Draft
San Juan Basin
Cumulative Overview

United States
Department
of the Interior

Bureau of Land Management
New Mexico State Office
Santa Fe, New Mexico

November 1982

NOTICE

This Draft Cumulative Overview (CO) is one of a series of environmental and related documents coordinated by the Bureau of Land Management's (BLM's) San Juan Basin Action Plan (SJBAP). The CO considers the social, economic, and environmental effects of six separate but related proposals within the San Juan Basin area of northwestern New Mexico.

This Draft CO should be used in conjunction with the individual environmental documents for the following proposed actions:

- Coal Preference Right Leasing
- San Juan River Regional Coal Leasing
- Bisti, De-na-zin, and Ah-shi-sle-pah Wilderness Study Areas
- Ute Mountain Land Exchange
- New Mexico Generating Station
- Bisti Coal Lease Exchange

This document analyzes the significant cumulative impacts of the proposed actions for which the BLM is preparing Environmental Impact Statements (EISs) in the San Juan Basin. For detailed information on a specific proposal listed above, the individual EIS or Environmental Assessment (EA) should be referenced. The effects of the end uses of the Ute Mountain Land Exchange are addressed in the New Mexico Generating Station EIS. The effects of the coal Preference Right Lease Applications are addressed in the San Juan River Regional Coal Leasing EIS.

This Draft CO and the Draft EISs should be retained to be used in conjunction with the Final CO and EISs. The Final CO may incorporate this draft by reference and it may include modifications and corrections of the draft.

At the end of Part Four of this document is a comment form for your use. In preparing comments if additional pages are needed, they may be attached to the comment form.

A limited number of copies of the Draft Cumulative Overview will be available upon request at the following BLM offices:

New Mexico State Office
Public Affairs Staff (912)
U.S. Post Office and Federal Bldg.
P.O. Box 1449
Santa Fe, NM 87501
(505) 988-6316 FTS 476-6316

For further information on the Draft Cumulative Overview contact:

Bob Armstrong, Coordinator
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P.O. Box 1449
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(505) 988-6212 FTS 476-6212

For further information on the overall San Juan Basin Action Plan contact:

Gene Day, Chief, San Juan Energy Project Staff
BLM, New Mexico State Office
P.O. Box 1449
Santa Fe, NM 87501
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Sincerely yours,

Charles W. Luscher

Charles W. Luscher
State Director

Enclosure

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
NEW MEXICO STATE OFFICE
P.O. BOX 1449
SANTA FE, NEW MEXICO 87501

IN REPLY REFER TO
1792 (934)

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Dear Reviewer:

Enclosed is a copy of the Draft Cumulative Overview for your review. This document analyzes the significant cumulative impacts of the proposed actions for which the BLM is preparing EISs in the San Juan Basin. The individual EISs are:

San Juan River Regional Coal Leasing EIS
Bisti, De-na-zin and Ah-shi-sle-pah
Wilderness Study Areas EIS
New Mexico Generating Station EIS

This Draft Cumulative Overview document is not, in and of itself, an EIS but is incorporated by reference in each of the three individual EISs listed above.

In order to assist the public in understanding the proposed actions and their related impacts, the Bureau of Land Management has scheduled five informal "Open House" meetings. All meetings are scheduled from 3 to 9 p.m. at the following locations in New Mexico:

Farmington	-	December 14, 1982	-	Farmington Civic Center
Albuquerque	-	December 14, 1982	-	Albuquerque Convention Center
Crownpoint	-	December 15, 1982	-	Crownpoint Navajo Chapter House
Gallup	-	December 16, 1982	-	Gallup Holiday Inn
Taos	-	December 16, 1982	-	Taos Kachina Lodge

Formal public hearings to receive public comments on the EISs are scheduled as follows:

Crownpoint - January 10, 1983, starting at 1 p.m., Crownpoint Navajo Chapter House.

Farmington - January 12, 1983, starting at 9 a.m. and 7 p.m., Farmington Civic Center.

Albuquerque - January 14, 1983, starting at 9 a.m. and 7 p.m., Albuquerque Four Seasons Motor Inn.

A specific time to testify at any of the formal public hearings can be reserved by contacting the BLM New Mexico State Office Public Affairs Staff at (505) 988-6316 or FTS 476-6316; however, no preregistration is required to testify. Written submissions are encouraged even if oral testimony is given.

Written comments will be accepted through close of business February 7, 1983, and should be sent to State Director (912), Bureau of Land Management, New Mexico State Office, P.O. Box 1449, Santa Fe, NM 87501.

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

DRAFT
SAN JUAN BASIN
CUMULATIVE OVERVIEW

SAN JUAN, McKINLEY, SANDOVAL, VALENCIA, AND, CIBOLA COUNTIES, NEW MEXICO

ABSTRACT

The Cumulative Overview (CO) considers the social, economic, and environmental impacts of six separate but related proposals within the San Juan Basin area of northwestern New Mexico. This CO document is not, in and of itself, an EIS but is incorporated by reference in each of the individual site-specific EISs (New Mexico Generating Station, San Juan River Regional Coal Leasing, and Wilderness Study Areas EISs). The CO is intended to facilitate the decision-making process by providing information to the BLM State Director, the Secretary of the Interior, and the public concerning the potential cumulative impacts of the proposed power plant, the use of coal resources and wilderness areas, and related proposals in the San Juan Basin.

Because all three proposed actions would be implemented at roughly the same time, some of the impacts of each would overlap geographically or temporally with impacts from the other two. As used in the CO, the term cumulative impacts refers to "new" (previously undiscussed) information and are defined to be of two types:

1. Combinations of previously identified significant impacts (from individual EISs) that show increased levels of magnitude or severity from those presented in the EISs and that, therefore, represent qualitative changes in the bases for mitigation planning.

2. Combinations of previously identified nonsignificant impacts that would occur coincidentally at sensitive or important locations, and in the aggregate would be considered significant.

Type of Action: (X) Administrative ( ) Legislative

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Comments Have Been Requested From:
See List in Part Four

Filed with EPA as a Part of the Following EISs:
San Juan River Regional Coal Leasing
Bisti, De-na-zin, and Ah-shi-sle-pah
Wilderness Study Areas
New Mexico Generating Station

Charles W. Luscher
Charles W. Luscher
State Director, New Mexico

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INTRODUCTION

The Bureau of Land Management (BLM) in New Mexico is responsible for the management of approximately 1.9 million acres of land and mineral resources in the San Juan Basin in northwestern New Mexico. This area is bounded roughly on the north by the Colorado-New Mexico border, on the south by Interstate 40 (I 40), on the west by the eastern border of the Navajo Reservation, and on the east by New Mexico Highway 44 (NM 44) (see Map 1-1).

Currently, the BLM is evaluating the following separate but interrelated proposals within the basin:

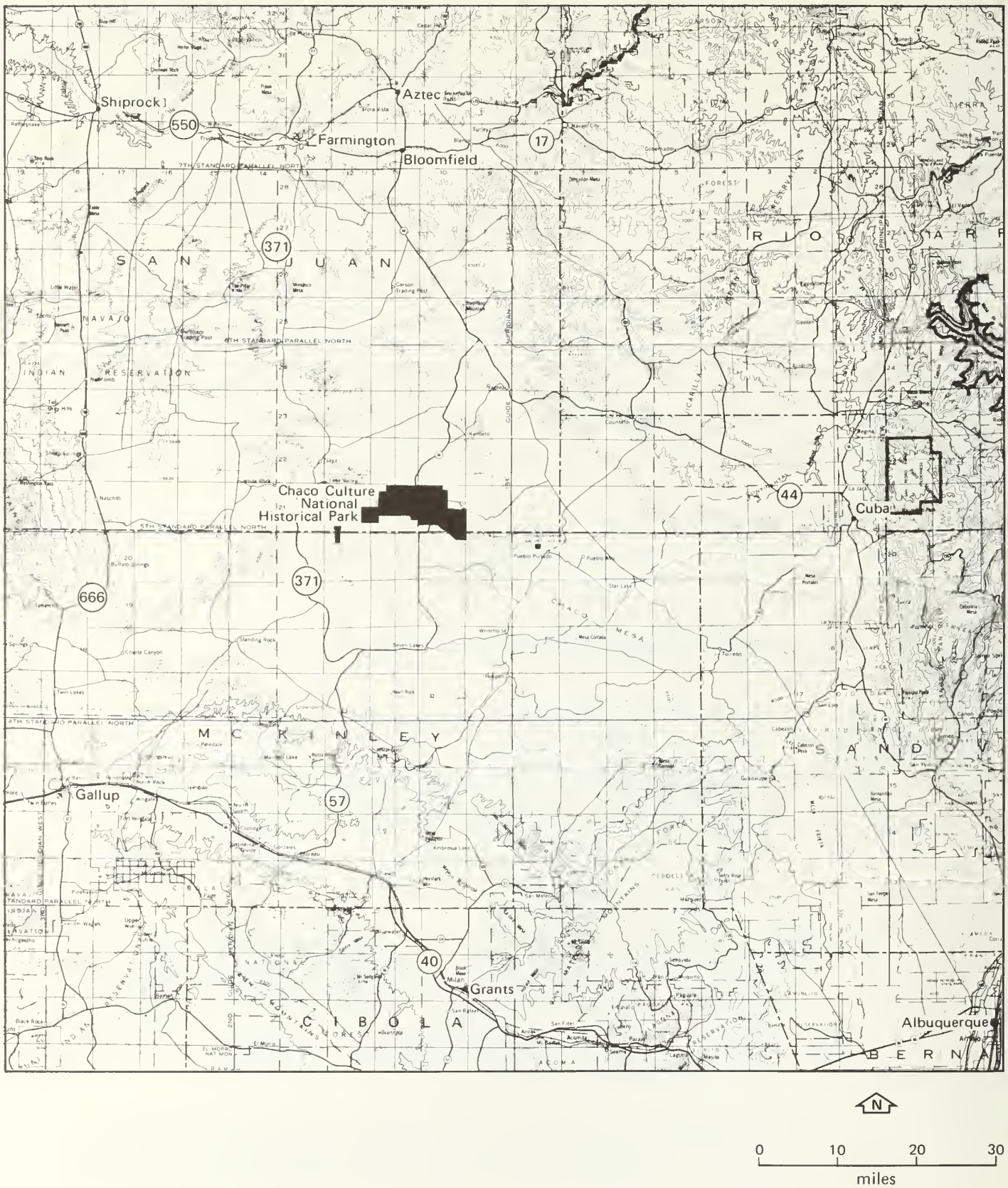
Coal Preference Right Leasing (PRLAs)
San Juan River Regional Coal Leasing (SJRRCL)
Bisti, De-na-zin, and Ah-shi-sle-pah
Wilderness Study Areas (WSAs)
Ute Mountain Land Exchange
New Mexico Generating Station (NMGS)
Bisti Coal Lease Exchange

Three of the above proposals require the preparation of individual Environmental Impact Statements (EISs): SJRRCL, WSAs, and NMGS. Environmental Assessments (EAs) have been prepared on the remaining proposals. These EAs have been used as one basis for the development of the various EISs. For information on potential impacts or detailed information on individual proposals, reference should be made to the individual environmental documents.

SCOPE OF THE CUMULATIVE OVERVIEW

This Cumulative Overview (CO) document is not, in and of itself, an EIS but is incorporated by reference in each of the individual EISs (NMGS, SJRRCL, and WSA EISs). The CO is intended to facilitate the decision-making process by providing information to the BLM State Director, the Secretary of the Interior, and the public concerning the potential cumulative impacts of the proposed power plant, the use of coal resources, wilderness areas, and related proposals in the San Juan Basin.

To consider the various proposals in a cohesive manner, the BLM developed the San Juan Basin Action Plan (SJBAP). The purpose of this plan is to provide a coordinated approach to the timely processing by BLM of the interrelated environmental assessments, and to ensure that each proposal is



Map 1-1. GEOGRAPHIC AREA OF INFLUENCE

considered within the context of the other proposals. Decisions relating to the six proposed actions will be made at several levels within the Department of the Interior. Preparation of the Cumulative Overview will reduce the potential for unforeseen environmental impacts by assuring that all decision makers have a more complete assessment of the interaction of the several decisions.

In order to accomplish the needed coordination, a San Juan Basin Action Plan Workgroup Steering Committee was established. This committee includes representatives of the BLM (with lead responsibility), the state of New Mexico, the Department of the Interior, the Bureau of Indian Affairs, and the Office of Surface Mining. The committee is not charged with and does not make management decisions; however, it does, through its members, make recommendations and suggestions on procedures, coordination, and schedules of the various activities involved in preparing the three individual EISs and the CO. The plan also called for the establishment of a three-person Project Management Staff (now called the San Juan Energy Project Staff) to provide the day-to-day coordination. The Chief of this Staff is directly responsible to the State Director of New Mexico.

DESCRIPTION OF PROPOSED ACTIONS

Coal Preference Right Lease Applications (PRLAs)

The proposed action is to define lease terms and conditions. This involves the leasing of 75,510 acres of public, Indian, State, and private lands underlain by federal coal for 26 PRLAs. Appendix A-1 of the PRLA EA lists the location and a legal description of each PRLA.

This acreage includes approximately 22,000 acres that would be mined by surface methods and approximately 26,650 acres that would be mined by underground methods. These figures are based on the assumption that surface mining methods would be used to recover coal to the 250-foot depth and underground methods would be used to recover coal reserves beyond the 250-foot depth. Approximately 2 billion tons of coal would be produced from the PRLAs.

Until the early 1970s, the federal government issued prospecting permits to interested parties to explore for coal in areas where workable 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, such noncompetitive coal leases are no longer permitted.

Under the Federal Coal Leasing Amendments Act a company with a pending application for a Preference Right Lease shall be entitled to a noncompetitive coal lease if the applicant can demonstrate that commercial quantities of coal on the prospecting permit lands were discovered within the term of the permit, other requirements having been met. As a matter of policy, the Department of the Interior will complete the processing of all PRLAs by

December 1, 1984. Since the PRLAs are nondiscretionary they were further considered in the SJRRCL EIS as the no-action alternative.

San Juan River Regional Coal Leasing (SJRRCL)

The federal coal program provides for the issuance of competitive coal leases through land-use planning and coal activity planning processes. The land use planning for the San Juan River Coal Region has been completed and lease sales are scheduled for September 1983.

This proposed action is contained in the Target Alternative of the SJRRCL EIS and includes 24 tracts, 19 of which would be surface mined and 5 underground mined. Approximately 1.32 billion tons of federal in-place reserves would be leased.

The San Juan River Regional Coal Team (RCT), established under the provisions of 43 CFR 3400.4, selected the 24 tracts which make up the Target Alternative. The RCT is responsible for guidance of the various actions pertaining to the competitive leasing of federally owned coal resources in the San Juan River Coal Production Region.

Wilderness Study Areas (WSAs)

There are three WSAs in the San Juan Basin: De-na-zin (NM-010-004), Ah-shi-sle-pah (NM-010-009), and Bisti (NM-010-057). These WSAs are located in and adjacent to PRLAs and near the proposed New Mexico Generating Station site. Two of the WSAs (De-na-zin and Ah-shi-sle-pah) overlap portions of the PRLAs.

The BLM New Mexico State Director is recommending as a proposed action to the BLM Director that: (1) the 3968-acre Bisti WSA and the approximately 19,922-acre De-na-zin WSA be designated as Wilderness Areas; and (2) the approximately 6536-acre Ah-shi-sle-pah WSA not be designated as a Wilderness Area.

Ute Mountain Land Exchange

The Public Service Company of New Mexico (PNM) has proposed an exchange of the surface estate on approximately 17,138 acres of private lands located on Ute Mountain in Taos County, New Mexico, for public land near Bisti, New Mexico. The total amount of public land being considered for exchange is approximately 27,715 acres. Of this amount, up to about 7780 acres of public land could be exchanged for the private land. Based on a preliminary appraisal, the 7780-acre figure is the approximate amount of public land that would be equal in value to the 17,138 acres of private land.

PNM proposed to acquire these public lands for the purpose of constructing the NMGS and related facilities, and possible new town.

New Mexico Generating Station (NMGS) and Ancillary Facilities

PNM proposes to construct a 2000-megawatt (MW) coal-fired electric generating plant approximately 35 miles south of Farmington, New Mexico, in San Juan County.

Four 500-MW units are proposed, with the earliest unit possibly being needed by 1990 and the other three units being needed through the 1990s. For the environmental analysis, the four units were assumed to be needed in 1990, 1993, 1995, and 1998, respectively. The no-action alternative (defined as NMGS not being built) and its possible consequences were also considered in the EIS.

Coal for NMGS is proposed to be acquired through long-term contracts with existing coal lease holders in the San Juan Basin. Sunbelt Mining Company, a wholly owned subsidiary of PNM, and Arch Minerals Company both own coal reserves adjacent to the NMGS site. Collectively, the Sunbelt and Arch Minerals reserves exceed the projected 40-year lifetime fuel requirements of NMGS; therefore, PNM would be assured of an adequate coal supply.

The proposed action for fuel handling systems would be to haul coal from the Bisti mine via private haul road by truck to a receiving facility located adjacent to the NMGS site. Coal would then be transferred by conveyor belt from the receiving station to active or emergency storage piles. The planned stack height for each NMGS unit would be about 575 feet, in order to conform with Environmental Protection Agency (EPA) standards. The stack lighting system would conform with Federal Aviation Administration (FAA) requirements.

The water management system would contain all equipment necessary to treat and supply all plant makeup water requirements, including potable water. The power plant would be designed and operated as a zero-discharge plant; wastewater would be reused by cascading it to uses requiring successively lower water quality. The final design of the water treatment system has not yet been determined.

The estimated water requirement for NMGS, with four units operating at rated capacity and a heat rejection system equipped with wet-cooling towers, would be 35,000 acre-feet per year. In order to supply this quantity of water to NMGS, the proposed action would involve acquiring rights to 35,000 acre-feet of water per year from the San Juan River, storing the water in the Navajo Reservoir for release upon demand, and using the natural channel of the San Juan River for delivery of water to a river diversion facility downstream.

The proposed action would include the construction of a diversion facility similar in design and operation to the existing diversion facility serving the San Juan Generating Station. The proposed facility would be located in the vicinity of Farmington. Pumps at the diversion facility would discharge water into a 36-inch inside-diameter (ID) pipeline that would deliver water to a storage reservoir near NMGS and ultimately to the power plant. The approximately 40-mile proposed pipeline would generally require a 90-foot construction rights-of-way (ROW), and would parallel the new and old portions of Highway 371. It would transport approximately 16,000 to 18,000 acre-feet of water per year starting in 1990. The proposed initial main water pipeline would supply water for NMGS Units 1 and 2. A second main 36-inch-ID pipeline would be constructed adjacent to the first (tentative completion date: 1995) for NMGS Units 3 and 4, and would also require a 90-foot

ROW for construction. This second main water pipeline would originate at the first of three intermediate pump stations and would terminate at the storage reservoir.

The proposed transmission system would consist of three 500-kV lines. The first line would link NMGS with PNM's approved 500-kV Four Corners-Ambrosia-Pajarito (FC-A-P) transmission line, located approximately 5 miles west of the NMGS. Two 500-kV lines would link NMGS with the Albuquerque distribution and load center at the proposed Rio Puerco Station. The proposed Rio Puerco Station would be located in the Albuquerque area, approximately 10 miles northwest of Rio Rancho. The NMGS-Albuquerque system would be installed in phases: the 500-kV loop in 1990 with commencement of commercial operation of Unit 1; the first 500-kV line with Unit 2 in 1993; and the second 500-kV line with Unit 4 in 1998.

Construction employment for station facilities would reach peaks of 1,515 employees in 1987 and 1,530 employees in 1992. Operations employment at station facilities would increase steadily, from 30 employees in 1989 to 900 employees in 1999 when all four units are expected on-line.

Bisti Coal Lease Exchange

In 1961, BLM issued two federal coal leases to Sunbelt Mining Company in an area approximately 30 miles south of Farmington.

BLM has subsequently inventoried the area for wilderness and has designated a portion of it as the Bisti WSA. Before BLM made this designation, members of the general public had given their support to the idea of preserving the Bisti.

In response to both the public support for preserving the Bisti and Sunbelt's desire to expedite development of its leases, Congress passed Public Law 96-475 on October 19, 1980. This law directs the Secretary of the Interior to issue federal coal leases on areas outside the Bisti WSA in exchange for all or portions of Sunbelt's two existing leases. Sunbelt would relinquish its coal leases in the Bisti WSA. This exchange involves coal leases only; no surface or other mineral rights would be affected. Both areas would retain existing surface ownership. The exact location of the new lease would be determined by avoiding resource conflicts, while still providing an economical mining area. The number of acres to be exchanged for the two leases has not been determined yet. The exact acreage figures will be identified in the Final Bisti Coal Lease Exchange EA.

Environmental impacts of the Bisti Coal Lease Exchange are included in the EA. The land to which the existing coal leases are to be transferred are included in the SJRRCL EIS as part of the Bisti #1 Tract in the Target Alternative.

SUMMARY OF ISSUES AND AREAS OF CONCERN

A Notice of Intent (NOI) to prepare the CO appeared in the Federal Register on November 13, 1980. The NOI sought public participation in determining the scope and significant issues to be considered. Some minor

points were amended in an additional Federal Register Notice published on September 10, 1982.

The majority of concerns expressed in these public meetings focused on impacts to air quality, American Indian concerns, cultural resources, socio-economics, and water resources. Concern was also expressed over reclamation of the lands after mining.

SCOPE OF THE ANALYSIS

As outlined in the SJBAP, separate environmental documents have been or are being prepared for the various proposals. These documents discuss the potential environmental, social, and economic effects of each individual proposal. Because all three proposed actions would be implemented at roughly the same time, some of the impacts of each would overlap geographically or temporally with impacts from the other two.

As used in the CO, the term cumulative impacts refer to "new" (previously undiscussed) information and are defined to be of two types:

1. Combinations of previously identified significant impacts (from individual EISs) that show increased levels of magnitude or severity from those presented in the EISs and that, therefore, represent qualitative changes in the bases for mitigation planning.

2. Combinations of previously identified nonsignificant impacts that would occur coincidentally at sensitive or important locations, and in the aggregate would be considered significant.

Impact assessment results from the three EISs were used as the basis for cumulative impact analysis. Summaries of these are presented in Tables 1-1 through 1-8. Essentially, this cumulative impact analysis re-evaluated the significance of impacts for those environmental resources with common (overlapping) spatial and temporal distribution. This assessment considered only the proposed actions of each EIS and not the alternatives.

The affected environment for cumulative impact analysis assumes that the impacts described in the three EISs occur in the context of baseline conditions. The baseline includes the existing environment and the effects of other actions that are under construction or have been at least partially authorized (e.g., the Plains Electric Power Plant near Pruitt, the Star Lake-Bisti Railroad, the Navajo Indian Irrigation Project [NIIP], etc.).

Based on a review of impacts from the three EISs, nine environmental resources were identified as having potential increases in impact significance beyond that presented in the individual EISs. Detailed discussion of methods and analysis results are reported in the Cumulative Overview Technical Report. These topics and a summary of cumulative impacts are presented in Table 1-9.

Table 1-1. SUMMARY OF IMPACT ASSESSMENT FINDINGS FROM SAN JUAN RIVER REGIONAL COAL LEASING EIS

Impact Topic	PRLA Coal Tracts	Target Level Coal Tracts
Air Quality	-	-
Geology, Topography, Minerals	-	-
Paleontology	-	-
Soils	-	-
Water	-	-
Range	-	-
Wildlife	-	-
Cultural Resources	-	-
Visual Resources	-	-
Wilderness	-	-
Recreation	-	-
Land Uses	-	-
Transportation	NS	-
Social and Economic Factors	+/-	+/-
Blasting	NS	-
Noise	NS	-

Key: - = Significant adverse impact
NS = No significant impact
+ = Significant beneficial impact

Table 1-2. SUMMARY OF IMPACT ASSESSMENT FINDINGS FROM WILDERNESS STUDY AREAS EIS

Impact Topic	Wilderness Study Areas		
	Bisti WSA	De-na-zin WSA	Ah-shi-sle-pah WSA
Mineral Resources	NS	NS	-
Paleontology	NS	NS	-
Soils	NS	NS	-
Water Resources	NS	NS	-
Livestock Grazing	NS	NS	-
Vegetation	NS	NS	-
Wildlife	+/-	+/-	-
Threatened and Endangered Species	+/-	+/-	-
Cultural Resources	NS	NS	-
Visual Resources	+	+	-
Recreation	+	+	-
Land Uses	NS	NS	-
Social and Economic Factors	+	+	+/-

Key: - = Significant adverse impact
NS = No significant impact
+ = Significant beneficial impact

Table 1-3. SUMMARY OF IMPACT ASSESSMENT FINDINGS FROM NEW MEXICO GENERATING STATION EIS

Impact Topic	Entire Proposed Project	Surface Water (San Juan River)	Proposed Pipeline P1	Proposed Transmission Line T1	Proposed Transmission Line T2
Climate	0	0	0	0	0
Air Quality	NS	0	NS	NS	NS
Noise	NS	0	NS	NS	NS
Geologic Setting	NS	0	NS	-	NS
Mineral Resources	NS	0	NS	NS	NS
Paleontological Resources	-	0	-	-	NS
Soils	NS	0	-	-	-
Hydrology	NS	NS	NS	0	0
Water Quality	NS	NS	NS	NS	NS
Vegetation	NS	NS	NS	NS	NS
Wildlife, Aquatic Biology	NS	NS	NS	NS	NS
Threatened and Endangered Species	NS	0	NS	0	0
Cultural Resources	-	0	-	-	-
Visual Resources	-	0	0	-	-
Recreation Resources	-	0	0	NS	NS
Wilderness Values	-	0	NS	NS	-
Transportation	-	0	0	0	0
Social and Economic Conditions	+/-	0	NS	NS	NS

Key: - = Significant adverse impact
NS = No significant impact
0 = No impact
+ = Significant beneficial impact

Table 1-4. SAN JUAN RIVER REGIONAL COAL LEASING EIS SUMMARY OF IMPACTS

Resource	Coal Preference Right Leasing (PRLAs)	Target Level
Air Quality[a] (New Mexico State TSP 24-hour Ambient Air Quality Standard is 150 $\mu g/m^3$)	Approximate TSP concentration is 100 $\mu g/m^3$	Would exceed New Mexico State 24-hour ambient air standard by 84 $\mu g/m^3$
Topography, Geology, Mineral, Resources	Alteration of topography on 31,970 acres. Some subsidence on up to 67,081 acres. Removal of up to 1.75 billion tons of coal.	Alteration of approximately 35,977 acres. Removal of approximately 1.2 billion tons of coal (696 million tons federal). Subsidence on up to 21,000 acres.
Paleontology	An estimated 1009 fossil localities destroyed by construction of mining-connected facilities. Population increases and increased access to the region would result in unauthorized collection and vandalism. However, during mining, subsurface information would become available.	An estimated 1493 fossil localities disturbed. Other impacts the same as under the No Action Alternative.
Soils	About 705 acres removed from production by facilities construction, resulting in long-term productivity loss. Over 31,970 acres disturbed by surface mining with short-term acceleration of erosion and sediment yield resulting. Soil mixing, contamination and compaction would also occur.	About 35,977 acres disturbed by surface mining, and 1700 acres by underground mining and surface facilities. Type of impacts the same as under the No Action Alternative.

Table 1-4. SAN JUAN RIVER REGIONAL COAL LEASING EIS SUMMARY OF IMPACTS (continued)

Resource	Coal Preference Right Leasing (PRLAs)	Target Level
Water Resources	Disruption of aquifers and destruction of shallow ground-water sources, less recharge to ground water, and use by mining companies of 12,850 acre-feet of water per year. Destruction of existing surface drainage patterns in mined areas.	Approximately 3700 acre-feet of water per year used during mining process. Other impacts the same as under the No Action Alternative.
Vegetation	Removal of vegetation on approximately 31,718 acres.	Removal of vegetation on approximately 35,977 acres.
Livestock, Grazing, and Improvements	Yearly vegetative production on 31,718 acres disturbed estimated at 4169 Animal Unit Months (AUMs). Short-term annual AUM losses can not be predicted until mine plans are submitted. Vegetative yield should return to, or near, full production in the long term. Ten dirt reservoirs, 2 wells, 2 windmills and 20.5 miles of fence destroyed.	An estimated 5798 AUMs lost, with 7 reservoirs and 15.7 miles of fence removed or destroyed. State sensitive species *Astragalus wingatus* impacted.
Wildlife	Surface mining to exclude about 31,718 acres from use by wildlife until after reclamation. Underground mining to reduce wildlife numbers through excluding wildlife from (and reducing use on the vicinity of) 705 acres needed for surface facilities. Indirect impacts on wildlife due to increased human activity in region. Possible disturbance to a raptor of high federal interest, 4 ferruginous hawks and 1 prairie falcon.	An estimated 35,977 acres removed from wildlife utilization during mine life. Possible disturbance to a golden eagle and nesting site.

Table 1-4. SAN JUAN RIVER REGIONAL COAL LEASING EIS SUMMARY OF IMPACTS (continued)

Resource	Coal Preference Right Leasing (PRLAs)	Target Level
Cultural Resources	A total of 171 sites identified throughout the PRLA area and 542+ predicted. Other projects may destroy between 126 and 174 sites within the competitive coal lease tracts. Site excavations and other forms of data recovery prior to mining would result in increased knowledge about past cultures in the region, although timeframes could affect the quality of data recovered. Unmitigated sites and roads in surface mining areas destroyed. Mining-related activities and population increases would accelerate damage.	A total of 185 sites identified, with 812 to 1098 sites predicted. Portions of Chacoan roads destroyed. Other impacts the same as under the No Action Alternative.
Visual Resources	Mining, construction, and use of related facilities would reduce the scenic values on 31,970 acres during a period of 20 to 40 years and longer. Impacts would occur to the proposed Continental Divide National Scenic Trail corridor.	An estimated 35,977 (VRM Class III-IV) acres would be affected in the same way as under the No Action Alternative. Significant impacts would occur to 4070 acres in Bisti Badlands.
Wilderness	Mining and associated activities would detract from the quality of the wilderness experience due to noise and visual distractions.	Impacts the same as under the No Action Alternative.

Table 1-4. SAN JUAN RIVER REGIONAL COAL LEASING EIS SUMMARY OF IMPACTS (continued)

Resource	Coal Preference Right Leasing (PRLAs)	Target Level
Recreation	Increased demand for recreation in the region, increased pressures on outside recreation areas due to population increase, and extraction of land from recreation use due to mining operations. Mining activities would detract from the quality of the recreation experience due to noise and visual impacts.	Impacts the same as under the No Action Alternative.
Land Use	Removal or relocation of nearly 379 acres of rights-of-way, including roads, powerlines, pipelines, transmission lines and railroads.	An estimated 363 acres affected; type of impacts the same as under the No Action Alternative.
Transportation	Increases in accidents, daily traffic, road maintenance, and new road construction. Accidents increased by more than 89, and average daily traffic (ADT) by more than 4,190 in the year 2000.	Accidents increased by more than 36, and ADT by more than 3,310 in the year 2000.
Social and Economic Conditions	Population would increase by 1,923 people (116%) in Cuba in the year 2000. Employment would increase by 5,191 jobs (16%) in Farmington and 1,731 jobs (324%) in Cuba in the year 2000. Lifestyles and cultural and religious values for Navajo people living on or near the PRLAs would be disrupted. Expansion of community infrastructures would be necessary.	Population would increase by 859 people (52%) in Cuba, 3,525 (17%) in Grants, and 3,525 (53%) in Milan in the year 2000. Employment would increase by 5,136 jobs (16%) in Farmington, 773 (145%) in Cuba, 3,172 (40%) in Grants, and 3,172 (121%) in Milan in the year 2000. Other impacts would be the same type as under the No Action Alternative.

Table 1-4. SAN JUAN RIVER REGIONAL COAL LEASING EIS SUMMARY OF IMPACTS (concluded)

Resource	Coal Preference Right Leasing (PRLAs)	Target Level
American Indian Concerns		
Residences	Approximately 55 Navajo families occupying the PRLA area and adjacent land relocated.	Seventy known occupants (Navajo) relocated.
Gravesites	Eleven known gravesites in surface mining areas disturbed if not identified and removed before mining. Belief in witchcraft occurring due to gravesite disturbance could have a profound effect on Navajo health and behavior.	On 23 to 33 known gravesites, impacts the same type as under the No Action Alternative.
Sacred Sites	Four sacred sites destroyed by surface mining and facilities construction if not recognized ahead of time. Population increases and noise, vibration, and dust from mining would cause adverse effects.	On three known sacred sites, impacts the same type as under the No Action Alternative.

[a]Figures for air quality are cumulative; they include the No Action Alternative.

Table 1-5. BISTI, DE-NA-ZIN, AND AH-SHI-SLE-PAH WILDERNESS STUDY AREAS EIS SUMMARY OF IMPACTS

Resource and WSA	Proposed Action (Wilderness Designation, Bisti and De-na-zin WSAs; No Special Designation, Ah-shi-sle-pah WSA)
Minerals	
Bisti[a]	No significant impacts.
De-na-zin	Recoverability of underground coal would be reduced from 200 million tons to 140 million tons.
Ah-shi-sle-pah	Strippable coal (270 million tons) could be removed.
Social and Economic Factors	
Bisti	Wilderness preservation values (unquantified) would be maintained. Wilderness recreation use values could increase to $41,369 annually by the year 2000. Navajo religious values would be preserved.
De-na-zin	Wilderness preservation values (unquantified) would be maintained. Wilderness recreation use values could increase to $207,416 annually by the year 2000.
Ah-shi-sle-pah	Wilderness preservation values (unquantified) would be lost. Recreation use values may decrease by the year 2000. Strippable coal reserves could be leased and mined.
Recreation	
Bisti	Area would be closed to recreational ORV use. Recreation values would be enhanced by the preservation of wilderness characteristics.
De-na-zin	Area would be closed to recreational ORV use. Recreation values would be enhanced by the preservation of wilderness characteristics.

Table 1-5. BISTI, DE-NA-ZIN, AND AH-SHI-SLE-PAH WILDERNESS STUDY AREAS EIS SUMMARY OF IMPACTS (continued)

Resource and WSA	Proposed Action (Wilderness Designation, Bisti and De-na-zin WSAs; No Special Designation, Ah-shi-sle-pah WSA)
Recreation (continued)	
Ah-shi-sle-pah	Due to potential surface mining, opportunity to use area for dispersed or primitive recreational activities could be lost during mine life.
Cultural Resources	
Bisti	Increased potential for management of archaeological resources would occur.
De-na-zin	Increased potential for management of archaeological resources would occur. However, some impacts from underground mining would also occur.
Ah-shi-sle-pah	The majority of archaeological sites on strippable coal areas would be destroyed by mining.
Paleontology	
Bisti	No significant impacts.
De-na-zin	No significant impacts.
Ah-shi-sle-pah	Impacts on 501 localities would be significant, although surface mining could provide some opportunity for recovery of some resources.
Visual Resources	
Bisti	The WSA would be reclassified from VRM Class II to VRM Class I to ensure protection of natural and visual resources.
De-na-zin	The WSA would be reclassified from VRM Class II to VRM Class I to ensure protection of natural and visual resources.
Ah-shi-sle-pah	The WSA would be reclassified from VRM Class II to VRM Classes III and IV because of visual changes.

Table 1-5. BISTI, DE-NA-ZIN, AND AH-SHI-SLE-PAH WILDERNESS STUDY AREAS EIS SUMMARY OF IMPACTS (continued)

Resource and WSA	Proposed Action (Wilderness Designation, Bisti and De-na-zin WSAs; No Special Designation, Ah-shi-sle-pah WSA)
Soils	
Bisti	No significant impacts.
De-na-zin	No significant impacts.
Ah-shi-sle-pah	Soil erosion and compaction, sediment yield could increase due to development of strippable coal.
Vegetation	
Bisti	No significant impacts.
De-na-zin	No significant impacts.
Ah-shi-sle-pah	Significant impacts could occur (until reclamation is complete) due to development of strippable coal on 4075 acres.
Livestock Grazing	
Bisti	No significant impacts.
De-na-zin	No significant impacts.
Ah-shi-sle-pah	Loss of 250 AUMs could occur until reclamation occurs due to development of strippable coal on 4075 acres.
Wildlife	
Bisti	Overall impacts of wilderness designation would be beneficial.
De-na-zin	Overall impacts of wilderness designation would be beneficial.
Ah-shi-sle-pah	Impacts could be significant until successful reclamation occurs due to potential development of strippable coal.

Table 1-5. BISTI, DE-NA-ZIN, AND AH-SHI-SLE-PAH WILDERNESS STUDY AREAS EIS SUMMARY OF IMPACTS (concluded)

Resource and WSA	Proposed Action (Wilderness Designation, Bisti and De-na-zin WSAs; No Special Designation, Ah-shi-sle-pah WSA)
Threatened and Endangered (T&E) Species of Plants and Animals	
Bisti	Generally, T&E species would benefit, but some adverse impacts would occur due to human presence.
De-na-zin	Generally, T&E species would benefit, but some adverse impacts would occur due to human presence.
Ah-shi-sle-pah	Impacts could be significant due to development of strippable coal.
Water Resources	
Bisti	No significant impacts.
De-na-zin	No significant impacts.
Ah-shi-sle-pah	Impacts to both ground water and surface water could be significant due to development of strippable coal.

[a]As a result of the Chaco Management Framework Plan, the Bisti WSA was closed to mineral leasing and is being placed under a minerals withdrawal. Therefore, no significant impacts could occur to the mineral resource under any of the types of designation proposed because no mineral development would take place.

Table 1-6. SUMMARY OF POTENTIAL IMPACTS FOR NMGS PROPOSED ACTION

Environmental Resources and Impact Topics	Proposed Action[a]
CONSTRUCTION/OPERATIONAL ACREAGE	8786[b]
AIR QUALITY	
Maximum estimated 24-hour/annual SO_2 ambient concentration increases in project vicinity due to NMGS alone (in ppm)	0.029/0.002
Maximum estimated 24-hour/annual NO_2 ambient concentration increases in project vicinity due to NMGS alone (in ppm)	0.054/0.003
Maximum estimated 24-hour/annual TSP ambient concentration increases in project vicinity due to NMGS alone (in $\mu g/m^3$)	13-27/3-5
GEOLOGIC HAZARDS	
Miles of ROW across areas with potential slope instability	38
Project component acreage in areas with spontaneous combustion potential	2813
MINERAL RESOURCES	
Consumptive use of coal/limestone over 40-year power plant life (in millions of tons)	300/4
Miles of ROW across recoverable coal (estimated underlying recoverable coal in millions of tons)	17.5 (18.8)
PALEONTOLOGICAL RESOURCES	
Project component acreage in highly sensitive areas	3707
Project component acreage in moderately sensitive areas	2252

Table 1-6. SUMMARY OF POTENTIAL IMPACTS FOR NMGS PROPOSED ACTION (continued)

Environmental Resources and Impact Topics	Proposed Action[a]
SOILS RESOURCE	
Project component acreage in areas with high wind erosion susceptibility	5126
Project component acreage in areas with high water erosion susceptibility	1532
HYDROLOGY	
Streamflow reduction (cfs) in the San Juan River downstream of the intake on an average basis	48
WATER QUALITY	
Estimated maximum increase in average levels of total dissolved solids downstream along the Colorado River at Imperial Dam in mg/l (percent increase)	4(0.39)
VEGETATION	
Acres of sand wash and saline lowland vegetation disturbed	702
Acres of badlands and steep slopes vegetation disturbed	323
Acres of shrublands and grasslands vegetation disturbed	7037
Acres of juniper and pinyon-juniper vegetation disturbed	722
Acres of riparian vegetation and irrigated cropland disturbed	2
WILDLIFE	
Acres of mule deer crucial winter range that would be disturbed during construction/ removed from production over the life of the project	67/36

Table 1-6. SUMMARY OF POTENTIAL IMPACTS FOR NMGS PROPOSED ACTION (continued)

Environmental Resources and Impact Topics	Proposed Action[a]
WILDLIFE (continued)	
Number of raptor nests within 5 miles of project components	51
Number of raptor nests within 1 mile of project components	2
THREATENED AND ENDANGERED SPECIES	
Number of threatened and endangered plant species with potential habitat disturbed	1 (Sclerocactus mesae verdae)
Number of threatened and endangered plant species potentially affected by acid precipitation	1 (Astragalus humillimus)
Number of threatened and endangered aquatic species potentially affected by acid precipitation	1 (Salmo clarki stomias)
VISUAL RESOURCES	
Project component acreage that would exceed contrast ratings for VRM Class II areas	364
Project component acreage that would exceed contrast ratings for VRM Class IV areas	1125
RECREATION	
Estimated maximum annual increase in fishing demand in user participation days for San Juan and McKinley counties (in 1992)	7183
Estimated maximum annual increase in boating, swimming, and waterskiing demand in user participation days for San Juan and McKinley counties (in 1992)	4176

Table 1-6. SUMMARY OF POTENTIAL IMPACTS FOR NMGS PROPOSED ACTION (continued)

Environmental Resources and Impact Topics	Proposed Action[a]
RECREATION (continued)	
Estimated maximum annual increase in camping, picnicking, and hiking demand in user participation days for San Juan and McKinley counties (in 1992)	10,208
Estimated maximum annual increase in sightseeing/visiting historical sites/photography demand in user participation days for San Juan and McKinley counties (in 1992)	4550/1654/4956
TRANSPORTATION	
Estimated addition of vehicles to crosstown traffic in Farmington during peak periods of the day for peak employment years (percent increase in traffic)	650 (10-20)
Estimated increase in vehicles during peak commute periods of the day along NM 371 for peak employment years	650
SOCIAL AND ECONOMIC CONDITIONS	
Estimated maximum annual population increase in San Juan County in 1995 (percent increase over baseline projections)	3400 (3.2)
Estimated maximum annual population increase in Farmington in 1995 (percent increase)	1975 (4.4)
Estimated peak annual increase in demand for housing units in 1995 in the greater Farmington area	1190
Projected maximum annual direct and indirect personal income generated in San Juan and McKinley counties in 1992 (in constant 1980 dollars)	75,671,000
Projected total direct and indirect personal income generated in San Juan and McKinley counties between 1984 and 2000 (in constant 1980 dollars)	782,282,000

Table 1-6. SUMMARY OF POTENTIAL IMPACTS FOR NMGS PROPOSED ACTION (concluded)

Environmental Resources and Impact Topics	Proposed Action[a]
SOCIAL AND ECONOMIC CONDITIONS (continued)	
Estimated undiscounted cumulative net surplus in municipal operating funds generated between fiscal years 1985 and 2000 (in constant 1980 dollars)	
Farmington	221,000
Aztec	161,000
Bloomfield	132,000
Estimated effects on all San Juan County operating funds between 1985 and 2000 (in constant 1980 dollars)	
1985	-2000
1990	+427,000
1995	+2,060,000
2000	+3,040,000

[a]For the purposes of this table, the Proposed Action includes: NMGS; proposed main water pipeline P1 (including Farmington intake pumping plant and 3 intermediate booster pump stations); proposed reservoir R1; proposed transmission line corridor T1; proposed transmission line corridor T2; proposed NMGS to FC-A-P 500-kV transmission line loop (T5); and Rio Puerco Station.

[b]Other land uses would be precluded on 3192 acres.

Table 1-7. SUMMARY OF NEW MEXICO GENERATING STATION EIS IMPACTS

Environmental Resources and Impact Topics	Water Supply	Water Delivery		Water Storage
	Proposed-35,000 ac-ft/yr from San Juan River	Proposed-Intake for Water Pipeline P1	Proposed-Water Pipeline P1[a]	Proposed-Reservoir R1
CONSTRUCTION/OPERATIONAL ACREAGE	NA	35	439[b]	640
GEOLOGIC HAZARDS				
Miles of ROW across areas with potential slope instability	NA	NA	1	NA
Miles of ROW across areas with spontaneous combustion potential	NA	NA	6.7	NA
MINERAL RESOURCES				
Miles of ROW across recoverable coal (estimated underlying recoverable coal in millions of tons)	NA	NA	5(5)	NA
PALEONTOLOGICAL RESOURCES				
Miles of ROW across highly sensitive areas	NA	NA	2	NA
Miles of ROW across moderately sensitive areas	NA	NA	37.7	NA
SOILS RESOURCE				
Miles of ROW across soils with high wind erosion susceptibility	NA	NA	31.7	NA
Miles of ROW across soils with high water erosion susceptibility	NA	NA	1.6	NA
Acres of soils which are highly susceptible to wind erosion	NA	0	346	35
Acres of soils which are highly susceptible to water erosion	NA	0	17	0

Table 1-7. SUMMARY OF NEW MEXICO GENERATING STATION EIS IMPACTS (continued)

Environmental Resources and Impact Topics	Water Supply	Water Delivery		Water Storage
	Proposed-35,000 ac-ft/yr from San Juan River	Proposed-Intake for Water Pipeline P1	Proposed-Water Pipeline P1[a]	Proposed-Reservoir R1
HYDROLOGY				
Steamflow reduction (cfs) in the San Juan River downstream of the intake on an average basis	48	NA	NA	NA
Drawdown (in feet) which would occur to ground-water users whose wells tap the Westwater Canyon Member, Dakota Sandstone, and Entrada Sandstone aquifers in the San Juan structural basin	NA	NA	NA	NA
WATER QUALITY				
Estimated maximum increase in average levels of total dissolved solids downstream along the Colorado River at Imperial Dam in mg/l (percent increase)	4 (0.39)	NA	NA	NA
Short-term increases in turbidity levels immediately downstream from intake construction activities (yes or no)	NA	Yes	NA	NA
VEGETATION				
Acres of sand wash and saline lowland vegetation disturbed	NA	2	4	27
Acres of badlands and steep slopes vegetation disturbed	NA	0	44	51
Acres of shrublands and grasslands vegetation disturbed	NA	31	350	562
Acres of juniper and pinyon-juniper vegetation disturbed	NA	0	41	0
Acres of riparian vegetation and irrigated cropland disturbed	NA	2	0	0

Table 1-7. SUMMARY OF NEW MEXICO GENERATING STATION EIS IMPACTS (concluded)

Environmental Resources and Impact Topics	Water Supply	Water Delivery		Water Storage
	Proposed-35,000 ac-ft/yr from San Juan River	Proposed-Intake for Water Pipeline P1	Proposed-Water Pipeline P1[a]	Proposed-Reservoir R1
WILDLIFE				
Miles of ROW across mule deer crucial winter range	NA	NA	2.8	NA
Acres of mule deer crucial winter range that would be removed from production over the life of the project	NA	35	1	0
THREATENED AND ENDANGERED SPECIES				
Number of threatened and endangered plant species with potential habitat traversed or affected	NA	0	1 (Sclerocactus mesae verdae)	0
CULTURAL RESOURCES				
Number of presently identified and/or historic sites within study area[c]	NA	NA	71	NA
VISUAL RESOURCES				
Percent VRM Class II	NA	0	0	0
Percent VRM Class III	NA	100	92	0
Percent VRM Class IV	NA	0	8	100
SOCIAL AND ECONOMIC CONDITIONS				
Projected tax revenues for year 1 after completion (in dollars)	NA	---[d]	502,580	[d]

NA = Not applicable.

[a]Including booster pump stations; final location of centerline could affect impact findings.

[b]ROW acreage would not preclude other land uses.

[c]Refer to NMGS EIS Cultural Resources Technical Report for definitions of study areas.

[d]Included within $502,580 listed for Proposed Water Pipeline P1.

Table 1-8. SUMMARY OF NEW MEXICO GENERATING STATION EIS IMPACTS

Environmental Resources and Impact Topics	Proposed-Transmission Line T1	Proposed-Transmission Line T2	Proposed-Transmission Line T5
CONSTRUCTION/OPERATIONAL ACREAGE	2594[a]	2448[a]	121[a]
GEOLOGIC HAZARDS			
Miles of ROW across areas with potential slope instability	9	23	5
Miles of ROW across areas with spontaneous combustion potential	12	1	1
MINERAL RESOURCES			
Miles of ROW across recoverable coal (estimated underlying recoverable coal in millions of tons)	12.5 (13.8)	0	0
PALEONTOLOGICAL RESOURCES			
Miles of ROW across highly sensitive areas	50	0	3
Miles of ROW across moderately sensitive areas	13	35	0
SOILS RESOURCE			
Miles of ROW across soils with high wind erosion susceptibility	56.6	37.3	5
Miles of ROW across soils with high water erosion susceptibility	23.5	32	0
VEGETATION			
Acres of ponderosa and pinyon pine and oak vegetation disturbed	0	0	0

Table 1-8. SUMMARY OF NEW MEXICO GENERATING STATION EIS IMPACTS (continued)

Environmental Resources and Impact Topics	Proposed-Transmission Line T1	Proposed-Transmission Line T2	Proposed-Transmission Line T5
VEGETATION (continued)			
Acres of sand wash and saline lowland vegetation disturbed	151	102	0
Acres of badlands and steep slopes vegetation disturbed	70	14	97
Acres of shrublands and grasslands vegetation disturbed	1988	2036	24
Acres of juniper and pinyon-juniper vegetation disturbed	385	296	0
WILDLIFE			
Acres of mule deer crucial winter range that would be disturbed during ROW construction (% of regional resource)	0	0	0
Acres of elk crucial winter range that would be disturbed during ROW construction (% of regional resource)	0	0	0
Number of raptor nests within 5 miles of corridor centerline	14	25	4
Number of raptor nests within 1-mile wide corridor	1	1	0
THREATENED AND ENDANGERED SPECIES			
Number of threatened and endangered plant species with potential habitat traversed	0	0	1 (Sclerocactus mesae verdae)

Table 1-8. SUMMARY OF NEW MEXICO GENERATING STATION EIS IMPACTS (concluded)

Environmental Resources and Impact Topics	Proposed-Transmission Line T1	Proposed-Transmission Line T2	Proposed-Transmission Line T5
CULTURAL RESOURCES			
Number of presently identified archaeological and/or historic sites within the study area[b]	73	164	NA
VISUAL RESOURCES			
Percent VRM Class II	5	5	0
Percent VRM Class III	30	43	0
Percent VRM Class IV	65	52	100
Miles of ROW that would exceed contrast ratings for VRM Class II areas (number of significantly impacted areas identified)	5 (1)	10 (1)	0 (0)
Miles of ROW that would exceed contrast ratings for VRM Class IV areas (number of significantly impacted areas identified)	20 (2)	0 (0)	0 (0)
SOCIAL AND ECONOMIC CONDITIONS			
Projected tax revenues for year 1 after completion (in 1993 dollars)	700,902	647,306	55,251

NA = Not available

[a]ROW acreage would not preclude other land uses.

[b]Refer to NMGS EIS Cultural Resources Technical Report for definitions of study areas.

Table 1-9. SUMMARY OF AFFECTED RESOURCES CONSIDERED IN THE CUMULATIVE OVERVIEW

Resource	Study Area	Impact Topic	Indicator of Significance	Findings
Air Quality	12.5 km radius from NMGS, overlapping TSP contours from NMGS and SJRRCL. All mine locations within 25 km of NMGS were identified to be included in the analysis.	Increase in total suspended particulate (TSP) concentrations from fugitive dust and stack emissions.	Concentrations ($\mu g/m^3$) in excess of any 24-hour or annual standard.	One small area close to Bisti mine No. 1 may experience TSP concentrations in excess of a standard; the potential for additional concentrations in excess of standards may occur in a worst-case situation in which a PRLA mine is located close to another mine (i.e., 1 km or less).
Noise	The study area included Bisti and De-na-zin WSAs, and mines and roads within 20 km of NMGS.	Increased noise levels from blasting, haul trucks, and employee-related travel.	Increment of 9 dB(A) above baseline noise levels in WSAs.	Increases in hourly noise levels greater than 9 dB(A) over baseline is predicted at the boundary of De-na-zin WSA, as a result of worker and haul road traffic in excess of 700 vehicles per hour on C-15.
Cultural and Paleontological Resources	Resources within 100-mile radius of greater Farmington area.	Primarily, indirect effects of increased exposure of resources to an increased population (i.e., vandalism, commercial looting, inadvertent damage) as well as deliberate conservation and interpretation of some resources.	Due to large numbers of sensitive resources and their prescribed significance (36 CFR 60.6, PL96-550, AIRFA, etc.), all adverse cumulative impacts are considered to be significant.	Impacts include conservation of some resources through land withdrawal, and preservation of important information through its acquisition and synthesis in connection with mitigation. Consumption of the resource base through research and mitigation activities, and loss of some resources to purposive or inadvertent disturbance of sites by a larger population.
Visual Resources	Overlapping portions of areas within selected visual ranges (3-10 miles) of NMGS and SJRRCL project features, which also are visible from key viewing points (primarily from WSAs, designated park and recreation areas, highway access points, and other scenic areas).	Degradation of scenic quality within the critical viewing distance from WSAs and other regionally important locations (e.g., cultural sites), due to landscape modifications from combined NMGS and SJRRCL actions.	Numerical contrast rating thresholds in the BLM VRM system (exceedence of any established threshold was considered to be significant).	Impacts from seven key viewing points, most significantly along the northern side of Chaco Culture National Historical Park, from within the WSAs, and at highway access points to these areas.

Table 1-9. SUMMARY OF AFFECTED RESOURCES CONSIDERED IN THE CUMULATIVE OVERVIEW (concluded)

Resource Type	Study Area	Impact Topic	Indicator of Significance	Findings
Recreation/ Wilderness	Recreation areas and all WSAs (9 areas) within 100-mile radius from Farmington and Grants.	Loss or degradation of recreation or wilderness resources or their essential characteristics, primarily as a result of an increased regional population and its consequent demand for and use of these resources, or their close proximity to the proposed actions.	Loss or degradation of resource areas from crowding of recreation facilities (based on unit-use standards); any degradation of essential environmental qualities (scenery, noise) associated with high quality recreation and wilderness experiences.	Degradation of the quality of wilderness experience in Bisti and De-na-zin WSAs, overcrowding of recreation areas close to Farmington and Grants, and degradation in the quality of dispersed recreation activities in the region.
Transportation	Roads and railroads linking Farmington area communities with Gallup and Grants-area communities. Includes all roads and railroads that provide access to NMGS and SJRRCL components.	Increased traffic volumes and safety hazards on existing roadways.	Increase in peak volume greater than peak volumes estimated for NMGS or SJRRCL individually, and close to, or greater than, designed roadway capacity or surface structure tolerance.	Significant overloading of NM 371 between Farmington and NMGS site.
Social and Economic Conditions	Communities in the greater Farmington area (Farmington, Aztec, Bloomfield, Flora Vista, Lee Acres, and Lower Valley) where allocation of the combined increases in population from NMGS and SJRRCL have been made.	Employment, population growth, housing, community infrastructure and services, and public finances.	10 percent annual growth rate or greater in population or public revenue. Shortfall of projected public revenues to meet projected demands, or inability of private sector to meet such demands. Demand for community facilities and services (housing, municipal services, education, health and human services, police and fire protection, recreation) in excess of existing and projected supply.	Significant population growth in 1985-86, significant expansion of regional economy from 1985-1995, excess housing demand in mid '80s and early '90s, shortfall of projected human services to demand. San Juan County would experience a slight deficit (approximately $17,000) in overall operating funds in 1984-85, and surpluses thereafter which could reach $2.6 million in 2000.
	Portions of San Juan Basin occupied and used primarily by the Navajo.	Opportunities to pursue traditional American Indian values and lifestyles.	Reduction of opportunities to pursue traditional values and lifestyles.	Unquantified, but probably significant reduction in opportunities to pursue traditional lifestyles.

PART TWO
AFFECTED ENVIRONMENT

This part of the CO describes those portions of the affected environment that would be subject to significant cumulative impacts from simultaneous implementation of the proposed actions (Map 2-1). The resources discussed in this part are limited to those resources that would be affected by impacts of the following types:

1. Aggregates of significant impacts (those identified as significant in the individual EISs) which because of their combined magnitude or severity within a definable (overlapping) study area represent a qualitative change in the bases for mitigation planning.

2. Aggregates of individually nonsignificant impacts (identified as not significant in individual EISs) which could occur coincidentally at sensitive or important locations (e.g., Chaco Culture National Historical Park) and in the aggregate would be considered to be significant for such locations.

AIR QUALITY

The intent of the air quality report was strictly limited to addressing cumulative impacts of the combination of effects of NMGS with SJRRCL, especially as they relate to environmentally sensitive areas (WSAs and Chaco Culture National Historical Park). Impacts from SJRRCL actions alone were not addressed unless there was a physical overlap by pollutant category with NMGS.

Impacts associated with emissions from NMGS with other emission sources in the San Juan Basin are addressed in detail in the NMGS EIS. Impacts associated with SJRRCL proposed actions are addressed in that EIS and in the Regional Air Quality Impact Analysis for the Regional EIS of the San Juan Basin Coal Region (ECOS 1982).

Potential cumulative air quality impacts of NMGS and SJRRCL are limited to increases in the total suspended particulate (TSP) level associated with emissions of particulate matter from fugitive dust and stack emissions. Although NMGS would be an emissions source of sulfur dioxide (SO_2), oxides of nitrogen (NO_x), and carbon monoxide (CO) as well as particulate matter, mining activity is a significant source of particulate matter only. Therefore, the potential cumulative impacts of the coal development actions and NMGS together would be limited to possible increases in the ambient concentrations of total suspended particulates.

LEGEND

- SJRRCL Mines (Target level)
- PRLA
- WSA
- NMGS facilities

N

0 10 20 30
miles

Map 2-1. LOCATION OF THE PROPOSED ACTIONS

The resulting levels of particulate matter were compared with the respective state and federal standards. Ambient standards are established by the EPA to protect against pollution levels that endanger public health, allowing an adequate margin of safety. Thus, if by conventional methods (i.e., computer dispersion modeling) these standards are not predicted to be exceeded, public health and welfare would not be expected to be endangered by the proposed activities.

Although both the NMGS and SJRRCL EISs project potential impacts on visibility, no cumulative visibility impact from the combined actions is projected. The NMGS has the potential to contribute to regional haze formation at large distances from the plant as a result of secondary aerosol formation and plume dispersion. Impacts from NMGS in the vicinity of the project would be limited to a slightly visible plume occasionally originating from stacks as high as 575 feet.

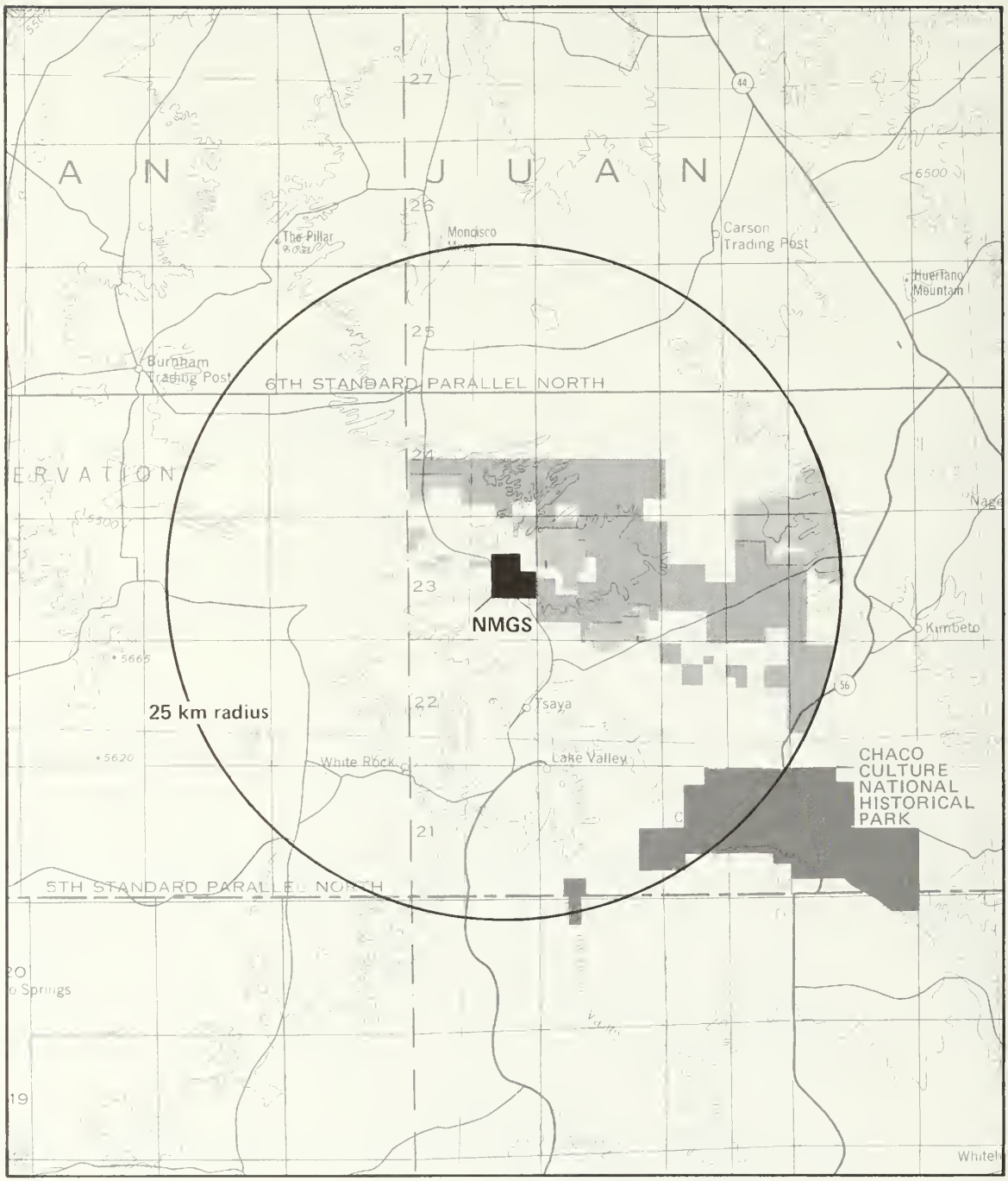
Visibility impacts from SJRRCL actions would result from ground level fugitive dust emissions from the mines. These emissions are not expected to interact with the NMGS plume, nor travel sufficient distances to affect or contribute to the formation of regional haze.

Study Area

The geographic area of study consists of those localities in which potential overlaps in TSP concentrations could occur between NMGS and the SJRRCL projects, which were determined by mapping concentration contours based on particulate emission estimates.

Increases were calculated in TSP concentrations resulting from NMGS and from the SJRRCL tracts in the vicinity of the mine. TSP increases from NMGS (from both stack and fugitive emission sources) were calculated to be confined primarily to an area within 5 kilometers of the center of NMGS. TSP increases from the mines were estimated to occur mainly within 5 kilometers of mine boundaries, but with some measurable deposition out to a 20-kilometer distance. A conservative union of the results of modeling NMGS and SJRRCL emissions, therefore, is a study area of a 25-kilometer radius, centered on NMGS (see Map 2-2). Within this circle, estimated emissions from each SJRRCL mine could be modeled, and plotted in relation to calculated TSP concentrations from NMGS. Within the 25-kilometer radius there are five SJRRCL mines (Bisti Nos. 1, 2, 4, 6, and 8) (see Table 2-1), and all of these mines have the potential to generate TSP concentrations that would overlap with and thus increase the level of TSP concentrations expected to result from operation of NMGS. Outside of the 25-kilometer radius there are six other SJRRCL mines, but these are not predicted to contribute any particulates to the cumulative impact of NMGS and SJRRCL, and are not considered further in the analysis of environmental consequences.

Emission estimates for the coal- and ash-handling and mining activities associated with NMGS were obtained from previously conducted analyses. Similarly, annual and short-term (24-hour average) impacts associated with the above-mentioned sources were contained in these studies. Estimates of emissions from mines were based on emission factors developed for a typical mine in the San Juan Basin. Mine sizes, coal production rates, and locations of projected development were also used in estimating projected emissions.



LEGEND

SJRRCL Mines (Target level)

PRLA

Map 2-2. CUMULATIVE AIR QUALITY STUDY AREA

Table 2-1. DISTANCE OF LEASE TRACTS FROM NMGS

Tract	Distance from Center of Tract to the Center of NMGS (km)	Closest Distance from Tract Boundary to NMGS Boundary (km)
La Plata #1	78.0	74.0
Johnson T.P.	89.0	82.0
Star Lake East #1	75.0	70.0
Star Lake West #2	61.0	58.0
Kimbeto #2	33.8	30.5
Gallo Wash #1	51.0	47.0
Bisti #1	4.2	0.5
Bisti #2	10.5	6.8
Bisti #4	8.8	4.4
Bisti #6	6.0	3.5
Bisti #8	8.0	6.8

Source: BLM 1982.

NOISE

Cumulative noise impacts associated with the proposed NMGS are considered with respect to sensitive receptors (Bisti and De-na-zin WSAs) and potential regional coal lease tracts. SJRRCL coal lease tracts and PRLAs would be developed in the vicinity of the NMGS; some of these developments in conjunction with NMGS may contribute to elevated noise levels in WSAs. Noise levels associated with coal development are considered to be due primarily to infrequent blasting and increased haul truck and worker traffic. Noise associated with NMGS emanates from coal- and ash-handling facilities, and commute traffic along New Mexico Highway 371 and County Road 15 (NM 371 and C-15).

Two alternatives are assumed for transporting production from the mines: (1) the use of trucks to haul production only to a rail facility (assumed to be the Star Lake-Bisti Railroad [RR]); and (2) the use of haul trucks as the only means of transporting the moved coal. Both are examined with respect to noise impacts.

Study Area

The definition of the study area is based upon the affected area associated with NMGS, as well as proposed coal lease tracts and/or PRLAs that could interact with the NMGS impact area. The region examined for cumulative noise impacts is roughly encompassed by a 20-kilometer (12.4-mile) radius from the center of NMGS. The Bisti and De-na-zin WSAs were considered the important receptor areas with respect to cumulative noise impacts. As discussed in the NMGS EIS Air Quality Technical Report, the NMGS and associated coal- and ash-handling facilities would cause elevated noise levels at the Bisti and De-na-zin WSAs. Noise increases associated with NMGS facilities at other areas such as the Ah-shi-sle-pah WSA and Chaco Culture National Historical Park were projected to be negligible. Thus, in this study, mines examined were only those that would be expected to cause elevated noise levels at the Bisti and De-na-zin WSAs.

Mines that could potentially result in increased truck traffic along NM 371 past the Bisti WSA and along C-15 past the De-na-zin WSA were identified and included in the cumulative noise analysis. These mines are: the Bisti mines, and PRLAs 3834 through 3838, 3852 through 3855, 6801, 6803, and 11916. Haul trucks associated with the proposed action coal tracts adjacent to and northwest of NM 57 were assumed to travel south on NM 57, remaining out of the area of influence for NMGS. For the same reason, production from potential coal lease tracts beyond the 20-kilometer range from NMGS were not included in haul truck and automobile frequency computations. This eliminated the Farmington and Gallup community areas.

Noise levels measured in the vicinity of the Bisti and De-na-zin WSAs indicated hourly sound levels ($L_{eq(1)}$) of 32 to 35 dB(A). These levels are representative of enclosed areas within the WSAs. Baseline noise levels representative of increased traffic flows (on NM 371 and C-15) without NMGS, and inclusive of blasting noise and haul truck and worker traffic associated with a "hypothetical mine," have been calculated for these WSAs. The procedure for such projections is discussed in the NMGS EIS Air Quality Technical Report. The hypothetical mine blasting would occur intermittently (approximately twice per week). An hourly noise level ($L_{eq(1)}$) of 76 dB(A) is projected as the baseline at the Bisti WSA boundary adjacent to NM 371. At a

point approximately 1/4 mile from NM 371 within the Bisti WSA, a baseline of 51 dB(A) is projected. At the boundary of the De-na-zin WSA, the baseline noise level is projected to range from 35 to 65 dB(A). Within the enclosed portions of the De-na-zin WSA, the level is expected to range from 35 to 40 dB(A).

CULTURAL AND PALEONTOLOGICAL RESOURCES

Cumulative impact analysis of proposed actions on cultural and paleontological resources focuses on indirect impacts. Direct impacts of approved individual projects (impacts such as loss or degradation of information from specific resources) that are location-specific are described in individual EISs, and because of location are mutually exclusive of direct impacts from other individual proposed actions. Indirect impacts from individual projects, on the other hand, may be overlapping and additive, and thereby may satisfy the definitions of significant cumulative impacts presented in the introduction to Part Two.

The cultural resources within and near to the San Juan Basin include an extensive body of physical evidence of a cultural history dating back 10,000 years or more. Other regional resources (objects, structures, or places) are used for socioculturally significant purposes by contemporary American Indian groups, and are included in the cultural resource base. Paleontological resources consist of some of the richest and most extensive fossiliferous beds in the country, and are considered to be of international importance. Together, the cultural and paleontological resources compose a huge, coherent body of information that is unusual for its abundance, regional extension, and temporal depth. These regional resources, in sum, provide unusual opportunities for research and interpretation at a scale and of a diversity which exceed the perspective of technical and management evaluations that customarily attend EIS documentation of individual projects, such as the several-component proposed actions.

The emphasis of cumulative impact analysis is on modifications to these regional sets of resources, and the consequent enhancement or degradation of the special qualities and opportunities that these regional sets provide. The impacts of interest are "indirect" because they do not concern specific modifications to individual cultural resources, but rather generalized modifications to a body of resources. As a matter of subtle emphasis, the corpus of resources is of greater concern than the component parts. Actions that would produce these indirect effects are the additive and overlapping dedication of resources as well as the cumulative increases in population in the region, and a cumulative increase in the attention invested in these resources by public agencies in anticipation of and in response to proposed actions.

Study Area

The geographic area of study for assessing cumulative impacts to cultural and paleontological resources is the general recreational area that would be used by the population influx that would implement the proposed actions if they are approved. This recreational area is defined as those lands within one day's drive (100 miles one way) of primary residential

communities, particularly Farmington. The area (Map 1-1) includes the entire San Juan Basin, and generally ranges from Cortez and Durango on the north in Colorado, east to Navajo Reservoir, down to the San Pedro Peaks area of Santa Fe National Forest and Jemez, southwest through the Laguna and Acoma Indian Reservations, west through the Ramah and El Morro area (southwest of Grants), and north in the general vicinity of Ganado, Chinle, and Teec Nos Pas.

Regionally Important Environmental Resources

Cultural Resources. As used within the BLM, "cultural resources" generally include (1) historic archaeological and architectural sites, or "historic properties" as defined under the National Historic Preservation Act of 1966 as amended; and (2) sites and areas of importance to traditional cultural lifeways, such as those of many American Indians. Traditional lifeways as cultural entities followed by individuals and communities are a human resource set that is evaluated in the Technical Report on Social and Economic Conditions for NMGS and in the Social and Economic Conditions section of this report.

The cultural resource base of reference in this cumulative impact assessment is defined and classified in the CO Technical Report. The resource base includes:

- Historic properties listed on, determined eligible for, or potentially eligible for the National Register of Historic Places (NRHP). The properties span a 10,000-year culture history that includes prehistoric, protohistoric, historic, and modern times, and could involve several hundred thousand sites.

- Historic properties with special protective status, especially those included within Chaco Culture National Historical Park, those designated or planned for designation as Chaco Culture Archaeological Protection Sites (APSs), Aztec Ruins National Monument, and the outlying archaeological and/or historic reserves such as Mesa Verde National Park, Canyon de Chelly National Monument, and El Morro National Monument. The Chaco Culture APSs are widely distributed and include 33 specific properties.

- Sites and resource areas of significance to the maintenance of traditional American Indian religious practices and values. These resources have not been inventoried systematically.

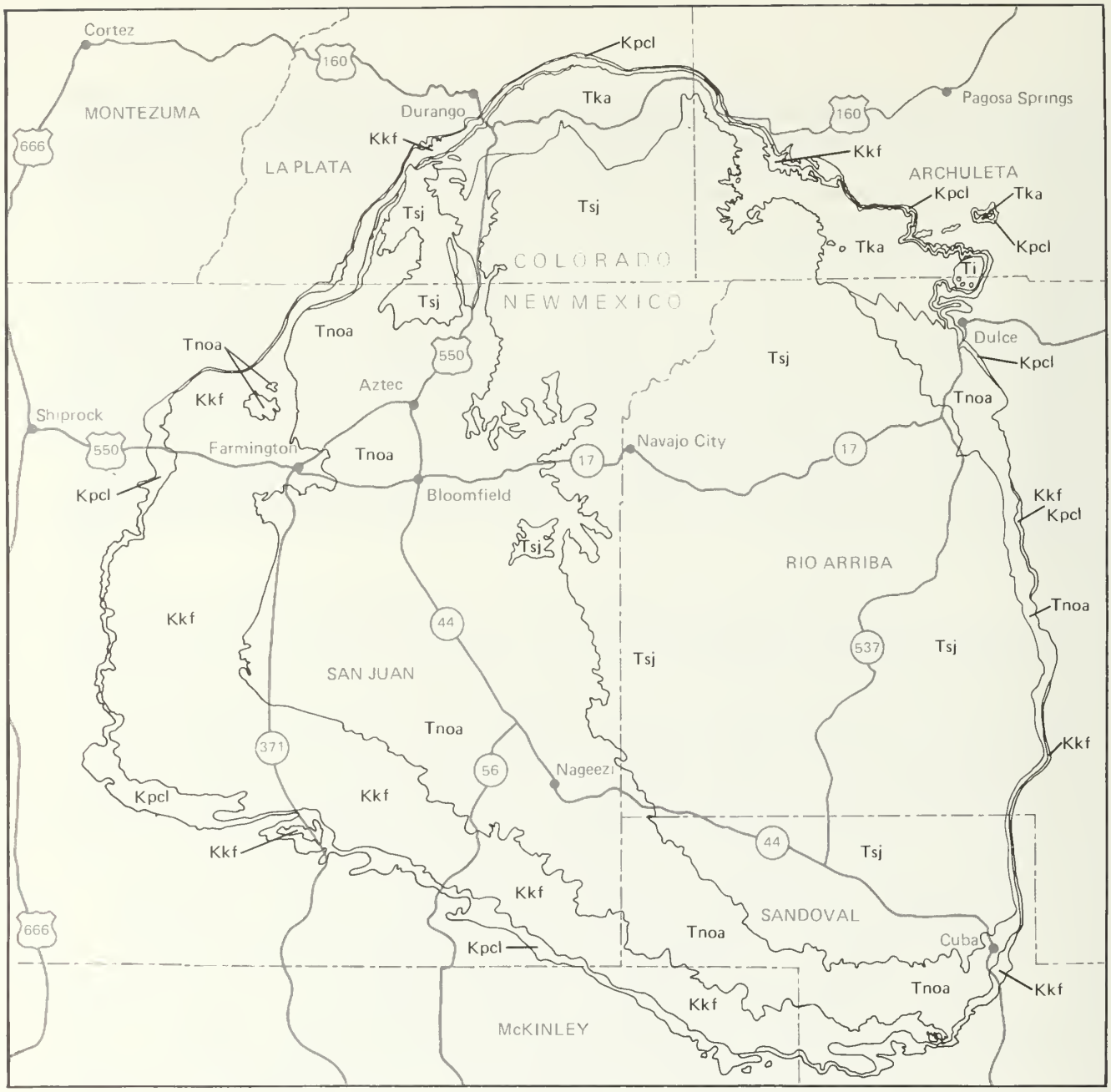
These resources all require general consideration under the National Environmental Policy Act of 1969 (91 Stat. 852) and its accompanying regulations (43 CFR 1500). In addition, they require consideration and, where prudent and feasible, preservation or even enhancement under the guidance of the National Historic Preservation Act of 1966 as amended (80 Stat. 915); the Reservoir Salvage Act of 1960 as amended by the Archaeological and Historic Preservation Act of 1974 (88 Stat. 174); the Archaeological Resources Protection Act of 1979 (93 Stat. 721), and other state and county laws as well as state, regional, tribal, and local regulations. The resources of

Chaco Culture National Historical Park and the Chaco Culture APSs merit particular scrutiny under the guidance of Title V of P.L. 96-550 (94 Stat. 3227), and resources of importance in the maintenance of traditional American Indian religious practices are required to be considered under the guidance of tne American Indian Religious Freedom Act of 1978 (92 Stat. 469).

Paleontological Resources. The San Juan Basin contains a 14,000-foot thickness of sedimentary rocks that were deposited sporadically over the last 600 million years (Map 2-3). Most of the geological formations occurring in the basin contain fossils, and a number of the formations are quite richly fossiliferous. A wide variety of ancient depositional environments is represented tnere and a huge diversity of fossils has been collected, ranging from microscopic plants and marine organisms to 80-foot-long dinosaurs (Table 2-2). These fossils have been the subject of intensive scientific research for more than 120 years by American and international paleontologists. The international significance of this resource is best expressed in the introduction to a recent publication on San Juan Basin paleontology (Lucas, Rigby, and Kues 1981:ix-x):

> It is difficult to overstate the role that the rocks and fossils of the San Juan Basin have played in our understanding of the evolution of life during the transition from Late Cretaceous to early Tertiary time. Any textbook, article, or lecture concerned with this period relies, directly or indirectly, on the fossil record of the San Juan Basin. The basin is one of a small number of places on the earth's surface where continental sediments containing Late Cretaceous dinosaurs are immediately overlain by rocks bearing some of the earliest Tertiary mammals. Therefore, it has figured prominently in discussions about the placement of the Cretaceous-Tertiary boundary. It has achieved additional biostratigraphic importance by producing three mammalian faunas--Puerco, Torrejon, and Tiffany--that are the standards for the North American land mammal "ages" that represent early, middle, and late Paleocene time. Indeed, the long succession of superposed vertebrate faunas ranging from the Late Cretaceous to early Eocene present in the San Juan Basin is absolutely unique; no sedimentary sequence as long, complete, and richly fossiliferous spanning the Mesozoic-Cenozoic boundary exists in a single basin anywhere else on earth. The importance of this sequence is augmented by the profound changes that occurred in vertebrate communities during this time. Mature terrestrial communities dominated by dinosaurs disappeared as the dinosaurs became extinct, giving way to the mammal-dominated communities that heralded the establishment and elaboration of mammalian hegemony.

Public and governmental concern for these fossils was demonstrated by the New Mexico State Legislature with the passage of protective legislation in 1978 (Joint Memorial 4) and 1979 (Senate Memorial 31; Bill 224, Laws of 1979, Chapter 237). Further support was expressed in 1980 with the passage of Bill 19 (Laws of 1980, Chapter 128) establishing a state-funded New Mexico Museum of Natural History; San Juan Basin fossils played an instrumental role in the development of this museum. A discussion of evolving trends in the legal significance of paleontological resources is presented in the CO Technical Report.



LEGEND

Miocene	Ti Intrusive igneous rocks	
Eocene	Tsj San Jose Formation	
Paleocene	Tnoa Nacimiento Formation Ojo Alamo Sandstone	
Upper Cretaceous	Kkf Kirtland Shale Fruitland Formation Kpcl Pictured Cliffs Sandstone Lewis Shale	
Northern Part	Tka Animas Formation	

Map 2-3. GENERALIZED MAP OF BEDROCK IN SAN JUAN BASIN

Table 2-2. SUMMARY OF GEOLOGY AND PALEONTOLOGY OF STUDY AREA

Formation	Age	Environment of Deposition	Fossils
Morrison Formation	Late Jurassic	Continental	Dinosaurs, mammals
Dakota Sandstone	Early(?) to Late Cretaceous	Continental to nearshore marine	Plants, invertebrates
Mancos Shale	Late Cretaceous	Offshore marine	Microfossils, invertebrates, plesiosaurs
Gallup Sandstone	Late Cretaceous	Nearshore marine, strandline	Invertebrates
Crevasse Canyon Formation	Late Cretaceous	Continental to nearshore marine	Plants
Point Lookout Sandstone	Late Cretaceous	Nearshore marine, strandline	Plants, invertebrates
Menefee Formation	Late Cretaceous	Continental	Plants, invertebrates
Cliff House Sandstone	Late Cretaceous	Nearshore marine, strandline	Invertebrates, sharks
Lewis Shale	Late Cretaceous	Offshore marine	Invertebrates
Pictured Cliffs Sandstone	Late Cretaceous	Nearshore marine, strandline	Invertebrates, sharks
Fruitland Formation	Late Cretaceous	Continental	Plants, invertebrates, sharks, fish, salamanders, frogs, turtles, crocodilians, dinosaurs, lizards, snakes, mammals
Kirtland Formation (exclusive of Naashoibito Member)	Late Cretaceous	Continental	Plants, invertebrates, sharks, fish, turtles, crocodiles, dinosaurs, mammals
Kirtland Formation (Naashoibito Member)	Late Cretaceous	Continental	Fish, turtles, crocodilians, dinosaurs, mammals
Ojo Alamo Sandstone	Early Paleocene	Continental	Plants, turtles, archosaurs, mammals
Nacimiento Formation	Early to Middle Paleozoic	Continental	Plants, invertebrates, fish, turtles, crocodilians, lizards, snakes, mammals

Directly Affected Resources

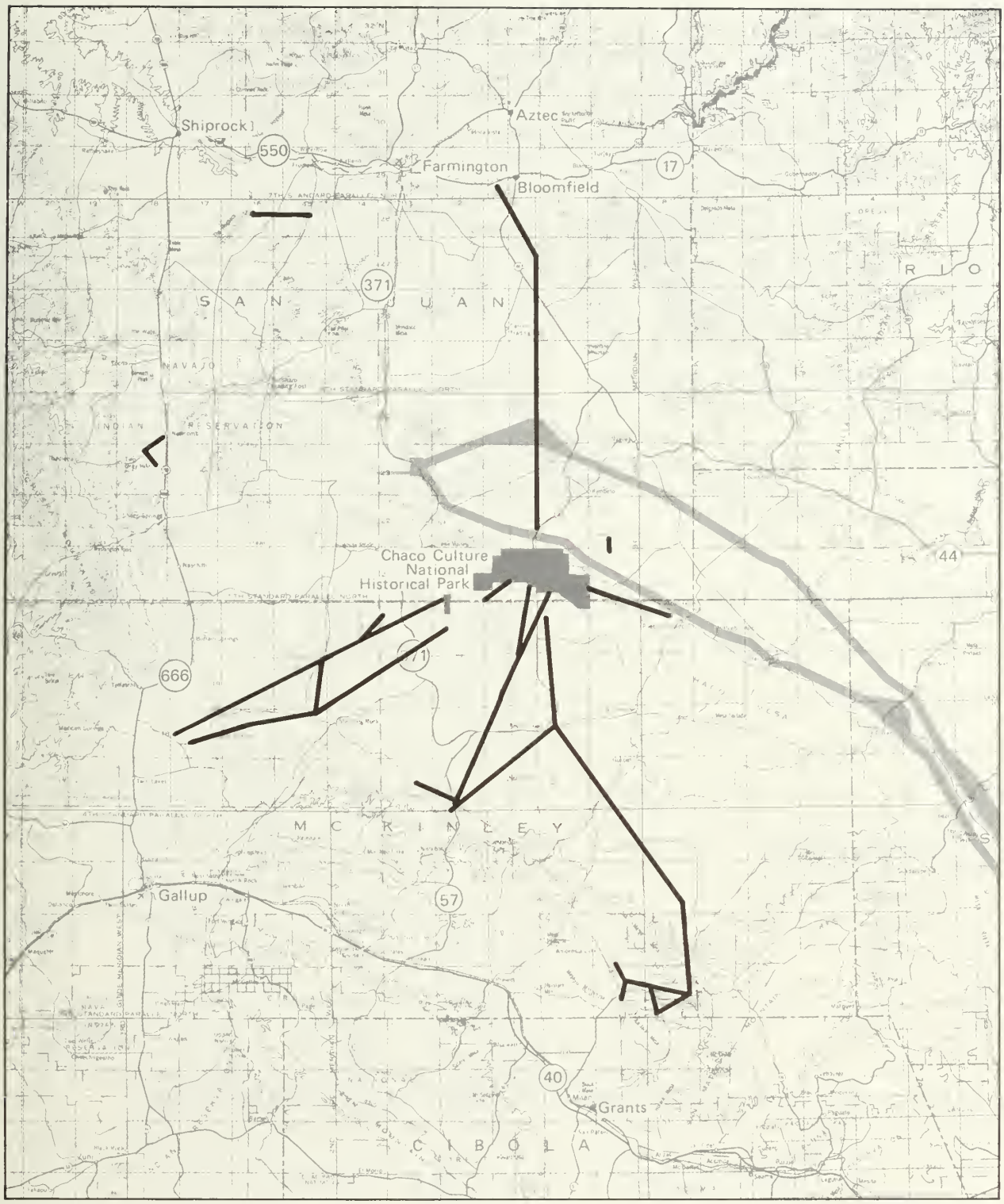
No new baseline data other than those reported in the three EISs were collected for the cumulative impact analysis. The EISs contain generalized descriptions of the regional cultural and paleontological resource bases, and more detailed descriptions of those resources that are subject to direct impacts from proposed actions. The directly affected resources are reviewed briefly here because they are generally representative of the regional resource base, they provide a basis for explications or examples that can be referenced readily in the EISs, and they were influential in the development of specific impact estimates and mitigation recommendations.

NMGS Cultural Resources. An intensive reconnaissance of the proposed plant site (4 square miles) resulted in the identification of 40 archaeological and 8 traditional Navajo religious sites there. Of the archaeological sites, 18 have Archaic remains, 5 are Anasazi-related, 8 are Navajo, 2 are historic, and the rest are of unknown affiliation. Little intensive survey has been conducted in the alternative areas of the proposed pipeline; the present data within the 1-mile-wide study corridors indicate that Archaic and Navajo sites are more frequent there. There has been no survey to identify traditional American Indian resources in those alternative areas. The alternative corridors for the proposed transmission lines have been more extensively surveyed and more frequently include Anasazi and Navajo sites, and could cross the Chacoan roads several times (see Map 2-4), and could be in visual proximity to several Chacoan outliers. Surveys to identify traditionally important Navajo resources in these alternatives are minimal yet, but a number of these have been recorded in the transmission system study areas. No identified Chacoan outliers (whether designated as APSs or not) would be directly impacted by the NMGS proposed action.

Direct impacts to any significant cultural resources on the plant site, reservoir, and intake structure are expected to be mitigated through data recovery stipulated in ROW grants. Once engineered ROWs are identified for the transmission lines and water pipelines, and intensive cultural resource inventories are completed for these, line reroutes would be designed, where prudent and feasible, to avoid significant cultural resources; where avoidance is impossible, data recovery would be completed to preserve an adequate sample of the impacted resource information.

NMGS Paleontological Resources. The proposed plant site acreage sits atop the fossiliferous Fruitland Formation, with a veneer (up to 5 meters thick) of alluvium covering 90 percent of the bedrock area. The proposed pipeline area generally crosses over (and sometimes through) bedrock of high paleontological sensitivity, with varying overburden; the transmission corridor alternatives are generally over zones of low to moderate paleontological sensitivity. The EIS for NMGS sets forth suggested mitigation to reduce the adverse direct impacts through scientific data recovery where resource avoidance is impossible.

SJRRCL Cultural Resources. The Target Level Alternative for the permitting of coal mining, complemented by permitting of mining on the PRLAs, would result in the surface disturbance of over 80,000 acres. Based on the presently available data, as incorporated within the environmental assessment



LEGEND

Prehistoric Road

NMGS facilities

N

0 10 20 30

miles

Map 2-4. MAJOR CHACOAN PREHISTORIC ROADS

documents supplemented by a recently completed predictive archaeological model (Kemrer 1982), it appears that some 1000 to 2000 archaeological sites would be disturbed if the Target Level Alternative were implemented. This disturbance would be from scientific data recovery as mitigation of adverse effects, or by destruction during mining operations. The estimated density of 8 to 17 sites per square mile of mine lands falls within the general range of site frequencies encountered for the San Juan Basin. There is no detailed breakdown of the probable cultural affiliation of these predicted sites (e.g., Archaic, Paleo-Indian, Anasazi, Chacoan). However, their distribution tends to reflect the general temporal and functional distributions of basin sites with a probable larger number of Chacoan sites associated with the PRLAs and leases in the Kirtland belt. Tables 2-3 and 2-4 summarize the cultural and paleontological resource base in areas of coal lands.

SJRRCL Paleontological Resources. At the present time, 2301 paleontological localities have been identified within the proposed Target Level Alternative tracts. These have been classed as Critical, Highly Important, Important, or Insignificant for the PRLAs, and Table 3-6 of the PRLA EA (BLM 1981) classes 44 percent of the then-identified resources as localities of significance meriting mitigative data recovery. No such classification of resources has been completed for the Target Level Alternative tracts.

WSA Cultural Resources. Three WSAs (Bisti, NM-010-057; De-na-zin, NM-010-04; Ah-shi-sle-pah, NM-010-09) are included in the EIS. Together, these WSAs include nearly 30,000 acres of relatively undisturbed lands, some of which (estimate 12,820 acres) have also been identified as PRLAs. A total of 62 archaeological sites have been identified in partial surveys of the WSAs; 54 of these sites are considered to be eligible for NHRP nomination. Three possible gravesites have been identified. Based on the survey data, about 250 archaeological sites are estimated to occur in the WSAs; about 150 of these are projected to lie in WSA-PRLA overlap areas. The badlands nature of much of the Bisti WSA is complemented by its apparent relative paucity of prehistoric or recent cultural resources, but this absence of identified sites may be a function of the types of survey conducted there. De-na-zin and Ah-shi-sle-pah WSAs are known and further predicted to have a large number of sites within them, but no Chacoan outliers or road segments and few Navajo sites have thus far been identified there.

WSA Paleontological Resources. Many significant paleontological localities have been identified in all three WSAs, and the area is the focus of international paleontological research (Table 2-5). The world reference section for paleontological magnetic stratigraphy is within the De-na-zin WSA, with many exposures marking the transition between the dinosaur-dominated Fruitland/Kirkland formations and the upper Ojo Alamo and Nacimiento mammalian-bearing formations.

VISUAL RESOURCES

The cumulative impact analysis for visual resources assesses increased visual contrast, as seen from a number of key viewing points, on landscapes occupied by the combination of the proposed actions. Key elements in this analysis are the viewing points (within WSAs, designated park and recreation

Table 2-3. COAL LANDS AND THEIR CULTURAL AND PALEONTOLOGICAL RESOURCE BASE: SURFACE MINING TRACTS

Tract	Proposed Action	Years in Production[d]	Acreage Subject to Direct Impacts[e]	Resources and Predicted Impacts: Archaeological No.[c]	Archaeological Effects[b]	Historical[o] No.	Historical Effects[b]	Native American No.	Native American Effects[d]	Paleontological No.[j]	Paleontological Effects[b]	Comments
La Plata No. 1	SJRRCL	7	1,070	15	Some						Minor	
Johnson Trading Post	SJRRCL	42	5,112	23-43	Some		Some			307	Major	
Star Lake East No. 1	SJRRCL	32	4,130	15-35	Some		Some			248	T.3-30: Minor; T.3-3: Major	May have agricultural soils and Anasazi sites[b]
Star Lake West No. 2	SJRRCL	14	1,216	6-13	Some		Some			130	T.3-30: Minor; T.3-3: Major	Proposed Continental Divide corridor[b]
Kimbeto No. 2	SJRRCL	20	1,135	8	Some					68	Major	
Gallo Wash No. 1	SJRRCL	7	1,906	6	Some					114	Major	
Bisti No. 1	SJRRCL	42	4,871	43	Some		Known Sites		Known Sites	292	Major	
Bisti No. 2	SJRRCL	38	4,598	12	Some					276	Major	
Bisti No. 4	SJRRCL	32	3,740	20-86	Some				Known Gathering Areas	224	Major	
Bisti No. 6/8	SJRRCL	4	560	14	Some				Known Burials	34	Major	
Lee Ranch East	SJRRCL	42	2,196	7	Some						Minor	Chacoan outlier[h]
Lee Ranch Middle	SJRRCL	42	8,572	32-43	Some						Minor	Chacoan road[i]
Lee Ranch West	SJRRCL	25	10,132	70-100	Some						Minor	
Divide	SJRRCL	42	4,325[f]	48-105							Minor	Chacoan outlier;[h] Chacoan road[i]
Hospah No. 1	SJRRCL	20	ND[f]	33	Some						Minor	
Catalpa Canyon	SJRRCL	5	730[g]	0							Minor	
Sundance	SJRRCL	22	1,597	23	Major						Minor	
Gamerco No. 1	SJRRCL	22	1,086	1-6							Minor	
Samson Lake No. 2	SJRRCL	29	973	32-47							Minor	
NM 8717	PRLA	40	480	ND							Minor	
NM 8715	PRLA	40	560	18-39						15	Major	1.6 mi. Chacoan road[n]
NM 11670	PRLA	40	80	17-38								1.6 mi. Chacoan road[n]
NM 8130	PRLA	40	1,580	48-100								0.5 mi. Chacoan road[n]
NM 8128	PRLA	40	1,900	70-140								
NM 9764	PRLA	40	190	4-17								
NM 585	PRLA	40	1,700	ND								
NM 3754	PRLA	40	900	46-147						2	Major	
NM 3753	PRLA	40	1,180	38-67						200	Major	
NM 3752	PRLA	40	1,620	33-63						199	Major	2.3 mi. Chacoan road[n]
NM 3918	PRLA	40	1,900	30-47						72	Major	6.75 mi. Chacoan road[n]
NM 8745	PRLA	40	60	4-29								1 mi. possible Chacoan road[n]

Table 2-3. COAL LANDS AND THEIR CULTURAL AND PALEONTOLOGICAL RESOURCE BASE: SURFACE MINING TRACTS (concluded)

Tract	Proposed Action	Years in Production[d]	Acreage Subject to Direct Impacts[e]	Resources and Predicted Impacts: Archaeological No.[c]	Archaeological Effects[b]	Historical[o] No.	Historical Effects	Native American No.	Native American Effects[d]	Paleontological No.[j]	Paleontological Effects	Comments
NM 3919	PRLA	40	1,900	29-56						8	Major	6.3 mi. Chacoan road[n]
NM 3755	PRLA	40	940	15-70+						40	Major	1.6 mi. Chacoan road[n]
NM 3837[m]	PRLA	40	1,655	43-142							Major	3.2 mi. possible Chacoan road[n]
NM 3836[m]	PRLA	40	1,920	48-75								9.9 mi. Chacoan road[n]
NM 3835[m]	PRLA	40	3,255	75-246+								1.75 mi. Chacoan road[n]
NM 6802	PRLA	40	340	0								
NM 3838[m]	PRLA	40	60	37-134+						72	Major	
NM 6804[a]	PRLA	ND	1,602	25-58								2 mi. Chacoan road[n]
NM 7235[a]	PRLA	ND	160	6-44								
NM 8129[a]	PRLA	ND	1,520	12-82								1.4 mi. possible Chacoan road[n]

[a]These tracts could be either surface or underground mine areas; under a worst case scenario they are included with surface mine data; acreage from Table 1-1, PRLA Environmental Assessment.

[b]Comments on "Effects" are from Tables 1-2, 3-3, 3-30 of SJRRCL DEIS (June 1982); if no comments are provided here, they were not provided in the DEIS.

[c]Number of archaeological sites is an estimate based on a predictive model; data are from SJRRCL DEIS (June 1982) for competitive leases. Number of sites on PRLAs is a preliminary estimate; high end is total number of sites in 2x2 km grids that overlap PRLA tract in whole or part; low end is a estimate based on approximate percentage of grid overlapping tract x estimated sites per grid. Data: Kemrer 1982, Map A.

[d]Data on PRLAs from Table 1-21 of SJRRCL DEIS (June 1982); on competitive coal leases, from BLM-Albuquerque.

[e]SJRRCL acreage from Table 3-30, PRLA data Table 3-3 of the SJRRCL DEIS (June 1982).

[f]Hospah No. 1: Table 1-6, SJRRCL DEIS [June 1982] says mine begins after 1987 and closes before 2000; data from BLM-Albuquerque says mine begins AD 2010; Table 3-30 says it begins AD 2018.

[g]Catalpa Canyon: 1990-1994.

[h]Data from p. 2-49, SJRRCL DEIS (June 1982).

[i]Data from p. 2-51, SJRRCL DEIS (June 1982).

[j]Known localities on PRLAs; estimated total population for each SJRRCL tract; (SJRRCL DEIS [June 1982]).

[k]SJRRCL DEIS (June 1982) gravesites and 7 known sacred sites will be affected by implementation of the Target Alternative.

[m]This PRLA would have both surface and underground mine components, but data are not presently available to distinguish which acreage would be subject to which action; therefore total acreage is used as a basis for estimating archaeo-sites present (worst-case scenario).

[n]Table 2-14. PRLA EA

[o]This is separated from "Archaeological" resources on the basis of comments in Table 1-2, SJRRCL DEIS (June 1982).

Table 2-4. COAL LANDS AND THEIR CULTURAL AND PALEONTOLOGICAL RESOURCE BASE: UNDERGROUND MINING TRACTS

Tract	Proposed Action	Years in Production	Acreage[a] Subject to Direct Impacts	Resources and Predicted Impacts: Archaeological No.	Archaeological Effects	Historical No.	Historical Effects	Native American No.	Native American Effects[c]	Paleontological[b] No.	Paleontological Effects	Comments
La Plata No. 2	SJRRCL	7	160	15	Some						Minor	
Kimbeto No. 1	SJRRCL	37	160	50-60	Some						Minor	
Naguzi	SJRRCL	67	160	336	Some						Minor	
Gallo Wash No. 2	SJRRCL	12	80	6	Some						Minor	
Hospah No. 2	SJRRCL	13	80	13	——						Minor	
NM 3834[d]	PRLA	25		87-114+						72	Minor	
NM 3835[d]	PRLA	25		75-246+							Minor	1.75 mi. Chacoan road[e]
NM 3836[d]	PRLA	25		48-75							Minor	9.9 mi. Chacoan road[e]
NM 3837[d]	PRLA	25		43-142						45	Minor	
NM 3838[d]	PRLA	25		37-134+						336	Minor	
NM 6801	PRLA	25		54-66+						49	Minor	2.0 mi. Chacoan road[e]
NM 6803	PRLA	25		65-130+						31	Minor	6 mi. Chacoan road[e]
NM 11916	PRLA	25		97-104+							Minor	2.9 mi. Chacoan road[e]

[a]SJRRCL DEIS, Tables 3-30, 1-7.

[b]SJRRCL DEIS (June 1982) Tables 3-3, 3-30.

[c]SJRRCL DEIS (June 1982) Table 3-11 indicates that 5 known gravesites and no known sacred sites would be affected by Target level mining.

[d]Some of this acreage would be surface mined; archaeological estimates are for entire PRLA without consideration of mining technique.

[e]Table 2-14, PRLA EA.

Table 2-5. CULTURAL RESOURCES OF THE WSAs

WSA	Acreage	Archaeological Resources[a]						American Indian Resources		Paleontological Resources				PRIAs Coincident with WSAs		
		Percent Area Surveyed	Estimated No. of Sites[b]	Estimated No. of Components	Known No. of Sites	Known No. of Components	National Register Eligible Sites	Gravesites	Identified Sacred Sites	Class I (Mitigation Essential)	Class II and Class III (Mitigation Recommended)	Class IV (Mitigation Optional)	Total	PRIA No.	Acreage Overlap (estimated)[b]	Estimated No. of Sites in Overlap Area[b]
Bisti	3,520	37	20	-	1	1	1	Possible	1	2	68	105	175	11916	320	1
De-na-zin	19,100	18	172	1,098	52	61	44	Possible	0	2	100	70	172	3834 3838	6700	108
Ah-shi-sle-pah	6,860	7	55	-	9	9-10	9	Possible	2	2	224	275	501	6804 3918 3919	5800	40

[a]Information is from the WSA DEIS (July 1982) except where noted.

[b]An estimate based on a visual inspection and prorating (for relative area) of data on Map A in Kemrer (1982).

areas, highway access points, and other scenic areas) and distances from proposed actions, the expected modification (addition of structures, or changes to land, water, or vegetation elements of the landscape), and the limited areas within which modification from more than one project are visible from the selected viewing points. Because one of the proposed actions (designation of Bisti and De-na-zin WSAs as wilderness areas) is based partially on preservation of scenic quality, the delineation of areas where combined landscape modifications would occur considers only the effects of NMGS and SJRRCL.

Study Area

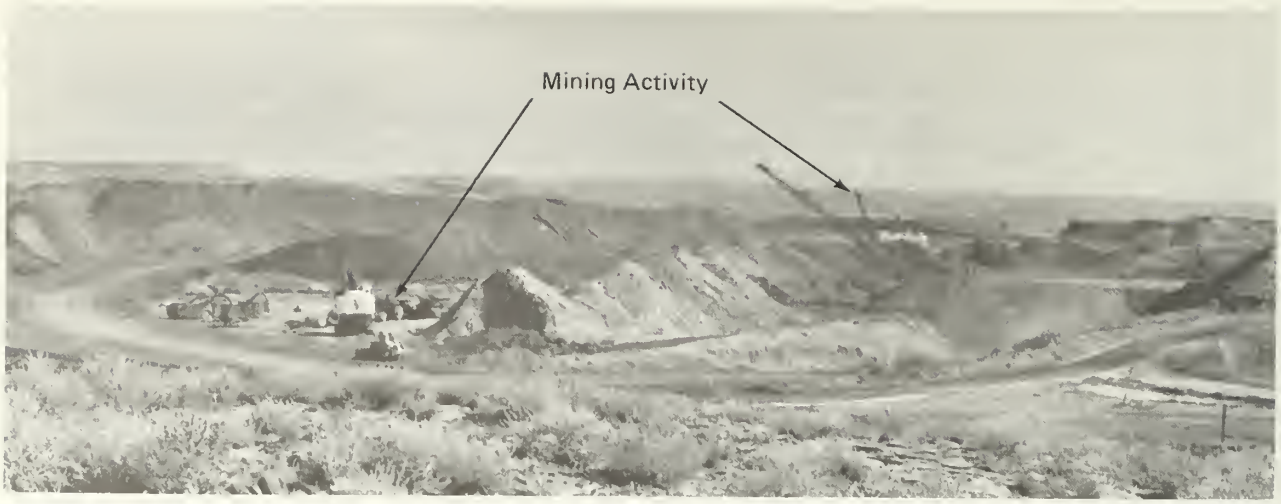
The areas of concern are overlapping portions of areas within selected visual ranges (3-10 miles) of NMGS and SJRRCL project features, which are also visible from key viewing points. The determination of effective visual ranges was based on a photo study that considered the degree of visual contrast produced by mining, construction, and structural additions (akin to the proposed actions), as viewed against the relatively homogeneous and subtly textured and colored background regional landscape. The distances beyond which the visual contrasts in unobstructed views of landscape alterations from proposed actions would not be significant are: 5 miles for surface mining (Figure 2-1), 3 miles for buried pipelines, 5 miles for power transmission lines, and 10 miles for the NMGS plant site. Areas where these 3-, 5-, and 10-mile zones around proposed features were seen to overlap were furtner evaluated for their visibility from key viewing points.

Key viewing points were selected from representative locations within regionally important scenic resource areas (described below). Viewshed analysis was then conducted to determine which of the overlapping visual impact zones could be seen from the key viewing points. The areas identified in this viewshed analysis were the loci of cumulative visual contrast impact assessment.

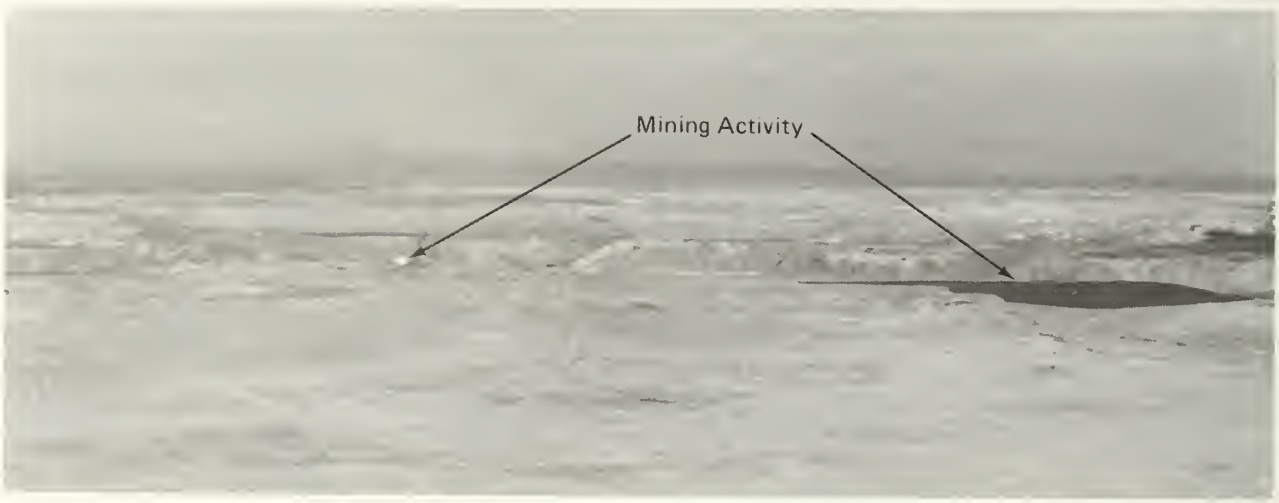
Regionally Important Environmental Resources

Important visual resources were selected on the basis of scenic quality, sensitivity (based on use volume and user values), and proximity to proposed project features (within the 3-, 5-, and 10-mile zones). These selection criteria are defined in the CO Technical Report. The selected regionally important visual resources are:

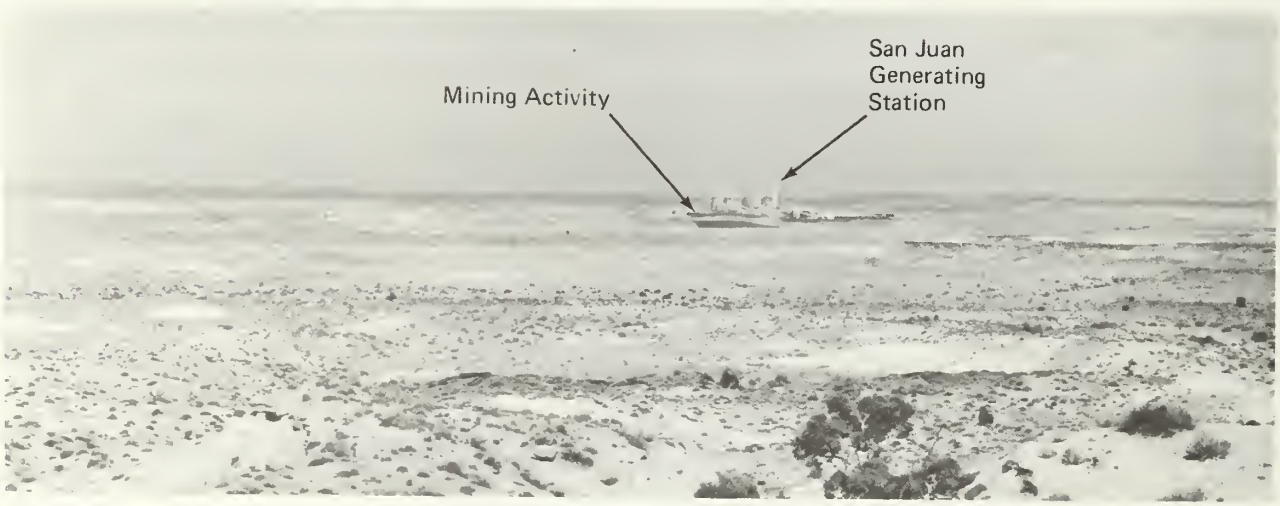
- Designated Park and Recreation Areas: Chaco Culture National Historical Park and the corridor for the proposed Continental Divide National Scenic Trail
- Wilderness Study Areas: Bisti, De-na-zin, Ah-shi-sle-pah, La Lena, Cabezon, Ignacio Chavez, Ojito, Empedrado
- Specific locations along NM 371 and NM 57 (access to scenic areas)
- BLM Class II Scenic Areas and Areas of Critical Environmental Concern (ACECs): Chaco Mesa, Chacra Mesa, and the connecting BLM land between Bisti WSA and De-na-zin WSA.



1–2 miles



2–3 miles



3–5 miles

Figure 2-1. DISTANCE ZONES FOR DETERMINING VIEWER SENSITIVITY TO MINING ACTIONS

- Chaco Culture Archeological Protection Sites and Outliers: Pierre's Site, Kim Indian Ruin, and Pueblo Pintado

RECREATION AND WILDERNESS RESOURCES

This section concerns the direct and indirect significant effects on the wilderness or recreation resources (use of land, and disturbance to vegetation, habitat, or outstanding landscape characteristics); and changes to the quality of the wilderness or recreation experience (due to increased visitor demand as well as project-related effects such as increased noise and illumination, reduced visibility, or alteration to scenic quality). Typical consequences resulting from excessive visitor use include damage to the resource (such as from vandalism), increased litter, and a need for additional services such as sanitary facilities at developed sites. Degradation of the quality of the wilderness or recreation experience is also associated with rapid increases in visitor use. In the San Juan Basin, the types of recreation activities and the quality of the recreation experience have strong ties with cultural resources, paleontology, and visual resources. Access to recreation resources is also strongly influenced by the location and condition of roads in the area (as discussed in the Transportation section). References to these other resources are made throughout this assessment.

Study Area

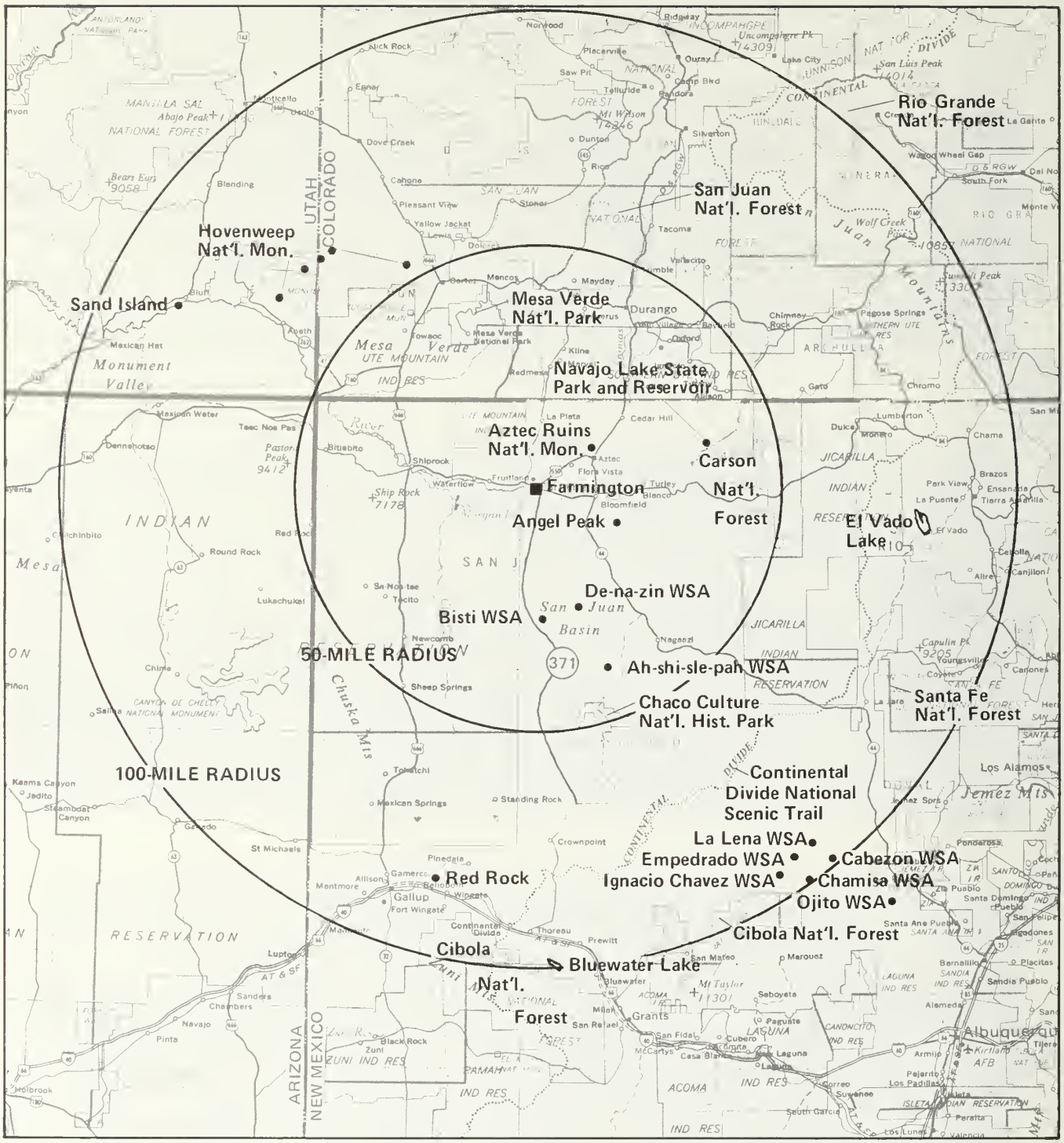
The recreation study area includes recreation-use areas within a 100-mile radius (one-day's travel distance) of Farmington, Aztec, and Bloomfield in San Juan County, where most of the labor forces for NMGS would reside, and the communities within the Thoreau, Grants, and Gallup area, where a large proportion of the labor force for coal development is expected to reside and where increased visitor use could affect recreation resources. Project-related impacts to wilderness were studied for an area that extends 60 miles from all proposed actions (see Map 2-5).

The NMGS EIS Wilderness Values and Recreation Resources Technical Reports (1982) provide a comprehensive description of the baseline for this study area and are the primary references for cumulative impact analysis. References are also made to the SJRRCL and WSAs EISs.

Regionally Important Recreation and Wilderness Resources

Recreation use in the study area consists primarily of dispersed recreation activities such as hunting, hiking, backcountry use, sightseeing (geological, zoological, and paleontological), rock collecting, visiting historic sites, and off-road vehicle (ORV) use. However, several recreational areas were identified as having particularly high recreation values and high visitor use. They are: Chaco Culture National Historical Park and Outliers, Angel Peak recreation area, proposed Continental Divide National Scenic Trail corridor, Navajo Lake State Park, Bluewater Lake State Park, and Cibola National Forest. For a comprehensive inventory of the major recreation resource facilities and visitor use by activity within the study area refer to the NMGS EIS Recreation Resources Technical Report (1982).

WSAs evaluated in the cumulative impact assessment included: Bisti, De-na-zin, Ah-shi-sle-pah, La Lena, Cabezon, Empedrado, Ignacio Chavez,



Map 2-5. REGIONAL RECREATION AREAS

Chamisa, and Ojito. The wilderness characteristics as well as the supplemental values of these WSAs are described in the NMGS EIS Wilderness Values Technical Report, and for the Bisti WSA and De-na-zin WSA, detailed information is contained in the Wilderness Study Area EIS.

TRANSPORTATION RESOURCES

The objective of cumulative impact analysis for transportation is to identify and assess the significance of impacts to the existing and planned infrastructure of roadways, rail, and air transportation in the study region resulting from the proposed actions. Cumulative impacts of interest include roadway congestion and traffic delays, increased accident potential, and increased maintenance demands or changing level of service requirements.

Study Area

The study area encompasses the primary communities of residence for the combined work forces projected for NMGS and SJRRCL, and is geographically defined by the major arterials (roads and railroads) that link the communities and provide access to the proposed mining tracts and NMGS components (see Map 2-6). Distribution of the work force to specific communities was estimated in the socioeconomic task, and is discussed in that section.

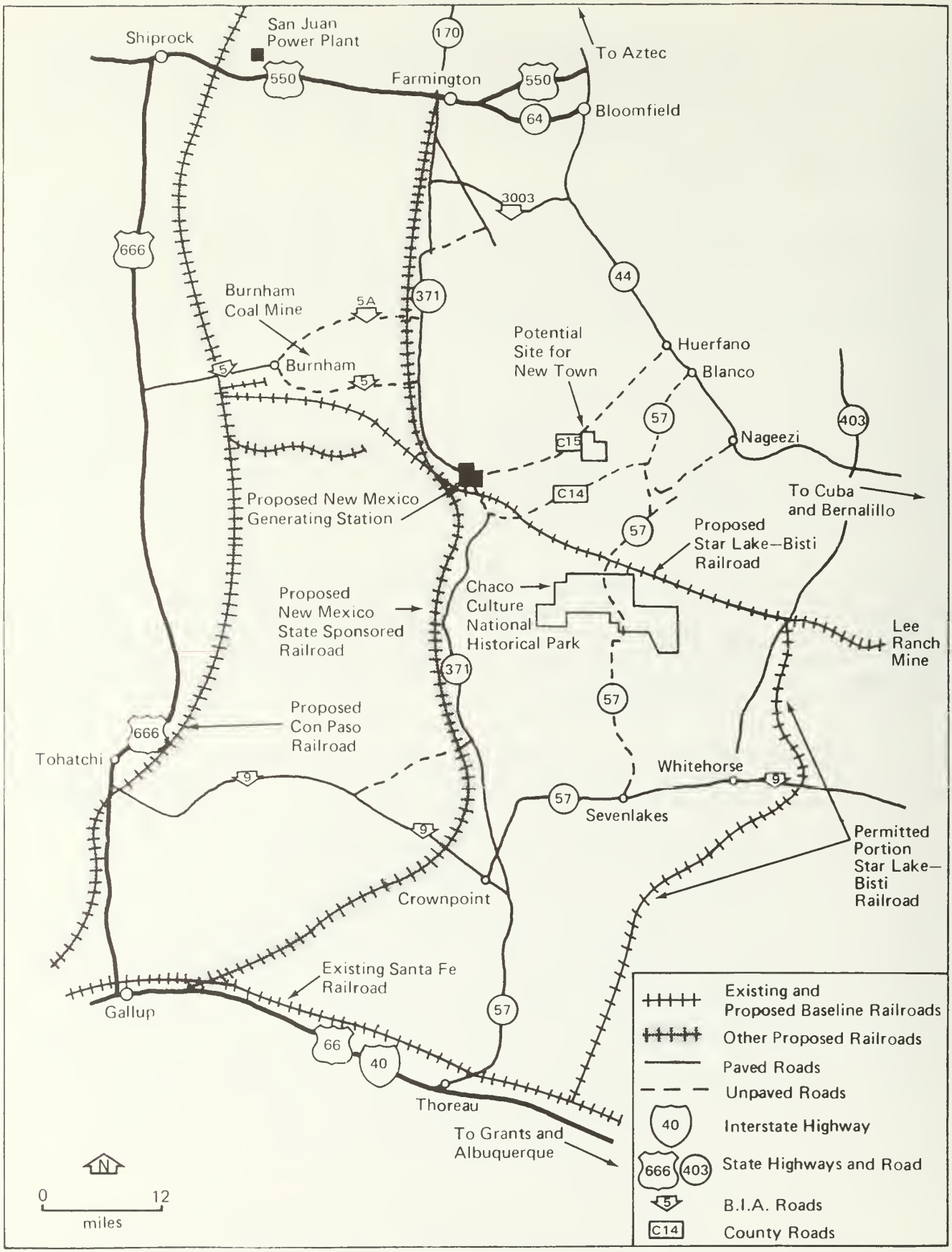
Because a major portion of the work force for the NMGS and SJRRCL proposed actions would reside in the greater Farmington area, the primary commute route is assumed to be NM 371 from Farmington south to C-14 immediately beyond the NMGS plant site. Some commute traffic could also use NM 44 to the unimproved county roads (C-14 and C-15); however, during inclement weather these county roads are impassable, and no state or county plans exist for improving them.

Regionally Important Transportation Resources

Regionally important transportation resources include the roadway and rail network in the study area (Map 2-6). Specifically, the following roads would be used during various periods of construction and operation for NMGS and SJRRCL: NM 371 from Farmington south to its juncture with NM 57 near Crownpoint; NM 57; C-14 and C-15 connecting NM 44 with NM 371 in the east-west direction; NM 44 from Bloomfield to Huerfano; NM 666 from Shiprock to Gallup; and Navajo Roads 5 and 9. Sections or roadways within municipal boundaries of the communities of influence that would be impacted include NM 550, Main Street, Broadway, San Juan Boulevard, and Bloomfield Highway in Farmington; and the section of NM 44 that extends from the junction with NM 64 through town in Bloomfield. Regionally important rail service includes the planned Star Lake-Bisti RR linking the Santa Fe RR at Gallup and Thoreau to the study area, which is considered part of the baseline for this project. Other rail lines proposed to serve the study region (Con Paso and New Mexico sponsored) are in the preliminary planning stage and are not included in the baseline condition. Each of these resources is described in more detail in the NMGS EIS Transportation Technical Report and the SJRRCL EIS.

SOCIAL AND ECONOMIC CONDITIONS

The NMGS and SJRRCL projects would produce changes in the region's population and potential economic structure. These changes, in turn, would



Source: Modified from BLM 1982.

Map 2-6. MAJOR TRANSPORTATION ROUTES IN THE SAN JUAN BASIN

alter population and economic characteristics and the levels of demand for housing, infrastructure, and services. The cumulative impact analysis is concerned with the combined effect of the proposed actions on the human environment (primarily communities) and on the institutions created to support it.

In the EISs, social and economic impacts were estimated for NMGS and SJRRCL independent of each other. When these two actions are viewed jointly over the years of their proposed construction and operation, both the magnitude of additive effects and their timing change.

The preliminary study region was defined as including: (1) overlapping portions of the NMGS and SJRRCL study areas in which cumulative social and economic impacts would be significantly more adverse or beneficial than those described in the individual EISs, and (2) areas outside the overlapping portions of the NMGS and SJRRCL study areas that would not be significantly affected by one proposed action but that might be affected when the two proposed actions were combined. The study region for which employment and population effects were projected focused on the communities of Farmington, Aztec, Bloomfield, Flora Vista, Lee Acres, Lower Valley, Crownpoint, Thoreau, Gallup, Grants, Milan, and Cuba (Refer to Map 1-1). Twenty percent of the projected population was allocated to dispersed places outside these communities.

Following the allocation of project-induced population to communities in the study region, attention was focused on a refined study area which included only those communities that would experience significantly greater adverse or beneficial impacts as a result of the combined proposed actions than with either NMGS or SJRRCL alone. These were the communities in the greater Farmington area. Thus the study area for detailed analysis was defined as the communities of Farmington, Aztec, Bloomfield, Flora Vista, Lee Acres, and Lower Valley (Waterflow, Fruitland, and Kirtland).

Regionally Important Environmental Resources

Regionally important social and economic resources are described in the Technical Report on Social and Economic Conditions prepared for the NMGS EIS. These include population, economy and employment, personal income, public finances, housing, and other local infrastructure and services (including municipal services, education, health services, human services, law enforcement, fire protection, and recreation).

PART THREE
ENVIRONMENTAL CONSEQUENCES

This part of the CO describes the methods of analysis and results of impact analysis for the areas and resources discussed in Part Two. Suggestions for mitigations are also made.

AIR QUALITY

Increases of ambient total suspended particulate (TSP) concentrations resulting from mining operations were projected by dispersion modeling for each mine, added to the modeled concentrations from NMGS, and then added to background levels. The results of this analysis for Target Level leases are below all applicable national ambient air quality standards for TSP and the 24-hour New Mexico TSP standard. Total predicted levels of TSP in excess of the annual New Mexico standard (60 $\mu g/m^3$) were indicated in a small area within 2 kilometers from one mine boundary. In the worst case, in which the PRLA mine was eventually located in an ambient air area, this violation would constitute a significant, albeit highly localized, impact.

Methods of Analysis

The emissions of TSP were considered for SJRRCL mines and for NMGS (both stack and fugitive sources). Since mine plans or operational data have not been developed for any of the proposed mines, a hypothetical mining assumption was constructed (including operations and operational parameters) to serve as a basis for estimating emissions factors. Emissions were projected as a function of coal production or acres to be mined, and included an assumption that areas exposed prior to reclamation would be three times the area mined per year. Table 3-1 presents the emissions estimates for the mines examined in this study.

Concentrations of TSP resulting from the proposed actions were derived by adding the location-specific and time-specific calculated concentrations resulting from SJRRCL mines to the calculated concentrations resulting from NMGS. The calculated concentrations were derived from computer models of atmospheric dispersion, run for both short-term and annual periods, under varying conditions and assumptions. These modeling techniques are described in the CO Technical Report and in the Technical Report for Air Quality for the NMGS EIS.

The increases in calculated concentrations of TSP were plotted for representative years during the operating life of the proposed actions, within a 25-kilometer radius of NMGS. The resulting cumulative concentration levels of TSP were compared to national and state standards. Results (concentrations) are expressed in $\mu g/m^3$ of TSP.

Indicators of Significance

Any increases in TSP concentration that would result in the concentration at any location being in excess of state or national ambient standards for that location were considered to be significant. Ambient standards exist for both 24-hour average concentrations and annual average concentrations, for the state of New Mexico and for the U.S. Ambient standards refer to external locations to which the public has access; in this case, these locations are outside mine or power plant boundaries.

Analysis Results

Projected TSP concentrations were evaluated for 1987 and 2000. Concentration increases (24-hour) associated with the SJRRCL mine are presented in Figures 3-1 and 3-2. Elements of the cumulative concentrations are the rural background TSP concentration, the TSP concentration (24-hour and annual) from SJRRCL mines, and the TSP concentration (24-hour and annual) from NMGS (see Table 3-2). Addition of 24-hour concentrations from both NMGS and SJRRCL to the background value does not result in concentrations that exceed 24-hour ambient standards in any location. Addition of the annual concentrations from both NMGS and SJRRCL to the background value does not exceed any standards in any locations for the 1987 case. For the 2000 case, the cumulative annual concentrations are predicted to exceed the New Mexico standard in a small area about a mile from Bisti mine No. 1. It is not clear whether the affected area would be subject to ambient standards, due to its close proximity to the mine. However, if the area were subject to ambient standards, this level would constitute a significant impact.

To address impacts from PRLAs, the VALMOD model was used to assess impacts from a typical 1-million-ton per year mine as a function of distance from the mine center. The analysis used an 11-kilometer receptor grid; the relationship of concentrations as a function of distance for both the 24-hour and annual average is presented in Figure 3-3. Mine operation parameters were considered identical to the Bisti No. 2 mine.

Additional impacts from PRLAs can be calculated using Figure 3-3. For example, if a 1-million-ton per year mine is located 5 kilometers from an area in which the annual average ambient level predicted by the previous modeling is 40 $\mu g/m^3$, there would be an additional impact of 6 $\mu g/m^3$ from that mine at that receptor. The total at that particular receptor would then be 46 $\mu g/m^3$, annual average.

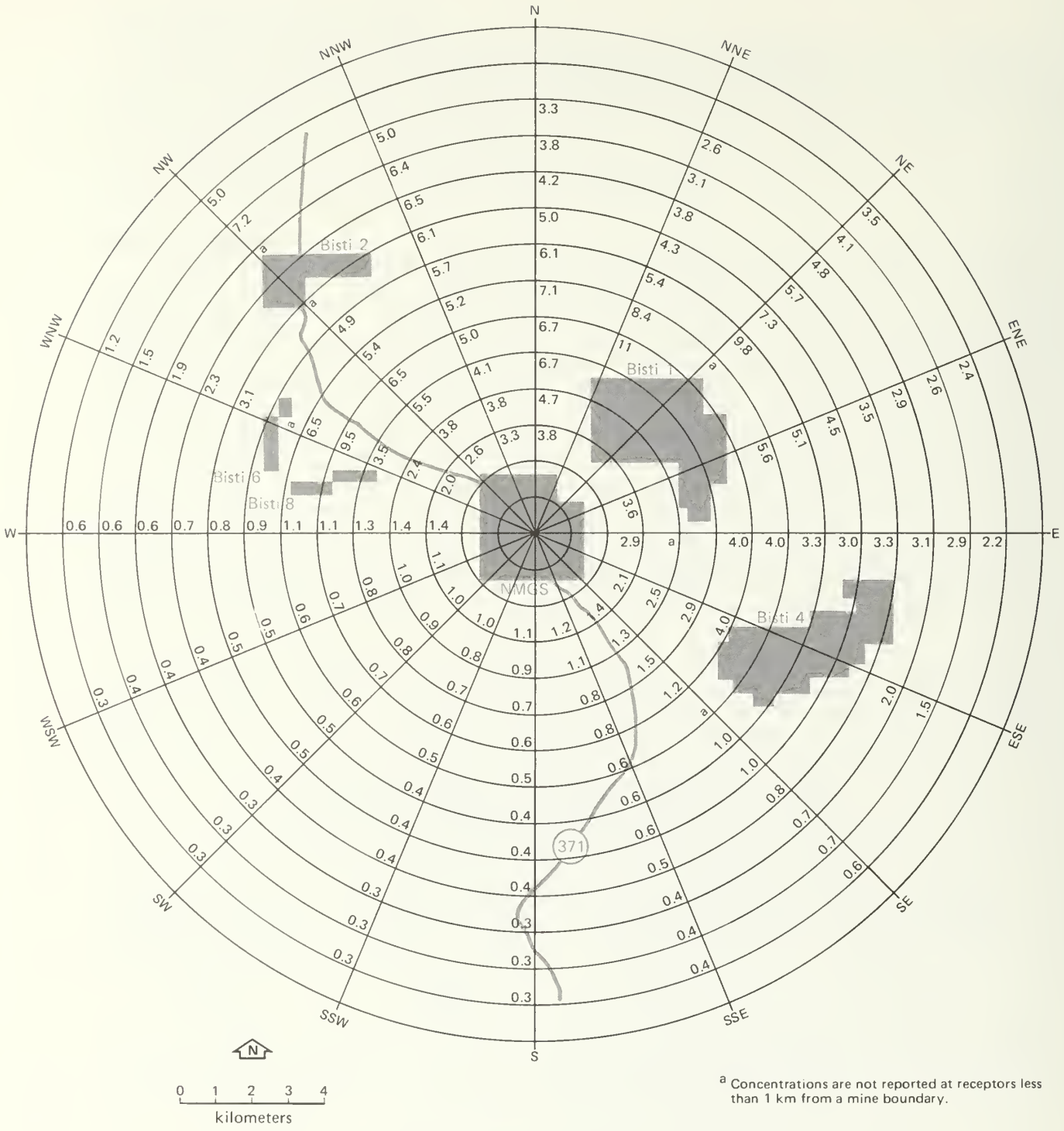
As can be seen from Figure 3-3, a PRLA mine located within 1 kilometer of another mine may result in the potential for exceeding the annual and/or 24-hour ambient standards for TSP. Such concentration would occur close to the mine boundary (i.e., within 1 kilometer of the boundary). The determination of an excessive concentration would also depend on the extent of land considered subject to ambient air standards. For purposes of this analysis, a mine itself is not considered so subject. However, the potential for additional concentrations in excess of standards may occur in a worst-case situation in which a PRLA mine is located close to another mine (i.e., 1 kilometer or less).

Table 3-1. MINE EMISSIONS AND ACTIVE AREAS USED IN MODELING ANALYSIS

Mine	Year	Emissions (ton/yr)	Active Area (acres)
Bisti #1	1987	259	356
	2000	800	356
Bisti #2	1987	114	96
	2000	366	96
Bisti #4	1987	107	240
	2000	270	240
Bisti #6 & 8	1987	84	252

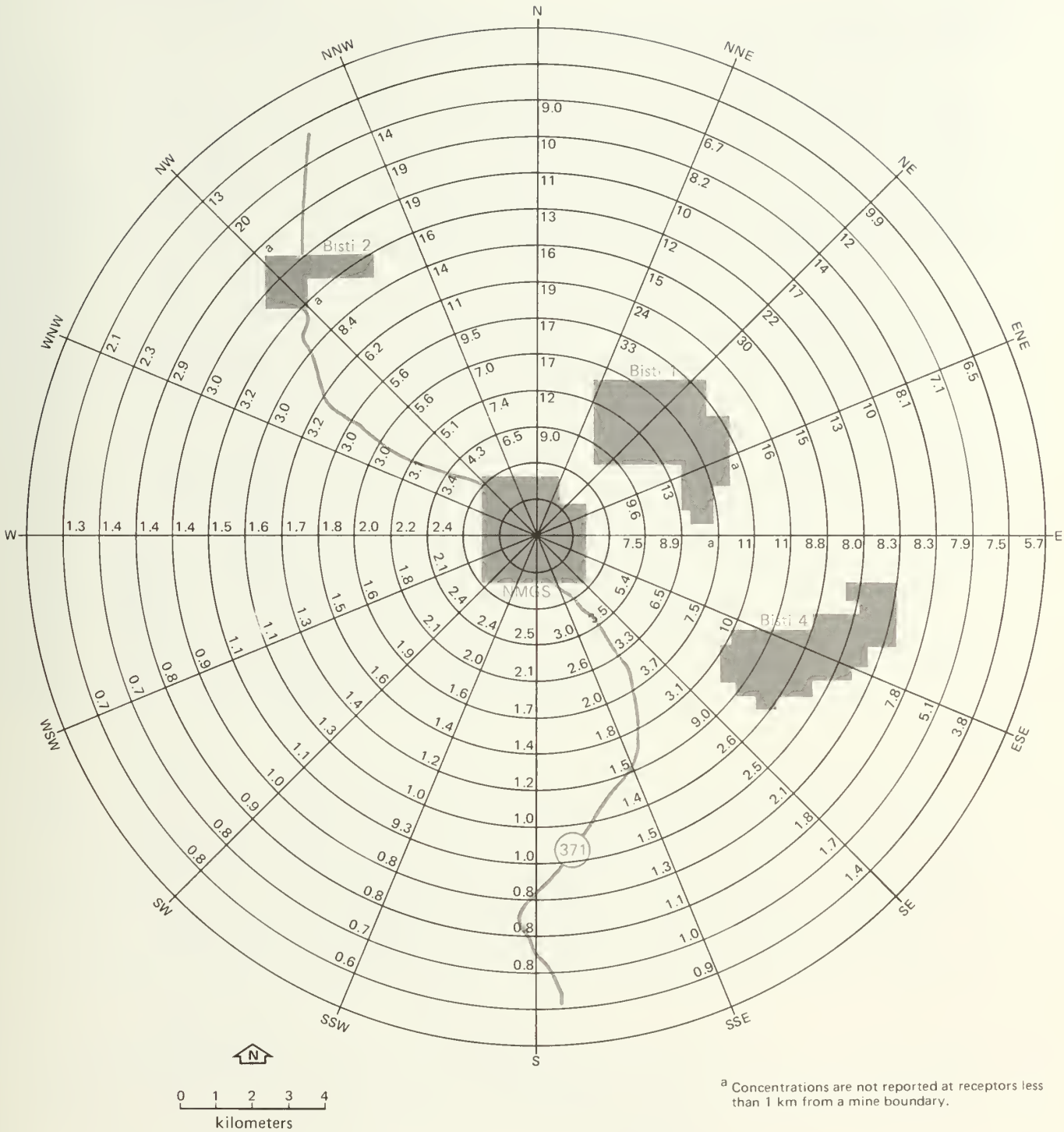
Table 3-2. SUMMARY OF MAXIMUM POTENTIAL IMPACTS ON TSP LEVELS RESULTING FROM EMISSIONS FROM NMGS (ERT 1981c)

Range of 5 Maximum 24-hour TSP Increase ($\mu g/m^3$)	Range of 3 Maximum Annual TSP Increase ($\mu g/m^3$)	Radius of Maximum 24-hour Impact Area (km)	Radius of Maximum Annual Impact Area (km)
13-27	4-5	5	4.5



[a] Concentrations are not reported at receptors less than 1 km from a mine boundary.

Figure 3-1. AVERAGE ANNUAL IMPACTS IN $\mu g/m^3$ FOR 1987 SCENARIO USING A 1.0 km RESOLUTION



[a] Concentrations are not reported at receptors less than 1 km from a mine boundary.

Figure 3-2. AVERAGE ANNUAL IMPACTS IN $\mu g/m^3$ FOR 2000 SCENARIO USING A 1.0 km RESOLUTION

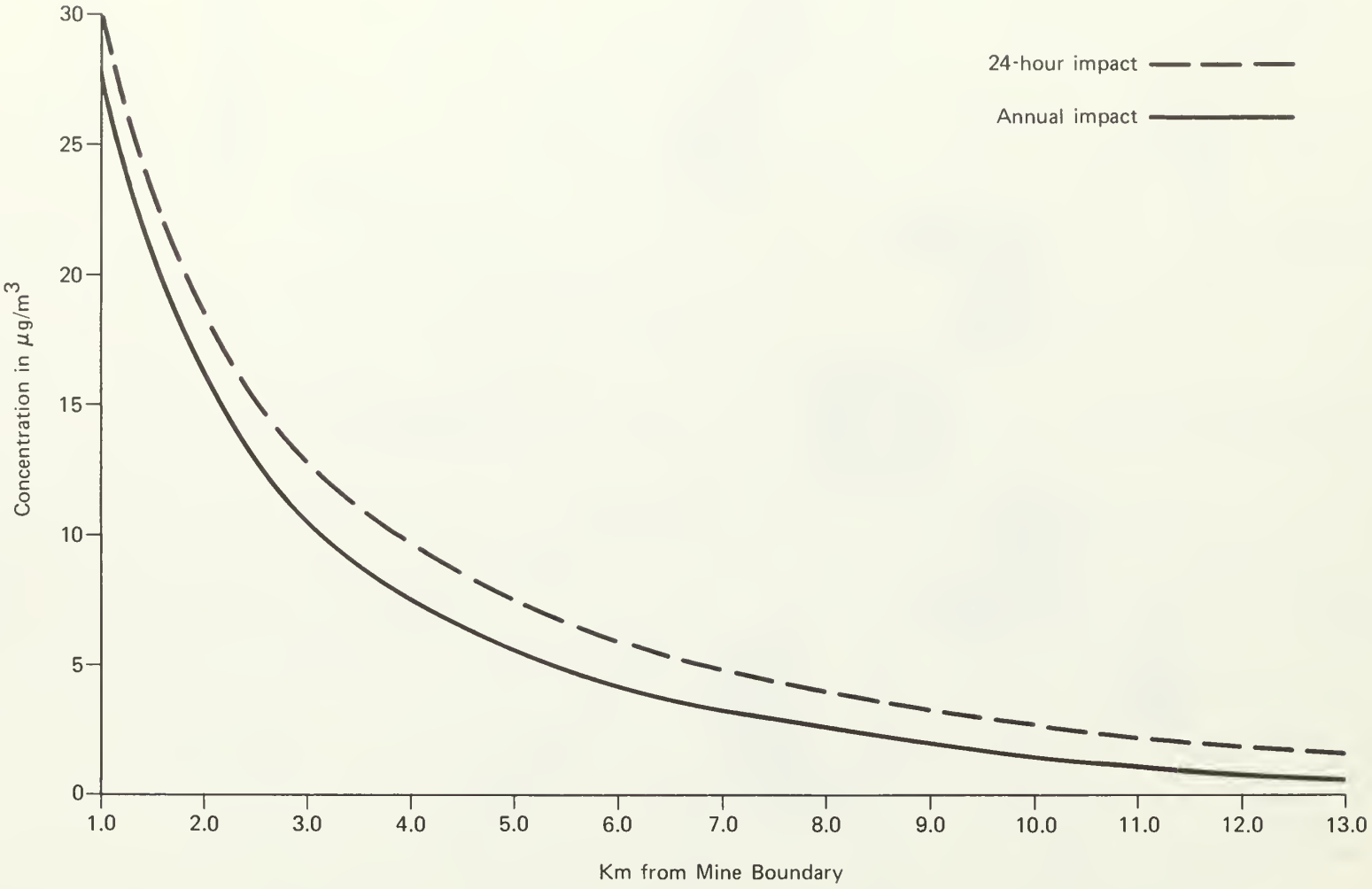


Figure 3-3. IMPACT ON TOTAL SUSPENDED PARTICULATE LEVELS FROM A TYPICAL ONE MILLION TON PER YEAR MINE

Suggested Mitigation

TSP concentrations in excess of both the New Mexico and national 24-hour ambient standard have been measured in the study area. These concentrations notwithstanding, EPA has issued its designation of "attainment" (i.e., in compliance with all applicable national ambient air quality standards) for TSP for the entire Four Corners Interstate Air Quality Control Region (AQCR). It is recognized that this region is predominantly semiarid, with less than 10 percent ground cover. As such, it is susceptible to dust storms and wind erosion. Monitored values of TSP that are greater than four times the 24-hour national standard have been reported; such values have been recognized by both the New Mexico Environmental Improvement Division (NMEID) and the EPA to be the result of natural erosion rather than anthropogenic activity.

The EPA's fugitive dust policy (EPA 1977a, 1977b) states that in rural areas, particulate matter of fugitive origin is of much less concern than that of nonfugitive origin. Emissions from mining operations--with the exception of diesel exhaust, which is relatively minor--are fugitive dust.

Emissions of fugitive particulate matter from mining operations can be reduced in a number of ways. Soils, if left undisturbed, will form a natural crust that is resistant to wind erosion. If the crust is disturbed, the soil surface becomes susceptible to erosion, even under light winds. Operations that result in disruption of this crust would increase fugitive emissions from mines. Measures that stabilize this crust or that reduce the amount of soil exposed to wind erosion would also reduce emissions. Such measures include chemical stabilization, watering, and minimization of disturbed areas. Mine-specific mitigation measures would be developed and required as part of the permitting process of the Office of Surface Mining. These would be based on specific mine plans to be submitted by the applicants.

NOISE

The combined noise effect of haul truck traffic (from both NMGS and SJRRCL mines), employee-related traffic from all projects, and blasting at the mines was considered in relation to its perception by users of the Bisti and De-na-zin WSAs. The analysis also recognized that a major portion of the people subject to project-related noise would be employees of the proposed actions; noise impacts to employees are managed under environmental health and safety regulations, and it is assumed that "on-site" noise would be confined to levels that are not significant by existing standards, or are mitigated at the receptor.

Methods of Analysis

The assessment of noise level contributions in the Bisti and De-na-zin WSAs included blasting, haul truck traffic, and employee-related automobile traffic.

As discussed in the NMGS EIS Air Quality Technical Report (which also discusses noise effects), the hypothetical mine associated with NMGS was evaluated to predict baseline noise levels in the WSAs of concern. Projections of baseline noise levels were also made based on traffic flows predicted on NM 371 and C-15. Assumptions about levels of coal production,

mining operations and operational parameters, and employee trip volume were derived from the Air Quality, Transportation, and Social and Economic analyses.

The baseline levels as well as impacts associated with the proposed mine development were evaluated using noise attenuation formulas, and projected noise levels associated with blasting, haul truck traffic, and employee-related automobile traffic. In the case of blasting, this was accomplished by considering the distance of a specific mine or mines to a given receptor (time-equivalent sound level method). For haul truck and automobile traffic, traffic volumes and frequency were used to compute noise levels at given receptors by considering the distance of the haul roads to the receptor (see the nomograph presented in Figure 3-4). Results were expressed as noise level increase (dB[A]).

Indicators of Significance

The analysis focused on potential receptors in the WSAs and considered increases in perceived noise levels (L_{eq}) to be of main interest.

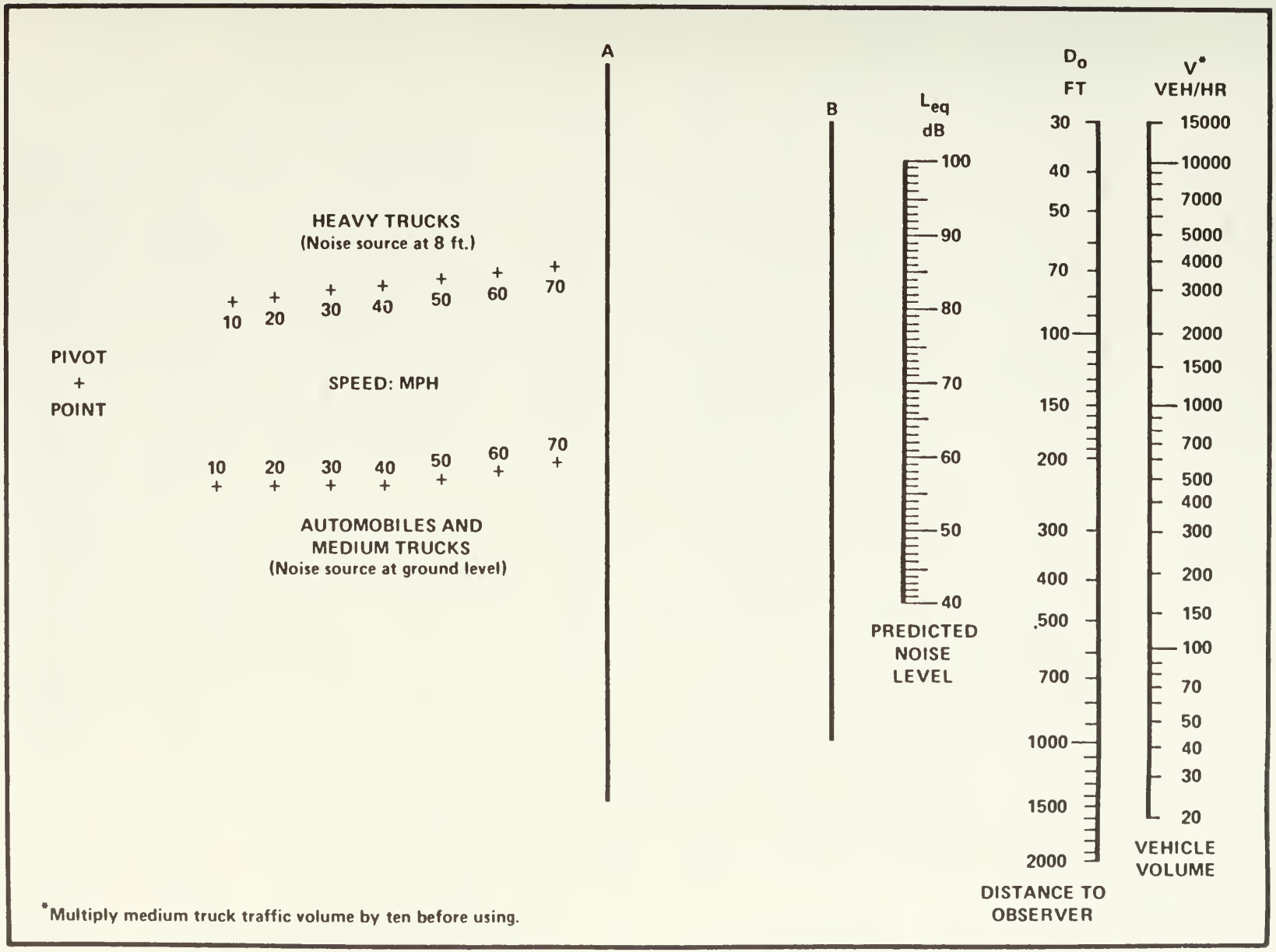
Perceptivity effects are related to how noise levels are likely to be judged (loud, soft, no difference) by the perceiver. Observations reveal that an increase of about 9 dB(A) represents a doubling of perceived loudness, or the "noisiness" of a sound. Because of the isolated nature of the WSAs and the low baseline noise levels there, it was assumed that a noise increase above 9 dB(A) would be considered an indicator of impact significance.

Analysis Results

Automobile traffic levels in excess of 15,000 vehicles per hour would be necessary on NM 371 in order to cause an increase of 9 dB(A) above baseline noise levels at the boundary of the Bisti WSA and within the WSA itself. A traffic volume of this magnitude is not projected to occur as a result of the potential coal activity, nor as a result of NMGS (see the Transportation Resources section below).

Hourly L_{eq} increases greater than 9 dB(A) may occur at the boundary of the De-na-zin WSA, depending on the degree to which C-15 would be used by employees of the hypothetical mine. If the traffic level on C-15 remains at its present low level, any increase in traffic on this road above 20 vehicles per hour would cause an increase greater than 9 dB(A) above baseline noise levels. On the other hand, if the hypothetical mine causes maximum usage of C-15, an additional traffic volume of 700 vehicles per hour would be necessary to cause a 9 dB(A) increase above baseline noise levels at the De-na-zin WSA boundary. A volume of 2000 vehicles per hour would be necessary to cause such an increase within the WSA itself.

No hourly L_{eq} increases greater than 9 dB(A) above baseline noise levels were projected due to haul truck traffic on NM 371. Increases above this level may occur at the boundary of the De-na-zin WSA, depending on the degree to which C-15 is traveled by haul trucks associated with the hypothetical mine.



Source: Department of the Air Force et al. 1978.

Figure 3-4. L_{eq} NOMOGRAPH FOR STREET VEHICLE ROADWAY NOISE

Blasting may cause instantaneous increases greater than 9 dB(A) at the two WSAs, depending on the location of the blast. Short-duration blasts located within 1 to 2 miles may cause such increases. Until more information is available relating to locations and frequency of the blasting, specific quantification at the receptors cannot be made.

Suggested Mitigation

Impacts associated with vehicular traffic (haul trucks and automobiles) can be lessened by reducing the total number of vehicles traveling in any given area and/or routing traffic away from sensitive areas. Carpools could reduce employee vehicle numbers; larger capacity trucks could reduce haul truck traffic volumes. Other design-based mitigation options (roadway design and use of physical barriers) are available for roads and blasting.

CULTURAL AND PALEONTOLOGICAL RESOURCES

The affected environment section defined the resources of interest to be regional sets of resources presenting unusual opportunities for research and interpretation because of the size and diversity of the sets. The cumulative impact analysis looks beyond direct effects on specific resources (these are described in the three EISs and would be mitigated) to consider indirect regional effects resulting from modifications to the regional resource sets. The impact analysis focuses on deliberate conservation of resources through withdrawal, as well as on depletion of the resource bases whether under controlled (mitigation-related) or uncontrolled circumstances and whether planned or inadvertent in nature.

Methods of Analysis

Little quantitative analysis is possible or appropriate in evaluating the indirect impacts to resource bases as qualitatively complex as the cultural and paleontological materials of the San Juan Basin. Using gross estimates of resource population characteristics and qualitative or judgmental criteria, the analysis focused first on a regional characterization of cultural and paleontological materials complemented by a description of the resources that would be conserved in or removed from that regional set. Second, information was developed about types, rates, and possible effects of increased vandalism, commercial looting, or other inadvertent damage to resources such as those of the San Juan Basin. Finally, information on projected baseline human populations and expected population increases related to the proposed actions was used as a basis for judging relative impacts of regional growth on the cultural and paleontological resources of concern.

The cultural and the paleontological resources are both generally finite, nonrenewable resource sets; the cumulative impacts to them are adverse or beneficial in similar ways. Therefore, the impact assessment discusses both cultural and paleontological resources together unless otherwise mentioned.

The analysis considers that permitting of NMGS and SJRRCL would result in the eventual surface disturbance of about 140 square miles, which, when multiplied by the estimated 13.5 potential sites per square mile for this region, could represent some 1890 sites. Wilderness designations would

achieve conservation of 27 to 47 square miles (depending on the treatment of PRLAs that overlap WSAs). Further, the proposed actions would be developed over a 40-year period, slowly committing surface areas to disturbance while concurrently allowing the implementation of various strategies of resource recovery, conservation, or other mitigative measures.

Indicators of Significance

Guidelines are presently available for evaluating the significance of individual resources. However, there is no generally accepted guidance for determining the threshold at which the impacts, particularly from cumulative projects such as under consideration here, accumulate so as to be significant in sum.

Analysis Results

Four generalized impacts are identified, premised on a projected substantial increase in the disturbance of cultural and paleontological resources by project components, employees, and induced population, as well as an enhanced level of deliberate resource conservation by resource management agencies.

1. Conservation of resources within designated wilderness lands or in other specified areas, with well-planned withdrawal of information from these resources through research and interpretation.

The management of wilderness areas would preserve prehistoric and historic information and resources as well as more traditional "wild lands" values. Designation of the Bisti and De-na-zin WSAs as wilderness lands could similarly conserve cultural and paleontological values there. In complement to this, it is likely that some significant resources would be identified and protected from disturbance (and therefore conserved for future use) in the transmission corridors, in set-aside areas of coal leases, or in other project-related lands.

2. Acquisition and synthesis of significant research information about the cultural and paleontological resources of the San Juan Basin, whether as part of well-scheduled data recovery prior to disturbance, or as emergency recovery of information and materials disturbed during project operations.

Various federal, state, county, and tribal laws, regulations, and policies require recovery of significant cultural and paleontological materials and information to mitigate adverse effects of surface or underground disturbance.

These actions would contribute to local and regional history as well as to scientific research on mammalian evolution and past human behavior. The strength of the contribution would depend on the validity, reliability, appropriateness, and timeliness of the recovery programs.

3. Consumption or depletion of a portion of the general San Juan Basin cultural and paleontological resource base, thus elevating the significance of remaining materials and traditions.

At the same time that benefit is being derived from the acquisition of new information, an impact would be accumulating--withdrawal of any part of a finite, nonrenewable resource base (such as that of either cultural or paleontological materials) diminishes that resource base for future users. Mitigative research conducted over the next 40 years on the proposed actions would be done in the context of current research standards, questions, and priorities; in the process it would use up part of the resource. Researchers a century from now could return to the original depositional context of site and localities to exercise other research choices. At the same time, decisions about the adequacy and direction of mitigative recovery programs over the next decades of the proposed actions would result in the "writing off" of part of the resource base as being of less significance. All this would have the adverse effect of changing the character of the total nonrenewable cultural and paleontological resource bases in some dimensions, and raising the value or significance of remaining resources in terms of future management choices and decisions.

Part of the cultural resource base of the San Juan Basin that would be cumulatively impacted by this "consumption" of lands and landmarks is the area's living cultural traditions and the individuals and communities who follow those traditions. Localities have significance for traditional American Indian subsistence and religious practices, and the geographic markers serve as mnemonic devices for the maintenance of traditional legends and cultural rationales. At present it is impossible to define the number of individuals to whom all or parts of these traditional values and locales have significance. Many individuals who themselves do not follow traditional ways appreciate the value of having a "reservoir" of both old and young people who retain cultural knowledge and rationales. As the number of people following or even understanding those traditional lifeways is diminished, the value of conserving the knowledge of those who retain it increases correspondingly. As the number of mnemonic landmarks is depleted, so too is the ability to retain the knowledge of cultural origins or patterns hindered.

No cultural pattern or tradition is so valuable that it should be kept frozen in time; cultures are by their very nature dynamic and constantly modifying themselves to human needs and contexts. At the same time, there is a critical threshold for any cultural pattern, particularly in an environment of rapid acculturation of a less technologically complex system toward a high-technology culture, beyond which that system cannot adapt without ceasing to have much relationship to its original values. There is concern that such a threshold may be reached in the San Juan Basin in the next generation; this would be a significant adverse impact on those individuals who wish to retain a strong sense of traditional ways and/or values. There is also concern that loss of the basic definition of any cultural pattern, anywhere, is a significant adverse impact on the diverse cultural dimensions of the world community.

4. Loss of the cultural and paleontological resource base through inadvertent and malicious vandalism, commercial looting, and natural erosion of otherwise undisturbed sites because of increased local populations.

This kind of impact is a current problem in the region that needs more management attention; implementation of the proposed actions is likely to significantly increase those damaging activities.

The phenomena that would contribute to this impact include:

- Increased public awareness of the resource base through public documents, public information on deliberate conservation or mitigation programs, and concomitant casual collection of resources by amateurs and souvenir hunters.

- Decrease in traditional taboo-based constraints on resource (especially cultural) disturbance due to a decrease in the presence of traditional Navajos relative to others. At the same time there would be an increase in awareness of resources among persons having familiarity with and access to resource-rich areas.

- Increased access to resource areas through the construction of roads and an increase in numbers of ORVs related to regional growth in population and personal income.

- Increased inadvertent destruction of resources due to erosion, enhanced by ORVs as well as by development and landscape modifications related to dispersed regional growth.

The question of how much vandalism, commercial looting, or natural erosion would be the indirect cumulative effect of permitting of the proposed actions is impossible to answer at the moment. The assertion that it would undoubtedly occur to some degree seems unarguable based on recent studies of that general topic within and outside the region.

Suggested Mitigation

Adverse effects could be lessened by the adherence over the coming years (or on an annual basis at minimum) to a careful strategy of monitoring the gains and losses that occur in the basin (such as by recording sites through videotaping or other tested techniques), and by a dynamic process of decision making about what to save and what to give up. Decisions about the management of the affected historic properties should be made in the context of a regional preservation plan, in concert with other federal, state, and local agencies and individuals. The BLM should clearly define a process to decide regional research objectives in active consultation with relevant agencies and the professional community.

VISUAL RESOURCES

Impact analysis for visual resources was concerned with the degradation of scenic quality within a critical viewing distance of identified sensitive viewing points, such as WSAs or other important public locations. The study focused on the increase in degree of visual contrast resulting from landscape modifications from NMGS and SJRRCL features.

Methods of Analysis

A four-step process was used, based on BLM's Visual Resource Management (VRM) system.

Step 1. Review of pertinent BLM data for the proposed actions. Regionally important visual resources were identified, along with proposed actions or features that would cause impacts to these resources. Data were mapped and tabulated.

Step 2. Completion of contrast ratings. Following a standardized BLM process, prospective changes in form, line, color, and texture were evaluated for each landscape feature in selected viewsheds. Ratings were prepared in terms of existing VRM objectives. This process was supplemented with a variety of manual and computer-generated graphic techniques.

Step 3. Determination of significance of cumulative visual impacts. VRM objectives are based on a set of factors that includes scenic quality and sensitivity, duration and timing of impacts, proximity of disturbance to use areas and viewing points, extent of visual contrast, and orientation of view. Identified impacts (based on contrast ratings) were cast in terms of these factors and compared to VRM objectives by VRM Class. Impacts that met VRM objectives were deemed nonsignificant.

Step 4. Develop mitigation measures. Cumulative impacts defined as significant were evaluated, and mitigation measures were suggested.

Indicators of Significance

Fulfillment of VRM objectives for the visual resource class subject to impact was the primary indicator of significance. VRM objectives are based on a composite of visual attributes that were rated quantitatively or by ordinal scaling for each landscape feature subject to impact. However, since the BLM procedure was designed for site-specific activities rather than multiproject regional assessments, the standard VRM process was expanded to include overlapping actions and cover a broad landscape area appropriate to this cumulative impact assessment.

Analysis Results

A listing of analytical results is presented in Table 3-3. Eleven visual resource areas were evaluated; seven of these were determined to have significant visual contrasts. The viewing points adversely affected by a combination of NMGS and SJRRCL landscape modifications were within the Bisti and De-na-zin WSAs and ACEC, at Pueblo Alto and Pueblo Pintado (northern side of Chaco Culture National Historical Park), and at two highway access points leading to the Bisti WSA and Chaco Culture National Historical Park (NM 371 and NM 57, respectively).

Specifically, changes in the characteristic line, form, and color of landscape elements would be as follows: (1) from viewing points within the Bisti and De-na-zin WSAs and ACEC and points along NM 371, the strong vertical features of the NMGS boiler stacks and associated plant facilities (e.g., transmission towers) in combination with changes in color and texture resulting from mining activities would be most prominent; (2) from Chaco

Table 3-3. VISUAL RESOURCES IN THE STUDY AREA

Visual Resource	Contrast Rating Factors: Viewing Site	Activity Site	Distance Zones	Projected Baseline: Action	Projected Baseline: Location[a]	NMGS EIS: Action	NMGS EIS: Location[a]	San Juan River Regional Coal Leasing EIS: Surface Mining: No.[b]	Surface Mining: Acres[c]	Surface Facility (acres)[d]	Location[a]	Scenic Quality[e]: Viewing Site	Scenic Quality[e]: Activity Site	Visual Sensitivity	View Orientation	Meets VRM Objectives	Cumulative Impact Significance
Bisti WSA	Badlands	Rangeland, badlands	0-2 mi 2-5 mi 5-10 mi	RR, T/L	S	Power plant, T1, T2	S	3 4 4	7000 6300 5600	165	N,W,SW,SE E SE,NE	A	C	High	I & E	No	Significant
De-na-zin WSA	Badlands	Rangeland, badlands	0-2 mi 2-5 mi 5-10 mi	Oil fields	N	New Town T1 Power plant	S & SE S SW	4 3 6	8255 4720 8495	250 165	S,W,SW S & SE SE	A	A, C	High	I & E	No	Significant
Ah-shi-sle-pah WSA	Badlands, rangeland	Rangeland	0-2 mi 2-5 mi 5-10 mi	RR, T/L	S	T2	S, Crosses	3	3800	40	Overlaps	A/B	C	High	I & E	Yes	Not Significant
Chaco Culture National Historical Park, Pueblo Alto	Rangeland, mesa	Rangeland, badlands	0-2 mi 2-5 mi 5-10 mi	RR, T/L Gallo Wash Mine	N & E E	T2	N & NE	1 3 8	1190 4740 5870	 40 255	N N & NE N,NE,NW	B	C	High	Vista (panoramic)	No	Significant
Chaco Culture National Historical Park, Pueblo Pintado	Rangeland, mesa	Rangeland	0-2 mi 2-5 mi 5-10 mi	RR, T/L	N & NE	T2	N & NE	2 1 5	3920 402 6235	125 100 180	N & NE N & NE NE,E,W	B	C	Mod	Open	No	Significant
Proposed Continental Divide National Scenic Trail corridor	Mesas, rangeland	Mesas, rangeland, badlands	0-2 mi 2-5 mi 5-10 mi	RR, T/L Star Lake Mine	Crosses	T1, T2	Crosses	1 2 4	2800 2500 7350	100 125 200	E & W East E & W	B&C	C	Mod	Open	Yes	Not significant
Chaco Mesa ACEC	Mesas	Rangeland	0-2 mi 2-5 mi 5-10 mi	T/L T/L Star Lake Mine	E N NE	T2	N & NE	6	9750	450	N & E	A	C	Mod	I & Vista-South	Yes	Not significant
Chacra Mesa ACEC	Mesas, rangeland	Rangeland	0-2 mi 2-5 mi 5-10 mi	Oil fields	E	T2	N & NE	4	8740	325	N & NE	B	C	Low	Vista-South	Yes	Not significant
Bisti De-na-zin ACEC	Badlands, rangeland	Badlands, rangeland	0-2 mi 2-5 mi 5-10 mi	RR,T/L,Oil fld	S & N	New Town Power plant, T1, T2	S, SE S	4 4 6	8255 6300 8495	250 165	S,W,SW E,S,SE SE & NE	A-C	C	Low	I & E	No	Significant
NM 57	Rangeland, badlands	Rangeland, badlands	0-2 mi 2-5 mi 5-10 mi	RR, T/L	Crosses	T1,T2	Crosses	4 4 4	6000 5500 7000	200 165 445	E & W E & W E & W	C	C	Mod	Open	No	Significant
NM 371	Rangeland, badlands	Rangeland, badlands	0-2 mi 2-5 mi 5-10 mi	RR, T/L	Crosses	Power plant, T1, T2	E, W	5 4 5	7520 5875 9400	165 250	E E E	C	A-C	Mod	Open	No	Significant

[a]Location: Viewing direction to proposed actions.

[b]Number of surface mining PRLAs or SJRRCL tracts.

[c]Total acres of disturbance over life of mines (average 30-40 years). Annual unreclaimed disturbance is approximately 334 acres per mine.

[d]Acres for surface and underground mine facilities.

[e]Class A = Areas that combine the most outstanding characteristics of each rating factor. Class B = Areas in which there is a combination of some outstanding features and some that are fairly common to the physiographic region. Class C = Areas in which the features are fairly common to the physiographic region.

Projected Baseline
RR - Starlake-Bisti Railroad
T/L - Fruitland Coal-Load Transmission

NMGS
T1, T2 - Proposed 500-kV Transmission Lines

View Orientation
I - Internal, enclosed views
E - External, open views
Vista - Elevated extensive views in direction indicated
Open - Unconfined views

Culture National Historical Park (Pueblo Alto, Pueblo Pintado) and points along access road NM 57 the changes in color and texture resulting from surface mining, in addition to the unnatural vertical and linear features of transmission lines, rail spurs, and haul roads would generate the highest visual contrasts. Night lighting and fugitive dust would draw attention to both coal and NMGS facilities and further detract from the natural landscape elements. Computer-generated simulations of landscape changes from the proposed actions as viewed from the Pueblo Alto site of Chaco Culture National Historical Park are shown in Figures 3-5 and 3-6; Figure 3-7 is an artist's rendering of these changes.

Suggested Mitigation

The following should receive priority: use of non-specular conductors and painted towers for segments of transmission line within view of important visual resource areas as identified in the Visual Resource section of the CO Technical Report (Bisti and De-na-zin WSAs, northern side of Chaco Culture National Historical Park, Pierre's Site) or consideration of resiting these segments of transmission line outside the 3-5 mile sensitive visual zone as seen from critical viewing points; creation of landscape buffers using excavated over-burden from mining between high-quality viewing points and major coal mining activity; and encouragement by BLM of visitor use in enclosed portions of WSAs where natural features buffer surrounding landscape disturbances. Flyers with mapped WSA boundaries and indicators of most protected portions within WSAs could be provided at gate information boxes.

RECREATION AND WILDERNESS RESOURCES

The resources of direct interest were those WSAs and recreation-oriented areas (including dispersed activity areas, as well as parks, forests, trails, etc.) close to the proposed actions. These areas were examined with regard to potential degradation of essential wilderness and recreation qualities resulting from the effects of the proposed actions, as well as increased user demand from a growing regional population. The extent of increased user demand is influenced by the availability of other wilderness and recreation opportunities within the study area, so user opportunities within 100 miles (an average 1-day travel distance) of Farmington and Grants were examined.

Methods of Analysis

A five-step approach was used. Step 1 was a review of individual EISs and population allocation figures developed for the CO to define the study area and identify impact issues. Step 2 was a projection of user participation days by wilderness and recreation activity (e.g., hiking, sightseeing, fishing) for area communities, based on increased population levels. Two worst-case projections were used for analysis, reflecting high-use periods. Step 3 compared aggregate projections of user participation (by activity) to available resources (by activity). Areas where potential overcrowding and maintenance problems would occur were identified (assuming those high-volume resources closest to affected communities would be affected first, and user overages would spill to the nearest resource of the same activity type and similar quality). Aggregate visitor use consequences then were compared to those previously identified in the individual EISs to determine the extent of added impact. Step 4 considered the direct impacts to recreation and wilderness areas projected in other analyses (visual

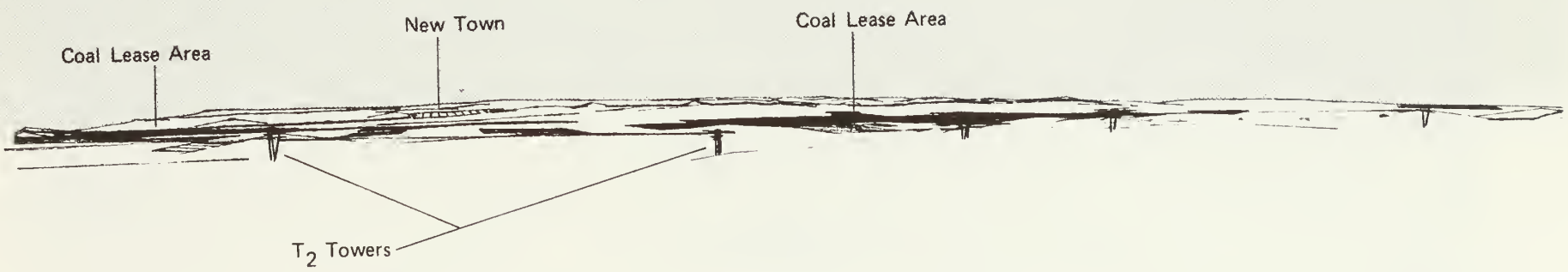


Figure 3-5. COMPUTER GENERATED PERSPECTIVE FROM PUEBLO ALTO-CHACO CULTURE NATIONAL HISTORICAL PARK (AT GRADE)

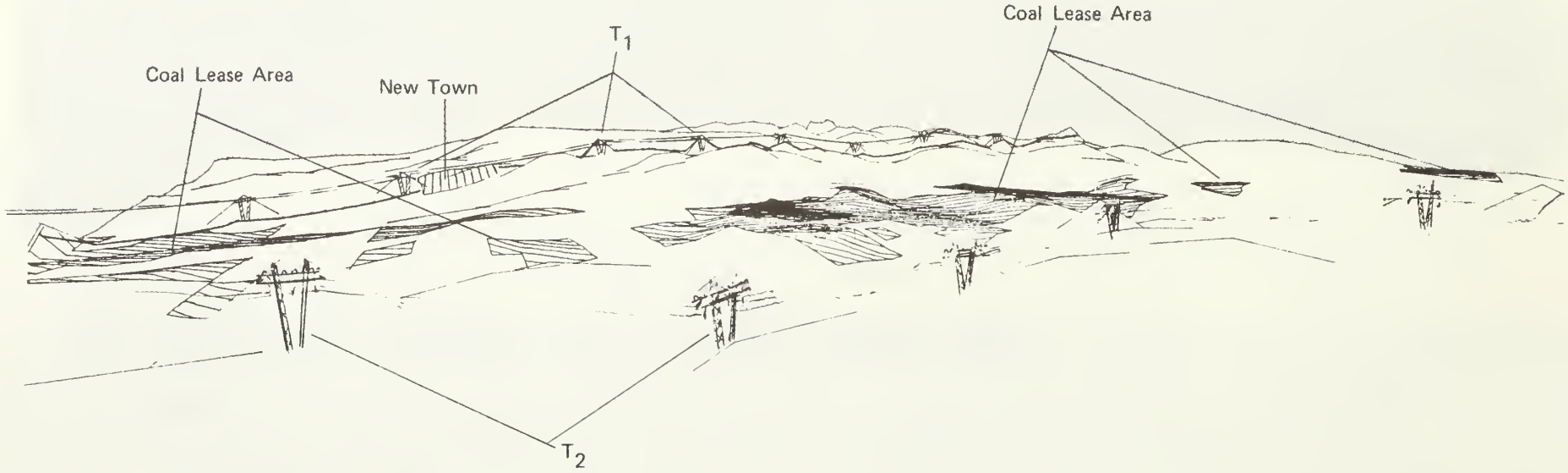


Figure 3-6. COMPUTER GENERATED PERSPECTIVE FROM PUEBLO ALTO RUINS-CHACO CANYON NATIONAL HISTORICAL PARK (TILTED VIEW WITH EXAGGERATED ELEVATIONS)

Figure 3-7. VISUAL SIMULATION OF LANDSCAPE MODIFICATIONS AS VIEWED FROM PUEBLO ALTO--CHACO CULTURE NATIONAL HISTORICAL PARK (Artist's Rendering)

resources, noise, cultural resources) to identify cross-discipline interactive impacts. Step 5 involved the development of indicators of significance and their application to the results of Steps 3 and 4 to identify significant cumulative impacts.

Indicators of Significance

Significant impacts were defined to be: any degradation of essential wilderness qualities of WSAs or recreation qualities of resource areas that would reduce opportunities for quality experience; and overcrowding of any area that would exceed the available facilities or resources, based on accepted unit-use standards.

Analysis Results

Projections of user participation and discussions of cumulative impacts to specific regionally important recreation and wilderness resources are presented in Tables 3-4 and 3-5.

The cumulative effects of the proposed actions differ from those reported in the individual EISs in both magnitude and extent of recreation and wilderness resources affected. Population changes directly related to the individual actions peak in the years 1992-1995 in the greater Farmington area for NMGS, and in 2019-2020 in the Gallup, Thoreau, and Grants area for coal development (see Social and Economic Conditions section). This shift in population growth from the northern portion of the study region to the southern portion over a period of 27 to 35 years would result in overlapping and additional impacts that would ultimately encompass the entire study area. One of the basic assumptions in the individual EISs was that people would seek quality recreation and wilderness opportunities at greater distances as the more familiar resource areas nearby became either crowded or of lower quality. Thus, impacts would not be severe as long as additional resource areas existed that would offer opportunities for similar recreation activities or wilderness experiences within a reasonable distance. Such a dilution of impacts becomes less plausible when simultaneous actions cause convergence on the same resource areas from opposite ends of the region (Table 3-6). Improved access to remote areas (new haul roads) and added exposure of these resources to employees would further increase the likelihood that the more remote resource areas would be affected along with those in current demand.

The Bisti, De-na-zin, and Ah-shi-sle-pah WSAs would be adversely impacted by the sights and sounds of NMGS construction, operation, and surrounding coal development, in addition to the effects of increased visitor use. Consequently, visitors seeking opportunities for hiking, camping, photography, and sightseeing in predominantly natural and quiet settings are likely to travel to the WSAs at the southern end of the study area (Ojito, Cabezon, La Lena, Chamisa, Empedrado, and Ignacio Chavez), and to the Cibola National Forest. As coal activity increases and population growth shifts to the communities of Gallup, Thoreau, and Grants, the southern resource areas would be called upon to provide primary recreation opportunities in response to increased visitor demand. This shift in demand would result in significant impacts similar to those described for the northern portion of the study area for earlier development phases.

Table 3-4. 1995 PROJECTED RECREATION DEMAND IN USER PARTICIPATION DAYS FOR THE STUDY REGION

Activity	Per Capita User Participation*		Greater Farmington Area							Thoreau, Grants, Gallup Area					Cuba Area		
			Farmington	Aztec	Bloomfield	Flora Vista	Lee Acres	Lower Valley	SUBTOTAL	Thoreau	Crownpoint	Grants	Milan	Gallup	Cuba	SUBTOTAL	TOTAL
Fishing	2.21	Baseline	99,008	16,022	14,365	11,050	13,370	13,592	167,407	3,204	3,094	39,546	12,940	53,528	3,032	115,344	282,751
		Impact	125,086	19,779	18,122	13,702	16,796	16,575	210,060	3,874	3,826	42,666	13,976	56,324	3,337	124,003	334,063
Boating	.64	Baseline	28,941	4,684	4,199	3,230	3,908	3,973	48,935	937	904	11,560	3,782	15,647	886	33,716	82,651
		Impact	46,383	7,300	6,751	5,136	6,298	6,234	61,403	1,618	1,697	18,583	6,098	23,400	1,410	36,246	97,649
Lake and River Swimming	.63	Baseline	28,627	4,633	4,154	3,195	3,866	3,930	48,405	927	895	11,434	3,741	15,477	877	33,351	81,756
		Impact	45,880	7,221	6,678	5,080	6,230	6,166	60,736	1,600	1,678	18,381	6,032	23,146	1,395	35,855	96,591
Camping	.65	Baseline	29,165	4,720	4,232	3,255	3,939	4,004	49,315	944	911	11,649	3,812	15,768	893	33,977	83,292
		Impact	36,847	5,826	5,338	4,036	4,948	4,882	61,877	1,141	1,127	12,568	4,117	16,591	983	36,527	98,404
Hiking	1.07	Baseline	47,936	7,758	6,955	5,350	6,474	6,580	81,053	1,552	1,498	19,147	6,265	25,916	1,468	55,846	136,899
		Impact	76,826	12,091	11,182	8,506	10,432	103,255	101,703	2,679	2,810	30,780	10,101	38,759	2,336	60,038	161,741
Picnicking	1.42	Baseline	63,616	10,295	9,230	7,100	8,591	8,733	107,565	2,059	1,988	25,409	8,314	34,394	1,948	73,605	181,677
		Impact	76,826	12,091	11,182	8,506	10,432	103,255	134,971	2,679	2,810	30,780	10,101	38,759	2,336	79,676	214,647
Backpacking	.07	Baseline	3,539	573	514	395	478	486	5,985	115	111	1,414	462	1,913	108	4,123	10,108
		Impact	4,471	707	648	490	600	592	7,508	138	137	1,525	500	2,013	119	4,432	11,940
Sightseeing	1.4	Baseline	62,720	10,150	9,100	7,000	8,470	8,610	106,050	2,030	1,960	25,052	8,197	33,909	1,921	73,069	179,119
		Impact	79,240	12,530	11,480	8,680	10,640	10,500	133,070	2,454	2,423	27,028	8,854	35,680	2,114	78,553	211,623
Visiting Historic Sites	.50	Baseline	22,803	3,690	3,308	2,545	3,079	3,130	38,555	738	713	9,108	2,980	12,328	698	26,565	89,790
		Impact	28,809	4,556	4,174	3,156	3,868	3,818	48,381	892	881	9,827	3,219	12,972	769	28,560	106,147
ORV Use	.55	Baseline	24,909	4,031	3,614	2,780	3,364	3,419	42,117	806	778	9,949	3,255	13,467	763	29,018	71,135
		Impact	31,470	4,976	4,559	3,447	4,226	4,170	52,848	975	962	10,734	3,516	14,170	840	31,197	84,045

*New Mexico State Planning Office, Outdoor Recreation 1976, A Comprehensive Plan for New Mexico, 1976.

Table 3-5. 2019 PROJECTED RECREATION DEMAND IN USER PARTICIPATION DAYS FOR THE STUDY REGION

Activity	Per Capita User Participation*		Greater Farmington Area							Thoreau, Grants, Gallup Area					Cuba Area		
			Farmington	Aztec	Bloomfield	Flora Vista	Lee Acres	Lower Valley	SUBTOTAL	Thoreau	Crownpoint	Grants	Milan	Gallup	Cuba	SUBTOTAL	TOTAL
Fishing	2.21	Baseline	133,705	21,326	19,338	14,918	18,232	18,454	225,973	4,544	4,391	56,364	18,442	75,679	4,458	163,878	389,851
		Impact	158,678	24,973	23,094	17,570	21,548	21,326	267,189	5,534	5,803	63,573	20,862	80,053	4,824	180,649	447,838
Boating	.64	Baseline	39,083	6,234	5,652	4,360	5,330	5,394	66,053	1,328	1,284	16,476	5,391	22,122	1,303	47,904	113,957
		Impact	46,383	7,300	6,751	5,136	6,298	6,234	78,102	1,618	1,697	18,583	6,098	23,400	1,410	52,806	130,908
Lake and River Swimming	.63	Baseline	38,660	6,166	5,591	4,313	5,272	5,336	65,338	1,314	1,270	16,297	5,332	21,882	1,289	48,274	113,612
		Impact	45,880	7,221	6,678	5,080	6,230	6,166	77,255	1,600	1,678	18,381	6,032	23,146	1,395	52,232	129,487
Camping	.65	Baseline	39,386	6,282	5,696	4,394	5,371	5,436	66,565	1,338	1,294	16,603	5,433	22,293	1,313	48,274	114,839
		Impact	46,742	7,356	6,803	5,175	6,347	6,282	78,705	1,630	1,710	18,727	6,145	23,581	1,421	52,232	131,919
Hiking	1.07	Baseline	64,735	10,326	9,362	7,222	8,828	89,345	189,818	2,200	2,126	27,289	8,929	36,641	2,158	79,343	269,161
		Impact	76,826	12,091	11,182	8,506	10,432	103,255	222,292	2,679	2,810	30,780	10,101	38,759	2,336	87,465	309,757
Picnicking	1.42	Baseline	85,910	13,703	12,425	9,585	11,715	11,857	145,195	2,911	2,822	36,216	11,850	48,626	2,864	123,966	269,161
		Impact	76,826	12,091	11,182	8,506	10,432	13,255	171,678	2,679	2,810	30,780	10,101	38,759	2,336	138,079	309,757
Backpacking	.07	Baseline	4,780	762	691	533	652	660	8,078	162	157	2,015	659	2,705	159	5,857	13,935
		Impact	5,672	893	826	628	770	762	9,551	198	207	227	746	2,862	172	4,412	13,963
Sightseeing	1.40	Baseline	84,700	13,510	12,250	9,450	11,550	11,690	143,150	2,878	2,782	35,706	11,683	47,942	2,824	103,815	246,965
		Impact	100,520	15,820	14,630	11,130	13,650	13,510	169,260	3,506	3,676	40,272	13,216	50,712	3,506	114,438	283,698
Visiting Historic Sites	.50	Baseline	30,794	4,912	4,454	3,436	4,199	4,250	56,220	1,047	1,011	12,982	4,248	17,430	1,027	33,570	89,790
		Impact	36,546	5,752	5,319	4,047	4,963	4,912	61,539	1,275	1,337	14,642	4,805	18,438	1,111	44,608	106,147
ORV Use	.55	Baseline	33,638	5,365	4,865	3,753	4,587	4,643	51,486	1,140	1,105	14,180	4,640	19,040	1,121	46,591	98,077
		Impact	39,921	6,283	5,810	4,420	5,421	5,365	67,220	1,392	1,460	15,994	5,249	20,140	1,214	45,449	112,669

*New Mexico State Planning Office, Outdoor Recreation 1976, A Comprehensive Plan for New Mexico, 1976.

Table 3-6. TYPES OF IMPACTS TO IMPORTANT RESOURCES

Recreation Resource	PRIA number	Coal Tract	NMGS Project Component	Type of Impact
Chaco Culture National Historical Park (Pueblo Alto)	3918 9764 6804 3755 3919	Kimbeto #1 Kimbeto #2 bypass	Transmission Line #2	N, D, SQ, ILL, VAN
Pueblo Pintado	8130 8128 11670	Gallo Wash #1	Transmission Line #2	N, D, SQ, VAN
Chaco Culture Archeological Protection Sites				
Pierre's Site		Nageezi #1	Transmission Line #1	N, D, SQ, VAN
Bisaani	8129		Transmission Line #2	N, D, SQ, VAN
Proposed Continental Divide National Scenic Corridor	8717 585	Star Lake East #1 Hospah #1 bypass Hospah #2 Divide Star Lake West #2 Johnston Trading Post	Transmission Line #1 Transmission Line #2	SQ, N, D ILL
Bisti WSA	6801 11916 3838 3834 3835 6802 3838 3638 6802	Bisti #1 Bisti #2 Bisti #6 Bisti #8 Bisti #4 A & B Bypass	Plant Site New Town	N, D, SQ, ILL, IS VAN

Table 3-6. TYPES OF IMPACTS TO IMPORTANT RESOURCES (concluded)

Recreation Resource	PRLA number	Coal Tract	NMGS Project Component	Type of Impact
De-na-zin WSA	6801	Nageezi #1	New Town	N, D, SQ,
	3834	Bisti #1	Plant Site	ILL, IS, VAN
	3838	Bisti #2		
	11916	Bisti #4 A & B		
	6802	Bisti #6 Bypass		
	3835	Bisti #8 Bypass		
	3753			
	3752			
	3754			
	7235			
	6803			
Ah-shi-sle-pah WSA	8129	Kimbeto #1	Transmission	N, D, SQ,
	* 3918	Kimbeto #2	Line #2	ILL, IS
	9764			
	* 3919			
	3745			
	6803			
	3755			
(* = overlaps with WSA)	* 6804			

N = increased noise
ILL = illumination from night lighting
D = increased dust
SQ = scenic quality contrasts
IS = impaired solitude
IA = impaired access to resource area along roads
VAN = increased opportunities for vandalism

The most prevalent impacts are related to changes in the scenic quality of landscapes surrounding the recreation and wilderness resource areas and those resulting from increased visitor use. These include:

- Increased vandalism and theft at cultural and paleontological resource sites used for sightseeing, photography, hiking.
- Visual impacts degrading the quality of views from WSAs and the northern side of Chaco Culture National Historical Park.
- Overcrowding of and expanded use of Navajo Lake State Park, Angel Peak Recreation area, Bluewater State Park, and sites within Chaco Culture National Historical Park.
- Reduction in the quality of dispersed recreation activities (particularly hiking, camping, picnicking, etc.).

Suggested Mitigation

Suggested mitigation presented in the NMGS and SJRRCL EISs apply to the kinds of impacts discussed above, particularily in regard to monitoring of user participation and prevention of vandalism to cultural and paleontological sites. In addition, several suggestions are unique to the findings of this cumulative impact assessment.

1. The BLM and Forest Service would benefit by monitoring visitor use at recreation areas and WSAs located in the southern extent of the study area (specifically Cibola National Forest, and the Ojito, Ignacio Chavez, Cabazon, Empedrado, Chamisa, and La Lena WSAs) to verify projected increases in demand and allow for management program shifts to provide additional facilities and supervision or maintenance.

2. Because access to Chaco Culture National Historical Park would be significantly affected by coal-related traffic use of NM 57, the Park Service could study feasible options for protecting visitor access along this route. For example, paving and widening of the roadway may be necessary to facilitate auto flow during periods of heavy coal-associated traffic. A similar mitigation measure may be necessary along the portion of NM 371 from Farmington to the Bisti and De-na-zin WSAs, to protect visitor access during peak construction periods for NMGS and coal-haul activity. C-15 could also be improved (paved and widened) as an alternative access route to these resource areas from Farmington-area communities.

3. Programs for reserving campsites (Navajo Lake State Park sites, Bluewater Lake, Angel Peak) would be necessary as demand exceeds supply. A coordinated program through the New Mexico State Natural Resources Department Planning Office is recommended.

4. Increased stocking programs in quality fishing areas (e.g., San Juan River) may be necessary above those levels discussed in the site-specific EISs.

TRANSPORTATION RESOURCES

The proposed actions and the population they would bring to the region would result in increased traffic volumes on some of the region's roadways, leading to traffic flow changes, increased accident potential, and increased roadway maintenance requirements.

Methods of Analysis

The methodology used for the CO transportation assessment began with a review of the technical reports and EISs for the NMGS and SJRRCL in order to identify and map the regionally important transportation resources (railroads and roads), and determine where transportation impacts could be additive or interactive. Work-force estimates, by year and by community of residence, were supplied by the CO Social and Economic Conditions task. Ten commute areas in the study area were identified using a gravity flow model to distribute the project work force to specific residential areas and commute corridors. Summary tabulations of average daily traffic (ADT) from past years on major roads in the study region were compared with projected ADT on the same roads associated with the work-force commute vehicles for the combined proposed actions for peak years of employment (Table 3-7).

Indicators of Significance

Three primary factors were considered in the assessment of impact significance: (1) the percentage of increase over baseline in ADT*; (2) the increase in traffic accidents attributable to increases in vehicle volume and the mix of passenger vehicles and large trucks on two-lane roads; and (3) the increases in roadway maintenance or surface damage resulting from use beyond a road's engineered load and capacity.

Analysis Results

Transportation impacts resulting from the combined actions of NMGS and SJRRCL are primarily concentrated along major arterials linking the greater Farmington area communities with the proposed NMGS plant site and surrounding coal tracts. Specifically, the portion of NM 371 from Farmington extending south just beyond the NMGS site to C-14 is estimated to increase ADT from 2540 in 1977 to a total of approximately 6353 by 1992, and approximately 5363 in the year 2019. Assuming a vehicle occupancy of two persons per auto and a three-shift work schedule, approximately 1000 commute vehicles would travel along these segments of NM 371 during peak hours during peak construction years for the combined proposed actions. For comparison, during the peak traffic year for NMGS alone, traffic was estimated to be 650 vehicles per hour (vph), concentrated during morning and evening commute hours. The baseline traffic volume along the same roadway segments (S 1336--20 and 21) was approximately 296 vph in 1977. The 1000 commute vehicles, and the 35 to 40 coal haul trucks, do not exceed the maximum vehicle capacity for a two-lane highway; however, they do represent a significant increase in roadway use.

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*Note: Average maximum vehicle capacity for a two-lane highway in northwest New Mexico is 1400 vehicles per hour traveling at a speed of 40 mph. Source: New Mexico Highway Dept., Planning Division 1982.

Table 3-7. COMPARISON OF AVERAGE DAILY TRAFFIC (ADT)* ALONG MAJOR ROADS FROM CUMULATIVE WORK FORCE

Road	Road Segment	Year	Baseline ADT Vehicle Type: Passenger Cars	Single Unit Trucks	Truck Tractor	Other Vehicles	Total	Projected ADT from Cumulative Actions, Year: 1992	2019	Total ADT, Year: 1992	2019
NM 44	1.5 mi S of Bloomfield	1980[a]	1919	2565	468	203	5155			7558	8013
NM 44	7.7 mi NW of Nageezi	1974[b]	1579	NA	279	NA	1858	2403	2858	4261	4716
NM 44	9 mi S of Bloomfield	1974[b]	2158	NA	381	NA	2538			4941	5396
NM 44	23 mi NW of Cuba	1974[c]	1230	NA	217	NA	1447			3850	4305
NM 371	10 mi N of McKinley/San Juan Co. Line - No. 12 mi	1977[c]	804	NA	176	NA	980	3813	2823	4793	3803
NM 371	22 mi N of County Line - No. 27 mi	1977[c]	2235	NA	305	NA	2540			6353	5363

Sources:

[a]BLM Farmington Resource Area 1982. SJRRC - EIS pgs. 2-71.

[b]New Mexico State Highway Department 1977. EA - NM 44 - Attachment 5.

[c]New Mexico State Highway Department 1976. EA - NM 371 - Attachment 4.

*Note: Average maximum vehicle capacity for a two-lane highway in New Mexico is 1400 vehicles per hour at a speed of 40 mph (New Mexico State Highway Department 1982, Planning Division).

Impacts resulting from the cumulative increase in traffic volume, as well as the mixing of heavy commercial vehicles with passenger vehicles, include: traffic congestion and delays for commuter vehicles, increased accident potential, degradation to roadway surfaces from near-capacity use and the continuous movement of commercial trucks, and increased emissions and noise levels from heavy traffic volume.

Increased commuter traffic within the Farmington-area communities would place additional pressures on the already stressed municipal roads in both Farmington and Bloomfield (see NMGS EIS Transportation Technical Report). The major collectors and arterials most affected would be US 550, Main Street, Broadway, Bloomfield Highway, and San Juan Boulevard. Impacts include added traffic delays, increased intersection accidents, competition for available parking along these roadways, and additional roadway maintenance and traffic control requirements.

Suggested Mitigation

Since the ROW for the segments of NM 371 from Farmington to the NMGS plant site is wide enough to accommodate two additional lanes (200 feet), and since this section would have the heaviest concentration of cumulative impacts, plans could be made to expand the roadway to four lanes or consider the addition of an exclusive truck lane for coal haul trucks prior to peak construction years (1995). Spot maintenance for roadways, and post-use reconstruction specifications, would be negotiated with mining companies as well as PNM as a part of ROW and highway use permits.

SOCIAL AND ECONOMIC CONDITIONS

Cumulative impact analysis focused on two topics: rapid growth in the region, and the ability of the affected communities to respond in a timely fashion to increased demand for housing, services, and facilities; and potential impacts on opportunities for the pursuit of traditional American Indian (especially Navajo) values and lifestyles. Rapid growth and its consequences would be initiated by an increase in employment opportunities resulting from development and operation of NMGS and SJRRCL. Together, the two projects would add approximately 9,000 direct jobs at peak, generating, in addition, about twice that number of indirect jobs. About one-third of the population associated with these jobs would seek residence in the southern part of the region (centered on the Grants-Gallup axis), and would result primarily from SJRRCL mining activity, with or without NMGS. Therefore, the cumulative impact analysis focuses on communities in the greater Farmington area which would be affected by the joint employment opportunities of both NMGS and SJRRCL.

Farmington-area communities would be affected by about 6,000 additional direct jobs and 12,000 to 13,000 indirect jobs between 1985 and 2040 as a result of the proposed actions. Consequent to the creation of employment opportunities affecting these communities would be increases in aggregate personal income and sharply increased demands for housing, infrastructure, and human services. Public finances would be affected in response to

increased demands and increased public revenues from the new population. Navajo values and lifestyles would be affected through a combination of a changing population composition, increased income, increased mobility, and a diminution of traditional support mechanisms.

Methods of Analysis

The approach taken in the CO first identified commute areas for NMGS and for individual coal tracts and PRLAs on the basis of location and access routes (Table 3-8). The total number of construction and operation workers was calculated annually for all proposed actions included within the boundary of each commute area. The proportion of local and nonlocal workers for each year was determined in light of projected annual changes in regional employment and annual changes in total NMGS and SJRRCL labor requirements.

Cumulative indirect employment was determined through the use of multipliers derived from an input-output model. Employment projections were translated into annual project-related population estimates on the basis of the anticipated household size of in-migrating workers. The in-migrating population associated with each commute area was allocated to communities in the study region through the use of a gravity model. The total number of project-related in-migrants subsequently was determined by community.

The analysis of the study area communities focused on projections of project-related jobs and population, demands for housing and public services and facilities, and public revenues and expenditures. Projections of services and facilities were generally based on a continuation of current levels of service. Changes in public revenues and expenditures were based on existing revenue and expenditure levels. (See the CO Technical Report, and Section 2 and Appendices A, B, and C of the Social and Economic Conditions Technical Report for NMGS EIS for additional information on methods.)

Indicators of Significance

The following threshold indicators were used:

- Projected annual population change exceeding 10 percent in existing communities (Table 3-9)
- Ten percent increase in county or community annual net revenues
- Inability of public-sector jurisdictions to meet costs of providing necessary services and facilities to new population prior to receipt of project-related revenues
- Need for community services and facilities (housing, municipal services, education, human services, health services, law enforcement, fire protection, and recreation) in excess of projected availability

Table 3-8. POPULATION DISTRIBUTION COEFFICIENTS, NMGS AND SJRRCL COMMUTE AREAS: 1985, 1990, AND 2000

	A (NMGS)			B (Bisti)			C (Ark 1)		
	1985	1990	2000	1985	1990	2000	1985	1990	2000
Farmington	0.625	0.639	0.638	0.628	0.644	0.642	0.618	0.634	0.634
Bloomfield	0.078	0.071	0.071	0.072	0.070	0.071	0.072	0.070	0.070
Aztec	0.070	0.075	0.072	0.075	0.074	0.072	0.077	0.076	0.075
Flora Vista	0.059	0.057	0.057	0.058	0.056	0.056	0.059	0.058	0.058
Lee Acres	0.071	0.069	0.070	0.071	0.069	0.069	0.072	0.070	0.068
Lower Valley	0.066	0.061	0.062	0.068	0.061	0.061	0.071	0.063	0.061
Crownpoint	0.018	0.018	0.019	0.017	0.016	0.017	0.020	0.018	0.020
Thoreau	0.012	0.011	0.011	0.010	0.010	0.011	0.012	0.011	0.012

	D (Hwy 57)			E (Gallo)			F (Cuba)		
	1985	1990	2000	1985	1990	2000	1985	1990	2000
Farmington	0.537	0.552	0.548	0.535	0.551	0.545	0.527	0.544	0.535
Bloomfield	0.105	0.103	0.104	0.094	0.092	0.093	0.092	0.090	0.090
Aztec	0.098	0.097	0.094	0.093	0.092	0.089	0.091	0.090	0.087
Flora Vista	0.064	0.063	0.063	0.062	0.061	0.060	0.061	0.060	0.059
Lee Acres	0.089	0.088	0.089	0.084	0.081	0.081	0.081	0.079	0.079
Lower Valley	0.066	0.059	0.059	0.067	0.060	0.060	0.068	0.061	0.060
Crownpoint	0.017	0.016	0.017	0.024	0.023	0.024	0.028	0.026	0.028
Thoreau	0.011	0.011	0.012	0.016	0.016	0.016	0.019	0.018	0.018
Cuba	0.011	0.011	0.015	0.024	0.023	0.032	0.034	0.033	0.044

	G (Crownpoint)		
	1985	1990	2000
Crownpoint	0.063	0.068	0.066
Thoreau	0.032	0.037	0.034
Gallup	0.335	0.319	0.285
Grants	0.420	0.425	0.453
Milan	0.150	0.152	0.162

	H (Grants)		
	1985	1990	2000
Thoreau	0.026	0.029	0.027
Gallup	0.293	0.279	0.246
Grants	0.501	0.510	0.535
Milan	0.179	0.182	0.192

	I (Gallup)		
	1985	1990	2000
Gallup	1.0	1.0	1.0

	J (La Plata)		
	1985	1990	2000
Farmington	0.671	0.686	0.685
Bloomfield	0.065	0.064	0.064
Aztec	0.066	0.065	0.063
Flora Vista	0.054	0.052	0.052
Lee Acres	0.065	0.064	0.064
Lower Valley	0.079	0.070	0.071

Table 3-9. POPULATION PROJECTIONS WITH AND WITHOUT NMGS AND SJRRCL, BY STUDY AREA COMMUNITY: 1981-2040

Year	Farmington			Aztec			Bloomfield			Flora Vista			Lee Acres			Lower Valley		
	Without	With	Percent Change	Without	With	Percent Change	Without	With	Percent Change	Without	With	Percent Change	Without	With	Percent Change	Without	With	Percent Change
1980*	31,222	N.A.	N.A.	5,512	N.A.	N.A.	4,881	N.A.	N.A.	3,834	N.A.	N.A.	4,677	N.A.	N.A.	4,736	N.A.	N.A.
1981	33,150	N.A.	N.A.	5,700	N.A.	N.A.	5,100	N.A.	N.A.	4,000	N.A.	N.A.	4,850	N.A.	N.A.	5,400	N.A.	N.A.
1982	34,950	N.A.	N.A.	6,000	N.A.	N.A.	5,450	N.A.	N.A.	4,150	N.A.	N.A.	5,050	N.A.	N.A.	5,400	N.A.	N.A.
1983	35,250	35,250	N.A.	6,050	6,050	N.A.	5,250	5,250	N.A.	4,200	4,200	N.A.	5,050	5,050	N.A.	5,000	5,000	N.A.
1984	36,050	36,200	2.7	6,150	6,150	1.7	5,500	5,500	4.8	4,250	4,250	1.2	5,150	5,150	2.0	5,200	5,200	4.0
1985	38,000	38,250	5.7	6,350	6,400	4.1	5,750	5,800	5.5	4,400	4,400	3.5	5,350	5,400	4.9	5,800	5,850	12.5
1986	39,050	42,700	11.6	6,550	7,050	10.2	5,700	6,200	10.3	4,500	4,850	10.2	5,450	5,950	10.2	5,550	5,950	1.7
1987	40,250	45,200	5.9	6,650	7,350	4.3	5,950	6,650	7.3	4,600	5,100	5.2	5,550	6,200	4.2	5,650	6,250	5.0
1988	41,300	47,200	4.4	6,750	7,600	3.4	6,050	6,900	3.8	4,650	5,250	2.9	5,650	6,400	3.2	5,750	6,450	3.2
1989	42,800	50,600	7.2	7,000	7,800	2.6	6,400	7,550	9.4	4,800	5,600	6.7	5,800	6,850	7.0	5,900	6,800	5.4
1990	44,250	54,050	6.8	7,250	8,550	9.6	6,350	7,650	1.3	4,950	5,900	5.4	5,950	7,150	4.4	6,000	7,050	3.7
1991	43,450	53,100	-1.8	6,900	8,300	-2.9	6,300	7,700	0.7	4,750	5,750	-2.5	5,800	7,050	-1.4	6,000	7,100	0.7
1992	44,000	54,800	3.2	7,100	8,650	3.0	6,350	7,900	2.6	4,850	5,950	3.5	5,900	7,300	3.5	6,000	7,250	2.1
1993	43,750	54,600	-0.4	6,950	8,500	-1.7	6,450	8,000	1.3	4,800	5,900	-0.8	5,900	7,350	0.7	6,000	7,250	0.0
1994	44,300	55,350	1.4	7,150	8,750	1.8	6,300	7,900	-1.2	4,950	6,100	3.4	5,950	7,400	0.7	6,100	7,350	1.4
1995	44,800	56,600	2.3	7,250	8,950	2.3	6,500	8,200	3.8	5,000	6,200	1.6	6,050	7,600	2.7	6,150	7,500	2.0
1996	45,150	56,900	0.5	7,300	9,000	0.6	6,550	8,250	0.6	5,050	6,250	0.8	6,150	7,700	1.3	6,250	7,550	0.7
1997	45,750	57,050	0.3	7,400	9,050	0.6	6,800	8,450	2.4	5,100	6,250	0.0	6,250	7,750	0.6	6,300	7,600	0.7
1998	46,300	57,600	1.0	7,450	9,100	0.6	6,550	8,200	-3.0	5,200	6,350	1.6	6,250	7,750	0.0	6,400	7,700	1.3
1999	46,800	58,200	1.0	7,450	9,100	0.0	6,750	8,450	3.0	5,250	6,450	1.6	6,350	7,850	1.3	6,450	7,750	0.6
2000	47,350	58,550	0.6	7,550	9,200	1.1	6,850	8,500	0.6	5,300	6,450	0.0	6,450	7,950	1.3	6,550	7,850	1.3
2001	48,000	59,000	0.8	7,650	9,250	0.5	6,950	8,550	0.6	5,350	6,500	0.8	6,550	8,000	0.6	6,650	7,900	0.6
2002	48,600	59,550	0.9	7,750	9,350	1.1	7,050	8,650	1.2	5,450	6,600	1.5	6,600	8,100	1.3	6,700	8,000	1.3
2003	49,200	60,050	0.8	7,850	9,400	0.5	7,100	8,700	0.6	5,500	6,650	0.8	6,700	8,150	0.6	6,800	8,050	0.6
2004	49,850	60,650	1.0	7,950	9,500	1.1	7,200	8,800	1.1	5,600	6,700	0.8	6,800	8,250	1.2	6,900	8,150	1.2
2005	50,500	61,300	1.1	8,050	9,600	1.1	7,300	8,900	1.1	5,650	6,800	1.5	6,900	8,350	1.2	7,000	8,250	1.2
2006	51,150	61,950	1.1	8,150	9,750	1.6	7,400	9,000	1.1	5,700	6,850	0.7	6,950	8,400	0.6	7,100	8,300	0.6
2007	51,850	62,650	1.1	8,250	9,850	1.0	7,500	9,100	1.1	5,800	6,950	1.5	7,050	8,500	1.2	7,150	8,400	1.2
2008	52,500	63,300	1.0	8,350	9,950	1.0	7,600	9,200	1.1	5,850	7,000	0.7	7,150	8,600	1.2	7,250	8,500	1.2
2009	53,200	64,000	1.1	8,500	10,050	1.0	7,700	9,300	1.1	5,950	7,100	1.4	7,250	8,700	1.2	7,350	8,600	1.2
2010	53,850	64,700	1.1	8,600	10,150	1.0	7,800	9,400	1.1	6,050	7,150	0.7	7,350	8,800	1.1	7,450	8,700	1.2
2011	54,550	65,400	1.1	8,700	10,250	1.0	7,900	9,500	1.1	6,100	7,250	1.4	7,450	8,900	1.1	7,550	8,800	1.1
2012	55,300	66,100	1.1	8,800	10,400	1.5	8,000	9,600	1.1	6,200	7,300	0.7	7,550	9,000	1.1	7,650	8,900	1.1
2013	56,000	66,600	0.8	8,950	10,450	0.5	8,100	9,650	0.5	6,250	7,350	0.7	7,650	9,050	0.6	7,750	8,950	0.6
2014	56,750	67,450	1.3	9,050	10,650	1.9	8,200	9,800	1.6	6,350	7,500	2.0	7,700	9,200	1.7	7,850	9,100	0.6
2015	57,450	68,500	1.6	9,150	10,750	0.9	8,300	9,950	1.5	6,450	7,600	1.3	7,800	9,300	1.1	7,950	9,200	1.1
2016	58,200	69,350	1.2	9,300	10,900	1.4	8,450	10,050	1.0	6,500	7,700	1.3	7,950	9,400	1.1	8,050	9,350	1.1
2017	58,950	70,200	1.2	9,400	11,050	1.4	8,550	10,200	1.5	6,600	7,750	0.6	8,050	9,550	1.6	8,150	9,450	1.1
2018	59,750	71,000	1.1	9,550	11,150	0.9	8,650	10,300	1.0	6,700	7,850	1.3	8,150	9,650	1.0	8,250	9,550	1.1
2019	60,500	71,800	1.1	9,650	11,300	1.3	8,750	10,450	1.5	6,750	7,950	1.3	8,250	9,750	1.0	8,350	9,650	1.0
2020	61,300	72,150	0.5	9,800	11,400	0.9	8,850	10,500	0.5	6,850	8,000	0.6	8,350	9,800	0.5	8,500	9,750	1.0
2021	62,100	72,950	1.1	9,900	11,500	0.9	9,000	10,600	1.0	6,950	8,100	1.3	8,450	9,950	1.5	8,600	9,850	1.0
2022	62,900	72,600	-0.5	10,050	11,450	-0.4	9,100	10,550	0.5	7,050	8,100	0.0	8,550	9,900	-0.5	8,700	9,850	0.0
2023	63,700	73,050	0.6	10,150	11,550	0.9	9,200	10,600	0.5	7,150	8,100	0.0	8,700	9,950	0.5	8,800	9,900	0.6

Table 3-9. POPULATION PROJECTIONS WITH AND WITHOUT NMGS AND SJRRCL, BY STUDY AREA COMMUNITY: 1981-2040 (concluded)

Year	Farmington			Aztec			Bloomfield			Flora Vista			Lee Acres			Lower Valley		
	Without	With	Percent Change	Without	With	Percent Change	Without	With	Percent Change	Without	With	Percent Change	Without	With	Percent Change	Without	With	Percent Change
2024	64,550	73,150	0.1	10,300	11,550	0.0	9,350	10,600	0.0	7,200	8,150	0.6	8,800	9,950	0.0	8,950	9,950	0.5
2025	65,400	72,900	-0.3	10,450	11,200	-3.0	9,450	10,200	-3.8	7,300	7,850	-3.9	8,900	9,600	-3.5	9,050	9,700	-2.5
2026	66,240	70,150	-3.8	10,550	11,200	0.0	9,600	10,200	0.0	7,400	7,850	0.0	9,000	9,600	0.0	9,150	9,700	0.0
2027	67,100	70,800	0.9	10,700	11,300	0.9	9,700	10,300	1.0	7,500	7,950	1.3	9,150	9,700	1.0	9,300	9,800	1.0
2028	68,000	70,850	0.1	10,850	11,350	0.4	9,850	10,350	0.5	7,600	7,950	0.0	9,250	9,700	0.0	9,400	9,800	0.0
2029	68,850	71,500	0.9	11,000	11,450	0.9	9,950	10,450	1.0	7,700	8,050	1.3	9,400	9,800	1.0	9,500	9,900	1.0
2030	69,750	71,900	0.6	11,100	11,550	0.9	10,100	10,450	0.0	7,800	8,100	0.6	9,500	9,850	0.5	9,650	10,000	1.0
2031	70,650	72,800	1.3	11,350	11,750	1.7	10,250	10,600	1.4	7,900	8,200	1.2	9,600	9,950	1.0	9,750	10,100	1.0
2032	71,600	73,750	1.3	11,400	11,800	0.4	10,350	10,750	1.4	8,000	8,300	1.2	9,750	10,100	0.5	9,900	10,250	1.5
2033	72,500	74,650	1.2	11,550	11,950	1.3	10,500	10,850	0.9	8,100	8,400	1.2	9,850	10,200	1.0	10,050	10,350	1.0
2034	73,450	75,600	1.3	11,700	12,100	1.3	10,650	11,000	1.4	8,200	8,500	1.2	10,000	10,350	1.5	10,150	10,500	1.4
2035	74,400	76,550	1.3	11,850	12,250	1.2	10,750	11,150	1.4	8,300	8,600	1.2	10,150	10,500	1.4	10,300	10,650	1.4
2036	75,350	77,550	1.3	12,000	12,450	1.6	10,900	11,300	1.3	8,450	8,700	1.2	10,250	10,600	1.0	10,400	10,750	0.9
2037	76,350	78,500	1.3	12,200	12,600	1.2	11,050	11,400	0.9	8,550	8,800	1.1	10,400	10,750	1.4	10,550	10,900	1.4
2038	77,350	79,500	1.3	12,350	12,750	1.2	11,200	11,550	1.3	8,650	8,950	1.7	10,550	10,900	1.4	10,700	11,050	1.4
2039	78,350	80,500	1.3	12,500	12,900	1.2	11,350	11,700	1.3	8,750	9,050	1.1	10,650	11,000	0.9	10,850	11,150	0.9
2040	79,350	81,550	1.3	12,650	13,050	1.2	11,500	11,850	1.3	8,900	9,050	0.0	10,800	11,150	1.4	11,000	11,300	1.3

Source: Adcock and Associates, Inc. 1982.

N.A. = not applicable.

*Census data.

Analysis Results

Results of the cumulative impact analysis are presented in terms of employment, housing, public services and facilities, public finance, and American Indian values and lifestyles. The significant social and economic impacts identified in this cumulative impact analysis are as follows:

- Significant population growth in the greater Farmington area in 1985-86
- Significant increases in employment, income, local tax bases, and general expansion of the regional economy from the mid-1980s through the 2020s
- Significant demand for housing in the greater Farmington area in the mid-1980s and the early 1990s
- Significant demand for permanent school facilities in the City of Farmington
- Potential inability of human service agencies in the study area to keep pace with demand
- Potentially significant impacts on Navajos' opportunities to pursue traditional values and lifestyles

Employment

NMGS employment would peak in 1992 with 1,804 workers; SJRRCL employment would peak in the year 2019 with 8,077 workers; and total direct employment of both proposed actions would peak in 2019 with 8,977 workers (Table 3-10). While total employment is projected to increase rapidly until 1990, between 1990 and tne early 2020s, annual changes in total employment would not be dramatic. Thus, while a large number of jobs would be created in the mid- to late 1980s, the proposed actions would not cause a cyclical boom-bust pattern in the regional economy during the subsequent five decades.

Direct employment from SJRRCL would be substantially larger than from NMGS. For example, in 1995 (the peak employment year for NMGS), NMGS workers would represent only 20.5 percent of the total NMGS and SJRRCL work force. Therefore, the development of coal tracts and PRLAs would have a greater effect on the region's economy and on personal income. Beginning in the late 1980s and continuing through the 2020s, the economy of the study region would become more heavily dependent on coal mining and its related activities.

Together, the proposed actions would result in substantial increases in employment and personal income in the Farmington area. For example, approximately 6,000 NMGS and SJRRCL construction and operation jobs would be available in this area from the 1990s to beyond 2020. During the same time, a substantial number of proposed action-related indirect jobs (between 12,000 and 13,000) would be created in the greater Farmington area. This would result in significant increases in personal income in the study area, which would, in turn, serve to strengthen the area's economy. In addition, Farmington's relative position as a major employment and economic center in New Mexico would be enhanced.

Table 3-10. CONSTRUCTION AND OPERATION EMPLOYMENT, NMGS AND SJRRCL: 1984-2040

Year	NMGS			SJRRCL			Total
	Construction	Operation	Total	Construction	Operation	Total	
1984	0	0	0	174	0	174	174
1985	85	0	85	130	44	174	259
1986	800	0	800	2866	86	2952	3752
1987	1630	0	1630	2198	711	2909	4539
1988	1505	0	1505	1917	1405	3322	4827
1989	914	30	944	3869	2157	6026	6970
1990	1080	200	1280	2636	3354	5990	7270
1991	1320	250	1570	1784	4113	5897	7467
1992	1530	274	1804	1556	4818	6374	8178
1993	1090	410	1500	1066	5483	6549	8049
1994	838	480	1318	856	5769	6625	7943
1995	1030	650	1680	520	5979	6499	8179
1996	775	700	1475	313	6185	6498	7973
1997	255	724	979	107	6391	6498	7747
1998	95	860	955	0	6497	6497	7452
1999	0	900	900	309	6448	6757	7657
2000	0	900	900	232	6412	6644	7544
2001	0	900	900	155	6335	6490	7390
2002	0	900	900	78	6360	6438	7338
2003	0	900	900	0	6437	6437	7337
2004	0	900	900	0	6437	6437	7337
2005	0	900	900	0	6437	6437	7337
2006	0	900	900	0	6428	6428	7328
2007	0	900	900	0	6418	6418	7318
2008	0	900	900	0	6405	6405	7305
2009	0	900	900	1061	6397	7458	8358
2010	0	900	900	796	6662	7458	8358
2011	0	900	900	530	6912	7442	8342
2012	0	900	900	265	6884	7149	8049
2013	0	900	900	0	6995	6995	7895
2014	0	900	900	685	6943	7628	8528
2015	0	900	900	616	6860	7476	8376

Table 3-10. CONSTRUCTION AND OPERATION EMPLOYMENT, NMGS AND SJRRCL: 1984-2040 (concluded)

Year	NMGS			SJRRCL			Total
	Construction	Operation	Total	Construction	Operation	Total	
2016	0	900	900	479	6983	7462	8362
2017	0	900	900	342	6924	7266	8166
2018	0	900	900	205	6991	7196	8096
2019	0	900	900	1013	7064	8077	8977
2020	0	650	650	851	7146	7996	8647
2021	0	650	650	662	7335	7997	8647
2022	0	650	650	473	6854	7327	7977
2023	0	450	450	284	7043	7327	7777
2024	0	450	450	95	6783	6878	7328
2025	0	200	200	0	4837	4837	5037
2026	0	200	200	0	4299	4299	4499
2027	0	200	200	0	4152	4152	4352
2028	0	0	0	0	3884	3884	3884
2029	0	0	0	0	3209	3209	3209
2030	0	0	0	0	2330	2330	2330
2031	0	0	0	0	2068	2068	2068
2032	0	0	0	0	1496	1496	1496
2033	0	0	0	0	860	860	860
2034	0	0	0	0	860	860	860
2035	0	0	0	0	850	850	850
2036	0	0	0	0	700	700	700
2037	0	0	0	0	685	685	685
2038	0	0	0	0	685	685	685
2039	0	0	0	0	685	685	685
2040	0	0	0	0	685	685	685

Sources: NMGS DEIS, p. 1-10 (NMGS); BLM 1982, unpublished data (SJRRCL).

Housing

Project-related in-migrants would seek housing in the greater Farmington area. In general, the housing demand would increase at a faster rate in each study area community as a result of the combination of proposed actions. The greatest annual rate of increase is estimated to occur in 1986 when housing demand would rise by 10.9 percent, or a total of 2550 units. An average of 726 housing units were added to the housing stock in Farmington, Aztec, and Bloomfield each year between 1970 and 1981. This figure is substantially below the projected 2550 units that would be needed in 1986 as a result of proposed actions. Moreover, housing starts in the past four years have dropped because of high mortgage interest rates. Thus, housing impacts in the greater Farmington area would be potentially significant in 1986. Other years in which housing demand increases by over 1000 units are projected are 1990 (1310 units) and 1992 (1060 units).

While it is possible to project housing demand related to the proposed actions, it is more difficult to predict housing supply. While there is enough land zoned for residential use in the greater Farmington area to meet projected needs for housing development for the foreseeable future, other factors (such as mortgage interest rates and perceived uncertainties about long-term economic stability in the region) will influence housing construction. Because housing construction has been relatively slow over the past few years, vacancy rates are now generally low in the greater Farmington area. A shortage of conventional single-family and multifamily units could continue through the mid-1980s, when housing demand would be greatest as a result of the proposed action. On the other hand, developers perceiving this unmet need may rapidly develop a variety of multifamily units, apartments, or mobile-home spaces in the greater Farmington area.

Public Services and Facilities

Under baseline conditions Farmington would have to purchase additional water rights around 1987 to meet projected needs beyond the year 2000. With the proposed actions, Farmington would have to purchase additional water rights in 1986 to meet projected demands of the city and associated Water Users Associations. Total water use would increase to 26,720 acre-feet per year by the year 2000 with the proposed actions, as opposed to 21,110 without. Aztec and Bloomfield both need to purchase additional water rights now in order to meet projected demand, with or without the proposed actions. Aztec's total annual water use would increase to 2740 acre-feet by 2000 with the proposed actions, as opposed to 2250 without. Bloomfield's total annual water use would increase to 2710 acre-feet by 2000 with the proposed actions, as opposed to 2190 under baseline conditions.

Without the proposed actions, the water treatment system capacity in Farmington would be adequate to meet projected needs beyond 2000; with the proposed actions, system capacity would have to be expanded in approximately 1993. To meet total projected needs either under baseline conditions or with the proposed actions, Aztec would have to expand its system's capacity around 1986. Bloomfield's water treatment system capacity of 1.5 million gallons per day would be reached in 1985 under baseline conditions, and earlier if the proposed actions were implemented.

Under baseline conditions, Farmington would need additional sewage treatment capacity in 1988; with the proposed actions that need would arise approximately two years earlier, in 1986. Sewage treatment system capacities in both Aztec and Bloomfield would be adequate to meet projected demands with or without the proposed actions beyond 2000.

In each community, as well as in San Juan County, the need for construction of additional fire stations would arise several years earlier than under baseline conditions. The greatest need would be experienced by San Juan County, which would require 17 fire stations by 2000 as a result of the proposed actions, compared with 14 stations under baseline conditions. Generally, the salaries of additional service personnel (such as police and firefighters) needed in the study area communities would be paid from operating funds as necessary between 1985 and 2000. As the population (and need) increases, revenues from property and sales taxes would also increase. A possible exception to this generalization is in the area of human services. Human service agencies in the greater Farmington area are currently operating at or near capacity, and have been dependent in the past on funding from federal and state government sources. At present, the continuation of substantial support from those sources is uncertain. Since it is likely that demand for human services in the study area would increase as the population grows (and perhaps especially in the mid-1980s when the greater Farmington area would experience potentially significant growth impacts), these services could sustain significant impacts.

Public Finances

Based on 1981 revenue and expenditure patterns, with the proposed actions Farmington operating funds indicate an overall surplus through 1990 and overall deficits thereafter to 2000. The general fund would have significant deficits through the 1990s, and other nonenterprise operating funds would have deficits through most of the 1980s and 1990s. Aztec operating funds show a surplus in all (nonenterprise) operating funds for all years. Bloomfield would experience a surplus in operating funds until 1990 and small deficits thereafter. The general fund would have small deficits through the 1990s, and other nonenterprise operating funds would have deficits in all years.

San Juan County would experience a slight deficit ($17,000) in overall operating funds in 1984-85, and surpluses thereafter which would reach $2.6 million in 2000. After 1985, revenues would exceed expenditures for the general fund. Once NMGS and the coal mines were developed, projected property taxes would provide approximately 80 percent of total revenues and would be sufficient to cover the projected costs of growth for San Juan County.

The Farmington Municipal School District would realize substantial surpluses in operating funds as a result of large property tax revenues from the proposed actions. The Aztec and Central Consolidated School Districts would experience deficits throughout the period as a result of the projected inadequacy of local revenue sources. The Bloomfield Municipal School District would have a deficit in 1985 but surpluses afterward, once property tax revenues from coal developments began to flow.

American Indian Lifestyles and Values

The NMGS EIS describes traditional Navajo lifestyles and values in the study area and assesses the potential impacts on these social and economic resources that would result from NMGS. It is anticipated that the proposed actions would accelerate trends in increasing mobility, increasing dependence on wage employment, geographic separation of family and clan members, experience of value conflicts, and stress associated with cultural change.

The proposed actions would be viewed by Navajos as causing neither all beneficial nor all adverse impacts. The increase in job opportunities could improve Navajos' access to wages without their having to leave the reservation and surrounding area, but it would also mean an influx of non-Navajos with different values and lifestyles. As population grows, the trading posts that have provided an important source of credit for traditional Navajos may be replaced by chain or department stores. In addition, special geographic locations in the existing environment to which some individuals and groups of traditional Navajos have attached sacred significance would be subject to increasing disruption and disfiguration as the proposed actions were implemented. The large population influx would lead to increased vandalism of sacred sites and burial places. As a result of tne cumulative effects of baseline planned developments, NMGS, and SJRRCL, significant impacts to the traditional values and lifestyles of Navajos and other American Indian groups could occur.

Suggested Mitigation

Both the NMGS and the SJRRCL EISs include recommendations for mitigation measures that would enhance potential beneficial impacts or reduce potential adverse social and economic impacts associated with each proposed action. Those recommended mitigation measures would apply to the potential cumulative impacts identified in this study as well.

The projected population growth would result in the Farmington area becoming a more important social and economic center in New Mexico, and the overall economic effects of the proposed actions would be beneficial. Significant impacts to housing and human services could occur, but they are difficult to predict accurately because of the elasticity in supply and financing mechanisms. These aspects of the study area's social and economic environment should be reassessed as individual projects are implemented in the mid-1980s. It is likely that there would be a need for specific mitigation programs, such as housing for construction workers or subsidization or incentive programs for employee housing.

PART FOUR
CONSULTATION AND COORDINATION

INTRODUCTION

This section discusses consultation and coordination that occurred during development of the various proposals. The purpose of this consultation process was to foster public participation and gather information regarding concerns about these proposals.

HISTORY OF COORDINATION EFFORTS

In developing a coordinated approach to completing the separate environmental analyses for the various proposed actions within the San Juan Basin, the BLM held several meetings and discussions with the State Legislature, Navajo Tribe, Bureau of Indian Affairs, Environmental Protection Agency, National Park Service, the Special Assistant to the Secretary of the Interior, and other federal and state agencies. This coordination effort resulted in the development of the SJBAP. This plan covers the relationship of the interrelated projects in the San Juan Basin.

A steering committee or work group was established September 18, 1980, to oversee the preparation of the various documents and the CO. The work group comprises representatives from the BLM State and District Offices, New Mexico State Government, Bureau of Indian Affairs, Navajo Tribe, Department of the Interior, and the various EA or EIS teams that were formed to prepare the environmental documents for the proposed actions in the San Juan Basin. Through this work group, concerned agencies were consulted and their comments were considered throughout development of the various environmental analyses for the proposed actions and the CO.

In addition, an initial mailing list of over 3000 names was developed to distribute information about the proposals and to inform the public about planned scoping meetings for the NMGS EIS and the CO. The information also included a summary of the other proposed actions. These scoping meetings were announced in the Federal Register, news releases, and radio spots in both English and Navajo languages.

In early 1981, the BLM held a series of 16 scoping meetings around the state on the proposed NMGS and CO. All meetings were open to the general public; however, each meeting was specifically oriented to a particular audience. These meetings were designed for the following target groups:

- Federal agencies
- State agencies
- Local agencies
- American Indians
- General public

An introduction and summary of the NMGS proposal and the CO was presented at all the scoping meetings. The summary was followed by slide/tape presentations that detailed the proposed activities within the San Juan Basin. A special Navajo language tape was also prepared for the meetings with Navajo Chapters.

Detailed information on results of the individual meetings and the public involvement process can be found in the Scoping Analysis and Public Involvement document prepared by BLM (May 1982). The document is a summary of the various scoping meetings held on the proposed NMGS EIS and the San Juan Basin CO. It is available for review at the Santa Fe, Albuquerque, and Farmington BLM offices.

Individual scoping meetings were held in November 1981 to gather public input for the environmental statement on the three WSAs. Results of these meetings were developed and published in January 1982. This document is also available at the Santa Fe, Albuquerque, and Farmington BLM offices.

In addition to the above meetings, agencies were invited to participate in the coordination of the various environmental documents through cooperative agreements of Memorandums of Understanding. As a result of this invitation, an agreement was entered into with the Navajo Nation to participate in the preparation of the CO.

Since the scoping meetings, many written comments have been received concerning the various proposed actions. Many of these written comments were received in time to be summarized in the May 1981 Scoping Analysis and Public Involvement document. Others not received in time are on file with the BLM and will be considered along with other information and data during the decision making process.

For further information on consultation and coordination efforts on the site-specific proposals, reference should be made to Chapter 4 of the respective environmental document.

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AVAILABILITY OF CUMULATIVE OVERVIEW TECHNICAL REPORT FOR PUBLIC REVIEW

The Technical Report prepared in conjunction with the CO is for public inspection and review at the locations listed below. Those entries with an asterisk (*) indicate formal or informal cooperating agencies for the site-specific EISs (SJRRCL, NMGS, and WSAs).

BLM has attempted to ensure that reading copies of the Technical Report are as widely available as possible. Additionally, individual copies of the Technical Report can be obtained from the BLM New Mexico State Office for a copying fee. Inquiries concerning Technical Report availability and copying costs should be directed to:

BLM, New Mexico State Office
Title Records and Public Assistance Section (943B)
U.S. Post Office and Federal Building
P.O. Box 1449
Santa Fe, NM 87501
(505) 988-6107 FTS 476-6107

Copies of the CO and its Technical Report have been forwarded to the U.S. Government Printing Office for inclusion in the Depository Library Network (DLN). The main DLN library for New Mexico is the University of New Mexico Library. Through the DLN system, these documents will be made available to interested public and university libraries throughout the United States.

Bureau of Land Management Offices

New Mexico State Office:

Public Affairs Staff (912)
Room 2016
U.S. Post Office and Federal Building
P.O. Box 1449
Santa Fe, NM 87501
(505) 988-6316 FTS 476-6316

Albuquerque District Office
3550 Pan American Freeway N.E.
P.O. Box 6770
Albuquerque, NM 87107
(505) 766-2455 FTS 474-2455

Farmington Resource Area Headquarters
900 La Plata Road
P.O. Box 568
Farmington, NM 87401
(505) 325-3581

Taos Resource Area Office
Montevideo Plaza
P.O. Box 1045
Taos, NM 87571
(505) 758-8851

Socorro District Office
198 Neel Avenue
P.O. Box 1219
Socorro, NM 87801
(505) 835-0412 FTS 476-6280

Las Cruces District Office
1705 N. Valley Drive
P.O. Box 1420
Las Cruces, NM 88001
(505) 524-8551 FTS 571-8312

Roswell District Office
1717 W. Second Street
P.O. Box 1397
Roswell, NM 88201
(505) 622-7670 FTS 476-9251

Carlsbad Resource Area Headquarters
114 S. Halagueno Street
P.O. Box 506
Carlsbad, NM 88220
(505) 887-6544

Other Department of the Interior Agencies

Bureau of Indian Affairs*
Albuquerque Area Office
123 4th Street
P.O. Box 2088
Albuquerque, NM 87198
(505) 766-3374 FTS 474-3374

Bureau of Indian Affairs*
Eastern Navajo Agency
P.O. Box 328
Crownpoint, NM 87313
(505) 786-5228

Bureau of Indian Affairs*
Navajo Area Office
Box M - Mail Code 305
Window Rock, AZ 86515
(602) 871-5151 FTS 479-5314

Bureau of Reclamation*
Upper Colorado Regional Office
125 S. State Street
P.O. Box 11568
Salt Lake City, UT 84147
(801) 524-5463 FTS 588-5463

Minerals Management Service*
South Central Region
505 Marquette Avenue N.W., Suite 815
Albuquerque, NM 87102
(505) 766-1173 FTS 474-1173

Minerals Management Service*
Resource Evaluation Office
411 N. Auburn
Farmington, NM 87401
(505) 327-7397 FTS 572-6254

National Park Service*
Southwest Regional Office
1100 Old Santa Fe Trail
Santa Fe, NM 87501
(505) 988-6375 FTS 476-6375

National Park Service*
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Pinon Building, 1220 St. Francis Drive
P.O. Box 728
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U.S. Fish and Wildlife Service*
Field Supervisor, Ecological Services
3530 Pan American Highway, Suite C
Albuquerque, NM 87107
(505) 766-3966 FTS 479-3966

U.S. Geological Survey (WRD)*
505 Marquette Avenue, Room 720
Albuquerque, NM 87101
(505) 766-2810 FTS 474-2817

Other Federal Agencies and Organizations

Environmental Protection Agency
Region VI
1201 Elm Street
Dallas, TX 75270
(214) 767-2716 FTS 729-2716

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c/o Division of Resources
P.O. Box 308
Window Rock, AZ 86515
(602) 871-6592

Pueblo of Zia*
General Delivery
San Ysidro, NM 87053
(505) 867-3304

Soil Conservation Service*
424 N. Mesa Verde
Aztec, NM 87410
(505) 334-9437

U.S. Corps of Engineers*
P.O. Box 1580
Albuquerque, NM 87103
(505) 766-2657 FTS 474-2657

USDA, Forest Service*
717 Gold Avenue
Albuquerque, NM 87102
(505) 474-1676 FTS 474-1676

USDA, Forest Service*
District Ranger
Mt. Taylor Ranger District
201 Roosevelt Avenue
Grants, NM 87020
(505) 287-8833

USDI, Bureau of Land Management
Division of Rights-of-Way (330)
18th and C Streets, NW
Washington, D.C. 20240
(202) 343-5441 FTS 343-5441

USDI, Bureau of Land Management
Denver Service Center (D-460)
Technical Publications Library
Denver Federal Center, Bldg. 50
Denver, CO 80225
(303) 234-2368 FTS 234-2368

New Mexico State Agencies

New Mexico State Environmental Improvement Division*
725 St. Michaels Drive
P.O. Box 968
Santa Fe, NM 87503
(505) 827-5271, ext. 2416

New Mexico Energy and Minerals Department*
525 Camino De Los Marquez
P.O. Box 2770
Santa Fe, NM 87503
(505) 827-3326

New Mexico Historic Preservation Bureau*
State Historic Preservation Officer
505 Don Gaspar Avenue
Santa Fe, NM 87503
(505) 827-2108

New Mexico Natural Resource Department*
Villagra Building
Santa Fe, NM 87503
(505) 827-5531

New Mexico Public Service Commission*
Bataan Memorial Building
Santa Fe, NM 827-3361
(505) 827-3361

New Mexico State Engineer's Office*
Bataan Memorial Building
Santa Fe, NM 87503
(505) 827-2423

New Mexico State Planning Office*
505 Don Gaspar Avenue
Santa Fe, NM 87503
(505) 827-5191

Other Organizations

Public Service Company of New Mexico
Alvarado Square
P.O. Box 2268
Albuquerque, NM 87158
(505) 848-2700

Public and University Libraries

Reading copies of the CO Technical Report and the Draft CO will be available at the following public and university libraries:

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Albuquerque Public Library
501 Copper Avenue NW
Albuquerque, NM 87102

Aztec Public Library
201 W. Chaco
Aztec, NM 87401

Crownpoint Community Library
c/o Lioness Club, P.O. Box 731
Crownpoint, NM 87313

Cuba Public Library
Box 5, La Jara
Cuba, NM 87027

Farmington Public Library
302 N. Orchard
Farmington, NM 87401

Gallup Public Library
115 W. Hill Avenue
Gallup, NM 87301

Mother Whiteside Memorial Library (Public)
525 W. High Street
P.O. Box 96
Grants, NM 87020

New Mexico State Library
325 Don Gaspar Avenue
Santa Fe, NM 87503

Harwood Foundation Library (Public)
25 LeDoux
P.O. Box 766
Taos, NM 87571

University/College Libraries

University of New Mexico
General Library
Albuquerque, NM 87131

Navajo Community College Library
Shiprock Branch
P.O. Box 580
Shiprock, AZ 87420

Northern New Mexico Community College
P.O. Box 250
Espanola, NM 87532

New Mexico State University
San Juan Campus
4601 College Blvd.
Farmington, NM 87401

University of New Mexico, Gallup Campus
Learning Resources Center
200 College Road
Gallup, NM 87301

New Mexico State University/Grants
1500 Third Street
Grants, NM 87020

New Mexico Highlands University
Donnelly Library
National Avenue
Las Vegas, NM 87701

College of Santa Fe
Fogelson Memorial Library
St. Michael's Drive
Santa Fe, NM 87501

Colorado State University
c/o Fred Schmidt
CSU Library
Fort Collins, CO 80523

Comments on the DCO have been requested from the following:

Federal Agencies

Department of Energy
Corps of Engineers
Forest Service
Soil Conservation Service

Federal Agencies (continued)

Environmental Protection Agency
Office of Surface Mining
Bureau of Reclamation
Geological Survey
Minerals Management Service
Bureau of Indian Affairs
National Park Service
Fish & Wildlife Service

Indian Tribes and Pueblos

Jicarilla Apache Tribe
Zuni Tribe
Navajo Tribe
Pueblo of Zia

State of New Mexico

Environmental Improvement Division
Public Service Commission
State Engineer
Historic Preservation Bureau
Energy & Minerals Department
State Planning Office
Natural Resources Department

Acre-foot -- the volume of water that would cover 1 acre to a depth of 1 foot, equivalent to 43,560 cubic feet. One cubic foot per second (cfs), flowing for 24 hours, is equivalent to 1.983 acre-feet.

Ambient -- in the case of air quality, the portion of the atmosphere external to buildings.

Areas of critical environmental concern (ACECs) for scenic values -- areas within the public lands where special management attention is required (when such areas are developed or used, or where no development is required) to protect or prevent irreparable damage to the scenic values.

Attainment -- a designation issued by the EPA to indicate an area's compliance with all applicable National Ambient Air Quality Standards (NAAQS). An area that is in compliance with the particulate matter standard, for example, is termed "attainment" for this pollutant. An area that is shown by monitoring or modeling to exceed a standard is designated "non-attainment" for the particular pollutant(s).

Background -- the area of a distance zone which lies beyond the foreground-middleground. Usually from a minimum of 3 to 5 miles to a maximum of about 15 miles from a travel route, use area, or other observer position. Atmospheric conditions in some areas may limit the maximum to about 8 miles or increase it beyond 15 miles.

Baseline -- air quality, water quality, or meteorological data used as a starting point in estimating the impact of new emissions.

Basic elements -- the four major elements (form, line, color, and texture) that determine how the character of a landscape is perceived.

Characteristic -- a distinguishing trait, feature, or quality.

Characteristic landscape -- the established landscape within an area being viewed. This does not necessarily mean a naturalistic character. It could refer to a farming community, an urban landscape, a primarily natural environment, or other landscape which has an identifiable character.

Color -- the property of reflecting light of a particular wavelength that enables the eye to differentiate otherwise unidentifiable objects.

Contrast -- the effect of a striking difference in the form, line, color, or texture of the landscape features within the area being viewed.

Contrast rating -- a method of determining the extent of visual impact for an existing or proposed activity that will modify any landscape feature (land and water form, vegetation, and structures).

Cretaceous -- the final period of the Mesozoic era thought to have covered the span of time between 135 and 65 million years ago.

Critical viewpoint -- the point(s) commonly in use or potentially in use where the view of a management activity is the most disclosing.

Cultural resources -- remains of human activity, occupation, or endeavor, as reflected in sites, buildings, artifacts, ruins, etc.

Decibel -- a unit for expressing the relative intensity of sounds on a scale from 0 (for the average least perceptible sound) to about 130 (for the average pain level).

Distant zone -- the area that can be seen as foreground-middleground, background, or seldom-seen.

Dominant elements -- the basic elements (form, line, color, texture) in a particular landscape which exert the greatest influence on the visual character of the landscape.

Emission -- a substance, whether gaseous or particulate, released by human activity into the air or water.

Foreground-middleground -- the area visible from a travel route, use area, or other observer position to a distance of 3 to 5 miles. The outer boundary of this zone is defined as the point where the texture and form of individual plants are no longer apparent in the landscape. Vegetation is apparent only in patterns or outline.

Form -- the mass or shape of an object or objects which appear unified, such as in the shape of the land surface or patterns placed on the landscape.

Ground water -- that part of the subsurface water that is the zone of saturation, supplies water to wells, and provides water that sustains the low flow of perennial streams.

Land form -- a term used to describe the many types of land surfaces which exist as the result of geologic activity and weathering, e.g., plateaus, mountains, plains, and valleys.

Landscape character -- the arrangement of a particular landscape as formed by the variety and intensity of the landscape features and the four basic elements of form, line, color, and texture. These factors give the area a distinctive quality which distinguishes it from its immediate surroundings.

Landscape features -- the land and water form, vegetation, and structures which compose the characteristic landscape.

Line -- the path, real or imagined, that the eye follows when perceiving abrupt differences in form, color, or texture. Within landscapes, lines may be found as ridges, skylines, structures, changes in vegetative types, or individual trees and branches.

Local workers -- people who do not change their place of residence to work on a project.

Nitrogen dioxide -- a molecule of one nitrogen and two oxygen atoms: NO_2.

Nitrogen oxides (NO_x) -- compounds produced by combustion, particularly when there is an excess of air or when combustion temperatures are very high. Nitrogen oxides are primary air pollutants.

Nonattainment area -- an area already characterized by significant levels of air pollution. Such areas are restrictive of any significant increases in certain pollutants caused by new sources (industrial or power plant).

Ozone -- a molecule of three oxygen atoms: O_3.

Paleocene -- an epoch of the early Tertiary period and the corresponding worldwide series of rock.

Paleontology -- a science that deals with the life of past geological periods and is based on the study of fossil remains of plants and animals.

Particulate matter -- any material, except water in a chemically uncombined form, that is or has been airborne and exists as a liquid or a solid at standard temperature and pressure conditions. Minute particles of coal dust, fly ash, and oxides temporarily suspended in the atmosphere.

Perception -- to become aware of and grasp mentally primarily through sight, but also through hearing, touch, taste, and smell.

Prehistory -- the time before wriiten history.

Quarternary -- the second period of the Cenozoic era as well as the corresponding system of rocks. It began two to three million years ago and extends to the present.

Sandstone -- any clastic sedimentary rock containing individual particles that are visible to the unaided eye or slightly larger.

Scenic area -- an area whose landscape character exhibits a high degree of variety, harmony, and contrast among the basic visual elements which results in a pleasant landscape to view.

Scenic quality -- the degree of harmony, contrast, and variety within a landscape.

Scenic quality class -- the value (A, B, or C) assigned a scenic quality rating unit by applying the scenic quality evaluation key factors which indicate the relative visual importance of the unit to the other units within the physiographic region in which it is located.

Seen area -- that portion of the landscape which can be viewed from one or more observer positions. The extent or area that can be viewed is normally limited by land form, vegetation, or distance.

Sedimentary -- rocks that are formed by the deposition of a sediment.

Sensitivity -- as applied to visual resource management, that degree of concern expressed by the user toward scenic quality and existing or proposed visual change in a particular characteristic landscape.

Short-term consequences -- lasting less than two visitor seasons

Simulation -- the realistic visual portrayal which demonstrates the perceivable changes in the landscape features of a proposed management activity through the use of photography, artwork, computer graphics, and other such techniques.

Study area -- one day's travel distance (100-mile radius) from major communities of residence

Sulfur dioxide (SO_2) -- heavy, pungent, toxic gas that is easily condensed to a colorless liquid, is used in making sulfuric acid, and is a major air pollutant, especially in industrial areas.

Tertiary -- the first period of the Cenozoic era, thought to have covered the time span between 65 and 3 to 2 million years ago.

Texture -- the interplay of light and shadow created by the variation in the surface of an object; the visual result of the tactile surface characteristics.

Total dissolved solids (TDS) -- an aggregate of carbonates, bicarbonates, chlorides, sulfates, phosphates, and nitrates of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts and are dissolved in water. High TDS values can adversely affect humans, animals, and plants. TDS is often used as a measure of salinity.

Use volume -- the total volume of visitor use each segment of a travel route or use area receives.

Variable -- a quantity that may assume any one of a set of values.

Visual resource -- the land, water, vegetative, animal, and other features that are visible on all lands (scenic values).

Visual resource management class -- the degree of visual change that is acceptable within the characteristic landscape. It is based upon the physical and sociological characteristics of any given homogeneous area and serves as a management objective.

Visual resource management (VRM) -- the planning, design, and implementation of management objectives to provide acceptable levels of visual impacts for all BLM resource management activities.

Visual sensitivity level(s) -- an index of the relative degree of user interest in scenic quality and concern and attitude for existing or proposed changes in the landscape features of an area in relation to other areas in the planning unit.

ac	acre
ac-ft	acre-foot
ACEC	area of critical environmental concern
ACHP	Advisory Council on Historic Preservation
APS	Archaeological Protection Sites
AQCR	air quality control region
AUM	animal unit month
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
Btu	British thermal unit
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Cumulative Overview
C-14	County Road 14
C-15	County Road 15
CO_2	carbon dioxide
cfs	cubic feet per second
dB(A)	decibels on the A-weighted scale
DLN	Depository Library Network
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FC-A-P	Four Corners-Ambrosia-Pajarito transmission line
FS	U.S. Forest Service
ft	foot
hr	hour
ICC	Interstate Commerce Commission
ID	inside diameter
I-40	Interstate Highway 40
km	kilometer
kV	kilovolt
kWh	kilowatthour
$L_{eq(1)}$	hourly noise level

L_{eq}	noise level
m	meter
MFP	Management Framework Plan
mg	milligram
$\mu g/m^3$	microgram per cubic meter
mg/l	milligram per liter
mi	mile
mm	millimeter
MOU	Memorandum of Understanding
MW	megawatt
NEPA	National Environmental Policy Act
NM	New Mexico
NMEID	New Mexico Environmental Improvement Division
NM 44	New Mexico Highway 44
NM 57	New Mexico Highway 57
NM 371	New Mexico Highway 371
NM 550	New Mexico Highway 550
NM 666	New Mexico Highway 666
NIIP	Navajo Indian Irrigation Project
NMGS	New Mexico Generating Station
NMPSC	New Mexico Public Service Commission
NMSHD	New Mexico State Highway Department
NMSO	New Mexico State Office
NOI	Notice of Intent
NO_x	nitrogen oxides
NO_2	nitrogen dioxide
NPS	National Park Service
NRHP	National Register of Historic Places
OD	outside diameter
ORV	off-road vehicle
PL	public law
PNM	Public Service Company of New Mexico
PRLA	preference right lease application
RCT	San Juan River Regional Coal Team
ROW	right-of-way
RR	Star Lake-Bisti Railroad
SCS	U.S. Soil Conservation
SJBAP	San Juan Basin Action Plan
SJRRCL	San Juan River Regional Coal Leasing
SO_2	sulfur dioxide
USC	U.S. Code

ton/day	tons per day
TDS	total dissolved solids
TSP	total suspended particulates
USGS	U.S. Geological Survey
VRM	Visual Resource Management
WSA	wilderness study area
yr	year
>	greater than
<	less than

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(date)

San Juan Basin Action Plan
Comment Form: Draft Cumulative Overview

Comments on this Draft Cumulative Overview will be accepted through close of business February 7, 1983

All comments should be sent to:

State Director (912)
Bureau of Land Management
New Mexico State Office
P.O. Box 1449
Santa Fe, NM 87501

Please sign and date all forms.

Form 1542 - 2
(May 1982)

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