence only. Travel outside this area is not included.

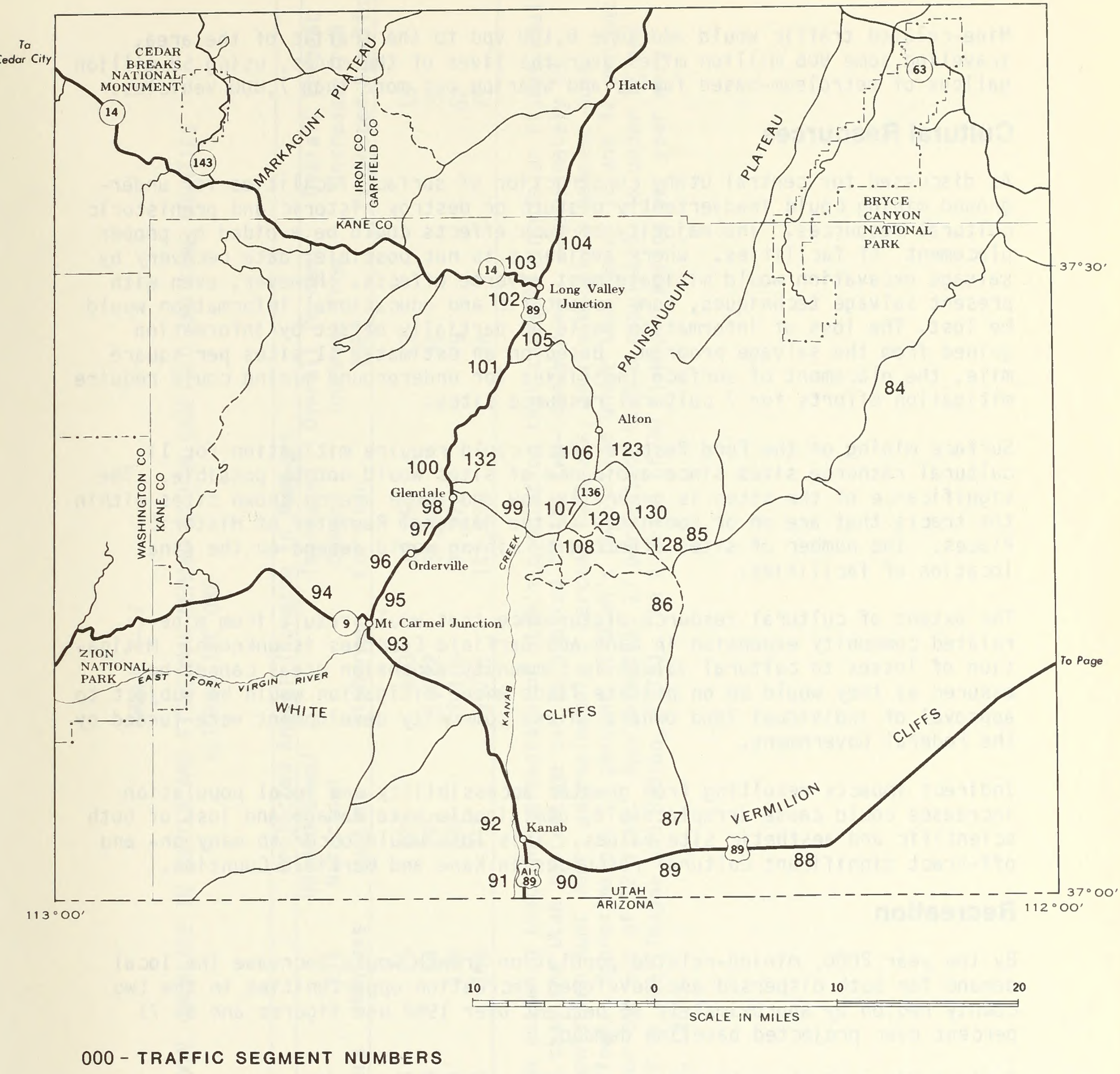


FIGURE 4-7
SOUTHERN UTAH TRAFFIC MAP
ALTERNATIVE ONE

Mine-related traffic would add some 6,100 vpd to the traffic of the area, traveling some 906 million miles over the lives of the mines, using 58 million gallons of petroleum-based fuels, and wearing out more than 7,800 vehicles.

Cultural Resources

As discussed for central Utah, construction of surface facilities for underground mining could inadvertently disturb or destroy historic and prehistoric cultural resources. The majority of such effects could be avoided by proper placement of facilities. Where avoidance is not possible, data recovery by salvage excavation would mitigate most adverse effects. However, even with present salvage techniques, some scientific and educational information would be lost. The loss of information would be partially offset by information gained from the salvage program. Based on an estimated 11 sites per square mile, the placement of surface facilities for underground mining could require mitigation efforts for 7 cultural resource sites.

Surface mining on the Ford Pasture tract could require mitigation for 11 cultural resource sites since avoidance of sites would not be possible. The significance of the sites is generally low and there are no known sites within the tracts that are on or nominated to the National Register of Historic Places. The number of sites affected by mining would depend on the final location of facilities.

The extent of cultural resource disturbance that would result from mine-related community expansion in Kane and Garfield Counties is unknown. Mitigation of losses to cultural values in community expansion areas cannot be assured as they would be on private lands where mitigation would be subject to approval of individual land owners unless community development were funded by the Federal Government.

Indirect impacts resulting from greater accessibility and local population increases could cause irreplaceable, unmitigable site damage and loss of both scientific and aesthetic site values. This loss would occur to many on- and off-tract significant cultural resources in Kane and Garfield Counties.

Recreation

By the year 2000, mining-related population growth would increase the local demand for both dispersed and developed recreation opportunities in the two county region by approximately 96 percent over 1982 use figures and by 71 percent over projected baseline demand.

Table 4-37 and Table 4-38 show the increases in demand for hunting, fishing, and ORV activity during the life of the mining operations. Increased demand for dispersed activities would result in the same types of impacts as identified for the central Utah region. In summary, the additional competition for fish and game would lead to less hunter and fisherman success or restricted harvests. Although the two-county region has adequate miles of primitive dirt roads to absorb the ORV demand without resource damage, the increase would conflict with other recreation uses, reducing the overall variety of dispersed recreation available and reducing the quality of the recreation experience to some visitors.

TABLE 4-37

PROJECTED LOCAL INCREASE IN HUNTER AND FISHERMAN DEMAND WITHIN GARFIELD AND KANE COUNTIES
ALTERNATIVE ONE

Year	Coal-Related Population	Projected Annual Increase in Numbers: Deer Hunters	Elk Hunters	Upland Game/ Waterfowl Hunters	Fishermen	Increased Demand for Fish	Overall Percent Increase from 1982	Overall Percent Increase from Projected Baseline
1987	1,474	258	25	125	663	19,890	17	15
1990	2,717	489	54	245	1,222	36,660	31	26
1995	6,913	1,244	138	622	3,109	93,270	79	62
2000	8,407	1,513	168	756	3,781	113,430	96	71

Note: Projections were made assuming that the percentage of Utah's population that currently hunts or fishes would remain the same, and that the Utah percentage can be applied to the two-county area. Approximately 18 percent of Utah's population hunt deer, approximately 2 percent hunt elk, approximately 9 percent hunt upland game or waterfowl. Approximately 53 percent of Utah's population under the age of 12 and 42 percent of the population over the age of 12 fish. Approximately 27 percent of Utah's population is under 12 and 73 percent is over 12 in age (Thayne and Hudson, 1978). An average of 30 fish per person per year were caught in 1977 (UDWR, 1978).

TABLE 4-38

PROJECTED LOCAL INCREASE IN OFF-ROAD VEHICLE DEMAND WITHIN GARFIELD AND KANE COUNTIES
ALTERNATIVE ONE

Year	Projected Coal-Related Population Increase	Projected Increase in Pickup and Four-Wheel Drive Numbers	Projected Increase in Motorcycle Numbers	Overall Percent Increase from 1982	Overall Percent Increase from Projected Baseline
1987	1,474	516	100	17	15
1990	2,717	951	190	31	26
1995	6,913	2,420	484	79	62
2000	8,407	2,943	589	96	71

Note: Projections were made assuming that the percentage of the population in the two-county region that owns off-road vehicles would remain the same (approximately 7 percent of the population currently owns motorcycles, and approximately 35 percent of the population currently owns four-wheel drive vehicles or light pickups) (UORA, 1978).

Developed camping and picnicking sites in the region would receive increased use by the new population. This would intensify present overcrowding, vandalism, and littering, and cause user dissatisfaction and deterioration of the environment and facilities. This overcrowded condition would cause additional recreational pressures on developed as well as dispersed areas. Federal and State governments would be under stress to provide adequate maintenance for existing developed sites and to construct adequate new sites.

Overcrowded conditions of recreation facilities in the towns would intensify, resulting in their deterioration and user dissatisfaction. Stress would be placed on local governments to provide urban recreation facilities to meet minimum standards recommended by UORA (1978).

Development of the tracts and related community expansion would displace dispersed recreational use from as much as 298 acres by 1987, 607 acres by 1990, 1,122 acres by 1995, and 1,496 acres by the year 2000. Because surrounding areas offer comparable or better opportunities, and access to these areas would not be eliminated, the recreational opportunity lost would not be significant, even when the increase in recreational demand is considered.

About 14 miles of road that would be improved or constructed for mining purposes would permanently improve accessibility for dispersed recreation. About 66 miles of exploration access roads would be available for recreation use from 1987 through 1990.

The visual and audio impacts from development of the Alton Amphitheater and Ford Pasture tracts would reduce the quality of the recreation experience to many people using the Alton-Skutumpah road for sightseeing south of Bryce Canyon. Other visitors would find the mining operations to be an interesting addition to their recreational experience. The increased industrial traffic on the Alton-Skutumpah route would result in danger and stress to the recreational visitor.

Fugitive dust visible from Yovimpa Point plus a possible loss in visual range in scenic vistas from Yovimpa Point (up to 2.6 percent over the baseline range in the year 2000 as discussed in the Air Quality section) could reduce the quality of the recreational experience for some of the approximately 650,000 annual park visitors. According to a visitor survey at Bryce Canyon National Park (Kelly, 1980) a large proportion of the visitors are concerned about possible changes in visual air quality, both at Yovimpa Point and in other areas of the park. Over 95 percent of the survey sampled stated that air quality affects their enjoyment of viewing overlooks or scenery in the Park.

Blasting and coal truck operation would be the main sources of noise from the mining operations. The proposed lease tracts, particularly the Ford Pasture tract proposed for surface mining, lie in-between the existing east and west Alton areas studies by Foch and Oliver (1980) for noise impacts on Bryce Canyon National Park. They concluded that noise in the Park from the west Alton area would be less than from the east Alton area but would be audible during a major portion of the time. Truck noise would be perceived as a droning (555 coal haul and truck round trips per day) while blasting would be louder but less frequent. Truck noise from the east Alton area would cause a 2- to 16-fold increase in the perceived loudness of sound levels in the park while blasting could be perceived as 64 times louder than natural background sound levels. Even though the proposed tracts are further from the park than east Alton and would have less impact because of distance, increases in noise would be significant as "even the detectability of man-made noise in pristine areas can be of significant annoyance to people" (EPA, 1977).

Visual Resources

Development of the five proposed southern Utah tracts would change the scenic character of portions of the tracts from natural to industrial during the life of the mines. Visual disturbance would in all cases be greatest during the active mining stage.

Development of the Ford Pasture tract through surface mining and associated onsite developments would modify the landform and create high manmade contrast to the natural setting. It is probable that the dragline, in excess of 200 feet high, as well as fugitive dust would be visible throughout the tract. Mining development would dominate the landscape as viewed from the Alton-Skutumpah road (Highway U-136). Visual contrast would be most obvious in the VRM Class III portion of the tract that is within the foreground of the road. Because of the visual impacts of mining, management objectives for VRM Class III and VRM Class IV areas would not be met during the life of the mine. Many people using the Alton-Skutumpah road would find the operations objectionable, as they would reduce the scenic qualities of the area, especially views of the pink cliffs. Others could find the surface mining operation to be an item of interest adding to the visual qualities of the area.

Developments associated with underground mining on the Alton Amphitheater tract would likely be highly visible from the Alton-Skutumpah road and from the town of Alton. Because the tract is close to Alton, mining roads, drill pads, and shaft hoists could be clearly visible and mining noise could be clearly audible from some dwellings, depending on placement of facilities. Thus, mining disturbance could degrade the visual resources enjoyed by many residents. However, it is unlikely that disturbance resulting from subsidence would be visible to most people. Because of the sensitivity of the visual area, development would probably exceed both VRM Class III and IV objectives during the life of the mine.

Visual conflicts resulting from underground mining development of the Flax Lakes, Fisher Canyon, and Mill Creek Canyon tracts would be less significant. Disturbance of the Flax Lakes tract may be visible from the Alton-Skutumpah road, but because of the viewing distance of approximately 6 miles, the manmade contrast would not be obvious to most people. Mining-related disturbance on the Fisher Canyon and Mill Creek Canyon tracts would not be visible from the Alton-Skutumpah road. It is also unlikely that subsidence occurring on any of the tracts would be perceptible to most people. Because these three tracts would not lose their natural landscape character as viewed from the Alton-Skutumpah road, their VRM Class III and IV standards would most likely be met.

Reclamation would be effective in reestablishing the present scenic quality and character of the Alton tracts within 10 years of completion of the mining operations. No outstanding or unique scenic qualities would be lost from development of any of the tracts. Because of these factors and also because manmade contrast would not be visible from any scenic attraction of national significance, nor from any major tourist travel route, development of the tracts would have little effect on the overall scenic character of the two-county region.

The mining facilities and disturbance would not be visible from Bryce Canyon National Park, but fugitive dust from development of all the tracts (particularly the Ford Pasture tract) could be visible at times from Yovimpa Point. This may adversely affect the recreational experience of some viewers.

Special Designation Areas

Mining activities, including new mines and transportation routes, would not directly impact any special designation area. However, the projected 71-percent increase in local recreational demand over the year 2000 baseline may result in increased ORV and other dispersed use of some of the 40 areas within the two-county region with special designation or potential for special designation. More intensive use and resultant littering and vandalism would degrade values for which the areas are being protected and/or reviewed. Agencies managing the lands would be under stress to protect these values. The degree of impact is not quantifiable. However, due to the temporary nature of impacts resulting from dispersed recreational use, it is extremely unlikely even in a worst case situation that possible degradation would affect the suitability of any area for special designation.

West-Central Colorado

Climate, Air Quality

As outlined in Chapter 3, several atmospheric pollutants in Delta County are approaching or exceed air quality standards. Any new emission source in the region would compound this situation. In order to determine the contribution of additional coal lease developments to the existing situation, pollutant concentrations were estimated using atmospheric dispersion modeling (principally PALDS and ISCLT). These models predict the resulting ground level pollutant concentrations by taking into account topography, wind speed and direction, and industrial/residential emission characteristics.

Figure 4-8 shows the region modeled and major emission sources. Table 4-39 summarizes the emission and production/population rates assumed for sources located in Figure 4-8. Increases in pollutants for population centers were estimated by scaling current (1978-82) pollutant levels with increased population projections. Concentration values were only projected in areas with significant current population or industry. Gaseous pollutant concentrations were not modeled due to the relatively small amount of gaseous emissions compared to the TSP levels. Overall, emissions due to Alternative One are estimated to be 9 percent greater than 1982 levels and 7 percent greater than the projected baseline.

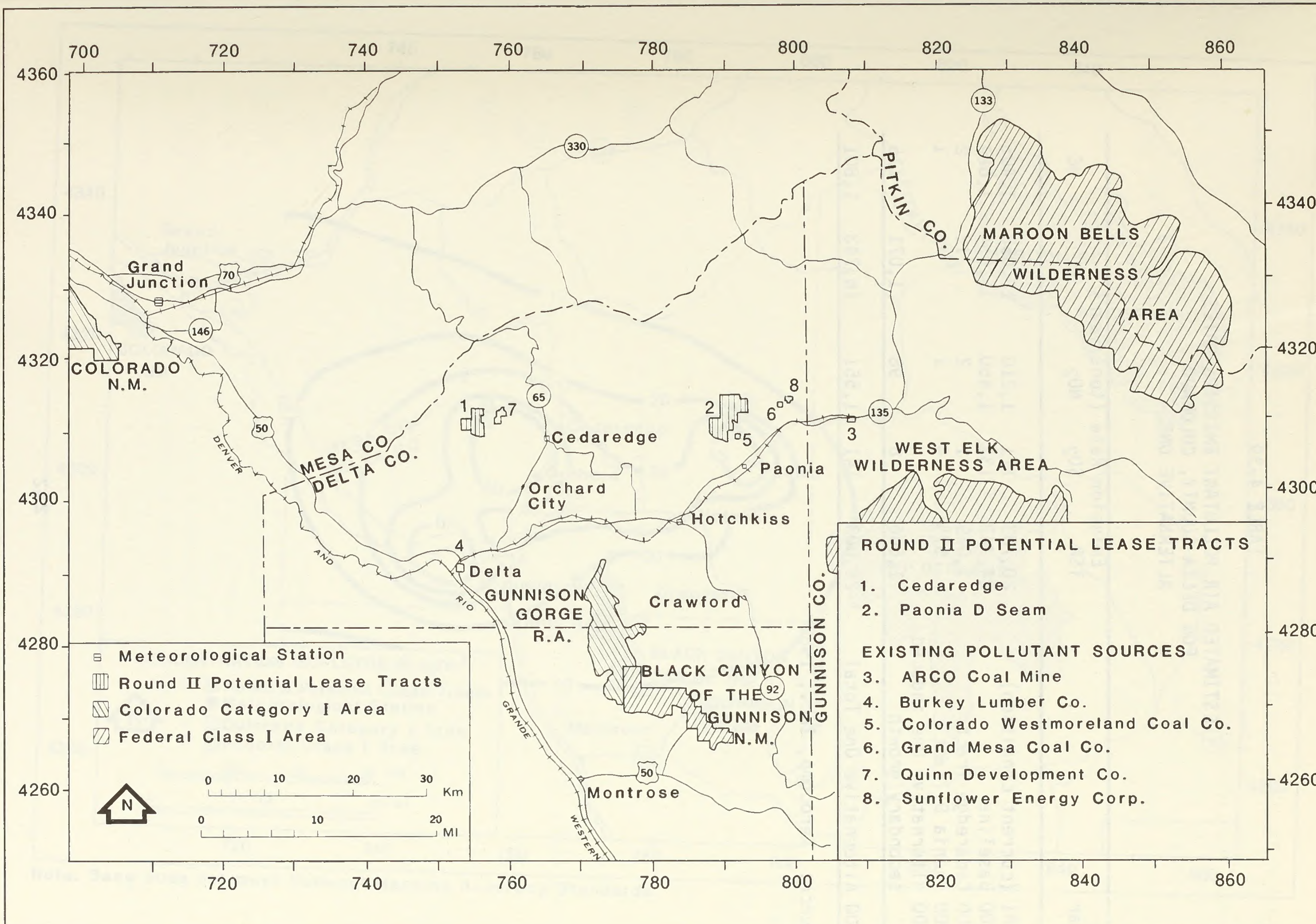
The most probable pollutants that would increase in towns are TSP, nitrogen dioxide, and carbon monoxide, but the level of uncertainty in predicting future pollution sources limits current modeling capabilities to accurately predict regional pollutant levels 20 years into the future.

The predicted annual average TSP concentrations (above a background concentration of 15 micrograms per cubic meter) for the year 2000 are shown in Figure 4-9. These levels represent the maximum concentrations which could result from direct mining activities, induced impacts, and regional growth. While most of the rural region is predicted to remain below the annual NAAQS, an area around Delta and one between Cedaredge to Orchard City may exceed the summary standard. Under worst-case 24-hour conditions it is likely that these same locations may also approach or exceed the 24-hour NAAQS. The secondary NAAQS for TSP is presently exceeded within an 85-square mile area. By the year 2000, the secondary NAAQS would be exceeded within a 190-square mile area of which 70 square miles would be attributable to Alternative One.

No perceptible visibility impairment is anticipated for the Black Canyon area of Gunnison National Monument and West Elk Wilderness Area. Also, due to the limited levels of sulfur and nitrogen-related pollutants, no significant impacts due to atmospheric deposition are anticipated.

Soils

Construction of mine facilities (portal facilities, vent shafts, and roads) and associated urban area expansion would cumulatively disturb approximately 180 acres by the year 2000. Mine facilities construction would result in 80 acres of this disturbance from 1987 through the year 2000. This land would be reclaimed at the end of the mine life and restored to its pre-mining land use.



Map intended for general locational purposes only.
Base does not meet National Mapping Accuracy Standards.

FIGURE 4-8

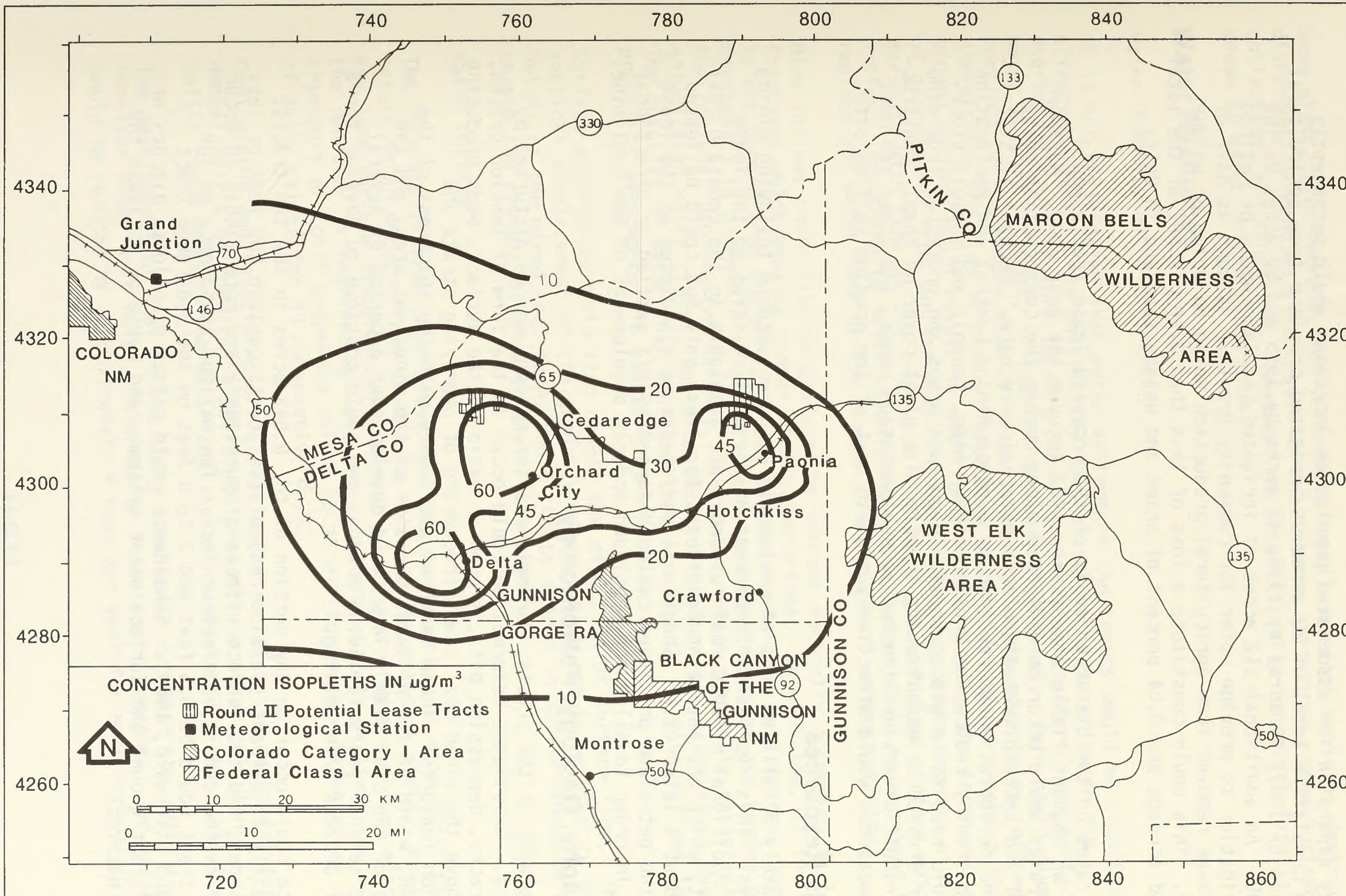
LOCATION OF MAJOR EMISSION SOURCES AND SENSITIVE RECEPTOR AREAS IN WEST CENTRAL COLORADO ALTERNATIVE ONE

TABLE 4-39

ESTIMATED AIR POLLUTANT EMISSION RATES
FOR DELTA COUNTY, COLORADO
ALTERNATIVE ONE

Year	Emission Rate (tons/year) TSP	SO_2	NO_2	CO	HC
1981 (current condition)	20,703	111	1,210	13,058	1,405
2000 Baseline	24,743	132	1,450	15,654	1,684
2000 Cedaredge Tract	1,019	1	2	12	2
2000 Paonia D Tract	575	4	1	6	1
2000 Alternative One induced secondary growth	1,666	8	98	1,071	115
2000 Alternative One Total	28,003	141	1,551	16,743	1,801

Source: Aerocomp, Inc., 1982



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 4-9

ANNUAL AVERAGE TSP CONCENTRATIONS IN WEST CENTRAL COLORADO - YEAR 2000

ALTERNATIVE ONE

Community expansion for associated population increases would permanently remove a cumulative total of 23 acres of irrigated cropland from agricultural production by 1987, 42 acres by 1990, 47 acres by 1995 and 50 acres by the year 2000. An additional 112 acres of irrigated cropland would be retired from irrigation to provide water for community growth. As much as half of this acreage removed from agricultural production would be prime or unique farmland. This would constitute a loss of less than 0.50 percent of the total irrigated acreage and 0.04 percent of prime and unique farmland in Delta County.

Erosion rates on the disturbed soils of the proposed lease tracts would increase an unquantifiable amount from 1987 through the year 2000. Maximum erosion rates would occur on disturbed areas during the construction phase when soil and unconsolidated geologic material were bare. Mechanical stabilization and revegetation as required by Surface Mining Control and Reclamation Act would greatly reduce the erosion rate. Also, topsoil and subsoil stockpiles would need to be placed on stable surface areas and protected from wind and water erosion by establishing an effective plant cover on them. Construction of runoff diversion structures, sedimentation ponds, and other sediment control measures would effectively contain most of the eroding soil on site.

Minerals Resources

Approximately 87 million tons of coal would be unrecoverable following mining activities. This represents 58 percent of the coal reserves on the lease tracts. Additional minable coal resources are available in the Paonia D coal bed tract, which are not being considered for lease sale but could be leased and mined at a later date. Should oil and/or gas be discovered on the lease tracts, the petroleum preserves could be tapped by off setting or directional drilling in order to allow for continued orderly development of the coal mine.

Topography, Geology, Paleontology

The topography of the tracts, during and after mining, may be disturbed by subsidence. Subsidence deformation could occur in the form of tension cracks, linear cracks, depression pits, trough or basin at the surface, beds producing rubble above the mined coal seam, fracturing of overlying strata and compression features. These features would vary with the thickness of the overburden, width of the pillars, the size of the mined out area, and the thickness of the coal seam. They could develop over a period of several months to several years following mining, and could continue to develop for a period of decades after mining.

Subsidence could occur on any portion of the 6,845 acres in the two tracts. Approximately 25 percent (1,711 acres) of the tracts contain 500 feet or less of overburden, and the surface effects of subsidence are more likely to occur where the overburden is 500 feet or less. The maximum subsidence on the Paonia D tract would be 8.5 feet and 3 to 8 feet on the Cedaredge tract (Dunrud and Osterward, 1980). Subsidence could offset pipelines, ditches or roads, disrupt ground and surface water systems, and cause or activate the geologic hazards.

Some plant, invertebrate, and vertebrate fossil material would be destroyed, disturbed, or removed as a result of coal mining activities, unauthorized collection, and vandalism. However, no scientifically important fossils are known to exist in the study area.

Water Resources

Water Quantity and Distribution

It is not anticipated that water systems in the tracts would be significantly affected, however, the possibility does exist that fracturing in the overburden could rupture local groundwater (perched aquifers) and surface water systems (streams, irrigation ditches, pipelines). This could divert portions of the entire flow of these systems into the mine (mine inflow), diminishing the flow at natural discharge areas. Fractures reaching the ground surface would result in additional mine inflow by the increased volume of percolation from surface precipitation. However, these impacts usually decrease with time as the fractures fill with sediment from surface water inflow. According to lease stipulations, the lessee would be required to replace any water lost on the tracts as a result of mining activity.

Mine inflows could also be produced by unknown naturally occurring faults and fractures which usually hamper mining operations. In addition, if the water is not pumped from the mine, it can proceed downdip (3 to 6 degrees north-northeast) in permeable strata of the Mesa Verde Formation and become part of the regional groundwater system. This water, which presently satisfies adjudicated water rights, would be lost to the Gunnison Basin River System. The quantity of water that would be lost as a result of mine inflows is presently unknown but is expected to be low.

Surface subsidence could also change the direction of surface flow. The vertical displacement of the ground surface, which can be as much as the height of the mined coal seam, could create scarps in stream channels and change the present divides of small watersheds.

Water Quality

The increase in land development and the construction of mine facilities would result in an unquantified short-term increase in sediment yield. However, for any land surface disturbances directly associated with the mining operation, the operator is required by regulation (30 CFR 817.42) to limit the offsite transport of total suspended solids to 35 milligrams per liter as an average of daily values for 30 consecutive days.

Coal mining and associated activities would increase the potential for accidental spills of chemicals, petroleum products or other pollutants. These spills could degrade the water quality on or adjacent to the lease tracts.

The development of coal in the study area would decrease the salinity in the Gunnison River near Delta, Colorado by less than 1 percent. The salinity would be reduced by approximately 8 tons per year for each irrigated acre lost to development and domestic water needs. However, half of the increase in domestic water needs would be discharged as sewage effluent which would increase total dissolved solids by approximately 200 milligrams per liter. In the year 2000, the change in water use on irrigated acreage would eliminate approximately 22 times more salt from entering the river system than would be added by the increased amount of sewage effluent (Table 4-40).

Water Rights and Uses

The leasing and development of coal would result in an increase in the consumptive use of water in the area (Table 4-40). This would cause a less than 1 percent reduction in the annual discharge of the Gunnison River. The water making up this additional use would come from existing permitted uses that are not being fully utilized or from the lease or purchase of current water rights for other uses such as irrigation.

The conversion of irrigation water to industrial (mine use) and domestic uses would result in a decrease in the number of irrigated acres (Table 4-40). The consumptive use of water for mining would decrease when mining ceases; however, demand for domestic use would continue if the related population increase remains in the area.

All water in the area has been appropriated by the State of Colorado, therefore, any additional decrees would have to be purchased, leased, or accompanied with an augmentation plan.

Vegetation

Approximately 80 acres of Pinyon-Juniper and Mountain Brush vegetation types would be removed on the lease tracts for the life of the mines. This loss of vegetation would be for the life of the mine and could eventually be successfully reclaimed. Vegetation composition and structure would differ from pre-mining conditions. Several years would be required to attain premining vegetation conditions.

In addition to the onsite disturbance there would be a loss of rural and agricultural land in the study area of about 100 acres for housing and related development by the year 2000. Of this figure, about 50 acres would be irrigated cropland. An additional 112 acres of irrigated croplands would be retired to provide water for community growth. These lands would not be reclaimed. No known listed or candidate threatened or endangered plant species would be disturbed by mining activities.

Wildlife

Eighty acres of wildlife habitat would be destroyed due to the construction of mine facilities and the production of coal. An additional 100 acres of habitat on private farmland and rangeland would be permanently converted to housing and commercial uses. Big game populations would be reduced due to this reduction of crucial winter range. This primary habitat loss would result in approximately 52 fewer deer and 8 fewer elk in the two herd units encompassing these tracts. This is slightly less than 1 percent of the 1981

TABLE 4-40

WEST-CENTRAL COLORADO
CUMULATIVE IMPACTS ON WATER RESOURCES
ALTERNATIVE ONE

	1987	1990	1995	2000
Consumptive Water Use From Population Increase[a] (Acre-Feet/Year)	101	188	213	227
Consumptive Water Use From Mining Operations (Acre-Feet/Year)	78	109	109	109
Total Consumptive Water Use (Acre-Feet/Year)	179	297	322	336
Percent Change in Discharge of Gunnison River near Delta, CO, From Consumptive Water Use	-0.01	-0.02	-0.03	-0.03
Irrigation Water Lost To Coal Development And Related Pop. Inc. (Acre-Feet/Year)	288	487	533	558
Decrease In Salinity From Loss of Irrigated Land (Tons/Yr)	702	1,187	1,299	1,360
Increase in Salinity from Sewage Effluent (Tons/Year)	27	51	58	62
Net Change in Salinity (Tons/Year) (+) Increase (-) Decrease	- 675	-1,136	-1,241	-1,298
Percent Change In Salinity at Gunnison River near Delta, CO	-0.09	-0.15	-0.16	-0.17

a Based on 225 gal./person/day and 50 percent return flow through sewage effluent.

legal elk harvest and about 4 percent of the 1981 legal deer harvest for the two herd units involved. Human activity and noise around the mine sites and other developments could cause some abandonment of otherwise suitable habitat even after the animals became accustomed to human presence. This in combination with the permanent loss of winter range on private land, increased disturbance on the winter range, increased poaching and additional recreation and hunting pressure would result in a long-term indefinite reduction in big game populations. After reclamation, habitat for 22 deer and four elk would once again be available.

During the production phase, big game vehicle mortality in the Cedaredge area would likely increase by approximately 20 deer and one elk per year. This estimate is based upon the current situation for a similar mining operation in the North Fork Valley. There would be a slight but unquantified increase in vehicle/big game collisions throughout the county due to increased human population and the attendant increase in vehicle traffic. This would persist beyond the life of the mines.

Although the known Golden Eagle nests on public land are protected by a buffer zone, uncontrolled activity associated with increased human population could result in eyrie abandonment or loss of the young. Other birds of prey which nest in this area would also be susceptible to this type of disturbance. Some raptors, including eagles, could suffer increased mortality from vehicle collisions, especially when feeding on road-killed deer during the winter.

The 100 acres of small game and non-game habitat on private land that would be lost to domestic and commercial uses could be considered a permanent loss. Some wildlife species such as pigeons, starlings, English sparrows and robins would prosper from this habitat alteration. Other species, such as bluebirds, towhees, chipping sparrows, pheasants, reptiles, amphibians, and rabbits would not find this altered habitat suitable.

The limited aquatic habitat located on the Paonia and Cedaredge tracts should not be adversely affected by the proposed mining activities. Water quality regulations that apply to mine operations should prevent significant negative impacts to the North Fork of the Gunnison or the Gunnison River.

Land Use

Existing land uses would not change significantly on either of the tracts or adjacent areas. By the year 2000, 100 acres of land would be devoted to urban expansion in order to accommodate the increased populations, fifty acres of which would be irrigated croplands. In addition to the 100 acres, 112 acres of irrigated cropland would be retired to provide water for community growth. This represents less than 0.50 percent of the irrigated acreage in the county and would not result in a significant loss of agricultural production or income. No lands used primarily for livestock grazing would be affected. Anticipated impacts to water systems on the tracts are discussed in the Water Resources Section.

Socioeconomics

Population is expected to increase 8 percent, employment by 6 percent and per capita income by 3 percent over the projected baseline between 1982 and 2000 (Table 4-41). Employment in North Fork coal mines may be expected to increase 50 percent by the year 2000 (PAS Model). Delta County would receive an additional $376,000 annually (a 60-percent rise) in coal tax revenues over the years 1990 to 2000.

Infrastructure

Communities that currently have infrastructural deficiencies would find them magnified by expanding populations. Difficulties in financing infrastructural expansion in the town of Delta would be expected to continue.

The communities expected to encounter the most infrastructural difficulties are Orchard City with a 10-percent population increase, Cedaredge and Orchard City unincorporated areas with a 16-percent increase, and Cedaredge with a 18-percent increase. Other Delta County communities are expected to experience population growth of less than 10 percent. Cedaredge and Orchard City are currently deficient in fire fighting facilities. Cedaredge is also deficient in water facilities. These deficiencies would become more critical as population growth continues to outstrip the communities' ability to expand infrastructural capacity.

Delta County with 600 additional students would require 25 additional classrooms and teachers by the year 2000; community population projections are not considered accurate enough to predict the school requirements of each community.

Social Conditions

Delta County residents would experience a 1.3 percent annual population growth rate between 1982 and 2000. This is less than half of the 1974-1981 rate of 3.7 percent, but 0.5 percent greater than the baseline growth rate. Number of crimes, while increasing at a lower rate than during the 1974-1981 period, would increase 24 percent over the projected baseline by the year 2000.

Transportation

Traffic on State Highway 65 at the intersection with State Highway 92 would increase by approximately 400 vehicles per day by the year 2000. The accident rate would increase by less than 1 per year. In addition, it is estimated that there would be 63 coal trucks and 12 service truck round trips per day resulting from coal production from the Cedaredge tract. This traffic increase would continue to be a safety concern of nearby Delta residents that would continue as long as the loadout facility near Delta is in operation.

The county road which would be used to transport coal from the Cedaredge tract is not designed to accommodate projected coal related traffic. The road would need to be redesigned and substantially improved to handle the increased traffic load. Lease stipulations for coal transportation from the Paonia D

TABLE 4-41

WEST-CENTRAL COLORADO
ECONOMIC GROWTH PROJECTIONS
ALTERNATIVE ONE

Year	Without Leasing	With Leasing	Difference	Percent Change
Population (PAS Model 1982)				
1982	22,830	22,830	0	0
1987	24,890	25,691	801	3
1990	25,399	26,891	1,492	6
1995	25,856	27,549	1,693	7
2000	26,047	28,212	2,165	8
Total Employment (PAS Model 1982)				
1982	8,712	8,712	0	0
1987	9,213	9,742	529	6
1990	9,411	9,982	571	6
1995	9,521	10,098	577	6
2000	9,925	10,507	582	6
Per Capita Income in 1980 Dollars (PAS Model 1982)				
1982	9,793	9,793	0	0
1987	9,397	9,854	457	5
1990	9,421	9,819	398	4
1995	9,435	9,776	341	4
2000	9,614	9,915	301	3

tract would eliminate coal traffic on Highway 133, which has been a concern of local citizens.

County-wide traffic associated with coal related population growth would not be expected to significantly overload any county or State road system. While traffic accidents would increase an unspecified amount, the accident rate (accident per vehicle mile) itself would not be expected to increase.

Cultural Resources

The construction of surface facilities such as roads, vent shafts, and structures would result in surface disturbance; however, these could be designed so as to avoid existing cultural sites. If sites cannot be avoided, mitigation measures would be applied as discussed in Chapter 2.

Unquantified indirect impacts would increase as a result of greater accessibility and local population increases. Recreational activities of two types, intentional, illegal activities associated with artifact collection and treasure hunting, and unintentional recreational use (hiking, hunting, ORV), would cause irreplaceable, unmitigatable site damage. Both scientific and aesthetic site values would be lost as a result of these indirect impacts. No known National Register Properties would be directly disturbed as a result of coal leasing.

Recreation

Increased recreation use on public and private lands is a natural outgrowth of population increases. This increased use would create a need for additional maintenance and administration in areas providing those settings and activity opportunities most utilized by the public. The utilization of other recreation opportunity areas would also occur as the increased use saturates those areas which currently provide the most desirable settings and activities, or as new demands surface. These anticipated impacts have not been quantified but would be expected to be minor.

Visual Resources

Coal development subsequent to leasing both tracts would increase the dominance of industrial and urban landscape features in the North Fork Valley. Visual impact resulting from underground mining and associated development on the tracts would modify the natural appearing landscape in areas, but overall the scenic character of the tracts would remain natural. Visual impact would be similar through all mining years. No outstanding or unique scenic qualities would be lost.

Development of new portals and associated facilities (e.g., buildings, transmission lines, and access roads) both on and off the tracts would not be anticipated to significantly impact visual resource values. Generally, development and disturbance would be similar to existing disturbance in the areas affected. Reclamation would be effective in re-establishing the present scenic quality and character of the tracts upon completion of the mining operations.

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Special Designation Areas

The Adobe Badlands and Gunnison Gorge Wilderness Study Areas could receive increased dispersed recreation use because of the coal related population increase, as would the West Elk Wilderness Area, Gunnison Gorge Recreation Lands, the Black Canyon of the Gunnison National Monument, and the Needle Rock Natural Area. However, the increase in anticipated use of these areas would be anticipated to be low as a result of coal leasing and no significant impacts would be expected.

Unavoidable Adverse Impacts

Four areas near Price, Castle Dale, Mt. Pleasant, and Alton, Utah, and two areas near Delta and Cedaredge, Colorado, would exceed the primary NAAQS for TSP. Annual TSP emissions would increase an average 10.6 percent over 1982 levels and 6.1 percent over the projected baseline in these areas by the year 2000. Secondary NAAQS would be exceeded in a 2,845 square mile area by the year 2000 of which 1,275 square miles would be attributed to implementation of Alternative One. The greatest contribution to the predicted concentrations would be coal related vehicular travel on unpaved roads. Visual impacts would be noticeable from many roads and highways often used for recreation purposes; however, the most significant impact to visual range would result from increased populations in towns and cities.

The loss of soil and vegetation productivity on 5,257 acres would be unavoidable. Approximately 2,503 acres would be eventually reclaimed following mining operations. The remaining 2,754 acres lost to community development, including irrigated croplands, would not be reclaimed. An unquantified amount of soil would be lost from disturbed areas prior to reclamation. The mining of coal in the region would result in 1,174.3 million tons of coal (62 percent) becoming unrecoverable by present technology. Changes in aquifers such as redistribution of ground water discharge and distribution of surface water due to subsidence could not be avoided. Consumptive use of water in the region would increase by 7,041 acre-feet by the year 2000. An additional 484 acre-feet would be required annually for mine development.

In affected drainage basins, tract development would result in a total sediment yield of approximately 80 acre-feet annually by the year 2000. About 48 acre-feet would come from the southern Utah tracts. Sediment from tracts in the Wasatch Plateau could end up in local reservoirs important as fisheries and community water sources. Approximately 81,047 acres would be susceptible to subsidence of up to 16 feet. Surface mining would alter topography on an additional 687 acres. The loss of wildlife due to occupation, disturbance of habitat, and illegal killing would increase. Highway mortality, mostly in central Utah, would be in excess of 200 deer and elk annually and would be unavoidable; however, vitality of the various herds should not be significantly affected. An unquantified amount of big game habitat, including winter range and calving grounds would be lost. Regionwide, the loss would be insignificant; however, in some specific areas, big game populations would be reduced.

Conversion of irrigated cropland to urban use and retirement of irrigated land to provide water for mining and community needs would result in a loss of less than 1 percent (approximately 1,978 acres) of agricultural land in the region.

Portions of three tracts on the Wasatch Plateau lie within Carbon County's land use zone where coal mining is not allowed. Zoning variances or rezoning would be necessary before mining could proceed. A potential conflict would exist with the Kane County Master Plan in the areas of water development and protection of irrigated croplands.

Population in the region would increase by 28,349 persons or 21 percent over the projected baseline by the year 2000. Housing needs would increase by over 8,000 units. Employment in the region would increase by 11,237 jobs or 20 percent by the year 2000 over the projected baseline. Capital and operating expenditure requirements of local counties, school districts, and municipalities would rise as a result of the need to expand public services and facilities. Unless communities plan needed improvements in advance and ensure adequate funding, there would be at least a temporary deterioration in the quality of services, causing inconvenience and dissatisfaction among those affected. These impacts would be most acute in central Utah.

Mine-related traffic would add over 20,000 vpd (21-percent increase) to highways in the region, over 13,000 of which would occur in the central Utah area. The largest increase in traffic would occur on Highway U-10 south of Price, Utah, and US-6 east of Price where travel limits would be exceeded. Traffic congestion in downtown Price would result from increased numbers of vehicles and increased numbers of coal trains going through the community. Unpaved secondary roads in the region would experience deterioration and safety problems due to increased coal related traffic.

Inadvertent destruction or disturbance of undetected cultural and paleontological resources and losses through illegal collection or vandalism could not be avoided. The increase in demand for recreational activities over the projected baseline resulting from population increases (71 percent in southern Utah, 18 percent in central Utah, and an undetermined but slight amount in west-central Colorado) could result in an undetermined amount of overutilization and crowding of existing recreation developments and reduced hunting and fishing success. The landscape modifications that would result from mining and associated development would degrade the visual quality of those areas; in some areas VRM standards would not be met.

Mining related noise and fugitive dust would be detected on occasion by visitors to Bryce Canyon National Park. While overall noise level would be low, it could still be perceived as significant to those in a pristine National Park environment.

The Relationship Between Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The increased population associated with mining development would result in a long-term decrease in air quality in the region.

Implementation of Alternative One would increase annual coal production in the region from 13 million tons in 1980 to about 55 million tons by the year 2000. Average annual production from the tracts alone would be 20.78 million tons when full production is reached. This would represent a significant commitment to coal mining in the region.

The short-term use of the environment for coal production and associated housing development would result in a long-term loss of soil and vegetation productivity on 2,754 acres permanently occupied by housing and acres retired from irrigation to provide water for community needs.

The extraction of 732.6 million tons (38 percent) of coal would render the remaining unmined 1,174.3 million tons (62 percent) of coal unrecoverable over the long term. Changes in aquifers and points of surface discharge due to subsidence would result in a long-term local change in surface water distribution and ground water storage. The short-term community and mining use of 7,525 acre-feet of water per year would be reduced by 484 acre-feet when mining ceases. The use of 7,041 acre-feet per year for community use would continue in the long term. Over the long-term, salinity at Imperial Dam would actually be reduced as water normally used for irrigation and returned to the system would be used for community development. This would more than offset salinity produced by active mining operations. Overall, the cumulative effect would be less than 1 percent.

Disturbance or occupation of habitat up to 40 years by mining activity would result in a long-term redistribution of wildlife populations and migration routes. Permanent occupation of 2,754 acres by urban development would cause a long-term loss of wildlife habitat occupied by pheasants, cottontail rabbits, mourning doves, and other small game. The loss of crop production on 776 acres occupied by housing and 1,202 acres retired due to conversion of water use would be a long-term loss in productivity.

The growth in population of 23,117 people in the region (21 percent over the projected baseline) would increase the area's potential productivity by enlarging its labor force, but the 11,237 jobs (20 percent over the projected baseline) associated with Federal lease mining would not continue in the long-term. Infrastructure improvement such as water systems would also contribute to increased community capacity by providing facilities useful for commerce and industry as well as the residential population. However, until these improvements are operational, deficiencies in community services could be anticipated.

Excavation and salvage of sites would expand knowledge of cultural resources in the region. The development of recreational facilities as a result of demand by the increased population would be a long-term increase in capacity of recreation developments in the region.

Irretrievable or Irreversible Commitment of Resources

Emissions attributable to coal related population growth and mining activity in the region would result in an irretrievable deterioration in air quality during the life of the mining operations. Soil and vegetation productivity on 5,257 acres would be irretrievably lost for the life of the mines or until reclamation was successful. Productivity on 2,754 acres occupied by housing or retired from irrigation would be irreversibly lost. Soil lost to wind and water erosion prior to reclamation would be irretrievable.

The 732.6 million tons of coal mined would be irreversibly lost as a resource and the 1,174.3 million tons of coal left in the ground would be irreversibly unrecoverable by present technology. Increased water consumption for mining and community needs would be irretrievable. Any change in aquifers, ground water storage potential, or point of discharge due to subsidence would be irreversible. The increased consumptive use of water for community and mining use (7,298 acre-feet per year) would be irreversible.

Big game losses through displacement from habitat, traffic mortality, or illegal killing would be irretrievable. Despite increased losses of individual animals, vitality of the individual herds would be expected to be maintained. Habitat for pheasants, cottontail rabbits, mourning doves, and other small game occupied by community development would also be irreversibly lost; however, this would be insignificant on a regionwide basis and overall population vitality would be maintained.

The growth in population of 23,117 persons foreseen under this alternative would be irreversible except at considerable economic and human cost. Likewise, the commitment of capital, physical resources, and labor to build over 8,000 housing units and infrastructure that would be required to support the growth in population, commerce, and industry would be an irretrievable impact. The loss of smalltown atmosphere and community solidarity in some communities as a consequence of coal development would be irreversible.

Development of the coal mines as proposed would result in the irretrievable consumption of over 300 million gallons of petroleum fuels.

The loss of cultural and paleontological resources in context would be irretrievable and any loss of interpretive values would be irreversible. The adverse impacts to visual resources would be irretrievable for the life of the mines, but in most cases would be reversible following reclamation. However, any loss of high quality scenery that would occur from surface mining the Blue Trail Canyon tract would be permanent. Noise produced by coal development in southern Utah could result in an irretrievable degradation of a recreation experience to some visitors to Bryce Canyon National Park.

Significant Cumulative Impacts

The cumulative impact assessment was developed by adding the impacts of Alternative One to those of the baseline (Alternative Four) for the year 2000. Only the most significant impacts are summarized below. The cumulative impacts are discussed by geographic area, i.e., central Utah, southern Utah, and west-central Colorado, to allow meaningful comparisons to present conditions within each area.

Central Utah

By the year 2000, in central Utah there could be an 89-percent increase in TSP emissions over the 1981 emission levels. Three areas would exceed primary NAAQS for TSP and there could be approximately a 2,310 square mile or 1,443-percent increase in area where the secondary NAAQS for TSP would be exceeded. About 1,040 square miles or 45 percent of the increase would be attributable to Alternative One.

Visual range from selected points in Canyonlands and Capitol Reef National Parks would be reduced by 6 to about 64 percent during 1 percent of the time. Such reductions could be perceptible to park visitors. Also, during 1 percent of the time a plume may be visible looking from Cathedral Valley in Capitol Reef National Park to the San Rafael Swell. About 21 to 24 percent of the reduction would result from Alternative One.

Community development resulting from mining would result in a permanent loss of soil productivity for about 2,685 acres by the year 2000. Approximately 985 acres or 37 percent of the loss would be attributable to Alternative One. Up to 123,643 additional acres of surface would be subject to subsidence of which 57 percent would be affected by Alternative One. A maximum subsidence of 16 feet with surface fractures could result.

An estimated 12,529 acre-feet of water would be required by the year 2000 for coal development and selected population growth of which 38 percent would be required by Alternative One. About 6,438 acre-feet of water would be consumptively used. This is about 0.44 percent of Utah's share of Colorado River water.

Projected mining activities would disrupt local aquifers, alter local ground water flow systems and cause redistribution of natural ground water flow systems. These impacts are not quantifiable but about 193 additional square miles would be subject to mining.

The four-county population would increase from an estimated 69,598 in 1982 to 117,977 in 2000, a 70-percent increase. Alternative One would contribute about 17,777 people or 36 percent of the increase. Corresponding increases in hunters, fishermen, and ORV use can be expected. The presence of a larger human population would exert greater pressures on wildlife populations through legal and illegal harvest, harassment, and displacement from habitat.

Cumulative loss of pheasant habitat would be insignificant on a regional basis but locally a 13-percent reduction in cock harvest could result in Carbon County.

Irrigated cropland lost as a result of community expansion and retired due to use of water for community purposes would be about 3,357 acres or 1.5 percent of the four-county agricultural land base. About 1,232 acres or 37 percent of the affected acreage would result from Alternative One. The retired lands would be among the most favorable for agricultural use in the four-county region.

By the year 2000 the four-county population would increase approximately 70 percent over the 1982 level which would lead to similar increases in the demand for housing, water connections, and other community infrastructural services. Front-end financing of these services would be a major problem and the quality of community services could deteriorate.

Traffic congestion would occur on U-10 between Price and Castle Dale, and on US-6 across Soldier Summit. Severe traffic congestion would occur in downtown Price as increased numbers of vehicles would be blocked by increased numbers of coal trains. Alternative One would contribute to an already poor situation. Nearly all highways affected by proposed coal development are approaching or have already exceeded the 200-year design traffic volume and the need for maintenance would increase.

By the year 2000 total population growth would increase the local recreational demand by approximately 70 percent over 1982 levels. By itself, Alternative One would increase the demand by only 26 percent. Such increases would result in overcrowding, user dissatisfaction, and deterioration of the environment at many sites in the four-county region.

Because of large increases in population, overcrowded conditions and user dissatisfaction at recreational facilities in towns and cities would also accelerate.

Southern Utah

By the year 2000, in southern Utah there would be a 137 percent increase in TSP emissions over the 1981 emissions level. There would be approximately a 185 square mile increase in area where the secondary NAAQS for TSP would be exceeded. About 89 percent of the increase would be attributable to Alternative One.

Visual Range from Yovimpa Point in Bryce Canyon National Park would be reduced from present conditions by about 3.3 percent.

Community development resulting from mining would result in a permanent loss of soil productivity on about 634 acres by the year 2000. Approximately 467 acres or 74 percent of the loss would be attributable to Alternative One.

An estimated 2,988 acre-feet of water would be required by the year 2000 for coal development and related population growth of which 75 percent would be required by Alternative One. About 1,551 acre-feet of water would be consumptively used. This is about 0.10 percent of Utah's share of Colorado River water. In conjunction with water requirements in central Utah, 0.54 percent of Utah's share of Colorado River water would be required for Alternative One.

The two-county population would increase from an estimated 8,800 in 1982 to 20,207 in the year 2000 for an increase of 130 percent. Alternative One would account for about 8,400 people or 75 percent of the increase. Corresponding increases in hunters, fishermen, and ORV use can be expected. The presence of a larger human population would exert greater pressures on wildlife populations through legal and illegal harvest, harassment, displacement from habitat, and highway mortality. Deer herd unit 60A would require even stricter control by the UDWR.

Irrigated cropland lost as a result of community expansion and retired due to use of water for community purposes would be about 793 acres or 1.7 percent of the two-county agricultural land base. About 584 acres or 74 percent of the loss would result from Alternative One. The affected irrigated croplands would be among the most favorable for agricultural use in the two-county region.

By the year 2000 the two-county population would increase approximately 130 percent over the 1982 level which would lead to similar increase in the demand for housing, water connections, and other community infrastructural services. Front-end financing would be a major problem and the quality of community services could deteriorate.

Traffic in Kanab would more than double by the year 2000 and traffic on Main Street would become congested.

By the year 2000 total population growth would increase the local recreational demand by 130 percent over 1982 levels. By itself Alternative One would increase demand by 96 percent. Such increases would result in overcrowding, user dissatisfaction, and deterioration of the environment at many sites in the two-county region.

Because of increases in population, overcrowded conditions and user dissatisfaction at recreational facilities in towns and cities would also accelerate.

West-Central Colorado

Subsidence could occur over areas that have been or would be mined in Delta County by the year 2000. The amount of surface that could be impacted is undetermined but would be greater than anticipated for Alternative One or Four independently. Some unquantifiable impacts to water resources, roads, pipelines, and ditches could result from overburden fracturing and subsidence.

By the year 2000 consumptive water use for mining and related community development would be about 857 acre-feet per year. This would reduce the average annual flow of the Gunnison River in Northern Delta County by about 0.08 percent. By the year 2000, the human population in Delta County would increase about 24 percent over the 1982 level. This would lead to increased poaching, hunting, and fishing pressure, more wildlife disturbance, and increased wildlife highway mortalities.

Community expansion and water leasing needs would remove or retire approximately 272 acres of irrigated cropland in Delta County by the year 2000. About half of the affected croplands would be prime and unique farmland. Leasing of the two proposed tracts would be responsible for about 172 acres of the affected land. Overall, less than 1 percent of the Delta County's agricultural land would be lost. Delta County's population would increase from 22,830 in 1982 to 28,212 in the year 2000. The communities of Delta, Orchard City, and Cedaredge would experience difficulty in financing infrastructural and education and recreational expansion to meet increased demands.

Alternative Two: (Preferred Alternative) High Level (1.670 Billion Tons)

The following analysis addresses the projected impacts of Alternative Two in central Utah. The impacts of implementing Alternative Two on southern Utah and west-central Colorado would be identical to those described for Alternative One and are not repeated here.

Central Utah

Climate, Air Quality

Air Quality Standards

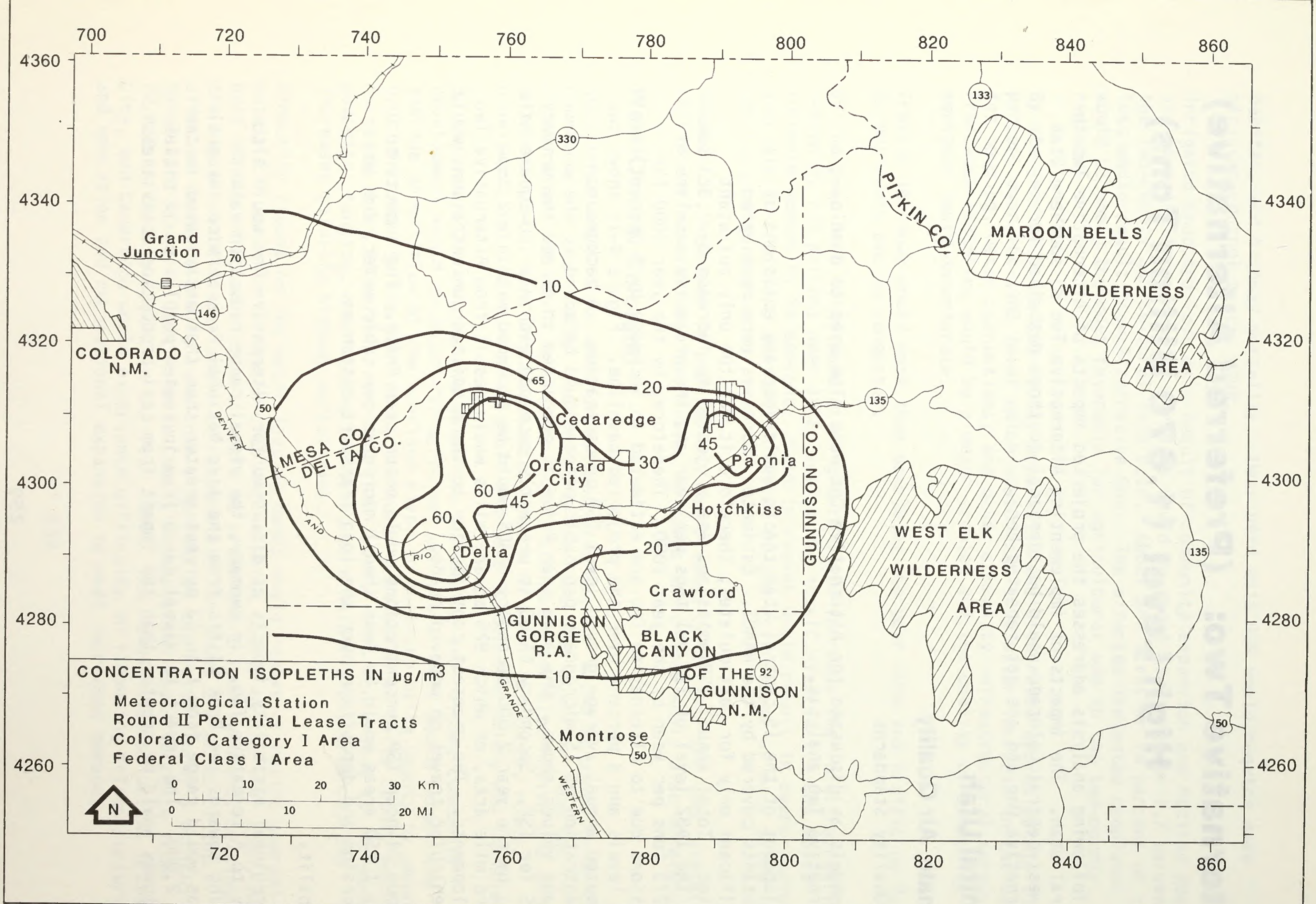
The models as discussed for Alternative One were also used to develop the Alternative Two analysis.

Development of the 15 central Utah tracts would increase emissions of all pollutants covered by the NAAQS. Estimated increases were considered significant only for particulates; therefore it was the only pollutant modeled. Total annual TSP emissions are projected to increase by 7,323 tons over the 1982 level of 111,981 tons per year and the projected baseline of 204,273 tons per year by the year 2000. Therefore, by the year 2000 TSP emissions due to Alternative Two are estimated to increase by 7 percent over 1982 levels and 4 percent over the projected baseline. Figure 4-10 shows the estimated annual average ground level TSP concentration. A background concentration of 15 micrograms per cubic meter should be added to the annual average values shown. One area near Price is predicted to exceed the primary NAAQS for TSP. Secondary NAAQS is presently exceeded within a 160-square mile area; by the year 2,000 secondary NAAQS would be exceeded within a 2,355-square mile area, of which 925 square miles would result from Alternative Two developments. The greatest contribution to the predicted concentrations would be vehicular travel on unpaved roads.

Maximum 24-hour TSP concentrations would occur near Price. The impacts to Class I PSD areas would be less than 1 microgram per cubic meter, due to dispersion and deposition over the long transport distances.

Visibility

The regional visibility impacts as discussed for Alternative One would also apply to Alternative Two. In summary, the visual range reduction values looking towards the Book Cliffs from the five National Park Service integral vistas would range from 1 to 13 percent greater than that anticipated in the year 2,000. The impact to visual range from increased population in cities and towns would be greater than the impact from coal production activities.



Map intended for general locational purposes only.
Base does not meet National Mapping Accuracy Standards.

FIGURE 4-10
WEST CENTRAL COLORADO
2000 MAXIMUM ANNUAL AVERAGE TOTAL SUSPENDED PARTICULATE CONCENTRATIONS (ug/m^3)
(Isopleth Value Indicates Predicted "worst-case" Increase Above Background Level of 15 ug/m^3)

Soils

Refer to Alternative One, central Utah Soils Section for applicable general discussion on causes of soil disturbances, impacts to soils located on coal tracts and on off-tract support sites, and erosion control potentials.

Table 4-42 displays cumulative disturbed acres resulting from exploration, mining, and community development for Alternative Two. The loss on community development areas would be permanent.

Table 4-43 presents estimated soil losses on critical soil erosion areas. The losses depicted are considered as averages over the potentially disturbed tract areas. As shown, the upper range of percent increases could be large, but would occur on a relatively small portion of total tract acreage (from 1 to 3 percent). Revegetation and erosion control measures would reduce soil erosion to acceptable levels within a 2-to 10-year period on most tract areas. Soil loss on all disturbed acres would exceed soil loss tolerance values.

In the following discussions, total acres of disturbance are discussed for exploration activities. For production activities, only soil impacts on cut and fill slopes are analyzed (see Central Utah, Soils Alternative One, for rationale and methodologies). The impacts under Alternative Two would be as analyzed under Alternative One, but would occur on fewer acres.

Soil disturbances from exploration activities in central Utah would be temporary (1 to 2 years) on approximately 223 acres.

Approximately 313 acres would be disturbed by production activities on steep slopes within critical soil erosion areas. In the Book Cliff tracts, 51 acres of steep slopes would be disturbed mainly on the Alkali Creek and Coal Creek tracts. Disturbances on steep slopes could result in soil losses of 50 tons or more per acre per year from combined water and wind erosion (BLM, 1982b).

In the Wasatch Plateau area, soil losses on exposed soils of cut and fill slope acres could range from 20 to 50 tons per acre per year on 67 acres in the Castle Valley Ridge tract and from 50 to 100 tons per acre per year on 195 acres in the Trail Mountain, Ferron Canyon, The Pines, and Quitchupah tracts. Due to the high erosion potential, low soil fertility, and high salt and clay content, revegetation problems would exist on the disturbed acres of these tracts.

Subsidence, as evidenced on coal lease operations within the Wasatch Plateau, could increase the potential for mass soil movement on the unstable soils of the Trail Mountain and Ferron Canyon tracts (see Topography Section). This could accelerate soil erosion and cause increased sediment transport into intermittent and perennial stream courses within or adjacent to these tracts.

Minerals Resources

Approximately 107.9 million tons or 47.1 percent of the coal in the Book Cliffs tracts, and 295.1 million tons or 42.3 percent of the coal in the Wasatch Plateau tracts, would be recovered using current mining techniques.

TABLE 4-42

CENTRAL UTAH
ACRES OF SOIL DISTRUBANCE ON COAL TRACT
AND COMMUNITY DEVELOPMENT AREAS

Alternative Two

Activity	Acres Disturbed 1987	1990	1995	2000	
Exploration[a]	222.7	222.7	222.7	222.7	The exploration and mining acres represent 2.7 percent of the total surface acres within the coal tracts.
Mining[b]	0	921.8	956.4	977.5	
Community Development[c]	159.9	282.2	802.4	968.4	
Totals	382.6	1,426.7	1,981.5	2,168.6	

Source: Round Two Tract Profiles. Round Two Leasing and socioeconomic data from the State of Utah Planning Coordinator's Office, 1982.

a Although included in cumulative total of disturbed acres, these exploration acres would be rehabilitated within a 3-year period after completion of exploration work.

b Includes 100 acres of off-tract loadout facilities.

c Soil productivity loss considered permanent on these acres.

TABLE 4-43

CENTRAL UTAH
ESTIMATED SOIL LOSSES[a] ON CRITICAL SOIL EROSION AREAS

ALTERNATIVE TWO

Coal Tracts	EXPLORATION ACTIVITIES Estimated Soil Loss Without Tract Developments[b]	Estimated Soil Loss With Tract Developments[c]	Differences Attributed to Tract Developments	Percent Increases Over Present	PRODUCTION ACTIVITIES Estimated Soil Loss Without Tract Developments[b]	Estimated Soil Loss With Tract Developments[c]	Differences Attributed to Tract Developments	Percent Increases Over Present
Book Cliffs Tracts	0.5 to 3.0	5.0 to 50.0 (Moderately steep areas)	4.5 to 47.0	900 to 1600	Same as shown for exploration[d]			
Alkali Creek, Coal Creek, Graves Hoffman Creek, Soldier Creek, and Whitmore Park		50.0 to 100.0 (steep escarpment areas)	49.5 to 97.0	1000 to 3200	0.5 to 3.0	5.0 to 50.0	4.5 to 47.0	900 to 1600
Wasatch Plateau Tracts								
Gooseberry, and Castle Valley Ridge	0.2 to 22.0	20.0 to 50.0	19.8 to 28.0	130 to 100	Same as shown for exploration.			
Trail Mountain, Ferron Canyon, The Pines, & Quitchupah	20.0+	50.0 to 100.0	30.0 to 80.0	200 to 400	Same as shown for exploration.			

[a] Tons per acre per year in water erosion rates on steep slopes unless otherwise indicated. Lack of site specific project and soil survey information prevents projection of cumulative total soil losses from construction activities on critical soil erosion areas as compared to total cumulative soil losses from natural erosion on these same areas.

[b] Source: Table 3-4.

[c] Site specific analyses for coal tracts to be included in the Uinta-Southwest Utah Coal Region Environmental Impact Statement: Round Two Leasing.

[d] Soil loss for production activities on the Book Cliffs tracts would be the same as for exploration activities with the exception of utility line routes where soil loss with tract development would be 0.5 to 20.0 tons per acre per year.

The mining of coal would result in total depletion of the coal resource as 552.3 million tons of unrecoverable coal, though still in the ground, would no longer be available as a mineral resource given present mining technology.

Surface and subsurface mining activities and subsidence could hinder the subsequent exploration and location of facilities related to oil and gas development in the Book Cliff and Wasatch Plateau areas. The potential reduction in recoverable resources cannot be estimated (see Land Uses).

Topography, Geology, Paleontology

Construction of surface facilities would cause permanent changes in topography on 1,100 acres in central Utah.

The subsidence impacts described for central Utah under Alternative One would also result under Alternative Two, but topography would be altered as a result of subsidence on portions of 43,981 total acres. Tension cracks, buckling, and troughs could be expected in these areas.

Moore and Nawrocki (1980) predict a maximum subsidence of 12 feet in the Book Cliffs and 16 feet in the Wasatch Plateau. Because of shallow overburden, the effects of subsidence would be greatest on the Ivie tract. The extent of the surface effects of subsidence could be considerably less than the area above the extracted coal, but theoretically could range up to 168 to 170 percent of the mined area.

As discussed for Alternative One, significant plant fossils used for correlation and paleo-environmental guides could be destroyed by coal removal activities in the fossil-rich Blackhawk Formation of the Book Cliffs and Wasatch Plateau Coal Fields. Significant disturbances to other scientifically important fossils would be avoided if mitigating measures are followed (Appendix 3). Surveys and mining activities could also expose new fossils and enhance paleontological studies.

Water Resources

Anticipated impacts on water resources as discussed under Alternative One for the central Utah tracts would also occur under Alternative Two.

Surface Water

Annual sediment yields on the lands that would be disturbed by mining and associated development of the 15 central Utah tracts could increase to about 25 acre-feet by the year 2000 (Table 4-44). This is .07 percent of the estimated combined annual sediment yield in the Green and Dirty Devil River basins.

Table 4-45 shows by river drainage basins the estimated increase in annual sediment yields from areas that would be disturbed by maximum development of the central Utah tracts.

TABLE 4-44

CENTRAL UTAH
IMPACTS ON WATER RESOURCES AND REGIONAL SIGNIFICANCE

ALTERNATIVE TWO

Item	1987	1990	1995	2000
Water requirement (acre-ft/year)				
Mining and exploration	89.0	222.4	222.4	222.4
For public supply	725.2	1280.8	3639.5	4392.8
Total	814.2	1503.2	3861.9	4615.2
Consumptive water use				
Total (acre-ft/year)[a]	451.6	862.8	2042.2	2418.8
Percent of runoff[b]	0.01	0.02	0.04	0.05
Increased annual sediment yield				
Total (acre-ft)	4.5	16.7	23.2	25.4
Percent[c]	0.01	0.04	0.06	0.07
Increase in salinity				
(milligrams per liter)[d]	0.04	0.07	0.18	0.21

[a] Assumes 50 percent of withdrawal for public supply and 100 percent of withdrawal for exploration and mining.

[b] Percent of combined average annual runoff of the Green River at Green River, Utah, and the Dirty Devil River near Hanksville, Utah.

[c] Percent of estimated annual yield upstream from the stations cited in footnote b.

[d] As determined at Imperial Dam. Does not include reduction in salinity from reduced irrigation return flow.

TABLE 4-45

CENTRAL UTAH
SEDIMENT YIELD INCREASE

ALTERNATIVE TWO

River Drainage Basins	Estimated Increase in Sediment Yield (acre-feet per year)	Percent of estimated annual basin yield
Price River	11.1	0.96
Dirty Devil River	7.8	0.64
Sevier River	5.2	0.17
San Rafael River	1.3	0.13
Total	25.4	N/A

Development of the Gooseberry tract in the Upper Price River subbasin could increase annual sediment inflow to Scofield Reservoir by less than 0.06 acre-feet. This is less than 0.11 percent of the average annual inflow from 1943 through 1979. The effect on the life and utility of the reservoir would be small. The effect of increased sediment production due to development of the Ferron Canyon tract would have a slightly larger impact on the life and utility of Millsite Reservoir. Annual sediment yields for acres disturbed by development of the Ferron Canyon tract could increase by an estimated 1.2 acre feet, or about 1.0 percent of the estimated annual sediment inflow to Millsite Reservoir.

Development of the 15 central Utah tracts would have only a minor impact on surface-water quality in the general area of the tracts, access roads, loadouts, and affected communities. The regional impact on water quality would also be negligible.

Water discharged from mines would increase the salinity in the receiving stream up to 2 or 3 milligrams per liter. Except in the case of transbasin diversion of water by mines and possible contamination of the mine water, the salt load of the receiving streams would not be significantly increased. Any increase in salt loading from mine dewatering would be negligible compared to the salt loading from irrigated lands in the lower stream reaches, especially those in the Price, San Rafael, and Dirty Devil River basins.

Recent GS studies by the (K.M. Waddell, written communication, GS, 1983) indicate that Scofield Reservoir in the Upper Price River basin is borderline between meso-eutrophic and eutrophic. Accidental pollution and pollution control failures on the Gooseberry tract could add nutrients to streams flowing into Scofield Reservoir. This would contribute to eutrophication of the reservoir.

According to the GS study there is no indication that present and past mining in the Scofield Reservoir basin has increased dissolved trace element concentrations in the reservoir water. Considering the amount of mining that has been done in the basin to date, it seems unlikely that mining of the tracts would significantly increase trace element concentrations in the reservoir or in runoff.

By the year 2000, 4,615 acre-feet per year more water would be diverted for mining and associated population growth under the Alternative Two. The annual consumption rate would be 2,419 acre-feet (Table 4-44). Salt concentration resulting from withdrawal of the water and salt loading resulting from return of the unconsumed water (chiefly from fluid-waste disposal systems) would have a minor effect on the salinity of the Colorado and Sevier Rivers. For example, the salinity of the Colorado at Imperial Dam would be increased by an estimated 0.21 milligrams per liter which is negligible compared to the salt loading of irrigation and natural runoff from the salt-bearing Mancos Shale.

Rock fracturing associated with the subsidence tends to divert more snowmelt and rainfall underground increasing ground-water recharge at the expense of overland runoff. Fracturing, could divert ground water and either reduce or increase the flow of springs that provide base flow to headwater streams. Subsidence-caused fracturing could also divert streamflow directly underground if the fracture intersects a stream channel and remains open.

Springflow and streamflow diverted underground by subsidence-caused fracturing would not be lost from the hydrologic system and might not be lost from the drainage subbasin in which it originates. The water would move through newly formed fractures and would degrade in quality more rapidly than it would as overland runoff. The chance of a subsidence-caused fracture reaching the land surface and diverting the flow of even one spring (or headwater stream) is very small.

Ground Water

Mining and mine dewatering would create pressure gradients in the local ground water systems causing ground water to move toward the mine workings. This could induce the movement of saline water (such as that found in the Mancos Shale) into freshwater aquifers such as the Star Point Sandstone, thus locally reducing the quality of the freshwater aquifers (Lines et al., 1982).

Underground mine workings would disrupt local ground water flow systems in the Blackhawk Formation and adjacent formations causing a redistribution of ground water discharge. New discharge points would generally be in the same drainage subbasins as the former natural discharge points, however, several of the tracts straddle the divides between drainage subbasins and mine workings would divert water from one subbasin to another. Mining of the Book Cliffs tracts could divert some ground water from the Uintah Basin to the Price River basin.

The volume of ground water that would be diverted from one drainage subbasin to another is probably very small compared to the total water yield of the individual subbasins affected. The fine grained, poorly permeable beds of the

Book Cliffs probably transmit about 30 acre-feet of water per year from the tracts to the Uinta Basin. This is only about 0.02 percent of the estimated mean annual runoff from the southern Uinta Basin as estimated by Price and Miller (1975). Proportionately small amounts of water probably are transmitted through the rocks in the area of the other central Utah tracts assuming mine workings on those tracts do not intersect as yet unmapped faults similar to those intersected in the Wilberg and Deer Creek mines.

Water Supply and Use

Development of the 15 central Utah tracts would require up to 4,615 acre-feet of water per year for mining and public water supply needs (Table 4-44). An estimated 2,419 acre-feet of water per year would be consumed annually. This is about 0.05 percent of the combined average annual runoff in the Green River at Green River, Utah and the Dirty Devil River near Hanksville, Utah. The estimated volume consumed annually would be about 0.16 percent of Utah's share of Colorado River water. Impacts on the available supply in individual drainage subbasins could be larger. Table 4-46 shows the estimated annual mine-and-population-related water requirement from affected drainage subbasins as related to average annual discharge at maximum flow gaging stations.

Maximum annual water requirement from affected drainage subbasins would range from about 0.5 percent of the annual discharge in the Sevier River basin to about 2.6 percent of the discharge of the Price River.

Vegetation

Implementation of this alternative involving development of coal on 15 central Utah tracts would directly disturb a total of 1,200 acres of vegetation by the year 2000. This disturbance would result from exploration activities, construction of surface facilities, access roads, powerlines, and loadout facilities. The majority of this disturbance would occur in the Pinyon-Juniper Woodland and Conifer-Aspen forest (Table 4-47).

An additional 1,757 acres of vegetation would be lost or altered as a result of community expansion and mine water use. By the year 2000, 968 acres of land would be required for community housing of which 484 acres would be irrigated croplands. In addition, 789 acres of agricultural lands would be retired from irrigation to provide water for mining and community needs. Table 4-47 summarizes disturbance by year and vegetation type.

Since mining plans have not been submitted or housing areas identified, the figures used are only estimates based on projected areas of development and the percentage of vegetation types found in those areas. The actual acreage of vegetation types that would be disturbed, should this alternative be implemented, may vary from these projected figures.

While cumulative vegetation disturbance would total 2,957 acres, actual activities resulting in vegetation loss would occur at different periods of time following lease issuance. As a result, disturbed portions of the acreage identified in Table 4-47 would be in various stages of reclamation by the year

TABLE 4-46
CENTRAL UTAH WATER REQUIREMENTS COMPARED TO RIVER BASIN RUNOFF

ALTERNATIVE TWO

River Drainage Basin	Gaged site (Figure 3-4)	Combined average annual discharge at gaged site (acre-feet)	Approximate total Round Two Leasing water requirement: Acre-feet	Approximate total Round Two Leasing water requirement: Percent of average annual gaged discharge
Price River	18	103,600	2,752.3	2.6
San Rafael River	46, 47	96,940	689.4	0.7
Dirty Devil River	55	16,820	318.2	1.9
Sevier River	58	162,300	855.3	0.5
Total	N/A	N/A	4,615.2	N/A

TABLE 4-47

CUMULATIVE VEGETATION DISTURBANCE BY VEGETATION TYPE: CENTRAL UTAH

ALTERNATIVE TWO

Vegetation Type	Direct Mining Impacts[a] (Acres)				Indirect Impacts[b] (Acres)	Total[c]
	1987	1990	1995	2000	2000	2000
Agriculture	-	-	-	-	1269.2[d]	1269.2
Desert Shrub	1.0	85.0	85.0	85.0	105.3	190.3
Sagebrush-Grass	49.0	102.1	115.9	120.9	10.5	131.4
Pinyon-Juniper Woodland	14.8	377.7	396.5	408.6	283.6	692.2
Mountain Brush	3.9	50.9	51.9	51.9	20.4	72.3
Ponderosa Pine	15.0	123.1	123.1	125.1	-	125.1
Aspen	8.0	36.8	36.8	36.8	-	36.8
Conifer-Aspen	81.5	272.9	272.9	274.9	-	274.9
Non-Productive	4.0	11.0	12.0	12.0	67.9	79.9
Other (Douglas fir, Mountain Meadow, Grassland, etc.)	45.5	85.0	85.0	85.0	-	85.0
TOTAL	222.7	1144.5	1179.1	1200.2	1756.9	2957.1

a Includes surface facilities, portal access, mining operations, exploration activities, powerlines, ventilation construction, and loadouts.

b Total lands lost to community development including agricultural lands retired from irrigation to provide water for community needs. This acreage was computed for the year 2000 only and does not include 75 acres of irrigated cropland that would be retired for exploration water requirements from 1987 through 1990.

c Total vegetation disturbance by the year 2000.

d Includes 484.1 acres lost to community development, 788.5 acres retired from irrigation to provide water for mining and community needs.

2000. The following summarizes major vegetation disturbing activities and if or when vegetation reclamation would likely occur.

Exploration activities involving construction of drill pads and access roads would disturb a total of 223 acres by the year 1990. By the year 2000 this acreage, while included in the cumulative total of acres disturbed, would be in advanced stages of reclamation.

Implementation of this alternative would result in the loss of 978 acres of vegetation for which no reclamation would begin until completion of mining activities. This would include areas used for surface facilities, portal access, powerlines, ventialtion installation, and loadout facilities. Certain access roads may continue to be used for other purposes following completion of mining and would not be reclaimed. Agricultural and nonagricultural lands surrounding local communities that would be lost to community expansion or retired from irrigation to provide water for community expansion would not be reclaimed.

Even though less than 50 acres of Douglas fir communities in the Book Cliffs would be removed, it would represent a permanent commitment of the resource as the stands are not reproducing themselves. The areas disturbed would eventually revert to a Mountain Brush community.

Implementation of this alternative would not direcltly impact any listed or candidate threatened or endangered plant species; however, inadvertent destruction of threatened or endangered species found in the region could occur through housing development, off-road vehicle activities, or unlawful collecting of these species.

For areas that would be reclaimed, the duration of the impact of total vegetation loss would depend upon the success of reclamation. As discussed in Alternative One, because of the well developed soils and annual average precipitation of 25 inches, reclamation attempts on the Wasatch Plateau and Book Cliffs tracts are expected to be 50 to 80 percent successful (Hagihara et al., 1972). On steep slopes and poorly developed soils in this area, 30 percent of revegetation attempts are expected to be successful.

Reestablishment of native species would be expected to occur through natural succession over the long term. On areas of Aspen-Conifer, Ponderosa Pine, or Pinyon-Juniper Woodland, restoration to the original type would take longer. Fifteen to 20 years or more would be required for a return to original conditions.

Wildlife

Terrestrial

The surface disturbance from production activities of 878 acres by the year 2000 could decrease the deer populations in herd units 33, 34, 35, 36, 38, 43, and 45 by 117 deer. Elk loss from habitat destruction including migration routes and calving grounds would be 28 animals per year or 0.3 percent of the potential Manti elk herd. The majority of the elk loss would be in critical winter range. No comparable losses of elk from the proposed mining activity would occur in the Avintaquin-White Rocks-Anthro-Argyle herd unit (Table 4-48).

Encroachment by mining activity on mountain lion and black bear home ranges, illegal killing, and loss of prey species such as deer and elk would reduce lion and bear populations by an unknown amount until reclamation was completed. The increased development and widespread human disturbance on this range would cause abandonment of some home areas and a reduction in size or use of others.

Acreage utilized in community development would be irreversibly lost as wildlife habitat. Half of the acreage would come from irrigated cropland adjacent to expanding communities. Many species inhabit these lands, notably pheasants, cottontail rabbits, doves, small birds, and mammals. With 1,273 acres of irrigated agricultural land committed to urban use or retired by 2000 (subdivisions and water right purchases), the regional pheasant population could be reduced by 329 birds potentially reducing the cock harvest by 241. Regionally this would be insignificant, but in Carbon County where about one-half of the community development would occur, the potential cock harvest loss would be up to 5.7 percent of the average annual harvest.

Surface expression of subsidence such as cracks, bulges, and displacements are not expected to directly affect wildlife, but any reduction or elimination of surface water flows and associated vegetation communities could adversely affect some species. Loss of water sources would result in reduced utilization of habitat by mobile species such as deer, elk, beaver, and birds, and elimination of species such as small mammals, reptiles, and amphibians that are unable to relocate. Because of lack of data on wildlife populations and the unpredictability of subsidence and its effects, the number of animals that could be affected cannot be quantified. At the projected production level up to 43,977 acres would be susceptible to subsidence.

Construction of a minimum of 39 miles of new utility lines (estimated length of new utility and new portal access) in the area would provide additional perching and hunting sites for raptors. This would be a beneficial impact; however, use of these structures along roadsides or in areas open to human access would expose the birds to illegal shooting and disturbance (BLM, 1981a). The extent of losses from this activity cannot be tabulated but approximately 12 miles of the new utility lines would be adjacent to portal access roads.

With this proposed level of production, 59 miles of new and improved portal access roads would be needed for access and truck hauling of coal. Most of these roads would be in deer and elk summer and winter ranges and vehicle traffic on them would present an additional hazard to wildlife (BLM, 1981). In the 1980-81 field year 292 deer were recorded as traffic mortalities in deer herd units 33, 34, 35, 36, 3, 43, and 45. By 2000 the 19-percent increase in traffic from coal hauling and commuting could increase the deer traffic mortality on existing roads to 347 animals per year. An additional

TABLE 4-48

CENTRAL UTAH
BIG GAME HABITAT DISTURBANCE
ALTERNATIVE TWO

Tract	Acres Disturbed	Plant Community	Wildlife[a] Use	Species	Losses/[b] Year
Alkali Creek	39.1	P-J/P. Pine[c]	HP Winter	Deer	5
Coal Creek	83.5	P-J/Sagebrush	HP Winter	Deer	6
Graves	0	P-J	HP Winter	Deer	2
Hoffman Creek	0	-	-	-	-
Soldier Creek	11.8	Sagebrush	S Summer	Deer	1
Whitmore Park	0	-	-	-	-
Acord	0	Sagebrush	HP Summer	Deer	0
			C Winter	Elk	0
Castle Valley		Conifer/	HP Summer	Deer	26
Ridge	155.0	Grass	HP Summer	Elk	7
Ferron Canyon	129.9	P-J/	HP Winter	Deer	10
		Sagebrush	HP Winter	Elk	7
Gooseberry	34.1	Aspen/Grass	HP Summer	Deer	13
			HP Summer	Elk	2
Ivie	2.0	Mt. Shrub	S Winter	Deer	0
			C Winter	Elk	0
Quitchupah	155.1	P-J/P.Pine	C Winter	Deer	11
			C Winter	Elk	7
Skumpah	76.0	Mt. Shrub	HP Summer	Deer	18
			C Winter	Elk	4
The Pines	114.1	P-J/Sagebrush	C Winter	Deer	21
			C Winter	Elk	5
Trail Mountain	76.9	P-J/Sagebrush	HP Winter	Deer	4
Totals	877.5			Deer	117
				Elk	28

[a] See Appendix I. HP, High priority; S, Substantial; C, Critical

[b] Includes 0.1 mile influence zone. Based on optimum herd management objective levels (UDWR, 1981a).

[c] Pinyon-Juniper/Pinyon pine

176 deer could become traffic mortalities on new roads (Table 4-49). However, this could decrease after the initial years of use because of habituation and dispersal of deer by human activity. Total traffic mortality (523) when combined with habitat losses would result in the loss of 1 percent of the region's deer population. Elk mortality due to increased traffic has not been estimated but is expected to be low.

Heavily traveled portal access roads could be a limiting factor to small, isolated animal populations and become a barrier to small animal movement especially among forest dwelling species (BLM, 1981a).

The escarpments of the Wasatch Plateau and the Book Cliffs are favored nesting sites for raptors especially golden eagles. Nesting concentrations are located in the south Wasatch Plateau and around Alkali Creek in the Book Cliffs. Impacts to raptor territories would be as analyzed for Alternative One, central Utah.

The human population increase in 1987 is expected to be 3 percent above the projected baseline, peaking at 17 percent above by 2000. Similar increase in hunters, fishermen, and ORV use (Recreation Section) would result. The presence of a larger human population and pressures on the wildlife populations through harvest, harassment, and displacement from habitat would be as analyzed in Alternative One, central Utah.

By 2000 an additional 4,175 2-wheel drive and 4-wheel drive trucks could be located in the four-county region. An increase in unregulated use of unimproved roads on the Wasatch Plateau and Book Cliffs would result and would adversely affect the elk habitat in the Manti herd unit (Lyon, 1979). This effect would also apply to other wildlife species inhabiting these areas.

Assuming a rate equal to the reported increases in population and issued citations discussed for Alternative One, the 17 percent human population increase projected by the year 2000 could result in a 62-percent increase in illegal taking of wildlife. Illegal killing of wildlife could significantly reduce big game populations.

Fisheries

Pollution of fisheries from coal wastes and coal mine drainage would not be anticipated with reasonable enforcement of applicable State and Federal laws. The impacts resulting from accidental mine related pollution, including fugitive dust from coal hauling trucks would be as analyzed for Fisheries in Alternative One. Such impacts would affect fisheries in Straight Canyon, Ferron and Salina Creeks.

Ferron Creek, Muddy Creek, Quitchupah Creek, and some tributaries of Huntington Creek could suffer dewatering in short sections if subsidence occurred and altered the channels. Mitigation measures could repair the channel and restore the flow avoiding permanent damage and total loss of fisheries.

TABLE 4-49

CENTRAL UTAH

POTENTIAL DEER TRAFFIC MORTALITY FROM NEW ROADS

ALTERNATIVE TWO

Tract	New Roads (miles)	Deer Range[a]	Deer Loss/ Year[b]	Mine Life[c]
Alkali Creek	1.6	HP Winter	2	25
Coal Creek	4.8	HP Winter	6	40
Soldier Creek	0	S Summer	0	40
Acord	0	HP Summer	0	18
Castle Valley Ridge	14.1	HP Summer	69	40
Ferron Canyon	11.7	HP Winter	28	20
Gooseberry	1.5	HP Summer	10	40
Ivie	0	S Winter	0	40
Quitchupah	8.5	C Winter	13	40
Skumpah	4.05	HP Summer	16	40
The Pines	7.9	C Winter	19	40
Blue Trail Canyon	2.1	Yearlong	0	20
Trail Mtn.	4.6	HP Winter	13	40
Totals	58.75		176	

[a] See Appendix I. HP, High priority; S, Substantial; C, Critical

[b] 1,280 acres (1 mile each side of road) X road length/deer density X 0.076 = deer loss/year. Divided again by 2 because occupancy of summer or winter range for 6 months.

[c] Deer losses at this rate only apply to initial years of road use.

Fishing pressure on popular waters such as Electric Lake, Huntington Creek, Joe's Valley Reservoir, Scofield Reservoir, Johnson Valley Reservoir, and Fish Lake could require additional hatchery production or limited harvests.

Threatened or Endangered Species

No significant impacts to threatened or endangered species or known habitats would be expected.

Land Use

Agriculture and Range

During the construction and production phases of coal resource development there would be changes from grazing to mining and support uses, from agricultural land to community use, and from irrigated cropland to retired cropland. Table 4-50 displays projected total acres of temporary and permanent land change by activity. Table 4-51 displays acreage permanently converted to community development, agricultural acreage permanently converted to community development, and irrigated cropland retired to provide community water. Impacts to non-agricultural and irrigated croplands located off of coal tract areas as well as the effects to existing uses on coal tract areas are discussed below.

Permanent land changes associated with community expansion would affect cropland agriculture and community development in Carbon, Emery, Sanpete, and Sevier Counties. By the year 2000, these counties would experience a permanent change of approximately 968 acres from grazing and agricultural uses to housing and community infrastructures. Of the 968 acres, 484 acres (50 percent) would be irrigated cropland (consisting mainly of alfalfa and small grains). The remaining 484 acres would be non-irrigated lands adjacent to existing communities. An additional 727 acres of irrigated croplands would be retired to provide community water requirements (Table 4-51). Permanent land changes would occur on 1,695 acres (Table 4-50) due to conversion of land for community expansion and the retirement of irrigated cropland to provide community water needs.

Water requirements for exploration and mining activities would also impact irrigated cropland. Water for approximately 75 acres of irrigated cropland would be diverted to exploration activities over a 3-year period. For mining activities, irrigation water sufficient for approximately 62 acres of cropland would be diverted annually during the life of the mines.

In summary, total agricultural lands affected by the year 2000 due to the conversion of irrigated croplands for community development, retirement of irrigated croplands for community water supply, and the diversion of water for exploration and mining activities would be 1,348 acres. Water for approximately 75 acres of cropland (retired by exploration activities) would be available for cropland use upon completion of exploration (1989). All of the affected irrigated cropland would be off the proposed coal tracts. These acres represent less than 1 percent of the total four-county cropland acreage,

Table 4-50

CENTRAL UTAH
ACRES OF LAND USE CHANGES DUE TO COAL TRACT DEVELOPMENTS
BY YEAR 2000
ALTERNATIVE TWO

	Projected Maximum[a] Total Acres Changed From One Land Use to Another	Temporary Land Changes Acres of Land Change Due to Mining Operations, Including On-Tract and Off Site Support Facilities	Permanent Land Changes--Acres Changed for Community Development and Acres Irrigated Cropland Retired to Provide Community Water Needs
		778 acres for access routes,[b] 322 acres for on-tract facilities 100 acres for off-site loadout facilities 62 acres of irrigated land retired for mine water	1,695
Totals	2,957	1,262	1,695

Source: Utah State Office - Bureau of Land Management (BLM, 1982a).

a Projected Maximum Total Acres Changed From One Land Use to Another are totals of Temporary Land Changes plus Permanent Land Changes.

b Exploration drill pads counted as part of access acres.

TABLE 4-51

CENTRAL UTAH
LANDS AFFECTED BY COMMUNITY DEVELOPMENT AND WATER REQUIREMENTS
ALTERNATIVE TWO

County	Total Acres Community Development [a]	Irrigated Acres for Community Development [b]	Additional Irrigated Acreage Retired [c]	Total Irrigated Lands Affected [d]	Total Acres Community Development [a]	Irrigated Acres for Community Development [b]	Additional Irrigated Acreage Retired [c]	Total Irrigated Lands Affected [d]
		1987				1990		
Carbon	62.5	31.4	46.9	78.3	121.7	60.9	91.3	152.2
Emery	44.4	22.1	33.0	55.1	100.0	50.0	75.1	125.1
Sanpete	20.5	10.3	15.5	25.8	19.8	9.9	14.9	24.8
Sevier	32.9	16.5	24.7	41.2	40.7	20.4	30.5	50.9
Total	160.3	80.3	120.1	200.4	282.2	141.2	211.8	353.0
		1995				2000		
Carbon	349.9	175.0	262.5	437.5	444.6	222.3	333.5	555.8
Emery	274.9	137.5	206.3	343.8	335.3	167.7	251.5	419.2
Sanpete	57.8	28.9	43.5	72.4	60.7	30.4	45.5	75.9
Sevier	119.8	60.0	89.9	149.9	127.8	63.9	96.0	159.9
Total	802.4	401.4	602.2	1,003.6	968.4	484.3	726.5	1,210.8

Source: Utah State Office, Bureau of Land Management (BLM, 1982a).

a,b,c Figures based on Analysis Assumptions and Guidelines listed in Chapter Four.

d Total Irrigated Lands converted and/or retired = b+c.

but they include lands that are among the most favorable for agricultural use (Utah Department of Agriculture, 1982). Some prime farmland could be among that which is converted and retired, unless planning avoided such areas. About 972 of the 1,348 acres of affected irrigated cropland would be in Carbon and Emery Counties. This would be 1.5 percent of the cropland in the two-county area (Utah Department of Agriculture, 1982). The remaining 376 acre irrigated cropland loss would occur in Sanpete and Sevier Counties, with no significant impacts to the two-county agricultural land base (0.2 percent).

Land changes from irrigated cropland to community use and from irrigated cropland to retired cropland would eliminate cattle, sheep, and horse grazing on such land. Due to variability of grazing numbers and season of use on the existing cropland acres, actual AUM losses could not be predicted. Due to the high grazing capacity on such areas, overall losses could be high, i.e., one AUM lost for every 5 acres converted. Such losses would significantly affect small operators.

There would be temporary land changes on 1,262 acres (Table 4-50). The following discussion presents the effects of these land changes on existing uses. Some of the effects would be long-term, extending beyond mine life.

Losses of livestock grazing numbers (AUMs) on BLM and FS allotments would be insignificant with a loss of less than 2 percent of the total AUM capacity of any Federal allotment and less than a 2 percent annual reduction on directly affected private surface.

As discussed for Alternative One, grazing reductions on BLM and FS allotments and private surface could require corresponding reductions of animal numbers on private off-tract areas during late fall, winter, and early spring months (seasons of nonuse on the tract areas).

There would be increased difficulty in moving livestock to and from grazing areas served by Deadman, Coal, Soldier, Dugout, Pace, Rock, and Cottonwood Creek Canyons and in Ferron and Link Canyons. Congestion caused by new developments and increased traffic in these canyons would result in greater hazards of vehicle collisions with migrating livestock.

As described for Alternative One, subsidence and dewatering of aquifers due to mining operations could temporarily reduce or eliminate livestock water sources, however, the lessee would be required to replace any water lost as the result of mining activities.

Energy and Minerals Development

Conflicts could result between the development of the coal tracts and the development and operation of existing leases if there were different lessees involved. These conflicts would mainly involve transportation and utility access.

Oil and gas development could be hampered by underground coal mining. In the Book Cliffs, quantification of the effects are unknown since the area of the tracts has not been sufficiently drilled to determine oil and gas potential. Coal development would be favored over oil and gas development (BLM, 1981a).

In the Wasatch Plateau area, exploration and development of coal resources on the Castle Valley Ridge and Trail Mountain tracts could conflict with the existing oil and gas exploratory well drilling and the development of potential and known oil and gas fields located within the boundaries of the above coal tracts. Quantification of the effects are unknown since information on oil and gas reserves and production potentials for the fields has not been published by the companies involved.

Rights-of-Way, Special Uses, Other Land Uses

As discussed under Alternative One adherence to EPA and State water discharge criteria and standards would protect the established beneficial uses of affected streams, including those streams classified as sources for domestic water systems. However, water contamination accidents or periodic system failures at mine locations (such as cited for Huntington Canyon - see Chapter 3, Land Uses) could require that the coal lessees or communities in Carbon and Emery Counties plan and fund new water treatment facilities and measures.

Subsidence within the tracts could degrade the quality and reduce the quantity of water from seven municipal watersheds in Carbon and Emery Counties. Communities deriving domestic water from affected springfed streams would have to upgrade existing treatment facilities and/or develop new water sources.

Exploration and production activities on the Trail Mountain and Ferron Canyon tracts could disturb the mechanical watershed treatment areas located on portions of these tracts and nullify past erosion control investments. However, the lessee would be required to repair the damage.

The Eccles Canyon road could be damaged by subsidence on the Gooseberry tract.

Land Use Plans, Controls, and Constraints

Federal Plans

All tracts identified in central Utah have been addressed in Federal Land Use plans (see Chapter One). National Forest System lands are being reevaluated in new Land Use Plans. The Secretary of the Interior would consult with the Secretary of Agriculture for consent to offer tracts located on National Forest Service System lands (43 CFR 3420.4-2). The Secretary of Agriculture's decision would be based on land and resource management plans directed by the National Forest Management Act of 1976. The Manti-LaSal and Fishlake National Forests are scheduled to complete the plans by October 1983. For all other tracts it has been determined that leasing would not conflict with any Federal Land Use plans if mitigating measures are applied as directed by the surface managing agency.

County Plans

All tract developments in central Utah would be in county zones where coal development would be permitted, with the exception of portions of the Castle Valley Ridge tract. Zoning variances or rezoning for the tract would have to be approved by Carbon County before mining could proceed.

All coal mine developments would be required to implement county mitigation requirements for protection of other land resources as well as for social and economic concerns (see Chapter 3 for description of county plan concerns). If such measures are applied and met, potential conflicts could be resolved to the satisfaction of the counties.

Socioeconomics

The assumptions pertaining to economic activity described in Alternative One also apply to Alternataive Two.

Population, Income, and Employment

Table 4-52 summarizes population and employment projections by county. Population increases would occur unevenly among the four counties with Carbon and Emery Counties receiving the largest part of the increase. By the year 2000 the distribution pattern would remain similar to that of 1987 with the exception of Carbon County which would receive the greatest proportion of the projected growth. By the year 2000 the population would increase by 16,700 persons or 24 percent over the 1982 population level and 17 percent over the projected baseline.

Assumptions described under Alternative One that were applied in generating personal income projections were also used in projecting the personal income of Alternative Two. The employment growth was used to project total wage payments and projected average per capita incomes. The county level projections of total personal incomes and per capita incomes are provided in Table 4-53. As stated previously this may tend to understate total income; however, these figures do clearly indicate that per capita income could be expected to increase with an increase in coal mining activities. By the year 2000 per capita personal incomes for 3 of 4 counties are projected to from 0.3 percent to 11 percent greater than the baseline projections (in 1980 dollars). The Carbon County projection is slighly lower than the baseline projection; the difference is not significant but does indicate that the economy is less dependent on relatively higher mining wages in determining per capita incomes than for projections of other years.

Infrastructure

Housing

The largest percentage increase in demand for housing would occur in Carbon County where the demand for additional single family units would reach 1,260 units by the year 2000. Table 4-54 provides a summary of the projected additional demand for housing by type for each county. Emery County would

TABLE 4-52

CENTRAL UTAH
POPULATION AND EMPLOYMENT PROJECTIONS BY COUNTY
ALTERNATIVE TWO
1987, 1990, 1995, 2000

County	Population	Total Employment
Carbon		
1987	1,100	750
1990	2,100	910
1995	6,100	2,500
2000	7,600	2,800
Emery		
1987	800	180
1990	1,800	370
1995	4,900	1,000
2000	5,700	1,100
Sanpete		
1987	370	340
1990	360	230
1995	1,000	610
2000	1,100	620
Sevier		
1987	590	620
1990	730	870
1995	2,200	2,200
2000	2,300	2,300
Total (year 2000)	16,700	6,820

TABLE 4-53

CENTRAL UTAH
TOTAL PERSONAL INCOME PROJECTIONS BY COUNTY
ALTERNATIVE TWO
1987, 1980, 1995, 2000

Year	1987	1990	1995	2000
		Carbon County		
Total Personal Income ($1,000)	358,283	399,817	460,352	515,258
Total Population (Baseline + Impact)	33,993	37,349	43,339	45,239
Per Capita Personal Income	$10,540	$10,705	$10,622	$11,390
		Emery County		
Total Personal Income ($1,000)	143,015	166,564	223,614	237,903
Total Population (Baseline + Impact)	14,889	16,587	19,941	20,355
Per Capita Personal Income	$ 9,605	$10,041	$11,214	$11,688
		Sanpete County		
Total Personal Income ($1,000)	129,259	143,517	176,012	194,535
Total Population (Baseline + Impact)	19,433	20,759	22,874	23,509
Per Capita Personal Income	$ 6,652	$ 6,914	$ 7,695	$ 8,279
		Sevier County		
Total Personal Income ($1,000)	170,112	214,370	284,180	321,599
Total Population (Baseline + Impact)	20,339	22,347	26,148	27,715
Per Capita Personal Income	$ 8,364	$ 9,593	$10,868	$11,604

Note: Figures are in 1980 dollars.

TABLE 4-54

CENTRAL UTAH
HOUSING DEMAND BY TYPE
ALTERNATIVE TWO
1987, 1990, 1995, 2000

County	Single Family Total	Single Family Increase	Multi-Family Total	Multi-Family Increase	Mobile Total	Mobile Increase
Carbon						
1987	6,522	222	1,631	56	2,625	92
1990	7,062	402	1,751	101	2,750	167
1995	7,920	1,020	1,980	255	2,875	425
2000	8,340	1,260	2,085	315	2,950	525
Emery						
1987	2,496	156	624	39	975	65
1990	2,730	330	683	83	1,000	137
1995	3,300	840	825	210	1,025	350
2000	3,300	900	825	225	1,000	375
Sanpete						
1987	3,372	72	843	18	1,375	30
1990	3,546	66	887	17	1,450	27
1995	3,834	174	959	44	1,525	72
2000	3,900	180	975	45	1,550	75
Sevier						
1987	3,594	114	899	29	1,450	47
1990	3,792	132	948	33	1,525	55
1995	4,386	366	1,097	92	1,675	152
2000	4,578	378	1,145	95	1,750	157
Total (year 2000)	20,118	2,718	5,030	680	6,950	1,132
Total additional units (year 2000)	4,530					

require 900 additional single family units, 225 additional multi-family units and 375 additional mobile home units under this alternative in the year 2000. Sanpete County would require 180 new single family dwelling units by the year 2000, and Sevier County would need an additional 378 single family units.

If required housing units are not available as needed, housing prices could increase to the point of causing personal hardship and the use of substandard housing would also increase.

Education

Educational growth by county is listed in Table 4-55. Emery School District would experience a 36 percent growth over baseline by the year 2000. This require an additional 64 teachers and additional classrooms to instruct the 1,600 additional students. By the year 2000 an additional 88 teachers would be needed to instruct the 2,207 additional school-age children in Carbon County representing a 23 percent increase in the school-age population over the baseline forecast.

By the 1990s, projected growth would stress the two school districts to meet required accommodations and maintain quality education. Careful planning would be required to ensure an adequate capital availability for operating costs and new facilities.

Sanpete County would receive a 5 percent growth over the projected baseline by the year 2000. This would mean 329 additional students over baseline forecasts of 6,501, requiring 13 additional teachers and additional classrooms. Sevier County would experience an 8 to 9 percent growth by the year 2000 culminating in a demand for 27 additional teachers to teach 693 additional students. With assistance from potential developers and lessees, the Sevier and Sanpete School Districts should be able to accommodate the anticipated growth.

Water and Sewer

The projected demand for water connections and capacity for wastewater treatment facilities are provided in Tables 4-56 and 4-57, respectively. Price would see an increase in demand for water connections that would reach 6,847 water connections by the year 2000. Sewage needs would grow to over 3.5 million gallons per day (mgd) of wastewater. Castle Dale in Emery County would need 1,095 water connections to handle growth forecasts by the year 2000. This would be coupled with a demand for a sewage treatment capacity that would reach 401,600 gallons per day by that time. In Sanpete County growth in demand for water connections would occur mostly in Ephraim, Fairview and Gunnison. The amount of sewage generated would also grow where communities such as Ephraim would need waste treatment capacity of 0.36 mgd in 1987 and 0.46 mgd by the year 2000. Likewise Gunnison would need sewage treatment facilities with capacity for 0.18 mgd of wastewater in 1987 and 0.22 mgd in the year 2000.

TABLE 4-55

IMPACTS ON EDUCATION, HEALTH, AND LAW ENFORCEMENT BY COUNTY
ALTERNATIVE TWO
1987, 1990, 1995, 2000

County	1987				1990			
	Projected Baseline Need	Total Need w/ Impact	Impact	Percent Change a	Projected Baseline Need	Total Need w/ Impact	Impact	Percent Change a
CARBON								
Education								
Students	7,890	8,096	206	3	8,863	9,265	402	5
Teachers	316	324	8	3	355	371	16	5
Health Facilities								
Hospital Beds	66	68	2	3	70	75	5	7
Doctors	18	19	1	6	19	21	2	11
Dentists	16	17	1	6	18	19	1	6
Nurses	66	68	2	3	70	75	5	7
Clinical Psych[b]	2	2	0	0	2	2	0	0
MSWs[c]	7	7	0	0	7	7	0	0
EMTs[d]	46	48	2	4	49	52	3	6
Ambulances	7	7	0	0	7	7	0	0
Nursing Homes	120	122	2	2	125	130	5	4
Law Enforcement								
Police	66	68	2	3	70	75	5	36
Police Cars	66	68	2	3	70	75	5	36
EMERY								
Education								
Students	3,987	4,127	140	4	4,390	4,720	330	8
Teachers	159	165	6	9	176	189	13	8
Health Facilities								
Hospital Beds	28	30	2	7	30	36	6	20
Doctors	8	8	0	0	8	10	2	25
Dentists	7	7	0	0	7	9	2	29
Nurses	28	30	2	2	30	36	6	20
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	3	3	0	0	3	4	1	33
EMTs[d]	20	21	1	5	21	25	4	19
Ambulances	3	3	0	0	3	4	1	33
Nursing Homes	35	37	2	6	36	43	7	19
Law Enforcement								
Police	28	30	2	7	30	36	6	20
Police	28	30	2	7	30	36	6	20

continued

TABLE 4-55 (cont'd.)

County	1995 Projected Baseline Need	1995 Total Need w/ Impact	1995 Impact	1995 Percent Change a	2000 Projected Baseline Need	2000 Total Need w/ Impact	2000 Impact	2000 Percent Change a
CARBON								
Education								
Students	9,889	11,425	1,536	16	9,692	11,899	2,207	23
Teachers	396	457	61	15	388	476	88	23
Health Facilities								
Hospital Beds	74	87	13	18	75	91	16	21
Doctors	20	24	4	20	21	25	4	19
Dentists	19	22	3	16	19	23	4	21
Nurses	75	87	12	14	75	90	15	20
Clinical Psych[b]	2	2	0	0	2	2	0	0
MSWs[c]	7	9	2	29	8	9	1	13
EMTs[d]	52	61	9	17	53	63	10	19
Ambulances	7	9	2	29	8	9	1	13
Nursing Homes	129	139	10	8	129	140	11	9
Law Enforcement								
Police	74	87	13	18	75	90	15	20
Police Cars	74	87	13	18	75	90	15	20
EMERY								
Education								
Students	4,716	5,916	1,200	25	4,459	6,059	1,600	36
Teachers	189	237	48	25	178	242	64	36
Health Facilities								
Hospital Beds	30	40	10	33	30	41	11	37
Doctors	8	11	3	38	8	11	3	38
Dentists	8	10	2	25	7	10	3	43
Nurses	30	40	10	33	30	41	11	37
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	3	4	1	33	3	4	1	33
EMTs[d]	21	28	7	33	21	28	7	33
Ambulances	3	4	1	33	3	4	1	33
Nursing Homes	36	44	8	22	35	43	8	22
Law Enforcement								
Police	30	40	10	33	29	41	12	25
Police Cars	30	40	10	33	29	41	12	25

continued

TABLE 4-55 (cont'd.)

County	1987 Projected Baseline Need	1987 Total Need w/ Impact	1987 Impact	1987 Percent Change a	1990 Projected Baseline Need	1990 Total Need w/ Impact	1990 Impact	1990 Percent Change a
SANPETE								
Education								
Students	4,930	5,002	72	1	5,508	5,572	64	2
Teachers	197	200	3	2	220	223	3	2
Health Facilities								
Hospital Beds	38	39	1	3	40	41	1	2
Doctors	10	11	1	10	11	11	0	0
Dentists	10	10	0	0	10	10	0	0
Nurses	38	39	1	3	41	42	1	2
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	4	4	0	0	4	4	0	0
EMTs[d]	27	27	0	0	29	29	0	0
Ambulances	4	4	0	0	4	4	0	0
Nursing Homes	83	84	1	1	82	83	1	1
Law Enforcement								
Police	38	39	1	3	41	42	1	2
Police Cars	38	39	1	3	41	42	1	2
SEVIER								
Education								
Students	5,282	5,397	115	2	6,032	6,163	131	2
Teachers	211	216	5	2	241	247	6	2
Health Facilities								
Hospital Beds	39	41	2	5	43	45	2	5
Doctors	11	11	0	0	12	12	0	0
Dentists	10	10	0	0	11	11	0	0
Nurses	39	41	2	5	43	45	2	5
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	4	4	0	0	4	4	0	0
EMTs[d]	28	28	0	0	30	31	1	3
Ambulances	4	4	0	0	4	4	0	0
Nursing Homes	78	79	1	1	78	80	2	3
Law Enforcement								
Police	40	41	1	3	43	45	2	5
Police Cars	40	41	1	3	43	45	2	5

continued

TABLE 4-55 (concluded)

County	1995 Projected Baseline Need	1995 Total Need w/ Impact	1995 Impact	1995 Percent Change a	2000 Projected Baseline Need	2000 Total Need w/ Impact	2000 Impact	2000 Percent Change a
SANPETE								
Education								
Students	6,315	6,588	273	4	6,501	6,830	329	5
Teachers	253	264	11	4	260	273	13	5
Health Facilities								
Hospital Beds	44	46	2	5	45	47	2	4
Doctors	12	13	1	8	12	13	1	8
Dentists	11	12	1	9	11	12	1	9
Nurses	44	46	2	5	45	47	2	4
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	4	5	1	25	4	5	1	25
EMTs[d]	31	32	1	3	31	33	2	6
Ambulances	4	4	0	0	4	5	1	23
Nursing Homes	78	80	2	3	70	71	1	1
Law Enforcement								
Police	44	46	2	5	45	47	2	4
Police Cars	44	46	2	5	45	47	2	4
SEVIER								
Education								
Students	7,203	7,771	568	8	7,619	8,312	693	8
Teachers	288	311	23	8	305	332	27	9
Health Facilities								
Hospital Beds	48	52	4	8	51	55	4	8
Doctors	13	14	1	8	14	15	1	7
Dentists	12	13	1	8	13	14	1	8
Nurses	48	53	5	10	51	55	4	8
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	5	5	0	0	5	6	1	20
EMTs[d]	34	37	3	9	36	39	3	8
Ambulances	5	5	0	0	5	6	1	20
Nursing Homes	77	81	4	5	71	75	4	6
Law Enforcement								
Police	48	52	4	8	51	55	4	8
Police Cars	48	52	4	8	51	55	4	8

[a] Percent Change: Change from Projected Baseline Need to Total Need with Impact.
[b] Clinical Psych: Clinical Psychologist.
[c] MSW: A person with a Master's Degree in Social Work.
[d] EMT: Emergency Medical Technician.

TABLE 4-56

CENTRAL UTAH
PROJECTED DEMAND FOR WATER CONNECTIONS BY COMMUNITY
ALTERNATIVE TWO
1987, 1990, 1995, 2000

County	1987 Total	1987 Impact	1990 Total	1990 Impact	1995 Total	1995 Impact	2000 Total	2000 Impact
Carbon								
East Carbon	558	7	549	13	560	31	547	33
Helper	234	44	1,277	53	1,577	332	1,408	147
Hiawatha	82	0	81	0	78	0	79	0
Price	4,950	183	5,493	368	6,419	952	6,847	1,159
Scofield	43	0	44	0	46	0	47	0
Sunnyside	175	2	173	4	176	10	173	11
Wellington	815	51	918	102	1,124	264	1,204	321
Emery								
Castle Dale	792	48	894	108	1,073	269	1.095	306
Cleveland	171	8	185	18	216	48	217	52
Elmo	106	6	114	12	134	31	136	35
Emery	146	21	173	43	239	107	149	18
Ferron	679	100	801	200	1,102	493	1,148	544
Huntington	844	34	890	77	996	192	1,007	218
Orangeville	562	34	619	77	738	192	754	218
Sanpete								
Centerfield	266	11	279	11	306	29	311	29
Ephraim	1,068	12	1,125	10	1,213	28	1,272	26
Fairview	417	27	486	24	534	64	538	67
Fountain Green	212	2	212	2	215	6	215	6
Gunnison	522	19	551	19	601	49	609	50
Manti	790	8	832	7	895	18	940	17
Moroni	371	5	390	5	404	13	407	14
Mt. Pleasant	911	24	980	22	1,037	58	1,041	60
Spring City	249	5	261	4	273	12	274	12
Wales	50	1	51	0	53	1	53	1
Sevier								
Aurora	352	22	373	24	429	62	443	63
Redmond	248	14	262	15	300	40	310	41
Richfield	2,499	97	2,702	123	3,140	339	3,210	353
Salina	812	60	859	63	1,003	166	1,038	171

TABLE 4-57

CENTRAL UTAH

PROJECTED CAPACITY FOR WASTEWATER TREATMENT FACILITIES
BY COMMUNITY (GALLONS PER DAY)

ALTERNATIVE TWO

1987, 1990, 1995, 2000

County	1987 Total	1987 Impact	1990 Total	1990 Impact	1995 Total	1995 Impact	2000 Total	2000 Impact
Carbon								
East Carbon	175,700	3,300	174,400	4,100	181,800	11,000	177,200	12,700
Helper	386,000	13,600	406,500	17,400	448,900	46,800	457,200	53,800
Hiawatha	25,700	0	25,700	0	25,100	0	25,400	0
Price	1,548,700	56,500	1,750,100	120,200	2,104,000	338,100	2,244,400	424,200
Scofield	13,500	0	14,000	0	14,800	0	15,000	0
Sunnyside	54,900	700	54,900	1,300	57,300	3,600	55,800	4,100
Wellington	254,900	15,700	292,700	33,300	371,300	93,600	400,200	117,500
Emery								
Castle Dale	282,500	14,700	322,800	33,200	392,900	95,400	401,600	111,900
Cleveland	61,000	2,500	67,100	6,000	78,500	16,400	79,700	19,200
Elmo	37,700	1,700	41,500	4,000	49,100	10,900	50,000	12,800
Emery	51,700	6,600	61,900	14,200	86,600	37,900	91,100	43,100
Ferron	239,200	30,700	285,400	65,400	400,100	174,900	420,500	199,000
Huntington	302,200	10,500	322,700	25,100	365,500	68,100	369,500	79,900
Orangeville	200,500	10,500	223,600	25,100	270,000	68,100	276,500	79,900
Sanpete								
Centerfield	91,300	3,400	97,100	3,500	110,000	10,200	112,600	10,800
Ephraim	366,200	3,700	392,600	3,200	436,900	9,700	459,200	9,500
Fairview	142,300	8,200	169,200	7,900	192,000	22,900	194,300	24,400
Fountain Green	72,800	600	73,600	600	77,000	1,800	77,400	1,900
Gunnison	179,100	5,800	191,900	6,100	216,600	17,500	220,200	18,500
Manti	270,900	2,500	290,400	2,200	322,700	6,500	339,300	6,400
Moroni	127,400	1,700	136,000	1,600	145,600	4,700	146,600	234,300
Mt. Pleasant	312,400	7,400	351,900	17,100	372,800	20,500	375,900	21,900
Spring City	85,300	1,500	91,000	1,400	98,100	4,100	98,800	4,400
Wales	17,000	200	18,100	200	19,300	600	19,500	600
Sevier								
Aurora	120,100	6,800	130,300	7,600	154,500	21,900	161,300	23,200
Redmond	84,600	4,400	91,900	5,000	108,200	14,300	112,900	15,100
Richfield	853,000	29,800	946,900	40,300	1,131,800	120,400	1,202,300	129,300
Salina	271,000	12,800	300,200	20,500	361,300	59,100	377,200	62,500

These communities would be under stress to provide these additional services. Failure to provide sufficient water and sewer capacity would result in substandard health and sanitary conditions reducing overall quality of life.

Public Safety

The level of impacts on law enforcement within the four-county area would be only slightly less than discussed for Alternative One. Through 1990, only Emery County would experience an increase in demand for law enforcement services that would be higher on average than the 2 percent per annum baseline forecasts. Emery County currently has 19 police officers, and under baseline forecasts would need a total of 29 police officers by the year 2000. Twenty-two additional police officers would be needed between the year 1982 and 2000 as a result of implementation of Alternative Two. This could raise the county's expenditure for law enforcement services by an additional $60,000 each year (1982 dollars) through the year 2000.

Growth in Carbon County's law enforcement needs would be consistently 3 to 5 percent per annum over the baseline from 1990 to the year 2000. This growth as shown in Table 4-55 would result in the need for 90 police officers in the year 2000 of which 15 officers would be the result of Alternative Two.

Although Sevier and Sanpete Counties would experience a substantial increase in demand for law enforcement services over the next two decades, the majority of this growth would be accommodated by baseline growth forecasts. Less than a 2 percent higher per annum growth over baseline projections is forecast. However, this does not negate the fact that the communities within those counties would need to make substantial investments in both capital facilities, such as jails, police stations, equipment, police vehicles, etc., to maintain the current level of law enforcement.

Carbon and Emery Counties which currently receive medical services from the Castleview Hospital in Price would need 27 additional hospital beds to meet demand generated from Alternative Two by the year 2000. In addition, the two counties would need an additional 7 doctors, 7 dentists, and 26 nurses which would represent a 37-to 43-percent growth over the projected baseline of medical manpower demand.

Sevier County would need an additional four new hospital beds by the year 2000. Also, additional physicians and dentists would be needed to accommodate growth from medium leasing. Sanpete County would not require significant additional medical services to accommodate implementation of Alternative Two.

Although an undetermined amount of expansion would be necesary in the number of volunteer fire-fighting staff and perhaps even some additional equipment in general, there would be only a limited effect on the fire protection abilities of all the communities in the four-county area with the exception of Price and Richfield. Price would require a full-time fire-fighting staff of 10 or 11 people by 1990 to meet anticipated demand. An additional three fire-fighters could be necessary by the end of the century. Additional equipment as well as water flow capability and distribution would also be necessary. Richfield would require a full-time fire-fighting staff of six by 1995.

If local fire protection efforts do not keep pace with population growth, the resultant short-fall would increse the risk of personal injury, death, and property destruction.

Additional fire fighting equipment, personnel and water would be necessary within most of the communities under the medium level scenario.

Solid Waste

Communities within Carbon, Emery, Sevier and Sanpete Counties should have adequate disposal areas for the additional solid waste generated under Alternative Two although additional landfill acreage may be necessary in Richfield, Fountain Green, Moroni and Mt. Pleasant. Failure to maintain adequate solid waste facilities would result in overuse of existing facilities and use of unauthorized areas resulting in possible degradation of surrounding land.

Social/Attitudes

The attitude of residents of the four-county area toward additional coal development in the future cannot be accurately predicted because social and political attitudes toward growth change in response to economic conditions. When employment is high, additional growth is generally opposed, but during periods of high unemployment economic development is promoted.

The projected population growth in Carbon and Emery Counties could change the social and political structure of communities. Because of the present cultural diversity of Carbon County, changes in social and political structure would probably be acceptable to long-time residents. However, in Emery County where there is a more homogeneous culture, the introduction of cultural diversity associated with growth in the coal industry may be opposed by the present residents.

The lifestyles of Sanpete and Sevier Counties would not be disrupted by the projected coal-related population growth and the creation of new jobs would be acceptable to local residents.

Transportation

Table 4-58 shows predicted increases in traffic due to development of the 15 central Utah tracts. Vehicles per day would increase by about 11,660 by the year 2000. Increased traffic would require increased road maintenance throughout the area and there would be an increased but unquantified number of traffic accidents. If road improvements are implemented as needed (see Alternative Four), the accident rate should remain typically low. Traffic patterns and traffic increases would be as analyzed for Alternative One, with the exception of removal of some traffic from U-96 north of Clear Creek due to for Alternative One, with the exception of removal of some traffic from U-96 north of Clear Creek due to the deletion of Blue Trail Canyon and Walker Flat tracts. The largest increases in traffic would continue to occur on Highway U-10 from Price southward to Castle Dale and on U.S. 6 from Castle Gate to Price. The vicinity of Price would continue to gain the bulk of the traffic,

TABLE 4-58

CENTRAL UTAH

MAXIMUM INCREASES IN TRAFFIC AND VEHICLE USE
ALTERNATIVE TWO

Feature	Coal Trucks	Service Trucks	Commuters	Other Trucks	Other Cars	Totals
Max. Vehicles/day	2,262	463	5,510	356	3,072	11,663
Total Million Miles[a]	297	193	1,926	26	200	2,639
Total Mi. Gals. Fuel[a]	73	36	76	5	7	197
Total Vehicles Lives[a]	294	380	19,266	52	1,998	21,990

[a] Within area of influence only. Travel outside this area is not included.

with the effects as analyzed under Alternative One. There would be moderate increases in traffic due to mining, increases in traffic jams in Price due to increased railroad activity, and increases traffic accidents due to increased congestion.

Mine-related traffic in the central Utah area would add about 11,600 vpd to the highways, traveling about 2.6 billion miles, using 197 million gallons of fuel and wearing out about 2,000 vehicles over the lives of the mines. Traffic associated with additional proposed mining would not by itself overload any of the State highways in the area.

Cultural Resources

As described for Alternative One, exploration and construction of surface facilities for underground mining could inadvertently disturb or destroy historic and prehistoric cultural resources. The majority of such effects could be avoided by proper placement of facilities and salvage excavation. The total number and significance of the affected sites is unknown.

The extent of cultural resource disturbance that would result from mine-related community expansion and recreational activity is unknown.

Both scientific and aesthetic site values would be lost as a result of these indirect impacts. This loss would occur to many on and off-site significant cultural resources in Carbon, Emery, Sanpete, and Sevier Counties.

Recreation

By the year 2000, mining-related population growth would increase the local demand (users originating from within the four-county region) for both dispersed and developed recreation opportunities in the four-county region by approximately 24 percent from 1982 use figures and by approximately 17 percent over the use figures projected for year 2000.

Table 4-59 and Table 4-60 show the anticipated increases in demand for hunting, fishing, and ORV activity, respectively, during the life of the mining operation. Increased demand for dispersed activities, as well as increased use of developed recreation sites and urban facilities, would result in impacts similar to those identified for Alternative One. The extent and intensity of those impacts are not quantifiable but would be very similar in degree to impacts from Alternative One. In summary, the additional competition for fish and game would lead to less hunter and fisherman success or restricted harvests. Increased use would increase ORV conflicts with other recreational uses. Overuse of developed campgrounds, picnic areas, playfields, swimming pools, and golf courses would result in continued deterioration of existing facilities, user dissatisfaction, and additional recreation pressures on undeveloped areas including the presently overused San Rafael/Buckskin Draw area. Federal, State, and local governments would be under stress to provide recreation facilities to meet minimum standards recommended by the UORA (1978).

TABLE 4-59

PROJECTED INCREASE IN LOCAL HUNTER AND FISHERMAN DEMAND WITHIN THE FOUR-COUNTY REGION
ALTERNATIVE TWO

	Projected Annual Increase in Numbers							
Year	Coal-Related Population	Deer Hunters	Elk Hunters	Upland Game/ Waterfowl Hunters	Fishermen	Increased Demand for Fish	Overall Percent Increase from 1982	Overall Percent Increase from Projected Baseline
1987	2,860	515	57	257	1,286	38,580	4	3
1990	4,990	898	100	449	2,244	67,320	7	5
1995	14,200	2,556	284	1,278	6,385	191,550	20	15
2000	16,700	3,006	334	1,503	7,510	225,300	24	17

Note: Projections were made assuming that the percentage of Utah's population that currently hunts or fishes would remain the same, and that the Utah percentage can be applied to the four-county area. Approximately 18 percent of Utah's population hunt deer, approximately two percent hunt elk, approximately nine percent hunt upland game or waterfowl. Approximately 53 percent of Utah's population under the age of 12 and 42 percent of the population over the age of 12 fish. Approximately 27 percent of Utah's population is under 12 and 73 percent is over 12 in age (Thayne and Hudson, 1978). An average of 30 fish per person per year were caught in 1977 (UDWR, 1978).

TABLE 4-60

PROJECTED INCREASE IN LOCAL OFF-ROAD VEHICLE DEMAND WITHIN THE FOUR-COUNTY REGION
ALTERNATIVE TWO

Year	Projected Coal-Related Population Increase	Projected Increase in Pickup and Four-Wheel Drive Numbers	Projected Increase in Motorcycle Numbers	Overall Percent Increase from 1982	Overall Percent Increase from Projected Baseline
1987	2,860	715	200	4	3
1990	4,990	1,248	349	7	5
1995	14,200	3,550	994	20	15
2000	16,700	4,175	1,169	24	17

Note: Projections were made assuming that the percentage of the population in the four-county region that owns off-road vehicles would remain the same (approximately 7 percent of the population currently owns motorcycles, and approximately 25 percent of the population currently owns four-wheel drive vehicles or light pickups) (UORA, 1978).

Development of the tracts and of homesites would displace dispersed recreational use from as much as 383 acres by 1987, 1427 acres by 1990, 1982 acres by 1995, and 2,169 acres by the year 2000. As in Alternative One, because surrounding areas offer comparable or better opportunities, loss of recreational opportunities from displacement would be minimal.

Although an unquantified amount of existing roads would be lost from use for recreational access, the 180 miles of road that would be improved or constructed for mining purposes would also improve accessibility for dispersed recreation.

Impacts to recreational traffic on the Myton, Coal Creek, Eccles Canyon, Huntington Canyon, Straight Canyon, Cottonwood Canyon, and Ferron Canyon roads would be the same as were identified in Alternative One (i.e., increase in danger, stress, and visitor dissatisfaction). As in Alternative One, visual and audio impacts from development of the Trail Mountain and Gooseberry tracts could degrade the visitor experience to some using Utah Highway 29, the Cottonwood Canyon road, Utah Highway 31, the Skyline Drive, and various recreation attractions, while improving it for others.

As in Alternative One, upgrading of the Ferron Canyon road would likely result in destruction of the Ferron Canyon Picnic Area. Should this happen, the approximately 803 annual visitor days the site receives would be displaced to other developed sites as well as to dispersed areas. Because of the small number of visitor days involved, impacts resulting from displaced visitor use would probably not be noticeable.

As in Alternative One, the loss of visual range from scenic vistas in Canyonlands and Capitol Reef National Parks (see Air Quality) may at times be perceptible to some park visitors, thus reducing the quality of their recreational experience.

Visual Resources

Visual impacts identified in Alternative One as specifically occurring from development of North Trough Springs, Blue Trail Canyon, Walker Flat, Dugout Pace and Mud Creek tracts would not occur under this Alternative. Otherwise impacts identified both on a specific and regional basis would be the same as identified under Alternative One. A summary follows.

Structures and surface disturbance from development of the Gooseberry tract would degrade the natural appearing vistas seen from Utah Highway 31 and from several recreation attractions. Structures and surface disturbance from development of the Trail Mountain tract would dominate the landscape as viewed from the Cottonwood Canyon road and Utah Highway 29. Visual resource management objectives would not be met in either area during the life of the mining operation.

In development of Soldier Creek, Whitmore Park, Alkali Creek, Ferron Canyon, and Ivie Creek tracts, careful placement of exploration roads, drill pads and ventilation shafts to avoid unnecessary disturbance and high visibility from the Myton road, Ferron Canyon road, and I-70, respectively, may prevent what would otherwise be temporary degradation of visual quality and probable conflict with the visual resource management objectives for these tracts.

Realignment of the Ferron Canyon road would result in temporary conflict with the partial retention objectives during the construction period.

Overall, no unique or outstanding scenic qualities would be lost from development of the tracts and reclamation would be effective in reestablishing the present scenic quality and character of the Wasatch Plateau and Book Cliff tracts within 10 years of completion of the mining operations. This, together with the fact that most mining activities would occur away from major travel routes, would result in the average visitor noting little change in the region's overall scenic character from development and reclamation of the tracts.

Special Designation Areas

Mining activities including new mines and transportation routes would not directly impact any special designation area. However, the increase in local recreational demand could result in increased ORV and other dispersed use of some of the 17 areas within the four-county region with special designation or potential for special designation. The more intensive use and resultant littering and vandalism would tend to degrade values for which the areas are being protected and/or reviewed. Although not quantifiable, the degree of impact would be similar in extent and intensity to Alternative One. Agencies managing the lands may be under stress to protect special values. However, due to the temporary nature of impacts resulting from dispersed recreational use, it is extremely unlikely even in a worst case situation that possible degradation would affect the suitability of any area for special designation.

Unavoidable Adverse Impacts

Two areas near Price and Alton, Utah, and two areas near Delta and Cedaredge, Colorado, would exceed the primary NAAQS for TSP. Average annual TSP emissions would increase by about 10.6 percent over 1982 levels and 6.1 percent over the projected baseline in these areas by the year 2000. Secondary NAAQS would be exceeded in a 2,730 square mile area by the year 2000, of which 1,160 square miles would be attributed to implementation of Alternative Two. The greatest contribution to the predicted concentrations would be coal related vehicular travel on unpaved roads. Visual impacts would be noticeable from many roads and highways often used for recreation purposes; however, the most significant impact to visual range would result from increased populations in towns and cities.

The loss of soil and vegetation productivity on 5,031 acres would be unavoidable. Approximately 2,308 acres would be eventually reclaimed following mining operations. The remaining 2,723 acres lost to community development including irrigated croplands would not be reclaimed. An unquantified amount of soil would be lost from disturbed areas prior to reclamation. The mining of coal in the region would result in 1,007.8 million tons of coal (60 percent) becoming unrecoverable by present technology. Changes in aquifers such as redistribution of ground water discharge and distribution of surface water due to subsidence could not be avoided. Community use of water in the region would increase by 6,964 acre-feet by the year 2000. An additional 446 acre-feet would be required for mine development.

In affected drainage basins, tract development would result in a total sediment yield of approximately 80 acre-feet annually by the year 2000. About 48 acre-feet would come from the southern Utah tracts. Sediment from tracts in the Wasatch Plateau could end up in local reservoirs important as fisheries and community water sources. Approximately 71,973 acres would be susceptible to subsidence of up to 16 feet. Surface mining would alter topography on an additional 622 acres. The loss of wildlife due to occupation, disturbance of habitat, and illegal killing would increase. Highway mortality, mostly in central Utah, would be in excess of 160 deer and elk annually and would be unavoidable; however, vitality of the various herds should not be significantly affected. An unquantified amount of big game habitat including winter range and calving ground would be lost. Regionwide, the loss would be insignificant; however, in some areas, big game populations would be reduced as a result.

Conversion of irrigated cropland to urban use and retirement of irrigated land to provide water for mining and community needs would result in a loss of less than 1 percent (approximately 1,957 acres) of agricultural land in the region.

Portions of three tracts on the Wasatch Plateau lie within Carbon County's land use zone where coal mining is not allowed. Zoning variances or rezoning would be necessary before mining could proceed. A potential conflict would exist with the Kane County Master Plan in the areas of water development and protection of irrigated croplands.

Population in the region would increase by 22,272 persons or 20 percent over the projected baseline by the year 2000. Housing needs would increase by over 7,000 units. Employment in the region would increase by 10,577 jobs or 19 percent over the projected baseline by the year 2000. Capital and operating expenditure requirements of local counties, school districts, and municipalities would rise as a result of the need to expand public services and facilities. Unless communities plan needed improvements in advance and ensure adequate funding, there would be at least a temporary deterioration in the quality of services, causing inconvenience and dissatisfaction among those affected. These impacts would be most acute in central Utah.

Mine-related traffic would add over 18,000 vpd (19 percent) to highways in the region, about 11,600 of which would occur in the central Utah area. The largest increase in traffic would occur on Highway U-10 south of Price, Utah, and US-6 east of Price where travel limits would be exceeded. Traffic congestion in downtown Price would result from increased numbers of vehicles and increased numbers of coal trains going through the community. Unpaved secondary roads in the region would experience deterioration and safety problems due to increased coal related traffic.

Inadvertent destruction or disturbance of undetected cultural and paleontological resources and losses through illegal collection or vandalism could not be avoided. The increase in demand for recreational activities over the projected baseline resulting from population increases (71 percent in southern Utah, 17 percent in central Utah, and an undetermined but slight amount in west-central Colorado) could result in an undetermined amount of overutilization and crowding of existing recreation developments and reduced hunting and fishing success. The landscape modifications that would result from mining and associated development would degrade the visual quality of those areas, in some areas VRM standards would not be met.

Mining related noise and fugitive dust would be detected on occasion by visitors to Bryce Canyon National Park. While overall noise level would be low, it could still be perceived as significant to those in a pristine National Park environment.

The Relationship Between Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The increased population associated with mining development would result in a long-term decrease in air quality in the region.

Implementation of Alternative Two would increase annual coal production in the region from 13 million tons in 1980 to almost 53 million tons by the year 2000. Average annual production from the tracts alone would be 19.01 million tons when full production is reached. This would represent a significant commitment to coal mining in the region.

The short-term use of the environment for coal production and associated housing development would result in a long-term loss of soil and vegetation productivity on 2,180 acres permanently occupied by housing and acres retired from irrigation to provide water for community needs.

The extraction of 659.7 million tons of coal (40 percent) would render the remaining unmined 1,007.8 million tons of coal (60 percent) unrecoverable over the long term. Changes in aquifers and points of surface discharge due to subsidence would result in a long-term local change in surface water distribution and ground water storage. The short-term community and mining use of 7,410 acre-feet of water per year would be reduced by 446 acre-feet when mining ceases. The use of 6,964 acre-feet per year for community use would continue in the long term. Over the long-term, salinity at Imperial Dam would actually be reduced as water normally used for irrigation and returned to the system would be used for community development. This would more than offset salinity produced by active mining operations. Overall, the cumulative effect would be less than 1 percent.

Disturbance or occupation of habitat up to 40 years by mining activity would result in a long-term redistribution of wildlife populations and migration routes. Permanent occupation of 2,180 acres by urban development would cause a long-term loss of wildlife habitat occupied by pheasants, cottontail rabbits, mourning doves, and other small game. The loss of crop production on 764 acres occupied by housing and 1,189 acres retired due to conversion of water use would be a long-term loss in productivity.

The growth in population of 22,272 people in the region (20 percent over the projected baseline) would increase the area's potential productivity by enlarging its labor force, but the 10,577 jobs (19 percent over the projected baseline) associated with Federal leases mining would not continue in the long-term. Infrastructure improvement such as water systems would also contribute to increased community capacity by providing facilities useful for commerce and industry as well as the residential population. However, until these improvements are operational, deficiencies in community services could be anticipated.

Excavation and salvage of sites would expand knowledge of cultural resources in the region. The development of recreational facilities as a result of demand by the increased population would be a long-term increase in capacity of recreation developments in the region.

Irretrievable or Irreversible Commitment of Resources

Emissions attributable to coal related population growth and mining activity in the region would result in an irretrievable deterioration in air quality during the life of the mining operations. Soil and vegetation productivity on 5,031 acres would be irretrievably lost for the life of the mines or until reclamation would be successful. Productivity on 2,723 acres occupied by housing or retired from irrigation would be irreversibly lost. Soil lost to wind and water erosion prior to reclamation would be irretrievable.

The 659.7 million tons of coal mined would be irreversibly lost as a resource and the 1,007.8 million tons of coal left in the ground would be irreversibly unrecoverable by present technology. Increased water consumption for mining and community needs would be irretrievable. Any change in aquifers, ground water storage potential, or point of discharge due to subsidence would be irreversible. The increased consumptive use of water for community and mining use (7,410 acre-feet per year) would be irreversible.

Big game losses through displacement from habitat, traffic mortality, or illegal killing would be irretrievable. Despite increased losses of individual animals, vitality of the individual herds would be expected to be maintained. Habitat for pheasants, cottontail rabbits, mourning doves, and other small game occupied by community development would also be irreversibly lost; however, this would be insignificant on a regionwide basis and overall population vitality would be maintained.

The growth in population of 22,272 persons foreseen under this alternative would be irreversible except at considerable economic and human cost. Likewise, the commitment of capital, physical resources, and labor to build over 7,000 housing units and infrastructure that would be required to support the growth in population, commerce, and industry would be an irretrievable impact. The loss of smalltown atmosphere and community solidarity in some communities as a consequence of coal development would be irreversible.

Development of the coal mines as proposed would result in the irretrievable consumption of over 260 million gallons of petroleum fuels.

The loss of cultural and paleontological resources in context would be irretrievable and any loss of interpretive values would be irreversible. The adverse impacts to visual resources would be irretrievable for the life of the mines, but in most cases would be reversible following reclamation. Noise produced by coal development in southern Utah could result in an irretrievable degradation of a recreation experience to some visitors to Bryce Canyon National Park.

Significant Cumulative Impacts

The cumulative impact assessment was developed by adding the impacts of Alternative Two to those of the baseline (Alternative Four) for the year 2000. Only the most significant in central Utah are summarized below. The cumulative impacts in southern Utah and west-central Colorado would be identical to those described for Alternative One and are not repeated here.

By the year 2000, in central Utah there could be an 89 percent increase in TSP emissions over the 1981 emission levels. One area near Price would exceed primary NAAQS for TSP and there could be approximately a 2,195 square mile or 1,371 percent increase in area where the secondary NAAQS for TSP would be exceeded. About 42 percent of the increase would be attributable to Alternative Two.

Visual range from selected points in Canyonlands and Capitol Reef National Parks would be reduced by 6 to about 64 percent during 1 percent of the time. Such reductions could be perceptible to park visitors. Also, during 1 percent of the time a plume may be visible looking from Cathedral Valley in Capitol Reef National Park to the San Rafael Swell. About 21 to 24 percent of the reduction would result from Alternative Two.

Community development resulting from mining would result in a permanent loss of soil productivity for about 2,668 acres by the year 2000. Approximately 968 acres or 36 percent of the loss would be attributable to Alternative Two. Up to 114,569 additional areas of surface would be subject to subsidence of which 39 percent would be affected by Alternative Two. A maximum subsidence of 16 feet with surface fractures could result.

An estimated additional 12,413 acre-feet of water would be required by the year 2000 for coal development and selected population growth of which 37 percent would be required by Alternative Two. About 6,361 acre-feet of water would be consumptively used. This is about 0.43 percent of Utah's share of Colorado River water.

Projected mining activities would disrupt local aquifers, alter local ground water flow systems and cause redistribution of natural ground water flow systems. These impacts are not quantifiable but about 179 additional square miles would be subject to mining.

The four-county population would increase from an estimated 69,598 in 1982 to 116,900 in 2000, an 68 percent increase. Alternative Two would contribute about 16,700 people or 35 percent of the increase. Corresponding increases in hunters, fishermen, and ORV can be expected. The presence of a larger human population would exert greater pressures on wildlife populations through legal and illegal harvest, harassment, and displacement from habitat.

Cumulative loss of pheasant habitat would be insignificant on a regional basis but locally a 13 percent reduction in cock harvest could result in Carbon County.

Irrigated cropland lost as a result of community expansion and retired due to use of water for community purposes would be about 3,336 acres or 1.5 percent of the four-county agricultural land base. About 1,211 acres or 36 percent of the affected acreage would result from Alternative Two. The retired lands would be among the most favorable for agricultural use in the four-county region.

By the year 2000 the four-county population would increase approximately 68 percent over the 1982 level which would lead to similar increases in the demand for housing, water connections, and other community infrastructural services. Front-end financing of these services would be a major problem and the quality of community could deteriorate.

Traffic congestion would occur on U-10 between Price and Castle Dale, and on US-6 across Soldier Summit. Severe traffic congestion would occur in downtown Price as incresed numbers of vehicles would be blocked by increased numbers of coal trains. Alternative Two would contribute to an already poor situation. Nearly all highways affected by proposed coal development are approaching or have already exceeded the 200 year design traffic volume and the need for maintenance would increase.

By the year 2000 total population growth would increase the local recreational demand by approximately 68 percent over 1982 levels. By itself, Alternative Two would increase the demand by only 17 percent. Such increases would result in overcrowding, user dissatisfaction, and deterioration of the environment at many sites in the four county region.

Because of large increases in population, overcrowded conditions, and user dissatisfaction at recreational facilities in towns and cities would also accelerate.

Alternative Three: Medium Level (1.316 Billion Tons)

The following analysis addresses the projected impacts of Alternative Three in central Utah. The impacts of Alternative Three on west-central Colorado would be identical to those described for Alternative One and are not repeated here. Under this alternative, no coal would be offered for lease in southern Utah.

Central Utah

Climate, Air Quality

The models discussed under Alternative One were used to develop the Alternative Three analyses.

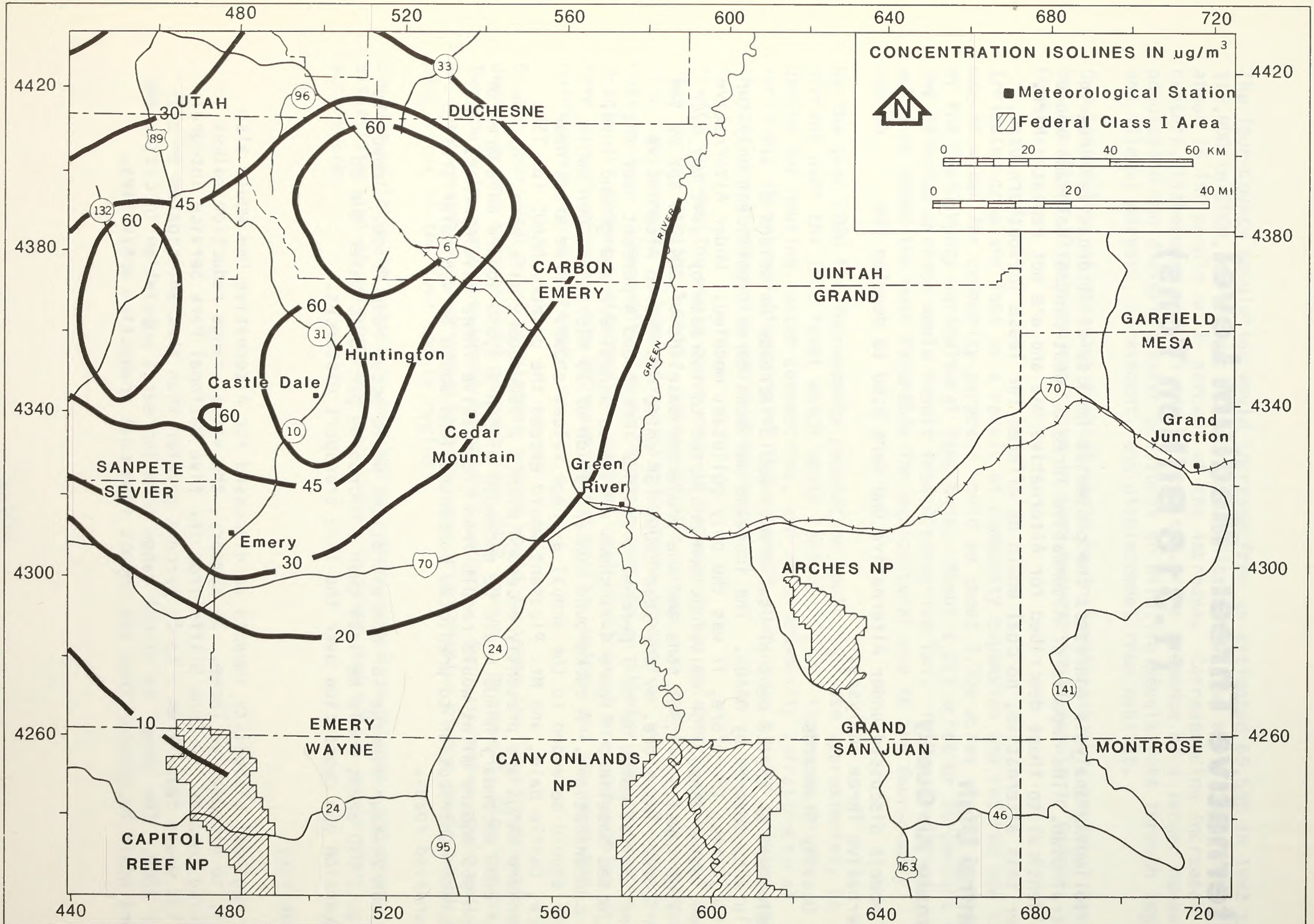
Air Quality Standards

Development of the 18 central Utah tracts would increase emissions of all pollutants covered by NAAQS. The increase was considered significant only for particulates, therefore, it was the only pollutant modeled. Under Alternative Three, total annual TSP emissions are projected to increase by 7,342 tpy over the 1982 level of 11,981 tons and the projected baseline of 204,273 tpy by the year 2000. Therefore, by the year 2000, TSP emissions due to Alternative Three are estimated to be 7 percent over 1982 levels and 4 percent over the projected baseline. Figure 4-11 shows estimated annual average ground level TSP concentrations. A background concentration of 15 micrograms per cubic meter should be added to the annual average values shown. Three areas near Price, Castle Dale, and Mt. Pleasant would exceed the primary NAAQS for TSP. Secondary NAAQS are presently exceeded within a 160-square mile area. By the year 2000 secondary NAAQS would be exceeded within a 2,395 square mile area of which 965 square miles would result from Alternative Three developments. The greatest contribution to predicted concentrations would be vehicular traffic on unpaved roads.

Maximum 24-hour average TSP concentrations would occur near Price. Impact to Class I PSD areas would be less than 1 microgram per cubic meter due to dispersion and deposition over the long transport distances.

Visibility

The regional visibility impacts as discussed for Alternative One would also apply to Alternative Three. In summary, the visual range reduction values looking towards the Book Cliffs from the five National Park Service integral vistas would range from 1 to 13 percent greater than that anticipated in the year 2000. The impact to visual range from increased population in cities and towns would be greater than the impact from coal production activities.



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 4-11

ANNUAL AVERAGE TSP CONCENTRATIONS IN CENTRAL UTAH - YEAR 2000

ALTERNATIVE THREE

Soils

Refer to the Alternative One Central Utah Soils section for general discussions on causes of soil disturbances, impacts to soils located on coal tracts and on off-tract support sites, and erosion control.

The cumulatively disturbed acres resulting from exploration, mining, and community development for Alternative Three are displayed in Table 4-61. The loss on community development areas would be permanent.

Table 4-62 presents estimated soil losses on critical soil erosion areas. The losses depicted are considered as averages over the potentially disturbed tract areas. As shown, the upper range of percent increases could be large, but would occur on a relatively small portion of the total tract acreage (from 1 to 3 percent). Revegetation and erosion control measures would reduce soil erosion to acceptable levels within a 2 to 10 year period on most tracts.

In the following discussion, soil impacts on total acres of disturbance are discussed for exploration activities. For production activities, only soil impacts on cut and fill slopes are analyzed (see Central Utah Alternative One for rationale and methodologies). The impacts under Alternative Three would be as analyzed under Alternative One, but would occur on fewer acres.

Exploration activities would be temporary (1 to 2 years) on approximately 255 acres.

Approximately 341 acres would be disturbed by production activities on steep slopes within critical soil erosion areas. In the Book Cliff tracts, 52 acres of steep slopes would be disturbed mainly on the Alkali Creek, Coal Creek, and Dugout-Pace tracts. Disturbances on steep slopes could result in soil losses of 50 tons or more per acre per year from combined water and wind erosion (BLM, 1982). In the Wasatch Plateau area, soil losses on exposed soils of cut and fill slope acres could range from 20 to 50 tons per acre per year on 94 acres in the North Trough Springs, and Castle Valley Ridge tracts and from 50 to 100 tons per acre per year on 195 acres in the Trail Mountain, Ferron Canyon, The Pines, and Quitchupah tracts. Due to the high erosion potential, low soil fertility, and high salt and clay content, revegetation problems would exist on the disturbed acres of these tracts.

Subsidence, as evidenced on coal lease operations within the Wasatch Plateau could increase the potential for mass soil movement on the unstable soils of the Trail Mountain and Ferron Canyon tracts (see Topography section). This could accelerate soil erosion and cause increased sediment transport into intermittent and perennial stream courses within or adjacent to these tracts.

Minerals Resources

Approximately 132.9 million tons or 36 percent of the coal in the Book Cliffs tracts, and 307.1 million tons or 42.2 percent of the coal in the Wasatch Plateau tracts, would be recovered using current mining techniques. Approximately 25.0 million tons of coal (34 percent of the total resource) would be recovered from the Walker Flat tract.

TABLE 4-61

CENTRAL UTAH
ACRES OF SOIL DISTURBANCE ON COAL TRACT
AND COMMUNITY DEVELOPMENT AREAS

ALTERNATIVE THREE

Activity	Acres Disturbed 1987	1990	1995	2000	
Exploration [a]	255.1	255.1	255.1	255.1	The exploration and mining acres represent 2.5 percent of the total surface acres within the coal tracts.
Mining [b]	0	977.9	1015.0	1038.1	
Community Development [c]	164.3	297.8	828.0	970.0	
Totals	419.4	1530.8	2098.1	2263.2	

Source: Round Two Tract Profiles. Round Two Leasing and socioeconomic data from the State of Utah Planning Coordinator's Office, 1982.

[a] Although included in cumulative total of disturbed acres, these exploration acres would be rehabilitated within a 3-year period after completion of exploration work.

[b] Includes 100 acres of off-tract loadout facilities.

[c] Soil productivity loss considered permanent on these acres.

TABLE 4-62

CENTRAL UTAH
ESTIMATED SOIL LOSSES[a] ON CRITICAL SOIL EROSION AREAS

ALTERNATIVE THREE

Coal Tract	EXPLORATION ACTIVITIES Estimated Soil Loss Without Tract Developments[b]	Estimated Soil Loss With Tract Developments[c]	Differences Attributed to Tract Developments	Percent Increases Over Present	PRODUCTION ACTIVITIES Estimated Soil Loss Without Tract Developments[b]	Estimated Soil Loss With Tract Developments[c]	Differences Attributed to Tract Developments	Percent Increases Over Present
Book Cliffs Tracts	0.5 to 3.0	5.0 to 50.0 (Moderately steep areas)	4.5 to 47.0	900 to 1600	Same as shown for exploration[d]			
		50.0 to 100.0 (steep escarpment areas)	49.5 to 97.0	1000 to 3200	0.5 to 3.0	5.0 to 50.0	4.5 to 47.0	900 to 1600
Wasatch Plateau Tracts								
Gooseberry, North Trough Springs, and Castle Valley Ridge	0.2 to 22.0	20.0 to 50.0	19.8 to 28.0	130 to 100	Same as shown for exploration.			
Trail Mountain, Ferron Canyon, The Pines, & Quitchupah	20.0+	50.0 to 100.0	30.0 to 80.0	200 to 400	Same as shown for exploration.			
Walker Flat	Water Erosion 0.5 to 1.0	0.5 to 1.0	0	0	e	--	--	--
	Wind Erosion 20.0+	50.0+	30.0+	200	--	--	--	--

[a] Tons per acre per year in water erosion rates on steep slopes unless otherwise indicated. Lack of site specific project and soil survey information prevents projection of cumulative total soil losses from construction activities on critical soil erosion areas as compared to total cumulative soil losses from natural erosion on these same areas.

[b] Source: Table 3-4.

[c] Site specific analyses for coal tracts to be included in the Uinta-Southwest Utah Coal Region Environmental Impact Statement: Round Two Leasing.

[d] Soil loss for production activities on the Book Cliffs tracts would be the same as for exploration activities with the exception of utility line routes where soil loss with tract development would be 0.5 to 20.0 tons per acre per year.

[e] The Walker Flat tract would be mined from an existing portal, therefore no soil losses are shown for production activities.

The mining of coal would result in total depletion of the coal resource as the 700.8 million tons of unrecoverable coal, though still in the ground, would no longer be available as a mineral resource given present mining technology.

Surface and subsurface mining activities and subsidence could hinder the subsequent exploration and location of facilities related to oil and gas development in the Book Cliff and Wasatch Plateau areas. The potential reduction in recoverable resources cannot be estimated at this time (see Land Uses).

Topography, Geology, Paleontology

Construction of surface facilities would cause permanent changes in topography on 1,193 acres in central Utah.

The subsidence impacts described for central Utah under Alternative One would also result under Alternative Three but topography would be altered only on portions of 51,847 total acres. Tension cracks, buckling, and troughs could be expected in these areas.

Moore and Nawrocki (1980) predict a maximum subsidence of 12 feet in the Book Cliffs, 16 feet in the Wasatch Plateau, and 6 feet on the Walker Flat tract. Because of shallow overburden, the effects of subsidence would be greatest on the Ivie and Walker Flat tracts. The extent of surface effects of subsidence may be considerably less than the area above the extracted coal, but theoretically could range up to 168 to 170 percent of the mined area.

As discussed for Alternative One, significant plant fossils used for correlation and paleo-environmental guides could be destroyed by coal removal activities in the fossil-rich Blackhawk Formation of the Book Cliffs and Wasatch Plateau coal field. Significant disturbances to other scientifically important fossils would be avoided if mitigating measures are followed (Appendix 3). Surveys and mining activities could also expose new fossils and enhance paleontological studies.

Water Resources

Virtually all of the impacts on water resources as discussed for Alternative One would also occur under Alternative Three.

Surface Water

Annual sediment yields on the lands that would be disturbed by mining and associated development could increase to nearly 27 acre-feet by the year 2000 (Table 4-63). This is 0.07 percent of the estimated combined annual sediment yield in the Green and Dirty Devil River basins.

Table 4-64 shows by drainage subbasin the estimated increase in annual sediment yields from areas that would be disturbed by development of the central Utah tracts.

TABLE 4-63

CENTRAL UTAH
IMPACTS ON WATER RESOURCES AND REGIONAL SIGNIFICANCE
ALTERNATIVE THREE

Item	1987	1990	1995	2000
Water requirement (acre-ft/year)				
Mining and exploration	109.0	254.1	254.1	254.1
For public supply	746.1	1350.5	3755.6	4400.6
Total	855.1	1604.6	4009.7	4654.7
Consumptive water use				
Total (acre-ft/year)[a]	482.0	929.3	2131.9	2454.4
Percent of runoff[b]	.01	.02	.04	.05
Increased annual sediment yield				
Total (acre-ft)	4.9	17.9	24.6	26.5
Percent[c]	.01	.05	.06	.07
Increase in salinity (milligrams per liter)[d]	.04	.08	.18	.21

[a] Assumes 50 percent of withdrawal for public supply and 100 percent of withdrawal for exploration and mining.

[b] Percent of combined average annual runoff of the Green River at Green River, Utah, and the Dirty Devil River near Hanksville, Utah.

[c] Percent of estimated annual yield upstream from the stations cited in footnote b.

[d] As determined at Imperial Dam. Does not include reduction in salinity from reduced irrigation return flows.

TABLE 4-64

CENTRAL UTAH
SEDIMENT YIELD INCREASE
ALTERNATIVE THREE

River Basins	Estimated Increase in Sediment Yield (acre-feet per year)	Percent of estimated annual basin yield
Price River	9.2	0.79
Dirty Devil River	9.7	0.79
Sevier River	5.2	0.17
San Rafael River	2.4	0.05
Total	26.5	N/A

Development of the Gooseberry tract in the Upper Price River subbasin could increase annual sediment inflow to Scofield Reservoir by less than 0.06 acre-feet. This is less than 0.1 percent of the average annual inflow from 1943 to 1979. The effect on the life and utility of the reservoir would be small. The effect of increased sediment production due to development of the Ferron Canyon tract would have a slightly larger impact on the life and utility of Millsite Reservoir. Annual sediment yields for acres disturbed by development of the Ferron Canyon tract could increase by an estimated 1.2 acre feet, or about 1.0 percent of the estimated annual sediment inflow to Millsite Reservoir.

Development of the tracts would have a minor impact on surface-water quality in the general area of the tracts, access roads, loadouts, and affected communities. The regional impact on water quality would also be negligible.

Water discharged from mines would increase the salinity in the receiving streams by up to 2 to 3 milligrams per liter. Except in the case of transbasin diversion of water by mines and possible contamination of the mine water, the salt load of the receiving streams would not be significantly increased. Any increase in salt loading from mine dewatering would be negligible compared to the salt loading from irrigated lands in the lower stream reaches, especially those in the Price, San Rafael, and Dirty Devil River basins.

Accidental pollution and pollution control system failures on the Gooseberry tract could add nutrients to streams that flow into Scofield Reservoir. This would contribute to eutrophication of the reservoir.

By the year 2000, 4,655 acre-feet per year more water would be diverted for mining and associated population growth. The annual consumption rate would be 2,454 acre feet (Table 4-63). Salt concentration resulting from withdrawal of the water and salt loading resulting from return of the unconsumed water (chiefly from fluid-waste disposal systems) would have a minor effect on the salinity of the Colorado and Sevier Rivers. For example, the salinity of the Colorado at Imperial Dam would be increased by an estimated 0.21 milligrams per liter which is negligible compared to the salt loading of irrigation and natural runoff from the salt-bearing Mancos Shale.

Rock fracturing associated with the subsidence tends to divert more snowmelt and rainfall underground increasing ground water recharge at the expense of overland runoff. Fracturing could divert ground water and either reduce or increase the flow of springs that provide baseflow to headwater streams. Subsidence-caused fracturing could also divert streamflow directly underground if the fracture intersects a stream channel and remains open. Springflow and streamflow diverted underground by subsidence-caused fracturing would not be lost from the hydrologic system and might not be lost from the drainage subbasin in which it originates. The water would move through newly formed fractures and would degrade in quality more rapidly than it would as overland runoff. The chance of a subsidence-caused fracture reaching the land surface and diverting the flow of even one spring (or headwater stream) is small.

Ground Water

Mining and mine dewatering would create pressure gradients in the local ground water systems causing ground water to move toward the mine workings. This could induce the movement of saline water (such as that found in the Mancos Shale) into freshwater aquifers such as the Star Point Sandstone, thus locally reducing the quality of the fresh water aquifers (Lines et al., 1982).

Underground mine workings would disrupt local ground water flow systems in the Blackhawk Formation and adjacent formations causing a redistribution of ground water discharge. New discharge points (in most cases mine discharge sites) would generally be in the same drainage subbasins as the former natural discharge points; however, several of the tracts straddle the divides between drainage subbasins and mine workings would divert from one drainage subbasin to another. Mining of the Book Cliffs tracts could divert some ground water from the Uinta Basin to the Price River Basin.

The volume of ground water that would be diverted from one drainage subbasin to another is probably very small compared to the total water yield of the individual subbasins affected. The fine grained, poorly permeable beds of the Book Cliffs probably transmit about 30 acre-feet of water per year from the tracts to the Uinta Basin. This is only about 0.02 percent of the estimated mean annual runoff from the southern Uinta Basin as estimated by Price and Miller (1975). Proportionately small amounts of water probably are transmitted through the rocks in the area of the other central Utah tracts, assuming mine workings on those tracts do not intersect as yet unmapped faults similar to those intersected in the Wilberg and Deer Creek mines.

Water Supply and Use

Alternative Three would require up to 4,655 acre-feet of water per year for mining and public water supply needs (Table 4-63). An estimated 2,454 acre-feet of water would be consumed annually. This represents about 0.05

percent of the combined average annual runoff of the Green River at Green River, Utah, and the Dirty Devil River near Hanksville, Utah, or about 0.17 percent of Utah's share of Colorado River water. Impacts on the available supply in individual drainage subbasins could be larger. Table 4-65 shows the estimated annual mine-and-population-related water requirement from affected drainage subbasins as related to average annual discharge at maximum flow gaging stations.

TABLE 4-65
CENTRAL UTAH WATER REQUIREMENTS COMPARED TO RIVER BASIN RUNOFF
ALTERNATIVE THREE

River Drainage Basin	Gaged site (Figure 3-4)	Combined average annual discharge at gaged site (acre-feet)	Approximate total Round Two Leasing water requirement: Acre-feet	Approximate total Round Two Leasing water requirement: Percent of average annual gaged discharge
Price River	18	103,600	2,150.8	2.1
San Rafael River	46, 47	96,940	1,116.4	1.1
Dirty Devil River	55	16,820	472.0	2.8
Sevier River	58	162,300	915.5	0.6
Total	N/A	N/A	4,654.7	N/A

Maximum annual water requirement from affected drainage subbasin would range from about 0.6 percent of the annual discharge in the Sevier River basin to about 2.1 percent of the discharge of the Price River.

Vegetation

Implementation of this alternative would directly disturb a total of 1,293 acres of vegetation by the year 2000. This disturbance would result from exploration activities, construction of surface facilities, access roads, powerlines, and loadout facilities. The majority of this disturbance would occur in the Pinyon-Juniper Woodland and Conifer-Aspen forest (Table 4-66).

An additional 1,768 acres of vegetation would be lost or altered as a result of community expansion and mine water use. By the year 2000, 970 acres of land would be required for community housing of which 485 acres would be agricultural lands. In addition, 798 acres of agricultural lands would be retired from irrigation to provide water for mining and community needs. Table 4-66 summarizes disturbances by year and vegetation type.

While cumulative vegetation disturbance would total 3,061 acres, actual activities resulting in vegetation loss would occur at different periods of time following lease issuance. As a result, portions of the acreage identified in Table 4-66 would be in various stages of reclamation by the year 2000. The following summarizes major vegetation disturbing activities and if or when vegetation reclamation would likely occur.

TABLE 4-66

CUMULATIVE VEGETATION DISTURBANCE BY VEGETATION TYPE: CENTRAL UTAH

ALTERNATIVE THREE

Vegetation Type	Direct Mining Impacts[a] (Acres)				Indirect Impacts[b] (Acres)	Total[c]
	1987	1990	1995	2000	2000	2000
Agriculture	-	-	-	-	1,282.8[d]	1,282.8
Desert Shrub	1.0	87.0	87.0	89.0	102.3	191.3
Sagebrush-Grass	44.3	121.1	128.9	131.9	10.5	142.4
Pinyon-Juniper Woodland	12.5	382.0	385.5	387.7	281.6	669.3
Mountain Brush	4.0	56.9	60.9	63.9	21.4	85.3
Ponderosa Pine	24.0	132.1	135.1	135.6	-	135.6
Aspen	9.5	38.9	40.9	43.9	-	43.9
Conifer-Aspen	96.0	306.6	320.6	323.6	-	323.6
Non-Productive	7.5	19.0	21.5	24.8	69.0	93.8
Other (Douglas fir, Mountain Meadow, Grassland, etc.)	54.3	89.7	89.7	92.8	-	92.8
TOTAL	255.1	1,233.3	1,270.1	1,293.2	1,767.6	3,060.8

a Includes surface facilities, portal access, mining operations, exploration activities, powerlines, ventilation construction, and loadout areas.

b Total lands lost to community expansion including agricultural lands retired from irrigation to provide water for community needs. This acreage was computed for the year 2000 only and does not include 90 acres of irrigated cropland that would be retired for exploration water requirements from 1987 through 1990.

c Total vegetation disturbance by the year 2000.

d Includes 485.2 acres lost to community development and 797.6 acres retired from irrigation to provide water for mining and community needs.

Strip mining and associated developments on the Blue Trail Canyon tract would result in total removal of vegetation from 65.0 acres by the year 2000. However, only about 4 acres would be disturbed annually by strip mining activities. Based on a projected reclamation plan it is anticipated that no more than 20 acres would be unreclaimed at any one time in the mining area.

Exploration activities involving construction of drill pads and access roads would disturb a total of 255 acres by the year 1990. By the year 2000 this acreage, while included in the cumulative total of acres disturbed, would be in advanced stages of reclamation.

Implementation of this alternative would result in the loss of 1,038 acres of vegetation for which no reclamation would begin until completion of mining activities. This would include areas used for surface facilities, portal access, powerlines, ventilation installation, and loadout facilities. Certain access roads may continue to be used for other purposes following completion of mining and would not be reclaimed. Agricultural and nonagricultural lands surrounding local communities which would be lost to community expansion or retired for irrigation to provide water for community expansion would not be reclaimed.

Even though less than 50 acres of Douglas fir communities in the Book Cliffs would be removed, it would represent a permanent commitment of the resource as the stands are not reproducing themselves. The areas disturbed would eventually revert to a mountain brush community.

For areas that would be reclaimed, the duration of the impact of total vegetation loss would depend upon the success of reclamation. As discussed in Alternative One, reclamation attempts on the Wasatch Plateau and Book Cliffs tracts are expected to be 50 to 80 percent successful (Hagihara et al., 1972). On steep slopes and areas of poorly developed soils in this area, 30 percent of revegetation attempts are expected to be successful.

Reestablishment of native species is expected to occur through natural succession over the long term. On areas of Aspen-Conifer, Ponderosa Pine, and Pinyon-Juniper Woodland, restoration to the original type would take longer. Fifteen to 20 years or more would be required for a return to original conditions.

Implementation of this alternative would not directly impact any listed or candidate threatened or endangered plant species; however, inadvertent destruction of threatened or endangered species found in the region could occur through housing development, off-road vehicle activities, or unlawful collecting of these species.

Wildlife

Terrestrial

The surface disturbance from production activities of 938 acres by the year 2000 could decrease the deer populations in herd units 33, 34, 35, 36, 38, 43, and 45 by 146 deer. Elk loss from habitat destruction including migration routes and calving grounds would be 31 animals per year or 0.3 percent of the potential Manti elk herd. The majority of the elk loss would be in critical winter range. No comparable losses of elk from the proposed mining activity would occur in the Avintaquin-White Rocks-Anthro-Argyle herd unit (Table 4-67).

Encroachment by mining activity on mountain lion and black bear home ranges, illegal killing, and loss of prey species such as deer and elk would reduce lion and bear populations by an unknown amount until reclamation was completed. The increased development and widespread human disturbance on this range would cause abandonment of some home areas and a reduction in size or use of others.

Acreage utilized in community development would be irreversibly lost as wildlife habitat. Half of the acreage would come from irrigated cropland adjacent to expanding communities. Many species inhabit these lands, notably pheasants, cottontail rabbits, doves, small birds, and mammals. With 1,283 acres of irrigated agricultural land committed to urban use by 2000 (subdivisions and water right purchases), the regional pheasant population could be reduced by 820 birds potentially reducing the cock harvest by 238. Regionally this would be insignificant, but in Carbon County where over one-half of the community development would occur, the potential cock harvest loss would be 4.5 percent of the average annual harvest.

Surface expression of subsidence such as cracks, bulges, and displacements are not expected to directly affect wildlife, but any reduction or elimination of surface water flows and associated vegetation communities could adversely affect some species. Loss of water sources would result in reduced utilization of habitat by mobile species such as deer, elk, beaver, and birds, and elimination of species such as small mammals, reptiles, and amphibians that are unable to relocate. Because of lack of data on wildlife populations and the unpredictability of subsidence and its effects, the number of animals that could be affected cannot be quantified. At the projected production level up to 51,847 acres would be susceptible to subsidence.

Construction of a minimum of 42 miles of new utility lines (estimated length of new utility and new portal access) in the area would provide additional perching and hunting sites for raptors. This would be a beneficial impact; however, use of these structures along roadsides or in areas open to human access would expose the birds to illegal shooting and disturbance (BLM, 1981a). The extent of losses from this activity cannot be tabulated but approximately 16 miles of the new utility lines would be adjacent to portal access roads.

With this proposed level of production, 64 miles of new and improved portal access roads would be needed for access and truck hauling of coal. Most of these roads would be in deer and elk summer and winter ranges and vehicle traffic on them would present an additional hazard to wildlife (BLM, 1981a). In the 1980-81 field year 292 deer were recorded as traffic mortalities in deer herd units 33, 34, 35, 36, 3, 43, and 45. By 2000 the 14 percent

TABLE 4-67

CENTRAL UTAH
BIG GAME HABITAT DISTURBANCE
ALTERNATIVE THREE

Tract	Acres Disturbed	Plant Community	Wildlife Use[a]	Species	Losses/ Year[b]
Alkali Creek	39.1	P-J/P. Pine[c]	HP Winter	Deer	5
Coal Creek	83.5	P-J/Sagebrush	HP Winter	Deer	6
Dugout Pace	2.5	Sagebrush	HP Winter	Deer	1
Graves	0	P-J	HP Winter	Deer	2
Hoffman Creek	0	-	-	-	-
Soldier Creek	11.8	Sagebrush	S Summer	Deer	1
Whitmore Park	0	-	-	-	-
Acord	0	Sagebrush	HP Summer	Deer	0
			C Winter	Elk	0
Castle Valley		Conifer/	HP Summer	Deer	26
Ridge	155.0	Grass	HP Summer	Elk	7
Ferron Canyon	129.9	P-J/	HP Winter	Deer	10
		Sagebrush	HP Winter	Elk	7
Gooseberry	34.1	Aspen/Grass	HP Summer	Deer	13
			HP Summer	Elk	2
Ivie	2.0	Mt. Shrub	S Winter	Deer	0
			C Winter	Elk	0
North Trough		Conifer/	HP Summer	Deer	28
Springs	58.1	Grass	HP Summer	Elk	3
Quitchupah	155.1	P-J/P.Pine	C Winter	Deer	11
			C Winter	Elk	7
Skumpah	76.0	Mt. Shrub	HP Summer	Deer	18
			C Winter	Elk	4
The Pines	114.1	P-J/Sagebrush	C Winter	Deer	21
			C Winter	Elk	5
Trail Mountain	76.9	P-J/Sagebrush	HP Winter	Deer	4
Walker Flat	0	Desert Shrub	S Winter	Deer	0
Totals	938.1			Deer	146
				Elk	31

[a] See Appendix 7. HP, High priority; S, Substantial; C, Critical.
[b] Includes 0.1 mile influence zone. Based on optimum management objective levels (UDWR, 1981a).
[c] Pinyon-Juniper/Pinyon pine

increase in traffic from coal hauling and commuting could increase the deer traffic mortality on existing roads to 333 animals per year. An additional 200 deer could become traffic mortalities on new roads (Table 4-68). However, this could decrease after the initial years of use because of habituation and dispersal of deer by human activity. Total traffic mortality (556) when combined with habitat losses would result in the loss of 1 percent of the region's deer population. Elk loss resulting from increased traffic has not been estimated but is expected to be low.

Heavily traveled portal access roads could be a limiting factor to small, isolated animal populations and become an obstacle to small animal movement especially among forest dwelling species (BLM, 1981a).

The escarpments of the Wasatch Plateau and the Book Cliffs are favored nesting sites for raptors especially golden eagles. Nesting concentrations are located in the south Wasatch Plateau and around Alkali Creek in the Book Cliffs. Impacts to raptor territories would be as analyzed in Alternative One.

The human population increase in 1987 is expected to be 4 percent above the projected baseline, peaking at 18 percent above by 2000. Similar increase in hunters, fishermen, and ORV use (Recreation Section) would result. The presence of a larger human population and pressures on the wildlife populations through harvest, harassment, and displacement from habitat would be as analyzed under Wildlife, Alternative One.

By 2000 an additional 4,440 2-wheel drive and 4-wheel drive trucks could be located in the four-county region. An increase in unregulated use of unimproved roads on the Wasatch Plateau and Book Cliffs would result and would adversely affect the elk habitat in the Manti herd unit (Lyon, 1979). This effect would also apply to other wildlife species inhabiting these areas.

Assuming a rate equal to the reported increase in population and issued citations discussed for Wildlife, Alternative One, the 18 percent human population increase projected by the year 2000 could result in a 66 percent increase in illegal taking of wildlife. Illegal killing of wildlife could significantly reduce big game populations.

Fisheries

Pollution of fisheries from coal wastes and coal mine drainage would not be anticipated with reasonable enforcement of applicable State and Federal laws. The impacts resulting from accidental mine related pollution, including fugitive dust from coal hauling trucks would be as analyzed in Alternative One.

Ferron Creek, Mud Creek, Muddy Creek, Quitchupah Creek, and some tributaries of Huntington Creek could suffer dewatering in short sections if subsidence occurred and altered the channels. Mitigation measures could repair the channel and restore the flow avoiding permanent damage and total loss of fisheries.

TABLE 4-68

CENTRAL UTAH
POTENTIAL DEER TRAFFIC MORTALITY FROM NEW ROADS
ALTERNATIVE THREE

Tract	New Roads (miles)	Deer Range[a]	Deer Loss/ Year[b]	Mine Life[c]
Alkali Creek	1.6	HP Winter	2	25
Coal Creek	4.8	HP Winter	6	40
Dugout Pace	0	HP Winter	0	45
Soldier Creek	0	S Summer	0	40
Acord	0	HP Summer	0	18
Castle Valley Ridge	14.1	HP Summer	69	40
Ferron Canyon	11.7	HP Winter	28	20
Gooseberry	1.5	HP Summer	10	40
Ivie	0	S Winter	0	40
North Trough Springs	5.0	HP Summer	24	40
Ouitchupah	8.5	C Winter	13	40
Skumpah	4.05	HP Summer	16	40
The Pines	7.9	C Winter	19	40
Trail Mtn.	4.6	HP Winter	13	40
Totals	63.75		200	

[a] See Appendix 7. HP, High priority; S, Substantial; C, Critical

[b] 1,280 acre (1 mile each side of road) X road length/deer density X 0.076 = deer loss/year. Divided again by 2 because occupancy of summer or winter range for six months.

[c] Deer losses at this rate only apply to initial years of road use.

Fishing pressure impacts on popular waters such as Electric Lake, Huntington Creek, Joe's Valley Reservoir, Scofield Reservoir, Johnson Valley Reservoir, and Fish Lake would be as analyzed in Alternative One.

Threatened or Endangered Species

No significant impacts to threatened or endangered species or known habitats would be expected.

Land Use

Agriculture and Range

During the construction and production phases of coal resource development there would be changes principally from grazing to mining and support uses, from agricultural land to community use, and from irrigated cropland to retired cropland. Table 4-69 displays projected total acres of temporary and permanent land change by activity. Table 4-70 displays acreage converted permanently to community development, agricultural acreage converted to community development, and irrigated cropland retired to provide community water. Impacts to non-agricultural and irrigated croplands as well as the effects to existing uses on coal tract areas are discussed below.

Permanent land changes associated with community expansion would affect cropland agriculture and community development in Carbon, Emery, Sanpete, and Sevier Counties. By the year 2000, these counties would experience a permanent change of approximately 970 acres from grazing and agricultural uses to housing and community infrastructures. Of the 970 acres, 485 acres (50 percent) would be irrigated cropland (consisting mainly of alfalfa and small grains). The remaining 485 acres would be non-agricultural lands adjacent to existing communities. An additional 728 acres of irrigated croplands would be retired to provide community water requirements (Table 4-70). Permanent land changes would occur on 1,698 acres (Table 4-69) due to conversion of land for community expansion and the retirement of irrigated cropland to provide community water needs.

Water requirements for exploration and mining activities would also impact irrigated cropland. Water for approximately 96 acres of irrigated cropland would be diverted to exploration activities over a 3-year period. For mining activities, irrigation water sufficient for approximately 70 acres of cropland would be diverted annually during the life of the mines.

In summary, total agricultural lands affected by the year 2000 due to the conversion of irrigated croplands for community development, retirement of irrigated croplands for community water supply, and the diversion of water for exploration and mining activities would be 1,373 acres. Water for approximately 90 acres of cropland (retired by exploration activities) would be available for cropland use upon completion of exploration (1989). All of the affected irrigated cropland would be off the proposed coal tracts. These acres represent less than 1 percent of the total four-county cropland acreage,

TABLE 4-69

CENTRAL UTAH
ACRES OF LAND CHANGES DUE TO COAL TRACT DEVELOPMENTS
BY YEAR 2000
ALTERNATIVE THREE

Projected Maximum[a] Total Acres Changed From One Land Use to Another	Temporary Land Changes Acres of Land Change Due to Mining Operations, Including On-Tract and Offsite Support Facilities	Permanent Land Changes--Acres Changed[c] for Community Development and Acres Irrigated Cropland Retired to Provide Community Water Needs
	834 acres for access routes,[b] 359 acres for on-tract facilities 100 acres for off-site loadout facilities 70 acres of irrigated land retired for mine water	1,698
Totals 3,061	1,363	1,698

Source: Utah State Office - Bureau of Land Management (BLM, 1982a).

a Projected Maximum Total Acres Changed From One Land Use to Another are totals of Temporary Land Changes plus Permanent Land Changes.

b Exploration drill pads counted as part of access acres.

c Figures shown are totals taken from Table 4-70 (Total Acres Converted column plus Additional Irrigated Acreage Retired column for year 2000).

TABLE 4-70

CENTRAL UTAH
LANDS AFFECTED BY COMMUNITY DEVELOPMENT AND WATER REQUIREMENTS
ALTERNATIVE THREE

Location (Census County Div.)	Total Acres Community Development a	Irrigated Acres for Community Development b	Additional Irrigated Acreage Retired c	Total Irrigated Lands Affected d	Total Acres Community Development a	Irrigated Acres for Community Development b	Additional Irrigated Acreage Retired c	Total Irrigated Lands Affected d
			1987				1990	
Carbon	64.5	32.4	48.4	80.8	132.1	66.1	99.1	165.2
Emery	44.2	22.1	33.2	55.3	100.6	50.3	75.5	125.8
Sanpete	22.5	11.3	17.0	28.3	23.2	11.7	17.4	29.1
Sevier	33.1	16.6	24.8	41.4	41.9	21.0	31.4	52.4
Total	164.3	82.4	123.4	205.8	297.8	149.1	223.4	372.5
			1995				2000	
Carbon	367.1	183.6	275.4	459.0	454.1	227.1	340.6	567.7
Emery	271.2	135.7	203.4	339.1	314.1	157.1	235.6	392.7
Sanpete	67.4	33.7	50.6	84.3	71.1	35.6	53.4	89.0
Sevier	122.3	62.7	91.7	154.4	130.7	65.4	98.0	163.4
Total	828.0	415.7	621.1	1,036.8	970.0	492.7	727.6	1,212.8

Source: Utah State Office, Bureau of Land Management (BLM, 1982a).

a,b,c Figures based on Analysis Assumptions and Guidelines listed in Chapter Four.

d Total Irrigated Lands converted and/or retired = b+c.

but they include lands that are among the most favorable for agricultural use (Utah Department of Agriculture, 1982). Some prime farmland could be among that converted and retired, unless planning avoided such areas.

About 960 of the 1,373 acres of affected irrigated cropland would be in Carbon and Emery Counties. This would be 1.5 percent of the cropland in the two-county area (Utah Department of Agriculture, 1982). The remaining 413 acre irrigated cropland loss would occur in Sanpete and Sevier Counties, with no significant impacts to the two-county agricultural land base (0.2 percent).

Land changes from irrigated cropland to community use and from irrigated cropland to retired cropland would eliminate cattle, sheep, and horse grazing on such land. Due to variability of grazing numbers and season of use on the existing cropland acres, actual AUM losses could not be predicted. Due to the high grazing capacity on such areas, overall losses could be high, i.e., 1 AUM lost for every 5 acres converted. Such losses would significantly affect small operators.

There would be temporary land changes on 1,363 acres (Table 4-69). The following discussion presents the effects of these land changes on existing uses. Some of the effects would be long-term, extending beyond mine life.

Losses of livestock grazing numbers (AUMs) on BLM and FS allotments would be insignificant with a loss of less than 2 percent of the total AUM capacity of any Federal allotment and less than a 2 percent annual reduction on directly affected private surface.

As discussed for Alternative One grazing reductions on BLM and FS allotments and private surface could require corresponding reductions of animal numbers on private off-tract areas.

There would be increased difficulty in moving livestock to and from grazing areas served by Deadman, Coal, Soldier, Dugout, Pace, Rock, and Cottonwood Creek Canyons and in Ferron and Link Canyons. Congestion caused by new developments and increased traffic in these canyons would result in greater hazards of vehicle collisions with migrating livestock.

Subsidence and dewatering of aquifers due to mining operations could reduce or eliminate livestock water sources. The livestock water sources provided by Ivie and Saleratus Creeks could be lost due to subsidence on the Walker Flat tract. Loss of these water sources would necessitate large reductions in grazing numbers on the Saleratus Allotment where there are 1,843 Federal and 325 private AUMs. This loss would be of a temporary nature as the lessee would be required to replace water lost as a result of mining activity.

Energy and Minerals Development

Conflicts could result between the development of the coal tracts and the development and operation of existing leases if there were different lessees involved. These conflicts would mainly involve transportation and utility access.

Oil and gas development could be hampered by underground coal mining. In the Book Cliffs and Emery areas, quantification of the effects are unknown since the area of the tracts has not been sufficiently drilled to determine oil and gas potential. Coal development would be favored over oil and gas development (BLM, 1981a).

In the Wasatch Plateau area, coal exploration and development of coal resources on the North Trough Springs, Castle Valley Ridge, and Trail Mountain tracts could conflict with the oil and gas exploratory well drilling and the development of potential and known oil and gas fields located within the boundaries of the above coal tracts. Quantification of the effects are unknown since information on oil and gas reserves and production potential for the fields has not been published by the companies involved.

Subsidence and surface disturbing operations associated with coal exploration and development on the North Trough Springs tract could damage wellhead facilities and pipelines and curtail gas production.

Rights-of-Way, Special Uses, Other Land Uses

As discussed under Alternative One, adherence to EPA and State water discharge criteria and standards would protect the established beneficial uses of affected streams, including those streams classified as sources for domestic water systems. However, water contamination accidents or periodic system failures at mine locations (such as cited for Huntington Canyon - see Chapter 3 Land Uses) could require that the coal lessees or communities in Carbon and Emery Counties plan and fund new water treatment facilities and measures.

Subsidence within the tracts could degrade the quality and reduce the quantity of water from seven municipal watersheds in Carbon and Emery Counties. Communities deriving domestic water from affected springfed streams would have to upgrade existing treatment facilities and/or develop new water sources. Highway U-31 and the Eccles Canyon road could also be damaged by subsidence on the Gooseberry tract.

Exploration and production activities on the Trail Mountain and Ferron Canyon tracts could disturb the mechanical watershed treatment areas located on portions of these tracts and nullify past erosion control investments.

Land Use Plans, Controls, and Constraints

Federal Plans

All tracts identified in central Utah have been addressed in Federal Land Use plans (see Chapter 1). The Secretary of the Interior would consult with the Secretary of Agriculture for consent to offer tracts located on National Forest Service System lands (43 CFR 3420.4-2). The Secretary of Agriculture's decision would be based on Land and Resource Management plans directed by the National Forest Management Act of 1976. The Manti-LaSal and Fishlake National Forests are scheduled to complete the plans by October 1983. For all other tracts it has been determined that leasing would not conflict with any Federal land use plans if mitigating measures are applied as directed by the surface managing agency.

County Plans

All tract development in central Utah would be in county zones where coal development would be permitted, with the exception of portions of the North Trough Springs, and Castle Valley Ridge tracts. Zoning variances or rezoning for these tracts would have to be approved by Carbon County before mining could proceed.

All coal mine developments would be required to implement county mitigation requirements for protection of other land resources as well as for social and economic concerns (see Chapter 3 for description of county plan concerns). If such measures are applied and met, potential conflicts could be resolved to the satisfaction of the counties.

Socioeconomics

The assumptions pertaining to economic activity described in Alternative One are also applicable to Alternative Three. It should be noted that for Alternative Three in Carbon, Emery, and Sevier Counties, the work force requirements are larger than for Alternative Two. Therefore, cumulative impacts would be greater.

Population, Income, and Employment

Population increases that would result from increased coal mining under Alternative Three would begin in 1987 with 3,010 additional people and reach 17,600 by the year 2000, an 18-percent increase over the baseline projection. The employment increase would range from 1,930 in 1987 to 7,260 by 2000. Population and employment projections for Alternative Three are provided in Table 4-71. Projections of total personal income and per capita income for the four counties are provided in Table 4-72. As in the previous alternatives, the total county projections are based on a weighted average of the baseline projections and the impact projections. Per capita incomes are projected to reach levels from 1 to 8 percent greater than the baseline projections.

Infrastructure

Housing

Carbon County would experience the largest increase in demand for housing under Alternative Three. By the year 2000 1,320 additional single family units, 550 additional mobile homes and 330 additional multi-family units would be necessary to accommodate projected growth. By the year 2000, Emery County would require 960 additional single family units, Sevier County would require 390 additional single family units, and Sanpete County would need 210 additional single family units. Table 4-73 summarizes the projected increases for housing by type for each county. If required housing units are not

TABLE 4-71

CENTRAL UTAH
POPULATION AND EMPLOYMENT
PROJECTIONS BY COUNTY
ALTERNATIVE THREE
1987, 1990, 1995, 2000

County	Population	Total Employment
Carbon		
1987	1,200	790
1990	2,400	1,000
1995	6,600	2,800
2000	8,200	3,200
Emery		
1987	800	180
1990	1,800	370
1995	4,900	1,000
2000	5,700	1,100
Sanpete		
1987	410	340
1990	420	250
1995	1,200	660
2000	1,300	660
Sevier		
1987	600	620
1990	750	890
1995	2,200	2,300
2000	2,400	2,300
Totals year 2000	17,600	7,260

TABLE 4-72

TOTAL PERSONAL INCOME PROJECTIONS BY COUNTY
ALTERNATIVE THREE
1987, 1990, 1995, 2000

County	1987	1990	1995	2000
Carbon				
Total Personal Income ($1,000)	360,393	403,924	499,302	536,759
Total Population (Basline + Impact)	34,031	37,535	43,827	45,832
Per Capita Personal Income	$10,590	$10,761	$11,393	$11,711
Emery				
Total Personal Income ($1,000)	144,111	167,484	225,328	240,469
Total Population (Basline + Impact)	14,893	16,598	19,969	20,392
Per Capita Personal Income	$ 9,676	$10,091	$11,284	$11,792
Sanpete				
Total Personal Income ($1,000)	130,359	144,462	178,622	197,357
Total Population (Basline + Impact)	19,469	20,820	23,049	23,696
Per Capita Personal Income	$ 6,696	$ 6,939	$ 7,750	$ 8,329
Sevier				
Total Personal Income ($1,000)	170,946	214,957	285,358	323,100
Total Population (Basline + Impact)	20,343	22,368	26,292	27,767
Per Capita Personal Income	$ 8,403	$ 9,610	$10,853	$11,636

Note: Figures in this table are in 1980 dollars.

TABLE 4-73

CENTRAL UTAH
HOUSING DEMAND BY TYPE
ALTERNATIVE THREE
1987, 1990, 1995, 2000

County	Single Family Total	Single Family Impact	Multi-Family Total	Multi-Family Impact	Mobile Homes Total	Mobile Homes Impact
Carbon						
1987	6,528	228	1,632	57	2,720	95
1990	7,098	438	1,760	110	1,932	182
1995	8,040	1,140	2,010	285	3,350	475
2000	8,400	1,320	2,100	330	3,500	550
Emery						
1987	2,496	156	624	39	1,040	65
1990	2,760	360	690	90	1,150	150
1995	3,300	840	825	210	1,375	350
2000	3,360	960	840	240	1,400	400
Sanpete						
1987	3,378	78	845	20	1,407	32
1990	3,558	78	890	20	1,482	32
1995	3,864	204	966	51	1,610	85
2000	3,930	210	983	53	1,637	87
Sevier						
1987	3,594	114	899	29	1,497	47
1990	3,798	138	950	35	1,582	57
1995	4,392	372	1,098	93	1,830	155
2000	4,590	390	1,148	98	1,912	162
Total year 2000	20,280	2,880	5,071	721	8,449	1,199
Total additional units (year 2000)	4,800					

available as needed, housing prices could increase to the point of causing personal hardships and the use of substandard housing would also increase.

Education

Projected education growth and needs are identified in Table 4-74. Emery County would experience the largest growth over baseline forecasts. In 1987, 147 additional students would require six new teachers over the baseline forecast. By the year 2000, 37-percent growth would occur representing a need for 66 additional teachers to serve the 1,649 additional school-age children in the district over the baseline needs.

By the year 2000 in the Carbon School District anticipated growth would be 24 percent over baseline forecasts. This would require 94 new teachers to teach the 2,370 additional students.

The Sanpete County School District, while projected to face a growth in the number of students under baseline forecasts, would receive a smaller percentage increase from Alternative Three than Carbon or Emery Counties. By 1987, implementation of this Alternative would add 79 additional students to the baseline forecast of 4,930. Another 317 students would be added by 2000 to the projected baseline of 6,315. Fifteen new teachers would be required beyond the baseline demand of 260 by the year 2000 to instruct a total of 6,884 students in Sanpete County.

In Sevier County the growth rate would increase by approximately 2 percent from the baseline growth forecasts by 1990. Between 1990 and 1995, however, growth over the baseline would increase to 8 percent and widen to 9 percent by the year 2000. At that time 27 additional teachers over the baseline demand for 305 teachers would be necessary to instruct the total 8,323 school-age children in the district.

The quality of education could deteriorate if proper planning and cooperation are not directed toward providing sufficient personnel, equipment, and facilities to keep up with the projected growth in student populations.

Water and Sewer

The Price River Water Improvement District provides water to much of Carbon County, particularly the Price area. The expansion of water rights, storage capacity and distribution lines would be necessary to absorb growth forecasts under Alternative Three. Water needs are found in Table 4-75 and sewer facility needs are identified in Table 4-76.

Sanpete County would experience increases in the demand for water connections in some of its communities. Ephraim would experience growth from a demand for 1,058 water connections in 1987 to 1,248 water connections by the year 2000. Fairview would grow from 420 water connections in 1987 to 554 water connections in the year 2000 while Mt. Pleasant would see demand rise from 914 water connections in 1987 to 1,056 water connections by the year 2000. Demand for

TABLE 4-74

CENTRAL UTAH
IMPACTS ON EDUCATION, HEALTH, AND LAW ENFORCEMENT BY COUNTY
ALTERNATIVE THREE
1987, 1990, 1995, 2000

	1987				1990			
County	Projected Baseline Need	Total Need w/ Impact	Impact	Percent Change a	Projected Baseline Need	Total Need w/ Impact	Impact	Percent Change a
CARBON								
Education								
Students	7,890	8,103	213	3	8,863	9,302	439	5
Teachers	316	324	8	3	355	372	17	5
Health Facilities								
Hospital Beds	66	68	2	3	70	75	5	7
Doctors	18	19	1	6	19	21	2	11
Dentists	16	17	1	6	18	19	1	6
Nurses	66	68	2	3	70	75	5	7
Clinical Psych[b]	2	2	0	0	2	2	0	0
MSWs[c]	7	7	0	0	7	8	11	14
EMTs[d]	46	48	2	4	49	53	4	8
Ambulances	7	7	0	0	7	8	1	14
Nursing Homes	120	122	2	2	125	130	5	4
Law Enforcement								
Police	66	68	2	3	70	75	5	7
Police Cars	66	68	2	3	70	75	5	7
EMERY								
Education								
Students	3,987	4,127	140	4	4,390	4,720	330	8
Teachers	159	165	6	4	176	189	13	7
Health Facilities								
Hospital Beds	28	30	2	7	30	33	3	10
Doctors	8	8	0	0	8	9	1	13
Dentists	7	7	0	0	7	8	1	14
Nurses	28	30	2	7	30	33	3	10
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	3	3	0	0	3	3	0	0
EMTs[d]	20	21	1	5	21	23	2	10
Ambulances	3	3	0	0	3	3	0	0
Nursing Homes	35	37	2	6	36	40	4	11
Law Enforcement								
Police	28	30	2	7	30	33	3	10
Police	28	30	2	7	30	33	3	10

(continued)

TABLE 4-74 (cont'd.)

County	1995 Projected Baseline Need	1995 Total Need w/ Impact	1995 Impact	1995 Percent Change a	2000 Projected Baseline Need	2000 Total Need w/ Impact	2000 Impact	2000 Percent Change a
CARBON								
Education								
Students	9,889	11,538	1,649	17	9,692	12,062	2,370	24
Teachers	396	462	66	17	388	482	94	24
Health Facilities								
Hospital Beds	74	88	8	11	75	92	17	23
Doctors	20	24	4	20	21	25	4	19
Dentists	19	22	3	16	19	23	4	21
Nurses	75	88	13	17	75	92	17	23
Clinical Psych[b]	2	2	0	0	2	2	0	0
MSWs[c]	7	9	2	29	8	9	1	13
EMTs[d]	52	61	9	17	53	64	9	17
Ambulances	7	9	2	29	8	9	1	13
Nursing Homes	129	141	12	9	129	141	12	9
Law Enforcement								
Police	74	88	8	11	75	92	17	23
Police Cars	74	88	8	11	75	92	17	23
EMERY								
Education								
Students	4,716	5,916	1,224	26	4,459	6,108	1,649	37
Teachers	189	237	48	25	178	244	66	37
Health Facilities								
Hospital Beds	30	40	10	33	30	41	11	37
Doctors	8	11	3	38	8	11	3	38
Dentists	8	10	2	25	7	10	3	43
Nurses	30	40	10	33	30	41	11	37
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	3	4	1	33	3	5	2	67
EMTs[d]	21	28	7	33	21	28	7	33
Ambulances	3	4	1	33	3	5	2	67
Nursing Homes	36	44	8	22	35	43	8	23
Law Enforcement								
Police	30	40	10	33	29	41	12	41
Police Cars	30	40	10	33	29	41	12	41

(continued)

TABLE 4-74 (cont'd.)

County	1987 Projected Baseline Need	1987 Total Need w/ Impact	1987 Impact	1987 Percent Change a	1990 Projected Baseline Need	1990 Total Need w/ Impact	1990 Impact	1990 Percent Change a
SANPETE								
Education								
Students	4,930	5,009	79	2	5,508	5,583	75	1
Teachers	197	200	3	2	220	223	3	1
Health Facilities								
Hospital Beds	38	39	1	3	40	41	1	2
Doctors	10	11	1	10	11	11	0	0
Dentists	10	10	0	0	10	10	0	0
Nurses	38	39	1	3	41	42	1	2
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	4	4	0	0	4	4	0	0
EMTs[d]	27	27	0	0	29	29	0	0
Ambulances	4	4	0	0	4	4	0	0
Nursing Homes	83	84	1	1	82	83	1	1
Law Enforcement								
Police	38	39	1	3	41	42	1	2
Police Cars	38	39	1	3	41	42	1	2
SEVIER								
Education								
Students	5,282	5,398	116	2	6,032	6,167	135	2
Teachers	211	216	5	2	241	247	6	2
Health Facilities								
Hospital Beds	39	41	2	5	43	45	2	5
Doctors	11	11	0	0	12	12	0	0
Dentists	10	10	0	0	11	11	0	0
Nurses	39	41	2	5	43	45	2	5
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	4	4	0	0	4	5	1	25
EMTs[d]	28	28	0	0	30	31	1	3
Ambulances	4	4	0	0	4	4	0	0
Nursing Homes	78	80	2	3	78	80	2	3
Law Enforcement								
Police	40	41	1	3	43	45	2	5
Police Cars	40	41	1	3	43	45	2	5

(continued)

TABLE 4-74 (concluded)

	1995				2000			
	Projected Baseline Need	Total Need w/ Impact	Impact	Percent Change a	Projected Baseline Need	Total Need w/ Impact	Impact	Percent Change a
SANPETE								
Education								
Students	6,315	6,632	317	5	6,501	6,884	383	6
Teachers	253	265	12	5	260	275	15	6
Health Facilities								
Hospital Beds	44	46	2	5	45	47	2	4
Doctors	12	13	1	8	12	13	1	8
Dentists	11	12	1	9	11	12	1	9
Nurses	44	46	2	5	45	47	2	4
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	5	5	0	0	5	5	0	0
EMTs[d]	31	32	1	2	31	33	2	6
Ambulances	4	5	1	25	4	5	1	25
Nursing Homes	78	80	2	3	70	71	1	1
Law Enforcement								
Police	44	46	2	5	45	47	2	4
Police Cars	44	46	2	5	45	47	2	4
SEVIER								
Education								
Students	7,203	7,778	575	8	7,619	8,323	704	9
Teachers	288	311	23	8	305	332	27	9
Health Facilities								
Hospital Beds	48	53	5	10	51	56	5	10
Doctors	13	14	1	8	14	15	1	7
Dentists	12	13	1	8	13	14	1	8
Nurses	48	53	5	10	51	56	5	10
Clinical Psych[b]	1	1	0	0	1	1	0	0
MSWs[c]	5	5	0	0	5	6	1	20
EMTs[d]	34	37	3	9	36	39	3	8
Ambulances	5	7	2	40	5	7	2	40
Nursing Homes	77	81	4	5	71	75	4	6
Law Enforcement								
Police	48	53	5	10	51	56	5	10
Police Cars	48	53	5	10	51	56	5	10

[a] Percent Change: Change from Projected Baseline Need to Total Need with Impact.
[b] Clinical Psych: Clinical Psychologist.
[c] MSW: A person with a Master's Degree in Social Work.
[d] EMT: Emergency Medical Technician.

TABLE 4-75

CENTRAL UTAH
PROJECTED DEMAND FOR WATER CONNECTIONS BY COMMUNITY
ALTERNATIVE THREE
1987, 1990, 1995, 2000

	1987		1990		1995		2000	
County	Total	Impact	Total	Impact	Total	Impact	Total	Impact
Carbon								
East Carbon	558	7	551	15	567	38	557	43
Helper	1,236	46	1,283	59	1,390	145	1,422	161
Hiawatha	82	0	81	0	78	0	79	0
Price	4,786	19	5,523	398	6,492	1,025	6,934	1,246
Scofield	43	0	44	0	46	0	47	0
Sunnyside	176	3	174	5	178	12	176	14
Wellington	817	53	926	110	1,144	284	1,228	345
Emery								
Castle Dale	792	48	895	109	1,075	271	1,098	309
Cleveland	171	8	186	19	214	46	218	53
Elmo	106	6	114	12	134	31	136	35
Emery	147	22	174	44	240	108	250	119
Ferron	679	100	803	202	1,106	497	1,152	548
Huntington	844	34	891	78	998	194	1,010	221
Orangeville	562	34	620	78	740	194	756	220
Sanpete								
Centerfield	256	1	259	1	278	1	283	1
Ephraim	1,058	2	1,117	2	1,187	2	1,248	2
Fairview	420	30	492	30	550	80	554	83
Fountain Green	212	2	212	2	215	6	215	6
Gunnison	505	2	534	2	554	2	561	2
Manti	783	1	826	1	879	2	925	2
Moroni	372	6	391	6	407	16	410	17
Mt. Pleasant	914	27	985	27	1,051	72	1,056	75
Spring City	250	6	262	5	275	14	277	15
Wales	50	1	52	1	54	2	54	2
Sevier								
Aurora	352	22	373	24	430	63	445	65
Redmond	248	14	263	16	301	41	311	42
Richfield	2,500	98	2,706	127	3,148	347	3,219	362
Salina	812	60	860	64	1,008	171	1,042	175

Note: Numbers indicate total demand for water connections, baseline plus impact.

NA - Information not available.

TABLE 4-76

CENTRAL UTAH
PROJECTED CAPACITY FOR WASTEWATER TREATMENT FACILITIES BY COMMUNITY
(GALLONS PER DAY)
ALTERNATIVE THREE
1987, 1990, 1995, 2000

County	1987 Total	1987 Impact	1990 Total	1990 Impact	1995 Total	1995 Impact	2000 Total	2000 Impact
Carbon								
East Carbon	174,700	2,300	175,300	5,000	184,300	13,500	180,100	15,600
Helper	386,500	14,100	408,200	19,100	453,300	51,200	462,100	58,700
Hiawatha	25,700	0	25,700	0	25,100	0	25,400	0
Price	1,550,600	58,400	1,759,500	129,600	2,128,900	363,000	2,275,100	454,900
Schofield	13,500	3,000	14,000	0	14,800	0	15,000	0
Sunnyside	55,000	800	55,200	1,600	58,100	4,400	56,700	5,000
Wellington	255,400	16,200	295,300	35,900	378,200	100,500	408,700	126,000
Emery								
Castle Dale	282,500	14,700	323,000	35,400	393,400	95,900	402,400	112,700
Cleveland	61,000	2,500	67,200	6,100	78,500	16,400	79,800	19,300
Elmo	37,700	1,700	41,500	4,000	49,200	11,000	50,100	12,900
Emery	51,800	6,700	61,900	14,200	86,800	38,100	91,300	43,300
Ferron	239,300	30,800	285,800	65,800	400,900	175,700	421,700	200,200
Huntington	302,200	10,500	322,900	25,300	365,900	68,500	370,100	80,500
Orangeville	200,500	10,500	223,800	25,300	270,400	68,500	277,100	80,500
Sanpete								
Centerfield	91,300	3,400	97,200	3,600	110,100	10,300	112,800	11,000
Ephraim	366,600	4,100	393,200	3,800	438,700	56,500	461,000	11,300
Fairview	143,500	9,400	171,100	9,800	197,500	28,400	200,200	30,300
Fountain Green	72,900	700	73,800	800	77,400	2,200	77,800	2,300
Gunnison	179,100	5,800	192,000	6,200	216,800	17,700	341,700	140,000
Manti	271,100	2,700	290,800	2,600	323,800	7,600	340,500	7,600
Moroni	127,600	1,900	136,400	2,000	146,700	5,800	147,800	6,200
Mt. Pleasant	313,400	8,400	343,600	8,800	377,800	25,500	381,200	27,200
Spring City	85,500	1,700	91,400	1,800	99,100	5,100	99,800	5,400
Wales	17,000	200	18,200	300	19,400	700	19,700	800
Sevier								
Aurora	120,100	6,800	130,500	7,800	155,000	22,400	161,800	23,700
Redmond	84,600	4,400	92,000	5,100	108,500	14,600	113,300	15,500
Richfield	853,300	30,100	948,100	41,500	1,134,300	122,900	1,205,300	132,300
Salina	276,600	18,400	300,700	21,000	362,500	60,300	378,600	63,900

Total is baseline plus impact.

sewer capacity would also increase significantly throughout the communities of Sanpete County, particularly in the communities of Gunnison, Ephraim, and Manti.

Water for culinary and industrial purposes in Sevier County would not pose any immediate constraint under Alternative Three. All of the potentially impacted cities have both adequate flow and adequate supply, however, Richfield is experiencing deficiencies in storage capacity. Richfield would see the growth in the total demand for water connections from the existing 1,902 connections to 4,303 by the year 2000. The water source for the city comes from one well and one underground spring. The water rights are more than adequate to meet present demand.

None of the potentially impacted communities with the exception of Richfield and Salina have wastewater treatment facilities. Salina is approaching the system's maximum capacity.

Public Safety

The impact on law enforcement services would be similar for Emery and Sanpete Counties to that discussed under Alternative Two. Carbon County, however, would experience a 23-percent increase for law enforcement services over baseline demand by the year 2000. Sevier County would also experience a slightly larger increase in demand for police services (10 percent) by the year 2000. Table 4-74 details the increases necessary to accommodate projected growth. Failure to provide adequate law enforcement capability could result in increases in the instances and severity of illegal activities in affected areas.

Health care needs are identified in Table 4-74. Carbon and Emery Counties are currently served by the 70-bed Castleview Hospital in Price. By 1987 the total of new bed demand would be 98 although only four beds would be a direct result of Alternative Three. By the year 2000, 28 additional beds would be required over a baseline demand of 105 beds.

By the year 2000, mental health staff would need to increase by three over the baseline demand of 14 in the Carbon/Emery areas. Three additional ambulances would also be required as a result of this alternative, one in Carbon County and two in Emery County.

Sanpete County would need only two additional hospital beds to handle the demand under Alternative Three through the year 2000, in addition to one more doctor, one dentist, and two nurses.

Sevier County would need a total of five additional hospital beds by the year 2000. In addition, one new doctor and one dentist would be necessary to meet the demand created by Alternative Three by the year 2000. Two additional ambulances and three EMTs would also be required.

Although some expansion will be necessary in the number of volunteer fire-fighting staff and perhaps some additional equipment in general, there would be only a limited impact on the fire protection abilities of all the communities in the study area under Alternative Three with the exception of Price and Richfield. Price would need a full-time fire-fighting staff of ten by 1990. An additional two people could be necessary the the year 2000. Richfield would need a full-time fire-fighting staff of six or seven by the year 2000. Inadequate fire protection capability would result in increased risk of personal injury or death and property damage.

Solid Waste

All impacted communities in Carbon, Emery, Sevier, and Sanpete Counties should have adequate disposal space for the additional solid waste generated by Alternative Three.

Social/Attitudes

The attitude of residents of the four-county area toward additional coal development in the future cannot be accurately predicted because social and political attitudes toward growth change in response to economic conditions. When employment is high, additional growth is generally opposed, but during periods of high unemployment economic development is promoted.

The projected population growth in Carbon and Emery Counties could change the social and political structure of communities. Because of the present cultural diversity of Carbon County, changes in social and political structure would probably be acceptable to long-time residents. However, in Emery County where there is a more homogeneous culture, the introduction of cultural diversity associated with growth in the coal industry may be opposed by the present residents.

The lifestyles of Sanpete and Sevier Counties would not be disrupted by the projected coal related population growth and the creation of new jobs would be acceptable to local residents.

Transportation

Table 4-77 shows predicted increases in traffic due to development of the 18 central Utah tracts. Vehicles per day would increase by over 12,700 by the year 2000. Increased traffic would require increased road maintenance throughout the area and there would be an increased but unquantified number of traffic accidents. If road improvements are implemented as needed (see Alternative Four), the accident rate should remain typically low. The traffic increases and patterns would be as discussed for Alternative One with the largest increases in traffic occurring on Highway U-10 from Price southward to Castle Dale and on US 6 from Castle Gate to Price. There would be moderate increases in traffic due to mining, increases in traffic jams in Price due to increased railroad activity, and increases in traffic accidents due to increased congestion.

TABLE 4-77

CENTRAL UTAH
MAXIMUM INCREASES IN TRAFFIC AND VEHICLE USE
ALTERNATIVE THREE

Feature	Coal Trucks	Service Trucks	Commuters	Other Trucks	Other Cars	Totals
Max. Vehicles/day	2,440	522	5,863	406	3,498	12,729
Total Million Miles[a]	322	220	2,070	32	248	2,892
Total Mi. Gals. Fuel[a]	80	41	81	6	9	217
Total Vehicles Lives[a]	322	439	20,706	64	2,486	24,012

a. Within area of influence only. Travel outside this area is not included.

Service trucks, coal trucks, and commuter traffic would add over 12,700 vehicles per day to the roads of the area, travel over 2.8 billion miles over the lifetimes of the mines, consume nearly 217 million gallons of fuel, and wear out nearly 24,000 vehicles, mainly family-type vehicles.

Cultural Resources

As described for Alternative One, exploration and construction of surface facilities for underground mining could inadvertently disturb or destroy historic and prehistoric cultural resources. The majority of such effects could be avoided by proper placement of facilities and by salvage excavation. The total number and significance of the affected sites is unknown.

The extent of cultural resource disturbance that would result from mine-related community expansion and recreational activity is unknown.

Both scientific and aesthetic site values would be lost as a result of these indirect impacts. This loss would occur to many on- and offsite significant cultural resources in Carbon, Emery, Sanpete, and Sevier Counties.

Recreation

By the year 2000, mining-related population growth would increase the local demand (users originating from within the four-county region) for both dispersed and developed recreation opportunities in the four-county region by approximately 25 percent from 1982 use figures and by approximately 18 percent over the use figures projected for year 2000.

Table 4-78 and Table 4-79 show the anticipated increases in demand for hunting, fishing, and ORV activity, respectively, during the life of the mining operation. Increased demand for dispersed activities as well as increased use of developed recreation sites and urban facilities, would result in impacts similar in type, extent, and degree to those identified in Alternatives One and Two. In summary, the additional competition for fish and game would lead to less hunter and fisherman success or restricted harvests. Increased ORV use would increase ORV conflicts with other recreational uses. Overuse of developed campgrounds, picnic areas, playfields, swimming pools, and golf courses would result in continued deterioration of existing facilities, user dissatisfaction, and additional recreation pressures on undeveloped areas including the presently overused San Rafael/Buckskin Draw area. Federal, State, and local governments would be under stress to provide recreation facilities to meet minimum standards recommended by UORA (1978).

Development of the tracts and of homesites would displace dispersed recreational use from as much as 419 acres by 1987, 1531 acres by 1990, 2,098 acres by 1995, and 2,263 acres by the year 2000. As in Alternatives One and Two, because surrounding areas offer comparable or better opportunities, loss of recreational opportunities from displacement would be minimal.

TABLE 4-78

PROJECTED INCREASE IN LOCAL HUNTER AND FISHERMAN DEMAND WITHIN THE FOUR-COUNTY REGION
ALTERNATIVE THREE

	Projected Annual Increase in Numbers							
Year	Coal-Related Population	Deer Hunters	Elk Hunters	Upland Game/ Waterfowl Hunters	Fishermen	Increased Demand for Fish	Overall Percent Increase from 1982	Overall Percent Increase from Projected Baseline
1987	3,010	542	60	271	1,354	40,620	4	4
1990	5,370	967	107	483	2,415	72,450	8	6
1995	14,900	2,682	298	1,341	6,700	201,000	21	15
2000	17,600	3,168	352	1,584	7,915	237,450	25	18

Note: Projections were made assuming that the percentage of Utah's population that currently hunts or fishes would remain the same, and that the Utah percentage can be applied to the four-county area. Approximately 18 percent of Utah's population hunt deer, approximately 2 percent hunt elk, approximately 9 percent hunt upland game or waterfowl. Approximately 53 percent of Utah's population under the age of 12 and 42 percent of the population over the age of 12 fish. Approximately 27 percent of Utah's population is under 12 and 73 percent is over 12 in age (Thayne and Hudson, 1978). An average of 30 fish per person per year were caught in 1977 (UDWR, 1978).

TABLE 4-79

PROJECTED INCREASE IN LOCAL OFF-ROAD VEHICLE DEMAND WITHIN THE FOUR-COUNTY REGION
ALTERNATIVE THREE

Year	Projected Coal-Related Population Increase	Projected Increase in Pickup and Four-Wheel Drive Numbers	Projected Increase in Motorcycle Numbers	Overall Percent Increase from 1982	Overall Percent Increase from Projected Baseline
1987	3,010	752	211	4	4
1990	5,370	1,343	376	8	6
1995	14,900	3,725	1,043	21	15
2000	17,600	4,400	1,232	25	18

Note: Projections were made assuming that the percentage of the population in the four-county region that owns off-road vehicles would remain the same (approximately 7 percent of the population currently owns motorcycles, and approximately 25 percent of the population currently owns four-wheel drive vehicles or light pickups) (UORA, 1978).

Although an unquantified amount of existing roads would be lost from use for recreational access, the 196 miles of road that would be improved or constructed for mining purposes would also improve accessibility for dispersed recreation.

Impacts to recreational traffic on the Myton, Coal Creek, Dugout Creek, Eccles Canyon, Huntington Canyon, Straight Canyon, Cottonwood Canyon, and Ferron Canyon roads would be the same as were identified in Alternative One (i.e., increase in danger, stress, and visitor dissatisfaction). Visual and audio impacts from development of the Trail Mountain and Gooseberry tracts would be the same as Alternative One.

As in Alternative One, upgrading of the Ferron Canyon road would likely result in destruction of the Ferron Canyon Picnic Area. Should this happen, the approximately 803 annual visitor days the site receives would be displaced to other developed sites as well as to dispersed areas. Because of the small number of visitor days involved, impacts resulting from displaced visitor use would probably not be noticeable.

As in Alternative One, the loss in range of scenic vistas viewed from overlooks in Canyonlands and Capital Reef National Parks (identified in the Air Quality Section of this document) may at times be perceptible to some Park visitors, reducing the quality of their recreational experience.

Visual Resources

Visual impacts identified in Alternative One as specifically occurring from development of the Blue Trail Canyon and Mud Creek tracts would not occur under this Alternative. Otherwise, impacts identified both on a specific and regional basis would be the same as identified under Alternative One. A summary follows.

Structures and surface disturbance from development of the Gooseberry tract would degrade the natural appearing vistas seen from Utah Highway 31 and from several recreation attractions. Structures and surface disturbance from development of the Trail Mountain tract would dominate the landscape as viewed from the Cottonwood Canyon road and Utah Highway 29. Visual resource management objectives would not be met in either area during the life of the mining operation.

In development of Soldier Creek, Whitmore Park, Alkali Creek, Ferron Canyon, and Ivie Creek tracts, careful placement of exploration roads, drill pads, and ventilation shafts to avoid unnecessary disturbance and high visibility from the Myton road, Ferron Canyon road, and I-70, respectively, may prevent what would otherwise be temporary degradation of visual quality and probable conflict with the VRM objectives for these tracts. Realignment of the Ferron Canyon road would result in temporary conflict with the partial retention objectives during the construction period.

Overall, no unique or outstanding scenic qualities would be lost from development of the tracts and reclamation would be effective in reestablishing the present scenic quality and character of the Wasatch Plateau and Book Cliff tracts within 10 years of completion of the mining operations. This, together with the fact that most mining activities would occur away from major travel routes, would result in the average visitor noting little change in the region's overall scenic character from development and reclamation of the tracts.

Special Designation Areas

Mining activities including new mines and transportation routes would not directly impact any special designation area. However, the increase in local recreational demand could result in increased ORV and other dispersed use of some of the 17 areas within the four-county region with special designation or potential for special designation. The more intensive use and resultant littering and vandalism would tend to degrade values for which the areas are being protected and/or reviewed. Although not quantifiable, the degree of impact would be similar in extent and intensity to Alternative One. Agencies managing the lands may be under stress to protect special values. However, due to the temporary nature of impacts resulting from dispersed recreational use, it is extremely unlikely even in a worst case situation that possible degradation would affect the suitability of any area for special designation.

Unavoidable Adverse Impacts

Three areas near Price, Castle Dale, and Mt. Pleasant, Utah, and two areas near Delta and Cedaredge, Colorado, would exceed the primary NAAQS for TSP. An average increase in annual TSP emissions of 7.7 percent over 1982 levels and 5.5 percent over the projected baseline would be expected in these areas by the year 2000. Secondary NAAQS would be exceeded in a 2,605 square mile area by the year 2000, of which 1,035 square miles would be attributed to implementation of Alternative Three. The greatest contribution to the predicted concentrations would be coal related vehicular travel on unpaved roads. No significant visibility impacts as viewed from National Parks would be anticipated. Visual impacts would be noticeable from many roads and highways often used for recreation purposes; however, the most significant impact to visual range would result from increased populations in towns and cities.

The loss of soil and vegetation productivity on 3,283 acres would be unavoidable. Approximately 1,373 acres would be eventually reclaimed following mining operations. The remaining 1,910 acres lost to community development would not be reclaimed. An unquantified amount of soil would be lost from disturbed areas prior to reclamation. The mining of coal in the region would result in 1,787.5 million tons of coal (60 percent) becoming unrecoverable by present technology. Changes in aquifers such as redistribution of ground water discharge and distribution of surface water due to subsidence could not be avoided. Community use of water in the region would increase by 4,855 acre-feet by the year 2000. An additional 363 acre-feet would be required annually for mine development.

In affected drainage basins, tract development would result in a total sediment yield of approximately 32 acre-feet annually by the year 2000. Sediment from tracts in the Wasatch Plateau could end up in local reservoirs important as fisheries and community water sources. Over 58,692 acres would be susceptible to subsidence of up to 16 feet. The loss of wildlife due to occupation, disturbance of habitat, and illegal killing would increase. Highway mortality, mostly in central Utah, would be in excess of 170 deer and elk annually and would be unavoidable; however, herd vitality should not be affected. An unquantified amount of big game habitat including winter range and calving grounds would be lost. Regionwide the loss would be insignificant although in some specific areas, big game populations would be reduced as a result.

Conversion of irrigated cropland to urban use and retirement of irrigated land to provide water for mining and community needs would result in a loss of less than 1 percent (approximately 1,375 acres) of agricultural land in the region.

Portions of two tracts on the Wasatch Plateau lie within Carbon County's land use zone where coal mining is not allowed. Zoning variances or rezoning would be necessary before mining could proceed.

Population in the region would increase by 19,765 persons or 14 percent over the projected baseline by the year 2000. Housing needs would increase by over 4,500 units. Employment in the region would increase by 7,842 jobs or 14 percent over the projected baseline by the year 2000. Capital and operating expenditure requirements of local counties, school districts, and municipalities would rise as a result of the need to expand public services and facilities. Unless communities plan needed improvements in advance and ensure adequate funding, there would be at least a temporary deterioration in the quality of services, causing inconvenience and dissatisfaction among those affected. These impacts would be most acute in central Utah.

Mine-related traffic would add over 13,500 vpd (15 percent increase) to highways in the region, over 12,700 of which would occur in the central Utah area. The largest increase in traffic would occur on Highway U-10 south of Price, Utah, and US-6 east of Price where travel limits would be exceeded. Traffic congestion in downtown Price would result from increased numbers of vehicles and increased numbers of coal trains going through the community. Unpaved secondary roads in the region would experience deterioration and safety problems due to increased coal related traffic.

Inadvertent destruction or disturbance of undetected cultural and paleontological resources and losses through illegal collection or vandalism could not be avoided. The increase in demand for recreational activities over the projected baseline resulting from population increases (18 percent in central Utah and an undetermined but slight amount in west-central Colorado) could result in an undetermined amount of overutilization and crowding of existing recreation developments and reduced hunting and fishing success. The landscape modifications that would result from mining and associated development would degrade the visual quality of those areas, in some areas, VRM standards would not be met.

The Relationship Between Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The increased population associated with mining development would result in a long-term decrease in air quality in the region.

Implementation of Alternative Three would significantly increase coal production in the region from 13 million tons in 1980 to about 48 million tons by the year 2000. Average annual production from the tracts alone would be 15.16 million tons when full production is reached. This would represent a significant commitment to coal mining in the region.

The short-term use of the environment for coal production and associated housing development would result in a long-term loss of soil and vegetation productivity on 1,910 acres permanently occupied by housing and retired from irrigation to provide water for community needs.

The extraction of 528.7 million tons of coal (40 percent) would render the remaining unmined 787.5 million tons of coal (60 percent) unrecoverable over the long term. Changes in aquifers and points of surface discharge due to subsidence would result in a long-term local change in surface water distribution and ground water storage. The short-term community and mining use of 5,218 acre-feet of water per year would be reduced by 363 acre-feet when mining ceases. The use of 4,855 acre-feet per year for community use would continue in the long term. Over the long-term, salinity at Imperial Dam would actually be reduced as water normally used for irrigation and returned to the system would be used for community development. This would more than offset salinity produced by active mining operations. Overall, the cumulative effect would be less than 1 percent.

Disturbance or occupation of habitat up to 40 years by mining activity would result in a long-term redistribution of wildlife populations and migration routes. Permanent occupation of 1,375 acres by urban development would cause a long-term loss of wildlife habitat occupied by pheasants, cottontail rabbits, mourning doves, and other small game. The loss of crop production on 535 acres occupied by housing and 840 acres retired due to conversion of water use would be a long-term loss in productivity.

The growth in population of 19,765 people in the region (14 percent over the projected baseline) would increase the area's potential productivity by enlarging its labor force, but the 7,842 jobs (14 percent over the projected baseline) associated with Federal lease mining would not continue in the long-term. Infrastructure improvement such as water systems would also contribute to increased community capacity by providing facilities useful for commerce and industry as well as the residential population. However, until these improvements are operational, deficiencies in community services could be expected.

Excavation and salvage of sites would expand knowledge of cultural resources in the region. The development of recreational facilities as a result of demand by the increased population would be a long-term increase in capacity of recreation developments in the region.

Irretrievable or Irreversible Commitment of Resources

Emissions attributable to coal related population growth and mining activity in the region would result in an irretrievable deterioration in air quality during the life of the mining operations. Soil and vegetation productivity on 3,283 acres would be irretrievably lost for the life of the mines. Productivity on 1,910 acres occupied by housing or retired from irrigation would be irreversibly lost. Soil lost to wind and water erosion prior to reclamation would be irretrievable.

The 528.7 million tons of coal mined would be irreversibly lost as a resource and the 787.5 million tons of coal left in the ground would be irreversibly unrecoverable by present technology. Increased water consumption for mining and community needs would be irretrievable. Any change in aquifers, ground water storage potential, or point of discharge due to subsidence would be irreversible. The increased consumptive use of water for community and mining use (4,991 acre-feet per year) would be irreversible.

Big game losses through displacement from habitat, traffic mortality, or illegal killing would be irretrievable. Despite increased losses of individual animals, vitality of the individual herds would be expected to be maintained. Habitat for pheasants, cottontail rabbits, mourning doves, and other small game occupied by community development would also be irreversibly lost; however, this would be insignificant on a regionwide basis and overall population vitality would be maintained.

The growth in population of 19,765 persons foreseen under this alternative would be irreversible except at considerable economic and human cost. Likewise, the commitment of capital, physical resources, and labor to build over 5,000 housing units and infrastructure that would be required to support the growth in population, commerce, and industry would be an irretrievable impact. The loss of smalltown atmosphere and community solidarity in some communities as a consequence of coal development would be irreversible.

Development of the coal mines as proposed would result in the irretrievable consumption of over 217 million gallons of petroleum fuels.

The loss of cultural and paleontological resources in context would be irretrievable and any loss of interpretive values would be irreversible. The adverse impacts to visual resources would be irretrievable for the life of the mines, but in most cases would be reversible following reclamation.

Significant Cumulative Impacts

The cumulative impact assessment was developed by adding the impacts of Alternataive Three to those of the baseline (Alternative Four) for the year 2000. Only the most significant in central Utah are summarized below. On a Uinta-Southwestern Utah Coal Region basis, this alternative would have less impact than Alternatives One and Two because no mining would take place in southern Utah or west-central Colorado. However, in central Utah the impacts would be similar to those described for Alternatives One and Two.

Central Utah

By the year 2000, in central Utah there could be an 89 percent increase in TSP emissions over the 1981 emission levels. There could be approximately 2,235-square mile or 1,396-percent increase in area where the secondary NAAQS for TSP would be exceeded. About 43 percent of the increase would be attributable to Alternative Three.

Visual range from selected points in Canyonlands and Capitol Reef National Parks would be reduced by six to about 64 percent during 1 percent of the time. Such reductions could be perceptible to park visitors. Also, during 1 percent of the time a plume may be visible looking from Cathedral Valley in Capitol Reef National Park to the San Rafael Swell. About 21 to 24 percent of the reduction would result from Alternative Three.

Community development resulting from mining would result in a permanent loss of soil productivity on about 2,670 acres by the year 2000. Approximately 970 acres or 36 percent of the loss would be attributable to Alternative Three.

Up to 122,435 additional acres of surface would be subject to subsidence of which 42 percent would be affected by Alternative Three. A maximum subsidence of 16 feet with surface fractures could result.

An estimated 12,453 acre-feet of water would be required by the year 2000 for coal development and selected population growth of which 37 percent would be required by Alternative Three. About 6,396 acre-feet of water would be consumptively used. This is about 0.44 percent of Utah's share of Colorado River water.

Projected mining activities would disrupt local aquifers, alter local ground water flow systems and cause redistribution of natural ground water flow systems. These impacts are not quantifiable but about 191 additional square miles would be subject to mining.

The four-county population would increase from 69,598 in 1982 to 117,800 in 2000, an 69 percent increase. Alternative Three would contribute about 17,600 people or 37 percent of the increase. Corresponding increases in hunters, fishermen, and ORV use can be expected. The presence of a larger human population would exert greater pressures on wildlife populations through legal and illegal harvest, harassment, and displacement from habitat.

Cumulative loss of pheasant habitat would be insignificant on a regional basis but locally a 12 percent reduction in cock harvest could result in Carbon County.

Irrigated cropland lost as a result of community expansion and retired due to use of water for community purposes would be about 3,338 acres or 1.4 percent of the four-county agricultural land base. About 1,213 acres or 36 percent of the affected acreage would result from Alternative Three. The retired lands would be among the most favorable for agricultural use in the four-county region.

By the year 2000 the four-county population would increase approximately 69 percent over the 1982 level which would lead to similar increases in the demand for housing, water connections, and other community infrastructural services. Front-end financing of these services would be a major problem and the quality of community could deteriorate.

Traffic congestion would occur on U-10 between Price and Castle Dale, and on US-6 across Soldier Summit. Severe traffic congestion would occur in downtown Price as incresed numbers of vehicles would be blocked by increased numbers of coal trains. Alternative Three would contribute to an already poor situation. Nearly all highways affected by proposed coal development are approaching or have already exceeded the 200-year design traffic volume and the need for maintenance would increase.

By the year 2000 total population growth would increase the local recreational demand by approximately 69 percent over 1982 levels. By itself, Alternative Three would increase the demand by only 18 percent. Such increases would result in overcrowding, user dissatisfaction, and deterioration of the environmen at many sites in the four-county region.

Because of large increases in population, overcrowded conditions and user dissatisfaction at recreational facilities in towns and cities would also accelerate.

Alternative Four: No Action (No Competitive Federal Leasing)

Introduction

Alternative Four, the No Action Alternative, would consist of no leasing or production of coal from any of the 27 tracts discussed in this EIS. However, as discussed in Chapter 2, the Uinta-Southwestern Utah Region would continue to be an active coal producing area. Present and projected coal production would continue from existing Federal and State leases and private lands. The State of Utah projects an annual production rate of 21.6 million tons by 1990 and through the year 2000. This coal would come from central Utah with no production anticipated from southern Utah coal fields. An annual production rate of 24 million tons by 1990 analyzed in the Final Environmental Statement, Development of Coal Resources in Central Utah (GS, 1979), is applicable for this baseline analysis and provides the majority of the analysis for this Alternative. For certain resources, additional data have been obtained and included in this analysis. BLM projects a 17.0 million ton coal production rate for west-central Colorado by 1990 increasing only slightly to 17.3 million tons by the year 2000. This projection is detailed in an environmental assessment prepared in support of this EIS by BLM's Uncompahgre Area Office in Montrose, Colorado. These analyses are used as the baseline for the projection of further impacts from additional coal leasing proposed in the other alternatives. The following is a summary of the analyses as contained in the previously mentioned ES and environmental assessment. For a more detailed discussion of impacts, the reader is referred to those documents.

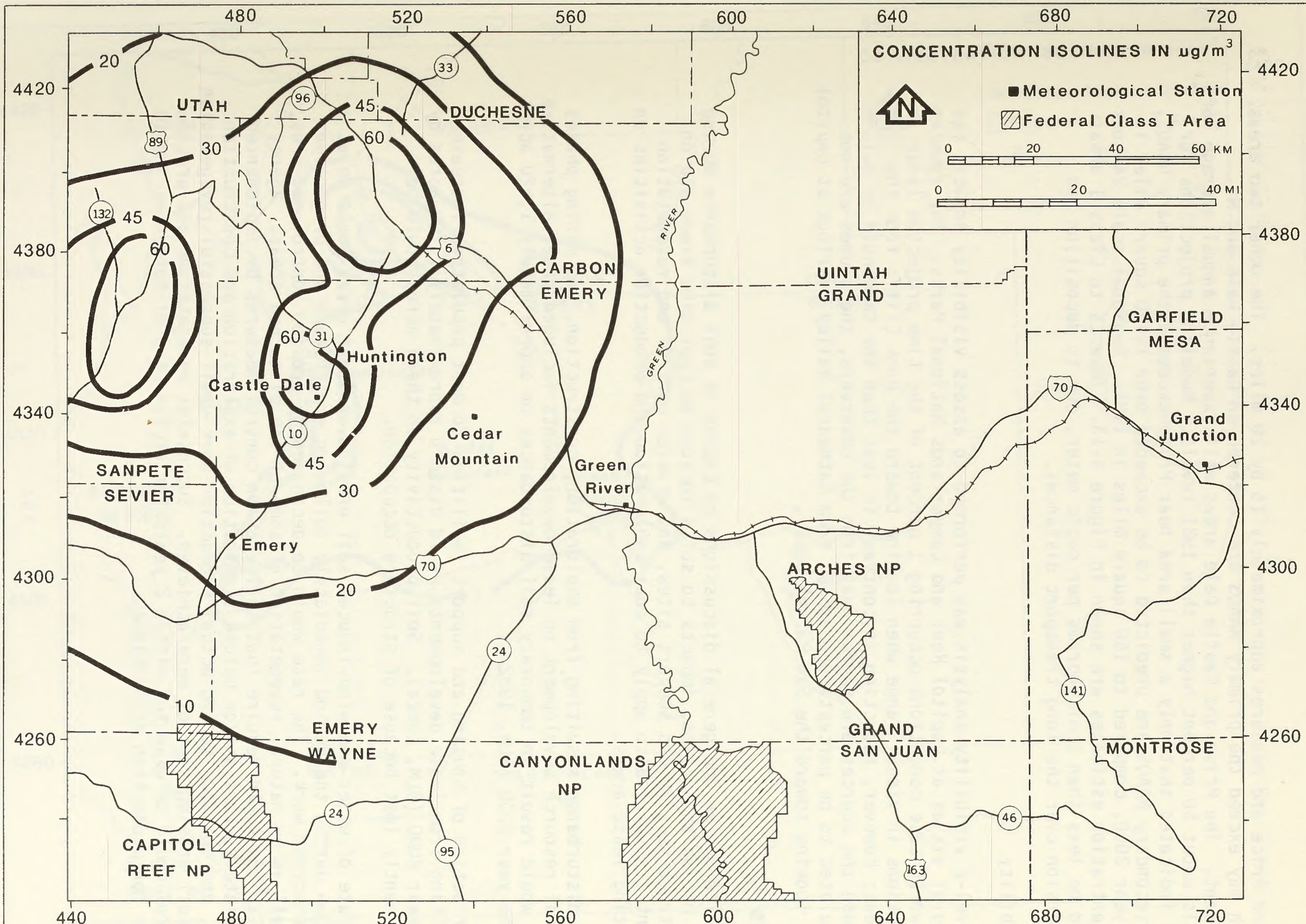
Central Utah

Climate, Air Quality

Air Quality Standards

Pollutant emissions for the year 2000 were calculated for all NAAQS criteria pollutants. Particulate, sulfur dioxide, and nitrogen oxides emission will increase with time due to population growth and new industrial sources. Carbon monoxide and hydrocarbon emissions are calculated to decrease slightly between now and the year 2000 due to more stringent vehicle emission controls. Overall, by the year 2000, TSP emissions are estimated to increase from 111,981 tpy in 1982 to 204,273 tpy by the year 2000, an increase of 92,292 tpy (82 percent).

Annual average concentration estimates are shown in Figure 4-12. A background of 15 micrograms per cubic meter should be added to the annual average concentrations shown. As a result of growth in population and industrial activity, TSP concentrations are expected to increase significantly. Three areas may potentially exceed the primary NAAQS. The largest is centered



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 4-12

ANNUAL AVERAGE TSP CONCENTRATIONS IN CENTRAL UTAH - YEAR 2000 around Price and measures approximately 15 by 20 miles. The other two areas which may exceed the primary NAAQS are centered on Castle Dale and Mt. Pleasant. The Price and Castle Dale areas will experience annual average TSP levels about 50 percent higher than 1981 levels. Modeling projections for 1981 indicated that only a small area near Price exceeded the primary NAAQS. The secondary NAAQS are predicted to be exceeded over 1,430 square miles in the year 2000, compared to 160 square miles in 1981. Regional scale 24-hour concentration estimates are shown in Figure 4-13. Impacts to Class I areas would be less than 1 micrograms per cubic meter, due to deposition and dispersion over the long transport distances.

Visibility

A level-2 visibility analysis was performed to assess visibility impacts for integral vistas at Capitol Reef and Canyonlands National Parks. The results for worst case conditions occurring 1 percent of the time projected large reductions in visual range when looking toward the Book Cliffs from the Class I areas; however, reduction in contrast is less than the threshold of 0.1. Because the sources are so far away from the observers, the plumes are not calculated to be perceptible, except from Cathedral Valley overlook at Capitol Reef looking toward the San Rafael Swell.

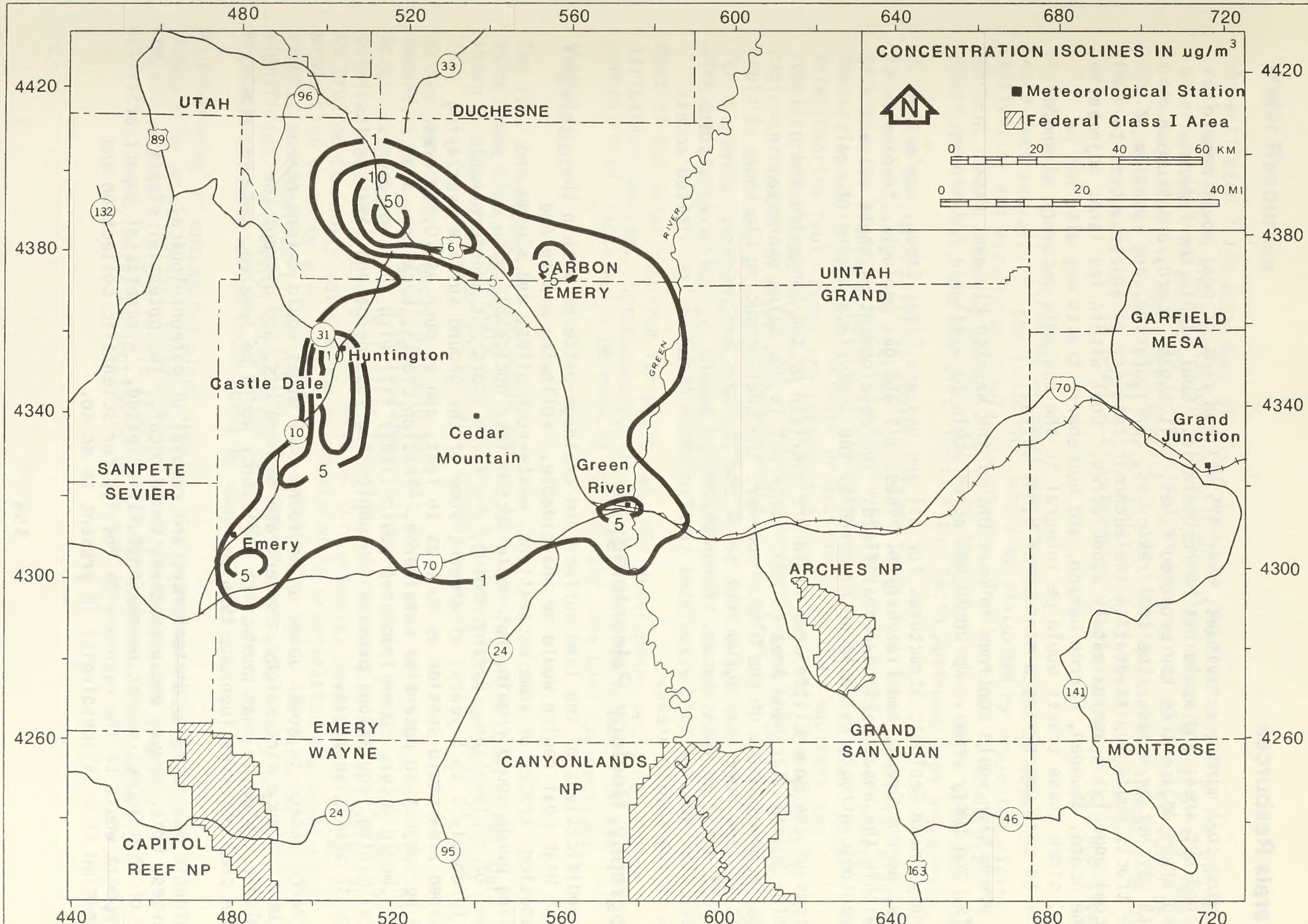
Soils

The Alternative One general discussions on causes of soil disturbance during coal mining activities, impacts to soils located on coal mine areas and on off-tract housing and support sites, and erosion control and revegetation potentials would also apply to coal exploration and production activities on existing lease areas.

Land disturbance resulting from exploration, construction, and mining phases of coal resource development on lease developments included under Alternative Four would result in temporary soil disturbances on approximately 1,620 acres by the year 2000 (BLM, 1982a).

Construction of housing and support facilities to meet population increases resulting from lease developments would disturb approximately 1,700 acres by the year 2000 (BLM, 1982a). Soil productivity on these acres would be permanently lost because of structure occupation.

The rate of water and wind-induced soil erosion on lease areas would be at a maximum during the period immediately following exploration and production construction work. The rate would be decreased by erosion control measures, as well as by natural revegetation of some of the disturbed areas. Agency regulations would require that soil erosion control measures be implemented immediately after and/or before termination of exploration and construction work, and continue during actual production work until successful revegetation and soil erosion control were achieved. Successful revegetation and erosion control could be expected within 2 years for exploration disturbances and 10 years for production disturbances.



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 4-13

24-HOUR TSP CONCENTRATIONS IN CENTRAL UTAH - YEAR 2000 (BASELINE)

Minerals Resources

Following coal mining activities, over 475 million tons of coal would remain in mined out areas and would not be recoverable. Coal within the Federal leased areas adjacent to the proposed Pines, Quitchupah, Acord, and Skumpah tracts may not be mined. The coal resources, configuration, and location of these tracts would be integral to the economic recovery of and/or access to the coal underlying approximately 2,660 acres. Coal within fee land, adjacent to the Acord, Skumpah, Ferron Canyon, and Gooseberry tracts may also not be mined, since these tracts would be integral to the economic recovery of and/or access to coal underlying a minimum of 5,540 acres.

Coal production would continue in portions of the Wasatch Plateau, Book Cliffs, and Emery areas. Up to 70,588 acres would be available for mining.

The only Known Geologic Structures for oil and gas are Clear Creek, Joe's Valley, Gordon Creek, and Flat Canyon. These oil and gas geologic structures are within the Wasatch Plateau coal field. The development of these oil and gas geologic structures could be hindered by the subsurface mining of coal.

Portions of the Book Cliffs coal field are overlain by the Sunnyside and Vicinity Special Tar Sand Area (STSA). Interest is now being expressed in extensive development of the STSA. However, the coal producing Blackhawk Formation lies more than 1,200 feet below the tar sand and no direct mining conflicts would be anticipated. An undetermined amount of traffic congestion between coal and tar sand associated traffic would occur on the limited access roads in the mining areas.

Topography, Geology, Paleontology

Some modifications of the land surface and drainage patterns within the central Utah coal region would be unavoidable. Following mining and reclamation, traces of some excavations, waste-rock piles, and sludge and settling ponds would remain, but would become less noticeable with each year because of reclamation. During mining, and for a short but undeterminable time (probably 3 to 5 years) afterward, some of the ground surface overlaying the mined area could subside as much as 16 feet, and as much as 70,588 ares could be subject to potential subsidence. Tension cracks, buckling, and troughs would occur. Open fractures would likely fill with soil and debris. Federal mining regulations provide for monitoring subsidence and limiting its effect in sensitive areas.

Subsidence damage to rocks above underground coal mines would deform other coal beds, reduce mine safety, concentrate methane gas, and disrupt the hydrologic regime so that production efficiency would be lowered, reducing the minable coal reserves (Dunrud, 1976).

Unavoidable destruction, disturbance, and removal of paleontological resources, both exposed and unexposed, would occur. The potential significance of this impact cannot be meaningfully assessed. A beneficial impact of development would be the exposure of fossils for scientific collection and examination if a paleontologist is present to do so.

Water Resources

An estimated 7,798 acre-feet of water would be required annually for projected coal development and population growth without implementing any of the leasing alternatives. An estimated 3,942 acre-feet per year of this water would be consumed. This is about 0.08 percent of the combined average annual flow of the Green River at Green River, Utah, and the Dirty Devil River near Hanksville, Utah. It is about 0.27 percent of Utah's share of Colorado River water.

By the year 2000, estimated sediment yields would increase by about 39 acre-feet annually on the lands that would be disturbed by projected mining activities and associated population growth. The increase is about 0.11 percent of the combined sediment yield of the Green River basin upstream from Green River, Utah, and the Dirty Devil River basin upstream from Hanksville.

Projected mining activities would continue to disrupt local aquifers, alter local ground water flow systems, and cause some redistribution of natural ground water discharge points as discussed under Alternative One. Mine dewatering would probably increase progressively as more aquifers and water-bearing fault zones are intersected by mine workings; the potential for subsidence and associated rock fracturing would also increase. Resulting regional impacts on water resources would be insignificant, but local impacts could be substantial depending on the mine and mining plans. The potential for accidental contamination of an important water source would also increase with the projected increases in mining.

Most of the water required for projected coal development would come from irrigation sources. Consequently, irrigated acreage in the area of the central Utah tracts would be reduced accordingly (see Land Use section).

Vegetation

The loss of vegetation that would result from development of coal mines and associated housing necessary to produce 21.6 million tons per year by 1990 is shown by vegetation type and percent in Table 4-80.

By the year 2000, vegetation would be lost or altered on 4,600 acres. Of this amount, 1,600 acres would be reclaimed following completion of mining and 25 acres of agricultural land retired for mine water use would be available for cultivation. About 2,975 acres occupied for community development or retired to provide community water would be committed to urbanization and vegetation production on these acres and would be permanently lost. In terms of total vegetation resources in the region, the loss of vegetation would not be significant. Successful reclamation of about 1,600 acres would increase vegetation production on those acres by about 40 percent.

No threatened or endangered plant species in the region would be directly impacted by proposed coal developments. Inadvertent impacts (loss of individual plants) could result from housing development, off-road vehicle activities, or unlawful collecting of these species.

TABLE 4-80
TOTAL IMPACTS ON VEGETATION
ALTERNATIVE FOUR

Vegetation Types	Direct Disturbance[a]	Indirect Impacts[b]	Total by the year 2000
Agricultural	850	1,300	2,150
Desert Shrub	850	-	850
Riparian	13	-	13
Grassland	153	-	153
Sagebrush-Grass	801	-	801
Pinyon-Juniper Woodland	470	-	470
Mountain Meadow	20	-	20
Aspen	58	-	58
Conifer Aspen	85	-	85
Total	3,300	1,300	4,600

[a] Includes acreage used for mining and community development.

[b] Includes irrigated croplands retired for community and mine water use.

Wildlife

The temporary loss of 1,600 acres of wildlife habitat resulting from construction and operation of proposed coal mines and ancillary facilities would occur. Permanent loss of about 1,700 acres of wildlife habitat by the year 2000 that would be occupied by houses and community facilities would be unavoidable. Many species inhabit these croplands, notably pheasants, cottontail rabbits, doves, small birds, and mammals. The resulting regional pheasant loss of nearly 1,560 birds, while insignificant on a regional basis, may be significant in certain local communities with sparse irrigated croplands.

Loss of wildlife would result from loss of habitat and increased human disturbance. Elk habitat on 353 acres of land occupied by surface facilities would be lost, and elk use on about 9,400 acres would be reduced due to human disturbance. Deer habitat on 1,404 acres would be lost due to construction of surface facilities and deer use on 7,256 acres would be reduced because of human disturbance. Carrying capacity for 260 deer would be lost annually. Any loss of the endangered bald eagle or peregrine falcon or other birds of national interest is not quantifiable but would be significant. Direct impacts on wildlife would include deaths resulting from construction and operation of the proposed mines, highway mortality, illegal killing, and deaths from wire strikes. Deer highway mortalities would increase by 95 deer annually because of increased traffic in the region. Long-term alteration of migration routes and use patterns would be unavoidable. Impacts to fisheries would be slight under reasonable enforcement of existing laws and regulations. However, accidental releases of materials toxic to fish and other aquatic organisms might occur.

The population increase in 1987 of 23 percent above 1982 levels and 44 percent by 2000 portends a similar increase in hunters, fishermen, and ORV use (Recreation section). The presence of a larger human population could exert greater pressures on the wildlife populations through harvest, harassment, and displacement from habitat. The legal harvest can be controlled by instituting more stringent regulations and harassment partially controlled by enforcement regulations, but the presence of humans in wildlife habitat could not be eliminated.

Land Use

A total of 4,600 acres would be changed from the existing uses to mining and support uses for existing and potential lease development by the year 2000. Approximately 2,975 of the 4,600 acres would be permanently changed from existing uses to that of new community development acreage; the remaining 1,625 acres would be temporary land changes resulting from mining operations (BLM, 1982a).

Approximately 50 percent (850 acres) of the 1,700 acres needed for new community developments would come from the four-county agricultural land base. An additional 1,300 acres of irrigated cropland would be retired from productivity to supply community water needs (BLM, 1982a). Thus, by the year 2000, 2,150 acres of agricultural lands would be affected. These acres represent about 0.9 percent of the four-county total of cropland area (Utah Department of Agriculture, 1982).

The loss of grazing capacity would be about 4,170 AUMs over the life of the existing and potential lease developments. Land changes from agricultural land to community use and from irrigated cropland to retired cropland would eliminate cattle, sheep, and horse grazing presently occurring on such land. Actual AUM losses cannot be predicted due to the variability of grazing numbers and seasons of use on the now-existing cropland acres. Due to the high grazing capacity of such acres, overall losses could be high, i.e., 1 AUM lost for every 5 acres converted. Such losses could significantly affect small operators.

Land Use Plans, Controls, and Constraints

The Alternative One discussion pertaining to Federal and County plans would apply to existing and potential coal lease development under Alternative Four.

Existing leases are presently located in both Carbon and Emery Counties (C-1 and CE-2 land use zones). In Carbon County, rezoning requests (from CE-1 to the CE-2 zone) would require approval by the county, and actual mine developments in the CE-2 zone would be required to implement the county's socioeconomic and land resource mitigation measures for potential or existing resource conflicts. In Emery County, existing and potential lease developments would be required to follow and meet established measures for both land use zones; no land use rezoning would be required.

No significant conflicts would exist between lease developments and the regulations of Emery County's M&G-1 land use zone, Sanpete County's FW-10 zone, and Sevier County's GRF-1 zone.

Socioeconomics

The baseline projections reflect the future based on the existing economic structure of the areas and the changing demographic characteristics of the population and are an attempt to depict the direction current trends are likely to take in the area without the additional coal leasing. The Utah Process Economic and Demographic Impact Projection Model and the Spatial Allocation Model were applied in making the baseline projections presented here.

It should be noted that the baseline projections assumed growth in Utah's coal industry to begin in 1982 and move toward the target of 21.6 million tons per year by the year 2000. Consequently, the short-term baseline projections presented here, which show substantial growth in Carbon and Emery Counties in 1982 and 1983, may be somewhat overstated due to the current recession.

Population, Income, and Employment

The baseline projection for the four counties shows the population increasing from 69,598 in 1982 to 100,200 by the year 2000, or a total increase of about

30,602. This represents a 44 percent change between the years 1982 and 2000. Over this same period, total employment in the area would increase by 6,400 jobs which is about an 18 percent increase; total employment in the year 2000 is projected at 41,200. Table 4-81 shows projected baseline figures by county for selected years through 2000.

These baseline projections have incorporated assumptions regarding coal projection, manufacturing, power plant construction, and commuting patterns which are important to understand in the analysis of the potential impacts of additional coal development. Additional information on these assumptions and detailed projections are presented in a technical report on file at the BLM Utah State Office.

The relationship between the State's per capita income and the per capita incomes of the counties was utilized in projecting baseline county personal income figures. The baseline income projections for the State assume an annual growth rate of 1.7 percent; by the year 2000 the State per capita income would be $11,568. Carbon County achieved high average per capita income levels relative to the State in the last half of the 1970s. It is assumed that this will be reversed during the next two decades and that by the year 2000, Carbon County per capita personal income would equal that of the State. Emery County per capita personal income is presumed to stabilize at 100 percent of the State figures for the entire projection period. Sanpete County's personal income figures have been consistently below the State average, and it has been assumed that the county would maintain per capita income that would be 70 percent of the State average over the projection period. Sevier County personal income has risen steadily in the past; it is assumed that this trend will continue and that by 1995 the county per capita income level will equal that of the State. The county per capita personal income and total personal income projections are provided in Table 4-82.

Infrastructure

Housing

The type of housing mix in a community is reflective of a number of variables including community preference, existing planning and zoning ordinances, land availability and personal income. The Department of Community and Economic Development, upon review of the existing conditions and elected officials' preferences of 25 rural communities, has determined that an appropriate guideline for housing mix percentages is 60 percent single family units, 15 percent multi-family units, and 25 percent mobile home units.

In the year 2000, under the baseline forecast, Carbon County would need 7,080 single family homes, 1,770 multi-family homes and 2,950 mobile homes. The largest demand for housing would be in the Price area. At the same time Emery County would require 960 single family units, 240 multi-family units and 400 mobile homes. In Sanpete county the demand for multi-family housing could reach 930 dwelling units by the year 2000, and single family homes could reach 3,720 units. Sevier County will need 4,200 single family units, 1,050 multi-family units and 1,750 mobile homes in the year 2000 under baseline growth forcasts (Table 4-83).

TABLE 4-81

CENTRAL UTAH
ALTERNATIVE FOUR
SUMMARY OF POPULATION AND EMPLOYMENT PROJECTIONS
BY COUNTY
1987, 1990, 1995, 2000

County	Total Population	Total Households	Total School-age Population	Total Employment
Carbon				
1987	32,900	10,500	7,900	13,400
1990	35,200	11,000	8,900	14,300
1995	37,200	11,500	9,900	15,200
2000	37,700	11,800	9,700	15,800
Emery				
1987	14,100	3,900	4,000	6,500
1990	14,800	4,000	4,400	6,700
1995	15,100	4,100	4,700	6,800
2000	14,700	4,000	4,500	6,800
Sanpete				
1987	19,100	5,500	4,900	6,900
1990	20,400	5,800	5,500	7,200
1995	21,800	6,100	6,300	7,800
2000	22,400	6,200	6,500	8,200
Sevier				
1987	19,700	5,800	5,300	8,000
1990	21,600	6,100	6,000	8,700
1995	24,100	6,700	7,200	9,700
2000	25,400	7,000	7,600	10,400
Year 2000 Totals	100,200	29,000	28,300	41,200

TABLE 4-82

BASELINE PERSONAL INCOME PROJECTIONS
BY COUNTY
1985, 1987, 1990, 2000

Year	PCPI[a] State of Utah	Carbon County PCPI	Carbon County Total Personal Income ($1,000)	Emery County PCPI	Emery County Total Personal Income ($1,000)	Sanpete County PCPI	Sanpete County Total Personal Income ($1,000)	Sevier County PCPI	Sevier County Total Personal Income ($1,000)
1985	$ 8,932	$10,182	304,869	$ 8,932	125,736	6,252	113,911	$ 7,592	140,460
1987	9,243	10,352	340,265	9,243	130,271	6,470	123,344	8,134	160,622
1990	9,736	10,612	373,107	9,736	143,879	6,815	139,040	9,493	205,191
1995	10,631	10,525	391,720	10,631	160,124	7,442	162,504	10,631	256,111
2000	11,568	11,568	435,605	11,568	170,073	8,098	181,533	11,568	293,989

Note: In 1980 dollars.
[a] Per Capita Personal Income.

TABLE 4-83

HOUSING DEMAND BY TYPE
ALTERNATIVE: BASELINE
1987, 1990, 1995, 2000

County	Single Family	Multi-Family	Mobile
Carbon			
1987	6,300	1,575	2,625
1990	6,660	1,650	2,750
1995	6,900	1,725	2,875
2000	7,080	1,770	2,950
Emery			
1987	2,340	585	975
1990	2,400	600	1,000
1995	2,460	615	1,025
2000	2,400	600	1,000
Sanpete			
1987	3,300	825	1,375
1990	3,480	870	1,450
1995	3,660	915	1,525
2000	3,720	930	1,550
Sevier			
1987	3,480	870	1,450
1990	3,660	915	1,525
1995	4,020	1,005	1,675
2000	4,200	1,050	1,750
Year 2000 Totals	17,400	4,350	7,250

Education

Baseline growth projections for 1987 anticipate a 76 percent increase in the number of students in the Carbon School District over the existing student population. By the year 1995, baseline growth of school-age children is expected to peak at 9,889 before dropping off to 9,692 school-age children in the year 2000. This growth will continue the demand for additional classrooms and teachers that the Carbon County School District has faced since the coal boom of the 1970s.

Emery County, which has experienced rapid growth for educational services due to large construction projects within the county, is forecast to have an increase of 685 students between 1982 and 1987. This represents a 21 percent growth or just over 4 percent a year. This growth rate is significantly slower than the years of peak construction employment. The growth rate for school-age children is forecast to continue to slow to under a 2.5 percent growth per year by 1995. The years following 1995 could see an actual decline in the number of students in the Emery County School District. This growth pattern of Emery County's school-age population will require creative planning by School District officials to ensure adequate educational facilities and personnel without over-building. The School District, having experienced boom/bust cycles in the past, has developed a growth plan that utilizes temporary classrooms to avoid over-building in boom times and to allow the tax base to be in place before incurring new debt for additional school construction.

Baseline growth forecasts for school-age children in Sanpete Coonty show 1,274 additional students in 1987. This is a 7 percent annual increase in students and will require a similar increase in teachers and school facilities. Between 1987 and 1990 growth should moderate to a 4 percent increase in school-age children per annum. Between 1990-1995 this should further moderate to a 3 percent annual increase in the number of school-age children. After 1995 the baseline growth in the number of school-age children will decrease to less than 1 percent growth per year.

The 1984 baseline forecasts for the Sevier School District project an increase of 1,233 new students or approximately 6 percent per annum growth rate of the school-age population. The growth rate for school-age populations will then begin a gradual slowdown through the year 2000 when the baseline school-age population is forecast to increase at less than 1 percent (.0058) per annum.

Water and Sewer

Price City in Carbon County has annexed over 600 acres since 1974. This new area has adequate water and sewer lines although the system is old and undersized. Expansion and upgrading of these sewer lines, as well as a new water storage tank would be required to absorb baseline growth forecasts. These two projects are estimated to cost over $1.5 million. Baseline demand for water connection is forecast to grow from 4,767 connections in 1987 to 5,125 in 1990, 5,467 connections in 1995, and reach 5,688 connections in the year 2000. The Price River Water Improvement District will also need to expand its sewer system to be capable of handling baseline growth forecasts. The plant currently is working at one-third over the designed capacity and to meet National Pollution Discharge Elimination System standards would require several improvements costing an estimated 3.8 to 4 million dollars.

Wellington, which is served by the Price River Water Improvement District, needs to upgrade its water and sewer, distribution, storage, and collection systems to handle baseline growth. Preliminary analysis estimates the cost of upgrading the water system to reach almost $730,000 to handle the 883 water connections forecast for the year 2000. The sewer system in the East Carbon/ Sunnyside area, which was constructed in 1979, appears to handle baseline growth forecasts through the year 2000 that could reach 216,200 gallons per day of waste. A recently passed bond election (1982) for a new water system calls for construction to commence in the spring of 1983 on a new water plant and distribution system that will be more than capable of handling baseline growth forecasts of 676 water connections required by the year 2000.

Most communities in Emery County are served by the Castle Valley Special Service District for culinary water services. Additional water rights, treatment, and storage facilities will be necessary to handle the baseline demand sited in Table 4-84. Adequate sewage capacity appears available to handle baseline growth forecasts in all Emery County communities as shown in Table 4-85 although infiltration problems are common.

Sanpete County communities have ample water rights and storage capacity for all communities with the exception of Moroni to handle baseline growth forecasts. Moroni has plans to add a 600,000 gallon storage tank and to construct a new distribution system to handle baseline growth forecasts. The majority of communities in Sanpete County sewage needs are served by septic tanks with the exception of Mt. Pleasant and Moroni. Moroni's sewer treatment facility is adequate to handle baseline growth forecasts that project waste to reach 141,600 gpd by the year 2000. Mt. Pleasant, on the other hand, will need to expand its sewer system to absorb the 305,000 gallons per day of waste forecast by 1987.

Richfield in Sevier County will need to expand and upgrade its water system to accommodate baseline growth forecasts. In fact, inadequate flow and storage already exists and this condition currently needs to be corrected. The trickling filter sewer system appears capable of handling baseline growth forecasts into the 1990s although expansion will then be necessary. Salina will need to expand its sewer system later in this decade to handle the baseline demand generated by 302,200 gallons of sewage generated per day by 1995. The remaining Sevier County communities outside of Richfield appear to have adequate water to handle culinary and industrial growth forecast under the baseline scenario.

Public Safety

Law enforcement needs of Carbon County are projected to increase by one additional officer per year from 1987 to 1995. Peak need would level off by 1995, and by the year 2000, only one more office would be required. The need

TABLE 4-84
CENTRAL UTAH
PROJECTED DEMAND FOR WATER CONNECTIONS
ALTERNATIVE FOUR

Year	1987	1990	1995	2000
Carbon County				
East Carbon	551	536	529	514
Helper	1,190	1,224	1,245	1,261
Hiawatha	82	81	78	79
Price	4,767	5,125	5,467	5,688
Scofield	43	44	46	47
Sunnyside	173	169	166	162
Wellington	764	816	860	883
Total	7,570	7,995	8,391	8,634
Emery County				
Castle Dale	744	786	804	789
Cleveland	163	167	168	165
Elmo	100	102	103	101
Emery	125	130	132	131
Ferron	579	601	609	604
Huntington	810	813	804	789
Orangeville	528	542	546	536
Total	3,049	3,141	3,166	3,115
Sanpete County				
Centerfield	255	268	277	282
Ephraim	1,056	1,115	1,185	1,246
Fairview	390	462	470	471
Fountain Green	210	210	209	209
Gunnison	503	532	552	559
Manti	782	825	877	923
Moroni	366	385	391	393
Mt. Pleasant	887	958	979	981
Spring City	244	257	261	262
Wales	49	51	52	52
Total	4,742	5,063	5,253	5,378
Sevier County				
Aurora	330	349	367	380
Redmond	234	247	260	269
Richfield	2,402	2,579	2,801	2,857
Salina	752	796	837	867
Total	3,718	3,971	4,265	4,373
Grand Total	19,079	20,170	21,075	21,500

TABLE 4-85
CENTRAL UTAH
PROJECTED DEMAND FOR WASTE WATER CONNECTIONS
ALTERNATIVE FOUR

Year	1987	1990	1995	2000
Carbon County				
East Carbon	172,400	170,300	170,800	164,500
Helper	372,400	389,100	402,100	403,400
Hiawatha	25,700	25,700	25,100	25,400
Price	1,492,200	1,629,900	1,765,900	1,820,200
Scofield	13,500	14,000	14,800	15,000
Sunnyside	54,200	53,600	53,700	51,700
Wellington	239,200	259,400	277,700	282,700
Emery County				
Castle Dale	267,800	287,600	297,500	289,700
Cleveland	58,500	61,100	62,100	60,500
Elmo	36,000	37,500	38,200	37,200
Emery	45,100	47,700	48,700	48,000
Ferron	208,500	220,000	225,200	221,500
Huntington	291,700	297,600	297,400	289,600
Orangeville	190,000	198,500	201,900	196,600
Sanpete County				
Centerfield	87,900	93,600	99,800	101,800
Ephraim	362,500	389,400	427,200	449,700
Fairview	134,100	161,300	169,100	169,900
Fountain Green	72,200	73,000	75,200	75,500
Gunnison	173,300	185,800	199,100	201,700
Manti	268,400	288,200	316,200	332,900
Moroni	125,700	134,400	140,900	141,600
Mt. Pleasant	305,000	334,800	352,300	354,000
Spring City	83,800	89,600	94,000	94,400
Wales	16,800	17,900	18,700	18,900
Sevier County				
Aurora	113,300	122,700	132,600	138,100
Redmond	80,200	86,900	93,900	97,800
Richfield	823,200	906,600	1,011,400	1,073,000
Salina	258,200	279,700	302,200	324,700

by 2000 would be 75 officers. Emery County would require one additional officer by 2000, bringing the total to 29. Sanpete County would need one additional officer a year through 1990. By 1995, another three policemen would be needed. Peak needs would be reached by 1995 when 44 officers and patrol cars would be required. Sevier County would be the most affected county under baseline conditions. The need would rise from 40 in 1987 to 51 officers by the year 2000. The years from 1990 to 1995 would experience the largest growth with five additional officers needed during this time.

Carbons County's need for health services shows continued growth under baseline conditions, with the most rapid growth taking place by 1990. EMTs, hospital beds, and nurses are the categories that show the greatest need by the year 2000. Nine hospital beds and nurses along with seven new EMTs would be required by 2000. Sanpete County would require seven more hospital beds, with four of the beds coming between 1990 and 1995. Seven additional nurses would be needed by 2000 as well. The need for nurses follows a steady growth rate under baseline conditions. Sevier County woud require 12 new hospital beds and an additional 12 nurses under baseline growth. EMTs would need to be increased by eight with six of the additional EMTs added by 1995 or almost one per year.

Transportation

Baseline traffic projections with no new Federal coal leasing includes existing and projected traffic resulting from present and projected coal mining development. This EIS takes advantage of a computer model which accounts for background or baseline traffic resulting from earlier and projected coal mining, the general population and projected population increases, and present and projected through traffic, such as long distance trucks, vacationers, and general travel. Results of this computer model are on file at the BLM Utah State Office.

In the central Utah area, secondary roads are generally adequate to accommodate anticipated traffic. Those secondary roads which are projected to carry mining traffic proposed at earlier dates are also projected to be upgraded in conjunction with mining development.

The Round One Final Environmental Impact Statement, BLM (1981a), pointed out the potential for overcrowding on U-10 southward from Price to Castle Dale. The computer analysis emphasizes this possibility and, in addition, points out that US-6 across Soldier Summit, from Castle Gate to Spanish Fork will also become severely overcrowded. The high traffic segment from Castle Gate into Price, is a four-lane highway which is presently being extended to bypass Price.

There is a potential for severe traffic congestion in downtown Price, both from sheer volume of traffic and from interruptions to traffic on U-10 less than a block south of the US-6/U-10 intersection, where the D&RGW railroad crosses U-10 at grade. Assuming that only half the coal mined and projected to be mined in the area passes across this intersection, and assuming that one 100-car coal train 1 mile long would require 5 minutes to pass, the crossing would be locked on the average half an hour per day, backing traffic into the US-6/U-10 intersection. Although the analysis was made for the year 2000 projected production, some traffic congestion should be expected almost immediately.

Highway construction and maintenance is primarily funded from taxes on motor fuel. Present funding formulas are not expected to meet the needs of maintenance required through increased traffic flows and are inadequate to accommodate any additional road construction. Nearly all of the highways impacted by already proposed coal development are approaching or have already exceeded the 200-year design traffic volume. This need for increased maintenance would continue.

Cultural Resources

Salvage excavation of threatened archaeologic or historic sites may be required. Data would be preserved, but an undetermined number of sites or portions of sites would be lost. Some loss would occur for buried sites encountered during dirt-moving operations even if they were recognized early. Changes in setting of sites, either by the introduction of project activities and facilities or by moving certain things to avoid impacts, would degrade archaeologic and historic values. Vandalism would occur due to an increased population and easier accessibility.

Positive impacts would also result from coal development. Valuable information has been gathered and other surveys could be necessary prior to any disturbance. The additional surveys would result in the accumulation of data that would otherwise not have been available until the future, or which may have been lost. Any salvage excavation that is required will result in the preservation of data and material (including some that might otherwise be lost to vandalism), although in situ value is lost.

Recreation

By the year 2000, projected population growth without additional leasing would increase the local demand for both dispersed and developed recreation opportunities in the four-county region by approximately 41 percent from 1982 use figures.

Table 4-86 and Table 4-87 show the anticipated increases in demand for hunting, fishing, and ORV activity, respectively, in the years 1987, 1990, 1995, and 2000. Increased demand for dispersed activities as well as increased use of developed recreation sites and urban facilities, would result in impacts similar in type to those identified in Alternatives One, Two, and Three. The extent and intensity of those impacts is not quantifiable but would be greater in degree than impacts resulting from Alternative One, Two, or Three if these impacts are considered alone because by the year 2000 the increase in population above 1982 levels would be as much as 20 percent greater than the projected coal based populations for the leasing alternatives. The additional competition for fish and game would lead to less hunter and fisherman success or restricted harvests. Increased ORV use would

TABLE 4-86
PROJECTED INCREASE IN LOCAL HUNTER AND FISHERMAN DEMAND
WITHIN THE FOUR-COUNTY REGION
ALTERNATIVE FOUR (NO ACTION)

		Projected Annual Increase in Numbers					
Year	Projected Population Increase	Deer Hunters	Elk Hunters	Upland Game/ Waterfowl Hunters	Fishermen	Increased Demand for Fish	Overall Percent Increase 1982
1987	16,202	2,916	324	1,458	7,286	218,580	23
1990	22,402	4,032	448	2,016	10,075	302,250	32
1995	28,602	5,148	572	2,574	12,862	385,860	41
2000	30,602	5,508	612	2,754	13,757	412,860	44

Note: Projections were made assuming that the percentage of Utah's population that currently hunts or fishes would remain the same, and that the Utah percentage can be applied to the four-county area. Approximately 18 percent of Utah's population hunt deer, approximately 2 percent hunt elk, approximately 9 percent hunt upland game or waterfowl. Approximately 53 percent of Utah's polulation under the age of 12 and 42 percent of the population over the age of 12 fish. Approximately 27 percent of Utah's population is under 12 and 73 percent is over 12 in age (Thayne and Hudson, 1978). An average of 30 fish per person per year were caught in 1977 (UWDR, 1978).

TABLE 4-87

PROJECTED INCREASE IN LOCAL OFF-ROAD VEHICLE DEMAND
WITHIN THE FOUR-COUNTY REGION
ALTERNATIVE FOUR (NO ACTION)

Year	Projected Population Increase	Projected Increase in Pickup and Four-Wheel Drive Numbers	Projected Increase in Motorcycle Numbers	Overall Percent Increase from 1982
1987	16,202	4,051	1,134	23
1990	22,402	5,601	1,568	32
1995	28,602	7,151	2,002	41
2000	30,602	7,651	2,142	44

Note: Projections were made assuming that the percentage of the population in the four-county region that owns off-road vehicles would remain the same (approximately 7 percent of the population currently owns motorcycles, and approximately 25 percent of the population currently owns four-wheel drive vehicles or light pickups) (UORA, 1978).

increase conflicts with other recreational uses. Overuse of developed campgrounds, picnic areas, playfields, swimming pools, and golf courses would result in continued deterioration of existing facilities, user dissatisfaction, and additional recreation pressures on undeveloped areas including the presently overused San Rafael/Buckskin Draw area. Federal, State, and local governments would be under stress to provide recreation facilities to meet minimum standards recommended by the UORA (1978).

Development of homesites for the projected population would displace dispersed recreational use (particularly upland game hunting) from as much as 1,200 acres by the year 2000. Because surrounding areas offer comparable or better opportunities, loss of recreational opportunities from displacement would be minimal.

The reduction in range of scenic vistas viewed from overlooks in Canyonlands and Capitol Reef National Parks (identified in the Air Quality section) would be perceptible to some Park visitors, reducing the quality of their recreational experience.

Visual Resources

Disturbance from development of existing lease areas would continue to modify the landscape character of isolated portions of the region both on and off lease. In most cases, mining activities would continue to be located away from major travel routes and would seldom be seen by individuals traveling through the region. Visual resource management objectives would probably not be met for the life of the mining operations in many instances, although in most cases reclamation would be effective in reestablishing the area's scenic quality. Because development would be localized, the average visitor would probably note little change in the area's overall scenic character.

Special Designation Areas

The increase in local recreational demand that is projected to occur, may result in increased ORV and other dispersed use of some of the 17 areas within the four-county region with special designation or potential for special designation. More intensive use would degrade values for which areas are being protected and/or reviewed. The extent and intensity of impact is not quantifiable but would be greater than that resulting from Alternatives One, Two, or Three if these alternatives are considered alone because by the year 2000 the increase from 1982 population levels would be as much as 20 percent greater than that projected for the coal based populations in Alternatives One, Two, and Three. Agencies managing the lands may be under stress to protect special values. However, due to the temporary nature of impacts resulting from dispersed recreational use, it is extremely unlikely, even in a worst case situation, that possible degradation would affect the suitability of any area for special designation.

Southern Utah

As explained in Chapter 2, the regional baseline projected through the year 2000 shows no coal development in southern Utah. However, even in light of this lack of development, some community growth in Kane and Garfield Counties is expected. As a result of this growth some associated environmental impacts would result and are summarized below.

The estimated 1.0 billion tons of in-place coal resource in the Alton coal field located outside of the proposed tracts would not be mined. Beneficial as well as adverse environmental and socioeconomic impacts associated with coal mining activities would not occur.

By the year 2000, TSP emission levels are estimated to be 120 percent greater than 1982 levels. Estimated annual TSP concentrations for the year 2000 are shown in Figure 4-14. Concentrations are higher than 1981 levels due to increased population in the area. Concentrations in the Kanab area (including a background of 15 micrograms per cubic meter) are predicted to be about equal to the secondary annual NAAQS of 60 micrograms per cubic meter, which is about 15 micrograms per cubic meter above the 1981 levels. Secondary NAAQS is not presently exceeded in Kane and Garfield Counties but by the year 2000 the standard would be exceeded over about 20 square miles. Reduction in visual range at Bryce Canyon National Park due to the expected population growth would not be perceptible.

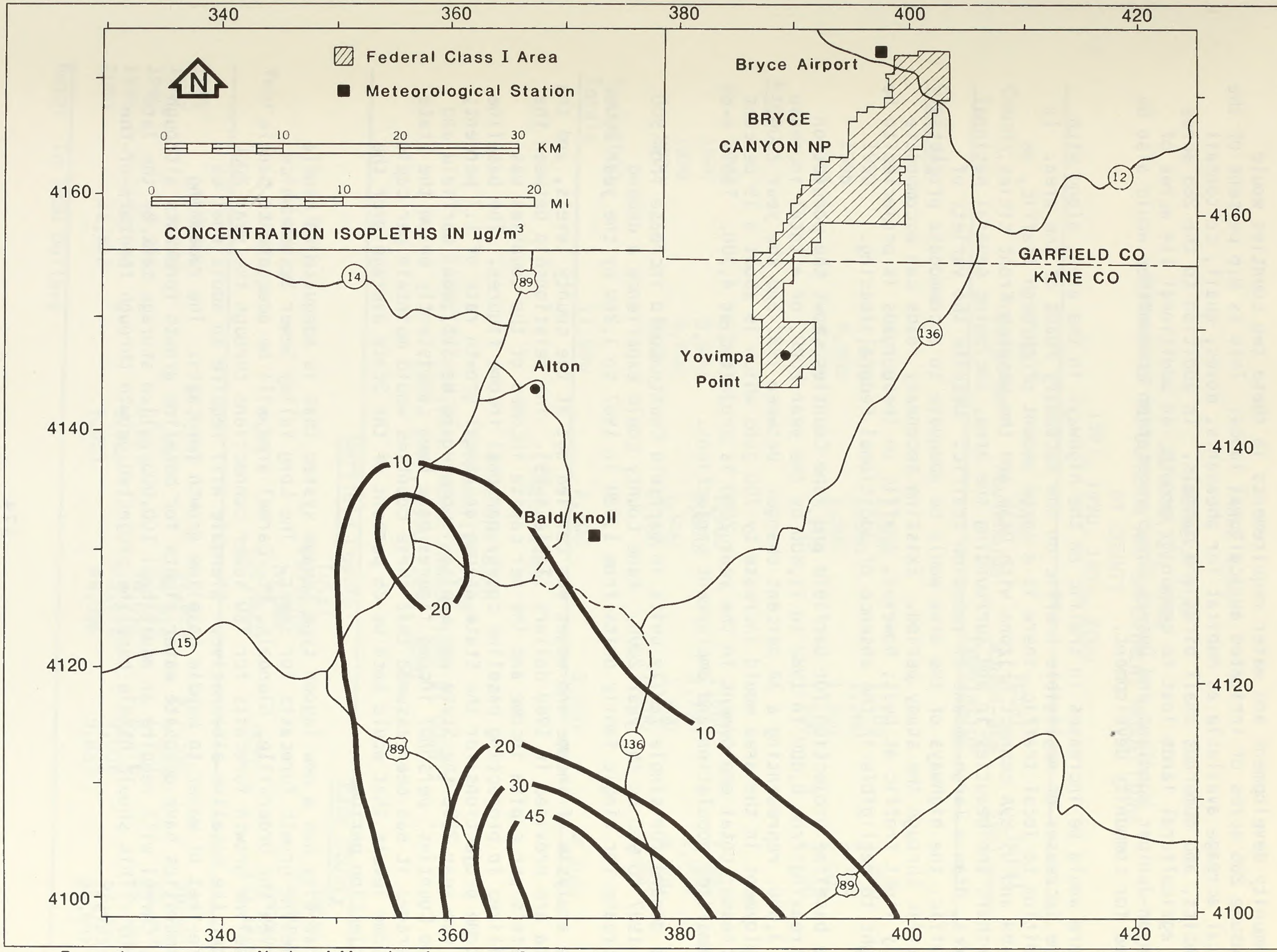
Soil disturbance would be that associated with projected community growth without coal lease development. Acres of community growth (cumulatively and by analysis year) for the Garfield and Kane County Census Divisions would be as follows: 1987, 61 acres; 1990, 94 acres; 1995, 133 acres; and 2000, 167 acres. Soil productivity on these acres would be permanently lost because of occupation by structures.

By the year 2000, an estimated 756 acre-feet of water would be required for projected population growth. An estimated 318 acre-feet per year of this water would be consumed. This is about 0.21 percent of the combined average annual flow of Kanab Creek near Fredonia, Arizona, and the Virgin River near Hurricane, Utah and about 0.03 percent of Utah's share of Colorado River water.

By the year 2000, sediment yields would increase by an estimated 4.7 acre-feet per year on the acres that would be disturbed to provide housing for the projectd population growth. This is about 0.1 percent of the estimated combined sediment yield of the Kanab Creek basin upstream from Fredonia, Arizona, and the Virgin River upstream from Hurricane, Utah.

The water required to meet projected population growth in the area would come from irrigation. Consequently, irrigated acreage would be reduced by 209 acres by the year 2000 due to community expansion and retirement of irrigated croplands to provide community water needs.

The population increase by the year 2000 in Kane and Garfield Counties would bring approximately an additional 716 deer hunters and 350 small game hunters to hunt in the area. The additional hunting pressure and travel on unimproved roads would tend to reduce game populations by an unknown amount and depreciate the value to wildlife of roadside habitat.



Note: Base does not meet National Mapping Accuracy Standards

FIGURE 4-14

ANNUAL AVERAGE TSP CONCENTRATIONS IN SOUTHERN UTAH – YEAR 2000 (BASELINE, NO DEVELOPMENT)

Community development and water requirements in these two counties would consume 285 acres of irrigated agricultural lands. This is 0.6 percent of the total acreage available as habitat for pheasants, doves, quail, cottontail rabbits, and numerous small birds and mammals. In addition to the 285 acres of agricultural lands lost to community growth, an additional 114 acres of Pinyon-Juniper Woodland and Desert Shrub vegetation communities would also be used for community development.

There would be increases in traffic on the highways in the area, along with some increases of negligible traffic on the secondary roads of the area. In addition to local traffic, there is a large amount of through traffic, as US-89 and US-89A connect Arizona with Utah and the Wasatch Front cities. Further, the beauties in and surrounding the area, including several National Parks, draw a large amount of vacation traffic. Despite the variety of traffic, the highways of the area would be adequate to accommodate projected traffic through the study period. Existing secondary roads can accommodate only light traffic at best; however, traffic on these roads is projected to be light to negligible in the absence of additional Federal leasing.

The baseline projection for Garfield and Kane Counties shows the population increasing from 8,800 in 1982 to 11,800 by the year 2000, or a total increase of 3,000, representing a 34 percent change. Between 1987 and the year 2000, employment in the area would increase by 700 jobs which is about a 19 percent increase; total employment in the year 2000 is projected at 4,300. Table 4-88 summarizes population and employment projections.

The demand for single family units in Garfield County could increase from 900 in 1987 to 960 by the year 2000. Kane County could experience a demand increase for single family units from 1,080 in 1987 to 1,260 by the year 2000.

The analysis of income and wages was carried out at the county levels, and the data are provided in 1980 dollars (Table 4-89). The relationship between the State's per capita income and the per capita incomes of the counties was utilized in projecting baseline county personal income figures. The baseline income projections for the State assume an annual growth rate of 1.7 percent; by the year 2000 the State per capita income would be $11,568. Garfield and Kane Counties' personal income figures have been consistently below the State average; it has been assumed that these counties would maintain per capita income levels that would both be 85 percent of the State average over the projection period.

Kanab City has a new lagoon type sewage system that is adequate to handle baseline growth forecasts for sewer. The Long Valley Sewer System which serves the Orderville, Glendale, Mt. Carmel area will be adequate to handle baseline growth forecasts for 760 sewer connections through the year 2000 under the baseline alternative. Glendale will require an additional 65 acre-feet of water to handle baseline growth forecasts. The remaining communities have adequate water rights for baseline growth forecasts although Mt. Carmel will require an additional 100,000 gallon storage tank by the late 1980s. This should handle baseline projected growth through the turn-of-the century.

TABLE 4-88

SOUTHERN UTAH
ALTERNATIVE FOUR
SUMMARY OF POPULATION AND EMPLOYMENT PROJECTIONS
BY COUNTY
1987, 1990, 1995, 2000

County	Total Population	Total Households	Total School-age Population	Total Employment
Garfield				
1987	4,400	1,500	1,100	1,800
1990	4,600	1,500	1,200	1,900
1995	4,800	1,500	1,300	2,000
2000	5,000	1,600	1,400	2,100
Kane				
1987	5,500	1,800	1,500	1,800
1990	5,900	1,800	1,700	1,900
1995	6,400	1,900	1,900	2,000
2000	6,800	2,100	2,100	2,200
Year 2000 Totals	11,800	3,700	3,500	4,300

TABLE 4-89

SOUTHERN UTAH
ALTERNATIVE FOUR
BASELINE PERSONAL INCOME PROJECTIONS BY COUNTY
1985, 1987, 1990, 1995, 2000

		Garfield County		Kane County	
Year	PCPI State of Utah	PCPI	Total Personal Income ($1,000)	PCPI	Total Personal Income ($1,000)
1985	$ 8,932	$ 7,592	32,623	$ 7,592	39,820
1987	9,243	7,857	34,924	7,857	43,308
1990	9,736	8,276	38,012	8,276	48,564
1995	10,631	9,036	43,671	9,036	57,623
2000	11,568	9,833	49,096	9,833	66,648

Note: In 1980 Dollars

Septic tanks handle the sewage needs in Hatch and Panguitch in Garfield County. This appears adequate to handle the baseline growth forecasts although Panguitch may need to consider another method for handling sewage later in the 1990s. The water system in these communities appear adequate to handle baseline growth which could require 639 connections in Panguitch by the year 2000.

Garfield School District is forecast to have only limited growth under the baseline forecast. By the year 2000 the school-age population is projected to reach 1,350 which would require only four additional teachers over the existing 50 teachers.

Kane County should experience a steady growth in demand for teachers growing from the existing 47 to 83 by the year 2000 to accommodate a projected student population that would increase from the existing 1,002 to 2,066 by the year 2000.

Garfield County will need to add one police officer to its roster by the year 2000. Kane County anticipates a slow but steady need for policemen under baseline conditions. They will require one additional officer every 2 years.

Projected population growth by the year 2000 would increase the local demand for both dispersed and developed recreation opportunities in the region by approximately 34 percent from 1982 use figures.

Table 4-90 and Table 4-91 show the anticipated increase in demand for hunting, fishing, and ORV activity, respectively, in the years 1987, 1990, 1995, and 2000. Increased demand for dispersed activities as well as increased use of developed recreation sites and urban facilities would result in impacts similar in type to those identified in Alternative One. The extent and intensity of those impacts is not quantifiable but would be less in degree than impacts resulting from Alternatives One or Two if these alternatives are considered alone because by the year 2000 the increase from 1982 levels projected for populations in Alternatives One and Two is 62 percent greater than that projected for the baseline population. The additional competition for fish and game would lead to less hunter and fisherman success or restricted harvests. Increased ORV use would conflict with other recreational uses. Overuse of developed campgrounds, picnic areas, playfields, swimming pools, and golf courses would result in continued deterioration of existing facilities, user dissatisfaction, and additional recreational pressures on undeveloped areas. Federal, State, and local governments would be under stress to provide recreation facilities to meet minimum standards recommended by the State Outdoor Recreation Agency (SCORP, 1978).

The increase in local recreational demand (users originating from within the two-county area) that is projected to occur even without leasing and development of the proposed tracts (34 percent increase above 1982 use figures by the year 2000), may result in increased ORV and other dispersed use of some of the 40 acres within the two-county region with special designation or potential for special designation. The more intensive use would tend to degrade values for which areas are being protected and/or reviewed. The probability for and

TABLE 4-90
PROJECTED INCREASE IN LOCAL HUNTER AND FISHERMAN DEMAND
WITHIN GARFIELD AND KANE COUNTIES
ALTERNATIVE FOUR (NO ACTION)

	Projected Annual Increase in Numbers						
Year	Projected Population Increase	Deer Hunters	Elk Hunters	Upland Game/ Waterfowl Hunters	Fishermen	Increased Demand for Fish	Overall Percent Increase 1982
1987	1,100	208	23	104	520	15,600	13
1990	1,700	299	33	150	747	22,418	19
1995	2,400	434	48	217	1,084	32,520	27
2000	3,000	535	59	267	1,336	40,080	34

Note: Projections were made assuming that the percentage of Utah's population that currently hunts or fishes would remain the same, and that the Utah percentage can be applied to the four-county area. Approximately 18 percent of Utah's population hunt deer, approximately 2 percent hunt elk, approximately 9 percent hunt upland game or waterfowl. Approximately 53 percent of Utah's population under the age of 12 and 42 percent of the population over the age of 12 fish. Approximately 27 percent of Utah's population is under 12 and 73 percent is over 12 in age (Thayne and Hudson, 1978). An average of 30 fish per person per year were caught in 1977 (UDWR, 1978).

TABLE 4-91
PROJECTED LOCAL INCREASE IN OFF-ROAD VEHICLE DEMAND
WITHIN GARFIELD AND KANE COUNTIES
ALTERNATIVE FOUR (NO ACTION)

Year	Projected Population Increase	Projected Increase in Pickup and Four-Wheel Drive Numbers	Projected Increase in Motorcycle Numbers	Overall Percent Increase from 1982
1987	1,100	385	77	13
1990	1,700	599	119	19
1995	2,400	840	168	27
2000	3,000	1,050	210	34

Note: Projections were made assuming that the percentage of the population in the two-county region that owns off-road vehicles would remain the same (approximately 7 percent of the population currently owns motorcycles and approximately 35 percent of the population currently owns four-drive vehicles or light pickups) (UDRA, 1978).

the extent and intensity of impact is not quantifiable but would be less than that resulting from Alternatives One or Two if these alternatives are considered alone because by the year 2000 the increase from 1982 levels that is projected for the baseline population is 62 percent less than the coal-based population projected in Alternative One and Two. Agencies managing the lands may be under stress to protect the special values associated with potential special designation areas, however, due to the temporary nature of impacts resulting from dispersed recreational use, it is extremely unlikely, even in a worst case situation, that possible degradation would affect the suitability for special designation of any area.

West-Central Colorado

Even without additional Federal leasing, a small amount of coal production is expected to continue in Delta County. Delta County mines are projected to produce a total of 1.53 million tons in 1987 lowering to 1.35 million tons per year in 1990 through the year 2000. The lower figure is approximately the production obtained during 1982. The drop in production would result from closure of the Orchard Valley mine when coal resources on that tract are exhausted in the late 1980s.

Given the situation described above, Delta County is expected to experience a 16 percent population increase, a 14 percent growth in employment, and a 2 percent fall in per capita income between the years 1982 and 2000. Employment in North Fork coal mines may be expected to decline from a 1982 figure of 975 to 885 employees in 2000 having reached a high of 1,145 in 1986.

This population growth rate, which would average less than 1 percent annually, would present no significant problems to Delta County infrastructural facilities. Delta County communities could be expected to expand these facilities to reduce deficiencies created during the 1974-1981 period of rapid growth.

Under this Alternative, Delta County residents would experience slower population growth and, as a consequence, reduced levels of environmental degradation, and employment opportunities than experienced in the period between 1974-1981.

By the year 2000, TSP emission levels are estimated to be 20 percent greater than 1982 levels. The secondary NAAQS would be exceeded within 120 square miles compared to 85 square miles in 1982. An undetermined amount of subsidence could occur over areas that have been and would be mined from existing holdings in Delta County. Some unquantifiable impacts to the water resources, roads, pipelines, and ditches could result from overburden fracturing and subsidence.

By the year 2000, the average daily traffic volume would increase an undetermined but expected low amount on all State and county roads in the area. The daily traffic volume on State Highway 65 at the intersection of State Highway 92 would increase to some 5,390 with approximately four accidents per year.

Urban area expansion would permanently remove from agricultural production a cumulative total of 57 acres of irrigated cropland by 1987, 71 acres by 1990, 84 acres by 1995, and 100 acres by the year 2000. Up to half of this acreage removed from agricultural production would be prime and unique farmland which would represent an over-all loss in the county of about 0.1 percent of irrigated croplands. An additional 100 acres of native vegetation would also be lost in urban development.

Although it cannot be quantified, human population increases would cause increased poaching incidence, more hunting and fishing pressure, more wildlife disturbance, and increased wildlife highway mortalities.

In the year 2000, the annual consumptive use of water would increase 521 acre-feet. The salinity reaching the area's stream channels would decrease by 2,086 tons/year. This would result primarily from the loss of irrigated acreage.

The expansion of present mines in the area could change the quantity, quality, and distribution of surface and groundwater. Due to the lack of specific information on future coal development, these impacts are not quantifiable.

CHAPTER 5

COORDINATION AND CONSULTATION

A notice of intent to prepare the Uinta-Southwestern Utah Coal Region EIS and hold scoping meetings for the EIS was published in the Federal Register Monday, April 5, 1982. In addition to the Federal Register notice, public notices were placed in local newspapers and aired on local radio stations. The formal public comment period extended to May 14, 1982. The schedule of the public meetings is summarized in Table 5-1.

On April 16, 1982, an interagency prescoping meeting was held at BLM Utah State Office. Representatives of Bureau of Land Management, Forest Service, and Minerals Management Service attended and developed a list of potential issues relative to the coal leasing program.

Several written and oral comments were received discussing both potential alternatives and issues to be analyzed in the EIS. Transcripts from the public meetings and written comments are available for review at the BLM Utah State Office. These comments were presented to the Regional Coal Team meeting on July 22, 1982, for their consideration in ranking tracts and formulating alternatives. Briefly summarized, suggestions for alternatives included:

1. Lease coal in dispersed geographic locations to reduce social and economic impacts on any one community or county.

2. Lease areas for surface mining only after all potential underground mining operations are exhausted.

3. Tracts nearest to National Parks should be leased only after more distant tracts have been leased and developed.

4. Several comments were received specific to the Paonia tract in Colorado and dealt with consideration of single seam leasing, altering tract boundaries and comparing impacts of new portal development to coal removal through nearby existing facilities.

The following issues, mostly general in nature, were also identified:

1. Purpose and Need for Leasing. Is there a need for additional leasing at the present time when the coal market is depressed and large areas in the region (e.g., the Kaiparowits Plateau) currently under lease are not being developed? Is additional leasing in the Alton Coal Field needed when development of the Allen/Warner Valley Project is questionable? There is a potential for loss of economic return to the Federal Government that would result from leasing at current low market values during the depressed coal market. The regional and national long-term demand for high Btu, low sulfur coal should be analyzed and balanced against current market conditions in assessing the need for coal leasing.

What contribution would increased coal leasing have toward national energy independence and the related reduction in the Nation's negative balance

TABLE 5-1

PUBLIC SCOPING MEETING SCHEDULE

Place	Date	Time	Location
1. Delta, Colorado	April 26, 1982	7:00 p.m.	Cafeteria, Delta Jr. High School
2. Castle Dale, Utah	April 27, 1982	7:00 p.m.	Emery County Courthouse
3. Price, Utah	April 28, 1982	7:00 p.m.	BLM, Price Area Office, 900 North Seventh East
4. Kanab, Utah	April 28, 1982	7:00 p.m.	BLM, Kanab Resource Area Office, 320 North First East
5. Salt Lake City, Utah	April 29, 1982	1:00 p.m.	Room 127, Salt Palace, 100 South West Temple

of payments in foreign trade? What are the cost benefits to industry of high quality and extensive quantity of coal available from a fairly centralized geographical area? Would local coal help meet the demand for coal in the Pacific Rim Market? Many of these issues are beyond the scope of this EIS.

2. Wildlife. The impacts of coal leasing on summer and winter critical habitat for game and non-game wildlife should be analyzed, and the possible disruption of migration routes and impacts to riparian habitats considered. What effect would leasing have on threatened and endangered species? Increased human populations would affect wildlife and wildlife habitat.

3. Vegetation. What would be the potential impacts on threatened or endangered plant species both listed and those not officially listed by the U.S. Fish and Wildlife Service but considered to be sensitive or endangered by the States of Utah or Colorado or by groups such as the Utah Native Plant Society?

4. Soil. The potential effects of accidental spills of toxic wastes on soil or water resources should be considered, and the ability to successfully rehabilitate disturbed areas analyzed.

5. Hydrology. Possible impacts to aquifers, surface water, and water quality should be analyzed, particularly impacts that could result from coal mining on municipal watersheds and loss of water resulting from mining beneath lakes or streams. How much water is available for coal mining, transportation activities, and associated population growth in relation to existing water rights and the Colorado River Compact?

6. Land Use. What are the impacts of leasing coal on multiple use management and development of other resources on lease areas, and what would be the effects of leasing, mining, coal transportation, and related human population increases on livestock grazing and grazing privileges? Conversion of agricultural land to urban land due to increased housing needs would result in loss of agricultural production. Leasing, mine development, and coal transportation could conflict with local zoning and permitting regulations.

7. Recreation. The increased population would affect dispersed and community recreation and recreational facilities. There are potential recreation-related secondary impacts of increased human populations on surface and ground water and fragile desert soils and vegetation.

8. Socioeconomics. Analyze the cumulative impacts on local community infrastructure from populations attributable to Federal coal leasing and mining, including demand for housing and impacts on the quality and availability of housing. Consider the distribution of resultant populations and effects on the relationship of incorporated and unincorporated areas. Social impacts including effects on health care, mental health services, jail facilities, crime prevention, and public safety should be analyzed.

Point out the beneficial aspects for employment and the general economy of the affected region such as the revenue contributions generated by Federal bonuses and royalties, half of which returns directly to the affected States.

The favorable climate for socioeconomic mitigation which allows for prepayment of certain taxes to fund mitigation efforts should also be included.

9. Transportation. The impacts of coal transportation on roads, highways, and highway and community safety should include a cost analysis for improvement and maintenance of affected roads. Analysis of traffic congestion on roads, highways, and in communities should be cumulative and consider future oil shale, tar sand, and nuclear waste disposal projects.

Contacts and informal consultation have been initiated with several State and Federal agencies including Office of Surface Mining, Fish and Wildlife Service, Geological Survey, National Park Service, Forest Service, Utah Division of Wildlife Resources, and Utah State Planning Coordinator's Office regarding impact analysis and other data contained in this EIS. The input received have been incorporated into the document as appropriate.

CHAPTER 6

INDIVIDUAL TRACT SUMMARY

Introduction

This chapter presents a summary of the probable development scenarios, application of the unsuitability criteria, and impact analysis of the individual tracts considered for leasing in this round. Many of the tracts could either be mined in association with or independent of adjacent coal properties. In such cases, for analysis purposes, independent operations are assumed because it would generally result in greater environmental impacts. The tracts are listed by coal field.

Central Utah: Book Cliffs Coal Field

Alkali Creek Tract

The Alkali Creek tract, 2,098.3 acres in size, is located about 11 air miles northeast of Price, Utah (Figure 6-1). The tract contains an estimated in-place coal resource of 33.8 million tons of which 15.0 million tons are estimated to be recoverable. Bureau of Land Management (BLM) administers 220 surface acres of the tract while 1878.3 acres are in non-Federal ownership. All of the coal on the tract is owned by the Federal Government.

The tract is bordered to the east by a Federal lease mined by Soldier Creek Coal Company and to the west by private coal owned by Sunedco. Either company may bid on the tract; however, for the purpose of this analysis it is assumed that a third party would be the successful bidder and that an entirely new mining operation would be established.

The coal would be mined underground by room and pillar and/or longwall methods and a new portal would be required. Average annual coal production would be 600,000 tons per year over a projected 25-year mine life. Approximately 45.8 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling, a new portal area, ventilation shafts, coal storage, and required access. Twenty-three acres of disturbance would occur on steep slopes which would be difficult to revegetate. Approximately 7.6 miles of new road construction would be needed. Coal would be trucked 18.0 miles on the Myton road and U.S. 6 from East Canyon to a new loadout east of Wellington, Utah. The average number of coal haul round trips per day would be 63 in addition to 12 incidental trips for service.

Approximately 185 permanent employees (including truckers) would be needed for the 25 years of mining. About 28 temporary employees would be needed for construction. The estimated water requirement for mining would be 12.9 acre-feet per year. Sources of water would be from diversions inside the mine, wells, or commercial sources.

Approximately 570 acres of land were identified as unsuitable for leasing consideration upon strict application of Criterion 11 (golden eagle nest); an

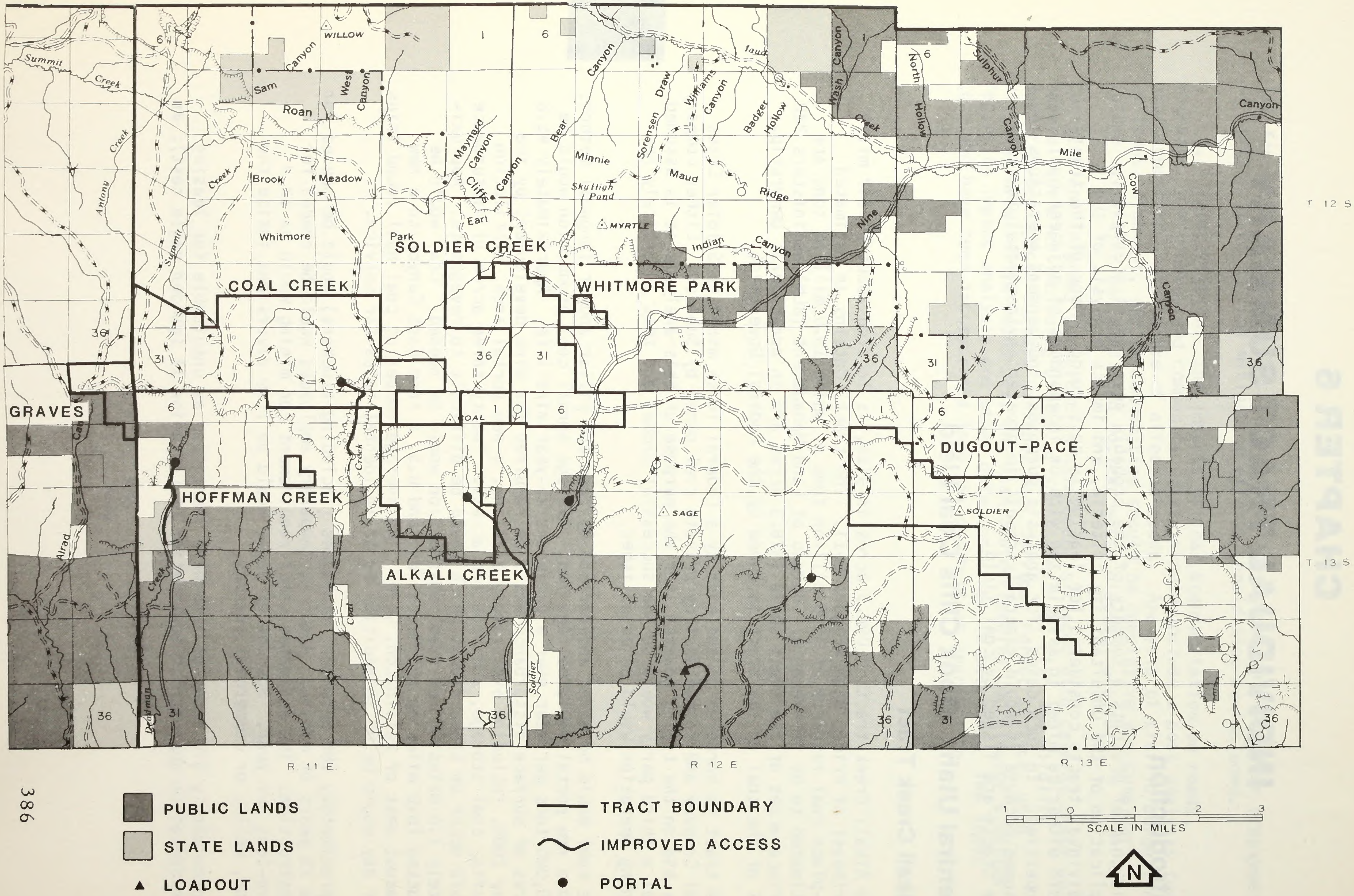


FIGURE 6-1
GRAVES, COAL CREEK, WHITMORE PARK, DUGOUT-PACE, ALKALI CREEK, SOLDIER CREEK AND HOFFMAN CREEK COAL TRACTS

additional 110 acres were identified as unsuitable upon strict application of Criterion 13 (prairie falcon nests). With application of the underground mining exemption, the above lands were found acceptable for leasing by application of specific stipulations covering scheduling of lease activities. Unsuitability Criterion 14 (migratory birds) has not been fully applied due to lack of data; the appropriate land use plan calls for necessary inventories to be conducted in an actual mine plan.

About 18.8 million tons of coal (56 percent of the total estimated resource) would remain underground and unrecoverable. Carbon County would receive added revenues from coal development and a 3 to 5 percent population increase in the area which would accompany tract development.

Coal Creek Tract

The Coal Creek tract, 4,198.09 acres in size, is located about 10 air miles northeast of Price, Utah (Figure 6-1). The tract contains an in-place coal resource of 114.4 million tons of which 46 million tons are estimated to be recoverable. BLM administers 40 surface acres of the tract while 4,158.09 acres are in non-Federal ownership. All of the coal on the tract is owned by the Federal Government.

The Coal Creek tract is bordered on the south by Federal coal leases owned by Tower Resources and coal lands owned by Sunedco. Both companies' properties include coal outcrops from which they could proceed with mining into the tract. However, considering the size of the tract and the available reserve, the development scenario considered will be that of a third operator who does not own adjacent coal properties. This operator would require a complete set of surface facilities.

The coal would be mined underground by room and pillar and/or longwall methods. A new portal would be required possibly in conjunction with other coal properties. Average annual coal production would be 1.15 million tons per year over a 40-year mine life. Approximately 92.1 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling, the portal area, ventilation shafts, coal storage, and required access. Approximately 4.5 miles of existing access roads would be improved and 10.05 miles of new road construction would be needed. Coal would be trucked for about 19.4 miles on the Coal Creek road and U.S. 6 to a new loadout east of Wellington, Utah. The average number of coal haul truck round trips per day would be 120 in addition to 23 trips per day for incidental service.

Approximately 358 permanent employees (including truckers) would be needed for the 40 years of mining. About 73 temporary employees would be needed for construction. The estimated water requirement for mining would be 24.7 acre-feet per year. Sources of water would include the mine, wells, and commercial sources.

Unsuitability Criterion 14 (migratory birds) has not been fully applied due to a lack of data; the appropriate land use plan calls for necessary inventories to be conducted in an actual mine plan.

About 46 million tons of coal would be mined with the remaining 68.4 million tons (59.7 percent of the estimated resource) remaining underground and unrecoverable. Carbon County would experience an increase in population and revenues as a result of tract development. A minor amount of wildlife habitat would be lost.

Dugout-Pace Tract

The Dugout-Pace Canyon tract, 3,149.62 acres in size, is located about 18 air miles northeast of Price, Utah (Figure 6-1). The tract contains an in-place coal resource of 106.7 million tons of which 25 million tons are estimated to be recoverable. The tract is comprised of non-Federal surface and Federal coal.

The tract is bordered by Federal coal leases held by Sunedco and Kaiser Steel. Both companies' properties include coal outcrops from which they could mine into the tract and are considered to be the only lease contenders. The principal surface facilities, such as, portal facilities and access roads, truck loadout, preparation plant, and rail loadout, would have been constructed regardless of the availability of the Dugout-Pace tract and are not addressed in this analysis.

The coal would be mined by underground methods. A room and pillar system would be employed with an average annual coal production of 555,000 tons per year over a 45-year mine life. Approximately 10.7 acres of surface disturbance would be required for exploratory drilling, ventilation shafts, and required access by the year 2000. Approxmately 0.5 miles of existing access roads would be improved and 4 miles of new road construction would be needed.

Coal would be trucked for 12.3 miles along the Dugout Creek Road (county road 6508) to U.S. Highway 6 to an existing loadout in the vicinity of Sunnyside Junction. The average number of coal haul truck round trips per day would be 57 in addition to 11 trips per day for incidental service.

Approximately 86 permanent employees (including truckers) would be needed for the 45 years of mining. The estimated water requirement for mining would be 11.9 acre-feet per year. Sources of water would be the mine, wells, or commercial sources.

Unsuitability Criterion 14 (migratory birds) has not been fully applied due to a lack of data; the appropriate land use plan calls for necessary inventories to be conducted in an actual mine plan.

Visual resource protection is considered important within 65 percent of the tract area; land use plan direction stipulates that proposed surface facilities would be disallowed within this scenic area if such facilities were not in accordance with scenic management criteria. Only 25 million tons of coal (23.4 percent of the estimated coal resource) would be recovered. Some dust from vehicular traffic on unpaved roads would be noticeable.

Graves Tract

The Graves tract, 550.16 acres in size, is located about 8 air miles northeast of Price, Utah (Figure 6-1). The tract contains an in-place coal resource of 19.8 million tons of Federal coal of which 7 million tons are estimated to be recoverable underground by room and pillar and/or longwall mining methods. BLM administers 228.28 surface acres of the tract while 322.88 acres are in non-Federal ownership. Due to the lack of coal outcrop on the tract and the depth of overburden, the Graves tract could be economically developed only from adjacent coal lands to the east, west or south held by Tower Resources and Blackhawk Coal Company (Price River Coal). In either case, required surface facilities would be off-tract and would have been constructed regardless of the availability of the Graves tract. Therefore, these facilities will not be considered in this development scenario. Annual production from the tract would be 700,000 tons. Mining of the tract would not increase annual production or require increased employment or additional water sources for the overall development operation.

Approximately 0.2 acres of surface disturbance would be required for exploration drill pads. No new road construction would be needed. Coal would be trucked 19.4 miles on the Hayes Wash road through Price to the existing Wildcat siding loadout on Consumers Wash. The average number of coal haul truck round trips per day would be 72 in addition to 14 trips per day for incidental service. The trucking of coal would be extended over a longer period of time but the number of truck trips per day would not increase.

Unsuitability Criterion 14 (migratory birds) has not been fully applied due to a lack of data; the appropriate land use plan calls for necessary inventories to be conducted in an actual mine plan.

About 12.8 million tons of coal (64.6 percent of the resource) would not be mined and would remain unrecoverable. Coal would be mined in the Blackhawk Formation which is potentially valuable for fossils.

Hoffman Creek Tract

The Hoffman Creek tract, 120 acres in size, is located about 9 air miles northeast of Price, Utah (Figure 6-1). The tract contains an estimated in-place coal resource of 2.0 million tons of which 1 million tons are estimated to be recoverable. BLM administers all 120 surface acres of the tract and owns all of the coal. Mining would be underground by room and pillar methods from adjacent coal properties to the north or west held by Tower Resources or Sunedco. Required surface facilities would be off-tract and would have been constructed regardless of the availability of the Hoffman Creek tract. Therefore, the surface facilities will not be addressed in this report.

Average annual coal production from the tract itself would be 153,000 tons per year for about 6.5 years. One million tons (50 percent of the total coal resource) would not be recovered. Tract development would lenghten mine life of adjacent properties but would not increase annual production of the mining unit or require additional employment. No surface disturbance would be required for mine development. Coal would be trucked 19.4 miles on the Hayes

Wash road through Price to the existing Wildcat siding loadout on Consumers Wash. The average number of coal haul truck round trips per day would be 15.9 in addition to 3.1 trips per day for incidental service. Use of the roads by miners, coal trucks, and service trucks would be extended 1 year but the number of truck trips per day would not be increased.

Unsuitability Criterion 14 (migratory birds) has not been fully applied due to a lack of data; the appropriate land use plan calls for necessary inventories to be conducted in an actual mine plan.

Soldier Creek Tract

The Soldier Creek tract, 2,168.02 acres in size, is located about 13 air miles northeast of Price, Utah (Figure 6-1). The tract contains an in-place coal resource of 81.9 million tons of which 37 million tons are estimated to be recoverable. The tract is comprised of non-Federal surface underlain by Federally owned coal. Due to the lack of outcrop on the tract and the depth of overburden, the tract could be economically developed only from adjacent coal lands to the south, east, or west. Soldier Creek Coal Company's lease and mine lies immediately south of the subject tract. Lands to the east of the tract include Federal and State coal leases held by Sunedco which are expected to support a large coal operation within several years. The tract is adjacent to the Alkali Creek tract to the west and also a State lease held by Bow Valley Coal Resources. Any or all of the parties holding these adjacent coal lands may be interested in obtaining the Soldier Creek tract. Development would be from an existing or planned portal on one of these adjacent operations.

The coal would be mined underground by room and pillar and/or longwall mining methods and would extend the life of an adjacent mine. Average annual coal production from the tract would be 925,000 tons per year over a 40-year mine life. Approximately 20.9 acres of surface disturbance would be required for mine development by the year 2000 for exploratory drill holes, ventilation shafts, and required access. About 5.75 miles of new road construction would be needed for exploratory drilling and a ventilation shaft. Coal would be trucked about 17.6 miles via the Soldier Creek road and U.S. Highway 6 to a new loadout east of Wellington, Utah. The average number of coal haul truck round trips per day would be 97 in addition to 19 trips per day for incidental service.

Approximately 163 permanent employees (including truckers) would be needed for the 40 years of mining. About 95 temporary employees would be needed for 1 year for construction of ventilation shaft facilities. The estimated water requirement for mining would be 19.9 acre-feet per year. Sources of water would be the mine, wells, and/or commercial sources.

By strict application of the unsuitability criteria, 50.65 acres associated with the location of County Road 381 were identified under Criterion 3. This area was found acceptable with the application of the underground mining exemption and a specific stipulation for road protection.

Dust from unpaved roads would be visable from surrounding areas. Revegetation of disturbance on steep slopes would be difficult. Tract development may violate Visual Resource Management standards in some areas. About 57.7 million tons of coal (70.4 percent of the resource) would not be recovered. Development of the tract would result in a slight population increase and increased county revenues.

Whitmore Park Tract

The Whitmore Park tract, 160 acres in size, is located about 14 air miles northeast of Price, Utah (Figure 6-1). The tract contains an in-place coal resource of 6.3 million tons of which 1.9 million tons are estimated to be recoverable. All surface acres are in non-Federal ownership while all of the coal on the tract is owned by the Federal Government. The Whitmore Park tract is a nearly isolated parcel of Federal coal land and would be mined in conjunction with non-Federal coal to the south or west. Any of the parties holding adjacent coal leases could be interested in obtaining the tract. Surface facilities would be constructed on other lease holdings, whether or not this tract is leased, and are not considered in this analysis.

The coal would be mined underground by room and pillar and/or longwall methods. Annual production would be 380,000 tons which would contribute to the overall production of a mining unit having a life of 40 years. About 4.4 million tons of coal (69.8 percent of the total resource) would not be recovered. The tract would provide 25 percent of the total mining unit's annual production for 5 years. Overall mine life would be extended by 1.3 years. Mining of the tract would not cause increased annual production of the mining unit or require increased employment or additional water sources. Approximately 0.3 acres of surface disturbance would be required for exploration drill hole pads. No new road construction would be needed. Coal would be trucked about 17.6 miles down the Soldier Creek road and U.S. Highway 6 to a new loadout east of Wellington. The average number of coal haul truck round trips per day would be 40 in addition to 8 trips per day for incidental service. Trucking would be required over the extended mine life but the number of truck trips per day would not increase.

County road 6502 crosses the tract and results in 50 acres being identified as unsuitable upon strict application of Criterion 3. Through the underground mining exemption this area was found acceptable for leasing with a specific stipulation on road protection. Unsuitability Criterion 14 (migratory birds) has not been fully applied due to a lack of data; the appropriate land use plan calls for necessary inventories to be conducted in an actual mine plan.

Central Utah: Wasatch Plateau and Emery Coal Fields

Acord Tract

The Acord tract, 120 acres in size, is located about 12 air miles west of the town of Emery, Utah (Figure 6-2). The tract contains an in-place coal resource of 3.4 million tons of which 1.5 million tons are estimated to be recoverable. The tract is comprised of non-Federal surface underlain by

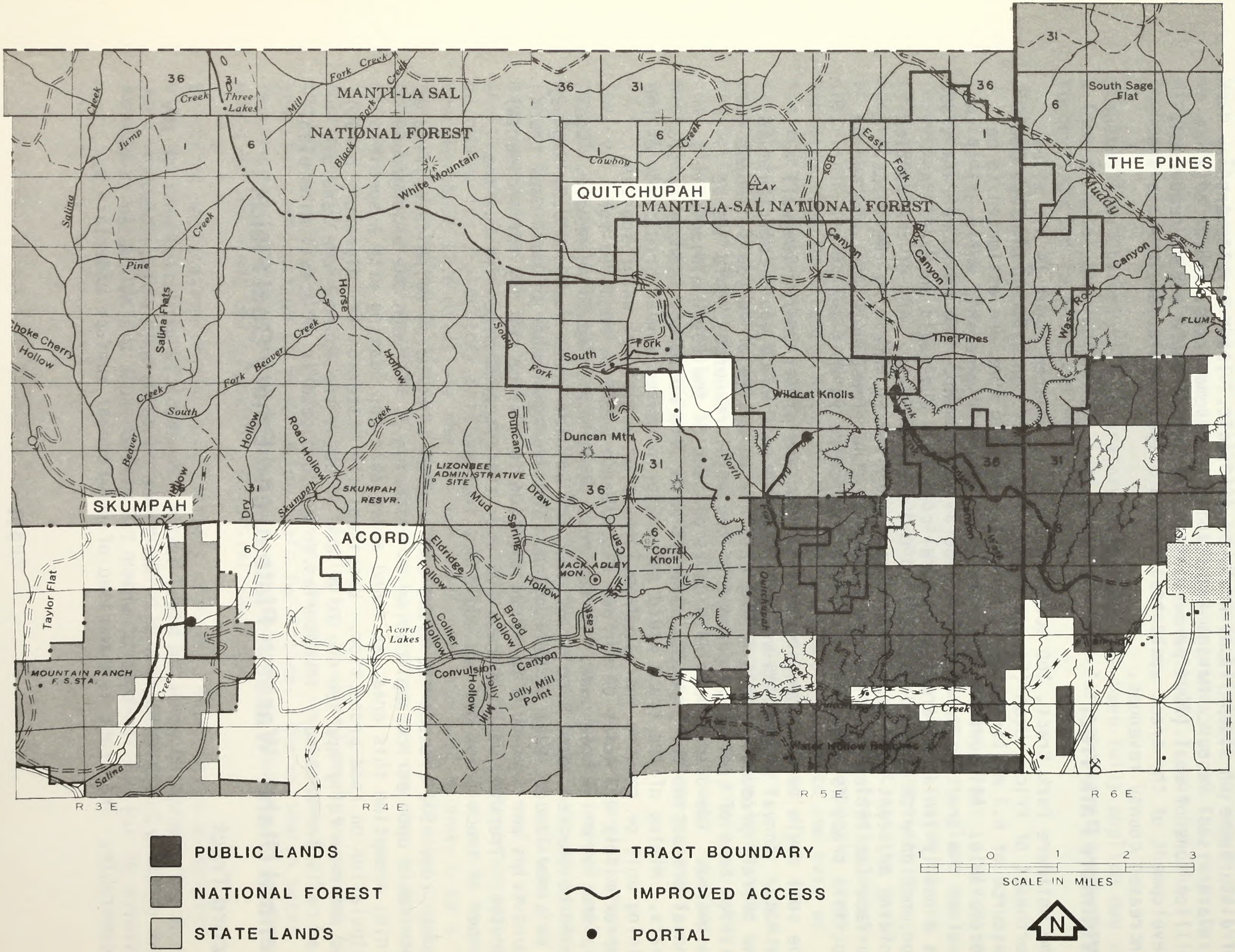


FIGURE 6-2
SKUMPAH, ACORD, QUITCHUPAH AND THE PINES COAL TRACTS

Federal coal. Coal Search Corporation currently controls 2,500 acres of Federal coal leases and 4,020 acres of private coal land surrounding the Acord tract. A mine plan is currently being developed for Coal Search's existing property. The Acord tract will allow Coal Search Corporation to block up additional coal and allow it to be mined in conjunction with surrounding lands, avoiding a possible by-pass situation. An alternate owner for the Acord tract itself is not a viable option because the tract is too small to economically support a separate mine. The possibility does exist that a party other than Coal Search Corporation could obtain the lease and negotiate with Coal Search Corporation for control of their existing property.

The coal would be mined underground by room and pillar methods. Average annual coal production would be 83,000 tons per year and would be mined in conjunction with an approximately 1.0 million ton per year operation over a 40-year unit mine life. About 0.5 acres of additional surface disturbance would be required for exploratory drilling including 0.25 miles of new access roads. Coal would be trucked about 83.4 miles on the Spring Canyon road, I-70, U.S. Highway 89, and Utah Highway 28 to the Levan loadout. The average number of coal haul truck round trips per day would be 9 in addition to 2 trips per day for incidental service. The tract would supply 83,000 tons of the 1 million tons per unit mine for about 18 years.

Approximately 15 permanent employees (including truckers) would be needed for the 40 years of mining. No temporary employees would be needed for construction. The estimated water requirement for mining would be 1.8 acre-feet per year. Sources of water would be the mine, wells, or commercial sources.

No exemptions or exceptions to the unsuitability criteria were applied to the Acord tract. Development of this tract would result in 15 new jobs being available for local miners. Nearly 40 to 60 percent of the lease tract could subside 8 to 10 feet causing tension fractures at the surface. Both ground water aquifers and surface water runoff would be disrupted, resulting in adverse impacts to existing livestock and wildlife water sources. About 1.9 million tons of in-place coal resource (55.8 percent) would not be recovered.

Skumpah Tract

The Skumpah tract, 639.8 acres in size, is located about 15 air miles west of Emery, Utah (Figure 6-2). The tract contains an in-place coal resource of 4.5 million tons of which 2 million tons are estimated to be recoverable. Federal surface administered by BLM and the Fishlake National Forest totals 520 acres while 119.8 acres are in non-Federal ownership. All of the coal on the tract is owned by the Federal Government. Coal Search Corporation currently owns Federal coal leases and private coal land adjacent to the Skumpah tract. A mine plan is currently being developed for their existing property. The tract will allow Coal Search Corporation to block up additional coal and allow mining in a westerly direction from existing leases to the Musinia fault zone. More importantly, however, the Skumpah tract would provide Coal Search Corporation a sloping 18 degrees incline access to the coal to be mined. An alternate owner for the Skumpah tract itself is not a viable option because of the limited amount of recoverable coal (2.02 million tons) on the tract. The possibility does exist that a party other than Coal Search Corporation could obtain the lease and then negotiate with Coal Search Corporation for control of their existing property. A new portal would be required for mining and all portal facilities would be located on private lands.

The coal would be mined underground by room and pillar methods. Average annual coal production would be 50,000 tons per year over a 40-year mine life.

Approximately 83 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling, construction of a portal area, ventilation shafts, coal storage, and required access. Approximately 3.75 miles of existing access would be improved and 6.3 miles of new road construction would be needed. Coal would be trucked about 83.4 miles on the Spring Canyon road, I-70, U.S. Highway 89 and Utah Highway 28 to the existing Levan loadout. The average number of coal haul truck round trips per day would be 5 in addition to 1 trip per day for incidental service.

Approximately 30 permanent employees (including truckers) would be needed for the 40 years of mining. About 128 temporary employees would be needed for construction. The estimated water requirement for mining would be 1.1 acre-feet per year. Sources of water would be the mine, wells, or commercial sources.

Unsuitability Criterion 1 (Federal systems lands) was applicable to the tract. The criterion was excepted based on a finding of compatibility between coal leasing activities and significant National Forest resource values.

Depending on amount of coal actually removed, 40 to 60 percent of the tract could subside. Subsidence of 8 to 10 feet would cause tension fractures at the surface. Both ground water aquifiers and surface water runoff would be disrupted, resulting in adverse impacts to existing livestock and wildlife water sources.

Quitchupah Tract

The Quitchupah tract, 9,986.35 acres in size, is located about 4 air miles west and northwest of Emery, Utah (Figure 6-2). The tract contains an in-place coal resource of 276.3 million tons of which 115 million tons are estimated to be recoverable. Federal surface ownership totals 9,906.35 acres with 80 acres owned by the State of Utah. Portions of the Federal surface are administered by Manti-LaSal National Forest, Fishlake National Forest, and BLM. All of the coal on the tract with the exception of an 80-acre parcel held by the State of Utah is owned by the Federal government.

The coal would be mined underground by room and pillar and longwall methods. The Quitchupah tract could be mined from adjacent leases or as a new operation. This analysis assumes a new operation. Average annual coal production would be 2,875,000 tons per year over a 40-year mine life. Approximately 183.8 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling, portal area, ventilation shafts, coal storage, and required utilities and access.

Approximately 4.4 miles of existing access would be improved and 19.6 miles of new road construction would be needed. Coal would be trucked about 10.4 miles down Dry Fork, along Quitchupah Creek to Highway U-10, and on to a loadout near Emery, Utah. The average number of coal haul truck round trips per day would be 300 in addition to 52 trips per day for incidental service.

Approximately 1,125 permanent employees (including truckers) would be needed for the 40 years of mining. About 175 temporary employees would be needed for construction. The estimated water requirement for mining is 61.8 acre-feet per year. Sources of water would be the mine, wells, or commercial sources.

Unsuitability Criteria 1 (Federal lands), 11 (eagle nests), 16 (floodplains), and 17 (municipal watersheds) were applicable to the tract but were excepted or exempted. A determination that significant values on National Forest lands would be compatible to coal leasing activities excepted Criterion 1. The tract was excepted and/or exempted from the remaining criteria based on the determination of no significant impacts or the implementation of appropriate mitigating measures and/or management requirements and constraints.

Subsidence could damage watershed resources and the hydrologic regime on the tract. The socioeconomic impacts of leasing and subsequent development of this tract would be both beneficial and adverse to the Emery area in that while needed jobs would be provided infrastructural stress could also result. Soil disturbing activities could cause increased erosion, soil displacement and compaction thus affecting vegetation productivity. Disturbance on steep slopes would be especially difficult to revegetate. An undetermined amount of big game winter range would also be lost. About 161.3 million tons of in-place coal resource (58.3 percent) would not be mined. A conflict for the small amount of suitable access in Link Canyon could occur.

The Pines Tract

The Pines tract, 8,920.9 acres in size, is located about 3 air miles northwest of Emery, Utah (Figure 6-2). The tract contains an in-place coal resource of 167 million tons of which 70 million tons are estimated to be recoverable. The surface is in Federal ownership. BLM administers 178 surface acres of the tract while 8,742.9 acres are administered by the Manti-LaSal National Forest. All of the coal on the tract is also owned by the Federal Government.

The coal would be mined underground by room and pillar and longwall methods. A new portal would be required as development of this tract would be a new operation. Average annual coal production would be 1,750,000 tons per year over a 40-year mine life. Approximately 140.1 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling, the portal area, ventilation shafts, coal storage, and required access. Approximately 7.7 miles of existing access would be improved and 14.2 miles of new road construction would be needed. Coal would be trucked about 15.1 miles down Link Canyon to Highway U-10 to a new loadout near Emery, Utah. The average number of coal haul truck round trips per day would be 182 in addition to 35 trips per day for incidental service.

Approximately 637 permanent employees (including truckers) would be needed for the 40 years of mining. About 110 temporary employees would be needed for construction. The estimated water requirement for mining would be 37.6 acre-feet per year. Sources of water would be the mine, wells, or commercial sources.

Unsuitability Criteria 1 (Federal lands), 11 (eagle nests), 16 (floodplains), and 17 (municipal watersheds) were applicable to the tract but were excepted or exempted. A determination that significant values on National Forest lands would be compatible to coal leasing activities excepted Criterion 1. The tract was excepted and/or exempted from the remaining criteria based on the determination of no significant impacts or the implementation of appropriate mitigating measures or management requirements and constraints.

Subsidence could damage watershed resources and the hydrologic regime on the tract. The socioeconomic impacts of leasing and subsequent development of this tract would be both beneficial and adverse to the Emery area in that while needed jobs would be available, infrastructural stress could also result. A conflict for the small amount of suitable access in Link Canyon could occur. Nearly 97 million tons of in-place coal (58 percent of the total resouce) would not be mined. Where surface disturbance would occur on steep slopes, revegetation success would be difficult.

Castle Valley Ridge Tract

The Castle Valley Ridge tract, 3,442.16 acres in size, is located about 16 air miles west-southwest of Price, Utah (Figure 6-3). The tract contains an in-place coal resource of 73.7 million tons of which 35 million tons are estimated to be recoverable. The Forest Service administers all 3,442.16 surface acres of the tract. All of the coal on the tract is also owned by the Federal Government.

The coal would be mined underground by room and pillar or longwall methods probably by continuation of Plateau Mining's existing operation. However, because the possibility exists that the tract could be developed independent of adjoining operations, the analysis considers independent access, portal construction and other surface facility development. Average annual coal production would be 875,000 tons per year over a 40-year mine life. Assuming new portal development, approximately 188.9 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling activities, the portal area, ventilation shafts, coal storage, and required access. Approximately 11.6 miles of existing access roads would be improved and 23.0 miles of new road construction would be needed. Coal would be trucked about 12.0 miles on the Castle Valley Ridge Road to the existing Wildcat siding loadout on Consumers Wash. The average number of coal haul truck round trips per day would be 91 in addition to 18 trips per day for incidental service.

Approximately 289 permanent employees (including truckers) would be needed for the 40 years of mining. Temporary employees needed for construction would be about 241. The estimated water requirement for mining would be 18.8 acre-feet per year. Sources of water would be the mine, wells, or commercial sources.

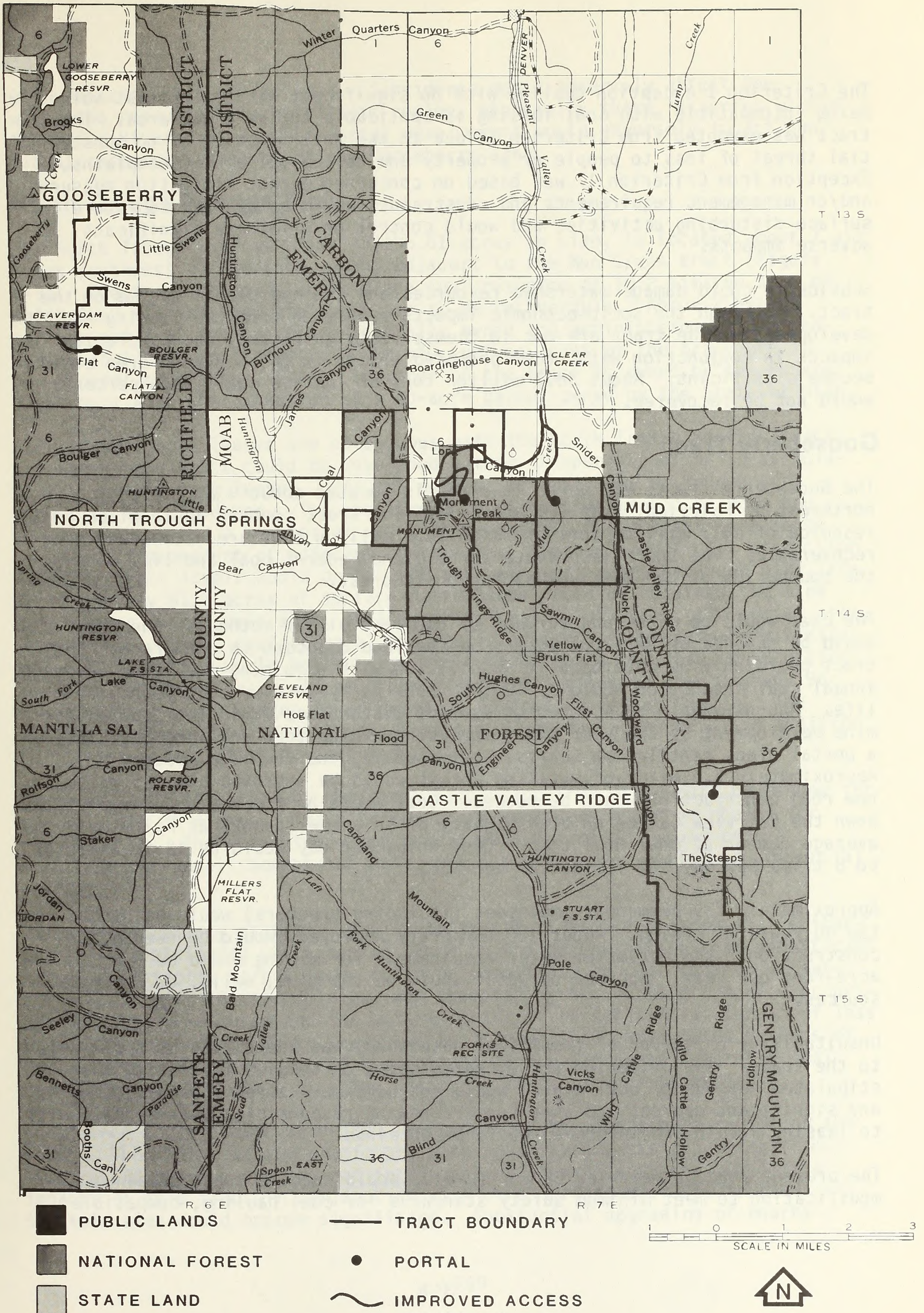


FIGURE 6-3

MUD CREEK, CASTLE VALLEY RIDGE, GOOSEBERRY AND NORTH TROUGH SPRINGS COAL TRACTS

The Criterion 1 exception dealing with no significant National Forest values being incompatible with coal leasing is applicable to the track area. The tract was exempted from Criterion 16 due to the determination of no substantial threat of loss to people or property and to the value of floodplains. Exception from Criterion 17 was based on concurrence that mitigation measures and/or management requirements and constraints would be applied to future surface disturbing activities and would control or eliminate significant adverse impacts.

Subsidence could damage watershed resources and the hydrologic regime on the tract. Although the socio-economic impacts resulting from the leasing and development of the tract are not in themselves significant, the cumulative impacts in conjunction with other proposed tracts in the Scofield area could become significant. About 38.7 million tons of inplace coal (52.5 percent) would not be recovered.

Gooseberry Tract

The Gooseberry tract, 920 acres in size, is located about 9 air miles northeast of Fairview, Utah (Figure 6-3). The tract contain an in-place coal resource of 46.3 million tons of which 16.0 million tons are estimated to be recoverable. The tract is private surface and Federal coal and lies within the boundaries of the Manti-LaSal National Forest.

The coal would be mined underground by room and pillar methods. The coal would be reached by vertical shafts on fee land adjacent to the tract. The tract could only be developed in association with adjoining fee land. Average annual coal production would be 400,000 tons per year over a 40-year mine life. Approximately 38.4 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling activities, a portal area, ventilation shafts, coal storage, and required access. Approximately 1.5 miles of existing access would be improved and 2.5 miles of new road construction would be needed. Coal would be trucked about 13.6 miles down the Fairview Canyon on Utah Highway 31 to a new loadout at Fairview. The average number of coal haul truck round trips per day would be 42 in addition to 8 trips per day for incidental service.

Approximately 229 permanent employees (including truckers) would be needed for the 40 years of mining. About 120 temporary employees would be needed for construction. the estimated water requirement for mining would be 8.6 acre-feet per year. Sources of water would be the mine, wells, or commercial sources.

Unsuitability Criterion 17 (municipal watershed) was identified as applicable to the tract. The criterion was excepted based on studies indicating that stipulated methods of coal mining would not adversely affect the watershed to any significant degree; and that concurrence of responsible governmental units to leasing within the watershed would be obtained.

The present road in Fairview Canyon (U-31), would require substantial modification to meet minimum safety standards for coal hauling, compatible with existing uses of the road. Subsidence would adversely affect the watershed resources and hydrologic regime, especially those resources within the Price River drainage. A portal developemnt would adversely impact the visual resource standards of the Gooseberry area.

North Trough Springs Tract

The North Trough Springs tract, 3,195.61 acres in size, is located about 7 air miles southwest of Scofield, Utah, adjacent to the Mud Creek tract (Figure 6-3). The tract contains an in-place coal resource of 30.2 million tons of which 12.0 million tons are estimated to be recoverable. About 2,555.61 surface acres of the tract are Federally owned and administered by BLM and Manti-LaSal National Forest. About 640 surface acres of the tract are in non-Federal ownership. All of the coal on the tract is owned by the Federal Government with the exception of a 40-acre parcel owned by the State of Utah.

Four Federal coal leases are contiguous with the North Trough Springs tract; therefore, the tract could be developed either independent of or in association with adjoining leases. For the purpose of analysis, an independent operation is considered. The coal would be mined underground by room and pillar methods and a new portal would be necessary if the tract were to be developed independent of adjacent operations. Average annual coal production from the tract itself would be 300,000 tons per year over a 40-year mine life. Approximately 81.3 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling, the portal area, ventilation shafts, coal storage, and required access. Approximately 2 miles of existing access would be improved and 9.75 miles of new road construction would be needed. Coal would be trucked about 8.4 miles on Utah Highway 96 through Clear Creek Canyon to an existing loadout in Eccles Canyon. The average number of coal haul truck round trips per day would be 31 in addition to 6 trips per day for incidental service.

Approximately 114 permanent employees (including truckers) would be needed for the 40 years of mining. About 26 temporary employees would be needed for construction. The estimated water requirement for mining would be 6.4 acre-feet per year. Sources of water would be the mine, wells, or commercial sources.

Three unsuitability criteria applied to the tract and were excepted. Criterion 1 (Federal lands) was excepted based on the determination that significant values on National Forest lands would be compatible to coal leasing activities. Criterion 16 (floodplains) was exempted by the formulation of appropriate mitigation measures and the determination of no substantial threat of loss to people or property or to the value of floodplains. Stipulated methods of coal mining and concurrence of appropriate government units regarding coal development on the tract excepted Criterion 17 (municipal watersheds).

Subsidence could damage watershed resources and the hydrologic regime on the tract. Though the socioeconomic and water quality impacts resulting from leasing and development are not in themselves significant, the cumulative impacts of this tract in conjunction with other proposed tracts in the Scofield area could become significant. Substantial upgrading of nearby access roads would be required to accommodate the increased coal traffic. Nearly 18.8 million toms of coal (60.2 percent of the total inplace resourcce) would not be mined.

Mud Creek Tract

The Mud Creek tract, 1,206.8 acres in size, is located about 7 air miles south of Scofield, Utah (Figure 6-3). The tract contains an in-place coal resource of 27.9 million tons of which 10 million tons are estimated to be recoverable The Manti-LaSal National Forest administers the surface of the tract and the coal on the tract is owned by the Federal Government.

The Mud Creek tract would likely be developed independent of any nearby coal operations. The coal would be mined underground by room and pillar methods and a new portal would be required. Average annual coal production would be 250,000 tons per year over a 40-year mine life. Approximately 36.4 acres of surface disturbance would be required for mine development by the year 2000, including the exploratory drilling, portal area, ventilation shafts, coal storage, and required access. Approximately 1.2 miles of existing access would be improved and 2.5 miles of new road construction would be needed. Coal would be trucked about 4.6 miles down Utah Highway 96 through Clear Creek Canyon to an existing loadout in Eccles Canyon. The average number of coal haul truck round trips per day would be 26 in addition to 5 trips per day for incidental service.

Approximately 69 permanent employees (including truckers) would be needed for the 40 years of mining. About 19 temporary employees would be needed for construction. The estimated water requirement for mining would be 5.4 acre-feet per year. Sources of water would be from the mine, wells, or commercial sources.

Three unsuitability criteria applied to the tract and were excepted. Criterion 1 (Federal lands) was excepted based on the determination that significant values on National Forest lands would be compatible to coal leasing activities. Criterion 16 (floodplains) was exempted by the formulation of appropriate mitigation measures and the determination of no substantial threat of loss to people or property or to the value of floodplains. Stipulated methods of coal mining and concurrence of appropriate government units regarding coal development on the tract excepted Criterion 17 (municipal watersheds).

Subsidence could damage watershed resources and hydrologic regime on the tract. Though the socioeconomic and water quality impacts resulting from leasing and development are not in themselves significant, the cumulative impacts of this tract in conjunction with other proposed tracts in the Scofield area could become significant. Nearly 17.9 milllion tons of coal (64.1 percent of the total resource) would not be recovered. Surface disturbance could result in minor losses of elk calving ground habitat.

Ferron Canyon Tract

The Ferron Canyon tract, 2,680.38 acres in size, is located about 11 air miles northwest of Ferron, Utah (Figure 6-4). The tract contains an in-place coal

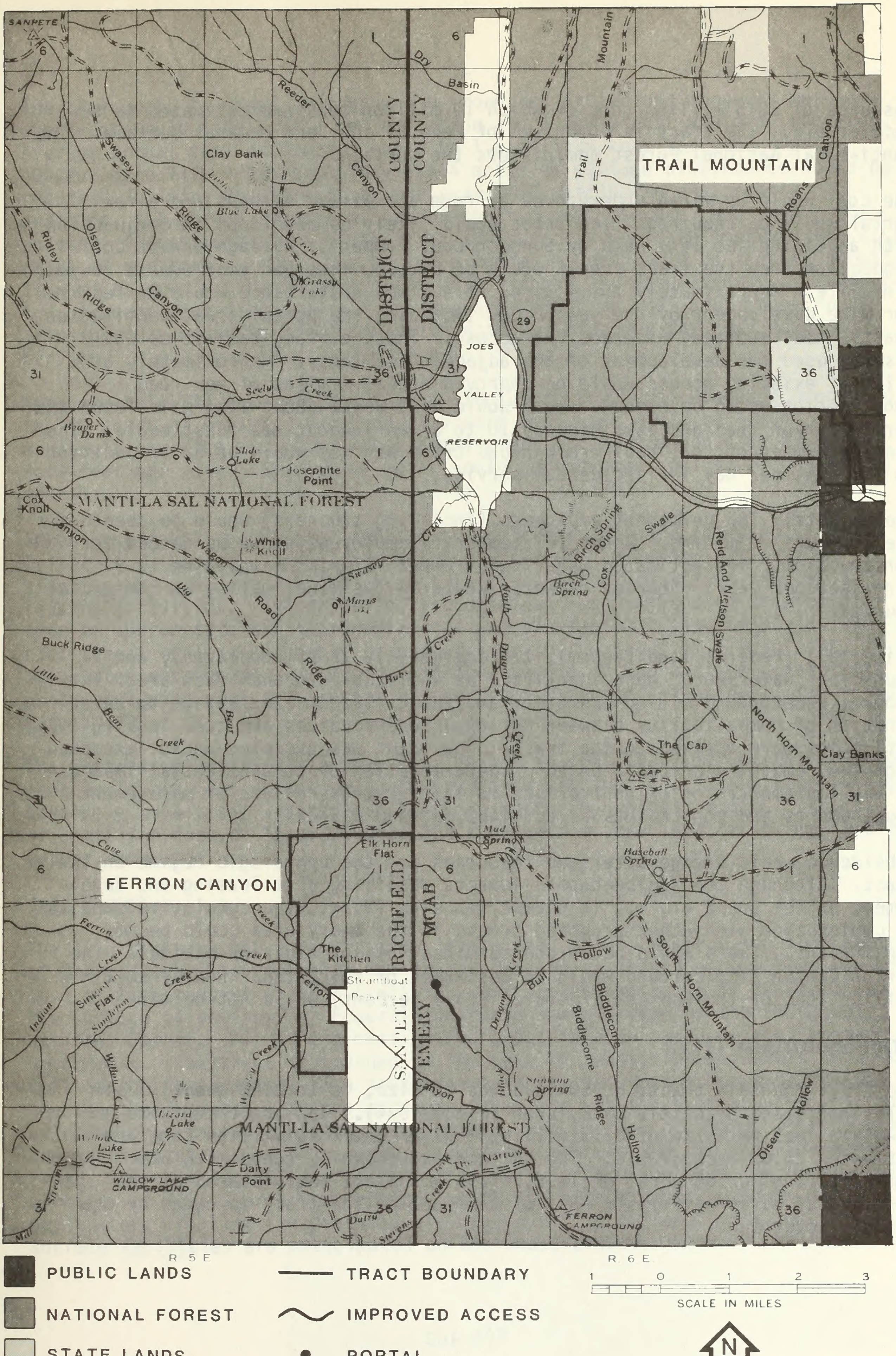


FIGURE 6-4
TRAIL MOUNTAIN AND FERRON CANYON COAL TRACTS

resource of 28.5 million tons of which 10 million tons are estimated to be recoverable. The tract is comprised of Federal coal and Federal surface. The Manti-LaSal National Forest administers the surface.

The coal would be mined underground by room and pillar methods and a new portal would be required. The tract would likely be developed in conjunction with adjoining fee land held by Sunedco Coal Company. Average annual coal production from the tract itself would be 500,000 tons per year over a 20-year mine life. Approximately 157.4 acres of surface disturbance would be required for mine development by the year 2000, including the portal area, ventilation shafts, coal storage, and required access. These surface facilities would also be used for development of the adjacent fee lands. Approximately 8.8 miles of existing access would be improved and 23.1 miles of new road construction would be needed. Coal would be trucked about 24.4 miles down the Ferron Canyon road and Utah Highway 10 to a new loadout near Castledale. The average number of coal haul truck round trips per day would be 52 in addition to 10 trips per day for incidental service.

Approximately 183 permanent employees (including truckers) would be needed for the 20 years of mining. About 147 temporary employees would be needed for construction. The estimated water requirement for mining would be 10.7 acre-feet per year. Sources of water would be the mine, wells, or commercial sources.

Criteria 1 (Federal land system), 11 (eaglenest), 16 (floodplains), and 17 (municipal watershed), were identified as applicable to the tract area. The general underground mining exemption and the Criterion 1 exception on determination of compatibility between National Forest values and coal leasing activities were applied to the tract. The tract was excepted and/or exempted from the remaining criteria based on determination of no substantial impacts or the implementation of appropriate mitigation measures and/or management requirements and constraints as outlined in 43 CFR 3461.1

Subsidence could damage watershed resources and the hydrologic regime on the tract. Although the socioeconomic impacts resulting from leasing and development of the tract are not in themselves significant, the cumulative impacts in conjunction with other proposed tracts in the Emery area could become significant. There would be an undetermined loss of riparian habitat. The Ferron Canyon Picnicground would be destroyed or relocated. Nearly 18.8 million tons of inplace coal resource (64.9 percent) would not be mined.

Trail Mountain Tract

The Trail Mountain tract, 6,950.61 acres in size, is located about 11 air miles northwest of Castle Dale, Utah (Figure 6-4). The tract contains an in-place coal resource of 87.3 million tons of which 40 million tons are estimated to be recoverable. The surface is Federally owned with BLM administering 202.66 acres while 6,747.95 acres are administered by the Manti-LaSal National Forest. All of the coal on the tract is owned by the Federal Government.

The coal would be mined underground by room and pillar and longwall methods. The tract would likely be a new operation and a new portal would be required. Average annual coal production would be 1.0 million tons per year over a 40-year mine life. Approximately 146.4 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling, the portal area, ventilation shafts, coal storage, and required access. Approximately 4.6 miles of existing access would be improved and 21.5 miles of new road construction would be needed. Coal would be trucked about 17.6 miles down Cottonwood Canyon to Utah Highway 29, Utah Highway 57, and on to a loadout near Castle Dale. The average number of coal haul truck round trips per day would be 104.2 in addition to 20 trips per day for incidental service.

Approximately 337 permanent employees (including truckers) would be needed for the 40 years of mining. About 55 temporary employees would be needed for construction. The estimated water requirement for mining would be 21.5 acre-feet per year. Sources of water would be the mine, wells, or commercial sources.

Three unsuitability criteria applied to the tract and were excepted. Criterion 1 (Federal lands) was excepted based on the determination that significant values on National Forest lands would be compatible to coal leasing activities. Criterion 16 (floodplains) was exempted by the formulation of appropriate mitigation measures and the determination of no substantial threat of loss to people or property or to the value of floodplains. Stipulated methods of coal mining and concurrence of appropriate government units regarding coal development on the tract excepted Criterion 17 (municipal watersheds).

The Cottonwood Road would be a safety hazard to coal traffic. Portal development would not meet visual resource standards for the area. Subsidence would adversely impact the watershed resources and the hydrologic regime. About 47.3 million tons of in-place coal (54.1 percent of the total resource) would not be recovered.

Ivie Tract

The Ivie tract, 1,040 acres in size, is located about 13 air miles southwest of Emery, Utah (Figure 6-5). The tract contains an in-place coal resource of 10.1 million tons of which 5.6 million tons are estimated to be recoverable The surface is entirely in Federal ownership administered by the Fishlake National Forest. All of the coal on the tract is also owned by the Federal Government. The tract is bounded on the west by fee surface/minerals owned by Coal Search Corporation. The southern, eastern, and northern boundaries of the tract correspond with the escarpments of the Wasatch Plateau. Because of adjacent private land, plateau escarpments, and surface occupancy restrictions due to the presence of bald eagle concentration areas and big game winter range, the only logical way to mine the tract is from the existing underground workings of Coal Search Corporation. With the exception of additional exploratory drilling and possible air breakouts, no surface disturbances or surface facilities are anticipated on the lease tract.

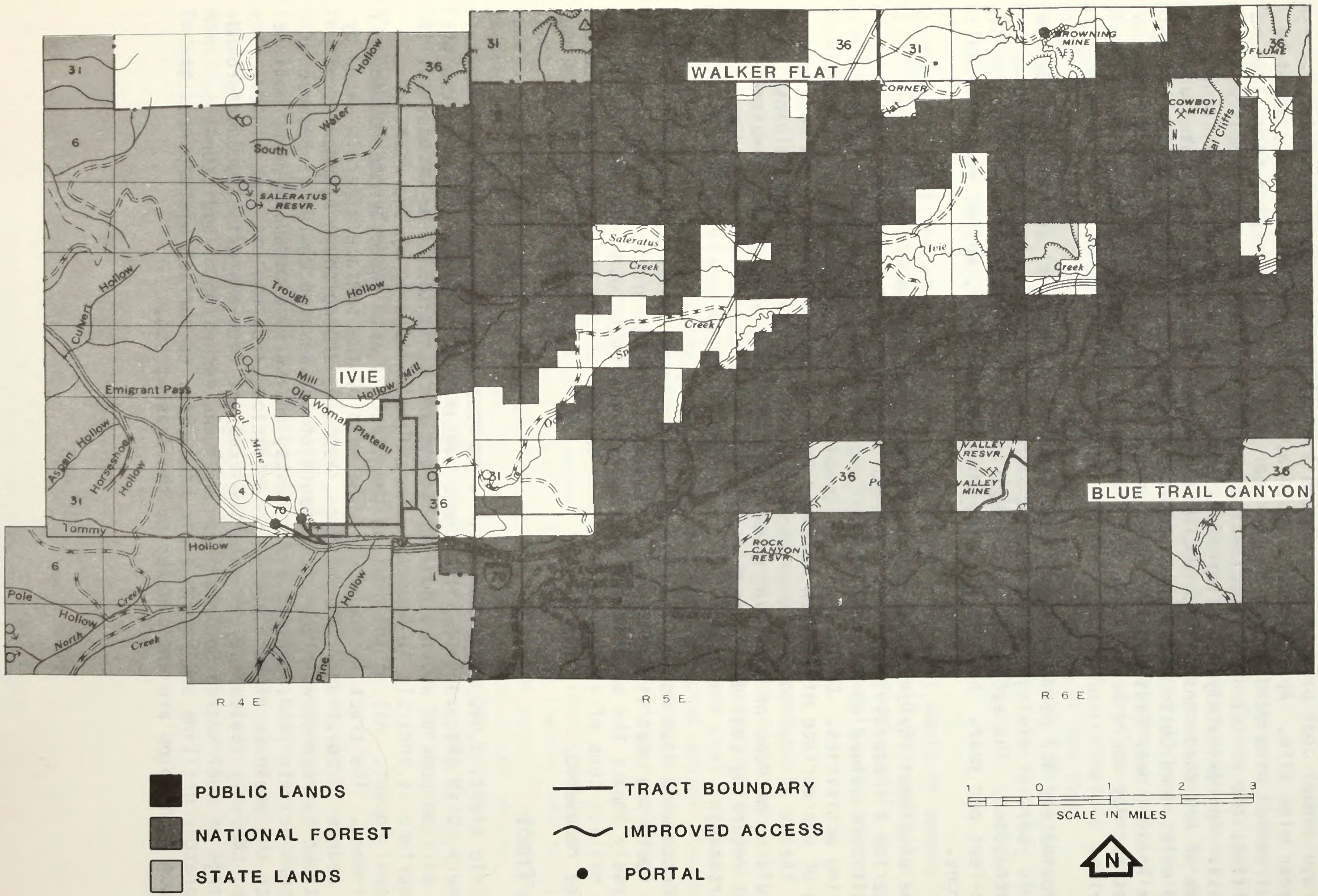


FIGURE 6-5
WALKER FLAT, BLUE TRAIL CANYON AND IVIE COAL TRACTS

The coal would be mined underground by room and pillar methods. Average annual coal production would be 140,000 tons per year over a 40-year mine life. Approximately 2.93 acres of surface disturbance would be required for ventilation shafts and exploration activities including about 0.5 miles of new access for exploratory drilling. Coal would be trucked about 16 miles on I-70 and Utah Highway 10 to a new loadout near Emery. The average number of coal haul truck round trips per day would be 15 in addition to 3 trips per day for incidental service.

Approximately 30 permanent employees (including truckers) would be needed for the 40 years of mining. Development of this tract would extend the life of adjoining operations up to 16 years. The estimated water requirement for mining would be 3.0 acre-feet per year. Sources of water would be the mine, wells, or commercial sources.

Unsuitability Criteria 1 (Federal lands), 9 (crucial habitat for threatened and endangered plant and animal species), 12 (eagle roost), and 15 (critical wildlife habitat) are applicable for this tract. An exception to Criterion 1 was based on the compatibility of coal leasing to the management of National Forest resources. Mitigation measures were formulated to implement the exceptions to the remaining criteria. The mitigation measures deal with inventories of habitat and the protection of habitat through coal activity scheduling and/or no surface occupancy requirements. In addition to the above criteria, a portion of two township sections have been classified by the Forest Service as exhibiting significant visual qualities; no surface disturbance or surface occupancy would be permitted in this area.

Development of this tract would provide 140 new mining related jobs. The entire surface area of the tract is critical deer and elk winter range and some loss of this habitat may occur. Coal development would need to be coordinated with oil and gas lessees to avoid conflicts. About 4.5 million tons of coal (44.5 percent of the estimated resource) would not be recovered.

Blue Trail Canyon Tract

The Blue Trail Canyon tract, 320 acres in size, is located about 10 air miles south of Emery, Utah (Figure 6-5). The tract contains an in-place coal resource of 1 million tons of which 0.9 million tons are estimated to be recoverable. The tract is composed entirely of Federally owned surface administered by BLM underlain by Federally owned coal.

The coal would be mined by surface methods most likely independent of surrounding operations. Average annual coal production would be 45,000 tons per year over a 20-year mine life. The tract would be surface mined and reclaimed over an area of about 4 acres per year. Approximately 64.9 acres of surface disturbance would be required for mine development by the year 2000, including the mine area, office space, coal storage areas, and required access. Twenty acres of mined area would be unreclaimed at one time. About 1.7 miles of existing access would be improved and an additional 1.7 miles of new road construction would be needed. Coal would be trucked about 19 miles on I-70 and Highway U-10 to a new loadout near Emery, Utah. The average number of coal haul truck round trips per day would be 8 in addition to 1 trip per day for incidental service.

About 12 permanent employees (including truckers) would be needed for the 20 years of mining. The estimated water requirement for mining would be 1.0 acre-foot per year. Sources of water would be wells or commercial sources.

Criterion 14 (migratory birds) has not been fully applied due to the lack of data. Necessary inventories would be required at locations where surface disturbance would be proposed in an actual mine plan. The inventory data would be used to formulate appropriate mitigation measures prior to mine plan approval.

Portions of the tract exhibit significant scenic resources. Site specific analyses would be required prior to mine plan approval to develop mitigation measures for protection of the scenic resources as viewed from Interstate 70. From 20 to 50 perhistoric cultural resources sites could exist on the tract. Evaluation of these sites could indicate the need for complete or partial salvage prior to surface mining activities. Such requirements would entail significant costs to the prospective coal lessee.

Walker Flat Tract

The Walker Flat tract, 1,520.43 acres in size, is located about 5.5 air miles southwest of Emery, Utah (Figure 6-5). The tract contains an in-place coal resource of 73.6 million tons of which 25 million tons are estimated to be recoverable. BLM administers 1,440 surface acres of the tract while 80.43 acres are in non-Federal ownership. All of the coal on the tract is owned by the Federal Government. The only logical way to mine the tract is in conjunction with the existing leases held by Consolidation Coal Company. Mining would be underground by room and pillar and/or longwall methods. With the exception of 1 acre for exploration drilling to further define the coal resource, no surface disturbances or surface facilities are anticipated.

Average annual coal production from the tract would be 625,000 tons per year over a 40-year unit mine life. The overall unit mine could produce 3 to 4 million tons per year. New road construction would not be needed and no increase in truck haulage of coal would be expected as the proposed Castle Valley Railroad would terminate at the portal area. However, 13 trips per day would be required for incidental service.

Approximately 42 permanent employees (including truckers) would be needed for the 40 years of mining. The estimated water requirement for mining would be 13.4 acre-feet per year. The mine would likely supply adequate water.

Unsuitability Criteria 2 (rights-of-way), 15 (critical wildlife habitat), and 16 (floodplains) were applicable to the tract. Appropriate and acceptable mitigation measures have been developed, excepting the criteria.

The livestock water sources provided by Ivie Creek and Saleratus Creek could be lost due to subsidence. Loss of these water sources would necessitate large reductions in grazing numbers on the Saleratus Allotment until the amount of water lost was restored by the lessee as required by Surface Mining Control and Reclamation Act. About 48.6 million tons of in-place coal (66 percent of the total resource) would not be recovered.

Southern Utah: Alton Coal Field

Alton Amphitheater Tract

The Alton Amphitheater tract, 2,781.15 acres in size, is located about 0.25 miles north and east of Alton, Utah (Figure 6-6). The tract contains an in-place coal resource of 74.8 million tons of which 24 million tons are estimated to be recoverable. The tract is comprised of Federal coal and private surface.

The tract would likely be mined in conjunction with adjacent leases, however, independent development is possible. For the purpose of this analysis, an independent operation is assumed. The coal would be mined underground by room and pillar and possibly longwall methods. Average annual coal production would be 600,000 tons per year over a 40-year mine life. Approximately 71.4 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling, the portal area, ventilation shafts, coal storage, and required access. Approximately 4.0 miles of existing access would be improved and 9.0 miles of new road construction would be needed. Coal would be trucked about 10.7 miles from the portal east of Alton to a planned coal slurry preparation plant near Bald Knoll. The slurry preparation plant is analyzed in the Allen-Warner Valley EIS (BLM, 1980a). The average number of coal haul truck round trips per day would be 63 in addition to 12 trips per day for incidental service.

Approximately 210 permanent employees (including truckers) would be needed for the 40 years of mining. About 50 temporary employees would be needed for construction. The estimated water requirement for mining would be 12.9 acre-feet per year. Sources of water would be the mine, possibly supplemented by surface water from Kanab Creek.

Criteria 3 (proximity to public sites), 16 (floodplains), and 19 (alluvial valley floors) were applicable. The general underground mining exemption would meet the suitability requirements for Criterion 3. Data for determination of suitability based on the remaining criteria are not available. Inventories will have to be completed and methods of coal mining stipulated in order to meet the suitability provisions of the criteria.

Significant visual resources exist on the tract. Coal lease operations would adversely affect the visual quality and may contrast with the expectations of recreation oriented visitors. Noise would increase with the development of the tract. It is probable that the sound levels would be above the decibals weighted sound level (dBA) set as the national average for residential areas. Availability of new jobs, changes in the personal income and population growth would be significant based on existing conditions within Kane and Garfield Counties. County infrastructure needs for such changes would require specific

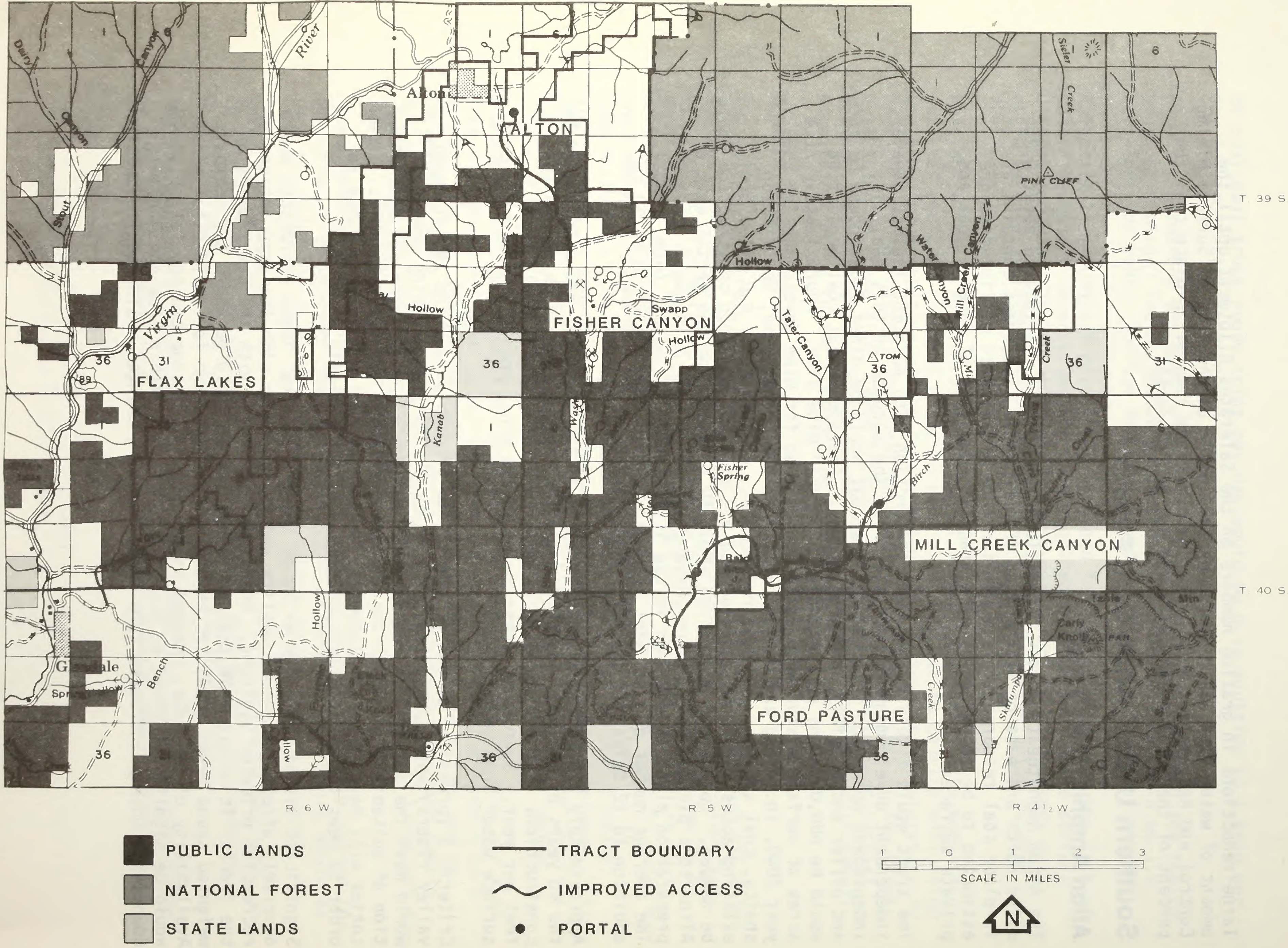


FIGURE 6-6
FLAX LAKES, FISHER CANYON, MILL CREEK CANYON, ALTON AND FORD PASTURE COAL TRACTS

socioeconomic mitigation involving the participation of appropriate Federal, State and local agencies and the coal lessee. About 50.8 million tons of in-place coal (67.9 percent) on the tract would not be recovered.

Fisher Canyon Tract

The Fisher Canyon tract, 5,724.91 acres in size, is located about 6 air miles southwest of Alton, Utah (Figure 6-6). The tract contains an in-place coal resource of 134 million tons of which 54 million tons are estimated to be recoverable. BLM administers 3,149 acres of Federal surface and Federal coal while 2,575.9 acres are private surface over Federal coal.

The coal would be mined underground by room and pillar methods. Logical access to the coal would be from existing leases to the south and new portal or other surface facilities would not be needed. Average annual coal production would be 1.35 million tons per year over a 40-year mine life. Approximately 60.2 acres of surface disturbance would be required for exploratory drilling purposes. About 18.0 miles of new road construction would be needed for exploratory drilling. Coal would be trucked 5.0 miles from an existing portal to a coal slurry preparation plant near Bald Knoll. The average number of coal haul truck round trips per day would be 141 in addition to 27 trips per day for incidental service.

Approximately 330 permanent employees (including truckers) would be needed for the 40 years of mining. About 70 temporary employees would be needed for construction. The estimated water requirement for mining would be 29.0 acre-feet per year. Sources of water would be from the mine possibly supplemented with surface flows from Thompson Creek.

Unsuitability Criterion 19 (alluvial valley floors) was applicable to the tract. Data for determination of suitability based on this criterion are not available. Inventories would have to be completed and methods of coal mining stipulated prior to meeting the suitability provisions of the criterion.

Underground mining and resulting subsidence could significantly affect spring flows on the tract. The continuity of the aquifers would change and some springs could cease to flow. Agricultural activities below the tract are highly dependent on the existing spring flows. The lessee would be required to replace any water lost as a result of coal mining.

Availability of new jobs, changes in personal income and population would all affect Kane and Garfield Counties. About 80 million tons on in-place coal (59.7 percent of the total resource) would not be mined.

Flax Lakes Tract

The Flax Lakes tract, 5,600.48 acres in size, is located about 0.5 mile west of Alton, Utah (Figure 6-6). The tract contains an in-place coal resource of 112.7 million tons of which 30 million tons are estimated to be recoverable. BLM administers 3,920.48 surface acres of the tract while 1,680 acres are in non-Federal ownership. All of the coal on the tract is owned by the Federal Government.

The tract would most logically be mined with adjacent lease holdings, however, independent development is possible. This analysis assumes an independent operation. The coal would be mined underground by room and pillar methods and a new portal would be required. Average annual coal production would be 750,000 tons per year over a 40-year mine life. Approximately 122.6 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling, the portal area, ventilation shafts, coal storage, and required access. Approximately 4.5 miles of existing access would be improved and 18.5 miles of new road construction would be needed. Coal would be trucked about 17.0 miles to a coal slurry preparation plant near Bald Knoll. The average number of coal haul truck round trips per day would be 78 in addition to 15 trips per day for incidental service.

Approximately 400 permanent employees (including truckers) would be needed for the 40 years of mining. About 100 temporary employees would be needed for construction. The estimated water requirement for mining would be 16.1 acre-feet per year. Sources of water would be the mine possibly supplemented with surface water.

No Unsuitability Criteria applied to this tract. Subsidence of up to 10 feet over most of the tract could not be avoided. Surface disturbance would result in soil runoff, and an increase in sediment yield over present conditions. Possible impacts to cultural resources have not been determined due to a lack of available data. Further studies are needed to develop appropriate mitigating measures. Based on 1975 travel data, nearly 20,000 visitors to the area would view the mining operation. These visitors are largely recreation oriented with the existing scenery an important part of the recreation experience. Noise associated with mining would be evident as mining is not now a part of the existing environment in southern Utah. Tract development would provide jobs and revenue in the counties; however local communities would also be under stress to provide necessary services for the increased population. About 82.7 million tons of in-place coal (73.3 percent of total resource) would not be mined.

Ford Pasture Tract

The Ford Pasture tract, 1,400 acres in size, is located about 16 air miles southeast of Alton, Utah (Figure 6-6). The tract contains an in-place coal resource of 36.3 million tons of which 20 million tons are estimated to be recoverable. The tract is comprised of Federal surface and Federal coal.

The Ford Pasture tract could be mined in association with other lease holdings or as an independent operation. The coal would be mined by both underground (room and pillar) and surface methods. About 56.5 acres per year would be surface mined for 12.4 years before the underground mining would begin.

Average annual coal production would be 1.0 million tons per year over a 20-year mine life. Approximately 644 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling, the portal area, surface mine area and coal storage, and required access. A maximum of 135.5 acres would be unreclaimed at one time. Access to the Ford Pasture tract would follow the Flax Lakes access and no additional portal access would be required. About 1.25 miles of new road construction would be needed for exploratory drilling. Coal would be trucked about 2.7 miles from the mine area to a coal slurry preparation plant near Bald Knoll. The average number of coal haul truck round trips per day would be 104 in addition to 20 trips per day for incidental service.

Approximately 330 permanent employees (including truckers) would be needed for the 20 years of mining. About 70 temporary employees would be needed for construction. The estimated water requirement for mining would be 21.5 acre-feet per year. Sources of water would be the mine area or wells possibly supplemented by surface water.

No Unsuitibility Criteria applied to this tract. About 20 to 30 prehistoric cultural resource sites are known to exist on the tract. Prior to surface mining operations these sites as well as all other sites identified subsequent to actual mining would be evaluated and then would be avoided or salvaged as appropriate. Such requirements would entail significant costs to the prospective coal lessee. About 16.3 million tons of in-place coal (44.9 percent of total resource) would not be recovered. Impacts to recreation, visual resources, socioeconomics, and noise would be similar to those described for the Alton Amphitheater, Flax Lakes, and Fisher Canyon tracts.

Mill Creek Canyon Tract

The Mill Creek Canyon tract, 6,562.48 acres in size, is located about 8 air miles southwest of Alton, Utah (Figure 6-6). The tract contains an in-place coal resource of 204 million tons of which 65 million tons are estimated to be recoverable. BLM administers 2,911 surface acres of the tract while 3,651.48 acres are in non-Federal ownership. All of the coal on the tract is owned by the Federal Government.

The tract would logically be developed from adjacent properties, however, independent development is also possible. This analysis assumes an independent operation. The coal would be mined underground by room and pillar methods and a new portal would be required. Average annual coal production would be 1.65 million tons per year over a 40-year mine life. Approximately 130.8 acres of surface disturbance would be required for mine development by the year 2000, including exploratory drilling, the portal area, ventilation shafts, coal storage, and required access. Approximately 4.5 miles of existing access would be upgraded and 20.5 miles of new road construction would be needed. Coal would be trucked about 5.0 miles to a coal slurry preparation plant near Bald Knoll. The average number of coal haul truck round trips per day would be 169 in addition to 33 trips per day for incidental service.

Approximately 550 permanent employees (including truckers) would be needed for the 40 years of mining. About 140 temporary employees would be needed for construction. The estimated water requirement for mining would be 34.9 acre-feet per year. Sources of water would be the mine possibly supplemented by wells or surface water.

Unsuitability Criteria 16 (floodplains) and 19 (alluvial valley floors) apply to the tract. Suitability provisions of these criteria cannot be adequately addressed until inventories and stipulated coal mining methods are completed. About 159 million tons of in-place coal (77.9 percent of total resource) would not be recovered. Impacts to recreation, visual resources, socioeconomics, and noise would be similar to those discussed for the Alton Amphitheater, Flax Lakes, and Fisher Canyon tracts.

West-Central Colorado: Paonia-Somerset Coal Field

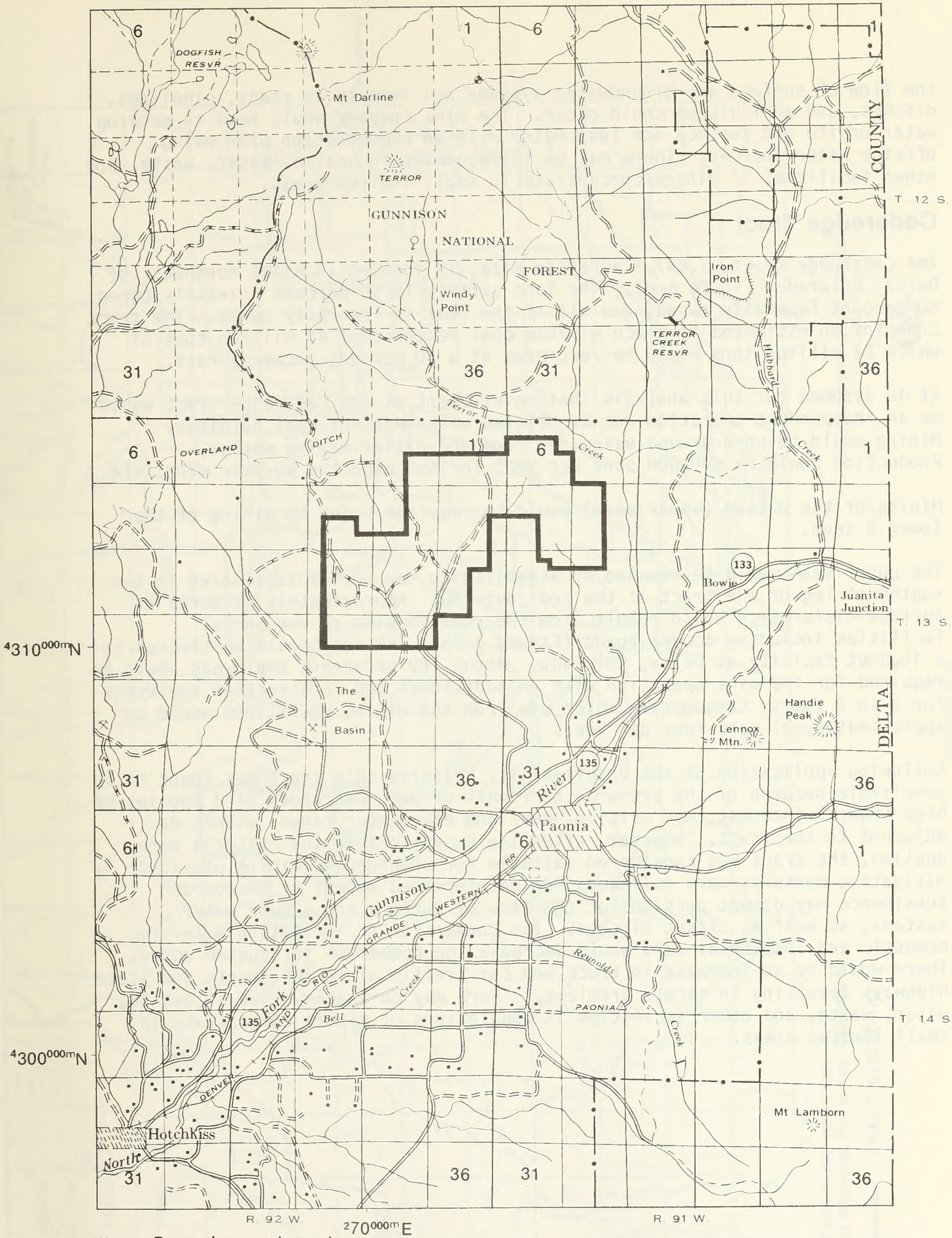
Paonia D Coal Bed Tract

The Paonia D Coal Seam tract is 4,997.85 acres in size and is located 3 miles north of Paonia and 30 miles east of Delta, Colorado (Figure 6-7). The land surface is 80 percent privately owned, 20 percent Federally owned, and all of the coal is Federally owned. The tract contains an estimated in-place coal resource (in the D seam) of 104 million tons of which approximately 80 million tons is minable. Approximately 40 million tons would be recovered at a 50-percent recovery rate. Mining would be underground using the room and pillar mining method. Only one of the three minable seams would be considered for leasing and mining at this time.

If the adjacent lease holder, Colorado Westmoreland, Inc., obtains the lease, the tract would be mined from their existing Orchard Valley Mine. Additional surface disturbance would be limited to ventilation shafts, drill holes and access roads. If another operator obtained the tract, an additional 40 acres of surface disturbance would be required for construction of new portal facilities, access roads, drill pads, and ventilation shafts. Annual coal production would average 1.5 million tons with a mine life of 27 years. Coal mined from the tract would be transported by a conveyor or other methods designed to avoid State Highway 133 to a loadout facility approximately 4 miles away.

About 275 permanent employees would be required for mine operation. If surface facilities are constructed, an additional 150 construction workers would be required for up to 2 years. If the adjacent coal owner does not obtain the proposed lease, their coal resources would be depleted by 1987 and employment would cease at the Orchard Valley Mine. At the same time, construction of new mine facilities on the lease tract would begin. As a result, it is not expected that there would be additional employees in the Paonia area if a new portal facility is constructed. Consumptive water use from the mining operations would be approximately 78 acre-feet per year.

Following application of the Unsuitability Criteria, this tract was found to be unsuitable because there were existing rights-of-ways, migratory bird species of high Federal interest, critical deer and elk winter range, a public road, historic sites potentially eligible for the National Register of Historic Places, and known golden eagle nest sites. However, after the exceptions to the criteria were applied, the tract was considered suitable provided certain mitigating measures were followed (Appendix 3). An undetermined amount of controlled subsidence which could divert portions of



Note: Base does not meet National Mapping Accuracy Standards

TRACT BOUNDARY

SCALE IN MILES

FIGURE 6-7
PAONIA 'D' TRACT

the flow of surface and groundwater systems and impacts to roads, pipelines, ditches, and agriculture could occur. The mine company would need to develop water onsite and replace any lost water with an augmentation plan using offsite water sources. There may be inadequacies in health, water, waste, and other facilities if miners concentrate in small limited areas.

Cedaredge Tract

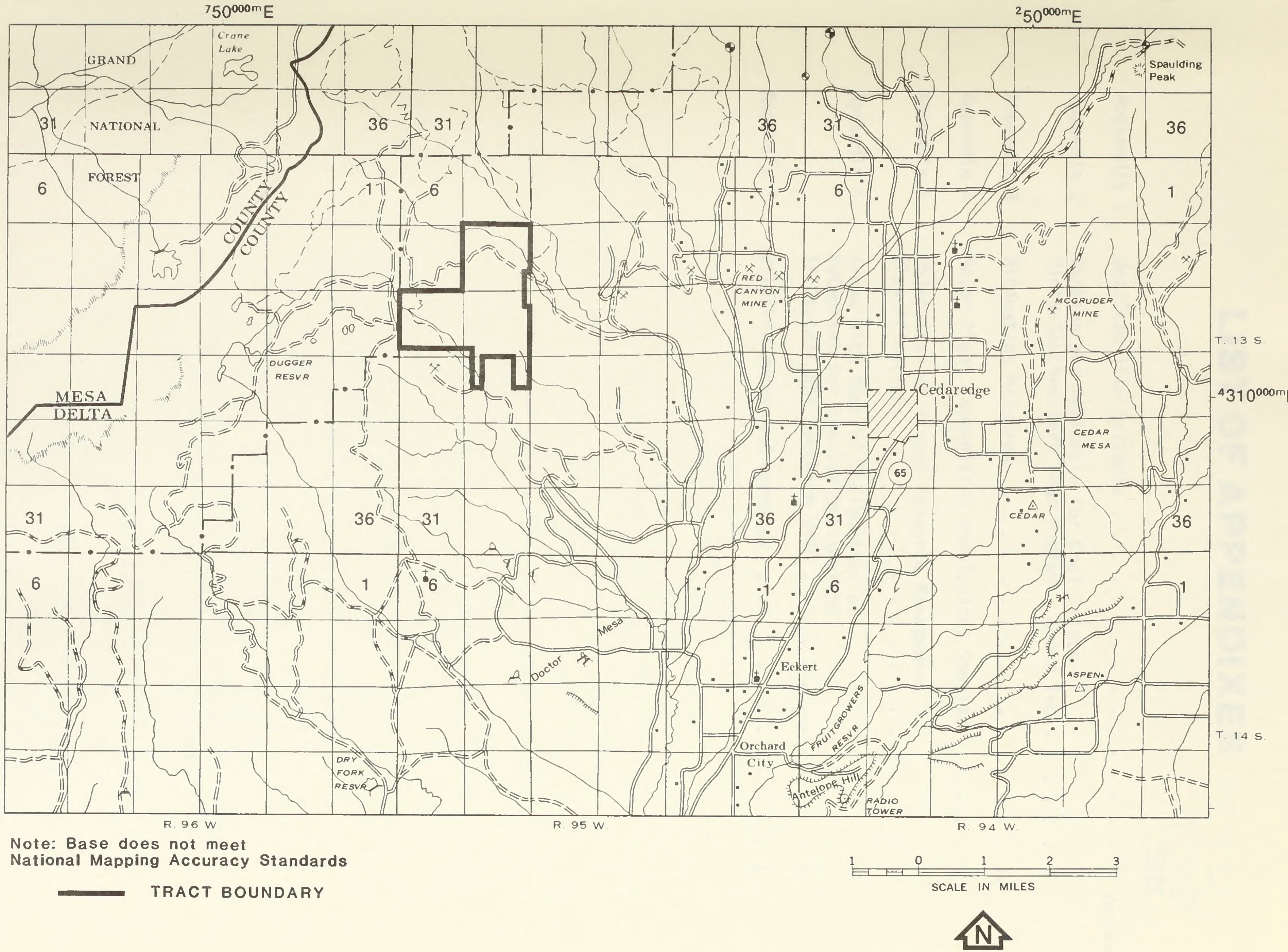
The Cedaredge tract, 1,847.2 acres in size, is located 14 miles northeast of Delta, Colorado (Figure 6-8). The land surface is 40 percent privately owned, 60 percent Federally owned, and all of the coal is Federally owned. The tract contains an estimated in-place minable coal resource of 45 million tons of which 23 million tons would be recovered at a 50 percent recovery rate.

It is assumed for this analysis that development of the Cedaredge tract would be an independent operation not associated with adjacent coal holdings. Mining would be underground using the room and pillar mining method. Production would be 600,000 tons per year for the expected 40-year mine life.

Mining of the D seam (upper seam) would be required prior to mining of the lower B seam.

The upper seam could be reached by establishing new portal facilities in the southeast leg of the tract at the coal outcrop. Approximately 40 acres of surface disturbance would result from the construction of new portal facilities including access roads (Figure 6-7). The coal would be trucked to a loadout facility at Delta, Colorado. About 160 permanent employees would be required for the mine operation with an additional 100 construction employees for 2 to 3 years. Consumptive water use from the mining operations would be approximately 31 acre-feet per year.

Following application of the Unsuitability Criteria this tract was found to be unsuitable because of the presence of rights-of-way, migratory bird species of high Federal interest, and critical deer and elk winter range, within or adjacent to the tract. However, after the exceptions to the criteria were applied, the tract was considered suitable for underground mining provided mitigating measures were followed. An undetermined amount of overburden subsidence may divert portions of the flow of surface and ground water systems, as well as offset ditches. The conversion of irrigation water to domestic and industrial uses would decrease the number of irritgated acres. There would be an increase in truck and car traffic along the county and State highways resulting in safety problems. There may be inadequacies in health, water, waste, and other facilities if populations of miners concentrate in small limited areas.



Note: Base does not meet
National Mapping Accuracy Standards

TRACT BOUNDARY

FIGURE 6-8
CEDAREDGE TRACT

LIST OF APPENDIXES

Subpart 3461—Federal Lands Review—Unsuitability for Mining

§ 3461.0-3 Authority.

(a) These regulations are issued under the authority of the statutes listed in § 3400.0-3 of this title.

(b) These regulations primarily implement:

(1) The general unsuitability criteria in section 522(a) of the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1272(a));

(2) The Federal lands review in section 522(b) of the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1272(b)); and

(3) The prohibitions against mining certain lands in section 522(e) of the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1272(e)).

§ 3461.0-6 Policy.

The Department shall carry out the review of Federal lands under section 522(b) of the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1272(b)) principally through land use planning assessments by the surface management agency regarding the unsuitability of Federal lands for all or certain stipulated methods of coal mining.

§ 3461.0-7 Scope.

Each criterion in § 3461.1 of this title uses the phrase "shall be considered unsuitable" as shorthand for "shall be considered unsuitable for all or certain stipulated methods of coal mining involving surface coal mining operations, as defined in § 3400.0-5(mm) of this title.

§ 3461.1 Criteria for assessing lands unsuitable for all or certain stipulated methods of coal mining.

(a)(1) *Criterion Number 1.* All Federal lands included in the following land systems or categories shall be considered unsuitable: National Park System, National Wildlife Refuge System, National System of Trails, National Wilderness Preservation System, National Wild and Scenic Rivers System, National Recreation Areas, lands acquired with money derived from the Land and Water Conservation Fund, National Forests, and Federal lands in incorporated cities, towns, and villages.

(2) *Exceptions.* (i) A lease may be issued within the boundaries of any National Forest if the Secretary finds no significant recreational, timber, economic or other values which may be incompatible with the lease; and (A) surface operations and impacts are incident to an underground coal mine, or (B) where the Secretary of Agriculture determines, with respect to lands which do not have significant forest cover within those National Forests west of the 100th meridian, that surface mining may be in compliance with the Multiple-Use Sustained-Yield Act of 1960, the Federal Coal Leasing Amendments Act of 1976 and the Surface Mining Control and Reclamation Act of 1977. (ii) A lease may be issued within the Custer National Forest with the consent of the Department of Agriculture as long as no surface coal mining operations are permitted.

(3) *Exemptions.* The application of this criterion to lands within the listed land systems and categories is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977. The application of the portion of this criterion applying to land proposed for inclusion in the listed systems does not apply to lands: to which substantial legal and financial commitments were made prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(b)(1) *Criterion Number 2.* Federal lands that are within rights-of-way or easements or within surface leases for residential, commercial, industrial, or other public purposes. Federally owned surface shall be considered unsuitable.

(2) *Exceptions.* A lease may be issued, and mining operations approved, in such areas if the surface management agency determines that:

(i) All or certain types of coal development (e.g., underground mining) will not interfere with the purpose of the right-of-way or easement; or

(ii) The right-of-way or easement was granted for mining purposes; or

(iii) The right-of-way or easement was issued for a purpose for which it is not being used; or

(iv) The parties involved in the right-of-way or easement agree, in writing, to leasing; or

(v) It is impractical to exclude such areas due to the location of coal and method of mining and such areas or uses can be protected through appropriate stipulations.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(c)(1) *Criterion Number 3.* Federal lands affected by section 522(e) (4) and (5) of the Surface Mining Control and Reclamation Act of 1977 shall be considered unsuitable. This includes lands within 100 feet of the outside line of the right-of-way of a public road or within 100 feet of a cemetery, or within 300 feet of any public building, school, church, community or institutional building or public park or within 300 feet of an occupied dwelling.

(2) *Exceptions.* A lease may be issued for lands:

(i) Used as mine access roads or haulage roads that join the right-of-way for a public road;

(ii) For which the Office of Surface Mining Reclamation and Enforcement has issued a permit to have public roads relocated;

(iii) If, after public notice and opportunity for public hearing in the locality, a written finding is made by the authorized officer that the interests of the public and the landowners affected by mining within 100 feet of a public road will be protected.

(3) *Exemptions.* The application of this criterion is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977.

(d)(1) *Criterion Number 4.* Federal lands designated as wilderness study areas shall be considered unsuitable while under review by the Administration and the Congress for possible wilderness designation. For any Federal land which is to be leased or mined prior to completion of the wilderness inventory by the surface management agency, the environmental assessment or impact statement on the lease sale or mine plan shall consider whether the land possesses the characteristics of a wilderness study area. If the finding is affirmative, the land shall be considered unsuitable, unless issuance of noncompetitive coal leases and mining on leases is authorized under the Wilderness Act and the Federal Land Policy and Management Act of 1976.

(2) *Exemption.* The application of this criterion to lands for which the Bureau of Land Management is the surface management agency and lands in designated wilderness areas in National Forests is subject to valid existing rights.

(e)(1) *Criterion Number 5.* Scenic Federal lands designated by visual resource management analysis as Class I (an area of outstanding scenic quality or high visual sensitivity) but not currently on the National Register of Natural Landmarks shall be considered unsuitable. A lease may be issued if the surface management agency determines that surface coal mining operations will not significantly diminish or adversely affect the scenic quality of the designated area.

(2) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977, on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(f)(1) *Criterion Number 6.* Federal lands under permit by the surface management agency, and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments shall be considered unsuitable for the duration of the study, demonstration or experiment, except where mining could be conducted in such a way as to enhance or not jeopardize the purposes of the study, as determined by the surface management agency, or where the principal scientific user or agency gives written concurrence to all or certain methods of mining.

(2) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(g)(1) *Criterion Number 7.* All districts, sites, buildings, structures, and objects of historic, architectural, archeological, or cultural significance on Federal lands which are included in or eligible for inclusion in the National Register of Historic Places, and an appropriate buffer zone around the outside boundary of the designated property (to protect the inherent values of the property that make it eligible for listing in the National Register) as determined by the surface management agency, in consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Office shall be considered unsuitable.

(2) *Exceptions.* All or certain stipulated methods of coal mining may be allowed if the surface management agency determines, after consultation with the Advisory Council on Historic Preservation and State Historic Preservation Office that the direct and indirect effects of mining, as stipulated, on a property in or eligible for the National Register of Historic Places will not result in significant adverse impacts to the property.

(3) *Exemptions.* The application of this criterion to a property listed in the National Register is subject to valid existing rights, and does not apply to surface coal mining operations existing on August 3, 1977. The application of the criterion to buffer zones and properties eligible for the National Register does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(h)(1) *Criterion Number 8.* Federal lands designated as natural areas or as National Natural Landmarks shall be considered unsuitable.

(2) *Exceptions.* A lease may be issued and mining operation approved in an area or site if the surface management agency determines that:

(i) With the concurrence of the state, the area or site is of regional or local significance only;

(ii) The use of appropriate stipulated mining technology will result in no significant adverse impact to the area or site; or

(iii) The mining of the coal resource under appropriate stipulations will enhance information recovery (e.g., paleontological sites).

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which includes operations on which a permit has been issued.

(i)(1) *Criterion Number 9.* Federally designated critical habitat for threatened or endangered plant and animal species, and habitat for Federal threatened or endangered species which is determined by the Fish and Wildlife Service and the surface management agency to be of essential value and where the presence of threatened or endangered species has been scientifically documented, shall be considered unsuitable.

(2) *Exception.* A lease may be issued and mining operations approved if, after consultation with the Fish and Wildlife Service, the Service determines that the proposed activity is not likely to jeopardize the continued existence of the listed species and/or its critical habitat.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977, or which include operations on which a permit has been issued.

(j)(1) *Criterion Number 10.* Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as endangered or threatened shall be considered unsuitable.

(2) *Exception.* A lease may be issued and mining operations approved if, after consultation with the state, the surface management agency determines that the species will not be adversely affected by all or certain stipulated methods of coal mining.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(k)(1) *Criterion Number 11.* A bald or golden eagle nest or site on Federal lands that is determined to be active and an appropriate buffer zone of land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

(2) *Exceptions.* A lease may be issued if:

(i) It can be conditioned in such a way, either in manner or period of operation, that eagles will not be disturbed during breeding season; or

(ii) The surface management agency, with the concurrence of the Fish and Wildlife Service, determines that the golden eagle nest(s) will be moved.

(iii) Buffer zones may be decreased if the surface management agency determines that the active eagle nests will not be adversely affected.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(l)(1) *Criterion Number 12.* Bald and golden eagle roost and concentration areas on Federal lands used during migration and wintering shall be considered unsuitable.

(2) *Exception.* A lease may be issued if the surface management agency determines that all or certain stipulated methods of coal mining can be conducted in such a way, and during such periods of time, to ensure that eagles shall not be adversely disturbed.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(m)(1) *Criterion Number 13.* Federal lands containing a falcon (excluding kestrel) cliff nesting site with an active nest and a buffer zone of Federal land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

(2) *Exception.* A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the falcon habitat during the periods when such habitat is used by the falcons.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(n)(1) *Criterion Number 14.* Federal lands which are high priority habitat for migratory bird species of high Federal interest on a regional or national basis, as determined jointly by the surface management agency and the Fish and Wildlife Service, shall be considered unsuitable.

(2) *Exception.* A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the migratory bird habitat during the periods when such habitat is used by the species.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(o)(1) *Criterion Number 15.* Federal lands which the surface management agency and the state jointly agree are fish and wildlife habitat for resident species of high interest to the state and which are essential for maintaining these priority wildlife species shall be considered unsuitable. Examples of such lands which serve a critical function for the species involved include:

(i) Active dancing and strutting grounds for sage grouse, sharp-tailed grouse, and prairie chicken;

(ii) Winter ranges most critical for deer, antelope, and elk; and

(iii) Migration corridors for elk.

A lease may be issued if, after consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not have a significant long-term impact on the species being protected.

(2) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(p)(1) *Criterion Number 16.* Federal lands in riverine, coastal and special floodplains (100-year recurrence interval) on which the surface management agency determines that mining could not be undertaken without substantial threat of loss of life or property shall be considered unsuitable for all or certain stipulated methods of coal mining.

(2) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(q)(1) *Criterion Number 17.* Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.

(2) *Exception.* A lease may be issued where the surface management agency in consultation with the municipality (incorporated entity) or the responsible governmental unit determines, as a result of studies, that all or certain stipulated methods of coal mining will not adversely affect the watershed to any significant degree.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(r)(1) *Criterion Number 18.* Federal lands with National Resource Waters, as identified by states in their water quality management plans, and a buffer zone of Federal lands ¼ mile from the outer edge of the far banks of the water, shall be unsuitable.

(2) *Exception.* The buffer zone may be eliminated or reduced in size where the surface management agency determines that it is not necessary to protect the National Resource Waters.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

(s)(1) *Criterion Number 19.* Federal lands identified by the surface management agency, in consultation with the state in which they are located, as alluvial valley floors according to the definition in § 3400.0–5(a) of this title, the standards in 30 CFR Part 822, the final alluvial valley floor guidelines of the Office of Surface Mining Reclamation and Enforcement when published, and approved state programs under the Surface Mining Control and Reclamation Act of 1977, where mining would interrupt, discontinue, or preclude farming, shall be considered unsuitable. Additionally, when mining Federal land outside an alluvial valley floor would materially damage the quantity or quality of water in surface or underground water systems that would supply alluvial valley floors, the land shall be considered unsuitable.

(2) *Exemptions.* This criterion does not apply to surface coal mining operations which produced coal in commercial quantities in the year preceding August 3, 1977, or which had obtained a permit to conduct surface coal mining operations.

(t)(1) *Criterion Number 20.* Federal lands in a state to which is applicable a criterion (i) proposed by that state, and (ii) adopted by rulemaking by the Secretary, shall be considered unsuitable.

(2) *Exceptions.* A lease may be issued when:

(i) Such criterion is adopted by the Secretary less than 6 months prior to the publication of the draft comprehensive land use plan or land use analysis, plan, or supplement to a comprehensive land use plan, for the area in which such land is included, or

(ii) After consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not adversely affect the value which the criterion would protect.

(3) *Exemptions.* This criterion does not apply to lands: to which the operator made substantial legal and financial commitments prior to January 4, 1977; on which surface coal mining operations were being conducted on August 3, 1977; or which include operations on which a permit has been issued.

§ 3461.2 Underground mining exemption from criteria.

(a) Federal lands with coal deposits that would be mined by underground mining methods shall not be assessed as unsuitable where there would be no surface coal mining operations, as defined in § 3400.0–5 of this title, on any lease, if issued.

(b) Where underground mining will include surface operations and surface impacts on Federal lands to which a criterion applies, the lands shall be assessed as unsuitable unless the surface management agency finds that a relevant exception or exemption applies.

§ 3461.3 Unsuitability assessment procedures.

§ 3461.3–1 Assessment and land use planning.

(a)(1) Each of the unsuitability criteria shall be applied to all coal lands with development potential identified in the comprehensive land use plan or land use analysis. For areas where 1 or more unsuitability conditions are found and for which the authorized officer of the surface management agency could otherwise regard coal mining as a likely use, the exceptions and exemptions for each criterion may be applied.

(2) The authorized officer of the surface management agency shall describe in the comprehensive land use plan or land use analysis the results of the application of each unsuitability criterion, exception and exemption. The authorized officer of the surface management agency shall state in the plan or analysis those areas which could be leased only subject to conditions or stipulations to conform to the application of the criteria or exceptions. Such areas may ultimately be leased provided that these conditions or stipulations are contained in the lease.

(b)(1) The authorized officer shall make his assessment on the best available data that can be obtained given the time and resources available to prepare the plan. The comprehensive land use plan or land use analysis shall include an indication of the adequacy and reliability of the data involved. Where either a criterion or exception (when under subsection (a) of this section the authorized officer decides that application of an exception is appropriate) cannot be applied during the land use planning process because of inadequate or unreliable data, the plan or analysis shall discuss the reasons therefor and disclose when activity planning, or, in the case of criterion 19, prior to approval of a permit, the data needed to make an assessment with reasonable certainty would be generated. The authorized officer shall make every effort within the time and resources available to collect adequate and reliable data which would permit the application of criterion 19 in the land use or activity planning process. When those data are obtained, the authorized officer shall make public his assessment on the application of the criterion or, if appropriate, the exception and the reasons therefor and allow opportunity for public comment.

(2) No lease tract shall be analyzed in a final regional lease sale environmental impact statement prepared under § 3420.4–5 of this title without significant data material to the application to the tract of each criterion described in § 3461.1 of this title, except, where necessary, criterion 19. If the data are lacking for the application of a criterion or exception to only a portion of the tract, and if the authorized officer determines that it is likely that stipulations in the lease or permit to conduct surface coal mining operations could avoid any problems which may result from subsequent application of the criterion or exception, such tract may be included and analyzed in the regional lease sale environmental impact statement.

(c) Any unsuitability assessments which result either from a designation or a termination of a designation of Federal lands as unsuitable by the Office of Surface Mining Reclamation and Enforcement, or from changes warranted by additional data acquired in the activity planning process, may be made without formally revising or amending the comprehensive land use plan or analysis.

§ 3461.3–2 Consultation on unsuitability assessments.

(a) Prior to adopting a comprehensive land use plan or land use analysis which assesses Federal lands as unsuitable for coal mining, the Secretary or other surface management agency shall complete the consultation set out in §§3420.1–6 and 3420.1–7 of this title.

(b) When consultation or concurrence is required in the application of any criterion or exception in § 3461.1 of this title, the request for advice or concurrence, and the reply thereto, shall be in writing. Unless another period is provided by law, the authorized officer shall specify that the requested advice, concurrence or nonconcurrence be made within 30 days.

(c) When the authorized officer does not receive a response either to a request for concurrence which is required by this subpart but not by law, or to consultation within the specified time, he or she may proceed as though concurrence had been given or consultation had occurred.

§ 3461.4 Relationship of leasing to unsuitability assessment.

§ 3461.4–1 Application of criteria on unleased lands.

(a) The unsuitability criteria shall only be applied, prior to lease issuance, to all lands leased after July 19, 1979.

(b) The unsuitability criteria shall be initially applied either:

(1) During land use planning or the environmental assessment conducted for a specific lease application; or

(2) During land use planning under the provisions of § 3420.1–4 of this title.

§ 3461.4–2 Application of criteria on leased lands.

The unsuitability criteria shall not be applied to leased lands.

directions except where the boundaries of the land are in irregular form, and connected by courses and distances to an official corner of the public land surveys. In Alaska, the description of unsurveyed land shall be connected by courses and distances to either an official corner of the public land surveys or to a triangulation station established by an agency of the United States such as the Geological Survey, the National Oceanic and Atmospheric Administration, or the International Boundary Commission, if the record position is available to the general public.

(2)(i) If the land is acquired land in a non-public land state which has not been surveyed under the rectangular system of public land surveys, the land shall be described as in the deed or other document by which the United States acquired title to the lands or minerals.

(ii) If the land constitutes less than the entire tract acquired by the United States, it shall be described by courses and distances between successive angle points on its boundary tying by course and distance into an identifiable point listed in the description in the deed or other document by which the United States acquired title to the land.

(iii) If the description in the deed or other document by which the United States acquired title to the land does not include the courses and distance between the successive angle points on the boundary of the desired tract, the description in the application shall be expanded to include such courses and distances.

(iv) The application shall be accompanied by a map on which the land is clearly marked showing its location with respect to the administrative unit or project of which it is a part. It is not necessary to submit a map if the land has been surveyed under the rectangular system of public land surveys, and the land description can be conformed to that system.

(v) If an acquisition tract number has been assigned by the acquiring agency to the tract, a description by tract number will be accepted.

(vi) Any accreted land not described in the deed to the United States shall be described by metes and bounds, giving courses and distances between the successive angle points on the boundary of the tract, and connected by courses and distances to an angle point on the perimeter of the acquired tract to which the accretions belong.

§ 3471.1-2 Land description in lease.

(a) All unsurveyed lands in a public land survey system state shall have a cadastral survey performed at Federal Government expense before a lease or license to mine may be issued, except for areas covered by a skeleton survey, i.e. Utah and Alaska, and the lease when issued shall be described by legal subdivision (section, township, and range), or aliquot part thereof (but no less than 10 acres).

(b) If the land is acquired land in a non-public land state, the land in the lease shall be described in the same manner provided for lease applications under § 3471.1-1(d)(2) of this title.

§ 3471.2 Effect of land transactions.

§ 3471.2-1 Disposal of land with a reservation of minerals.

(a) Where the lands included in a lease or license to mine have been or may be disposed of with reservation of the coal deposits, a lessee or the holder of a license to mine must comply fully with the law under which the reservation was made. See, among other laws, the Acts of March 3, 1909 (34 Stat. 844; 30 U.S.C. 81); June 22, 1910 (35 Stat. 583; 30 U.S.C. 83–85); December 29, 1916, as amended (39 Stat. 862; 43 U.S.C. 291–301); June 17, 1949 (63 Stat. 200); June 21, 1949 (63 Stat. 214; 30 U.S.C. 54); March 8, 1922 (42 Stat. 415; 48 U.S.C. 376–377); and October 21, 1976 (90 Stat. 2759; 43 U.S.C. 1719).

(b) Any sale or conveyance of acquired lands by the agency having jurisdiction shall be subject to any lease or license to mine previously issued under the Mineral Leasing Act for Acquired Lands.

(c) Leases on acquired lands outstanding on August 7, 1947, and covering lands subject to the Mineral Leasing Act for Acquired Lands may be exchanged for new leases to be issued under that act.

(d) When: (1) the coal is to be mined by other than underground mining techniques, (2) the surface of the land is owned by a qualified surface owner, and (3) the lease is issued after August 3, 1977, the lessee shall comply with the terms of the written consent of the qualified surface owner not inconsistent with Federal and state mined land reclamation laws and regulations.

§ 3471.2-2 Effect of conveyance to State or local entity.

(a) If the United States has conveyed the title to, or otherwise transferred control of the land surface containing the coal deposits to (1) any state or political subdivision, agency, or its instrumentality, (2) a college, any other educational corporation, or association, or (3) to a charitable or religious corporation or association, the transferee shall be notified by certified mail of the application for the license to mine or lease, or the scheduling of a lease sale. The transferee shall be given a reasonable period of time within which to suggest any stipulations necessary for the protection of existing surface improvements or uses to be included in the license or lease and state the supporting facts, or to file any objections to its issuance and state the supporting facts.

(b) Opposition by the state or local entity is not a bar to issuance of the license to mine or lease for the reserved minerals in the lands. (See, however, §3461.1(b).) In each case, the final determination on whether to issue the license to mine or lease is based on the best interests of the public.

§3471.3-1 Protection of bona fide purchaser.

(a) The Secretary's right to cancel or forfeit a lease for any violation shall not adversely affect the title or interest of a bona fide purchaser of any lease or any interest therein. A bona fide purchaser must be a person, association, or corporation qualified to hold such lease or interest, even though the holdings of the party or parties from which the lease or interest therein was acquired or their predecessor(s) in title (including the original lessee of the United States), may have been cancelled or forfeited for any such violation.

(b) Any party to any proceedings with respect to a violation of any provision of the mineral leasing laws may be dismissed promptly as a party by showing that he/she holds and acquired his/her interest as a bona fide purchaser without having violated any provisions of the mineral leasing laws.

(c) If a party waives his or her rights under the lease, or if such rights are suspended by order of the Secretary pending a decision, rental payments and time counted against the term of the lease shall be suspended as of the first day of the month following the filing of the waiver or the Secretary's suspension until the first day of the month following the final decision in the proceeding or the revocation of the waiver or suspension.

§3471.3-2 Sale of underlying interests.

If, in any proceeding to cancel or forfeit a lease or any interest therein acquired in violation of any of the provisions of the mineral leasing laws, the lease or interest therein is cancelled or forfeited, and if there are valid options to acquire the lease or an interest therein that are not subject to cancellation, forfeiture, or compulsory disposition, this lease or interest therein shall be sold to the highest responsible qualified bidder by competitive bidding, in a manner similar to that provided for in the offering of leases by competitive bidding, subject to all outstanding valid interests and options. If less than the whole interest in the lease or interest therein is cancelled or forfeited, the partial interest shall be sold in the same way. If no satisfactory offer is obtained as a result of the competitive offering of

§3461.5 Exploration.

(a) Assessment of any area as unsuitable for all or certain stipulated methods of coal mining operations pursuant to section 522 of the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1272) and the regulations of this subpart does not prohibit exploration of such area under subpart 3410 of this title and under 30 CFR 211.2(a).

(b) An application for an exploration license on any lands assessed as unsuitable for all or certain stipulated methods of coal mining shall be reviewed by the Bureau of Land Management to ensure that exploration does not harm any value for which the area has been assessed as unsuitable.

APPENDIX 2
RANKING AND RATIONALE FOR COAL TRACTS
UINTA-SOUTHWESTERN UTAH REGION - ROUND TWO

Tract Name	Coal Field	Summary Ranking	Rationale
Alkali Creek	Book Cliffs	High	Tract is one of the few remaining larger tracts in the field with coal outcrop. High quality coal near potential shipping points. Minimum environmental impact anticipated. Some county concern for providing infrastructure for population growth.
Coal Creek	Book Cliffs	Medium	Large reserve of high quality coal with potential for a new operation. More exploration needed. Environmental impacts expected to be minimal. Some county concern for providing infrastructure for population growth.
Dugout-Pace	Book Cliffs	Medium	Adjacent to and most likely developed from existing holding. Good quality coal but anticipated low recovery due to depth. Environmental impacts expected to be minimal. Some county concern for providing infrastructure for population growth.
Graves	Book Cliffs	High	Adjacent to and most likely developed from existing operation. High quality coal but low recovery due to depth. Minimual environmental impact anticipated. Potential for adding 5 years operation to an existing operation.
Hoffman Creek	Book Cliffs	High	A small, isolated parcel of coal adjacent property under development. High quality coal. Environmental and socioeconomic impacts would be significant.
Soldier Creek	Book Cliffs	High	A larger tract of high quality coal with feasible access through adjacent properties. More exploration needed. Environmental impacts expected to be minimal. Some county concern for providing infrastructure for population growth.
Whitmore Park	Book Cliffs	Medium	Small tract of high volatile B bituminous coal. Fits in with other holdings. Environmental and socioeconomic impacts expected to be minimal.

APPENDIX 2 (cont'd)

Tract Name	Coal Field	Summary Ranking	Rationale
Gooseberry	Wasatch Plateau	Medium	A small tract that fits with other holdings. Coal data lacking but expected to be good. Impact from mining expected to be minimal but coal transportation could be a problem. Sanpete County supports development.
North Trough Springs	Wasatch Plateau	Medium	This is a mid-sized tract with limited coal information. Access best through present holdings. County has expressed concern about additional mining in the Scofield reservoir drainage. Potential added socioeconomic impact.
Mud Creek	Wasatch Plateau	Low	Limited coal and geologic information available. Access believed limited. Further mining in Scofield Reservoir drainage of concern to county.
Castle Valley Ridge	Wasatch Plateau	High	High quality coal but some faulting expected. Access limited except through existing operation. Environmental impact expected to be limited. Limited socioeconomic impact if an existing operation obtains the lease.
Trail Mtn.	Wasatch Plateau	High	Large tract with high quality coal expected. Access limited except through existing holdings. Environmental impact is likely low. Emery County concerned with rapid growth and financing infrastructure.
Ferron Canyon	Wasatch Plateau	Medium	Tract lacks information concerning coal quantity and quality but is expected to be very good. Access to tract is somewhat limited. Fits best with existing holdings. Environmental impacts are expected to be mitigable. Emery County has expressed concern about providing infrastructure for population growth.
The Pines	Wasatch Plateau	Medium	A larger tract of high quality coal. Access will be at high cost. Necessary rail transportation has not been developed. Environmental impacts expected to be mitigable. Emery County is concerned with financing infrastructure for population growth.

APPENDIX 2 (cont'd)

Tract Name	Coal Field	Summary Ranking	Rationale
Quitchupah	Wasatch Plateau	High	The largest tract under consideration. Good geologic information for delineation. High quality coal. Two access points. Minimal environmental impacts. Emery County concerned with financing infrastructure development.
Skumpah	Wasatch Plateau	Medium	A smaller tract of coal which is essential for economic access to an existing lease block. Minimal environmental impact anticipated. Sevier County supports expansion of coal mining.
Acord	Wasatch Plateau	High	Tract is surrounded by other holdings. Leasing prevents bypass or emergency leasing. Minimal environmental impact. County supports coal development.
Ivie	Wasatch Plateau	High	Very good quality coal; fits in with a mining operation on fee land. Good geologic and coal information. Minimal environmental impact. County supports coal development.
Walker Flat	Emery	High	Underground minable tract adjacent existing holdings. Access for a new operation limited. Minimal environmental impact anticipated. Emery County has expressed concern about financing growth.
Blue Trail Canyon	Emery	Low	Small reserve, limited coal information. Surface minable tract. Reclamation potential anticipated to be fair to poor. County concerned with financing infrastructure for development.
Alton Amphitheater	Alton	Medium	Subbituminous A coal. Good access. More exploration needed. Near the town of Alton. Concern with impact on water. County is encouraging coal development. Necessary coal transportaion lacking.
Fisher Canyon	Alton	Medium	Subbituminous A coal. Potential exists for faulting and splitting. Inadequate data indicated need for further drilling. Low favorability for access and transportation. County is encouraging coal development.

APPENDIX 2 (concluded)

Tract Name	Coal Field	Summary Ranking	Rationale
Flax Lakes	Alton	Medium	Subbituminous A-B coal. Problem with faulting and access. Transportation of low desirability. Potential concern with water. County supports coal leasing and development.
Mill Creek Canyon	Alton	Medium	Subbituminous C coal. Further exploration needed. Low desirability for access and coal transportation. Some environmental concern. County supports coal leasing and development.
Ford Pasture	Alton	Medium	Subbituminous A, B, or C coal. Surface and underground minable. Most logically mined with adjacent property. Further exploration needed. Low desirability for access and transportation. Reclamation potential good. County supports coal leasing.
Cedaredge	Paonia-Sumerset	High	High volatile C bituminous to subbituminous A coal, underground minable, access good. Some critical big game habitat involved and potential impact on water sources. County supports leasing and development.
Paonia D Seam	Paonia-Sumerset	High	High volatile C bituminous coal, underground minable. Best access from existing facilities but other development possible. Some critical big game habitat, potential impact on water sources. County supports leasing and development.

APPENDIX 3
MITIGATING MEASURES

The following standard stipulations will be attached to all leases issued as a result of the final leasing decision. Minor modifications may be incorporated to allow for regulation and policy differences between surface management agencies.

The Regional Director shall mean the authorized representative of the Office of Surface Mining. The Authorized Officer shall mean the State Director, Bureau of Land Management or his delegated authority. The Authorized Officer of the Surface Management Agency shall mean the Forest Supervisor, Forest Service or District Manager, Bureau of Land Management as appropriate. Surface management agency for private surface is the Bureau of Land Management, except within Forest boundaries, the surface management agency for private surface shall be the Forest Service.

1. The Lessee will be responsible to comply with all applicable Federal, State, and local laws and regulations.

2. In accordance with Sec. 523(b) of the "Surface Mining Control and Reclamation Act of 1977," surface mining and reclamation operations conducted on this lease are to conform with the requirements of this Act and are subject to compliance with Office of Surface Mining Regulations, or as applicable, a Utah or Colorado program equivalent approved under cooperative agreement in accordance with Sec. 523(c) and final determination of suitability for mining. The United States Government does not warrant that the entire tract will be susceptible to mining.

3. All support facilities, structures, equipment, and similar developments will be removed from the lease area within two years after the final termination of use of such facilities. All disturbed areas and those areas occupied by such facilities will be rehabilitated in accordance with an approved reclamation plan, the "Surface Mining Control and Reclamation Act of 1977" Office of Surface Mining Regulations or approved Utah or Colorado program as applicable.

4. (a) Before undertaking any activities that may disturb the surface of the leased lands, the Lessee may be required to conduct a cultural resource field inventory and a paleontological appraisal of the mine plan area, exploration plan areas and adjacent areas that may be affected by lease related activities. The cultural resource field inbentory will be required on all areas not previously inventoried at the required level of intensity. The paleontological appraisal will be required if the Regional Director or Authorized Officer surface management agency has reason to believe the surface of the area to be affected has potential to contain fossils of scientific interest. If inventory and/or appraisal is required they shall be conducted by qualified professionals approved by the Authorized Officer Surface Management Agency and an acceptable report of the inventory or appraisal submitted to the Regional Director and Authorized Officer Surface Management Agency. The report shall contain the published literature relating to the area, results of the field inventory and recommendations for protecting any cultural or paleontological resources of scientific interest that are identified as being affected. The lessee shall undertake measures to protect these resources in accordance with instruction from the Regional Director or

the Authorized Officer Surface Management Agency if activities are associated with coal exploration outside an approved mining permit area.

(b) The lessee shall protect all paleontological and cultural resource properties within the lease area from lease-related activities until mitigation is applied. If disturbance of any cultural or paleontological resourcs of significant scientific interest cannot be avoided the lessee shall undertake such measures in accordance with instruction from the Regional Director and the Authorized Officer Surface Management Agency if activities are associated with coal exploration outside an approved mining permit area. This may include but not limited to in situ evaluation and collection and preservation for future analysis. The lessee shall not commence surface disturbing activities until permission to proceed is given by the Regional Director or Authorized Officer Surface Management Agency as appropriate. The cost of conducting the inventories, appraisals, preparing reports and carrying out mitigation as directed prior to mining of the area in question shall be borne by the lessee.

(c) If cultural or paleontological resources are discovered during operations conducted under this lease that might be altered or destroyed by his operations, the lessee shall immediately bring such fossils or cultural artifacts to the attention of the Regional Surface Management Director or the Authorized Officer Surface Management Agency as appropriate. The lessee shall not disturb such discoveries except as may be subsequently authorized by the Regional Director or Authorized Officer Surface Managment Agency. Lease operation may continue as long as the specimen and site would not be damaged or destroyed by the activity. The Regional Director or Authorized Officer Surface Management Agency shall evaluate or have evaluated such discoveries within two (2) working days and notify the lessee as to what action is to be taken with respect to such discoveries. The cost of any required salvage of such fossils or cultural artifacts during mining operations will be borne by the United States Government.

(d) These conditions apply to all fossils and cultural resources of significant scientific interest discovered within the lease area whether discovered on the surface, overburden, interburden or coal seam or seams. Fossils of significant scientific interest do not include those fossils commonly encountered in coal during mining operations. Skeletal remains shall be considered significant. All such fossils and cultural resources determined to be of significant scientific interest shall remain under the jurisdiction of the United States until ownership is determined under applicable law.

5. The lessee shall, prior to entry upon the lease, conduct an intensive field inventory for threatened and endangered plant and/or animal species, bald or golden eagles, or migratory species of high Federal interest on those areas to be disturbed and/or impacted including the access routes to the lease area. The inventory shall be conducted by a qualified specialist(s) approved by the Authorized Officer, Surface Management Agency, and a report of the inventory and recommendation for the protection of these species submitted to and approved by the Authorized Officer, Surface Management Agency, and Regional Director or Authorized Officer as appropriate. An acceptable report of any findings shall include the specific location, distribution, and habitat

requirements of the species. The lessee shall protect these species within the lease area from any activities associated with operations conducted under the terms of the lease and shall undertake such protective measures as may be required by the Authorized Officer, Surface Management Agency, and Regional Director or Authorized Officer, as appropriate.

The following stipulations will be included in addition to the standard stipulations on all leases issued on Forest Service land.

1. The coal contained within the lease area and authorized for mining under this lease shall be extracted only by underground mining methods.

2. Powerlines used in conjunction with mining of coal from this lease shall be constructed so as to conform with the publication <u>Suggested Practices for Raptor Protection on Powerlines, The State of the Art 1981</u> (Raptor Research Report No. 4, Raptor Research Foundation c/o Dept of Veterinary Biology; University of Minnesota).

3. The lessee shall provide for the suppression and control of fugitive dust on all haul roads, and at coal hauling, transportation, and storage facilities. The migration of road surfacing materials shall be controlled by watering, chemical treatment, or hard surfacing. Loss of gravel courses shall be periodically replaced.

4. In order to avoid surface disturbance on steep canyon slopes and the need for surface access, all surface breakouts for ventilation tunnels shall

be constructed from inside the mine, except at specific locations approved by the Regional Director with the concurrence of the Authorized Officer, Surface Management Agency and the Authorized Officer.

5. Prior to mining, the lessee shall perform a study to secure adequate baseline data to quantify the existing surface resources on and adjacent to the lease area. The study will be established in consultation with and approved by the Authorized Officer, Surface Management Agency, the Regional Director, and Authorized Officer Supervisor and shall be adequate to locate, quantify, and demonstrate the interrelationship of the geology, topography, surface hydrology, vegetation, and wildlife. Baseline data will be established so that future programs of observation can be incorporated at regular intervals for comparison.

6. The lessee shall establish a monitoring system to locate, measure, and quantify the progressive and final effects of underground mining activities on the topographic surface, underground and surface hydrology, and vegetation. The monitoring system shall utilize techniques which will provide a continuing record of change over time and an analytical method for location and measurement of a sufficient number of points over the lease area. The monitoring shall be an extension of the baseline data and shall be conducted by a method approved by the Regional Director in consultation with and concurrence by the Authorized Officer Surface Management Agency and Authorized Officer.

7. Underground mining operations shall be conducted in such a manner so as to prevent surface subsidence that would (1) cause the creation of hazardous

conditions such as potential escarpment failure and landslides, (2) cause damage to surface structures, and improvements, and (3) damage or alter the flow of perennial streams. The lessee in his mining plan shall provide specific measures for the protection of escarpments. The Regional Director in consultation with and concurrence of the Authorized Officer and Authorized Officer, Surface Management Agency, shall approve such measures and may prescribe any additional measures to be employed such as mining methods, specify the amount of coal recovered, and determine any corrective measures considered necessary to assure that escarpment failure does not occur except at specifically approved locations, or that hazardous conditions are not created.

8. Existing surface improvements required for the surface uses of the lease area will need to be protected or maintained to provide for the post-mining continuance of the current land uses. Existing surface improvements whose utility may be lost or damaged as result of mining activities are to be replaced or restored.

In addition to the standard stipulations, special stipulations will be included in the lease terms. These stipulations are based on the mitigating measures contained in the individual site specific tract profiles. The stipulations will generally relate to special conditions or situations inherent in the characteristics or situations expected to be created by the mining of the tract. These stipulations generally relate to one or more of the following:

1. Provide those conditions under which a lease may be issued as set forth under the "exemptions" contained in the "unsuitability criteria" regulations (43 CFR 3460).

2. Set forth the reclamation goals for post - mining land use(s).

3. Minimize conflict between existing and potential land uses and coal mining.

4. Minimize impacts to other resource values or provide for the protection of other resources.

5. Provide special environmental protection requirements related to specific tract conditions.

6. Provide special safety and hazard reduction requirements.

7. Provide protection of future government interests.

The special stipulation will contain the following types of requirements.

1. The use of special construction and mining technology.

2. No surface occupancy of specific areas of a lease.

3. Restrict certain surface activities such as drilling to specific times of the year.

4. Require maintenance or upgrading or existing facilities such as roads to accommodate coal mining operations and existing uses.

5. Protection of scenic values.

6. Protection of existing government land improvements and facilities.

7. Additional studies may be required to be performed by the lessee before mine plans approval.

The following measures would be made stipulations to one or both of the Colorado tracts (Cedaredge and Paonia D). These measures may be modified as deemed necessary by BLMs Uncompahgre Resource Area Office in Montrose, Colorado.

1. All surface disturbance, including subsidence and fracturing, would be avoided inside of a defined buffer zone on all perennial streams and other areas supporting riparian vegetation (e.g., some intermittent streams, stockponds, springs, seeps, etc.). This pertains to areas in and adjacent to the lease tracts. A minimum width of 100 feet would be maintained as the buffer zone on each side of the center of the stream, spring, etc. Where the riparian vegetation is more that 100 feet in width the entire riparian zone will be protected. When disturbance within a riparian vegetation buffer zone cannot be avoided, review and approval from BLM (after consultation with other agencies) shall be necessary prior to the commencement of any on-the-ground work.

2. Mining and associated activities will be conducted in a fashion that will prevent changes to natural streamflow velocities. When a change in streamflow velocities cannot be avoided, approval from BLM would be necessary.

3. Mine operations shall be planned to manage water entering, moving through, and exiting from disturbed areas. This includes reducing the amount of water and the length of time that water comes into contact with any pollution-forming material.

4. The lessee shall formulate and incorporate into the mine plan, a spill contingency plan which specifies the following as a minimum:

a. methods for locating the source of the discharge,

b. how discharge would be stopped,

c. how spill would be contained, and

d. responsibility for and techniques employed in repair and clean-up.

5. Coal extraction shall be prohibited where overburden subsidence or fracturing would disrupt the quantity or quality of a surface or ground water supply needed to satisfy an adjudicated water right (including irrigation water supplies to alluvial valley floors and prime/unique farmland). In addition, the lessee shall engineer the coal extraction process to induce overburden subsidence and fracturing as soon as possible after mining. This would remove the major risk of having water supply interruptions emerge beyond the mines' life expectancy.

6. Detailed geotechnical studies shall be conducted prior to construction of portal and associated facilities to determine if the area is compatible with the new portal site.

7. A visual contrast analysis will be made prior to construction of proposed surface modifications and reclamation efforts to assure minimum visual impact at all stages of tract development, and compliance with BLM's Visual Resource Management (VRM) policies.

8. State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, etc.) shall be used in areas identified in Unsuitability Criteria 2, 3, 14, and 19 (Appendix 1) to be protected from subsidence. These techniques would ensure that sufficient coal is left in place to prevent subsidence.

9. An appropriate angle of draw as dictated by the site-specific geologic and mining conditions shall determine the area of influence for maximum coal removal in the areas identified in Unsuitability Criteria 2, 3, 14, and 19 (Appendix 1) to be protected from subsidence.

10. The lessee shall consult with all owners of occupied dwellings and maintain or, with the owner's consent, adjust the designated 300-foot buffer zone in order to mine near private dwellins located on the Paonia D tract.

11. With respect to the golden eagle nest sites identified on the Paonia D Tract:

a. No permanent suface facilities or disturbances shall be located within a one-half mile radius buffer zone around each golden eagle nest site.

b. No surface activities will be allowed within a one-half mile radius buffer zone around each golden eagle site from March 1 to July 1.

c. Any proposed activities in, or adjacent to, these buffer zones will require approval from the BLM, on a site-specific basis, after consultation with the U.S. Fish and Wildlife Service.

d. This one-half mile buffer zone would also apply to any eagle nests discovered in the future.

12. A seasonal closure on surface activities, from December 1 to April 15, shall be imposed on all portions of the tracts identified as "most critical big game winter range". Where surface facilities must be located on these ranges, off-site habitat improvement or mitigation may be required. Such activities must be approved by the BLM after consultation with the Colorado Division of Wildlife.

13. All coal transportation from the Paonia D tract will be by conveyor or other permanent alternative method to avoid truck hauling on State Highway 133.

14. Coal extraction shall be prohibited where overburden subsidence or fracturing would disrupt the quantity or quality of a surface or ground water

supply needed to satisfy an adjudicated water right (including irrigation water supplies to alluvial valley floors and prime/unique farmland). In addition, the lessee would be required to engineer the coal extraction process to induce overbuden subsidence and fracturing as soon as possible after mining. This would remove the major risk of having water supply interruptions emerge beyond the mines' life expectancy.

15. The description of hydrology required by 30 CFR 783.13 will include the collection of at least five years of base line water quality and quantity data (surface and groundwater) in and adjacent to the lease tract. Base line data is necessary to measure potential quality and quantity changes to the water resource by future mining activities.

16. The lessee shall be required to replace the water supply, with equal or higher quality water, of any owner of a vested water right which is injured as a result of mining activities. To ensure the protection of the adjudicated water right holders, in and adjacent to the lease tracts, the lessee would incorporate into the mine plan a water right replacement plan that is both workable and reasonable. The plan would be subject to review and approval by the BLM (at a minimum, this plan shall conform to Federal Regulation 30 CFR 783.17, "Alternative Water Supply Information").

17. As an outcome from the protest to the North Fork Management Framework Plan Amendment (December 1981) the BLM has incorporated some additional objectives into the amendment decisions. The objectives were formulated for use in subsequent planning actions to protect the water resource. The

objectives included, among others, water insurance. This objective is one of the less desirable options because it may only add another set of actions to an already complex permitting and and regulatory process. Further, a potential water insuror may require data on possible hazards far in excess of any existing legal requirements prior to the issuance of a policy. Therefore, the BLM would require the lessee to purchase water insurance only for major foreseeable risks to the water resource. Since the mitigating measures in this document and ones developed in subsequent activity planning will eliminate any major foreseeable risk to the water resource, the BLM would not require that the lessee purchase water insurance. However, it still is an option that could be incorporated into the water replacement plan, developed by the lessee at the mine plan stage of the coal lease process.

APPENDIX 4
MAJOR PLANT COMMUNITIES AND TYPICAL SPECIES

Vegetation Type	Major Vegetation Species	
	Common Name	Scientific Name
Utah		
Riparian	Fremont Poplar	Populus fremontii
	Sandbar willow	Salix exiqua
	Kentucky blugrass	Poa pratensis
	Greasewood	Sarcobatus vermiculatus
	Saltcedar	Tamarix pentandra
Grassland	Squirreltail grass	Sitanion hystrix
	Sandberg bluegrass	Poa secunda
	Sticky rabbitbrush	Chrysothamnus viscidiflorus
Sagebrush-Grass	Big sagebrush	Artemisia tridentata
	Indian ricegrass	Oryzopsis hymenoides
	Cheatgrass	Bromus tectorum
Pinyon-Juniper	Gambel oak	Quercus gambelii
	Utah juniper	Juniperus osteosperma
	Pinyon pine	Pinus edulis
	Big sage	Artemisia tridentata
Mountain Brush	Mountain snowberry	Symphoricarpos orephilus
	Gambel oak	Quercus gambelii
	Yarrow	Achillea millefolium
	Mountain mahogany	Cercocarpus montanus
Ponderosa Pine	Ponderosa pine	Pinus ponderosa
	Douglas fir	Pseudotsuga menziesii
	Bittergrush	Purshia tridentata
	Serviceberry	Amelanchier utahensis
Aspen-Conifer	Quaking aspen	Populus tremuloides
	Douglas fir	Pseudotsuga menziesii
	Mountain juniper	Juniperus scopulorum
	Alpine fir	Abies lasiocarpa
	Engelmann spruce	Picea engelmannii
Aspen	Quaking aspen	Populus tremuloides
	Tailcup lupine	Lupinus caudatus
	Nodding brome	Bromus anomalus
	Big sage	Antemisia tridentata
	Dandelion	Tarazacum officinale

APPENDIX 4 (concluded)

Vegetation Type	Major Vegetation Species	
	Common Name	Scientific Name
Mountain Meadow	Slender wheatgrass	Agropyron trachycaulum
	Bluegrass	Poa spp.
	Needlegrass	Stipa lettermannii
	Larkspur	Delphinium nelsonii
	Cinquefoil	Potentilla fruiticosa
West-Central Colorado		
Sagebrush	Big sagebrush	Artemisia tridentata
	Muttongrass	Poa fendleriana
	Kentucky bluegrass	Poa pratensis
	Bottlebrush squirreltail	Sitanion hystrix
	Arrowleaf balsamroot	Balsamorhiza sagittata
Pinyon-Juniper	Utah Juniper	Juniperus osteoperma
	Big sagebrush	Artemisia tridentata
	Gambel oak	Quercus gambelii
	Common serviceberry	Amelanchier alnifolia
	Muttongrass	Poa fendleriana
Mountain Shrub	Gambel oak	Quercus gambelii
	Common serviceberry	Amelanchier alnifolia
	Kentucky bluegrass	Poa pratensis
	Elk sedge	Carex geyeri
Aspen	Quaking aspen	Populus tremuloides
	Thurber fescue	Festuca thurberi
	Kentucky bluegrass	Poa pratensis
	Nodding brome	Bromus anomalus
Riparian	Cottonwood	Populus sp.
	Chokecherry	Prunus virginiana
	Skunkbush	Rhus trilobata
Agricultural	Major crops are alfalfa and fruit.	

APPENDIX 5
OBJECTIVES OF VISUAL RESOURCE MANAGEMENT CLASSIFICATIONS

The BLM and Forest Service use scenic quality, sensitivity, and visual distance criteria to determine visual management objecties for public lands under their respective jurisdictions. Visual management terminology differs between the two agencies, but management objectives are similar as outlined below:

FOREST SERVICE TERMINOLOGY	BLM TERMINOLOGY	MANAGEMENT OBJECTIVE
Preservation	Class I	This class provides for natural ecological changes only. (There are no Class I areas within any of the lease tracts.)
Retention	Class II	Changes in any of the basic landscape elements should not be evident in the management activity.
Partial Retention	Class III	Changes in the basic elements may be evident in the management activity. However, modifications should remain subordinate to the landscape character.
Modification-Maximum Modification	Class IV	Changes may subordinate the landscape character, but must reflect what could be natural occurrence in the characteristic area.
Unacceptable Modification	Class V	Change is required. The area has been disturbed to a point where rehabilitation is needed to bring it back into character with the surrounding landscape.

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Modification-Maximum Modification	Class IV	Changes may subordinate the landscape character, but must reflect what could be natural occurrences within the characteristic area.
Unacceptable Modification	Class V	Change is required. The area has been disturbed to a point where rehabilitation is needed to bring it back into character with the surrounding landscape.

APPENDIX 6
AREAS WITH SPECIAL DESIGNATION OR POTENTIAL FOR SPECIAL DESIGNATION IN CENTRAL AND SOUTHERN UTAH

Agency	Name	Present Designation	Potential Designation	Reference
Central Utah				
FS	4-307		Wilderness[a]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	Link Flat	Natural Area	Wilderness[b]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-060-067		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-060-068A		Wilderness[d]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-060-054		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-060-023		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-060-025		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-060-007		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-060-028		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-060-029A		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-060-045		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
NPS	Cleveland-Lloyd Dinosaur Quarry	Natural Landmark		Natural Landmarks Inventory, (HCRS, 1979)
NPS	Capitol Reef (NP-906)	National Park	Wilderness[a]	Utah Wilderness Status Map, (BLM, 1981c)
NPS	Green River		Wild & Scenic	Nationwide River Inventory, (NPS, 1982)
NPS	Range Creek		Wild & Scenic	Nationwide River Inventory, (NPS, 1982)
NPS	Price River		Wild & Scenic	Nationwide River Inventory, (NPS, 1982)
NPS	San Rafeal River		Wild & Scenic	Nationwide River Inventory, (NPS, 1982)
Southern Utah				
FS	4-254		Wilderness[a]	Utah Wilderness Status Map, (BLM, 1981c)
FS	4-259		Wilderness[e]	Utah Wilderness Status Map, (BLM, 1981c)
FS	4-260		Wilderness[a]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	Phipps-Death Hollow	Natural Area	Wilderness[f]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	The Gulch	Natural Area	Wilderness[f]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	North Escalante	Natural Area	Wilderness[f]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	Escalante Canyon	Natural Area	Wilderness[f]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	Devil's Garden	Natural Area	Wilderness[f]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	Paria Canyon	Primitive Area	Wilderness[f]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-050-238		Wilderness[d]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-050-242		Wilderness[d]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-050-248		Wilderness[d]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-050-249		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-050-241		Wilderness[d]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-050-247		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-040-075		Wilderness[g]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-040-076		Wilderness[g]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-040-078		Wilderness[g]	Utah Wilderness Status Map, (BLM, 1981c)

APPENDIX 6 (concluded)

Agency	Name	Present Designation	Potential Designation	Reference
BLM	UT-040-268		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-040-077		Wilderness[d]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-040-082		Wilderness[d]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-040-061		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-040-230		Wilderness[d]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-040-217		Wilderness[c]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-040-247		Wilderness[d]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-040-248		Wilderness[g]	Utah Wilderness Status Map, (BLM, 1981c)
BLM	UT-040-079		Wilderness[g]	Utah Wilderness Status Map, (BLM, 1981c)
NPS	Little Rockies	Natural Landmark		Natural Landmarks Inventory, (HCRS, 1979)
NPS	Canyonlands (NP-905)	National Park	Wilderness[a]	Utah Wilderness Status Map, (BLM, 1981c)
NPS	Zion (NP-930)	National Park	Wilderness[a]	Utah Wilderness Status Map, (BLM, 1981c)
NPS	Bryce Canyon (NP-903)	National Park	Wilderness[a]	Utah Wilderness Status Map, (BLM, 1981c)
NPS	Capitol Reef (NP-906)	National Park	Wilderness[a]	Utah Wilderness Status Map, (BLM, 1981c)
NPS	Glen Canyon	National Recreation Area		
NPS	Dirty Devil River		Wild & Scenic	Nationwide River Inventory, (NPS, 1982)
NPS	Deep Creek River		Wild & Scenic	Nationwide River Inventory, (NPS, 1982)
NPS	Escalante River		Wild & Scenic	Nationwide River Inventory, (NPS, 1982)
NPS	North Fork Virgin River			
NPS	Paria River		Wild & Scenic	Nationwide River Inventory, (NPS, 1982)
NPS	Colorado River		Wild & Scenic	Nationwide River Inventory, (NPS, 1982)
State of Utah	Kodachrome Basin	State Reserve		

a Administratively endorsed as suitable for wilderness designation.

b The natural area is an instant study area (ISA) for wilderness review.

c The unit has been determined to contain wilderness values and is a wilderness study area (WSA).

d A portion of the unit was determined to contain wilderness values and was designated as a WSA, and the remainder of the unit was released from wilderness review. This decision was subsequently appealed. The entire unit is currently subject to interim management protection until a decision concerning management of the unit is again reached (timeframe unknown).

e Recommended for further planning.

f The natural/primitive area and contiguous lands together comprise an instant study area (ISA) for wilderness review.

g The unit was determined to lack wilderness character and was released from wilderness review. This decision was subsequently appealed. The unit is currently subject to interim management protection until a decision concerning management of the unit is again reached (timeframe unknown).

APPENDIX 7
WILDLIFE TERMS AND FORMULAS

I. Pheasant Population Estimate Formula

Cock Harvest: from Harvest Survey in annual report

Post-Season Hens/Cocks: from Winter Sex-Ratio Counts in the annual report

Percent Cocks Harvested: calculated by change in ratio from pre-season to post season =

$$\frac{\text{Post Cocks/Hens (from Winter Sex Ratio counts)} - \text{pre cocks/hens (assumed 1.2 hens/cocks)}}{\text{Post Cocks/Hens}}$$

Pre-season Population: Cock Harvest: percent harvested = Pre-season Cocks: pre-season cocks x 1.2 (assumed hens/cocks pre-season) = pre-season hens; then combine cocks and hens for total

Pheasants per acre in the fall = estimated cocks, hens or total ÷ acres of cropland in county.

II. Game Habitat Designations (UDWR)

C - Critical - Sensitive use areas that, because of limited abundance and/or unique qualities, constitute irreplaceable, critical requirements for "high interest wildlife."[a]

HP - High Priority - Intensive use area that due to relatively wide distribution do not constitute critical values but which are highly important to "high interest wildlife."

S - Substantial - Existence areas used regularly by "high interest wildlife" but at moderate levels with little or no concentrated use.

Y - Yearlong (limited value) - Occasional use areas that either are sparsely populated or that show sporadic or unpredictable use by "high interest wildlife."

[a] High Interest Wildlife: All wildlife species classed as game; economically important species (consumptive or noncomsumptive value); species of special aesthetic, scientific, or education value; and species designated by the Division of Wildlife Resources as declining or of limited distribution due to habitat constraints. Does not include Federally listed threatened and endangered species.

LIST OF PREPARERS

Name and Agency	Education	EIS Assignment
	CORE TEAM	
Ronald Bolander, BLM	M.S. Ecology	Team Leader, Vegetation
Greg Thayn, BLM	PhD. Botany	Technical Coordinator, Noise
Larry Eyre, BLM	B.S. Botany	Editor, Reviewer
Garth Heaton, FS	B.S. Forest Management	Soils, Land Use
Max Nielson, BLM	M.S. Agricultural Economics	Special Assistance
	UTAH TEAM	
Margaret Matthies, BLM	B.S. Natural Resources	VRM, Wilderness, Recreation
Bob Randolph, BLM	M.S. Geology	Paleontology
Don Hook, BLM	B.S. Civil Engineering	Transportation
David Hillier, BLM	B.A. Economics	Socioeconomics
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GLOSSARY

ACRE-FOOT. The quantity of water required to cover 1 acre to a depth of 1 foot; equal to 43,560 cubic feet or 325,900 gallons.

ALLUVIAL. Pertaining to deposits made by flowing water.

ANIMAL UNIT MONTH (AUM). The amount of forage required to graze one cow or five sheep for a 1 month period. A measure of range capacity.

ANNUAL AVERAGE DAILY TRAFFIC. Theoretically this would be a summation of all the vehicles passing one point divided by the number of days in the year. Practically, this figure is usually based on sample traffic counts adjusted on the basis of nearby permanent traffic count stations. Peak traffic counts would be substantially greater.

ANTICLINE. Applied to strata which dip in opposite directions from a common ridge or axis.

AQUIFER. A zone, stratum, or group of strata that can store and produce water and can yield water to wells in economically significant quantities.

BUTEO. The broad-winged, soaring buzzard hawks.

BUTTE. An isolated hill with steep sides and a top that is flat.

CE-1 ZONE, CE-2 ZONE. Lands within Carbon and Emery Counties determined by the counties to be critical environmental zones and are accordingly ascribed limited uses.

COAL FIELD. An area of country, the underlying rocks of which contain minable coal seams.

COLLUVIAL. Consisting of alluvium in part and containing angular fragments of the orignial rocks.

CONTINUOUS MINER. A mining machine designed to remove coal from the face and load the coal into cars or conveyors without the use of drills or explosives, employing instead a rotating head which cuts up and down the coal face.

CROWDED (TRANSPORTATION). Any two-lane State highway which is or would be carrying an equivalent of 5,000 vpd, counting each truck as five autos in rolling terrain.

DEMONSTRATED RESERVES. A collective term for the sum of measured and indicated coal reserves or resources in a given area.

DIP. The angle at which a bed or stratum is inclined from the horizontal.

DOME. A symmetrical structural uplift having approximate circular outline in plain view.

DRAGLINE. A type of excavating equipment which casts a ropehung bucket a considerable distance, collects the dug material by pulling the bucket toward itself on the ground with a second rope, elevates the bucket, and dumps the material on a spoil bank, in a hopper, or on a pile.

EYRIE. The nest of a bird of prey.

FAULT. A fracture or a fracture in the earth zone along which there has been displacement of the two sides relative to one another parallel to the fracture.

FISHEDOUT. A permanent reduction in expected or previously experienced fishing success on a particular water body to the point of abandonment of the effort by the majority of the participants.

FLOODPLAIN. The flat ground along a stream covered by water at the flood stage.

GLACIATION. In geology, pertaining to, characteristic of, produced, deposited, or derived from a glacier.

GRABEN. A depressed segment of the earth's crust bounded on at least two sides by faults.

INFERRED RESOURCE. A mineral (e.g., coal) for which quantitative estimates are based largely on broad knowledge of the geologic character of the deposit and for which there are few, if any, samples or measurements.

INFRASTRUCTURE. The basic equipment, utilities, productive enterprises, installation and service essential for the development, operation, and growth of an organization, a city, or a nation.

IN PLACE RESOURCE. The total amount of coal both inferred and demonstrated, estimated to be located in a given area.

INSTANT STUDY AREA. An area that was officially designated as a natural or primitive area prior to the 1976 passage of FLPMA.

JOINT. A divisional plane that divides a rock and along which there has been no visible movement parallel to the plane.

KNOLL. A usually small rounded land eminence.

KNOWN GEOLOGIC STRUCTURE (KGS). A natural underground reservoir capable of holding oil and gas.

KNOWN RECOVERABLE COAL RESOURCE AREA (KRCRA). An area of country, including Federal land, which meet minimum standards for recoverable coal deposits in accordance with accepted mining practices as determined by the Geological Survey.

LAND MANAGEMENT PLAN. A plan establishing the allocation of land resources and the decisions relating to the coordination of the various uses and activities within a planning unit.

LIMESTONE. A sedimentary rock which contains at least 50 percent calcium carbonate and magnesium carbonate.

LIMIT ANGLE. The angle of inclination from the vertical of the line connecting the edge of the mine workings and the edge of the subsidence area. The limit angle is positive if the width of the subsidence trough is wider than the mined panel, or negative if the width of the subsidence trough is narrower than the mined panel.

LITHIC SCATTER. An archaeological site characterized by the presence of flaked tools, chips, cores, or flakes only.

LOGICAL MINING UNIT (LMU). An area of coal land that can be developed and mined in an efficient, economical, and orderly manner with due regard for the conservation of coal reserves and other resources.

LONGWALL MINING. A system of mining on straight coal faces in which the developing headings are driven to the boundary or limit line and then the coal seam is extracted by longwall faces retreating toward the entry.

MAXIMUM MODIFICATION. A Forest Service visual resource management classification that allows for management activities to dominate the landscape character in foreground, middleground, and background areas.

MINING PLAN. A complete mining and reclamation operation plan prepared in compliance with the Mineral Leasing Act of 1920, Surface Mining Control and Reclamation Act of 1977, and other applicable laws and regulations.

MITIGATING MEASURE. Methods used (often included as lease stipulations) to reduce the significance of or eliminate an anticipated environmental impact.

MODIFICATION. A Forest Service visual resource management classification that allows for management activities to dominate the landscape character in background areas.

MOLLUSCS. Invertebrate animals (such as oysters, snails, or clams) with a soft unsegmented body usually enclosed in a calcareous shell.

MONOCLINE. An abrupt downward flexure of nearly horizontal strata without any corresponding bend to form an anticline or syncline.

NATIONAL PARK. A land/water area designated by Congress as part of the National Park system to be managed by the National Park Service to preserve unique natural values of distinction while providing for public enjoyment of the area.

NATIONAL RECREATION AREA. A land/water area with nationally significant recreational potential designated by Congress as part of the National Park system to be managed by the National Park Service to provide for public use and enjoyment while protecting public values.

NATIONAL REGISTER PROPERTY. A site, structure, district, building, or object deemed significant in American history, architecture, archaeology, or culture which is identified on a list maintained by the Secretary of the Interior.

NATURAL AREA. Public land area, designated by the BLM as a Natural Area, to be managed in a manner that protects the area's unique or unusual natural values.

NATURAL LANDMARK. Land or water containing geological or ecological values of National significance that is officially registered as a National Natural Landmark to encourage preservation and enhancement of the scientific and educational values of the site.

NORMAL FAULT. A fault where the upper wall of rock over an inclined fault plane has been depressed with respect to the rocks below the fault plane.

OVERBURDEN. Material of any nature, consolidated or unconsolidated, that overlies a deposit of useful material, ores, or coal.

PARTIAL RETENTION. A Forest Service visual resource management classification that allows for management activities to be visually evident but subordinate to the landscape character.

PERCHED AQUIFER. Unconfined ground water separated from an underlying body of ground water by an unsaturated zone.

PLANNING AREA. A group of planning units for which a single Land Management Plan has been prepared.

PLANNING UNIT. The basic management unit of BLM administered lands or National Forest lands. Land Management Plans are generally prepared for these units.

POTABLE WATER. Water suitable for human use and consumption.

PREFERENCE RIGHT LEASE APPLICATION (PRLA). Until the early 1970s, the Federal Government issued prospecting permits to interested parties to explore coal for in areas where economically valuable deposits were not known to exist. By demonstrating that the permit area contained commercially valuable coal, a prospecting permit holder could apply for, and obtain, a lease to mine the deposit. Such lease applications were called preference right lease applications (PRLAs) and leases were issued without competition. Under the Federal Coal Leasing Amendments Act of 1976, non-competitive coal leases are no longer permitted, subject to valid existing rights.

PRESERVATION. A Forest Service visual resource management classification that allows for natural ecological changes only.

PRIMITIVE AREA. Public land area, designated by the BLM or Forest Service as a Primitive Area, to be managed in a manner that protects the area's primitive recreational values.

QUATERNARY. Comprises all geologic time from the end of the tertiary up to the present.

RAPTOR. Living on prey; a group of carnivorous birds consisting of hawks, eagles, falcons, vultures, and owls.

REGIONAL COAL TEAM. A specific coal production region's Federal/State team which pursuant to 43 CFR 3400.4(b) considers and suggests policy for regional leasing target setting, tract delineation, and site-specific analysis in the coal production region; guides and reviews tract ranking; and conducts the selection and sale scheduling process in order to recommend regional lease sale alternatives to be analyzed in the Regional Lease Sale Environmental Impact Statement and to be recommended to the Secretary of the Interior.

RETENTION. A Forest Service visual resource management classification that allows only for management activities that are not visually evident.

REVERSE FAULT. A fault where the rock mass on one side of an inclined fault plane is pushed over the rock mass on the other side of the fault plane, and where the hanging wall appears to have moved up in relation to the foot wall.

ROADLESS AREA REVIEW AND EVALUATION II. The Forest Service review and evaluation of public lands under its jurisdiction for Congressional wilderness designation.

ROADLESS INVENTORY UNIT. An area of public lands under jurisdiction of the BLM that is roadless, is at least 5,000 acres in size, or is contiguous to an area that is undergoing wilderness inventory.

ROCK SLOPE. An inclined passage (portal) driven through rock strata to obtain access to the coal.

ROOM AND PILLAR. A system of mining in which the coal is mined in rooms separated by narrow ribs or pillars. The rooms are driven parallel to each other. The pillars are usually pulled as mining operations retreat from the area.

SCOPING. Process used for determining the range of issues to be addressed, potential significant issues, and possible alternatives which should be considered in an EIS. Scoping also identifies insignificant issues which do not require analysis. Federal, State, and local agencies, and the public sector participate in the scoping process.

SEDIMENTARY. A descriptive term for rock formed of sediment, or rocks formed by precipitation from solution.

SEDIMENT YIELD. The amount of soil an area loses every year through natural processes, usually expressed in acre-feet per square mile per year. One acre-foot per square mile per year, reduced to simpler terms, means that a square mile of land loses about 0.01 inches of soil every year. This is a result of the normal and ongoing processes of water and wind erosion.

SHALE. A laminated sediment, in which the constituent particles are predominantly of the clay grade.

SITE SPECIFIC ANALYSIS. An environmental assessment prepared for a specific coal tract, detailing environmental impacts expected to result from the leasing and development of that tract.

STATE RESERVE. State land area of unique or unusual natural values, managed by the State to protect and enhance those values.

STIPULATION. A condition or requirement attached to a lease, usually dealing with protection of the environment or recovery of the coal.

SUBSIDENCE. Surface sinking, caving, or distortion resulting from the collapse of underground mine workings.

SURFACE MINING. Mining at or near the surface where the overburden is removed to expose and extract the coal.

SYNCLINE. A fold in rocks in which the strata dip inward from both sides toward the axis.

TOPSOIL. The fertile, dark colored surface soil, or "A" horizon.

TRACT. A defined area of land which will logically be proposed as a single lease offering. At the preliminary tract stage, the exact boundaries of tracts are still subject to adjustment based on subsequent analysis and revised coal information.

UNACCEPTABLE MODIFICATION. A Forest Service visual resource management classification that identifies areas where manmade disturbance is excessive and rehabilitation is necessary.

UNDERGROUND MINING. A mining method used to extract coal where the overburden is not removed, as opposed to surface mining.

UNSUITABILITY CRITERIA. Criteria, specified in coal management regulations 43 CFR 3461 that identifies those lands which shall be considered unsuitable for all or certain stipulated methods of coal mining.

VRM (VISUAL RESOURCE MANAGEMENT). The system by which the Forest Service and BLM classify and manage the visual resource of public lands under their respective jurisdictions. Based on their scenic qualities, sensitivities, and the distances from which they are viewed, the lands are classified into management units.

VRM CLASS I. A BLM visual resource management classification that allows for natural ecological change only.

VRM CLASS II. A BLM visual resource management classification that allows for management activities that are not visually evident.

VRM CLASS III. A BLM visual resource management classification that allows for management activities to be visually evident but subordinate to the landscape character.

VRM CLASS IV. A BLM visual resource management classification that allows for management activities to subordinate the landscape character.

VRM CLASS V. A BLM visual resource management classification that identifies areas where manmade disturbance is excessive and rehabilitation is necessary.

WILD AND SCENIC RIVER. Rivers officially designated by Congress as part of the National, Wild, and Scenic River System to be managed in a manner that protects wild, scenic, and/or recreational values.

WILDERNESS AREA. Public land area officially designated by Congress as part of the National Wilderness Preservation System, to be managed in a manner that protects the area's naturalness, solitude, and primitive and recreational values.

WILDERNESS STUDY AREA. An area of public lands under jurisdiction of BLM that has been determined and declared to have wilderness character through inventory and evaluation.

ABBREVIATIONS

AADT	Annual Average Daily Traffic
ACEC	Area of Critical Environmental Concern
Acre-ft/year	Acre-feet per year
ADT	Average Daily Traffic
AQRV	Air Quality Related Values
AUM	Animal Unit Month
BACT	Best Available Control Technology
BLM	Bureau of Land Management
Btu	British thermal unit
CE-1	Critical Environmental Zone 1
CE-2	Critical Environmental Zone 2
CO	Carbon Monoxide
CFR	Code of Federal Regulations
Cfs	Cubic feet per second
dBA	Decibels Weighted Sound Level
DOI	Department of the Interior
D&RGW	Denver and Rio Grande Western Railway Company
DTV	Daily Traffic Volume
EIS (ES)	Environmental Impact Statement
EMRIA	Energy Minerals Rehabilitation Inventory and Analysis
EMT	Emergency Medical Technician
EPA	Environmental Protection Agency
ERT	Environmental Research & Technology, Inc.

Abbreviations (cont'd.)

FAA	Federal Aviation Administration
FCLAA	Federal Coal Leasing Amendments Act of 1976
FLPMA	Federal Lands Policy and Management Act of 1976
FS	Forest Service
FW-10	Forestry and Watershed Zone 10
gal/min	Gallons per minute
GS	Geological Survey
GMU	Game Management Unit
GRF-1	Grazing, Recreation, and Forestry Zone 1
HCRS	Heritage Conservation and Recreation Service
Hwy	Highway
I-70	Interstate Highway 70
ICC	Interstate Commerce Commission
IPP	Intermountain Power Project
ISA	Instant Study Area
ISCLT	Industrial Source Complex Long Term Model
KGS	Known Geologic Structure
KRCRA	Known Recoverable Coal Resource Area
LMU	Logical Mining Unit
MER	Maximum Economic Recovery
MESOPUFF	Mesoscale Puff Model
MFP	Management Framework Plan
MGD	Million gallons per day

Abbreviations (cont'd.)

M&G-1	Mining and Grazing Zone 1
Mgd	Million gallons per day
Mg/L	Micrograms per liter
MMS	Minerals Management Service
MSW	Master's Degree in Social Work
MTPY (MTY)	Million tons per year
MU-160	Multiple Use Zone 160
MW	Megawatt
NA	Not Available or Not Applicable
NAAQS	National Ambient Air Quality Standards
NMHC	Non-Methane Hydrocarbons
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Point Discharge Elimination System
NPS	National Park Service
ORV	Off-road vehicle
OSM	Office of Surface Mining
PALDS	Point, Area, Line Model with Deposition and Sedimentation
PAS	Planning and Assessment System Model
PCPI	Per Capita Personal Income
PLUVUE	Plume Visibility Model
PRLA	Preference Right Lease Application
PRWID	Price River Water Improvement District
PSD	Prevention of Significant Deterioration

Abbreviations (cont'd.)

RARE II	Roadless Area Review and Evaluation II
RCT	Regional Coal Team
SAM	Spacial Allocation Model
SBA	Small Business Administration
SCS	Soil Conservation Service
SCORP	State Comprehensive Outdoor Recreation Plan
SEUALG	Southeastern Utah Association of Local Government
SHPO	State Historical Preservation Officer
SMCRA	Surface Mining Control and Reclamation Act
SRS	San Rafael Swell
STSA	Special Tar Sand Area
TDS	Total Dissolved Solids
T&E	Threatened and Endangered
TPY	Tons per year
TSP	Total Suspended Particulates
U-10	Utah State Highway 10
UDOT	Utah Department of Transportation
UDWR	Utah Division of Wildlife Resources
UORA	Utah Outdoor Recreation Agency
UPED	Utah Process Economic and Demographic Impact Projection Model
UP&L	Utah Power and Light Company
US 6	United States Primary Highway 6
USFWS	United States Fish and Wildlife Service

Abbreviations (cont'd.)

VPD	Vehicles per day
VRM	Visual Resource Management
WPRS	Water and Power Resources Service
WSA	Wilderness Study Area

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UINTA-SOUTHWESTERN UTAH COAL STUDY REGION

UTAH COAL LEASES

REF. NO.	LESSEE	SERIAL NUMBER
1	AMCA Coal Leasing Inc.	SL-027304
		SL-063058
		U-010581
2	Beaver Creek Coal Company	U-020641
		SL-064903
		U-8319
		U-33454
3	Bishopsgate Coal Corporation	U-47973
4	California Portland Cement Co.	SL-051279-063188
	(Soldier Creek Coal Co.)	U-50722
5	Carbon Emery Bank	SL-063720
		U-08606
		U-024814
6	Carroll County Coal Co.	U-7653
7	Coastal States Energy Co.	SL-062583
	(Southern Utah Fuel Co.)	U-053995
		U-062453
		U-0149084
		U-28297
		U-47080
8	Consolidation Coal Co. and	U-073039
	Kemmerer Coal Co.	U-073040
		U-073041
		U-090231
		U-0101213
		U-0101214
		U-0101215
		U-0101217
		U-0101218
		U-5287
9	C.O.P. Coal Development Co.	U-024316
		U-024318
10	Energy Reserves Group	U-0141171
		U-0141176
		U-0141177
		U-0141178
11	Sunoco Energy Development Co.	U-05067-08916
		U-07064-027821
		U-07746
		U-089096
		U-092147
		U-0144820
12	Franklin Real Estate Co. and	SL-029093-046653
	Blackhawl Coal Co.	SL-046652
		SL-048442-050115
		SL-071737
		U-019524
		U-058184
		U-046345
25	United States Fuel Co.	SL-025431
		SL-069985
		U-026583-058261
26	United States Steel Corp.	SL-046612
27	Utah Power & Light Co.	SL-050133
		SL-051221
		U-02664
		U-06039
		U-014275
		U-024317
		U-024319
		SL-06407-064621
		SL-064900
		SL-066116
		U-1358
		U-47978
		U-47979
28	Wasatch Coal Co.	SL-063011
29	Eliza & Lloyd Wilberg	SL-036407
30	Consolidation Coal Co.	U-098783
		U-098784
		U-098785
		U-098787
		U-0103107
		U-0103109
		U-0103129
		U-0103130
		U-0105418
		U-0149373
31	Ceasar Fulton	SL-071561
32	El Paso Gas Co.	U-083000
		U-083005
		U-0115791
		U-0115792
		U-0115793
		U-0115833
		U-0130985
		U-0130986
		U-0130988
		U-0130989
		U-0136512
		U-0140836
		U-0140837
		U-0148535
		U-24427
		U-27835
33	George H. Frandsen	SL-048223
		SL-050638
25	United States Fuel Co.	SL-025431
		SL-069985
		U-026583-058261
26	United States Steel Corp.	SL-046612
27	Utah Power & Light Co.	SL-050133
		SL-051221
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		U-06039
		U-014275
		U-024317
		U-024319
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		U-47979
28	Wasatch Coal Co.	SL-063011
29	Eliza & Lloyd Wilberg	SL-036407
30	Consolidation Coal Co.	U-098783
		U-098784
		U-098785
		U-098787
		U-0103107
		U-0103109
		U-0103129
		U-0103130
		U-0105418
		U-0149373
31	Ceasar Fulton	SL-071561
32	El Paso Gas Co.	U-083000
		U-083005
		U-0115791
		U-0115792
		U-0115793
		U-0115833
		U-0130985
		U-0130986
		U-0130988
		U-0130989
		U-0136512
		U-0140836
		U-0140837
		U-0148535
		U-24427
		U-27835
33	George H. Frandsen	SL-048223
		SL-050638
34	Hiko Bell Mining and Oil Co.	U-0118366
		U-0120794
		U-0146654
35	Peabody Coal Co.	U-096476
		U-096477
		U-098786
		U-0101140
		U-0101141
		U-0103108
		U-0103131
		U-0103132
		U-0103133
		U-0113254
		U-0115656
		U-0115657
36	Malapia Rosource Co.	U-087805
		U-087806
		U-087807
		U-087828
		U-087833
		U-087834
		U-087835
		U-087836
		U-092138
		U-092139
		U-092140
		U-092141
		U-092142
		U-096486
		U-096494
		U-096486
		U-096494
		U-096495
		U-096496
		U-096497
		U-096508
		U-096509
		U-0101142
37	S.H. West	U-0103141
38	Aaron H. & Veola H. Rasmussen	SL-049042
39	Nevada Electric Investment Co.	SL-064507
		SL-058575
		U-060745
		U-060746
		U-065012
		U-083072
		U-098705
		U-0101153
40	Utah International Inc.	U-098774
		U-098775
		U-0105404
		U-0115938
		U-0122579
		U-0122582
		U-0122583
		U-0122584
		U-0122623
		U-0122647
		U-0122649
		U-0122650
		U-0122651
		U-0122652
		U-0122675
		U-0124768
		U-0126916
		U-0140770
		U-0147999
		U-0149582
41	King Cannel Coal Co.	SL-050619-052424
42	W.A. Land Co.	U-47977
43	Emery Energy	U-7958
44	Utah Power & Light	U-1362
45	Royal Land Co.	SL-066145
		SL-068754-U-1215

UTAH PREFERENCE RIGHT LEASE APPLICATIONS

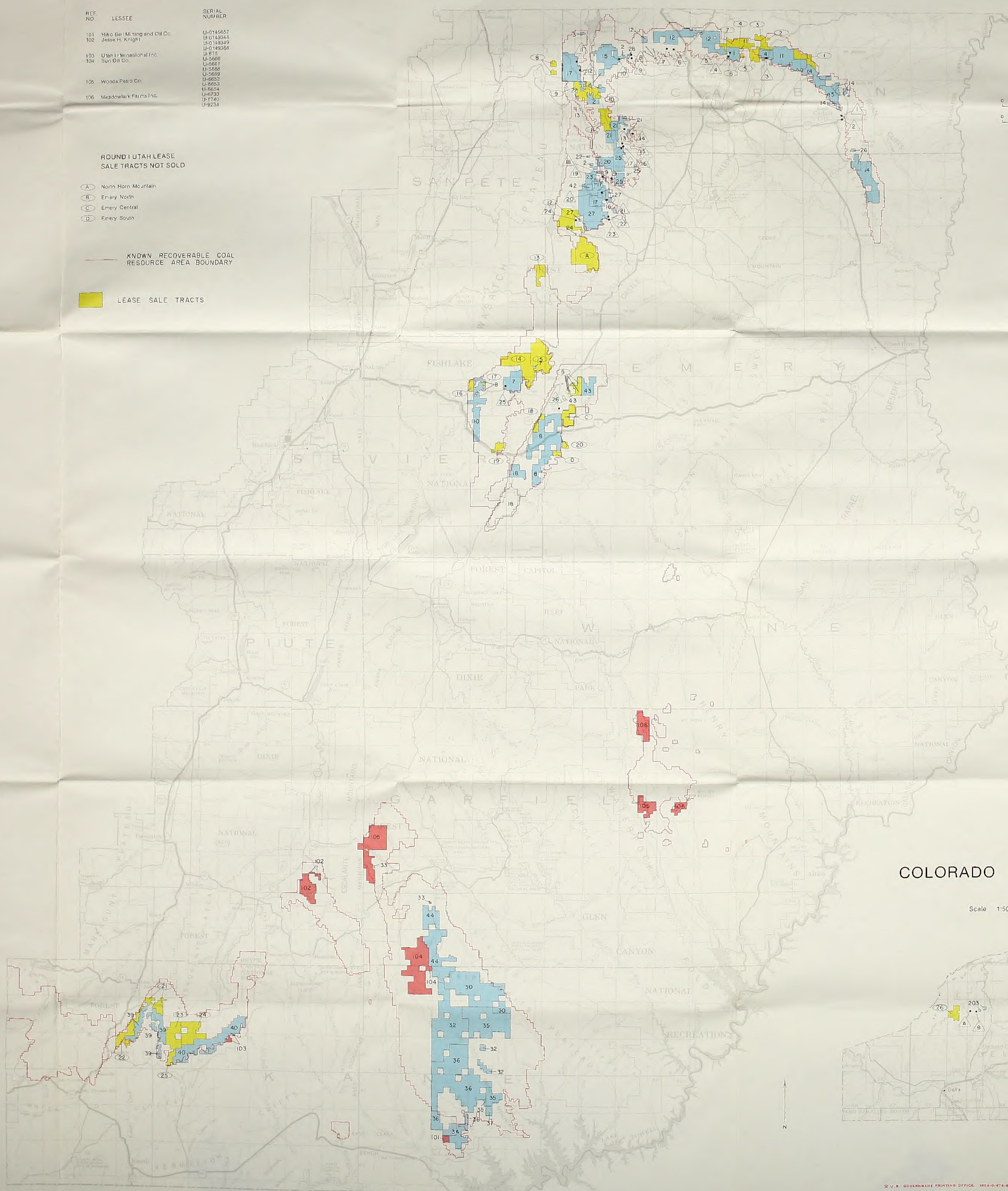
REF. NO.	LESSEE	SERIAL NUMBER
101	Hiko Bell Mining and Oil Co.	U-0145657
102	Jesse H. Knight	U-0149348
		U-0149349
		U-0149368
103	Utah International Inc.	U-675
104	Sun Oil Co.	U-5666
		U-5667
		U-5668
		U-5669
105	Woods Petro Co.	U-6652
		U-6653
		U-6654
106	Meadowlark Farms Inc.	U-6733
		U-6740
		U-9238

ROUND I UTAH LEASE SALE TRACTS NOT SOLD

- A North Horn Mountain
- B Emery North
- C Emery Central
- D Emery South

KNOWN RECOVERABLE COAL RESOURCE AREA BOUNDARY

LEASE SALE TRACTS



Scale 1:500,000

0 10 20 30 40 MILES

0 10 20 30 40 50 KILOMETERS

ACTIVE UTAH COAL MINES

1. Sunnyside #1
2. Sunnyside #3
3. Soldier Canyon
4. Pinnacle
5. Apex
6. Price River #3
7. Price River #5
8. Gordon Creek #2
9. Gordon Creek #6
10. Gordon Creek #3
11. Skyline 1 & 2
12. Belina #1
13. Star Point #2
14. Star Point #1
15. King #4
16. King #5
17. King #6
18. Bear Canyon
19. Coop
20. Huntington Canyon #4
21. Deer Creek
22. Beehive
23. Deseret
24. Trail Mountain
25. Sulco #1
26. Emery Deep

ROUND II LEASE SALE TRACTS (UTAH)

- 1 Dugout-Pace
- 2 Whitmore Park
- 3 Soldier Creek
- 4 Coal Creek
- 5 Alkali Creek
- 6 Hoffman Creek
- 7 Graves
- 8 Gooseberry
- 9 North Trough Springs
- 10 Mud Creek
- 11 Castle Valley Ridge
- 12 Trail Mountain
- 13 Ferron Canyon
- 14 Quitchupah
- 15 The Pines
- 16 Skumpah
- 17 Acord
- 18 Walker Flat
- 19 Ivie
- 20 Blue Trail Canyon
- 21 Alton Amphitheater
- 23 Fisher Canyon
- 24 Mill Creek Canyon
- 25 Ford Pasture

ROUND II LEASE SALE TRACTS (COLORADO)

- 26 Cedaredge
- 27 Paonia D. Seam

COLORADO COAL LEASES

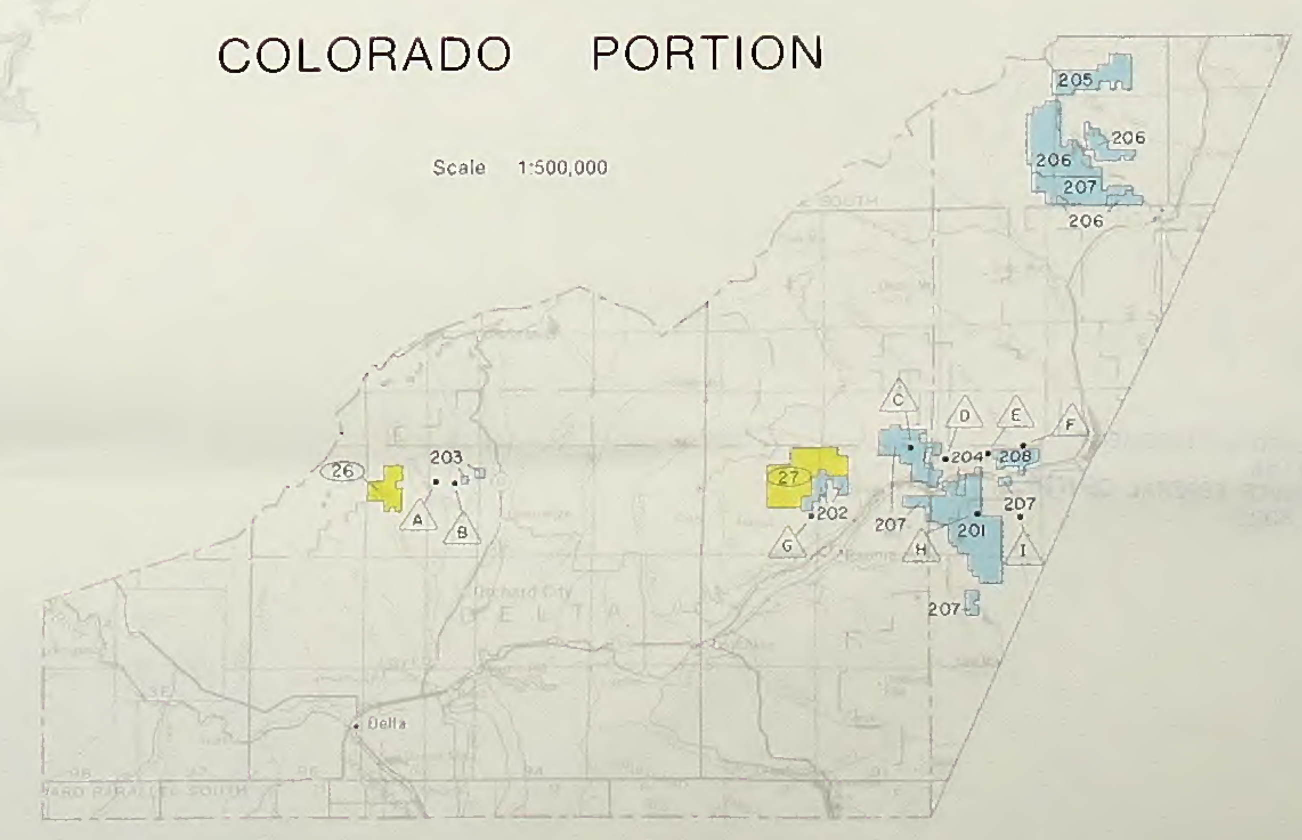
REF. NO.	LESSEE	SERIAL NUMBER
201	Atlantic Richfield Co.	D-044569
		C-0117192
		C-1362
202	Colorado Westmoreland, Inc.	C-25079
		C-27432
		D-036955
203	Grand Mesa Coal Co.	D-036906
		D-055156
204	Anchor Coal Co.	D-052501
205	Carland Coal Co.	C-08172
206	Mid-Continent Coal and	C-09005
	Coke Company	C-09004
		C-011646
		C-030345
		C-074632
		C-0115606
		C-0125456
		C-0125457
		C-12640
207	U.S. Steel	D-052504
		D-052558
		C-030344
		C-030346
		C-033301
		C-033302
		C-051669
		C-068389
		C-0125485
		C-1894
		C-7852
		C-7853
		C-12638
		C-12639
208	Western Slope Carbon Inc.	D-042921
		D-056724
		C-17130
		C-27103

ACTIVE COLORADO COAL MINES

- A Tomahawk
- B Red Canyon
- C Blue Ribbon
- D Somerset
- E Hawksnest East
- F Hawksnest West
- G Orchard Valley
- H Bear
- I Mt. Gunnison #1

COLORADO PORTION

Scale 1:500,000



U.S. DEPARTMENT OF THE INTERIOR

MARCH 3, 1849